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Adapting to Climate Change: Perspectives from Rural Communities in Lombok, Eastern Indonesia

Thesis submitted by

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PREFACE

Lombok is one of the poorest islands in Indonesia, where people suffer many hardships. Poverty, environmental degradation and economic volatility are constant problems. Climate variability is increasingly exacerbating the challenges that people face. In 2009, I attended a workshop about the impacts of climate change on small islands, which was held by the World Wildlife Fund's (WWF) Nusa Tenggara office. Since then, I have held discussions with WWF and many other institutions from my position in the provincial government. I have tried to understand how to integrate climate issues into development planning. I have become convinced that rigid scientific predictions derived from models are not going to solve the problems related to climate issues. It has become increasingly clear that a much better understanding of the factors that determine the ability of people to cope with climate fluctuations is needed, especially if there is to be any hope of helping them to deal with long-term change.

In 2010, I was awarded an Australian Award Scholarship to pursue studies towards a Doctor of Philosophy degree. This gave me the opportunity to spend four years studying adaptation and development in rural areas of Lombok. As a development planner and local person, I have tried to demonstrate that rural communities in Lombok have endogenous strengths, which need to be reinforced if they are to deal with future climate uncertainties.

My first visit in 2011 to the three study locations mentioned in this thesis brought a new insight for me as a researcher and development practitioner. In the three different locations, I saw that the stage of development differed, even though some development programs were implemented in similar ways. Each community had complex but distinct socio-economic problems. On the basis of this 'first sight', I began to question why different communities and households were more vulnerable than others, and how this related to their current level of development. The

research reported here is an attempt to find answers to the question of what pre-determines people's ability to cope with climate variability and other changes in their livelihoods.

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So which of the favors of your Lord (Allah) would you deny? (QS. Ar-rahman, 13)

First and foremost, I express my deepest gratitude to Allah the Greatest, the Most Compassionate and Merciful. At the beginning of my plan to pursue a PhD, I was told by my colleagues that doing a PhD was not as easy as I might think. Another strong comment from my colleagues in the local development planning board in West Lombok District, claimed that a PhD is too high a degree for regular jobs in local government in Indonesia. In fact, I acknowledge that obtaining a PhD is not a stress-free journey (for sure!), but along the way, I have developed much knowledge and other valuable experiences that I have never encountered during my professional career. All of those experiences will be absolutely vital for local development in Indonesia.

I would not have made it this far without a huge contribution from the many people I met throughout my journey. I would like to deliver my gratitude and acknowledgement to my supervisors, Professor Jeff Sayer, Professor Steve Turton, Dr. Intu Boedhihartono and Dr James Butler, for their endless support and motivation. They knew that I needed more support than others, as my progress was slow. I first met Professor Sayer and Dr Boedhihartono in Bali and later they agreed to supervise my PhD under the Development Practice Program, along with Professor Turton. The supervisory team was consolidated further when I met Dr Butler from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the first time as he was leading research in West Nusa Tenggara Barat Province; his research coincidentally being in line with my PhD topic.

My special gratitude goes to the Australia Awards Scholarships (AAS) Program for the second chance of pursuing study in Australia. I would like to thank the AAS liaison officers, Alex Salvador and Katherine Elliot, who were always there for any problems and complaints that I had. I send my gratitude to James Cook University, especially the Graduate Research School for providing the budget for data collection. I also thank the International Student Centre at James Cook University for providing continual support and regular free lunches.

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STATEMENT OF THE CONTRIBUTION BY OTHERS

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- Professor Jeffrey Sayer (Principal supervisor)
- Professor Steve Turton (Co-supervisor)
- Dr Agni Klintuni Boedhihartono (Associate supervisor)
- Dr James Butler (Associate supervisor)

Study design and analytical supports

Aspect of assistance	Nature of assistance, names and contribution
Proposal writing and study design, fieldwork	I was helped by Professor Jeffrey Sayer and Dr James Butler to design my study and proposal writing. Dr Ilan Kelman helped during proposal writing and choosing the methods. Professors Jeffrey Sayer and Steve Turton, and Dr Intu Boedhihartono and James Butler accompanied me when pilot testing the methodology and evaluation.
Chapters writing and analytical assistance	I collected the data, designed the Chapter outlines, and analysed the data. Specific contributions were given as follows: - Professor Jeffrey Sayer helped me restructure and edit Chapters 1, 2, and 5, and a potential paper based on Chapter 3; - Dr James Butler supported me with the arguments and writing of Chapters 4, 6, and 7, and a potential paper based on Chapter 4; - Professor Chris Margules helped me to refine and edit Chapters 1, 4, 5 and 6; - Professor Steve Turton helped me to restructure Chapter 3 and with reviewing all chapters; - Dr Intu Boedhihartono provided comments on the draft outline in Chapter 5; - Mr Tri Hardianto from the Indonesian Central Bureau of Statistics assisted me with statistical analysis.

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ABSTRACT

Climate change and increasing variability will have especially profound adverse impacts upon the lives of rural communities in developing countries. However, households have differing asset bases and livelihood strategies, and therefore may have variable levels of vulnerability. Designing appropriate climate adaptation strategies must take these differences into account. This study examined the heterogeneity of vulnerability amongst rural communities in Lombok, Indonesia, and considers implications for climate adaptation policy interventions. Three villages, with differing natural resource bases, were selected as case studies: forest, rain-fed agriculture, and coastal fisheries and aquaculture. Based on a questionnaire survey (n=250), a household typology was generated. Cannon's (2008) vulnerability framework was applied to analyse the factors driving vulnerability for each household type in the villages. Interviews (n=72) with individuals from different household types were also employed to determine their perceptions about vulnerability and adaptation preferences. Participatory focus group discussions and social network mapping were also utilised to triangulate causes of vulnerability and dependencies between household types.

Three main key conclusions emerged. First, although climate variability contributes to increased livelihood vulnerability, the degradation of traditional institutions through modernisation and social change was considered to be a more serious problem. In particular, traditional institutions are an important source of adaptive capacity for poorer households. Second, community structures are complex, with different household types depending on one another for support. Social cohesion and mutual assistance are important for maintaining livelihood activities both in difficult times and during normal daily situations. Third, current development programs do not account for this variability of household types, their adaptation needs or the linkages between them. As a result, wealthier households benefit more than poorer ones, and there is little evidence of 'trickle down' benefits from rich to poor. This inequality could potentially lead to maladaptation.

These patterns were similar across all case study villages. However, the dynamic interactions among households types differed based on the strength of social cohesion and local institutions. Therefore adaptation policies must be better designed and be more egalitarian. Specifically they must restore and maintain traditional institutions and social capital. The 'vulnerability components framework' from Cannon (2008) was used to identify necessary intervention points for different household types. These components are interlinked to each other and enable understanding of what causes some people to be more at risk of a hazard than others.

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CHAPTER 1: INTRODUCTION

There is a general consensus throughout the world that climate change will have especially profound adverse impacts upon the lives of the rural poor. According to the World Bank Development Report (World Bank 2009), around 70 percent of the world's extremely poor people live in rural areas and their livelihoods depend on activities that are susceptible to climate change. The poor and marginalised have the least capacity to deal with the impacts of environmental changes (Metz & Kok 2008). Their poverty may be exacerbated by climate change and increasing climate variability and extremes.

There are many reasons to believe that adverse climate impacts will be especially acute in the poorer, remote islands of eastern Indonesia. These impacts are likely to be highest in areas with weak institutions and where the people are particularly short of assets – education, savings, land, health – that might enable them to adapt to changes. The remote islands of eastern Indonesia are at great risk; they are isolated and have weaker government institutional capacities than the main islands in the west of the country. They also have the highest incidence of poverty in the country, experience highly variable climate conditions, and have a high level of dependence on agriculture (MoE 2010a).

The percentage of the population experiencing chronic malnutrition ranges from 8 percent in a normal year, to 12 percent in El Niño years (Skoufias et al. 2010). Climate variation drives crop failure and has other severe impacts on agriculture, notably crop yields. However, a study conducted by Skoufias et al. (2010) on 'Welfare Impacts of Rainfall Shocks in Rural Indonesia' showed that the empirical evidence for welfare losses due to weather shocks is rather weak. The most vulnerable households were those that had low levels of income with limited assets and little access to resources and services. Household adaptation strategies and actions to deal with climate stressors have also received little attention (Skoufias et al. 2010). The complexity of individual situations creates a significant challenge in formulating climate adaptation policies at local and regional levels.

Indonesia has a National Climate Change Adaptation Strategy (MoE 2007b), which was developed by the national government and disseminated to provincial and local administrative levels. Out of necessity, it is a very general document and it prescribes broad policy guidance; it does not, and could not, deal with the specificity of the multitude of situations found in the 17,000 islands of the Indonesian archipelago. In general, it prescribes actions that government agencies might take to help the population deal with climate change and increasing climate extremes.

The National Action Plan Addressing Climate Change (NAPACC) is expert-driven and presents a top-down view of how adaptation might be addressed. The Action Plan was developed in 2007 by the State Ministry of Environment, with contributions from several other related ministries, departments and institutions (MoE 2007b). It has been communicated to local governments at the provincial- and district-levels, but there is little evidence on the extent to which it has influenced the climate plans and programs of the provinces or regencies. There appears to have been minimal effort to draw upon local knowledge and behaviour in developing the plans.

People throughout eastern Indonesia have a long experience of dealing with fluctuating climates. As a consequence of this, they have accumulated knowledge and local institutional arrangements that have enabled them to cope with climate variability and other livelihood changes in the past. In general, this local knowledge has not been taken into consideration in the development of government plans for climate adaptation. In fact, the complexity of socio-ecological contexts in eastern Indonesia varies from one community to another, even on a single island. A study conducted by Butler et al. (2014) in West Nusa Tenggara Province shows that vulnerability drivers are highly varied across the region. These drivers are categorised into three clusters: (i) political, developmental, climate and environmental change, (ii) economic growth and (iii) modernisation. Community structures and dynamics also have to be considered in developing future adaptation policies.

My study addresses the fundamental gaps in adaptation policies adopted by Indonesian government at all levels. I examine the underlying attributes of a community's vulnerability and adaptation needs, based on household asset structures. The asset structure describes the main sources of household livelihoods. The main hypothesis of my thesis is that social-ecological dynamics and linked asset structures require locally specific adaptation strategies. Understanding the vulnerability of asset structure groups to climate and other changes is not merely a technical challenge, it is a social and institutional challenge. I have sought to establish baseline information on existing coping strategies (Butler et al. 2014; Wise et al. 2014). Finally, I examine the issues that will need to be addressed in deciding whether to adopt a utilitarian approach to benefit as many people as possible; or an egalitarian approach which focuses on the poorest households (Brooks et al. 2011). There is also a need to identify interventions which will result in a 'no-regrets' policy for climate adaptation strategies (Christoplos 2010).

1.1 Climate Variability and Change in Indonesia

1.1.1 Climate Impacts

Indonesia is an archipelagic country and is prone to climate-related stresses and other natural hazards (Rampengan et al. 2014). Climate variability and associated weather extremes have already had devastating impacts on several big cities on the main islands of the country (Case, Ardiansyah & Spector 2007), but it is especially threatening to the small islands, particularly those in oceanic locations (MoE 2007a). The increase in temperature in recent decades has triggered more frequent storms, strong winds and erractic rainfall patterns (Parry et al. 2007). This has had major impacts, particularly on people who already suffer from poverty and marginalisation; climate change and increasing weather extremes will make their lives even worse.

Climate-related hazards and risks affect Indonesia in several different ways. WWF Indonesia has identified four main potential climate impacts in Indonesia (Case, Ardiansyah & Spector 2007). The first is changes in water and food availability. This is driven by the decline of precipitation in some parts of the country and this trend is projected to continue, particularly in the south-eastern provinces. Increasing duration and intensity of dry seasons will lead to greater frequency of droughts. Conversely, other parts of the country have experienced increases in rainfall which has led to flooding, especially in big cities such as Jakarta and Semarang. In 2007, it was reported in *The Jakarta Post* that the Jakarta floods inundated 145,742 houses, at least 57 people were killed, and 80 districts were affected. This triggered chaotic traffic conditions and damaged infrastructure (Bappenas 2007). Changes in water availability also hit the agriculture sector, where seasonality and rainfall changes led to declines in food production.

The second potential climate impact is sea-level rise. The Fifth Assessment report for Asia by the Intergovernmental Panel for Climate Change (IPCC), reported that the increase in sea-level varied across coastal areas in Asia by 1-3 mm/year, depending on spatial location (Hijioka et al. 2014 ; IPCC 2014). This trend is projected to escalate to about 5.4 mm per year and could increase further in the next century. Sea-level rise is causing coastal erosion and destruction of fish nursery grounds. These changes will have serious impacts on the livelihoods of coastal communities, most notably of fishermen.

The third potential climate-related impact is the loss of biodiversity and ecosystem services. This impact has many inter-related components. According to the IPCC's Fourth Assessment report for Asia, climate change has the potential to put up to 50 percent of Asia's total

biodiversity at risk (Cruz et al. 2007). The combination of effects of climate change and habitat fragmentation are likely causes of the increased risk of extinction (Hijioka et al. 2014). Changes in the distributions of plants and animals through the availability of suitable habitats are also projected in response to both direct and indirect impacts of climate change. For example, natural selection in Mongolian taiga forests has been reported to respond heterogeneously to recent climate changes, where regeneration of diverse species is more widespread than the increased growth of existing stands of larch. In marine ecosystems, 88 percent of coral reefs have been damaged globally and the degree of damage is expected to increase during the next 30 years (Wilkinson 2004 cited in Case, Ardiansyah & Spector 2007). The increase in carbon dioxide is also degrading marine ecosystems; for example, temperature rise and acidification combine to cause coral bleaching.

Long periods of drought and strong winds are expected to trigger more frequent forest fires and this will be a threat to terrestrial habitats and native flora and fauna species. However, changes in climate could also benefit some areas: for example, the cereal-producing areas in northern and eastern Kazakhstan, Central Asia (Hijioka et al. 2014). Farmers in these areas are likely to have a longer growing season and warmer winters.

The fourth climate-related impact is on human health. Temperature increases and more extreme weather events will provoke changes in the distribution and frequency of vector-borne and water-borne diseases, especially diarrhoeal diseases, which will increase morbidity and mortality (Checkley et al. 2000). During rainy periods dengue fever is also expected to rise (PEACE 2007).

Eastern Indonesia has additional problems as several of the poorest provinces lie along the El Niño Southern Oscillation (ENSO) gradient. They are likely to suffer from food shortages caused by droughts and erratic rainfall (United Nations Development Programme 2007). For example, in East Nusa Tenggara province (West Timor, East Sumba and islands east of Flores), most of the local communities already suffer from climate variations. A report from the United Nations Development Program (UNDP) (2007) argued that this situation is exacerbated by poor soils and the lack of availability of alternative food sources. As a consequence, more than one third of the population in many of these districts live below the poverty line.

Figure 1.1 shows the concentration (percentage) of people living below the poverty line in Indonesia, and notes the higher concentration of poverty in eastern provinces (dark red color). Erratic rainfall patterns also disrupt water supplies, both for irrigation and drinking water (United Nations Development Programme 2007). On Lombok and Sumbawa islands (West

4

Nusa Tenggara Province), the variability of rainfall has reduced the number of permanent water sources from 580 to 180, and has depleted the water levels of main rivers in the regions (Bappeda NTB 2010a).
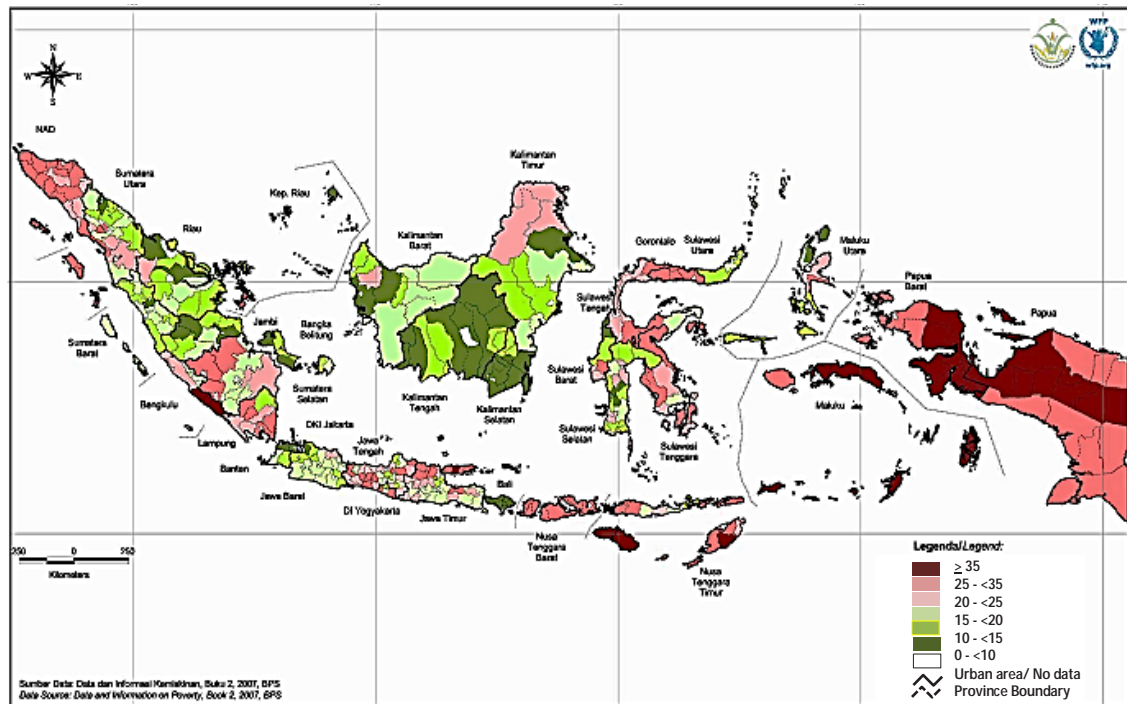
Figure 1.1 Map of the proportion (%) of people living below the poverty line (DKP 2009)

1.1.2 Policy responses at the national level

Regulations and policy

The Indonesian government has made climate change mitigation and adaptation a top priority in its development strategies. The National Action Plan Addressing Climate Change (NAPACC) was developed in 2007. This document is part of the formal commitment of all countries who signed the United Nations Framework Convention on Climate Change (UNFCC) (Agrawal 2008). In Indonesia, the development of the NAPACC was led by the State Ministry of Environment with contributions from several other related ministries, departments, and institutions (MoE 2007b).

There are three main themes in the document: mitigation, adaptation and institutional capacity improvement. The plan describes several strategies to increase resilience in six of the highest risk sectors: (i) agriculture, (ii) coastal and marine fisheries, (iii) infrastructure, (iv) health, (v) forestry and (vi) biodiversity. The NAPACC proposes an institutional arrangement for climate adaptation in all sectors which are heavily reliant on national government departments and institutions. The role of provincial and local governments and of civil society and local stakeholders receives little attention in the document.

In response to the NAPACC, the Indonesian government, through its National Development Planning Agency or *Badan Perencanaan Pembangunan Nasional* (BAPPENAS), has prepared a 'National Development Planning Response to Climate Change'. This is referred to as the 'Yellow Book' (MoE 2010a). The main purpose of this book is to integrate climate change strategies into general development planning. The basic principle is that climate change strategies must involve all sectors and be based upon intense coordination amongst all stakeholders. The objectives of the Yellow Book are:

(i)   to integrate climate change programs as a part of national development planning

(ii) to present sectoral and cross-sectoral priorities on climate change within the framework of sustainable development

(iii) to provide an overview of funding mechanisms and institutional arrangements

(iv) to provide clear guidance for development partnerships on climate change.

The Yellow Book is used as a bridging document to allow climate issues to be incorporated into future development plans (MoE 2010a). It specifically targets the Mid-term Development Plan or *Rencana Pembangunan Jangka Menengah Nasional* (RPJMN) for 2010-2014, and the government annual work plan, or *Rencana Kerja Pemerintah* (RKP 2009, 2010). The RPJMN identifies sectoral and cross-sectoral issues, and makes budget allocations (Figure 1.2).
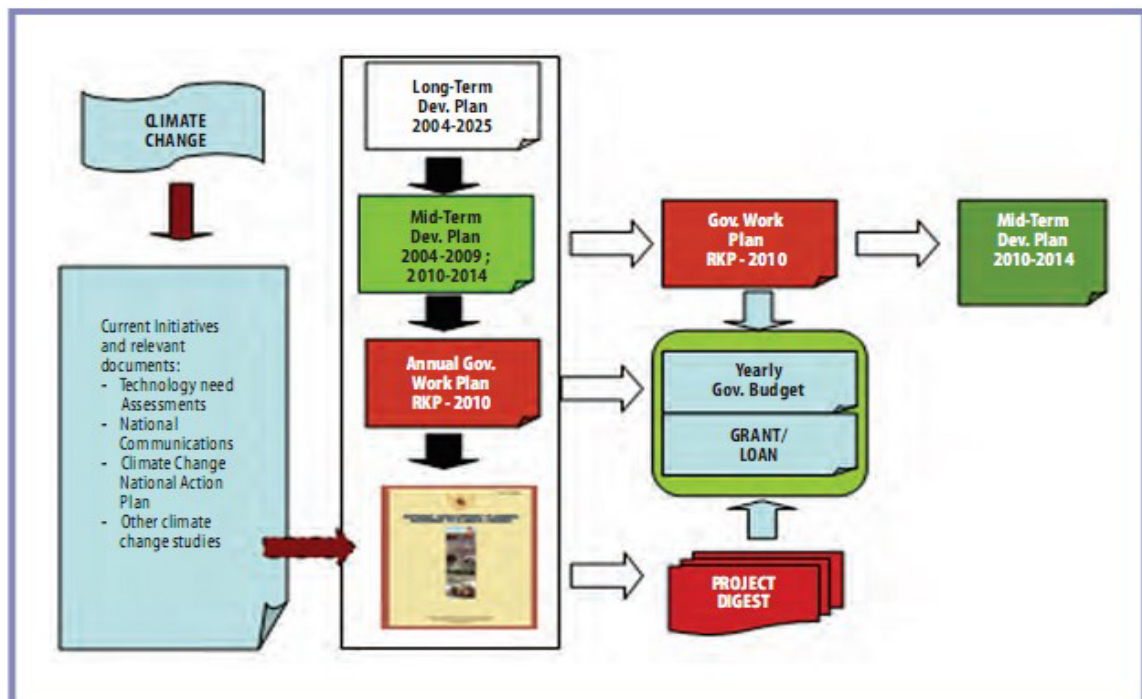
Figure 1.2 Flowchart showing the process involved in the development of the Indonesian Climate Change Sectoral Roadmap (ICCSR) (MoE 2010a)

The integration of climate change and development programs is expected to be achieved through the Indonesian Climate Change Sectoral Roadmap (ICCSR). This is intended to exploit

synergies between the climate actions planned within development sub-sectors (Bappenas 2010). The ICCSR describes sectoral policies, strategies and programs for adaptation to and mitigation of climate change. The sectoral road map also provides detailed technical descriptions of sectoral policy directions and long-term sectoral commitments to emission reductions and adaptation measures (Figure 1.3).
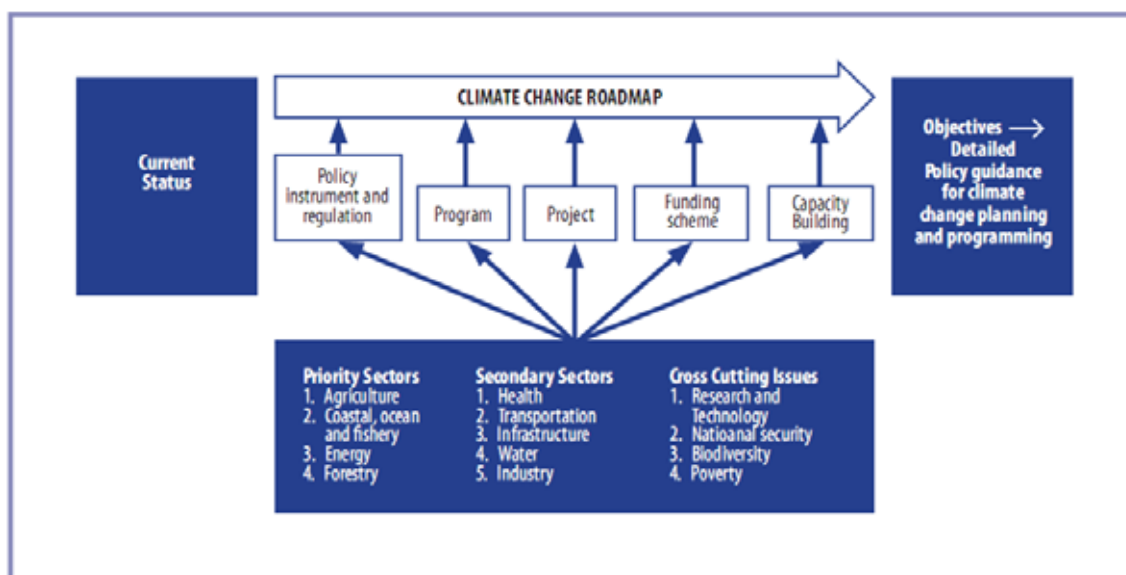
Figure 1.3 Flowchart showing the process involved in the development of the Indonesian Climate Change Sectoral Roadmap (ICCSR) (MoE 2010a)

The ICCSR also provides guidance for financial resource allocations especially from international donor agencies. In conjunction with the climate change program referred to in the Yellow Book, the Indonesian government has developed an integrated financing institution in order to pool all financial resources provided by donors (Simamora 2008). The Indonesian Climate Change Trust Fund (ICCTF) has been developed to promote coordinated action to respond to climate change (Bappenas 2009). The rationale for the development of the ICCTF is to mobilise external funds to support climate change measures, and also to serve as a means to support the sectoral roadmap in mainstreaming climate change issues into national development plans. The specific objectives of the ICCTF are:

(i)   to align donor support for climate change actions with Government of Indonesia (GoI) policies

(ii)   to improve targeting of investment in climate change using decentralised structures

(iii)   to accelerate priority investment in climate change mitigation and adaptation measures which the GoI cannot support with its own means

(iv)   to prepare and promote a comprehensive policy framework for mitigation and adaptation

(v)   to facilitate private sector investment in climate change initiatives.

Knowledge disparities and unclear direction

In September 2009, the president of Indonesia, Susilo Bambang Yudhoyono, announced a commitment of Indonesia under his leadership to voluntarily reduce domestic greenhouse gas (GHG) emissions by 26 percent from the 'Business As Usual'-level by the year 2020. The declaration included information on several focus areas (degraded and potentially degraded areas) and sectors (such as transportation, forest and land use change) that would be priorities in achieving Indonesia's 26 percent emissions reduction target. Subject to adequate international support, this target could be raised to 41 percent (MoE 2010a). This pledge was made by the president at the summit held during the Conference of the Parties (COP-15) of the UNFCCC on 19th January 2010. This conference, which was attended by 115 world leaders from both developed and developing countries, was claimed to have obtained the highest ever political commitment to constrain carbon and respond to climate change, in both the short- and long-term.

In response to this commitment, Indonesia has increased its efforts to reach its targets, both for climate change mitigation and adaptation. However many challenges remain, especially in disseminating information to all local governments, private institutions and communities. Disparities of knowledge and information have impeded the progress of central government in reaching the target of reduced GHG emissions. Zulkifli Hasan, a previous forestry minister, stated that 'many of the regents (heads of districts) do not understand climate change' (Jakarta Post 2011). The disparities of information and knowledge about climate change adaptation and mitigation policies in Indonesia may compound development problems and encourage corruption, due to unclear guidance of what outcomes are being sought.

Furthermore, it is apparent from the policy responses listed, that climate change strategies in Indonesia have prioritised mitigation, even though several documents assert the importance of achieving a balance between adaptation and mitigation. The climate institutions and taskforces will face many challenges in program implementation. These challenges may be triggered by many factors, such as the low capacity of local government, knowledge disparities and high levels of political dependency. In fact, climate change actions may become marginalised given the gravity and number of other sectoral problems and the general underperformance of many sectoral and regional institutions.

1.2 Vulnerability, livelihood, adaptation and development: An overview

1.2.1 Contextualising vulnerability in times of rapid change

Vulnerability is a complex and contested concept amongst different interest groups. This is especially true in the context of global environmental change, where definitions of vulnerability are often debated. Weichselgartner (2001) argued that different understandings of the concept of vulnerability derive from epistemological orientations and methodological practices. At a practical level, understanding of vulnerability is influenced by the types of hazard and their scale, context and location. Weichselgartner (2001) describes three different approaches to vulnerability studies.

The first approach describes a pre-existing condition and emphasises the degree of vulnerability to biophysical and technological hazards. It is derived from hazards and disaster studies. In this field, concepts of vulnerability arise from different epistemological perspectives and practical methodologies. Two main factors to consider are: (i) the vulnerability of the system and its capacity to act, along with the extent of impact of the hazardous events (Timmerman 1981) and (ii) a human-centred approach, where the individual or group is the vulnerable object, which may also be applied to other entities such as community or place (Lewis 1999; Lewis & Kelman 2010; Wisner et al. 2004). From a public health perspective, vulnerability is characterised by 'at risk' and 'risk factors'. For example, individuals or communities can become victims of certain diseases through exposure to infectious agents (Schwarzer 1994).

The second approach to vulnerability studies considers the capacity to respond to particular hazards, especially in the context of the social construction of vulnerability derived from historical, socio-cultural and economic processes of societies. From humanitarian assistance fields, the 'vulnerability concept' focuses on the emergency and recovery response to any disaster or conflict which are regarded as potentially causing 'immediate or imminent' harm (Von Braun 1991; Watts & Bohle 1993; Wisner 2009).

The third approach is a combination of the first two and is derived from biophysical conditions and social preparedness in specific locations. This last approach comes from development studies which have focused on the concept of 'deprivation traps' linked to livelihood (Chambers & Conway 1991; Scoones 1998). 'Deprivation' is defined as the poverty line, which is measured in terms of income. The effort to raise the line needs to understand other dimensions of poverty and well-being. Therefore, this concept embraces all elements that relate to a feature

of livelihood security and insecurity which also involve seasonality and health. More recently, the concept has included climate change as one component of analysis.

In the context of this study, I perceived that vulnerability is largely conceived as the absence of capacity to deal with natural hazards, including hazards triggered by climate change, because it is constrained by economic power and authority. Therefore, I revisit the concept of vulnerability from Wisner et al. (2004, p. 11), who defined vulnerability as 'the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of an extreme natural event or process'. This definition also incorporates sustainability and livelihood 'capital or assets', allowing the analysis of seasonality, health and natural resources as contributing factors to vulnerability (Scoones 1998, 2009).

1.2.2 Vulnerability framework for analysis

From conceptual understandings, vulnerability concepts then developed into practical frameworks for assessment and analysis. The multi-dimensionality of vulnerability assessment frameworks has been recognised in numerous studies at different scales (administrative, social ecological or economic), and various disciplines (Eriksen & Kelly 2007; Fussel 2007; Kelman 2011; OBrien et al. 2007; Wisner et al. 2004). Cutter (1996), among others, proposed a 'hazard of place model', which highlighted the importance of an integrated consideration of vulnerability assessment, including the integration of biophysical and social elements. Turner et al. (2003) developed a vulnerability framework by integrating several key components, including exposure, sensitivity, short-term and long-term responses to potential hazards.

A framework for identifying factors or indicators of underlying vulnerability was also developed by Eriksen and Kelly (2007); they identified key requirements of vulnerability indicators to climate change in secondary data. Wisner et al. (2004) developed the Pressure and Release (PAR) model to examine the contextual processes underlying vulnerability. This model focuses on progression of vulnerability in creation of disasters through the ongoing connecting process of 'root causes', 'dynamic pressures', and 'unsafe conditions', which meet the potential natural hazards criteria (Wisner, Gaillard & Kelman 2011). The PAR framework helps to understand the complexity of social and environmental long-term consequences of disastrous events. In this model, root causes are a reflection of the real conditions (when a disaster happens) and distribution of power in a society. These can create unsafe conditions through dynamic processes. Different forms of unsafe condition (such as weak human capacity, degradation of natural resources, low income and unsafe living conditions) put people or a

society in a vulnerable condition and makes them susceptible to disasters when climate or other hazards occur. In this context, nature is perceived as providing an 'opportunity' by providing resources to improve livelihoods and meet direct human needs; but at the same time nature can be a 'hazard' as extreme natural events become more frequent and extreme, and impact more forcibly on human activities. Therefore in the PAR model, climate change is considered as a long-term process of natural changes that creates both opportunities and hazards at the same time (Kelman & Gaillard 2008; O'Brien et al. 2006; Wisner, Gaillard & Kelman 2011).

In general, all frameworks are complementary and largely provide for the needs of policy-makers. 'Asset vulnerability' frameworks (Moser 1998) and 'asset-based' approaches to social risk management (Siegel & Alwang 1999) provide slightly different concepts. In the first framework, Moser (1998) emphasised the asset management of urban poor populations in reducing their vulnerability by accumulating tangible and intangible assets. This framework moved from the static measurement of the poor, which only captured income-poverty assessment, to a more comprehensive approach to asset portfolio management.

In line with this, the second framework is related to asset-based risk management strategies. According to this approach (Siegel & Alwang 1999), risk management strategies depend on:

(i) household wealth, which is manifested in the quantity and quality of the asset portfolio perception of risky events and outcomes
(ii) management objectives
(iii) the availability of risk management instruments.

These two frameworks focus on assets as being central to increase the adaptive capacity and reduce the vulnerability of poor people. As Siegel and Alwang (1999, p. 10) stated, 'Risk management strategies are household-specific and can change over time as conditions change'.

In this study, I use 'asset vulnerability' frameworks and 'asset-based' approaches to social risk management, to address the specific and contextual aspects of the vulnerability of different assets using vulnerability components (Cannon (2008). I will explain these components further in Section 1.3.4, as part of the framework of this study.

1.2.3 Livelihoods and global change

The 'livelihood concept' captures the capabilities and resources needed to sustain the basic needs of individuals, communities or societies. The concept of 'sustainable livelihoods' is based on the three fundamental principles of capability, equity and sustainability (Chambers & Conway 1991). According to Chambers & Conway (1991), a sustainable livelihood represents the capability of people to sustain their lives by maintaining, or gaining, basic needs. Furthermore, they argue that a livelihood is sustainable if it has the ability to cope with and recover from stresses and shocks; can maintain capabilities and assets; enhance well-being in terms of income; and provide equity and a livelihood for future generations at all scales and levels (Chambers & Conway 1991). 'Stresses' refers to the gradual process of disturbing forces such as long drought; population pressures on resources; effect of climate variability on agriculture productivity; and ecological change leading to bio-economic productivity. 'Shocks' refers to sudden disturbing forces such as floods, droughts, earthquake, storms, famines and landslips.

The 'sustainable livelihood concept (SL)' has been incorporated into development programs and activities, especially as a framework for analysing poverty reduction and assessing development outcomes (Ashley, Carney & Britain 1999; Sayer et al. 2007; Scoones 1998). The concept has been the subject of continuous development in the last 15 years, and has been widely adopted by many international aid agencies and non-government organisations (NGOs), such as Care, Department for International Development (DFID), Oxfam and United Nations Development Programme (UNDP) (Dazé, Ambrose & Ehrhart 2009; Ellis 2000b; Sayer & Campbell 2004; Stanford et al. 2014; Tittonell 2014).

Drawing from the definition of sustainable livelihoods above, Scoones (1998, pp. 5-7) recognised five indicators for assessing the sustainability of livelihoods, which have been adopted in policy discourse world-wide. They are:

 (i) labour opportunities for livelihood benefits

 (ii) poverty reduction

 (iii) well-being and capabilities. Indicators can be identified to assess material livelihoods (e.g. income and food), as well as factors such as self-esteem, security, happiness, stress, vulnerability, power and exclusion

 (iv) livelihood adaptation, vulnerability and resilience, which refers to the ability of a livelihood to deal with stresses and shocks from external disturbances and changes; also known as coping and adapting capacity

(v)   natural resource basis of sustainability, which refers to the resilience of the environment and its ability to maintain productivity and provide livelihood services when shocks or stresses have occurred.

Agrawal and Perrin (2009) classified the basic coping and adaptation responses applied to livelihood risks into four categories: (i) mobility, (ii) storage, (iii) diversification and (iv) communal pooling.

They argued that livelihoods and adaptation in rural households are highly influenced by the role of local institutions in distributing climate risk impacts, organising incentive structures for households and communities, and mediating external interventions to adapt them to the local setting.

In pursuing sustainable livelihood strategies, people have different options, depending on their tangible and intangible assets. Much of the literature describes five categories of capital assets that are commonly used to assess or describe sustainable livelihoods world-wide (Bebbington 1999; Sayer et al. 2007; Scoones 1998) (Figure 1.4). They are (i) financial or economic capital, (ii) natural capital, (iii) human capital, (iv) social capital and (v) physical capital.

Financial capital
Remittances
Household income
Credit associations
Employment

Social capital
Social organisation
Corruption
Local networks
Awareness of
boundaries

Natural capital
Deforestation rate
Frequency of fires
Level of erosion
Levels of biodiversity

Physical capital
Rural access to roads
Rural electrification
Village water supply
Housing quality

Human capital
Quality healthcare
Infant mortality
Quality of education
Skill levels

Figure 1.4 Indicators for the five capital assets (adapted from Sayer et al. 2007)

Scoones (1998) argues that the combination of these capital assets defines livelihoods based upon personal capabilities, tangible assets (e.g. stores and material resources) and intangible assets (e.g. claims to and access to resources).

This is not to say that livelihood is not a matter of material well-being, but rather that it also includes non-material aspects of well-being. Livelihood should be seen as a dynamic and holistic concept. In the words of Bebbington (1999, p. 2022):

> A person's assets, such as land, are not merely means with which he or she makes a living: they also give meaning to that person's world. Assets are not simply resources that people use in building livelihoods: they are assets that give them the capability to be and to act.

> Assets should not be understood only as things that allow survival, adaptation and poverty alleviation: they are also the basis of agents' power to act and to reproduce, challenge or change the rules that govern the control, use and transformation of resources.

The position of assets in the livelihood system, as stated by Bebbington (1999), is closely aligned to the focus of my study. Livelihood approaches should address the transforming structures and processes (DFID 1999), policies, institutions and mediating institutions and organisations (Ellis 2000b; Leach, Mearns & Scoones 1999; Scoones 1998). The transforming structures are related to institutional arrangements that operate in all levels from household to the international arena, including private and public entities.

Morse (2013) listed six challenges of the livelihood approach, with regards to livelihood assets and policy implementation (Morse 2013, pp 43-46). Three of them were relevant to this thesis:

(i)   the paradox of a 'people-centred' approach. The existence of 'people' is questionable in livelihood analysis even though there is 'Human capital'. It explains institutions, policies and influences but these aspects do not represent 'people' as a centre of analysis. Instead, the livelihood approach needs to focus on 'culture' as an important attribute to understand people

(ii)   the complexity of measuring and analysing livelihood assets

(iii)   the limitations of vulnerability analysis, especially for unpredictable shocks and risks caused by both natural and non-natural hazards, which affect the resilience of people in the face of those hazards (Kelman & Mather 2008).

As Sayer (2009 p. 10) argues, the improvement of people's livelihoods should not only focus on 'what the people are doing now, but what they might do in future in facing economic challenges'.

To address the three limitations of livelihood above, one suggestion is for livelihood approaches to be carried out or designed at the relevant scale (e.g. at the household-level).

1.2.4 Adaptation and development

Global climate change policy initially focused on collective negotiation of urgent action to reduce greenhouse gas emissions caused by human activities. The international community agreed to address mitigation and adaptation as climate change policy responses, which were 'complementary', 'substitutable', or 'independent' of each other (IPCC 2007). Climate change adaptation was to be addressed across global and local scales, through international, national, and local government actions, with the aim of reducing vulnerability to the expected impacts of climate change (United Nations Framework Convention on Climate Change 2007).

Climate change adaptation is now perceived as being central to many development programs in both developed and developing countries. In fact, 'adaptation' has become a magic word for international donors supporting development assistance (Meadowcroft 2009; World Bank 2009). Literature on climate adaptation has expanded tremendously in the past few decades. Definitions of adaptation to climate change vary among scholars and context. However, adaptation cannot be separated from development. In this context, 'development' is related to the continuous process of improving human societies (Rist 2008). Therefore, this study takes a definition that encompasses sustainability in human dimension and livelihood activities.

This study followed the definition from Rennie and Singh (1996, p. 18) who defined adaptation as 'ways in which local individuals, households and communities have changed their mix of productive activities, and modified their community rules and institutions in response to vulnerabilities, in order to meet their livelihood needs and adapt to unpredictable changes including climate change'. In general, this definition addresses adjustment by humans in relation to improving their livelihood system, and at the same time reducing their vulnerability.

Many scholars have identified the characteristics of adaptation based on purpose, occurrence, timeline and location (Ayers & Dodman 2010; Kates 1985; Klein, Schipper & Dessai 2005; Smit & Wandel 2006; Vogel et al. 2007). For instance, the definition of adaptation is similar to that of a coping mechanism (Huq & Reid 2004). The terms 'anticipatory adaptation' and

'reactive adaptation' refer to the time of response to climate change impacts, where 'anticipatory adaptation' is taken before impacts occur; and 'reactive adaptation' is conducted after the impacts have taken place. Moreover, the terms 'adaptation to climate variability' versus 'adaptation to climate change' explain the difference in the root cause of climate change between human-induced and naturally occurring climate variability. In fact, both adaptation terms depend on the characteristics of climate stimuli such as temperature, precipitation, rainfall and salinisation.

'Climate' describes the interaction or dynamic changes in the atmosphere (weather) over a long period of time (e.g. years, decades, centuries) (Pittock, AB 2013). 'Adaptation to climate variability' is the response to variations in short-term climate conditions such as annual precipitation and any associated weather events.

In contrast, 'adaptation to climate change' refers to adjustment in the face of new climate conditions, which may arise both naturally and through human activities over long periods of time (Pittock, A & Jones 2000; Smith et al. 2000).

The literature distinguishes 'planned adaptation' from 'autonomous adaptation' to climate change (Nelson, Adger & Brown 2007; Pittock, A & Jones 2000). 'Planned adaptation' describes adaptation that takes climate change and variability specifically into consideration. In contrast, 'autonomous adaptation' refers to a spontaneous response that is not consciously triggered by climate stimuli, but is instead caused by ecological changes in natural systems and by market or welfare changes in human systems (IPCC 2007). In the context of long-term vulnerability, autonomous adaptation has limited application since it only considers ecological changes in natural systems and market and welfare changes in human systems. The definition disregards other spontaneous adaptation measures, such as changes from nature due to human efforts in conservation.

The majority of the studies listed above also highlight the importance of human behaviour in climate change adaptation. This includes institutional dimensions and adaptation within social systems (Agrawal 2008; Christoplos et al. 2009; Fankhauser, Smith & Tol 1999; Smithers & Smit 1997). Putting emphasis on the human dimension has enriched the conceptual debate about climate adaptation. This notion is based on the fundamental concept that climate change adaptation cannot be separated from a long history of human development and risk management (Christoplos et al. 2009; Lewis 1999).

The complexity of climate change impacts is inter-related with ongoing development practices. In this regard, many development agencies (e.g. the World Bank) have argued that adaptation should be integrated or mainstreamed into development agendas (Schipper 2007). This integration is supported by many scholars who provide frameworks and technical guidance (Huq, Reid & Murray 2006; Klein et al. 2007). In fact, mainstreaming adaptation has faced many challenges and barriers. Taking the example of international development assistance for weather extremes in Mozambique, Sietz et al. (2011) found that the barriers to integrating climate change adaptation exist at all institutional levels, from individuals to organisations. These barriers hinder both climate adaptation and ongoing development processes, such as institutional arrangements and availability of resources and information; and are made worse by unclear mandates and networks.

Drawing this insight into the climate change adaptation-vulnerability and development nexus, adaptation can be divided into two different approaches: (i) an 'adaptation approach' to development and (ii) a 'vulnerability reduction approach' to development (Schipper 2007). Integrating or mainstreaming adaptation into development processes is the fundamental idea of the adaptation approach. This concept comes from multilateral and international agencies where the central point is that climate change adaptation processes should be embedded into the development agenda (e.g. World Bank and UNDP). As a consequence, many development projects should take into account, or mainstream, climate change considerations. The term 'climate-sensitive project' (Schipper 2007) has been used to describe these approaches.

In contrast, some scholars have argued that vulnerability reduction should be considered first in the development agenda before specific adaptation strategies are conducted (Christoplos 2010; Kelman & West 2009; O'Brien et al. 2006; Schipper 2007). The basic reason for this approach is that the vulnerability of societies is usually caused not by climate stress, but rather by other pressures (Wisner et al. 2011). This situation can be seen in developing countries, which are also struggling with social, economic and other developmental problems. Different approaches to adaptation strategies can be seen in Figure 1.5.

Adaptation Approach

Adaptation to Climate Change Impacts → Vulnerability Reduction → Development

Vulnerability Reduction Approach

Development → Vulnerability Reduction → Impact Reduction → Adaptation
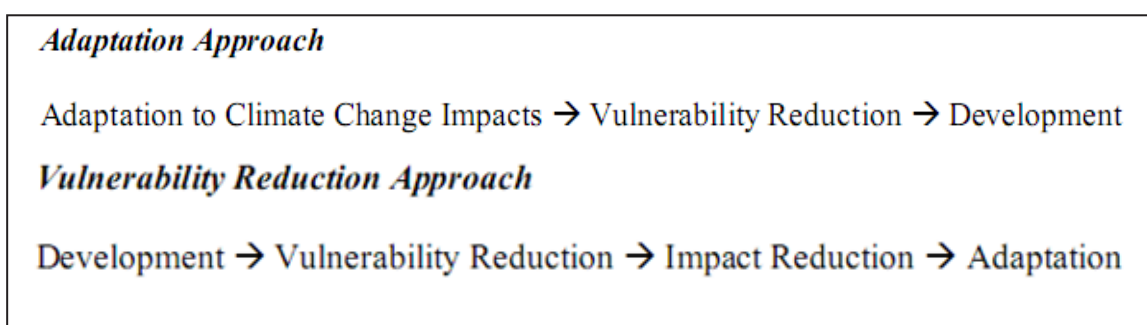
Figure 1.5 Different approaches to linking adaptation and development (Schipper 2007)

Climate change adaptation strategies should not only consider climate impacts on the community, but also take into account other changes. These changes may weaken the community's capacity to adapt to any changes in their everyday lives. Gaillard (2010) argued that 'development failure' is closely related to the fundamental causes of vulnerability of the people who suffer from disasters triggered by climate and natural hazards. Similarly, Schipper (2007) asserted that the level of people's vulnerability to climate-related and other hazards is linked to the inability of development processes to reach their goal. This implies that adaptation to reduce impacts from particular climate hazards should also consider development problems related to the impacted people or objects. This highlights the importance of considering development contexts and perceptions contributing to vulnerability, when developing adaptation strategies.

1.2.5 Vulnerability components for household analysis: framework of the study

The framework for my study uses six vulnerability components to understand why some people are more vulnerable than others, and the interconnections between vulnerability and resilience. These components are interconnected and will be used as a diagnostic tool to understand the vulnerability condition and perceptions of household groups in this study. Any disconnection or problems with any component can be identified as a potential point of policy intervention for development. The components will be indicated in each chapter for detailed discussion.

I have used Cannon's (2008) five vulnerability components and added a sixth to examine the heterogeneity of vulnerability drivers, along with their capacity for resilience amongst different livelihood assets at the household-level, within three rural communities in Lombok, Indonesia. These components are:

     (i)   livelihood strength and resilience
     (ii)   well-being
     (iii)   self-protection
     (iv)   social protection
     (v)   governance
     (vi)   institution.

'Institution' was added as the sixth vulnerability component since institutions play a pivotal role in driving governance through formal and informal structures (Van Kersbergen & van Waarden

2004). Institutions have an influence on social and self-protection because they mediate income and resources; they also govern social protection to respond to hazards.

The six components of vulnerability are interlinked and highlight the potential of intervention points (Cannon 2008). Therefore, by understanding the condition of each component we can map or analyse potential disconnections to determine whether a person or group of people is more vulnerable or resilient than others.

The first vulnerability component is livelihood strength and resilience. Strength refers to the flexibility of livelihood assets in maintaining the appropriate return, or livelihood benefits, which is indicated by higher and lower levels of returns (Cannon 2008; Siegel & Alwang 1999). This flexibility usually depends on the quality and quantity of available and accessible assets of individuals. In the context of natural hazards, including climate variability, livelihood resilience also becomes an important concern. Pelling (2003, p. 48) defined resilience as 'one component of vulnerability, or the ability of an individual to cope with or adapt to hazard stress. These acts include the planned preparation and spontaneous, or premeditated, adjustments to be undertaken in facing hazards including climate hazards or other livelihood pressures'. A livelihood is considered to be resilient when it can 'adapt' using existing resources based on the ability of individuals or groups (Davoudi 2012; Weichselgartner, Juergen & Kelman 2014).

The second component is well-being, which is represented by individual attributes such as physical status, nutrition consumption and mental condition. This component is highly connected with an individual's livelihood ability and strength. Well-being is a basic condition that reflects individual ability, and is not necessarily influenced by being part of a community or group (Cannon 2008). However, individual or household well-being can be improved when there are interventions from outside, such as food security, provision of improved nutrition and educational programs.

The third component is self-protection, which refers to the ability of individuals to provide resources (e.g. knowledge, materials and skills) and income to protect themselves from climate hazards. Self-protection is most likely to be an individual process which is also influenced by livelihood conditions. This concept is in line with 'self-insurance' on the asset-based approach to social risk management, proposed by Siegel and Alwang (1999). In this context, a livelihood is the first 'line of defence' against any shocks and trends (Cannon, Twigg & Rowell 2003; Gaillard, et al. 2009) . For example, a person could build a cyclone-proof house if they have sufficient income from livelihood activities. Therefore, livelihood strength and resilience directly determine the performance of households or individuals in protecting themselves.

The fourth component is social protection. This is related to the availability of external support if the impacts of natural hazards and other shocks are beyond one's self-protection ability. Social protection is important for certain households or groups that may not have sufficient livelihood resources for future prevention in facing any shocks and trends. This protection might be provided by local institutions, government and other organisations. Social protection could provide technical knowledge and/or material assistance.

The fifth component is governance, which is defined as 'the sum of the many ways individuals and institutions, public and private, manage their common affairs [….] It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest' (Governance Global 1995, p. 2). Hence, governance is much more than just government, and has a strong influence on driving livelihood outcomes. Governance influences the distribution of risks through power and relations, which are driven by formal and informal institutions. Potential key disconnection is the erosion of local institutions, which could undermine the quality of governance systems. Bad governance is more likely to put people in a more vulnerable condition and will directly influence the reliability of social protection.

The last vulnerability component is the institution. The term 'institution' has been broadly used to describe the social arrangements for reducing uncertainty in human societies (CGIAR 2012). Hodgson (2006, p. 2) defines institutions as 'systems of established and prevalent social rules that structure social interactions'. This definition covers both the formal (e.g. government organisations) and informal systems (e.g. traditional institutions and collective action) which apply 'rules of the game' or regulation. In this way, institutions constrain human interaction and behaviour in order to stabilise expectations in human needs (Mehta et al. 1999; O'Riordan & Jordan 1999).

The interconnections between vulnerability and resilience that were used to understand why some people are more vulnerable to natural hazards and shocks than others, are shown in Figure 1.6.
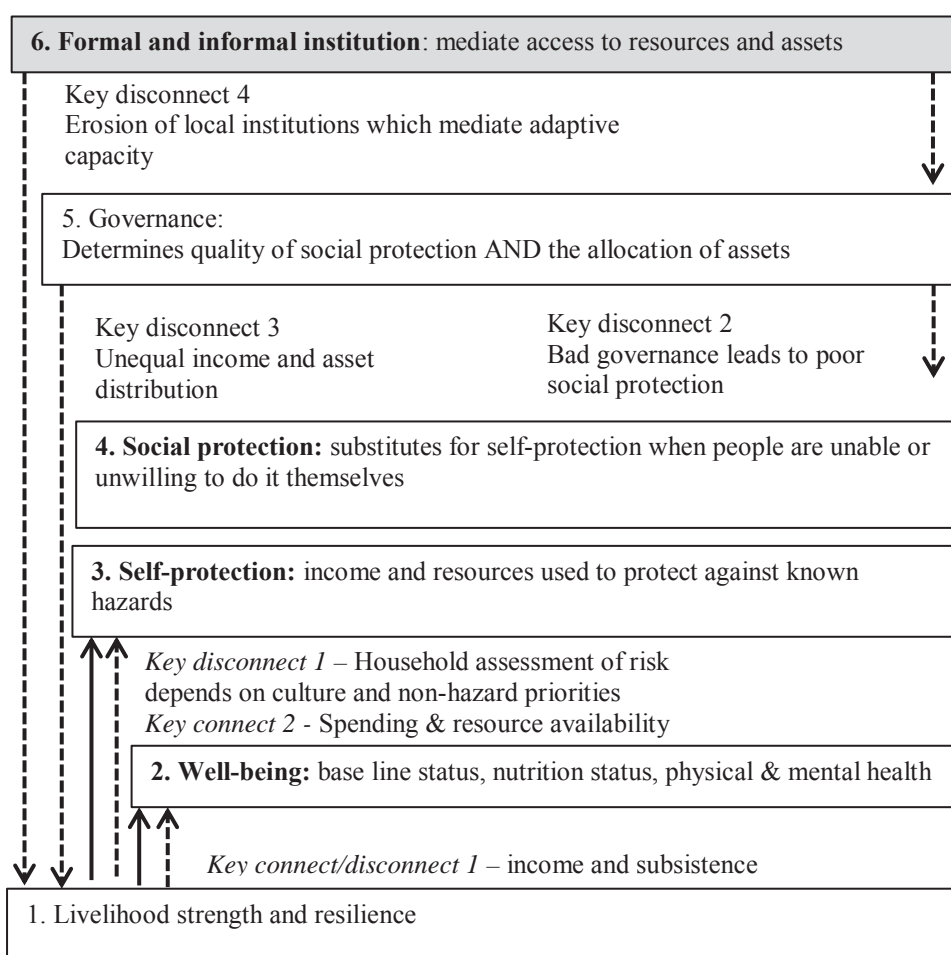
Figure 1.6 Six vulnerability components and their main determinants (Adapted from Cannon 2008).

Note: The extent of a person's vulnerability is determined by the strength and resilience of their livelihood (box 1), in the face of sudden or gradual disturbing forces, including climate hazards. The quality of a person's well-being (box 2) and self-protection (box 3) is highly determined by their livelihood strength. The distribution of assets and income is related to governance structures which also determine the quality of social protection (box 4). Livelihood flexibility and differences among different groups of people are strongly influenced by the type of governance in operation (box 5). The governance framework that exists in society is strongly influenced by formal and informal institutions which mediate access to resources.. Institutional dynamics within society regulate the ability of an individual to build self-protection from livelihood disturbances (box 6). Poor governance is unlikely to provide social buffers during hardships (Manuta & Lebel 2005). This, in turn, may affect the self-protection component because, when governance is strong, self-protection could be replaced by communal protection in the event that individuals are unable to protect themselves. For example, some areas with better governance and institutional arrangements than others will provide more opportunities for NGOs and other organisations to fill gaps resulting from insufficient development. Dashed arrows show the indirect connection/influence of one component to another, while solid arrow shows direct connection/influence of component. However, one component could have two lines of connection. For example, self-protection could directly influence the livelihood strength and resilience, but it also weakened the people livelihood if they do not have stable incomes and access to resources disconnections (dashed arrows). Institutions and potential disconnections (4) to governance, social and self-protection. A disconnection happens when one component is not adequately supported by other components.

1.3 Research aim and objectives

My study aimed to examine the heterogeneity of vulnerability amongst rural communities on Lombok island, Indonesia, and consider implications for adaptation policy interventions. My main hypothesis was that the diversity of social-economic dynamics and linked asset structures require locally-specific adaptation strategies.

My main research question was '*How can complex socio-economic dynamics and household asset differences inform development interventions to aid adaptation*?' Specifically:

- How do household asset types influence vulnerability and coping preferences?
- How do interdependencies amongst households influence vulnerability and adaptation options?
- What are the implications of household asset structures for developing adaptation strategies and reducing future vulnerability?

Research objectives

- to examine the influence of asset differentiation on household vulnerability and coping strategies
- to investigate the relevance of local institutions for vulnerability and adaptation
- to analyse the inter-dependency of households during difficult and normal conditions
- to provide recommendations for development interventions to account for differences in households' asset structures.

1.4 Thesis organisation and structure

My thesis is divided into seven chapters. Chapters 3-6 present the results of empirical studies carried out on the island of Lombok in Indonesia. Figure 1.7 provides the general structure of thesis organisation and shows the connection of thesis objectives with chapter contents.

- **Chapter 1** introduces the research context and background, including the concepts, conceptual framework and research components.
- **Chapter 2** describes the study location, its general characteristics and the methodology used in the study.
- **Chapter 3** analyses the household type based on relative livelihood assets in three study villages. Vulnerability perceptions and coping preferences are also investigated to see the differences among household types.

Chapters 4-6 focus on detailed conditions of the village of Ekas Buana (coastal community) as a case study.

- **Chapter 4** elaborates on the role of local institutions in mediating vulnerability and adaptation. This chapter also specifically focuses on how vulnerability components are used as a framework to define household types in Ekas Buana.
- **Chapter 5** examines the inter-dependencies among households during normal conditions and times of hardship. These inter-dependencies can also be used as intervention points for adaptation.
- **Chapter 6** discusses the linkages between adaptation needs of each household type and how current development programs match with asset structure and capacities. Potential points of interaction are based on the dependency map described in Chapter 5.
- **Chapter 7** synthesises the four empirical chapters (3-6), and provides insight for future adaptation by considering the heterogeneity and complexity of household structure in three villages.
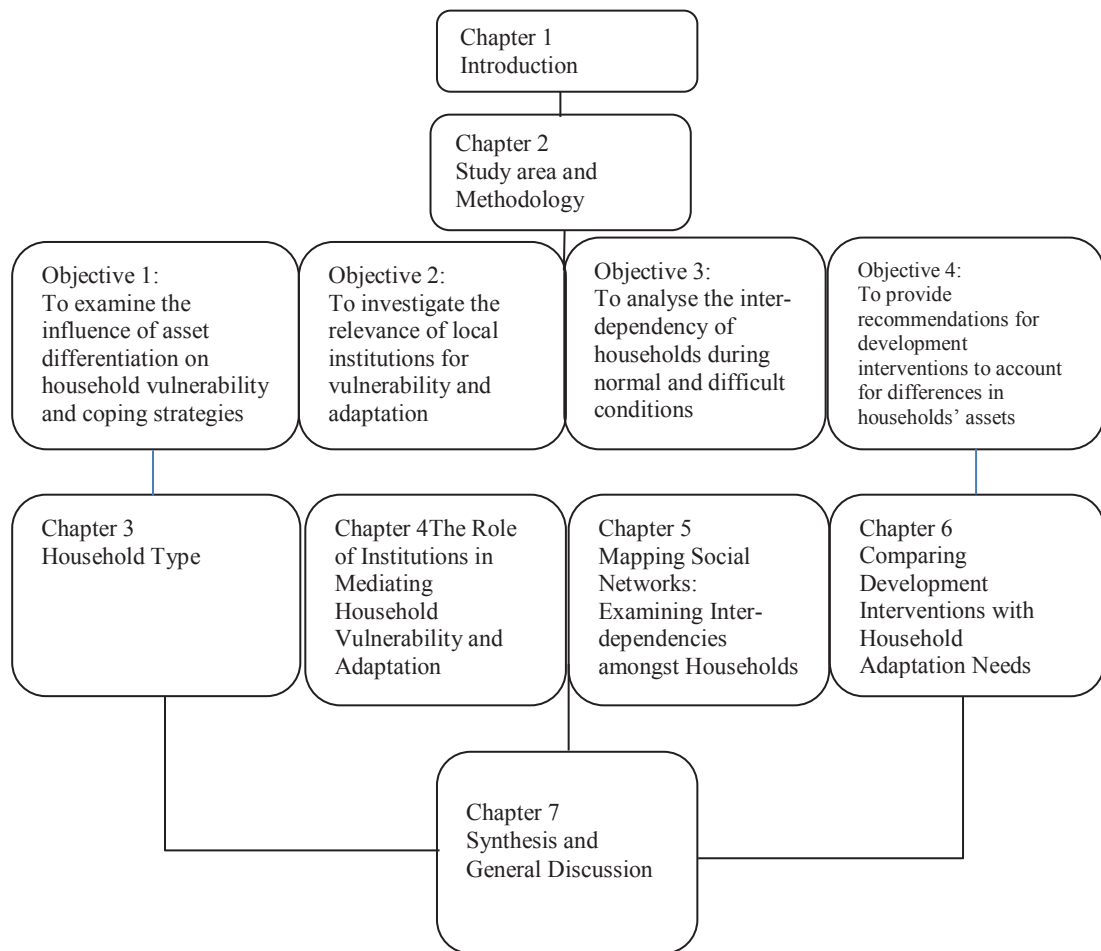
Figure 1.7 Thesis structure

In Chapter 1, I explained the background of this thesis, factual impacts and policies, theories reviews, and study framework using vulnerability components. In Chapter 2, I will elaborate on the study area and the methods used in examining the heterogeneity of vulnerability and capacity in three communities on Lombok, with different cultural and physical environments.

CHAPTER 2: STUDY AREA AND METHODOLOGY

2.1 Introduction

Rural areas in eastern Indonesia are highly sensitive to climate variability and other changes in their livelihood systems. Poverty, the environment and local economic conditions also determine the capability of communities to deal with change. I first describe the socio-economic characteristics and development settings of my study areas on Lombok island. I then outline the research methodology and strategies employed for my data collection and analysis.

2.2 Study area

2.2.1 Geography and land use

Lombok lies in the island archipelago of south-eastern Indonesia. The East and West Nusa Tenggara island group extends west from West Papua province on the island of New Guinea, towards the island of Bali. Lombok lies between latitudes 8° 12' South (S) and 8° 15' S, and longitudes 115° 46' East (E) and 116° 28' E, and covers an area of 4,725 km^2. It is one of the two main islands in West Nusa Tenggara (NTB) Province of Indonesia; the other main island is Sumbawa which covers an area of 15,448 km^2. Lombok is bordered by the Java Sea to the north, Alas Bay to the east, the Indian Ocean to the south and Lombok Bay to the west (Figure 2.1). My study was conducted in three villages on Lombok island: Santong, (a forest community), Pandanwangi (a rain-fed agriculture community) and Ekas Buana (a coastal community).
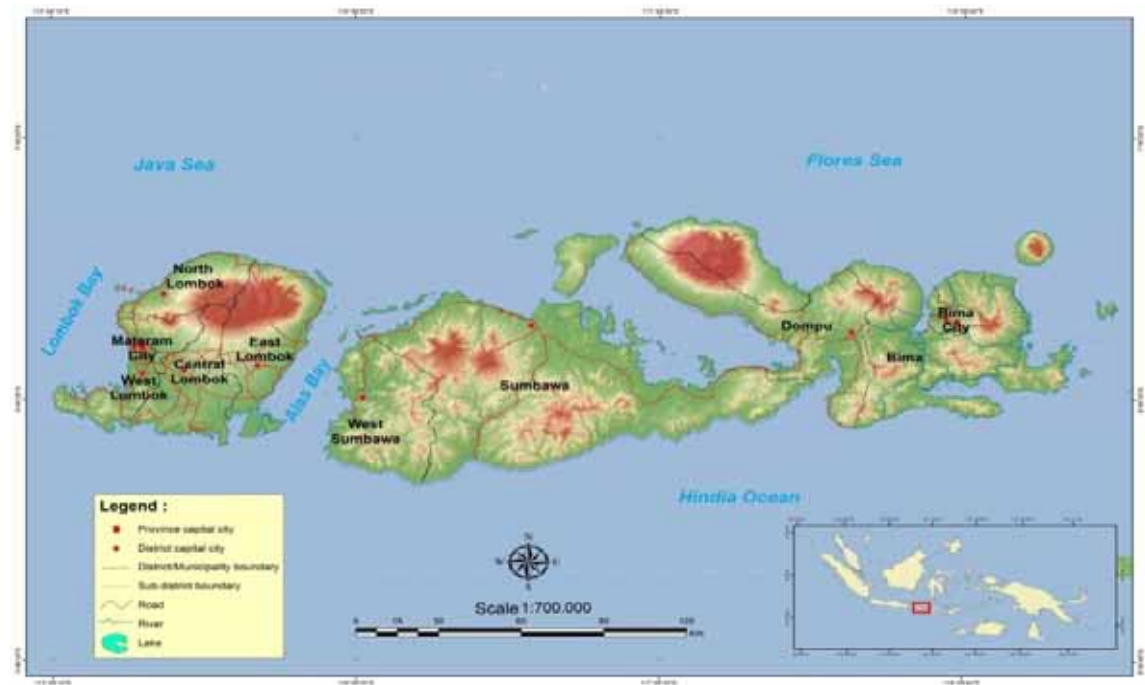
Figure 2.1 Geographical location of Lombok island, Indonesia (Bappeda NTB 2010b).

The existence of the active volcano, Mount Rinjani (3,726 m), has influenced the soil structure and climate of Lombok. Volcanic activity and topography have resulted in a series of different agro-ecological zones across the island. These biophysical characteristics have determined the pattern of livelihood activities of the population. Livelihoods range from rain-fed agricultural systems in the southern part of the island, to dryland cropping activities in the northern areas (Sjah & Klock 2007). In general, land use in Lombok Island is predominantly paddy field (31%), forest (26%) and dryland/rain-fed agriculture (23%) (Figure 2.2). These three contrasting landscapes influence people's livelihood activities and the local economy. Intensive irrigated agricultural systems are mostly located in the areas surrounding the Mount Rinjani catchment, which covers most of the centre of the island.
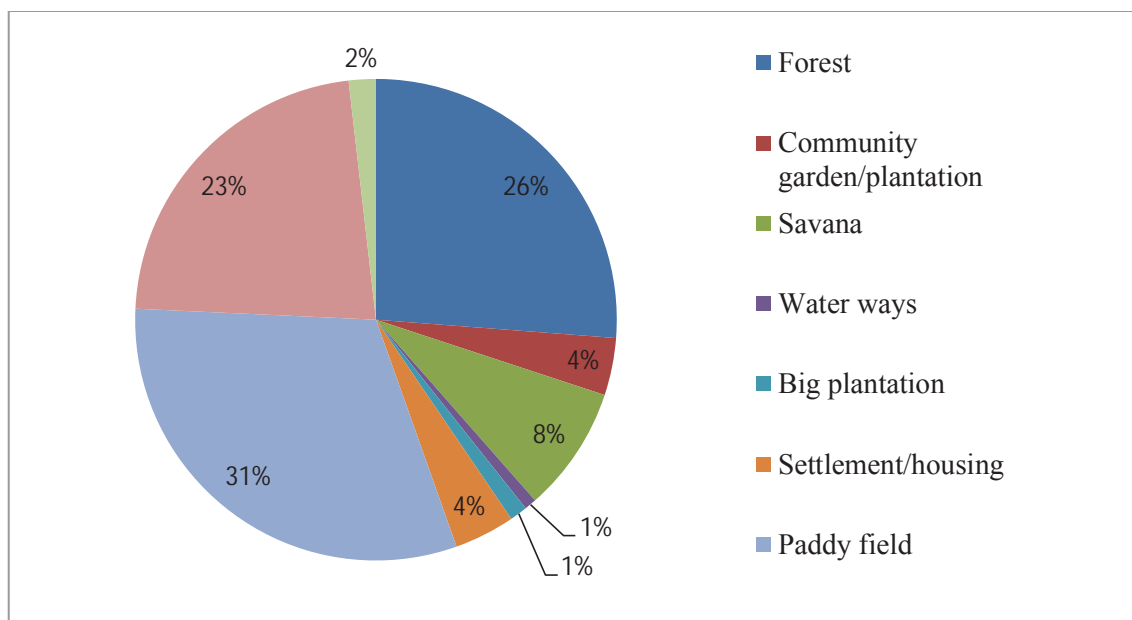
Figure 2.2 Distribution of land use types in Lombok (Bappeda NTB 2010b).

2.2.2 Socio-economic characteristics

Lombok consists of five administrative areas: Mataram (the capital city of West NTB province), West Lombok, North Lombok, Central Lombok and East Lombok. The total population of Lombok is 3.2 million people, with an annual growth rate of 2.3 percent (BPS 2012a). Population growth is higher than the Indonesian average which was 1.49 percent in 2000-2010 (BPS 2012b). The distribution of the population is uneven across the island (Table 2.1). In the northern part of the island, the density averages 250 people per square kilometre, compared to more than 6,500 people per square kilometre in Mataram and surrounding areas, where the more fertile soils are situated.

In terms of the Human Development Index (HDI), Lombok island ranks among the lowest positions, at the national-level. The HDI measures the social and economic dimensions of development achievements, using a statistical tool (Sagar & Najam 1998). HDIs represent education attainment (expected years of schooling, mean of years of schooling), health of people (life expectancy for health), and economic dimension (purchasing power parity, gross National Income per capita for standard of living). Almost all districts on the island have low HDIs when compared to other districts on adjacent Sumbawa island (Table 2.1). The poverty rate is high, with 21.94 percent of the total population living below the poverty line (BPS 2011).

The predominant indigenous people of Lombok, the *Sasak*, made up to 90 percent of the population in 2010 (Fachry 2011), and are predominantly Muslim. Another common ethnicity is the Balinese, who have been in Lombok since the 17th century. The Balinese still maintain their culture and religion, which has also influenced the *Sasak* culture. Other ethnicities occur in small numbers, and this contributes to the diversity of the island; these include Japanese, Chinese, Arabs and people from neighbouring islands, such as Sumbawa and Sulawesi (BPS 2012a).

In Lombok, agriculture plays a dominant role in supporting the rural economy. In 2013, the agriculture sector grew by 2.5 percent, with a total economic growth in 2013 of around 5.6 percent (BPS 2013a). Other sectors, such as services (e.g. tourism industry, banking), construction and transportation, provide a slightly higher contribution to the economy, but these activities are mostly concentrated in developed urban areas. Since the primary livelihood activities in rural areas are agriculture-based, the possession of land is a vital asset for generating income (Sjah, Cameron & Woodford 2006). Most of the agriculture in Lombok is by smallholders and is typified by extremely small land holdings (less than 2 ha), with a mix of crops, trees and livestock (Lisson et al. 2010). The smallholders are often involved in contract farming in order to gain access to markets.

Smallholder farmers tend to bear more risks since they do not have access to market information or alternative purchasers of their produce. This situation may lead farmers to take risks, which can lead to bankruptcy and the sale of their assets. Market uncertainty and dependence on single purchasers makes farmers vulnerable and adds to the fragility of their livelihoods.

Decentralisation has occurred since 1999 (Jakimow 2014) and many local governments have focused all their efforts on economic growth. Local development was impacted by liberalisation of the economy but also by the financial crises of 1997 and 2008. Increases in basic staple commodity prices also placed greater burdens on daily life, and day-to-day living became more challenging for the poor. One of the more common strategies for coping with difficult situations in the poor rural communities in Lombok, is undertaking migrant labour in Malaysia, Saudi Arabia and other middle-eastern countries (Butler et al. 2014). In 2012, 90 percent of the total migrant workers leaving NTB province were from Lombok (BPS 2013c). They work in various occupations, but mostly as housekeepers and plantation workers.

Table 2.1 Total population, area, density, Human Development Index (HDI) and poverty rate of each administrative region in Lombok Island.

Administrative Region	Total population	Area (km^2)	Density (people /km^2)	Individual HDI	HDI Ranking at provincial level	Poor people	%
West Lombok	613,161	1,054	582	63.82	8	121,249	20.01
Central Lombok	875,231	1,208	724	63.51	9	163,458	18.81
East Lombok	1,123,488	1,606	700	65.78	7	259,396	23.23
North Lombok	203,564	810	251	61.9	10	82,474	40.81
City of Mataram	413,210	61	6,741	74.58	1	59,128	14.53
Total NTB Province	**3,228,654**	**4,739**	**1,799.62**	**67.73**	**32 of 33**	**708,213**	**21.94**

Source: West Nusa Tenggara 2013 and the Wealth Regional Indicators for 2011 (BPS 2011, 2013c).

2.2.3 Climate variability and changes

Lombok has a monsoon climate with two seasons (rainy and dry) and an average total annual rainfall of 1,200-1,700 mm (MoE 2010b). The rainy season occurs between December and February, with January being the wettest month. Due to its geographical location, Lombok is strongly affected by El Niño Southern Oscillation (ENSO) events, which can cause both drought and floods that exceed long-term averages. Climate variability is influenced by topographical patterns from the northern to the southern part of the island (Qian, Robertson & Moron 2010). Topography of the island also influences the onset and the duration of the rainy season. For example, areas surrounding Mount Rinjani experience higher rainfall; in contrast, droughts and prolonged dry seasons usually occur in the southern part of the island.

Soil types are varied and this creates differences in the natural and agricultural systems. The combination of rainfall patterns and soil types has resulted in a diversity of agro-ecological zones such as rain-fed and irrigated agriculture, and dryland systems (Sjah & Klock 2007).

A study of climate change vulnerability conducted in Lombok by the Ministry of Environment (MoE) and Deutsche Gesellschaft für Technische Zussamenarbeit (GTZ) (2010b) found that there have been significant changes in rainfall and temperature patterns between 1961-1990 to 1991-2007(Figure 2.3A-B). This study also predicted a relative increase in temperature of around 1°C by 2050 (Figure 2.3B), and continuing increases in temperature of 2-3°C by the year 2100 (MoE 2010b). The study predicted significant impacts on water resource availability, sea-level rise, and natural resource-based economic sectors such as agriculture, fisheries and forestry (MoE 2010b).
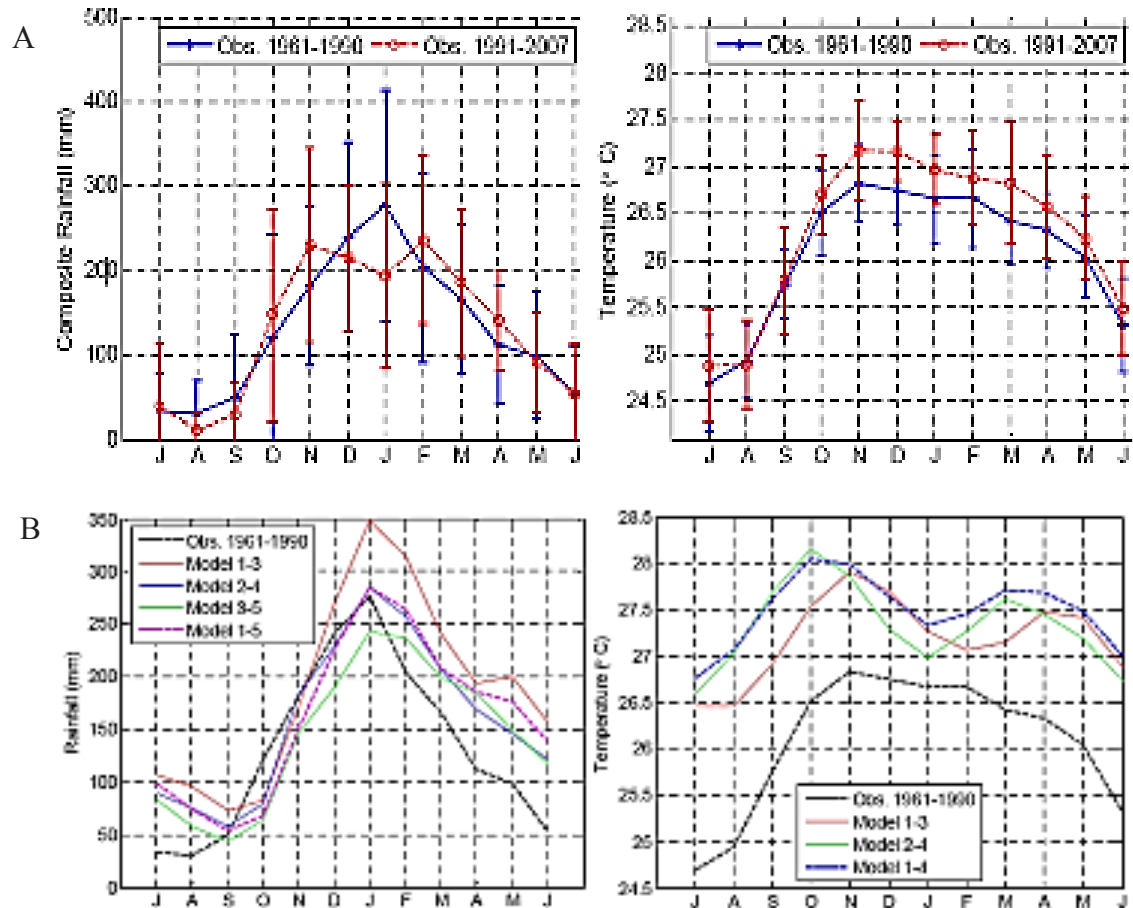
Figure 2.3 A comparison between baseline conditions (1961-1990) of monthly average composite rainfall and temperature predicted for 2020-2050.(Fig. 2.3A: rainfall (left) and temperature (right). Fig 2.3B shows predicted rainfall and temperature for 2020-2050, using different models: (1) European Centre Hamburg (ECHAM5) model, (2) Geophysical Fluid Dynamics Laboratory (GFDL2.0) model, (3) GFDL2.1, (4) Magnetic Resonance Imaging (MRI) model, and 5) Commonwealth Science And Industrial Research Organisation (CSIRO) model (adapted from MoE-GTZ 2010).

The implication of this prediction is that the northern and central part of the island, especially the area surrounding Mount Rinjani, will experience much wetter conditions during rainy seasons in the future. The increased intensity of rainfall could trigger more landslides and flooding because the deforestation rate is quite high in that area. In the agricultural areas in the south of the island longer dry seasons could cause crop failures and lead to food insecurity (Yasin & Ma'shum 2006).

2.3 Study locations

Three villages in different agro-ecological zones were selected for this study: Santong (a forest community), Pandanwangi (a rain-fed agriculture community) and Ekas Buana (a coastal community). Santong village is situated in North Lombok District, while Pandanwangi and Ekas Buana are located in East Lombok District (Figure 2.4). The selection of these three villages was based on their potential sensitivity to climate variability and socio-environmental changes. The selection was also based on consultation with several local NGOs and government organisations at the provincial- and district-level; as well as a discussion with CSIRO in Australia who were conducting research on climate futures and rural livelihood adaptation strategies in West Nusa Tenggara province.
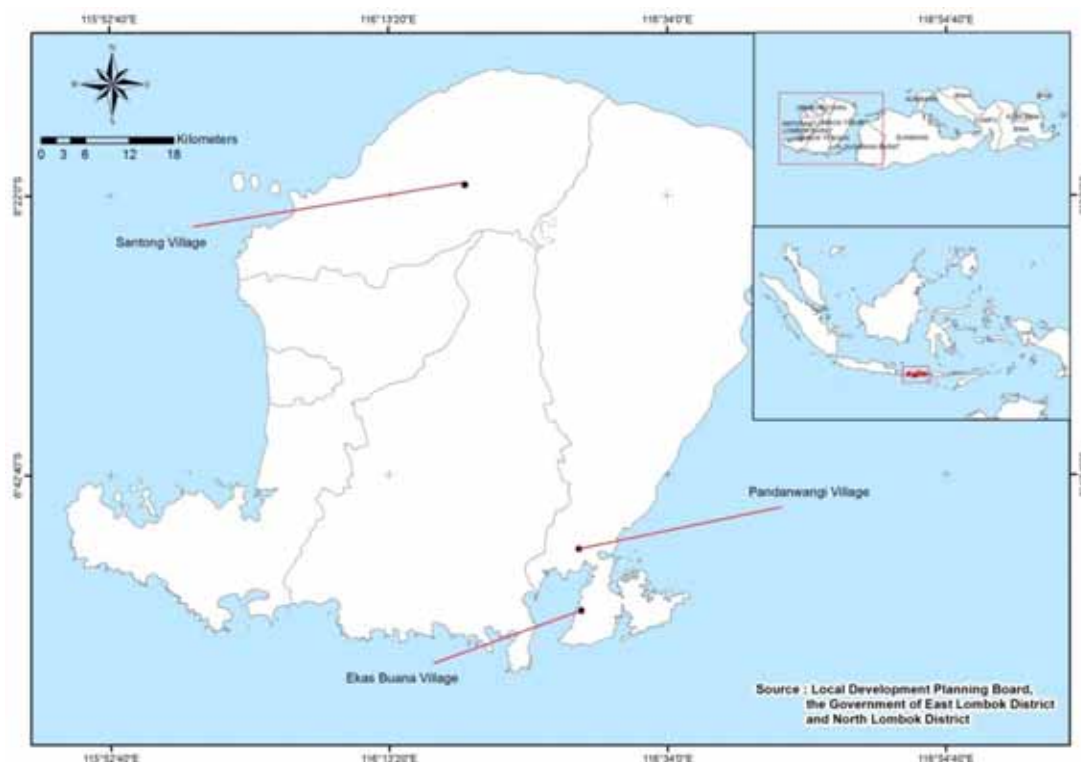
Figure 2.4 Locations of the three study sites in Lombok

2.3.1 General characteristics, livelihood activities and historical overview

A. Santong

Santong village is located in Kayangan sub-district, North Lombok. In 1997, Santong was divided into five sub-villages and further extended to 12 in 2011. The sub-villages were

Temposodo, Santong Asli, Gubuk Baru, Subak Sepulu, Waker, Santong Timur, Santong Barat, Santong Tengah, Suka Demai, Mekarsari, Cempaka and Sempakok.

In 2013, Santong had a population of 5,819 people with 2,778 men and 3,042 women, 100 percent were Muslim (BPS 2014). The dominant ethnicity in Santong Village is *Sasak*. However, the population also includes people from other parts of Indonesia including Java, Sulawesi, Sumbawa and Sumatra.

Santong is well-known for its successful community forestry program. Currently, 225 ha of forest land are under community management by 258 households (Tuarita 2012). Community Forestry (CF) programs are able to bring significant benefits to local people, while at the same time strengthening local institutions which conserve the forest ecosystem through traditional knowledge (Figures 2.5A-B). Community forestry generates local economic activity and provides job opportunities for local people. In addition to CF there are small-scale plantations of cloves, coffee and cocoa, irrigated agriculture and cattle husbandry. Forestry and agriculture are the main sources of income for the people of Santong. These natural resource-based livelihoods are supplemented by small local businesses and services.

Initially the Santong area was entirely covered by forest. The community used a slash-and-burn agricultural system regulated by strong customary laws. In the early 20th century, even though the forest was nominally under state authority, forest management was governed by a traditional natural resources manager called '*Mangku Alas*' (a person who is responsible for forest management; in Satria 2007 p. 203).

In 1957 the Ministry of Forestry changed the status of the protected forest to limited production forest and a private company was granted a licence to log the forest. Under this new regulation local people were forbidden from entering the forest and utilising forest products. This increased tensions between the local community and the state. In 1970, clove cultivation was introduced to the area through a government program. The community tried to move from subsistence farming to a market economy. However clove cultivation was a top-down imposition and its viability was influenced by a range of external factors. Cloves are still cultivated but they have not yielded the local economic benefits that had been expected. Sixteen years after the introduction of the clove plantation program, the government initiated a coffee program as a buffer zone around the protected forest; but it was unsuccessful due to unclear land ownership and poor technical support from the national and provincial governments.

In 1997, the government launched the Community Forestry Program at the site of the coffee plantation. At the beginning of this period, there was no clear guidance from central government on who was eligible to manage the land, and the protected forest was almost totally cleared by loggers. However, the community was able to exercise a degree of self-organised land management through traditional local institutions. This initiative by the people allowed Santong to achieve a more stable condition than the other two villages in this study. A farmers' co-operative was established with the aim of strengthening community forestry activities. Trees and cash crops were diversified to provide more income sources for the members of the community forestry group (Figures 2.5C-D).

Figures 2.5A-D. Conditions of forest and livelihood activities in Santong Village. Picture A was taken before CF began and picture B was taken in the same location under community management. Picture C is showing the harvesting time of banana as a weekly cash crop. Picture D portrays the CF trees and crop structure.

B. Pandanwangi

Geographically, Pandanwangi is located in the south of East Lombok District. Pandanwangi is administered under Jerowaru sub-district, which borders Batu Putik village in the north,

Jerowaru village in the east, Pemongkong village in the south, and Wakan and Suka Damai villages in the west. Pandanwangi consists of 15 sub-villages. In 2013, the total population was 8,333 people, with 3,382 women and 3,951 men (BPS 2013b). People in Pandanwangi are predominantly Muslim, with relatively strong traditions and culture.

The landscape is dominated by rain-fed agriculture in the area around the village. Approximately 90 percent of the people work as farmers, 8 percent as fishers, and the rest work in various occupations, such as teaching, public service and trading or commerce. However, in practise, people often combine a number of formal and informal occupations.

Pandanwangi people were originally highly dependent on cassava and maize crops as they had limited knowledge of dryland cultivation. In 1966, people began cultivating 'big paddy' (a variety of rice that is native to Lombok) for their own consumption. However, productivity was low because they could only harvest one crop per year.

In the early 1980s, 'Green Revolution' rice varieties were introduced to Lombok. However, poor subsistence farmers did not have the resources to access these new varieties or to purchase fertiliser, and they faced difficulties because of their limited farming skills. (Cederroth & Gerdin 1986).

In the early 1990s, people learnt to diversify agricultural crops and utilise land more effectively. During this period, agricultural transformation was imposed by a top-down program from the national government. This program promoted the increased use of fertiliser, irrigation and planting materials. This program did not take into account the existence of strong local commitment to traditional agricultural practices and crop varieties, traditional irrigation systems, employment structures and land tenure practices (Simmons, Winters & Patrick 2005). The conflict between the new government programs and traditional practices led to the community becoming highly reliant on government assistance.

From 1993 to 1995, the introduction of tobacco significantly increased incomes in Pandanwangi (Figure 2.6A). Since then, many traditional dams which are called *Embung*, were revitalised and rebuilt (Figure 2.6B). Profits from tobacco enabled people to accumulate land and cattle during this period. This crop generated more employment from early plantation to post-harvest processing (Figure 2.6C). Tobacco was grown under contract farming arrangements with tobacco companies (Patrick 2004). Tobacco corporations provided financial credit, seeds, technology, knowledge and ongoing supervision of the farmers, who in turn sold their tobacco to the companies (Simmons, Winters & Patrick 2005). Nevertheless, there were controversial

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social, environmental and financial issues. Companies have the right to refuse a farmer's products if their quota is already reached (Nugraha 2012). Smallholder farmers have to bear the risks since they do not have access to any other markets.

A.

B.   C.

Figures 2.6A-C. Tobacco plantation (A), *Embung* traditional dam (B) and tobacco processing in Pandanwangi in 2013 (C).

C. Ekas Buana

Ekas Buana village is considered to be one of the poorest villages in East Lombok District (Badan Ketahanan Pangan Daerah/Local Food Security Agency 2012). The total population was 3,295 in 2013 with 1,836 women and 1,459 men. Ekas Buana comprises three sub-villages: Ekas, Sungkun and Kuang Adil. Ekas Buana lies in a coastal area, characterised by dry, hilly land, mangroves, sea grass, sand dunes and coral reefs. It covers a total area of 849 ha, and comprises settlements, wetlands, dryland farming and tree plantations. The village economy depends on a combination of rain-fed agriculture (e.g. maize, chillies, paddy rice) and aquaculture (e.g. lobsters, groupers, seaweed), and 40 percent of households are engaged in artisanal fishing (Figure 2.7).

Development of the village of Ekas Buana began when farmers established a settlement in Ekas Bay in 1920. Most of these farmers came from rain-fed agricultural areas near the current site of the village. They were helped by Buginese seafarers who had already settled in other parts of the bay. The Buginese people originated in southern Celebes (Sulawesi) and are well-known maritime people with adept fishing skills.

In early 1980, seaweed cultivation was introduced by a local company, PT. Surya Indah. People then diversified from traditional fishing to include seaweed growing (Figure 2.7A). Seaweed cultivation is labour-intensive and the seaweed is harvested four times a year. Seaweed cultivation created employment in labouring jobs in both pre- and post-harvest seaweed processing. Seaweed farming was profitable and contributed to a remarkable change in people's livelihoods. Seaweed cultivation enabled the people in Ekas Buana to accumulate assets to develop other businesses as alternative sources of income. However, this increase in wealth was accompanied by an increased spread of risk. During the initial years of seaweed cultivation, there was extensive clearance of coastal vegetation specifically for the construction of seaweed drying floors.

In 1997, fishers started to learn techniques for lobster cultivation. They used simple structures made from bamboo called *Kerambas*, which are floating cages for fish and lobsters (Figure 2.7B). In 2012, fishermen developed a simple tool to trap lobster larvae (Figure 2.7C). *Kerambas* created an opportunity for fishers to diversify their sources of income and improved the availability of employment. This opportunity attracted outside investors who also extended the aquaculture to include groupers (a type of coral fish that can be raised in *Kerambas*). The community started to be connected with markets through middle-men. They also learnt simple aquaculture management from neighbouring fishing villages (Figure 2.7D).

In 2005, fishers developed an environmentally-friendly fishing method called *Mobok*, which involves using a strong light during the night to attract fish to the proximity of a boat, allowing the fish to be speared. *Mobok* fishing does not damage coral reefs and fishers only catch large fish, mainly for family consumption.

Seaweed production started to decline in 2008, although the cause of this decline has not been identified. As a result, the local economy in Ekas Buana has suffered and there has been an increase in destructive fishing practices and crime.

A.

B.

C.

D.

Figures 2.7A-D. Livelihood activities in Ekas Buana. Seaweed farming (A), floating cage (*Keramba*), simple tools to trap lobster larvae (C), and a fisher preparing his nets (D).

2.4 Methodology

Vulnerability and capacity are multi-dimensional and complex concepts. Multiple techniques are needed to understand the factors that lead people to become vulnerable or resilient. My research used case studies to examine the different determinants of vulnerability and capacity for adaptation in the three villages. I focused on institutional adaptability and its impact on livelihood changes in the communities. Variations amongst households within the community were also studied.

2.4.1 Understanding of patterns and stories using mixed methods:

'Mixed methods' refers to the combination of quantitative and qualitative methods used to understand or solve a research problem (Newing et al. 2011). The quantitative method

corresponds to a post-positivist world-view by putting forward a theory to be tested and specifying a hypothesis. In contrast, qualitative methods adopt a constructivist world-view and emphasise the subjective nature of reality and the importance of process in its assessment (Creswell 2009). Figure 2.8 depicts the differences between the two methodological approaches. The qualitative approach demonstrates the flexibility of the research process and the nature of the specificity of methods in achieving the research objectives and goals. In contrast, the quantitative methods focus on controllable subjects and responses, which is a passive process that yields generalised outputs. Figure 2.8 shows the potential for mixing these methods by combining quantitative and qualitative approaches. I felt that this was appropriate given the aims and objectives, availability resources, and the nature of participants of the study.

More qualitative		More quantitative
Increasing control over subject matter and format of responses		
Participant observation	Qualitative interviews	Questionnaires
	Focus groups	Other structured interviews
	Community workshops	
	Participatory approaches	
Increasing flexibility/openness to the unexpected		
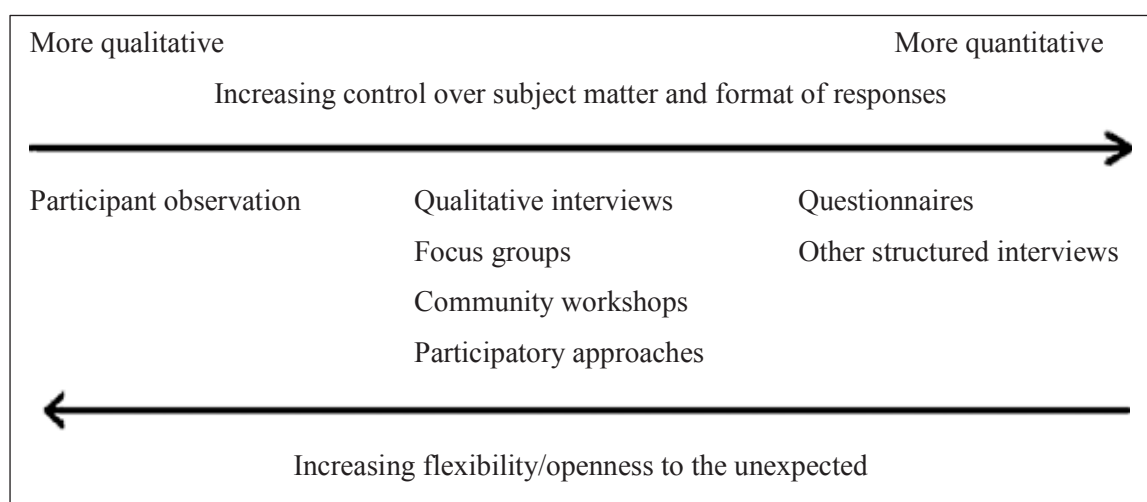
Figure 2.8 The qualitative and quantitative continuum with mixed method integration in social research (adapted from, Newing et al. 2011)

Newing et al. (2011) explain two basic models of mixed methods design: sequential and concurrent. The sequential design is used to examine a particular sequence of factors with a range of methods, with the initial results used to inform the use of other methods in the next step of data collection. In contrast, the different methods in concurrent design are employed in-parallel during the ongoing research process (e.g. triangulation and data gathering), in order to address different aspect of the research objectives. Creswell (2013) classified these models further into 15 typologies of mixed methods strategies drawn from evaluation, nursing, public health, education policy and research, and social and behavioural research. The nature and the requirements of the research dictate the selection of a particular model for mixed methodological research.

From these typologies, concurrent embedded design was chosen for my research strategy. In this strategy, researchers collect and analyse information using both quantitative and qualitative methods interchangeably, depending on the nature of the specific research question. The

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primary method that guides the research process is the participatory method involving historical timeline, problem mapping, seasonal calendar, network mapping, heat-map matrix, and visualisation mapping. Secondary methods are then used to support the next steps and are embedded into the primary method.

To fully understand the complexity of vulnerability and capacity in a community, the use of different tools is required. In this context, a mixed methods approach can play a vital role in addressing research needs. Cannon (2008) argued that vulnerability should be understood in the context of individuals and households in the community. He also added that a community needs to be understood as a dynamic entity which has negative and positive attributes in its structure.

The complexity of the interactions between various aspects of a community's livelihood systems needs to be examined carefully. A study conducted by Ravera et al. (2011) revealed the vital role of different methods and frameworks, such as participatory approaches, interviews, and systems dynamic modelling, to uncover the complexity of vulnerability and adaptive strategies in an agro-pastoral semi-arid system in Nicaragua. Different tools and a multidimensional vulnerability framework were used to stimulate discussion among stakeholders. Several tools and processes used by Ravera et al. (2011) such as participatory problem mapping, inspired my study and helped in understanding the perceptions of vulnerability drivers among different household types.

2.4.2 Research process

The research process describes the utilisation of methodologies in addressing study questions and objectives (Figure 2.9).
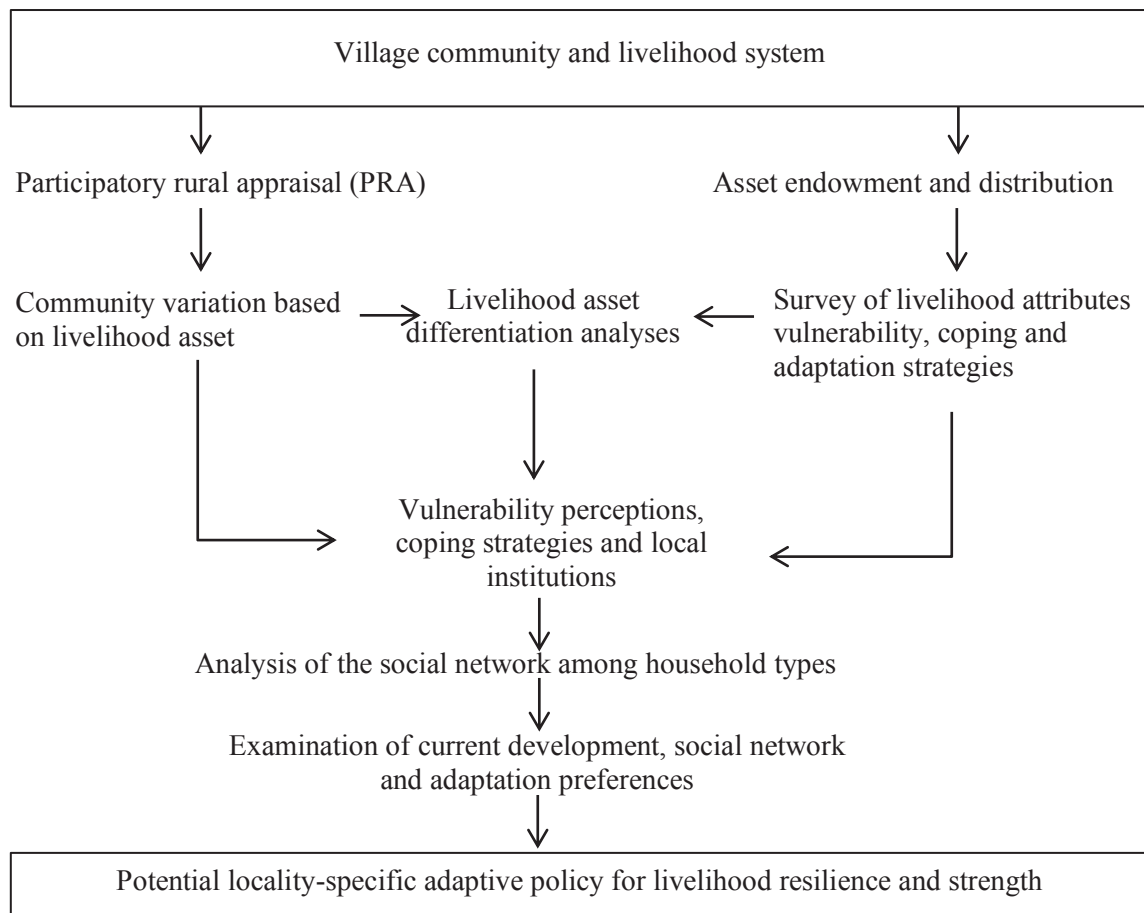
Figure 2.9 Research process used in this study

I included three main processes: (i) analysis of variation of a household's type and vulnerability factors, (ii) assessment of vulnerability components and dynamics and (iii) network mapping and development analyses. These three processes led to the following four research outcomes. First, I identified a household type based on asset differentiation, as the basis for the next process. Second, I investigated vulnerability perceptions, and coping and adaptation strategies among household types. Third, I analysed social networking among household types, to assess the level of dependency and interaction. Last, I examined future aspirations of different household type categories, using findings from social networking and current development programs, to identify potential policies for adaptation strategies.

Over all, the research was carried out in several stages using methods appropriate to the situation. Preliminary field visits were organised in November 2011 and January 2012. The aim of these visits was to gain an initial understanding of the communities and their environment. Follow-up visits were made for data collection from June to December 2012, and the final visits were made between July and October 2013 to verify data and communicate results with the communities.

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2.4.3 Sampling methods

Household differences were identified in the first informal group meeting in all three villages. This meeting was conducted to understand the current situation and household variation in each village. Since this study aimed to examine members of the community with different asset endowments, a purposive sampling technique was used for gathering data from questionnaires (Tongco 2007).

The first group meeting for the pilot study was carried out in Pandanwangi village in October 2012. The participants were asked about their most important assets for generating and sustaining their incomes. In Pandanwangi and Santong, respondents agreed that size of land holding was the most important asset for generating and sustaining incomes, whilst in Ekas Buana it was the number of boats, *Kerambas* and amount of land, that were the most important productive assets. After setting up the criteria for respondents, the questionnaire survey was conducted (see Appendices 1 and 2). Subsequent participatory approaches were used to address some issues related to interactions between households in their livelihood activities. At this stage, historical time-lines and network maps were developed.

Interviews were conducted in order to obtain more in-depth information, especially about what factors might impede community livelihood activities. A combination of opportunistic and snowball sampling techniques were used for interviews (Kemper, Stringfield & Teddlie 2003). Snowball sampling is particularly relevant in this type of study, in order to identify participants for the sampling exercise. Therefore, sampling was started by approaching respondents based on criteria from the type of asset groups. The possession of assets was used as a criterion to ensure that the full range of potential perspectives was sampled. Stakeholders were sampled across a range of possible strategies and preferences for adaptation. The purpose of this was to get more information on the main problems limiting livelihoods and to identify coping mechanisms employed.

2.4.4 Data collection and analyses

2.4.4.1 Data collection

Table 2.2 shows how the research questions were answered using a range of methods for data collection and analyses, based on each research objective. The procedure closely followed the approaches used in mixed methodology studies, as discussed in Section 2.4.1. Participatory rural appraisals (PRA) were used as the first method to examine the condition of village communities and their livelihood systems in the three villages (Table 2.2). For example, I

conducted group discussions after obtaining results from PRA in order to get more detailed information about household asset differentiation for the questionnaire surveys.

Table 2.2 The correlation between research questions, objectives, data collection and analyses.

Research questions	Research objectives	Data collection strategies	Methods of analysis
How do household asset types influence vulnerability and coping preferences?	To examine the influence of asset differentiation on household vulnerability and coping strategies.	▪ Participatory Rural Appraisal (PRA) ▪ Group discussion ▪ Questionnaire survey ▪ Interviews	▪ Qualitative analyses (description, coding methods and frequencies) ▪ Quantitative analyses (descriptive statistic and descriptive discriminant analysis (DDA))
How do interdependencies amongst households influence vulnerability and adaptation options?	To investigate the relevance of local institutions for vulnerability and adaptation.	▪ Group discussion ▪ Interviews	▪ Qualitative analyses (description and coding methods)
	To analyse the inter-dependency of households during difficult and normal conditions.	▪ Participatory network mapping and group discussion ▪ interviews	▪ Qualitative analyses (description and coding methods, and a social network analysis)
What are the implications of household asset structures for developing adaptation strategies and reducing future vulnerability?	To provide recommendations for adaptation interventions based on local livelihood asset differences.	▪ Participatory activities on heat map matrix ▪ Questionnaire survey ▪ Document reviews	▪ Qualitative analyses (description and coding methods, and a heat map analysis) ▪ A quantitative analysis (descriptive statistics)

A. Questionnaire survey

A questionnaire survey was used to gather categorical data from different household types (see Appendices 1 and 2). The questionnaire was not a complete household survey that aimed to collect detailed baseline data on socio-economic characteristics. Rather, this study only gathered information that was relevant to the understanding of the heterogeneity of household livelihood characteristics in relation to their vulnerability perceptions, coping preferences and

adaptation needs. The variables used to characterise livelihoods were selected using the literature on vulnerability assessments (Moser & Ahmad 2008; Siegel & Alwang 1999; Wisner et al. 2004), and livelihood studies (Ellis 2000b; Scoones 1998), but adapted to address local realities. Studies on asset-based approaches were explored in order to understand the conceptual vulnerability and asset differentiation among households (Moser 1998; Prowse & Scott 2008; Siegel & Alwang 1999). In this context, local characteristics, expert knowledge and responsiveness were important in understanding grounded adaptive capacity for policy making (Ford et al. 2010).

The livelihood capitals were utilised as a basis for the development of the questionnaire. The characteristics of livelihoods encompassed household size, education, income, institutional arrangements, main job, asset endowment and number of crop types exploited. The selected sample size, totalled across the three villages, was 250 respondents, with 80 respondents in Santong, 90 respondents in Pandanwangi and 80 respondents in Ekas Buana. Questionnaire surveys were conducted during field work between August and October 2013. Pilot testing was conducted in Pandanwangi village with 20 respondents. Some adjustments had to be made to accommodate the different nature of livelihoods in Santong and Ekas Buana villages. However, the main questions remained the same in order to allow for a comparison of responses from the three villages. Table 2.3 shows the division of questions into themes, examples of contents and sources of questions.

Table 2.3 Themes in the questionnaire survey and sources of questions.

Main themes in questionnaire	Example of contents	Source of questions
Individual livelihood capital asset	▪ Income ▪ Education ▪ Land ownerships ▪ Institutional engagement	Literature review, initial meeting and group discussion
Livelihood threats/problems	▪ Experienced threats and problems	Literature review and group discussion
Perceptions and knowledge about climate variability	▪ Perceptions of changes ▪ Source of information	Literature review and informal discussion
Coping strategies	▪ List of coping strategies in conjunction with experienced threats	Literature review and informal discussion
Aspirational adaptation	▪ List of adaptation priorities	Literature review and informal discussion

B. Participatory approaches

A participatory approach was used in order to obtain objective and comprehensive information regarding community livelihood situations. This focused on vulnerability perceptions, capacities and future aspirations in dealing with natural hazards and other livelihood shocks (Chambers 1994a; Kumar 2002). As a bottom-up approach, participatory methods also provided recognition of people's perspectives, by taking into account the local context and priorities (Scoones 2009). Using several participatory tools, participants discussed key information in a simple language that emphasised their livelihood assets, condition and strengths.

To encourage a high level of engagement from the community, flexible and friendly environments were created in order to minimise the distance between the researcher and the participants. Participatory activities were conducted at times convenient for the participants. In these circumstances people felt more inclined to talk freely and discuss their experiences and aspirations relevant to the research objectives (Chambers 1994b; Kumar 2002). Participatory approaches not only aimed to obtain information for my research, but also to provide a learning space for the community and allow participants to reflect on their own situations.

Participatory activities were conducted with local people using various methods (Dazé, Ambrose & Ehrhart 2009; Kumar 2002) and varying degrees of involvement. These tools also considered community variations in household levels of livelihood assets and the condition of each village (Table 2.4). The tools applied in this study included:

- *An historical timeline* - a process of examining information about changes in nature, hazards, institutional aspects and behaviour over recent decades
- *Problem mapping* - a process of understanding people's knowledge related to vulnerable conditions and capacities to overcome limitations to their livelihood system. This also allowed for asset differentiation among households
- *Seasonal calendar* - a process of gathering information on seasonal activities in one-year periods in order to identify stresses, hazards, diseases and other factors influencing livelihoods
- *Network mapping* - a process of understanding social interaction within a community in order to examine the dependencies and connections among different households types
- *Visualisation mapping* - a process of imagining future landscape scenarios through visualisation techniques and descriptions
- *Heat-map matrix* - a participatory exercise for comparing adaptation needs and current development programs. This was used only in Ekas Buana as a specific case study for this thesis.

Participatory exercises, which needed larger groups, were held in the office of the Head of the village. However small group meetings were more efficient than larger groups, due to people's increased availability. Meeting in small groups was also more effective in situations where a group or individual might dominate the discussions excessively and reduce the willingness of minority groups to speak up (Chambers 1994b).

Since this research aimed to focus on household variations, participants were selected based on productive asset criteria, such as cultivated land, fishing gear and aquaculture equipment. Detailed processes and considerations for establishing household typologies are discussed in Chapter 3.

Table 2.4 Participatory tools and detail of activities in each study location.

Village	Qualitative tools used	Frequency	Total number of participants	Scope
Santong	Problem mapping	2	8	Community
	Historical timeline	1	3	Community
	Seasonal calendar	1	5	Households
	Visualisation mapping	1	7	Households
	Social network exercise	1	6	Households
Pandanwangi	Problem mapping	3	8	Community
	Historical timeline	1	4	Community
	Seasonal calendar	1	6	Households
	Visualisation mapping	1	8	Households
	Social network exercise	1	6	Households
Ekas Buana	Problem mapping	1	6	Community
	Historical timeline	1	4	Community
	Seasonal calendar	1	6	Households
	Visualisation mapping	2	7	Households
	Social network exercise	2	7	Households
	Heat-map matrix	1	10	Households

C. Group discussion

Group discussions were divided into focus group discussions, and small group discussions and meetings (Newing et al. 2011). These discussions were held prior to individual interviews and structured data collection in order to establish a brief description of livelihood assets and

differences. However, other focus group discussions were also conducted to help with the understanding of specific problems, especially when information from different household groups was needed. For example, discussions about traditional approaches used by both rich and poor households were held, to gain more information about mutual assistance in managing cattle grazing. This information needed to be examined further from the perspective of the two household types.

D. Interviews

Interviews collected qualitative data and were conducted based on lists of pre-determined questions that addressed specific aspects of the research (Newing et al. 2011). Several questions attempted to unravel household and community capacities to deal with hazards and difficulties. This method provided space for information that was too sensitive to discuss in groups, such as individual beliefs or actions that were important for personal strategies. I was flexible in time and location for interviews, based on respondents' agreement and availability.

During the fieldwork, 68 households were individually interviewed from July to the end of October 2013, across the three villages. The questions asked were not in a specific order, but instead flowed as a part of discussions. This strategy allowed the interviewer and respondents to enjoy the flexibility of the interview process, allowing further discussion of specific issues. Moreover, this type of interview helped to bridge any gaps in the list of topics covered during the investigation (Kitchin & Tate 2000).

The number of respondents in each village was: Santong (n=18), Pandanwangi (n=26), and Ekas Buana (n=24). Additional respondents were included from the government (n=8) and NGOs (n=3). My research was located in two sub-districts. In North Lombok district I interviewed resource persons from the forest department (n=1), local development planning board (n=1), local forestry management unit (n=1), and head of the sub-district (n=1). In the East Lombok District, I interviewed officers from the Department of Fisheries (n=1), agriculture (n=1), local development planning board (n=1), and food security department (n=1). I did not record data from interviews using a recorder device as this would distance me from the respondents. Instead, interviews were recorded using hand-written notes. This method allowed me to highlight important information and explain the data from participatory activities. To ensure the integrity and objectivity of information, I clarified and confirmed all information at the end of the interview process.

E. Field observation

Field observations aimed to provide an understanding of a community's daily activities, their work, interactions, world-views and ways of life (Dazé, Ambrose & Ehrhart 2009; Newing et al. 2011). This method is especially important when the research is dealing with community livelihoods and natural resource management. During data collection, I stayed approximately two months in each village to observe and document the community's daily routines. Through daily interaction with the local people I became acquainted with their routine activities and understood the influence of nature-based livelihoods on household asset differences among the villages. By doing this, I was also able to identify the constraints and workloads of the different household groups, in relation to their different livelihood and occupational activities.

2.4.4.2 Data analyses

A. Quantitative data analyses

To define household types, Discriminant Analysis (DA) was employed. Dependent variables were taken from the most productive assets that the case study communities used to sustain their livelihoods. The purpose of DA was to investigate differences among groups on the basis of the attributes of the cases, indicating which variables or characteristics contribute most to group separation (Stevens 2009; Tefera, Perret & Kirsten 2004). Variables were selected using a stepwise analysis (Stevens 2009).

As a multivariate method, discriminant analysis can be used in two different ways: descriptive and predictive discriminant analyses (Huberty & Olejnik 2006). Descriptive discriminant analysis (DDA) is used when a study needs to understand group differences in relation to the set of outcome variables; in this context, variables are determined. On the other hand, predictive discriminant analysis is employed if there is single grouping variable and the study intends to examine how well group membership can be predicted (Huberty & Olejnik 2006).

This study employed DDA since the research question aimed to understand the significant variables that contributed to group differences and separation among the three villages. The descriptive technique successively identified the linear combination of attributes known as canonical discriminant functions (equations), which made the maximum contribution to group separation (Huberty & Olejnik 2006). The dependent variables were determined from the differentiation of household groups in each village.

I used chi-square tests and cross tabulation statistical analysis to compare coping preferences of livelihood asset groups among villages. Validity and reliability tests were also conducted using Friedman's test to ensure the integrity of data from the questionnaire (Creswell & Clark 2007).

B. Qualitative data analyses

The data obtained from participatory activities and interviews were in the Indonesian language, *Bahasa*. I typed and structured all information into a Microsoft Word document and then entered it into a computer program called *NViVo*, that analyses qualitative data.

Coding techniques were used for the interview data, and thematic analysis for information obtained from the group meetings. Coding is 'a systematic form of annotation that involves marking sections of the text with standardized 'codes' (abbreviations or numbers written in the margins) that indicate the themes that they touch upon' (Newing et al. 2011, p. 245). In this study, three basic processes of structuring data for coding were used: (i) coding the variables or initial coding, (ii) categorising or axial coding and (iii) finding themes from the category or selective coding (Bazeley & Jackson 2013; Ezzy 2002; Neuman 2005).

Themes were identified based on interconnection codes in the open coding. Theme and coding analyses were conducted in English; however, they were based on data gathered in *Bahasa Indonesia*. In order to ensure data integrity, 'forward and backward' translation processes were necessary (Nurjannah et al. 2014). For example, coded data were translated into English and then translated back to *Bahasa Indonesia* to confirm the consistency of the meaning. Bar charts were used to depict the results of the analyses.

I used open coding when I obtained the first data from interviews. Open coding allowed me to identify any essential words (Appendix 4), statements and sentences that referred to subjects of questions. This stage provided more space to explore the ideas behind my data in order to get categorisations and themes for the next steps (Neuman 2005). These codes, or variables, represented a first impression of all information regarding vulnerability, capacity and adaptation that were being asked in the guideline questions.

Examples of initial codes are 'weakness of local institutions and leadership', 'materialism', 'individualism', 'high dependency on middlemen', 'crop diversity', and 'basic needs'. From this initial coding, I then began to identify the interconnection among codes and started to group them into several categories. Examples of these categories were 'social and institutional changes' (from initial codes 'weakness of local institutions and leadership', 'materialism', 'individualism'); and 'market and prices' (from codes 'high dependency on middlemen', 'commodities', 'basic needs').

The last step involved finding the central themes for those categorisations. In this phase, the coding was finished when it reached saturation, or no more new codes could be retrieved from

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existing data (Ezzy 2002). I found several themes during this process, such as livelihood problems, capacity and coping strategies. The same procedures were also applied to the data from the participatory activities and group discussions. Figure 2.10 shows the code structure and qualitative data treated in *NViVo*. All of these data were used for further analyses in each chapter, but specific analyses of social networks and heat map analyses are explained in further detail in Chapters 5 and 6.
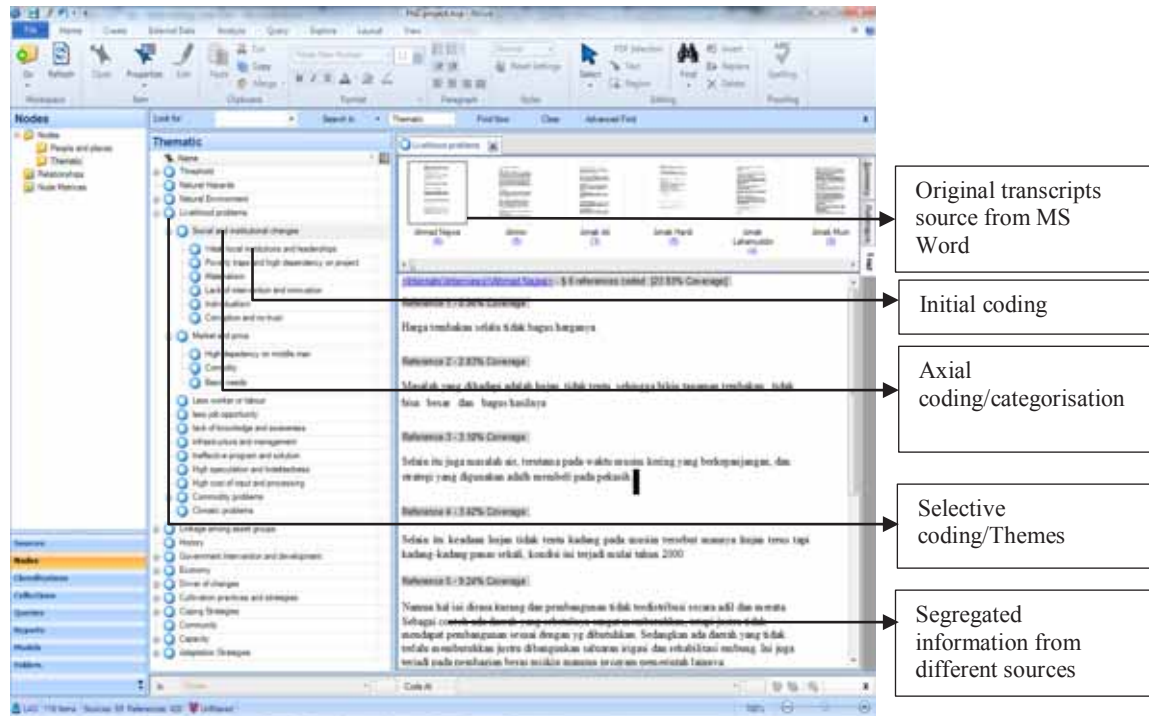
Figure 2.10 Coding structure in *NViVo*

2.5 Chapter summary

This chapter has outlined the regional and local information obtained to establish baselines for this research. The methodological approach using mixed methods which were adapted to be consistent with research goals and objectives. This chapter has provided an outline of the research pathway for data collection and analyses.

In the next chapter, I will analyse the household livelihood assets type in the three villages. I then examine the perceptions of vulnerability drivers using interview data and preferences for coping strategies (from questionnaire data) based on different household types.

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                    │        Chapter 1        │
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   │ An examination of the heterogeneity of vulnerability amongst rural│
   │ communities in Lombok Island, Indonesia, and its implications for │
   │            adaptation policy interventions.                       │
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| **Chapter 3** Household Type | **Chapter 4** The Role of Institutions Mediating Household Vulnerability and Adaptation | **Chapter 5** Mapping Social Networks: Examining Inter-dependencies amongst Households | **Chapter 6** Comparing Development Interventions with Household Adaptation Needs |

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                    │        Chapter 7        │
                    │      Synthesis and      │
                    │    general discussion   │
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In this chapter, I explained the process of developing household types based on participatory approaches then I analysed the significant differences in three villages. I used household type as a focus unit of further analysis. In this chapter, I also examined the different perceptions of vulnerability drivers among household types and preferences of coping strategies.

CHAPTER 3: HOUSEHOLD TYPES

3.1 Introduction

Factors determining livelihood vulnerability in rural households of developing countries vary depending on socio-economic and environmental settings (Ellis 2000b; Scoones 1998). Responses to pressures are determined by opportunities and constraints in the environments. The diversity of responses towards livelihood disturbances is reflected by different socio-economic attributes, including the asset portfolio of households within a community. Households manage their assets in response to risk and attempt to reduce their vulnerability.

Siegel and Alwang (1999) identify two important determinants of livelihood vulnerability: (i) expected returns and (ii) variable returns in livelihood assets. Households with low asset endowments are the most vulnerable to external stresses. They are more vulnerable and less able to cope with even small stressors, compared to households with more diverse asset portfolios. Households seek to diversify their activities in order to minimise risk. They attempt to combine a diversity of activities, acquire skills and build asset endowments in order to have greater capacity to deal with shocks (Barrett, Reardon & Webb 2001). I therefore examined the components of the livelihood strategies of households in my three study villages in order to understand how people are responding to pressures.

Researchers have examined livelihood activities by making classifications of livelihood strategies. For example, Sallu et al. (2010) classified three different livelihood strategies (accumulator, diversifier and dependent) using household surveys from two settlements in Botswana, southern Africa. This classification was used to understand livelihood trajectories, vulnerability and resilience in the communities based on a three-element vulnerability framework developed by Fraser (2011). Fraser also examined the transition of community members from one category to another and its influence on their vulnerability and resilience.

Joseph et al. (2013) studied links between livelihoods and coping strategies using a qualitative dynamic system in three coastal villages in Central Java, Indonesia. Occupational groups were used as a unit of analysis and the study examined the correlation between occupational transitions and destruction of natural assets within livelihood systems. They found that coastal degradation was one of the driving factors influencing the transformation of the socio-ecological systems (Pelling 2011). Dorward et al. (2009) classified different livelihood strategies into three categories (hanging in, stepping up and stepping out). These classifications

were used to depict the dynamic aspirations of poor people by considering the diversification of their livelihood. Dorward also examined the impacts of government policies on livelihood diversification.

In agro-ecosystems, Tittonell et al. (2005) examined the soil fertility management of smallholders using five representative farm types, based on socio-economic information and production activities. This research revealed that the poorest farm type (Type 5) was highly dependent on the wealthiest farmers (Types 1-2); whilst intermediate types of farms (Types 3-4) represented different crop production strategies to achieve subsistence and market demand.

A more interdisciplinary study conducted in the Telangana region of Andhra Pradesh, India, looked at the dynamic adaptive capacity and future orientation of several farmer groups, based on their livelihood characteristics (Jakimow, Williams & Tallapragada 2013). They found that of three classifications, the small and marginalised farmers were least likely to leave their agriculture practices, while medium-scale farmers faced downward social mobility, or followed previous generations' livelihood activities. In the case of India, although the social status (including caste) tended to inhibit farmers from working in labouring jobs, medium-scale farmers were likely to seek work in cities, but the possibility of achieving this was limited by caste discrimination. The third group consisted of farmers with large areas of cultivated land and this land endowment enabled them to diversify into more lucrative activities.

Most studies have looked at community livelihood strategies within a specific environment. However, few studies compare household asset group vulnerability in different ecosystem contexts. Research at the household-level has tended to focus on existing responses to climate variability and other changes, while higher-level studies have explored in more detail, the quantification of climate variability or climate change impacts on people and places (Osbahr et al. 2008; Vermeulen et al. 2013). Hence, the complexities and dynamics of changes in household livelihoods are often under-explored.

In Chapter 2, I briefly explained the general characteristic of communities in three different villages. This chapter examines the influence of asset differentiation on household vulnerability and coping strategies (Objective 1). The main hypothesis is that households with different assets are subject to different vulnerability drivers which depend upon different ecosystem and social contexts. Five over-arching research questions are addressed in this chapter:

      (i)   How are households defined, in terms of asset attributes and structure in the communities?

(ii)   What significant sources of differences among types exist in the three villages?

(iii)   What influences perceptions of vulnerability in the three villages?

(iv)   How are asset differences influencing coping decisions in each village?

(v)   What are the implications of household types for future adaptation policy?

To address these questions, my study first defines the differences between households which are based on the number of productive assets a household owns. The objective of differentiation analyses is to examine what characteristics separate each household type within each village. The second step is to examine the influence of household types on livelihood vulnerability and coping preferences.

3.2 Vulnerability and assets: understanding the link for analysis

The link between livelihood vulnerability and assets has been studied by many researchers, in both rural and urban areas (Chambers 1989; Ellis & Allison 2004; Moser 1998; Scoones 2009; Siegel & Alwang 1999). Chambers (1989) suggests that vulnerability is influenced by external and internal attributes of livelihoods. External factors refer to any 'shocks, risks and stress that an individual or household is subject [to]' (Chambers 1989, p.33). Internal aspects are related to a lack of ability to cope, without damaging loss. Such loss could include: weak physical condition, being economically impoverished, social dependency and being psychologically threatened.

Another dimensional analysis of asset-vulnerability linkages was conceived by Moser (1998), who argued that 'vulnerability' is comprised of sensitivity and resilience. 'Sensitivity' is related to the ability of a system to respond to any external disturbances, while 'resilience' refers to the way in which a system recovers from stress across a specific time span. Livelihood assets determine the vulnerability of individual people or households. The more assets people have, the less vulnerable they are to external shocks and trends. Conversely, the fewer assets people have, the more likely they are to be impacted negatively by these external pressures.

Following Moser & Dani (2008, p. 5), my study defines assets as 'the resource endowments and capabilities that people have, to sustain their livelihoods and to enhance their welfare'. 'Endowments' here refer to the rights and resources that social actors have (De Haan & Zoomers 2005). 'Vulnerabilities' reflect the risk factors of livelihood activities (Ellis 1998), and 'asset portfolios' are determined by the outcome of livelihood strategies. Moser (1998) further concluded that 'asset functions' are a means for individuals, households or communities to cope with difficult situations. Different asset portfolios might help prioritise interventions, especially

for improving the access of poor people to different assets which might enable them to expand and substitute livelihood strategies (Dorward et al. 2001; Ellis 2000b).

3.3 Methods

Data were collected using three different methods: (i) group meetings and direct observation, (ii) distribution of questionnaires (n=250) and (iii) interviews (n=79). The various methods of data collection contributed to answering the research questions of this chapter in different but complementary ways. I have covered the detailed aspects of data collection in Section 2.4.4.1. During data collection, I stayed for about two months in each village to gain an insight into how people with different assets were connected to each other (Chapter 5), and the ways in which this connectivity influenced their ability to solve their problems. The participatory activity was initiated in response to a particular event, for instance an extreme weather event.

For data analyses, I have also elaborated on the methods used (see Section 2.4.4.2). Discriminant Analysis was used to define household types. Dependent variables were the most productive asset that the case study communities used to sustain their livelihoods.

3.4 Results

3.4.1 Defining household types by livelihood asset attributes

Using a typology approach, I attempted to define types of households in each village. Typologies were used to develop and describe the relative similarity of household groups and communities that face similar constraints and benefits, and that presumably could be affected by external factors in the same ways (Perret & Kirsten 2000).

Categorisation of household types started during the initial group meeting in each village. The participants agreed to define household classifications based on productive assets that are important for generating income from various types of commodities. In Santong (forest community) and Pandanwangi (rain-fed agriculture community), participants agreed that size of land holding was the most important asset for generating and sustaining their income, while in Ekas Buana (coastal community), the number of boats and *Keramba*, and cultivated land were nominated as the most productive assets.

In the context of my study, the term 'commodity' described various types of crops in Santong and Pandanwangi, and different types of fish and aquaculture products, such as lobster,

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groupers and seaweed, in Ekas Buana. The consensus on productive assets used for this classification was important considering the different ecosystem-based livelihood activities.

3.4.2 Characteristics of livelihood assets in three villages

During group meetings in the early stages of the research, community participants discussed the general characteristics of livelihood assets in their area. This information was then summarised into three categories which comprised: (i) resource endowments (these refer to the rights and assets that households have), (ii) social aspects and (iii) livelihood diversification (Table 3.1).

Households in Type 1

The livelihood portfolios of Type 1 households include labouring and subsistence cultivation activities. Many households in Santong, including households without land and those with communal land, i.e. members of the community forest group, rely mainly on labouring jobs. Hence, households within this type are highly connected with the most affluent households of Types 3 and 4, for whom they work. Some Type 1 households might also use a traditional system of mutual sharing of cattle or land with other types of households.

In Pandanwangi, Type 1 households have the opportunity to save and invest their wages from labouring in the tobacco season. Tobacco demands an intensive labour force at all stages of processing. A single family can potentially generate more income by involving their entire family in the work force.

In Ekas Buana, livelihood diversification has more limited options than the other two villages; they rely on occasional labouring jobs, such as feeding lobsters or groupers, and selling fish. In general, Type 1 households rely heavily on traditional or informal institutions as social protection from any disturbances.

Households in Type 2

People in this household type are more likely to increase their assets if they can properly manage their resource endowment. In Santong, for example, members of households in this type might meet their daily expenses from an agroforestry commodity (e.g. bananas, betel nut, spices), and make savings or investments by renting and cultivating other people's land. This pattern can also be found in Pandanwangi. During the tobacco season there, farmers usually rent more land to increase their production. However this strategy is risky, considering the need for additional inputs and other uncertain drivers such as prices, variability in weather conditions and limited knowledge. In Ekas Buana, Type 2 households also have the potential to improve

their assets, especially during the high season of particularly profitable fish. Deep-sea fishing is a lucrative activity for generating income, but also involves a high cost and is more vulnerable to unpredictable weather.

Households in Type 3

In terms of livelihood strategies, this group has a similar pattern to households in Type 2. However, some differences are found with crop diversification and other alternative livelihood activities. This group also has more flexibility for trying different ventures and strategies.

For example, in Santong, households in this category might become small distributors of cloves or cocoa commodities. They collect the dried commodity from other farmers and sell it again to Type 4 households. In Pandanwangi, households in this category sometimes have difficulties in increasing their productivity due to financial constraints. However, as medium-scale farmers, their financial status might not be directly related to their land size. Hence, farmers usually start cultivation by borrowing money for farming activities. In Ekas Buana, the Type 3 household differed in its ability to expand its activities. Constructing *Keramba* initially requires a high level of investment and there is also high risk from severe weather conditions. Some fishers might have strong financial support from relatives and networks, but others might just start the activities by themselves.

Households in Type 4

This group has more flexibility in livelihood strategies and activities. In Santong, this type of household can be recognised by its stable position, due to its diversified livelihood sources. Many households of this type get technical assistance from external organisations such as NGOs and government departments. In Pandanwangi, households in this type are more likely to get benefits from development programs and other forms of assistance from external organisations. In Ekas Buana, this type of household is able to provide more employment by extending its aquaculture activities and land cultivation.

Table 3.1 General characteristics (resources, livelihood activities and social characteristics) of livelihood asset Types 1-4, in three villages on Lombok island.

Livelihood asset types and characteristics	Santong (Forest community)	Pandanwangi (Rain-fed agriculture community)	Ekas Buana (Coastal community)
Type 1	**No asset (land) /≤ 0.25 Ha**	**No asset (land) /≤ 0.25 Ha**	**No asset for fishing and aquaculture**
Asset and livelihood strategies	Some households might become members of community forestry programs, with very limited input and few opportunities to expand their land. Some of them might depend only on labouring jobs	Very limited resources endowment, some households might have a small piece of land (< 0.25 ha). There is high mobility in labouring jobs, especially during harvest time. People might become local tobacco sellers	Very limited assets, and production is highly dependent on other household types. Vulnerable to climate variability and others changes.
Social characteristics, formal and informal institutional involvement	Headed by females or males (middle-aged or older), with limited skills, and involved with local institutions. Usually with no formal schooling.	Possibly headed by females (middle-aged or older) but it might also be headed by males (middle-aged or older) with limited skills, and involved with informal institutions. Usually no formal schooling	Predominantly headed by females (middle-aged or older) and young families. Most likely to have no savings.
Livelihood diversification strategies	High mobility, especially for non-farm jobs and highly reliant on Types 3 and 4 households for work or income. One possible strategy to move from current position is to become a migrant worker	Limited diversification as most become labourers or small-holder farmers with limited inputs. A small number of people might be regarded as a different type as a result of working overseas	Highly reliant on other household types. Limited ability to change their living conditions unless going overseas as migrant workers. High mobility to do other jobs, but constrained by lack of skills and networks
Type 2	**Small size of land (≤ 0.49Ha)/Renter**	**Small size of land (≤ 0.49Ha)/Renter**	**Boat and fishing net**
Asset and livelihood strategies	Members of community forestry, sometimes are able to combine the livelihood strategies with farming cattle and goats (mostly based on mutual sharing with Types 3 and 4)	Quite low resource endowment and predominantly renting other land to expand the production of their own land. It is commonly high risk, depending on market prices and it might result in debt. High mobility in labouring jobs.	Subsistence activities are highly dependent on local markets. Needs more inputs to scale up production. Vulnerable to climate variability and the condition of natural resources
Social characteristics, formal and informal institutional involvement	Mostly headed by, middle-aged or older males with elementary or no formal schooling. Active in local institutions	Mostly headed by middle-aged or sometimes older, males. The level of education varies from no formal schooling to some schooling. Households might be involved in formal institutions, especially for collective activities.	Mainly headed by middle-aged males with a young family. Engaged with particular formal and informal institutions. Educational background varies from no formal schooling to senior high school. More likely to have savings, but quite limited.
Livelihood diversification strategies	High mobility for non-farm jobs and transportation services during harvest time. Sometimes are collectors post-harvest from Types 1 & 2, and on-sell the dry commodity (e.g. cocoa) to Types 3 & 4	Livelihood diversification might include labouring in non-farm jobs and some family members might become migrant workers, especially when they are trapped in debt	Limited ability to diversify. Commonly barters with farmers as a coping strategy. Sometimes has ability to invest income in other agricultural products such as tobacco. Likely to go overseas as migrant workers.

Type 3	Medium size of land (0.9 - 0.5 Ha)	Medium size of land (0.9 - 0.51 Ha)	Boat and *Keramba*
Asset and livelihood strategies	Middle income earners, mostly a combination of community forestry land, irrigated paddy fields and cattle production. Sometimes involved in local businesses such as commodity brokers.	Quite variable size of land for subsistence farmer, but they might be able to expand the production by renting more land. Sometimes high speculation and become trapped in debts. Some of them might have cultivated a variety of different crops and some of them might have cattle for investment	Medium cultivation area with a medium-sized *Keramba* (9 x 9 m^2) and a limited ability to invest.
Social characteristics, formal and informal institutional involvement	Mostly headed by a middle-aged male, and the education level ranges from secondary to senior high school. Active and quite well connected with formal and informal institutions	Possibly headed by middle-aged to older males. They might occasionally be involve in informal institutions and have secondary level of education	Mainly headed by middle-aged males with a young family. Engaged with formal and informal institutions. Educational background varies from no formal school to senior high school. More likely to have savings.
Livelihood diversification strategies	Relatively high diversification strategies, in combination with cattle and chicken farm production.	Likely to have diversification especially in labouring jobs during harvest time, and other businesses such as small shops.	Likely to be diversified, but depends on the production and price of commodities. More likely to invest their income in agricultural production.
Type 4	Large size of land (≥ 1 Ha)	Large size of land (≥ 1 Ha)	Boat, *Keramba* and land
Resource endowments and livelihood strategies	High resources endowment, mostly a combination of community forestry land, well-irrigated paddy field, and gardens. This household type is involved in high production of all commodities, including cattle and has a variety of businesses.	High resources endowment, with some cattle,. and cultivation of a variety of crops. Predominantly connected with tobacco company; many have tobacco leaf drying equipment which can generate income during harvest time. Rice production is relatively high, for consumption and for sale when cash is needed.	Large cultivation area (varying from 1 to ≥1.5 Ha) and more than one big cage (18 x 18 m^2). Ability to invest in other assets, such as land, and expanding their businesses.
Social characteristics, formal and informal institutional involvement	Mostly headed by middle-aged males whose minimum educational level attained is senior high school, but this may vary (many also have a bachelor degree). Active and highly connected with formal and informal institutions	Possibly headed by middle-aged or older males. The level of education is mostly senior high school and tertiary education. Occasionally connected to informal institutions for collective action, and well-connected to formal institutions such as bank and government departments	Mainly headed by older males, with varied educational backgrounds. Likely to engage with formal and informal, and financial institutions. Likely to have savings.
Livelihood diversification strategies	High diversification and expansion to other businesses. Some people might become distributors of certain commodities (e.g. cocoa, banana, cloves) for intra-regional trades.	High diversification and investment in land to improve production. Some people might work in different sectors such as trades and education.	Very likely to have a diverse livelihood portfolio. Likely to cultivate more than one commodity. Has a combined income from agriculture and fisheries. Has more opportunities to expand their livelihood on non-natural resources activities.

Respondent characteristics

The characteristics of respondents enabled me to determine the livelihood assets of each household. These characteristics include: household size, education, main occupation, number of crops, income and institutional engagements (Table 3.2).

Of the 250 respondents, those from Santong and Ekas Buana had similar household sizes. Respondents from these two villages tended to have medium-sized families (three to four family members). A high percentage of respondents with no formal schooling were found in Santong (40 percent). However, in 2001, the local government set up a program to reduce illiteracy and established a community centre for learning activities. This meant that people with no previous formal schooling could learn basic reading and writing skills in order to help them deal with administrative paperwork, required for their daily activities.

The three characteristics of households, i.e. main occupation or job, productive assets, and commodities, were highly correlated with the asset endowment and natural resources of each village. Most of the income for households was derived from the main occupation. However, households in Ekas Buana combined farming and fishing, especially the Type 4 households (i.e. those who owned a boat, *Keramba* and land). The types of assets reflected the different environments on which livelihoods were based.

Total income and institutional characteristics were used to describe the financial and social capital of the households. Total income referred to the cash earnings of the household, obtained from any source on an average monthly basis. The income category was based on the minimum wage in Lombok. Social capital was based upon the household links with local institutions that are related to their livelihood portfolio and daily activities.

Table 3.2 Respondents characteristics and frequencies

Name of Variables (data type)	Descriptions	Coding	Relative Frequency (%), n = 250		
			Santong (n=80)	Pandanwangi (n=90)	**Ekas Buana (n=80)**
Household_size	'1'	1	1.3	23.3	**2.5**
(ordinal)	'2'	2	15.0	61.1	**15.2**
	'3'	3	52.5	15.6	**51.9**
	'≥4'	4	31.3	23.3	**30.4**
Education	No formal education	1	40.0	30.0	**28.8**
(Categorical)	elementary school	2	36.3	23.3	**21.3**
	secondary school	3	8.8	22.2	**30.0**
	senior high school/tertiary education	4	15.0	24.4	**20.0**

Name of Variables (data type)	Descriptions	Coding	Relative Frequency (%), n = 250		
			Santong (n=80)	Pandanwangi (n=90)	Ekas Buana (n=80)
Main Job	Labour	1	22.5	22.2	20
(Categorical)	farmer	2	77.5	77.8	25
	Fishers	3	-	-	40
	Fishers and farmer	4	-	-	15
Asset	no asset/≤ 0.25 Ha	1	25.0	35.6	20
(Categorical) Independent variable	Boat and net/Small plot of land (≤ 0.49 Ha)/tenant	2	26.3	24.4	25
	Boat and cage net/Medium plot of land (0.9 - 0.51 Ha)	3	18.8	14.4	40
	Boat, cage net and land/Large plot of land (≥ 1 Ha)	4	30.0	25.6	15
Commodity	No commodity crop	1	27.5	21.1	2.5
(Categorical)	Cultivating 1 commodity crop	2		2.2	21.3
	Cultivating 2 commodity crops	3	8.8	72.2	72.5
	Cultivating ≥ 3 commodity crops	4	63.8	4.4	3.8
Income (Rupiah= Rp)	< 625.000	1	60.0	83.3	48.8
(Categorical)	625.000-1.150.000	2	33.8	14.4	45.0
(Rupiah is Indonesian currency) A$1= Rp 9,500	1.150.001-1.675.000	3	2.5	1.1	5.0
	> 1.675.000	4	3.8	1.1	1.3
Institutional engagements	No institutional engagement	1	11.3	2.2	17.5
(Ordinal)	Engage with 1-2 institutions	2	67.5	75.6	82.5
	Engage with 3-4 institutions	3	21.3	17.8	
	Engage with > 4 institutions	4		4.4	

Household differences and livelihood characteristics

The stepwise analysis method was able to identify and select the significant variables or predictors that contribute to distinguish household types (Appendix 3). Indicators of discriminant analysis are Wilks' lambda (λ) distribution, which indicates the significance of discriminant function in separating cases into groups.

Table 3.3 shows the statistical summary of a stepwise analysis, based on main employment, commodity, and income to determine group differentiation in Santong. In Pandanwangi, only two variables were selected: main job and commodity. In Ekas Buana, the determinant variables selected were: main job, commodity, income and household size.

Table 3.3 Stepwise results of selecting significant variables

Village	Step	Entered	Wilks' Lambda (λ)							
			Statistic	Exact F				Approximate F		
				Statistic	df1	df2	Sig.	Statistic	df1	df2	Sig.
Santong	1	Main_job	.129	171.000	3	76.000	.000				
	2	commodity	.074	66.661	6	150.000	.000				
	3	income	.066					41.216	9	180.247	.000
Pandanwangi	1	Main_job	.558	22.747	3	86.000	.000				
	2	commodity	.498	11.820	6	170.000	.000				
Ekas Buana	1	commodity	.365	44.160	3	76.000	.000				
	2	Main_job	.187	32.807	6	150.000	.000				
	3	income	.142					24.583	9	180.247	.000
	4	household_size	.116					20.232	12	193.431	.000

Note: At each step, the variable that minimises the overall Wilks' Lambda is entered. a) Maximum number of steps is 12. b) Maximum significance of F to enter is .05. c) Minimum significance of F to remove is .10.

Commodity and main job are the most significant variables differentiating households in the three villages. This also indicates that commodity diversification enhances the ability of each household type to deal with future shocks and changes.

Asset types and discriminant function

Discriminant analysis results can be further interpreted by describing each group in terms of its profile, using the group means of the selected variables. In order to specify the role that each independent variable plays in predicting group membership we must link together the relationship between the discriminant functions and the groups defined by the dependent variable. Links must be made between the significant independent variables in the discriminant functions, and the differences in group means for each of the variables. These group means are called centroids (Huberty & Olejnik 2006). The un-standardised coefficients show the degree of

influence on each selected variable (Table 3.4). Function 1 differentiated households based on the employment variable. In Santong and Ekas Buana, household type 4 was the highest positive value for main source of employment (2.176 and 7.469 respectively) while in Pandanwangi household type 2 had the highest positive value (0.706) for this variable. Function 2 separated households based on commodity where household type 4 in Santong and Ekas Buana had the highest positive value (0.453 and 2.776) while in Pandanwangi Type 2(0.393) was highest. Using cluster plots, this analysis gives a visualisation of differentiation trends. Coloured circles represent the individual cases, which in this context refer to respondents with different asset types. The differentiation pattern could be identified by looking at the distances between the group centroids for each individual case. Any individual cases which were closer to a group mean (centroid), belong to that group. In the graph, only function 1 and 2 were used to represent the x and y axes.

Table 3.4 Functions at group means (centroids)

Village	Type of asset endowments/household types	Function		
		1	2	3
Santong	Labour/no asset (land) / ≤ 0.25 (Type 1)	-5.910	.028	-.001
	Small size of land (Less 0.5 Ha)/Renter (Type 2)	1.779	-.528	-.024
	Medium size of land (0.9 - 0.51 Ha) (Type 3)	1.908	-.023	.070
	Large size of land (more than 1 Ha) (Type 4)	2.176	.453	-.022
Pandanwangi	Labour/no asset (land) / ≤ 0.25 (Type 1)	-1.222	.013	
	Small size of land (Less 0.5 Ha)/Renter (Type 2)	.706	.393	
	Medium size of land (0.9 - 0.51 Ha) (Type 3)	.585	-.473	
	Large size of land (more than 1 Ha) (Type 4)	.694	-.126	
Ekas Buana	Labour/no asset (Type 1)	-4.413	-.242	.711
	Boat and net (Type 2)	-1.574	.927	-.231
	Boat and cage net (Type 3)	.827	-.435	-.026
	Boat, cage net and land (Type 4)	7.469	2.776	.850

Note: Unstandardised canonical discriminant functions evaluated at group means, (-) and (+) show the direction of function value)

The graphs in Figures 3.1A-C show the distribution of the discriminant pattern of household types in Santong (Graph A), based on selected variables in the previous process of analysis in Table 3.4. Three household types (Types 2, 3 and 4) were located close to each other. Households with no assets or which were only relying on labouring jobs are discriminated by their relative distance from others. The same pattern was also apparent in Pandanwangi (Graph B) where Type 1 households were located closer to the other three groups. In contrast, Ekas Buana (Graph C) showed different patterns for discriminant distribution, where group centroids were strongly differentiated from each other. This means that the selected variables were significant in defining the differences among household types in Ekas Buana.

Canonical Discriminant Functions

A)

Village: Santong

B)

Village: Pandanwangi
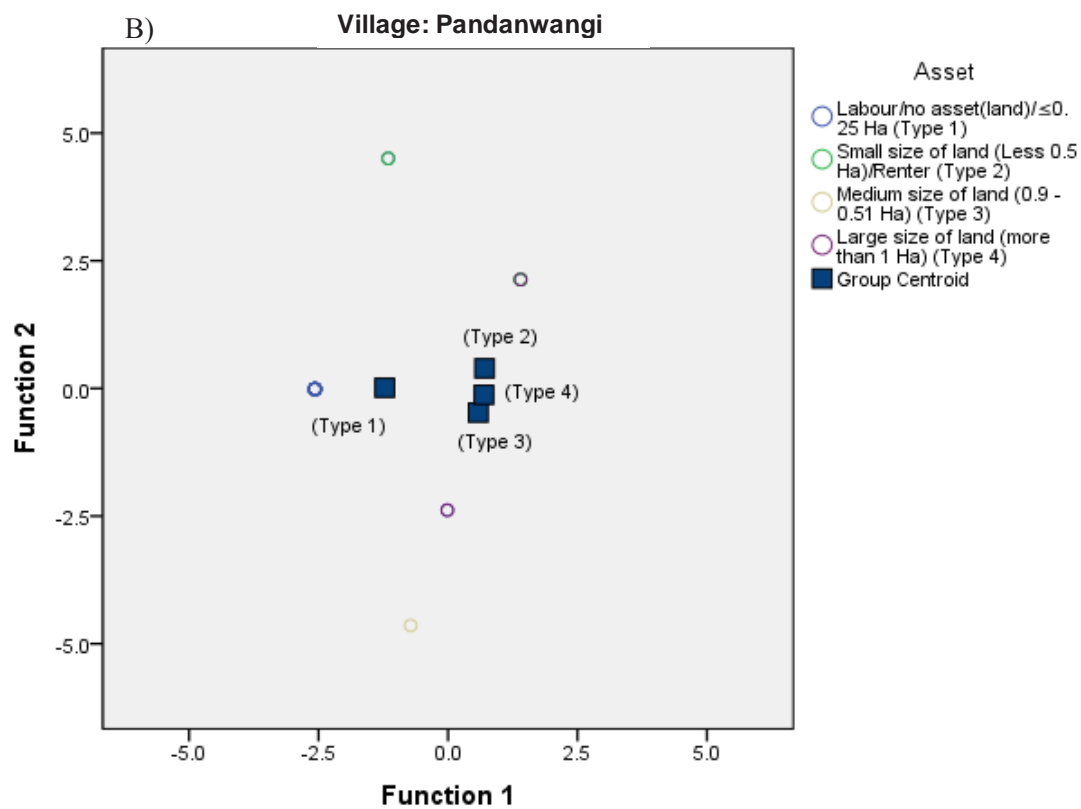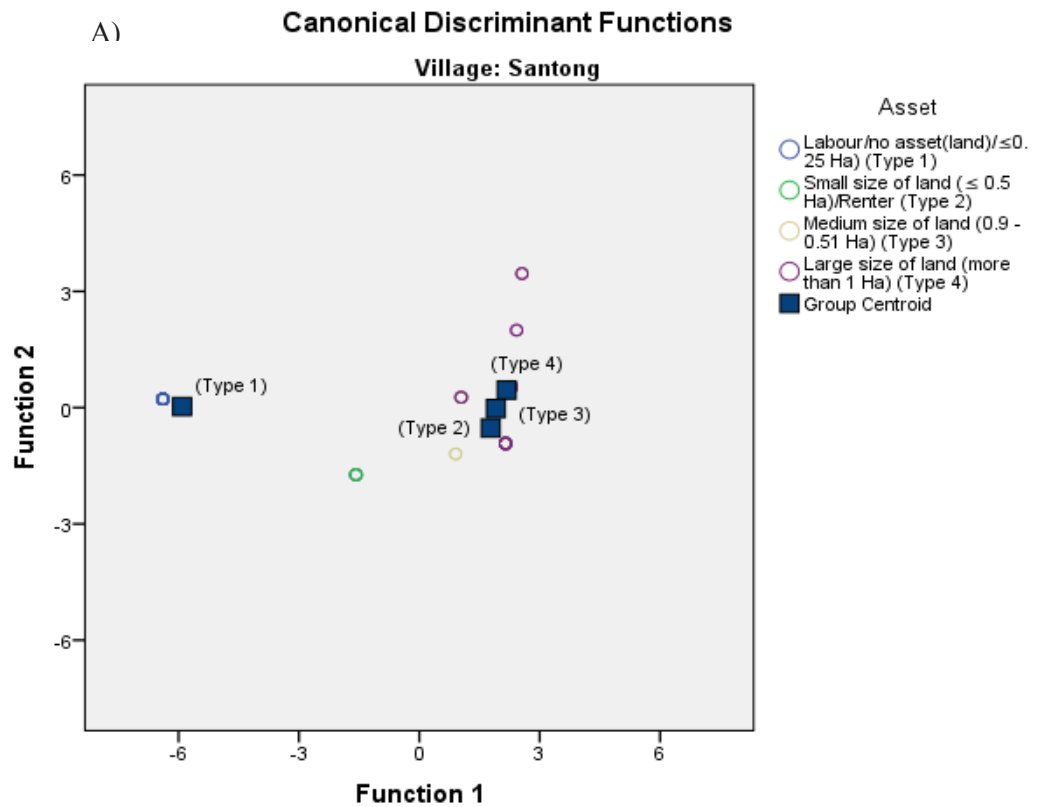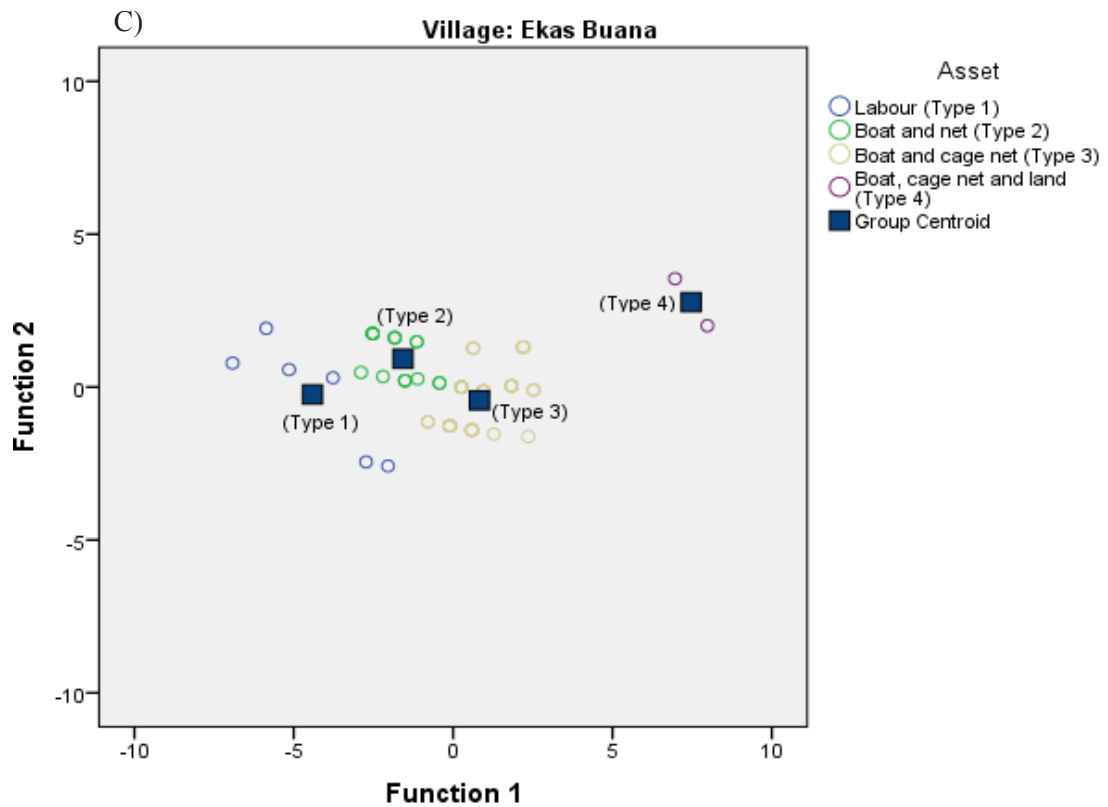
Figures 3.1 A-C. Cluster plots showing the separation trend of livelihood types in each village. The coloured circles indicate individual cases of analysis based on asset types. The '-' and '+' values (x and y axes) represent the direction of group classification

3.4.3 Underlying drivers of livelihood vulnerability asset groups

Data for this section were generated from interviews. I used bar graphs to depict the respondent references (the total number of times any specific problems appeared in data) for each underlying factor of livelihood vulnerability.

Respondents in Santong showed a diversity of livelihood issues. In Figure 3.2, weather was mentioned consistently as a constraint for all household activities. Climate hazards reported by respondents included longer rainy seasons, strong winds, and 'oily smog' or air pollution that spreads from Mount Rinjani across to community gardens and forests. These hazards had different effects on different plants. For example, the water and oil contained in the 'oily smog' had the potential to damage the leaves and fruits of trees, particularly cocoa and banana, by causing them to rot.
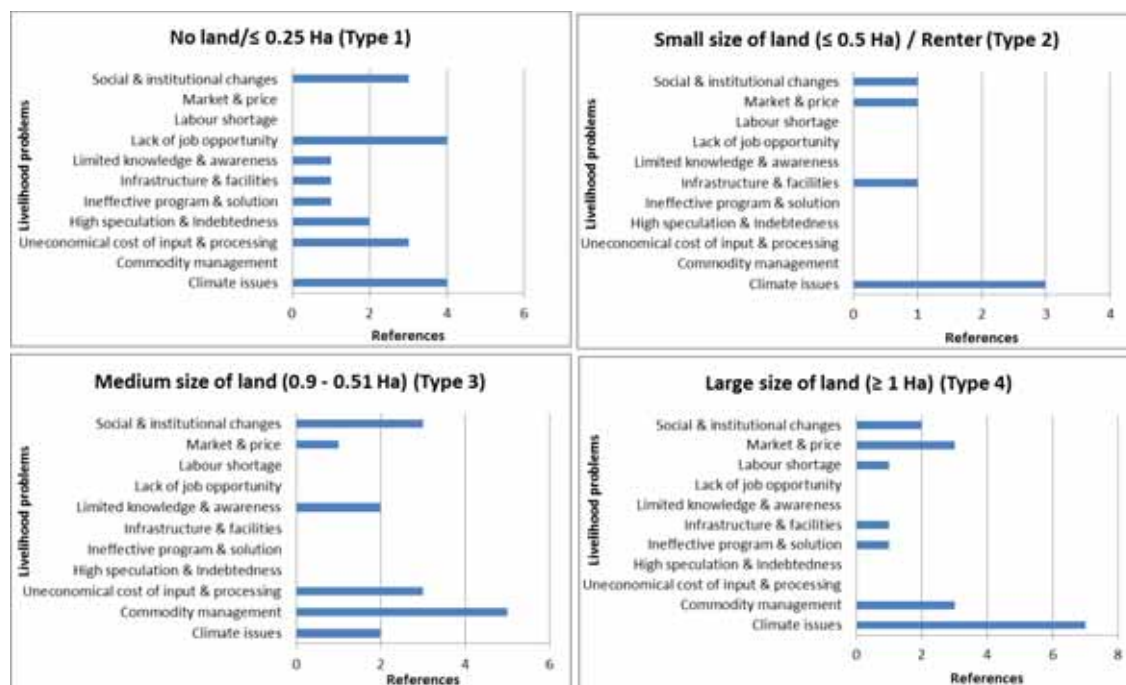
Figure 3.2 A comparison of the perceptions of livelihood vulnerability drivers in Santong, by household type (Types 1-4).

Social and institutional changes were also perceived as a vulnerability driver in Santong. The people were heavily reliant on local institutions and social cohesion for their coping strategies (Chapter 2) and collective action was an important contributor to their livelihoods.

Households in Type 1 perceived climate issues and lack of job opportunities as their biggest concerns. In Type 2 households, climate issues were mentioned as being of most concern, while in wealthy households, Types 3 and 4, identified commodity management problems as having the potential to threaten their livelihood systems.

People in Pandanwangi also identified social and institutional changes as becoming issues in their livelihoods now, especially for Types 1 and 2 (Figure 3.3). Households in these types were involved in collective action and other traditional institutions.

Traditional rules and knowledge are encompassed in the traditional *Awig-awig* (local rules), *adat* (local tradition) and *pituah* (ancestor advice or local belief); *Besiru* (helping each other) and *Gotong royong* (collective action); *Gubug* (neighbourhood networks); and *Nyalamak dilau* or *Selametan laut* (fishing ceremonies) (arrangements for natural resource management). These traditional institutions have few assets, in both normal circumstances and in difficult times. In contrast, households which had many assets (Types 3 and 4) tended to perceive livelihood vulnerability drivers as those related to their commodities. For example, these latter types were

concerned with issues of financial speculation and indebtedness, market and price, and the uneconomical cost of inputs and processing.
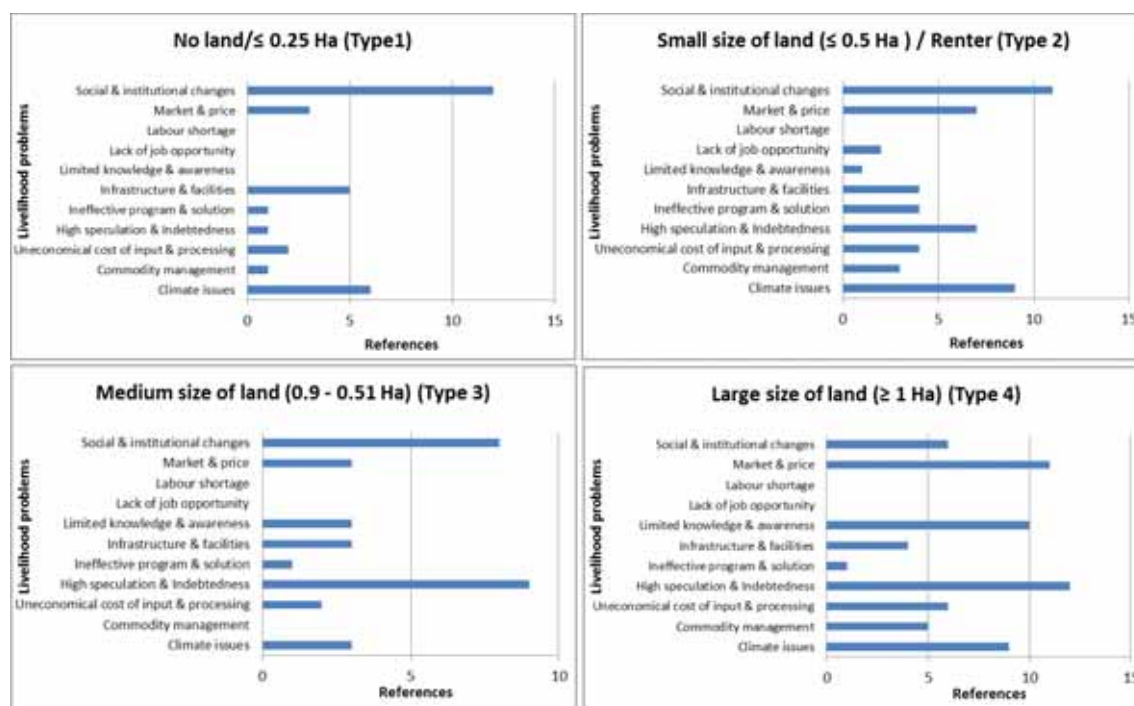
Figure 3.3 A comparison of the perceptions of livelihood vulnerability drivers in Pandanwangi, by household type (Types 1-4).

These vulnerability drivers were dominant since most of the people rely on tobacco as their main income source. Indebtedness and financial speculation resulted from a lack of capacity to increase land productivity and lack of access to price information. Farming systems in Pandanwangi were based on traditional practices and were similar to other places in Lombok. Farmers followed what they had learned from previous generations. Although agricultural extension agents sometime visited the village, the knowledge that they contributed was limited. People who were connected with tobacco companies received better guidance on land preparation and use of fertiliser. However, they were dependent on their own knowledge in dealing with other factors influencing productivity, such as water management, weather and seed quality.

In Ekas Buana, a comparison of livelihood vulnerability drivers perceived by different household types showed some clear differences between types (Figure 3.4).
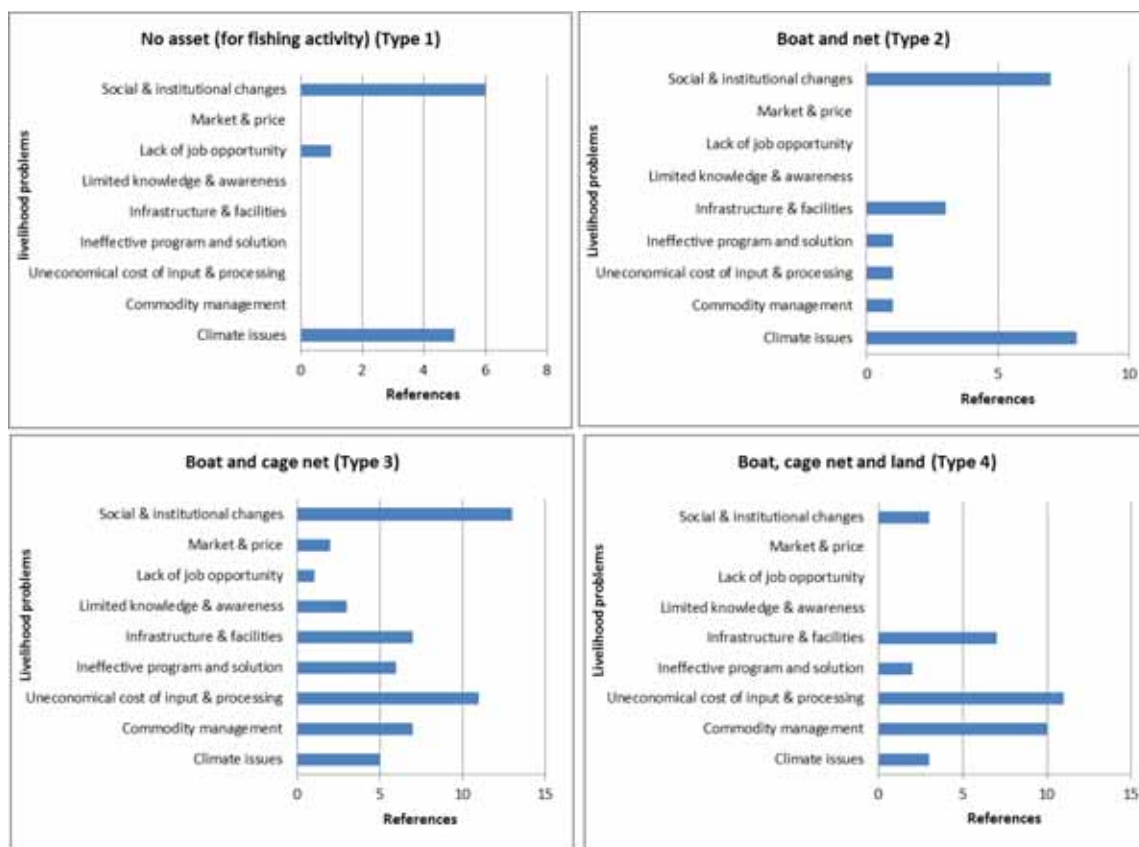
Figure 3.4 A comparison of the perceptions of livelihood vulnerability drivers in Ekas Buana, by household type (Types 1-4).

For Type 1 households, social and institutional change and climate variation were the most important issues. This appeared to result from the fact that the households were highly dependent on traditional institutions. Since households in Type 1 rely on their income from labour and selling fish, climate variation has a profound influence. Similarly, climate variability and social and institutional change were regarded as important issues by Type 2 households. These households mostly depend on traditional fishing practices, hence weather is a major issue. Social and institutional changes and uneconomical input and processing costs were the most important issues for Type 3 households. The high costs of inputs and processing and commodity management problems were the most important issues for Type 4 households.

Examples of detailed problems that were mentioned by respondents during the interviews are provided in Table 3.5.

Table 3.5 Examples of detailed issues, mentioned most often by respondents that are perceived as increasing their livelihood vulnerability.

Issues	Santong	Pandanwangi	Ekas Buana
Social and institutional changes	• Limited efforts to teach young generation about local knowledge and customs • Early marriage	• Degradation of traditional values • Leadership crises • People tend to be more individualistic due to the increase in economic capability	• Degradation of traditional values • Leadership crises • People tend to be more individualistic due to the increase in economic capability
Markets and prices	• Unstable price of cloves • Limited access to markets, especially when surplus production • Low financial support	• Unstable price of tobacco • Low bargaining position when surplus production • No access to market prices	• No access for commodity prices • No access to markets
Shortage of workers and labourers	• Labour shortages during harvest season		
Lack of job opportunities	• Few job opportunities when harvest fails	• Limited alternative jobs, especially after harvest	• Limited alternative seasonal occupations
Limited knowledge and awareness	• Limited knowledge on how to increase productivity of land and value-add to commodities	• Limited technical knowledge of how to increase land productivity • Limited knowledge of commodity inputs management	• Lack of awareness and knowledge of sustainable fishing • Limited knowledge of post-harvest fishing processes
Infrastructure and management	• Lack of infrastructure for drinking water and irrigation	• Lack of infrastructure for drinking water and irrigation • Lack of water irrigation management • Lack of basic infrastructure such as sanitation and roads	• No drinking water • No electricity • Poor road construction
Ineffective programs and solution	• Development programs are often given to people who are not the people who need them	• Many projects were not related to farmers' basic problems (e.g. price of fertiliser)	• No solutions for problems with aquaculture activities and seaweed farming • Unequal distribution of development projects and benefits
High speculation and Indebtedness		• High speculation leading to bankruptcy • Farmers have a tendency to produce more without having access to global prices • Some farmers must get loans at the beginning of the cultivation process	
Uneconomical cost of input	• Low production rate of coffee due to the high	• All agriculture inputs (e.g. fertilisers, seeds,	• High cost of fishing equipment and fuel

and processing	cost of inputs and maintenance	etc.) keep increasing in price and the stock is commonly not available in the time needed. • High cost of tobacco processing	• The price of lobster larvae is increasing
Commodity management	• Limited skills in post-harvest processing		• Diseases in lobster and grouper (fish) • Decline in production of seaweed due to unknown cause
Climate issues	• Frequency of rainy days is increasing, the rain is falling more heavily • Oily smog and extreme weather events (e.g. strong winds) are becoming more frequent	• Unpredictable weather patterns, rainy season is sometime longer than dry season or vice-versa	• The intensity of strong winds and stormy weather is causing more damage than in the past

3.4.4 Household types and coping decisions

Coping strategies were highly connected to the quantity and quality of assets of an individual or household. In order to understand whether there is differentiation in coping preferences among household types, respondents were asked if there were any events which may have disturbed their livelihood activities over a one-year period; and to explain how they had coped or responded to these events. Some variations in coping preferences were shown by household types in Santong and Pandanwangi; while responses in Ekas Buana were only concerned with two strategies. Interestingly, results showed that getting help from relatives or friends were dominant options for coping preferences in all three villages. Social cohesion within the villages became an important strategy because of cultural values and the sense of togetherness formed by their social network. Coping strategies in Santong revealed various results in different household types (Figure 3.5).

A. Santong

For Type 1 households, the most important coping preferences were getting help from friends or relatives (50 %), followed by getting jobs in or outside of the village (20 %). Similar patterns were also shown by Type 2 households. A majority of respondents preferred to use their social
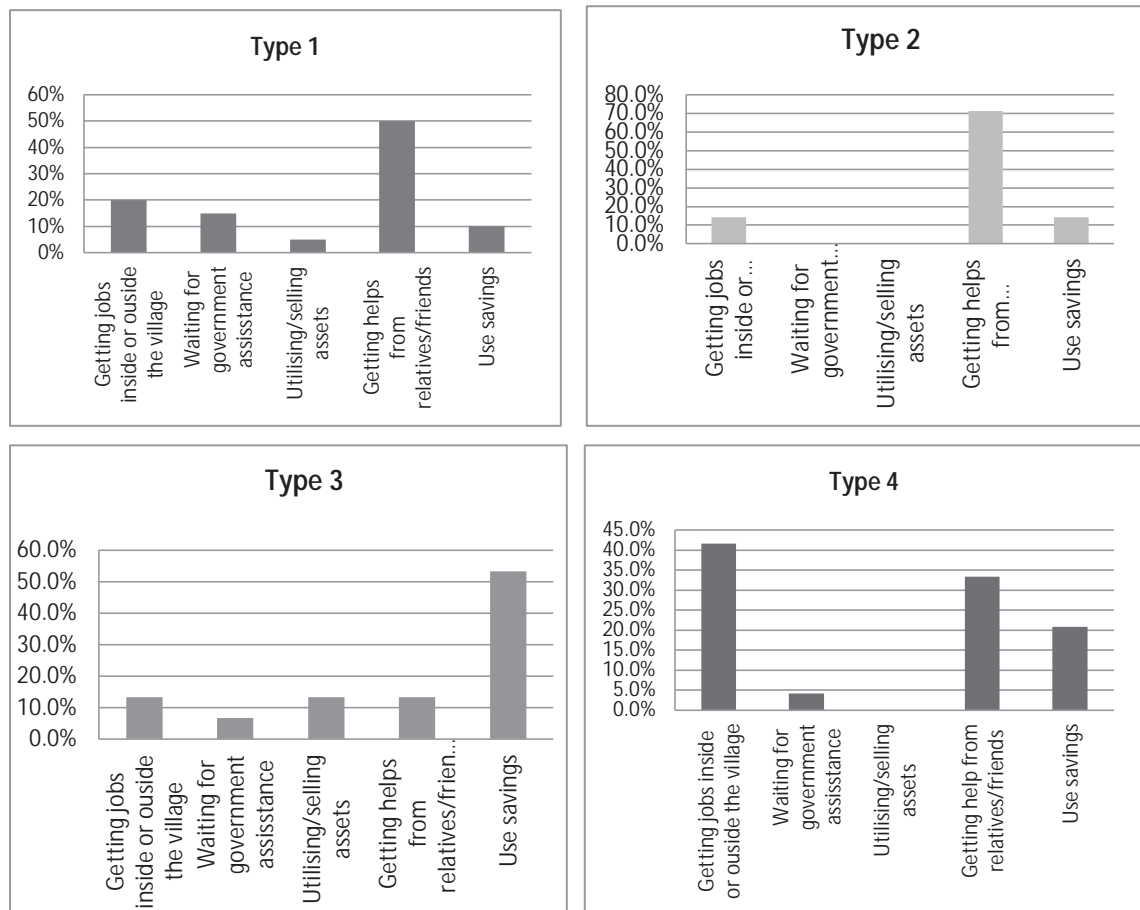
Figure 3.5 Coping preferences in response to extreme weather events in Santong, by household type (Types 1-4).

cohesion for coping responses (71.4%). In contrast, Types 3 and 4 households chose different strategies. Type 3 households chose to use their savings (53.3 %) as their main option for dealing with any weather hazards, while Type 4 households preferred to seek other employment as their main preference, followed by getting help from their friends or relatives.

B. Pandanwangi

In Pandanwangi, three different asset types showed similar patterns for coping preferences (Figure 3.6).
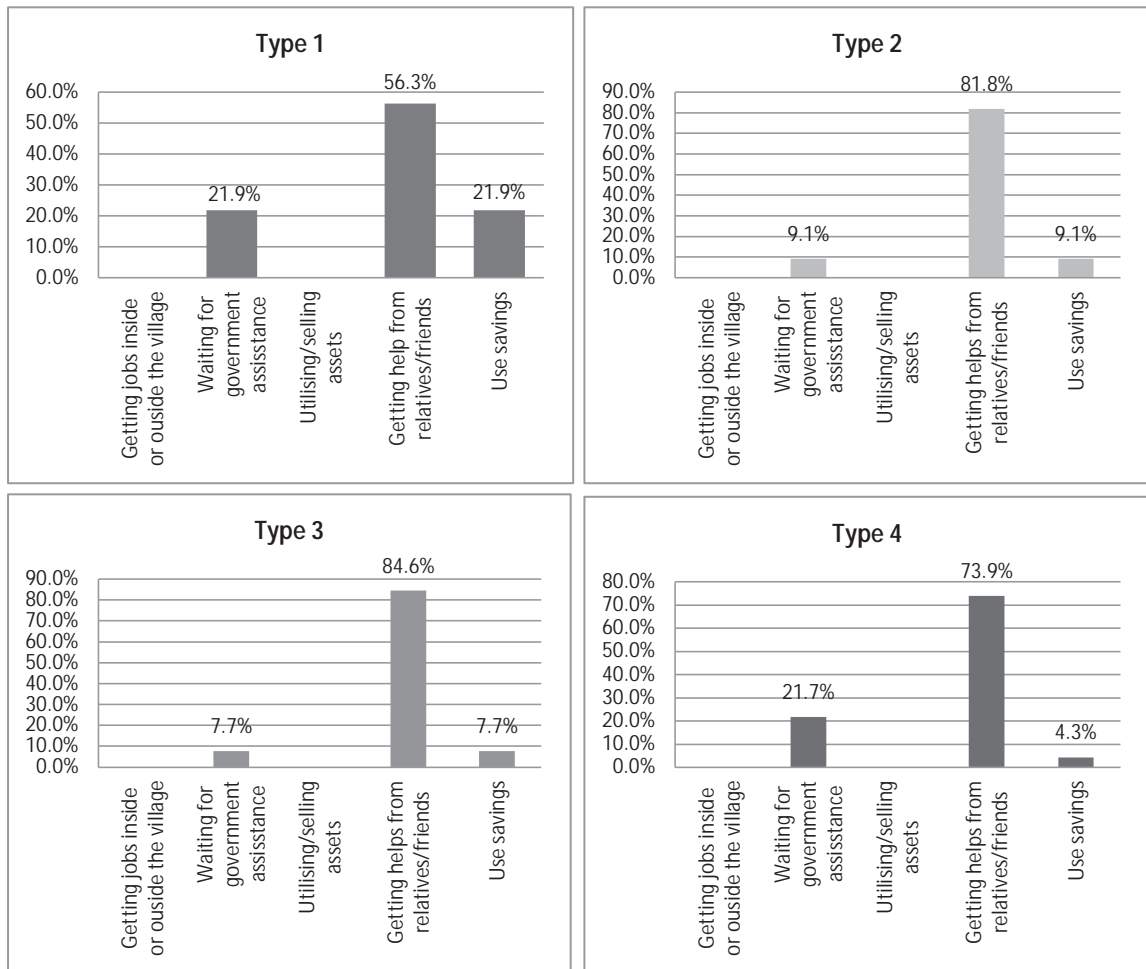
Figure 3.6 Coping preferences in response to extreme weather events in Pandanwangi, by household type (Types 1-4).

Getting help from friends/relatives was the most important strategy in all asset types. People in Pandanwangi still retained their social cohesion and collective actions for supporting their livelihood activities. However, since the village economy was growing strongly due to the introduction of tobacco, people tended to value social interactions as a source of monetary or material advantage. For Type 1, the second option was waiting for government assistance and to use savings (21.9 percent for each coping preference). A similar pattern was also shown by Types 2 and 3, where government assistance and use of savings are similarly distributed, while in Type 4, the percentage for using government assistance was much higher than the use of savings option.

C. Ekas Buana

A similar pattern of coping preferences was also seen in Ekas Buana (Figure 3.7).
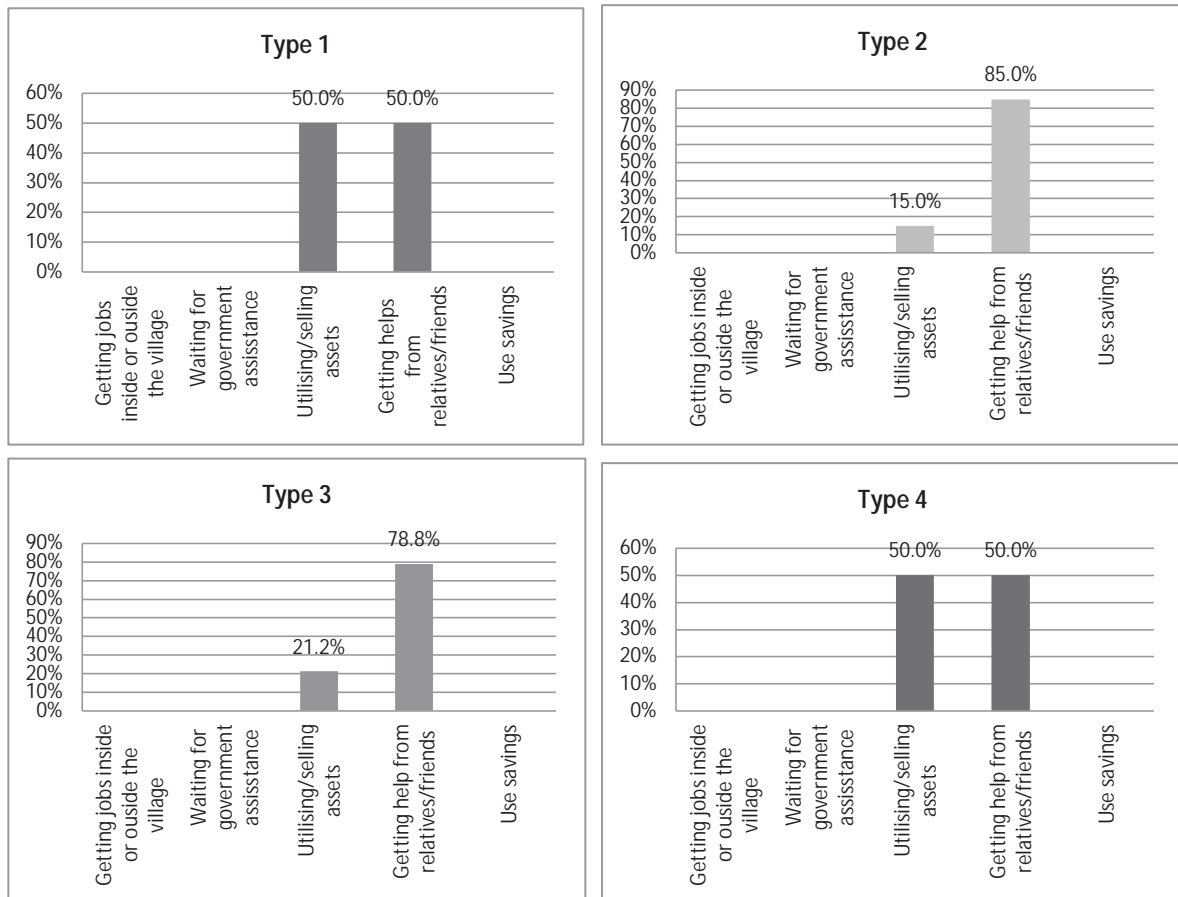
Figure 3.7 Coping preferences in Ekas Buana

Social cohesion and networks among fishers were high. Respondents who chose this option were relatively varied in their proportions.

Fishers in Ekas Buana were living mostly on communal land, based on a legacy system. In this system, any family member can build a house in any place within the settlement area, as long as they have family relationships with surrounding households. Therefore, social connectedness among households has become important in determining people's capacity to cope with any disturbances in their livelihood system. The secondary preferences for coping was utilising or selling assets. This refers to any asset that can easy to be converted into cash, such as vehicles, cattle or jewellery. Many respondents in Ekas Buana kept poultry to support their daily consumption. Interestingly, none of the respondents selected government assistance as a coping strategy.

3.5 Discussion

The quantitative data revealed significant differences of each household's asset type based on their livelihood characteristics. These differences may or may not influence people's perceptions of vulnerability drivers and coping preferences (Dorward et al. 2009).

The interview data on problems of vulnerability perceived by respondents showed that there was an explicit correlation among selected variables for different asset type groups. Asset differences influence different vulnerability drivers among household types, and these results supported this main hypothesis.

Meanwhile, the pattern on coping preferences indicated that social connectedness was an important and predominant coping strategy used by respondents.

3.5.1 Asset type and determinant characteristics

I used discriminant analysis in this study to be able to select variables that differentiated asset types in three villages. The cluster graphs of the canonical discriminant coefficient showed how selected variables separate different asset types, based on their discriminant function.

In general, there were two similar selected variables across the villages; these were (i) commodity (which refers to the type and number of cultivated commodities) and (ii) main job (which represents the main occupation as a source of income to the household). Other variables were specifically selected for each village, such as income (Santong and Ekas Buana), and household sizes (Ekas Buana), while in Pandanwangi the selected variables were only main job and commodity.

The number of cultivated commodities and main occupation became important variables, since these three villages are highly dependent on natural resources (NR)-based livelihood activities (Ellis 2000a, 2000b). Although some members of households might be working in non-NR sectors, their income was mostly generated from farming and fishing activities. In this context, environmental differences became a significant indicator in influencing a household's ability to diversify their commodity and livelihood activities.

Total income can provide precise information (Newing et al. 2011), and is also an important predictor for other variables, such as asset endowments and occupation. However, in Pandanwangi, income was not selected as a significant discriminant variable in the household

type. In contrast, in both Santong and Ekas Buana, total income became a significant variable of the discriminant function.

Size of household was considered to be one of the most significant variables, since in coastal communities the productive assets are based on the number of boats and *Keramba* that households own. For example, a household in Ekas Buana might have more than one boat and *Keramba*, because the number of boats is sometimes correlated with the number of children in the family. In this village, children become an important source of labour and income, and the parent provides assets for them, to be managed as part of their portfolio (Deressa et al. 2009). In contrast, in agricultural and forest communities, the ability to provide more land for children is quite limited; parents are forced to divide their land when they give it to their children as a legacy (Paavola 2008; Tesfaye et al. 2011). In this case, the household sizes were negatively correlated with the ability of a family to provide enough assets for their livelihood activities.

The cluster distribution of canonical discriminant function in the three villages showed significant results for this method of differentiating asset types (see Figure 3.1).

In Santong and Pandanwangi, the centroids of asset types in household's cluster tend to be close to each other in Types 2, 3 and 4, while Type 1 is significantly separated from the other Types. This indicated that the selected variables (main occupation, commodity and income) were relatively similar for households with assets, compared to households with no assets.

In contrast, Ekas Buana showed a different distribution of group means. This result suggested that selected variables had significantly differentiated the household type in Ekas Buana. But in Santong and Pandanwangi, significant differentiation was only shown by Type 1, and other Types were not significantly differentiated.

3.5.2 Vulnerability and coping strategies within household type

Quantitative data analysis confirmed the differentiation of household type in the three villages. This finding was also supported by qualitative information obtained from interviews and group meetings, suggesting relative differences between household types, regarding their livelihood concerns. Interestingly, almost all asset types perceived social and institutional changes as the most important problem in undermining livelihood activities. This result was positively correlated with coping preferences, where dominant respondents asserted that social networks were of major importance in enabling them to cope with both climate variation and other

stresses such as commodity cost processing and input prices (Pelling & High 2005; Wisner 2010).

The correlation of vulnerability and asset endowment was reflected in the findings. Households with more assets tended to focus more on individual livelihood issues (such as commodity problems, market and prices, and high cost of inputs and processing) rather than communal issues (such as collective action and mutual assistance) (Siegel & Alwang 1999). These findings confirmed Moser's (1998) suggestion of a correlation between asset endowment and vulnerability. This situation was clearly shown in my data from Ekas Buana and Pandanwangi, whereas in Santong there was more variability in the perceptions of vulnerability drivers.

Issues of social and institutional changes as underlying factors that increase livelihood vulnerability were also described by Schwarz et.al (2011) in the Solomon Islands. Social aspects, including community cohesion, good leadership and individual support for collective action, were critical factors determining people's perceptions regarding coping and resilience-building in the Solomon Islands. Similar findings on institutional changes as factors contributing to people's vulnerability were also noted by Sallu et. al. (2010) in rural Botswana. These findings indicate that local institutions have a significant role in enhancing rural community resilience.

Interaction is embedded in traditional institutions, such as collective action and mutual assistance. In fact, rural communities in developing countries rely heavily on local institutions for their livelihoods (Butler et al. 2014; Ellis 2000a; Schwarz et al. 2011). This also reflects the importance of local institutions in mediating livelihood activities and coping preferences (Ellis & Allison 2004). Social ties, traditional knowledge and institutions underpin rural community coping mechanisms (Aldrich 2012b; Bankoff 2003; Gaillard, et al. 2008).

Several local institutions in the three study villages have similar roles in mediating people's livelihoods. However, the influence of prosperity may create a divide in the social interactions among households (Fazey et al. 2011). Butler et al. (2014) argued that positive impacts of a growing economy in rural areas in Lombok were leading to an increase in individualism and materialism amongst local people. Economic prosperity was undermining people's capacity to deal with future changes.

Across the three villages, social connectedness was the main resource used to deal with livelihood vulnerability. The improvement in the local economy contributed to the ability of people to accumulate physical assets. In Pandanwangi, for instance, the growing demands for

tobacco had shifted people's lifestyles to focus more on accumulating assets. The focus on income-generation had reduced social values in family and community. In the past, people were respected because of their solidarity and engagement in social activities. However this situation has changed since people have become more affluent and social values have become more influenced by material possessions. A dilemma has emerged locally between improving the local economy, and at the same time maintaining social cohesion and local institutions.

3.6 Chapter summary

A typology of households based on productive assets was developed using participatory activities and questionnaire surveys. The results from discriminant analysis indicated that household differentiation was determined by several significant variables, notably the number of commodities (e.g. crops, fish, and aquaculture products), main occupation, income and household size. These differences were correlated with vulnerability drivers and coping preferences.

My study also examined the vulnerability factors based on perceptions among different household types. The purpose of this analysis was to understand the variations and similarities of issues perceived by different respondents, in weakening livelihood activities (Grothmann & Patt 2005). The most important findings of this study were that two household types (Types 1 and 2) perceived social and institutional changes as the most important problems in their livelihoods. In contrast, households with more assets (Types 3 and 4) tended to be more concerned with commodity-related problems and other developmental issues as determinant drivers for livelihood vulnerability.

In Lombok, traditional institutions provide social security (Cannon 2008), especially when local people are facing difficult times. Several local institutions in the three study villages have similar roles in mediating people's livelihoods. However, the influence of prosperity may create a divide in the social interactions among households (Fazey et al. 2011). Butler et al. (2014) argued that positive impacts of a growing economy in rural areas in Lombok were leading to an increase in individualism and materialism in local people. Economic prosperity was undermining people's capacity to deal with future changes.

These findings challenge the current conventional wisdom that development will enhance people's ability to deal with stresses such as climate change. Development policies have to recognise that asset differences and livelihood strategies will determine how development can help reduce people's vulnerability. Development programs and other interventions need to be

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directed at building or strengthening social connections and avoiding asset dependence which may be a temporary solution

In the next chapter, I will examine the role of local institutions in mediating vulnerability and adaptation, using Ekas Buana village as a detailed case study.

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                    │   Chapter 1     │
                    │  Introduction   │
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                    │   Chapter 2     │
                    │  Study area and │
                    │   Methodology   │
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    │ An examination of the heterogeneity of vulnerability      │
    │ amongst rural communities in Lombok Island, Indonesia,    │
    │ and considers implications for adaptation policy          │
    │ interventions.                                            │
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Chapter 3 Household Typology	Chapter 4 The Role of Institutions Mediating Household Vulnerability and Adaptation	Chapter 5 Mapping Social Networks: Examining Inter-dependencies amongst Households	Chapter 6 Comparing Development Interventions with Household Adaptation Needs

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                    │   Chapter 7     │
                    │  Synthesis and  │
                    │ general         │
                    │ discussion      │
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Findings from Chapter 3 showed that the most frequent vulnerability driver mentioned by most households is 'social and institutional change'. Hence, in the next chapter I will investigate the relevance of local institutions for each household type and analyse the connection between institutional changes, functionality, and its development towards hybrid governance for strengthening community resilience (Objective 2).

CHAPTER 4: THE ROLE OF INSTITUTIONS IN MEDIATING HOUSEHOLD VULNERABILITY AND ADAPTATION

4.1 Introduction

Chapter 3 showed that most respondents in this study asserted that one of the main drivers in increasing livelihood vulnerability among different household types is social and institutional change. Institutions play an important role in mediating livelihood strategies and responses to climate variability (Christoplos et al. 2009). Scholars have recognised the connection between coping strategies and institutional arrangements (Agrawal 2008; Christoplos et al. 2009; Eakin 2005; Jakimow 2013; O'Riordan & Jordan 1999) because institutions reinforce particular power relations and patterns of access to resources and opportunities. Numerous studies have explored the role of assets and institutions in livelihoods, but few have examined how development causes them to change, or how traditional governance can be proactively melded with modern approaches to enhance resilience.

This chapter examines the critical functions of local traditional institutions in mediating vulnerability and adaptation, by using detailed results from Ekas Buana village as a case study. This chapter addresses research Objective 2, which aims to investigate the relevance of local institutions to vulnerability and adaptation. I first examine linkages between assets and institutions. Second, I examine how institutions mediate individuals' livelihoods and produce social outcomes. Last, I show how institutions develop or influence pathways for bridging power and the dynamics of developmental change.

Four research questions are addressed:

- (i) What are the causes of vulnerability for people with different sets of assets?
- (ii) What kind of institutions are important, and why?
- (iii) What is driving the change in these institutions?
- (iv) What are potential strategies to support traditional institutions?

I then identify and discuss hybrid institutions that could be promoted as part of climate adaptation and development programs.

4.2 Linkages between assets and institutions

A livelihood is perceived as a dynamic and comprehensive concept rather than a narrow understanding of 'making a living' (De Haan & Zoomers 2005). This description suggests that assets facilitate not only the pursuit of livelihood strategies, but also give meaning to people's lives. Bebbington (1999, p. 2022) elaborates further on the dynamic and holistic concepts of assets: 'they are the basis of an agent's power to act and to reproduce, challenge or change the rules that govern the control, use and transformation of resources'.

The institutional context of livelihoods enables or hinders peoples access to assets and activities (Ellis 2000b). Allison and Ellis (2001) argued that institutions determine the sustainability of individuals' and households' livelihood adaptability and capacity. Bebbington (1999) suggested that the transformation and improvement of capital assets are a reflection of the ability to engage synergistically with related institutions. Therefore, the availability and quality of assets is influenced by the distribution of wealth and income within different groups, and this is determined by power relations within the institutional context (Cannon 2008).

Hall and Taylor (1996) elaborated on the three main regulatory pillars of institutional construction: (i) Rational Choice Institutionalism (RCI), (ii) Historical Institutionalism (HI) and (iii) Sociological Institutionalism (SI). These three pillars provide different perspectives on how institutions are developed and changed (O'Riordan & Jordan 1999). In RCI, institutions emerge to reduce the transaction cost of repeating activities and collective action problems (Jakimow 2013). In contrast, HI examines institutions in terms of political economy, which structures collective behaviour and produces distinctive outcomes (Hall & Taylor 1996). Sociological or cultural institutionalism (SI) considers institutional changes driven by world views, and is based on a series of alternative institutional platforms (Hall & Taylor 1996; O'Riordan & Jordan 1999). This means that the establishment of institutions is influenced by the broader contextual environment, rather than by a functional goal as in RCI.

4.3 Methods

Data were collected through field observations, interviews (including group discussions) and participatory activities (see Section 2.4.4.1). Preliminary fieldwork was conducted from December 2012 to January 2013, followed by in-depth studies from July to October 2013. The in-depth studies focused on 24 respondents, representing the different household types identified in Chapter 3. Secondary data were collected from government agencies, published studies and reports, and national and regional newspapers. To gain grounded information and

trust, I joined daily community activities and ceremonies such as wedding parties and other events.

Data were analysed qualitatively using three steps in coding (initial or open coding, axial coding and selective coding) using *NVivo,* version 10 discourse analysis software (Ezzy 2002; Neuman 2005). Detailed qualitative data processing and analysis were explained in detail in Section 2.4.4.

4.4 Results

4.4.1 Household type

In Chapter 3, Table 3.1 describes the nature and extent of local institutions for each household type. Four main types of households were identified:

Type 1: No assets. This household type had the lowest level of asset accumulation. Their main activity involved buying fish from fishers and selling to the local market. Therefore they depended on the other three household types, especially for fish products. However, some of them diversified by processing fish into other products (e.g. cooked fish or shrimp paste) and selling them to local markets for higher prices. This group was usually dominated by middle-aged women and men, with no children accompanying them. In many cases, their children had moved to another village or were working overseas and commonly experienced the same poor conditions as their parents.

Type 2: Own boats and fishing nets. This was the predominant household type in Ekas Buana. They had small- to medium-sized traditional boats with outboard engines. They were highly dependent on weather conditions because their main source of income is from fishing. They usually caught fish inside Ekas Bay, but also fished outside the bay using larger fishing nets. During extreme weather, members of this group worked as labourers, especially for Type 4 households. They might also work outside the village in construction or agriculture, and some worked overseas as migrant workers.

Type 3: Own boats and Kerambas. This household type had a medium-level of asset accumulation. Usually they combined aquaculture with traditional fishing, using a small boat and nets. This household type was transitional, moving away from relying only on traditional fishing, towards aquaculture. They mainly cultivate lobster and breed the larvae using simple techniques, involving the use of a specially designed trap made from cement paper or cement

sack. This is placed around the *Keramba* and traps the larvae inside. During difficult times, this household type worked as labourers in agriculture.

Type 4: Own boats, Kerambas and land. This household type was the greatest asset accumulator. The main products of aquaculture were lobster and grouper, plus breeding of lobster larvae using simple technology. Households sometimes employed workers to support their activities, especially for feeding lobsters and during harvesting time. They benefitted from any government-funded programs that support aquaculture because they had capital to invest in new technology. During times of hardship, this type coped well because they had diverse sources of income.

4.4.2 Local institutions and livelihoods

Throughout Lombok, institutions relevant to livelihood and climate variability are varied but they all play crucial roles. Institutions that mediate access to resources provide social security and enable networks to be established for collective action. Mutual assistance and traditional financial systems are highly developed and play a crucial role during crises. Traditional institutions that provide guidance and information on weather, climate and the environment are also pertinent because they guide fishers in utilising resources and pursuing other activities in sustainable ways. Beyond these traditional institutions, other formal organisations and external institutions (e.g. government policies and programs) also mediate community livelihoods.

Three main domains of traditional institutions exist in Ekas Buana (Table 4.1). They are:

(i) a socio-economic cluster comprising: *Banjar,* a small group within a community with specific activities; *Ijon* (a traditional financial institution); religious groups: *Besiru* (helping each other) and *Gotong royong* (collective action) and *Gubug* (neighbourhood networks)

(ii) traditional rules and knowledge encompassed in the traditional *Awig-awig* (local rules), *Adat* (local tradition) and *Pituah* (ancestor advice or local belief)

(iii) arrangements for natural resource management, which are described as *Nyalamak dilau* or *Selametan laut* (fishing ceremony).

These three domains influenced community livelihoods both every day and during crisis situations.

The institutions from these three domains mediated and benefitted the household types in different ways. Households of Types 1 and 2 were getting most of the benefits, especially those involving social security and daily activities, such as *Banjar* and *Ijon*. In contrast, households of Types 3 and 4 were less reliant on socio-economic institutions because they either had their own credit, or could access it from more formal sources (e.g. banks). However, Types 3 and 4 relied on local knowledge and regulation, especially *Awig-awig*.

Table 4.1 Characteristics of the three domains of local institutions and their benefits to household types in Ekas Buana

INSTITUTION AND DOMAIN	CHARACTERISTICS	Benefits and degrees of importance for household types			
		Type 1	Type 2	Type 3	Type 4
Socio-economic					
• Informal institutions: *Banjar*	• *Banjar* is a small unit or group of people within a community that collectively funds and organises social events such as wedding and death ceremonies	• Provides financial and material support, but sometimes they cannot contribute • Highly important	• Provides financial and material support • Social security • Highly important	• Provides material support and social identity • Important	• Provides social identity • Low importance for social security
• Traditional financial system: *Ijon*	• *Ijon* is a traditional finance credit system • Provides fast, easy and accessible funding (Partadireja 1974) • Based on trust between money lender and borrower	• Provides financial support during difficult times • Highly important	• Provides financial support during difficult times • Highly important	• Important, depending on occasion	• Not important
• Religious (Islamic) group	• Community-level worship • No administrative boundary, and depends on the influence of local Islamic leaders (*Tuan Guru*) • Contributes to education by building and managing schools and other physical infrastructure (Kingsley 2012)	• Provides free education, worshipping and social networks • Highly important	• Provides free education, worshipping and social networks • Highly important	• Provides worshipping and social networks • Less important for education	• Provides worshipping and social networks • Low importance for education
• Collective action: *Besiru* and *Gotong Royong*	• *Besiru* is an ethos that builds activity in *Banjar*, meaning 'support each other' (Tolomundu & Yamin 2008). • *Gotong Royong* involves collective action • Became a national program during	• Provides mutual assistance • Labour exchange • Highly important	• Provides mutual assistance • Labour exchange • Highly important	• Provides mutual assistance • Low importance	• Provides mutual assistance • Not important for labour change

	President Soeharto's time, in relation to government program and projects (Bowen 1986).				
• Neighbourhood network: *Gubug*	• *Gubug* represents kinship and social networks • Generates strong social solidarity (Tolomundu & Yamin 2008).	• Provides social identity and cohesion • Highly important	• Provides social identity and cohesion • Highly important	• Provides social identity • Important	• Provides social identity • Important
Traditional knowledge					
• Local regulation: *Awig-awig*	• *Awig-awig* is colloquially known as 'local rules'. • Involves collective decision-making among communities.	• Provides rules for individual access to resources • No direct benefits	• Provides rules that govern exchange value of resources • Important	• Provides rules that govern exchange value of resources • Important	• Provides rules that govern exchange value of resources • Important
• Unwritten rules, beliefs: *Pituah* and *Adat*	• Provides guidance to respect natural resources • Provides guidance on doing activities including weather advice • Contextual, is based on the characteristics of an area and its resources	• Provides moral responsibility to conserve marine environment • Not important	• Provides moral responsibility and control to conserve marine environment • Not important	• Provides moral responsibility to conserve marine environment • Not important	• Provides moral responsibility to conserve marine environment • Not important
Local natural resource management					
• Informal ceremony: *Nyalamak Dilau* or *Selametan laut*	• A ceremony that must be conducted in coastal areas of south-east Lombok to thank God (Khafid 2007) • It is forbidden to catch fish during this ceremony	• Provides cultural identity • Not important	• Legitimises fisheries management and access • Low importance, but must obey the rules	• Legitimises fisheries management and access • Low importance, but must obey the rules	• Legitimises fisheries management and access • Low importance, but must obey the rules

4.5 Discussion

4.5.1 Vulnerability components and livelihood asset type

Understanding the nature, strength and diversity of livelihoods is important in examining people's vulnerability and capacity for facing future uncertainty. Specifically, elements of vulnerability could explain the underlying factors making people's livelihoods more vulnerable. Cannon (2008, p. 4) argued that 'People's livelihood assets are their first 'line of defence' against disasters'. This study revealed the degree to which, vulnerability is experienced differently by different household types, depending on their perception of livelihood problems. Gaillard and Maceda (2009) also highlighted the influence of individual characteristics, such as income and diversity of assets, in determining individual perceptions.

Vulnerability components in Ekas Buana were interconnected. The components were used to understand which sections or groups had the greatest level of vulnerability (Cannon 2008; Cannon, Twigg & Rowell 2003). I was also able to examine the nature of vulnerability that one person experiences compared to others. This study showed that household management was an important factor in determining the ability of individual households to cope with natural hazards. This reality was also found in fishery-based coastal communities in Bangladesh where the most vulnerable households were not necessarily the most exposed ones. Rather, vulnerability was a combination of unequal influences of biophysical and socio-economic household characteristics within communities (Islam et al. 2014). This highlights the fact that vulnerability was the result of interactions between livelihood conditions and scale of hazards, including climate hazards. Households with more diversified livelihood assets might be able to cope better than those with fewer assets.

Diversification is a strategy that has been identified by many scholars as enhancing resilience (Badjeck et al. 2010; Ellis 1998; Islam et al. 2014) . In Ekas Buana, the community had been dependent upon seaweed cultivation since the early 1980s. Seaweed cultivation had enabled people to accumulate assets and improved livelihoods. Hence, improving the diversification of fishery commodities and livelihoods as alternative activities might be expected to enhance the resilience of fishers in Ekas Buana. This action needs to take into account the socio-economic, cultural and local institutions which influence livelihoods. A study conducted by Coulthard (2008) of artisanal fisheries in the South Indian Lagoon, south-east India, also found that diversification of livelihood activities could help fishers reduce risks from extreme weather events and climate variability. This evidence was supported by Badjeck et al. (2010) who asserted that poverty was only one of the causal factors in determining the inability of

households to adapt to environmental changes, but that 'specialisation traps' in livelihood activities also made people more vulnerable. In addition, diversification and flexible livelihoods should consistently support poverty reduction initiatives and improve sustainable fisheries management.

My study also found that intervention in the social protection component did not directly protect each household or individual within the community. However, social protection was more likely to benefit particular groups in the community, especially households with many assets. These households had more access to government for gaining development programs due to their livelihood asset endowment.

Any programs or decisions need to consider community knowledge of local resources and experienced risks (van Aalst, Cannon & Burton 2008). For example, native vegetation may not only minimise coastal erosion, but it could also provide habitat for native species. Considering and using local knowledge might be more sustainable than using purely expert-driven strategies.

4.5.2 Asset structures and adaptation

There is a consensus that people with many assets will be able to adapt better than those with few assets (Moser & Ahmad 2008). The dynamic process of development (or drivers of change) shows the capacity of the households to cope and adapt to particular pressures in shaping their livelihoods. This study revealed the livelihood vulnerability for different household types, and provides an important contribution to understanding how they transform their assets in flexible ways to adjust to different shocks and trends (Bebbington 1999). Flexibility in building livelihoods within household types was closely linked to institutional contexts and the nature of the community (Gaillard, et al. 2009; Wisner, Gaillard & Kelman 2011) .

Examining the connection of institutions to different asset groups provides a clear description of what kind of institutions are important for particular groups, or what might be relevant to all groups. Such critical considerations are seemingly absent in regular development planning. Understanding different livelihood assets might also be a vital step in developing interventions for enhancing community resilience and creating better conditions for future adaptation (Wisner 2010).

An analysis of assets provides a basis for understanding the connection between livelihood asset distribution and vulnerability. Understanding the fine-scale impacts of interventions of a priority group might help avoid mis-targeted adaptation policy programs and minimise the potential for maladaptation (Butler et al. 2014; van Aalst, Cannon & Burton 2008), especially given the expected rapid future changes caused by both natural and anthropogenic hazards.

4.5.3 Potential of hybrid institutions and institutional revitalisation

In general, social and institutional changes were the key concerns of people in Ekas Buana. Most rural areas in Lombok still rely on local institutions to support their livelihood activities. Social changes, such as modernisation and globalisation, were also accelerating the degradation of local culture and institutions (Butler et al. 2014; Fazey et al. 2011). Community capacity had limitations in practice. Understanding these limitations is an important step in avoiding maladaptive and ineffective interventions in the future. Developing hybrid institutions would also help the households in maintaining their livelihood system. In the context of this thesis, hybrid institution involves the translation of scientific and traditional knowledge into understandable and practical guidance (Table 4.2).

Table 4.2 Potential future interventions, by institution type, to support livelihood activities at Ekas Buana

(RCI = Rational Choice Institutionalism, HI = Historical Institutionalism (HI), and SI = Sociological Institutionalism)

Local institution	Potential actions for future interventions and connection to institutional arrangements
Socio-economic systems • Informal institutions: *Banjar*	Revitalise *Banjar* through: ▪ Strengthening the institution: communal trust (RCI) ▪ Strengthening the community's capacity as member in *Banjar* (RCI) ▪ Developing networks with external institutions such as NGOs and providing more activities that could improve knowledge and awareness, such as social learning on post-fishing processes (RCI)
• Traditional financial systems: *Ijon*	Introduce community-based macro-finance systems: ▪ Change the normal mechanisms to be more transparent and accountable but still use traditional values (SI) ▪ Develop networks with banks (HI) ▪ Integrate household management as an internal control (HI)
• Religious (Islamic) groups	▪ Improve the control mechanisms when religious groups plan to join a political party (HI)
• Collective action: *Besiru* and *Gotong royong*	Revitalise *Besiru* and *Gotong royong* through: ▪ Changing the mechanism of participation, for example, by involving young people: rational and purposive goals (RCI) ▪ Imposing more moral sanctions if any member does not participate (SI)

• Neighbourhood network: *Gubug*	▪	Change how people perceive themselves as a source of capacity, rather than as static entities (SI)
Traditional knowledge • Local rules: *Awig-awig*	▪ ▪ ▪	Develop common goals based on what people know and need to know (RCI) Translate scientific and traditional knowledge into understandable and practical guidance (RCI) Change incentive structures, sanctions and rewards (HI)
• Unwritten rules, beliefs: *Pituah*	▪	Translate myths into more common sense and practical implementation (HI)
Natural resources management • Informal ceremony: *Nyalamak Dilau* or *Selametan laut*	▪	Translate scientific and traditional knowledge into understandable and practical guidance (RCI)

One particular institution that was important in Ekas Buana was *Awig-awig* (local rules) in fisheries management. These rules could directly influence the sustainability of livelihood activities in this village. The district government had formalised *Awig-awig* in law. However, the legitimacy and implementation of *Awig-awig* has been questioned by fishers and communities. The fundamental question is why could *Awig-awig* not achieve legitimacy and be well-implemented? The answer was that the content and system of implementation of *Awig-awig* did not reflect the way fishers and the community define their basic problems, which were framed by their socio-cultural background in traditional fisheries management.

As Wiser (2010) argues, external initiatives have two weaknesses when they are expected to help farmers to adapt to climate variability: (i) failure to understand a complex livelihood system and (ii) a tendency to focus only on technical research without considering a community's capacity to act independently. These two weaknesses were also asserted by Siregar and Crane (2011) in the case of a climate field school program in Indonesia. They highlighted that adaptation to climate variability was not merely about a technical transformation, but was embedded in social re-organisation and negotiation processes.

Fundamental aspects of integrating local institutions and knowledge have not only improved local management, but have also sustained traditional systems in supporting livelihood systems in the future. Taking an example from the revitalisation of *Sawen*, a traditional resource management system in North Lombok, Satria (2007) found four factors that determine the success of attempts to revitalise traditional institutions:

> (i) the legitimacy earned from local stakeholders. This factor reflected the grounded acceptance of the system from broader entities in the community, where the institution is rooted and developed

(ii) homogeneity in terms of culture, livelihood and economic interests. Homogeneity in relevant aspects of the institutions will be an important factor in building a communal consensus to revive the system

(iii) organisational networking, building a coordinated organisation within which the institution was applied

(iv) acknowledgement from local government.

Legitimacy of the system was grounded not only in the community, but also in the government, in order to align with formal development activities (Hall & Taylor 1996).

Not all factors could be generalised, but in Ekas Buana these factors were lacking in existing local fishery management. In fact, the need to develop hybrid institutions, based on local capacity for adaptive management is an important step to avoid maladaptive actions in livelihood systems (Fazey et al. 2011; Satria 2007; Wisner 2010).

4.6 Chapter summary

This chapter showed how institutional aspects shape livelihood strategies and vulnerability of different household types. General causes of vulnerability and livelihood insecurity in Ekas Buana were driven by local institutional changes and weakness. Even though climate pressure was not really weakening the household livelihoods system, it contributed to exacerbating the vulnerability of the people; however, other factors, such as uneconomical cost of inputs and processing might also diminish people's capacity to adapt to future uncertainty. The causes and factors of vulnerability among different household types were varied according to their relevant livelihood activities and resources. Components of vulnerability showed which factors need to be addressed to achieve livelihood security and resilience. In fact, almost all of the household types identified erosion of local institutions as being a vital factor in determining their livelihood activity. Some important findings of this study are highlighted below:

- Almost all of the local traditional institutions covered in this study had a vital role in mediating community livelihoods, especially for the poor.
- Mutual assistance or collective action, social networks and traditional knowledge accounted for the capacity of the community.
- Local institutions were undermined by development through increases in materialism, individualism, lack of role models and modernisation.
- The idea of using community capacity as a rudimentary input for future adaptation was a way to avoid 'no-regret and maladaptive' policy actions. However, capacity also had limitations in facing extreme shocks and trends.

- Understanding these limitations was not simply a question of addressing more structural strategies and knowledge gaps that gradually eroded the social basis of production. Existing risk management and historical power relations in the community also had to be taken into account (Siregar & Crane 2011).

- Imposing any program on a community, without considering the institutional arrangements that already exist in that community is problematic. Instead, the focus should be on strengthening local institutions by emphasising a targeted program that takes into account the composition of livelihood asset groups, and explores the potential integration of innovative hybrid governance arrangements, based on cultural diversity and local needs. This applies to any climate change adaptation policy that might be developed.

In the next chapter, I discuss further the interaction and interdependency among household types, based on the results from this chapter.

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                    ┌─────────────────┐
                    │ Chapter 1       │
                    │ Introduction    │
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                    ┌────────┴────────┐
                    │ Chapter 2       │
                    │ Study area and  │
                    │ Methodology     │
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┌──────────────────────────┴──────────────────────────────────────┐
│ An examination of the heterogeneity of vulnerability amongst     │
│ rural communities in Lombok Island, Indonesia, and considers     │
│ implications for adaptation policy interventions.                │
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Chapter 3	Chapter 4	Chapter 5	Chapter 6
Household Typology	The Role of Institutions Mediating Household Vulnerability and Adaptation	Mapping Social Networks: Examining Inter-dependencies amongst Households	Comparing Development Interventions with Household Adaptation Needs

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                    ┌─────────────────┐
                    │ Chapter 7       │
                    │ Synthesis and   │
                    │ general         │
                    │ discussion      │
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Evidence from Chapter 4 revealed that social-economic institutions were most relevant to support and mediate poor households' livelihoods. They still rely on social networks, mutual assistance and collective actions, as a source of social security. Components vulnerability on each household type reflected the current status of their condition and identified potential areas for intervention. Therefore, the next chapter will examine further the inter-dependencies of each household type in developing social networks during normal conditions and difficult times (Objective 3).

CHAPTER 5: MAPPING THE SOCIAL NETWORK: EXAMINING DEPENDENCIES AMONGST HOUSEHOLDS

5.1 Introduction

People's livelihoods require the use of assets to produce outputs, to meet their consumption requirements and aspirations, and to invest in additional assets for the future. Asset mobilisation takes place in the context of an uncertain and changing environment (Dorward et al. 2009). Assets determine people's capacity to cope with any changes in their livelihoods. Studies of the roles of assets in coping strategies and poverty reduction are numerous (Dorward et al. 2001; Hunt 2012; Mathie & Cunningham 2005; Moser & Felton 2007; Reardon & Vosti 1995) and asset-based approaches for risk management are widely advocated (Prowse & Scott 2008; Siegel & Alwang 1999).

Management of assets as the providers of livelihood benefits is a significant component in the development of social policies (Moser & Ahmad 2008). Assessment of asset portfolios can contribute to the measurement of individual and community vulnerability and resilience. A study of urban poverty reduction strategies (Moser 1998) showed how asset portfolio management affected vulnerability and resilience in four communities from developing countries (Zambia, Ecuador, the Philippines and Hungary). Capabilities of asset management were positively linked to the ability of individuals in developing to improve their coping strategies. This study found that the complexity of interactions between different assets determined those livelihood strategies that were aimed at reducing vulnerability. Social networks and other forms of social organisation among households also emerged as important factors in increasing resilience.

Coping strategies are steps taken by individuals or groups to minimise the impacts of hazards or other external pressures and are based on physical and social assets. People's ability to cope is not only determined by individual and group capacity, but also by knowledge and experience, political and social changes, technology and the nature of the impacting hazard (Pelling 2003). People's decisions on coping are regarded as 'rational choices' based on their capacities and experiences (Adger 1996).

Vulnerability and the ability to cope with, or adapt to hazards are influenced by community structures, social groups, household assets, gender, age, ethnicity, history and both physical and psychological health (Burton 1993; Chambers 1989). Adger (1996, p. 28) identified a three-tier hierarchy of coping strategies for rural societies. Each level of strategy involved the gradual process of erosion of fundamental assets, which were adjusted to support short- and long-term

household survival. These strategies comprised 'initial use of insurance mechanisms' (e.g. selling jewellery, borrowing money and looking for other sources of food), 'disposal of key productive assets' (e.g. selling land, livestock and/or houses), and 'destitution distress migration' (e.g. migrating to find new livelihoods).

Examining livelihood strategies in different types of households can be used to understand the opportunities and constraints to building livelihood security and enabling future adaptation (Dorward 2007). However, few studies explore the interaction of households with different livelihood asset types using social network analyses (Cannon 2008). Interactions between different types of households can create social and kinship networks, but also may contribute to resilience building (Aldrich 2012b). As Bebbington (1999) has argued, social networks are a critical asset to access and utilise livelihood resources in order to promote people's well-being.

Social network analysis has been widely applied to understand the characteristics of social connectedness and interaction for collective actions in a community (Prell, Hubacek & Reed 2009; Schiffer 2007). In Indonesia, particularly in Lombok, rural communities are highly reliant on social networks in many aspects of their daily life.

This chapter attempts to analyse the interaction between different asset groups in realising their livelihood activities, in both normal situations and difficult times. For the purposes of this study, 'normal' situations or conditions are defined as being those experienced under weather conditions that approach long-term averages; and 'difficult' times or 'times of hardship' are defined as those experienced as a result of floods, droughts and other exceptional weather events.

Understanding the linkages between household types is important to capture the critical value of social networks. Such analysis is often overlooked in development program and adaptation policies. Therefore, the main hypothesis of this study is that: *Different household types are interdependent and derive benefits from social networks. This dependency influences their coping strategies and the development of their adaptive capacity.*

To address the hypothesis, my research investigates four questions:

    (i)   How do the livelihood asset groups develop social networks during periods of difficult conditions?

    (ii)   Do different types of households interact in different ways?

    (iii)   What patterns of interactions occur in the network structure?

(iv)   Which parts of networks can be strengthened or improved to help with future adaptation?

5.2 Social capital and network analysis

In Chapters 3 and 4 I showed that social networks were the preferred coping strategy amongst the different household types that I studied on the island of Lombok. Social capital, in various forms, was an important contributor to increasing resilience and strengthening adaptive capacity. Social capital is a fundamental component of livelihood strategies (see Chapter 1). Following Putnam's work (1993, p. 167), social capital is defined as 'features of social organisation, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions'. Furthermore, Burt (2000) argued that social capital is contextual and is a function of human capital assets. Social capital is reinforced by social structures which produce positive benefits and privileges such as social networks and cohesion (Burt 2000; Coleman 1988). Scholars have argued that social capital is one of the prerequisites for developing community resilience and adaptive capacity in the face of natural hazards and other livelihood changes and, therefore presumably, for dealing with climate change (Aldrich 2012b; Gaillard, JC 2007; Pelling & High 2005).

There are two vital balancing components within social capital, which provide the foundations for analysing different studies. These two components include:(i) types of interpersonal relationships (such as bonding, bridging and linking social capital) and (ii) trust and reciprocity (Burt 2000; Pelling & High 2005).

'Bonding Social Capital' is defined as a horizontal interaction and relationship within networks, such as friends, relatives and neighbours (Njuki et al. (2008). 'Bridging Capital' refers to links between different networks, which requires collaboration and coordination. The relationship among households groups in a community is an example of this form of social network. 'Linking Social Capital' is provided by the interaction of groups in a community with external institutions or agencies in positions of higher influence (Aldrich 2012b; Woolcock & Narayan 2000). Figure 5.1 provides a graphical representation of the relationships between different components of social capital.

Government representative,
nongovernmental organization (NGO),
or authority figure

Linking Social Capital
(across vertical gradients)

**Bonding
Social
Capital**
*(within
networks)*

**Bridging
Social Capital**
(between networks)

Network A   Network B
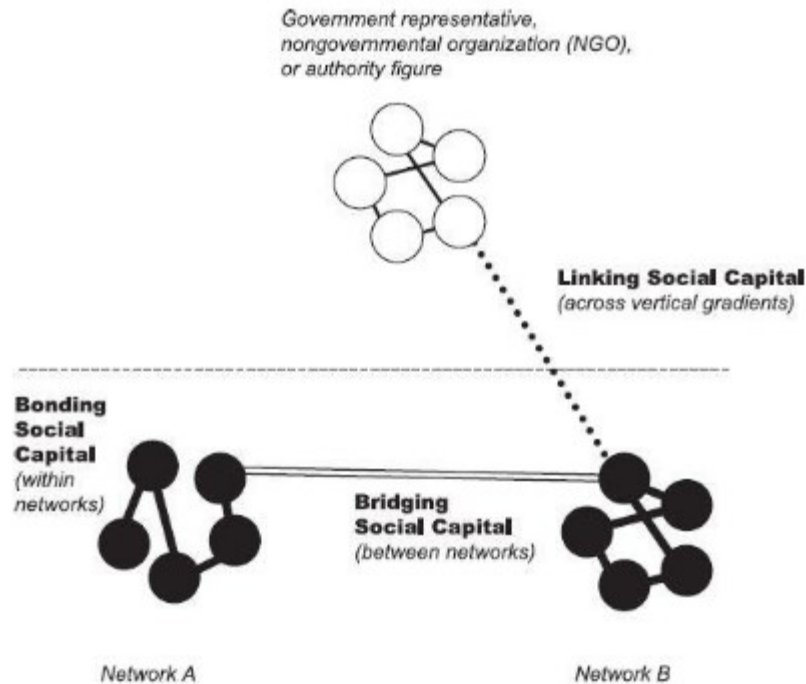
Figure 5.1 Types of social capital (Aldrich 2012a).

The second component of social capital is trust and reciprocity. This component is embedded in the quality of social structures. Trust is related to expectations within a community or group, and amongst individuals and is based on shared norms, such as spiritual beliefs, justice, professional standards and behavioural codes (Burt 1992; Pelling & High 2005). Trust is based upon collective actions where people are bound by cultural norms and behavioural codes of conduct. Trust is reinforced by reciprocity, which is gradually developed during continuous interactions (Pelling & High 2005). Mutual assistance, such as '*Gotong royong*' (mutual assistance) in Indonesia is one example of such reciprocity and trust (Bowen 1986).

Social networks are initiated by 'actors.' Actors are people or organisations whose social connections provide benefits to the various individuals or households involved with them. The social networks may include friends or relatives from inside or outside the village, local middle-men, local enterprises, local co-operatives, money-lenders, traditional institutions and the village government.

These relationships interact in structural patterns which can be analysed in order to understand the social networks which go beyond individual attributes (Schiffer & Peakes 2009; Scott 2000). Such analyses attempt to examine actors' relationships, their positioning, and how these

relationships are structured in overall networks. These relationships can then be analysed to aid understanding of the structural patterns that emerge between actors.

In natural resources management literature and disaster studies, the influence of individual actors and groups is discussed (Aldrich 2012b; García-Amado et al. 2012; Prell, Hubacek & Reed 2009). This literature shows that social networks produce different outcomes, depending on their strength and density. Aldrich (2012b) observed that areas with dense social networks tend to recover quickly from disasters.

Three mechanisms come into play to support recovery from disasters. First, social networks and ties can provide information, financial and administrative support, and guidance, when ties are strong, but also even with weak ties (Granovetter 1973). Second, those with strong ties are more likely to undertake strong collective actions in order to mobilise resources, overcome barriers and present their demands for external support. Third, strong networks provide the opportunity for individual community members to articulate their voices in soliciting support from authorities in working together to minimise the obstacles to recovery.

Prell et al. (2009) argued that there are some trade-offs in different networks properties engaged in natural resources management. For example, people with strong social ties tend to believe in what they have experienced in the past and are less inclined to seek new perspectives from outsiders. Likewise, people in close-knit societies tend to be very conservative and unwilling to experiment and learn.

Table 5.1 Characteristics of network structures (adapted from Prell, Hubacek & Reed 2009)

Strong ties	Trade-offs	Weak ties	Trade-offs
Good for communicating and working with complex information	+	Tend to act as a bridge across diverse actors and group	+
Hold and maintain trust between actors	+	Connect together otherwise disconnected segments of the network	+
Highly influence one another on related views, thoughts and behaviours	+	Good for communicating about and working with simple tasks	+
Create and maintain the reciprocity of norms of trust	+	New information tends to flow through these ties	+
Actors sharing strong ties are more likely to keep redundant information	-	Not ideal for complex tasks or information	-
Innovation among actors is less likely to be encouraged due to the actors being less exposed to new ideas	-	Actors sharing weak ties are less likely to trust one another, therefore ties can break more easily	-

Note: '+' and '-' indicate positive and negative trade-offs of characteristics in the network structures

In social network analysis, interactions amongst actors are closely related to positions of power and influence in a network; this is called the 'centrality' (Schiffer 2007). Borgatti (2006, p. 1) defined centrality as 'the structural importance of actors in a network'. Actors with more ties tend to have an advantageous position because they are able to access more resources from the network (Hanneman & Riddle 2005). Influence depends upon the 'degree' of centrality which is determined by the total number of links that connect an actor to other actors. In the context of this study, it refers to the intensity of interaction among household types. Centrality is used to examine the interactions amongst different household types as the basis for developing adaptation strategies.

5.3 Methods

This study revealed commonalities between the villages of Santong, Pandanwangi and Ekas Buana, despite their different environments and cultural contexts. However, for this study, the mapping of social networks was only undertaken for Ekas Buana.

Two main methods for data collection were employed: (i) participatory methods for mapping social networks and (ii) interviews. Detailed information on the participatory methods and interview techniques used is given in Chapter 2.

Net-Map was used to combine social network analysis, stakeholder mapping and power mapping (Schiffer 2007). Net-Map is a participatory technique that allows participants to understand, visualise, discuss and improve the situations in which they find themselves. The Net-Map method (Schiffer & Hauck 2010) enabled an in-depth analysis of the influence of networks on the different links which support coping strategies.

I chose situations where an unusually long dry or rainy season had strongly impacted the community's livelihood in the preceding five years (Dazé, Ambrose & Ehrhart 2009). Each household type answered and discussed the questions based on their experiences. In this process, participants were asked to graphically represent the nature of their interactions.

Participants were free to add any activities and information that they considered had formed part of their main coping strategies. For example, all households identified 'borrowing money' as one of their important coping strategies in difficult times. They might also lend money to other actors or institutions. Participants also mentioned and rated the level of influence of each actor in helping other households.

The result of this participatory activity was a visual depiction of causal networks. Figures 5.2A-B show the process and the result of network mapping on the relationships between household types and other actors during normal and difficult times. The diagram was supported with a detailed explanation based on the interviews and discussions. All network data were entered into a social network analysis computer program, *Visualyzer*, in order to visualise and assess the network structure and the degree of dependency among household types (Schiffer & Hauck 2010).

Social Network Analysis (SNA) explores the achievements of actors, and the developments within groups of actors, by looking at the structure of the linkages between them (Hanneman 2005). Interviews were used in order to get detailed information about the interactions occurring between household types and other actors.

More specifically, respondents were asked:

- To whom does each household type connect, under normal conditions and during difficult times?
- How are households and actors linked to each other and through what sort of connections (formal or informal)?
- Which parts of the links in the networks are crucial to enhance the household's capacity for future adaptation to climate variability and disaster?
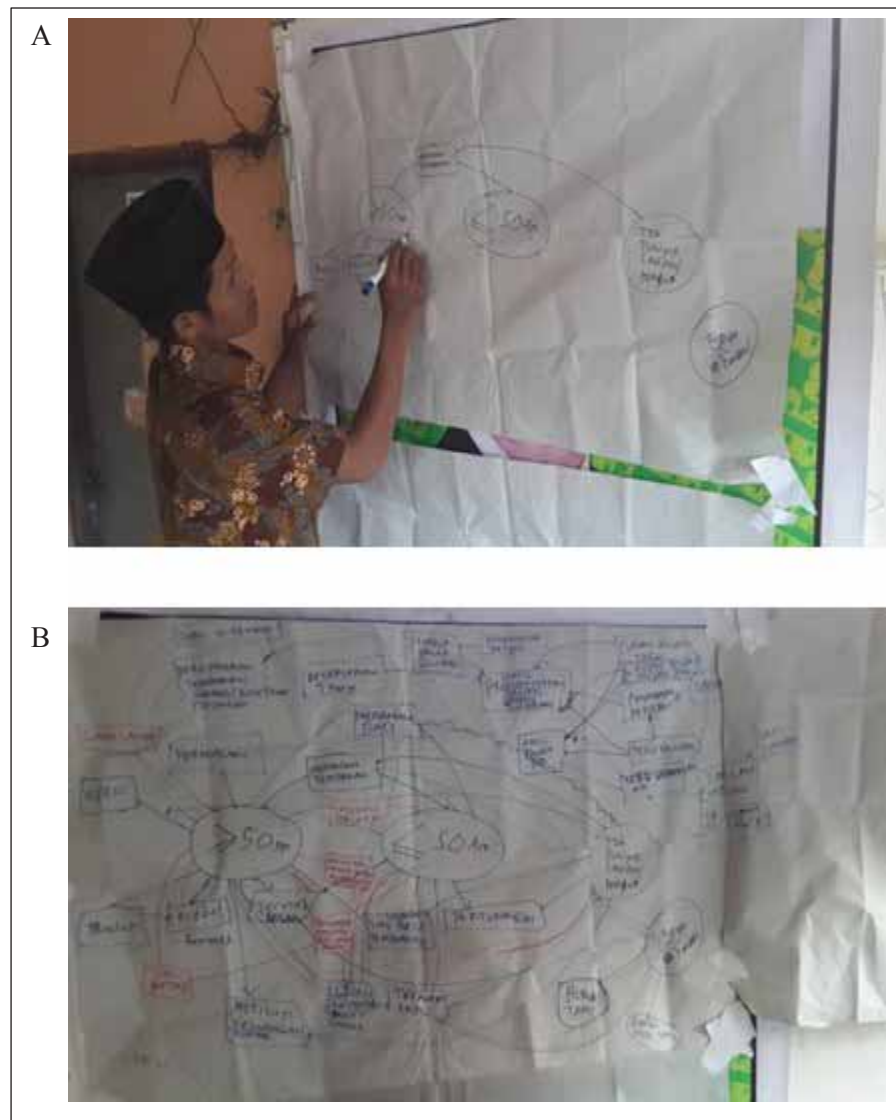
Figure 5.2A-B. Network mapping process (A) and results (B).

5.4 Results

The participatory social network mapping in Ekas Buana allowed respondents to identify several external actors that were important under normal conditions and during difficult times (Figures 5.3 and 5.4 respectively). The external actors included local enterprises, money-lenders, friends or relatives from inside and outside the village, local middle-men, local co-operatives, traditional institutions and the village government.

5.4.1 The network structure

Data from participatory activities and interviews showed that the networks of households interacted differently during normal and difficult times. Network structures under normal conditions had more connections than during difficult times, and the degree of dependency among household types was relatively stable. This result confirms the findings in Chapter 3,

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where most respondents mentioned 'getting help from relatives and friends' as their preferred coping strategy.

There was strong evidence from the network mapping that interactions were concentrated within similar types of households.

Strong connections were also mediated by local, traditional institutions. For example, after extreme weather events and strong winds in 2012, many fishers' *Kerambas* were destroyed by high waves. But the fishers assisted each other in cleaning up and reconstructing the remaining *Kerambas*. The recovery process was coordinated by a traditional institution, the *Banjar,* which is a small unit or group of households within a community, which organises social events. All households engaged in this work out of solidarity and concern for the community. In this case, the roles of local institutions (both formal and informal) were important to direct the efforts of the people. Several types of traditional institutions still exist in Ekas Buana. Financial institutions such as money-lenders, local middle-men and co-operatives still exist, and are important actors during difficult times.

Figure 5.3 shows the network structure in normal conditions. The intensity of interaction was higher compared to the intensity during times of hardship (Figure 5.4). The interactions among households and other external actors were also fewer than at difficult times. During normal conditions, households tended to reinforce productive networks to strengthen and diversify livelihood activities. This pattern was apparent from the additional links to sources of investment, projects and savings institutions.

Three main external actors contributed to the network structure. These were: (i) local co-operatives, (ii) traditional institutions and (iii) local entrepreneurs. The links with these actors were built during normal times but the actors then had an important function of providing social security during difficult times. For example, households across all the Types (1-4) reached agreements with local entrepreneurs and small businessmen to invest their money.
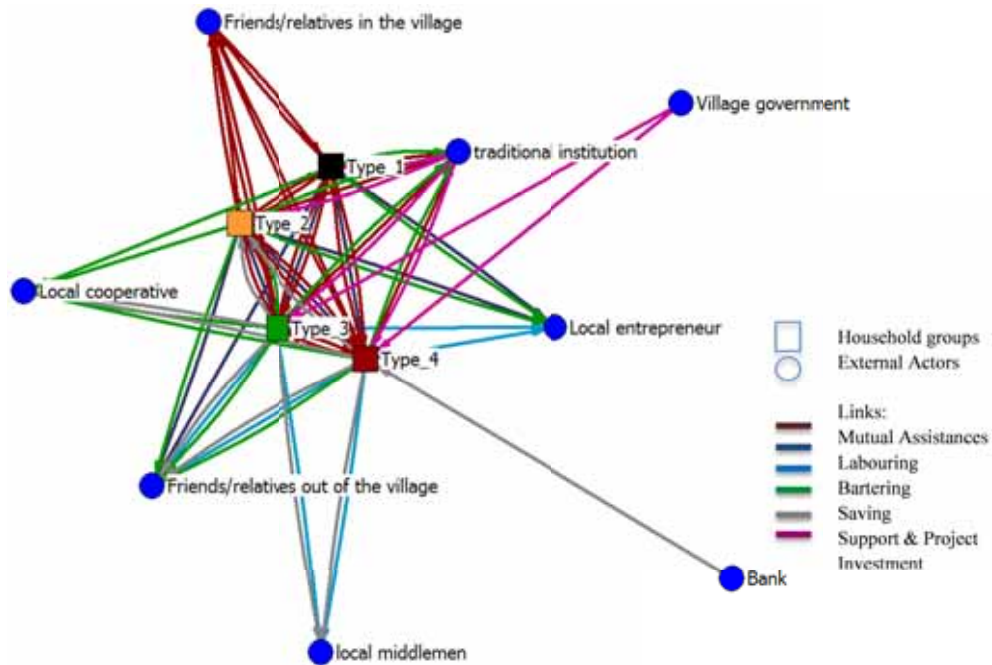
Figure 5.3 Network structure during normal conditions

During difficult times, each household type had different connections with external actors (Figure 5.4). Households with few assets (Types 1 and 2) were linked to informal external actors, such as money-lenders and middle-men. In contrast, households with more assets (Types 3 and 4) tended to be connected with formal institutions, such as banks and local co-operatives. Village governments and traditional institutions were strongly linked to all household types.
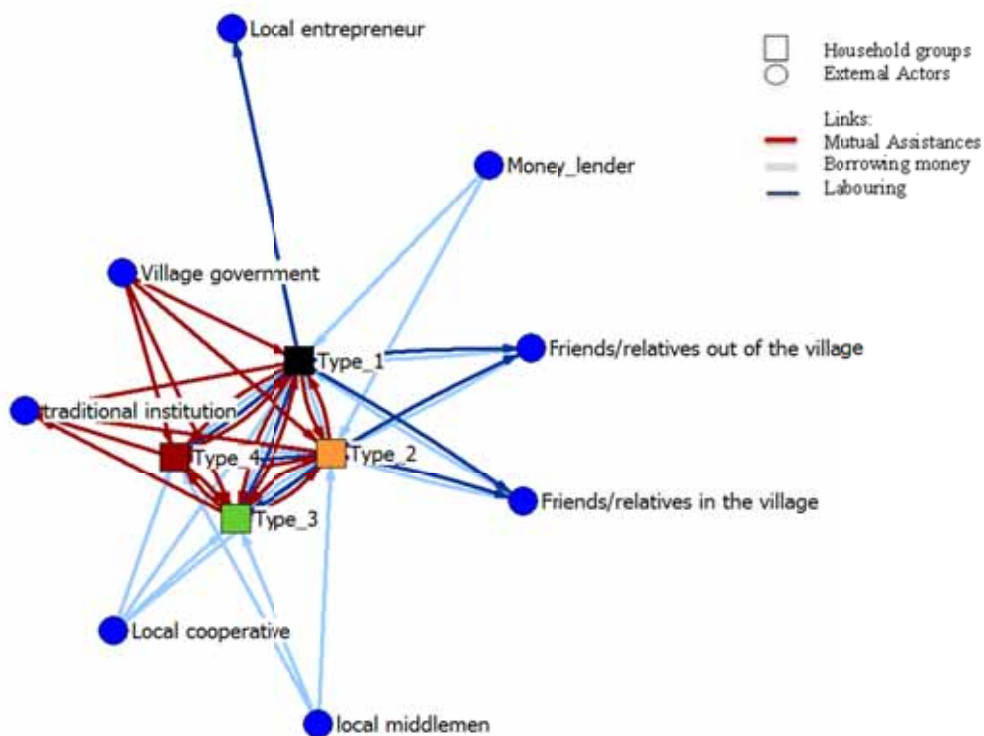
Figure 5.4 Network structure during difficult times.

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Although social networks among household types in Ekas Buana remained strong during both normal and difficult conditions, respondents did identify several threats that could reduce the existing social cohesion within communities. They included:

(i)   the growth of the local economy. For example, during difficult times households with few assets, Types 1 and 2, were dependent on traditional institutions for support for their daily activities. However when the local economy improved, people became less concerned with social activities than they had been in the past. As one of the respondents from a Type 1 household stated, '*People tend to participate in mutual assistance activities if they have some interests, but not for all social actions, as they did in the past.*'

(ii)   the decline in voluntary involvement in all social development activities. For example, some community members participated in social activities (e.g. mutual assistance and collective actions), but only when incentives, such as money, were provided.

5.4.2 Network centrality: the pattern of dependencies

'Centrality' plays an important role in understanding the connectivity among actors and households in a network structure. Centrality describes the distribution of information and resources used by network actors when managing natural assets. Network centrality analysis in this study focused on explaining the degree of both in-degree centrality and out-degree centrality. 'In-degree centrality' refers to the total number of connections that an actor has received from others – referred to as 'a node'. 'Out-degree centrality' refers to the total links initiated or initiated by an actor or a node (Borgatti 2005; Prell, Hubacek & Reed 2009; Schiffer & Hauck 2010). The in-degree and out-degree centralities can provide insights about the materials or resources which are being used by households, both during normal conditions and difficult times.

The degree of centrality of the networks in Ekas Buana during normal conditions and difficult times showed that Type 1 and 2 households tended to have a higher degree of centrality during difficult times. These household types intensified their connection to other actors or households, as a response to asset limitations, to cope with natural hazards or other shocks. Many households tried to get financial assistance from friends or relatives both within or from outside the village (see Figure 5.4).

In contrast, Types 3 and 4 households had stronger degree of centrality connections in normal conditions. Fish catches during normal conditions sometimes yielded a surplus, which enabled the households to invest in other forms of assets. For example, they might invest in an

agricultural crop, such as rice or tobacco for resale when the prices increased. Investments of this sort helped to diversify their livelihood activities. Reciprocal investments which involved social connections occurred when these households lent money to poorer households. For instance, Type 3 households gave loans to Type 1 households to enable them to market fresh fish, and then accepted fishing equipment in return as payment.

During times of hardship Types 1 and 2 households had higher in-degree connections. In this case, the poorer households received more assistance than under normal conditions. Usually they received help from other Types 3 and 4 households and had higher out-degree connections during normal conditions.

Rich households developed more connections than poorer households. Their occupations required them to engage in more interactions with formal institutions such as banks, government offices and middle-men. Households with many assets were able to exploit economic opportunities more effectively than those with few assets.
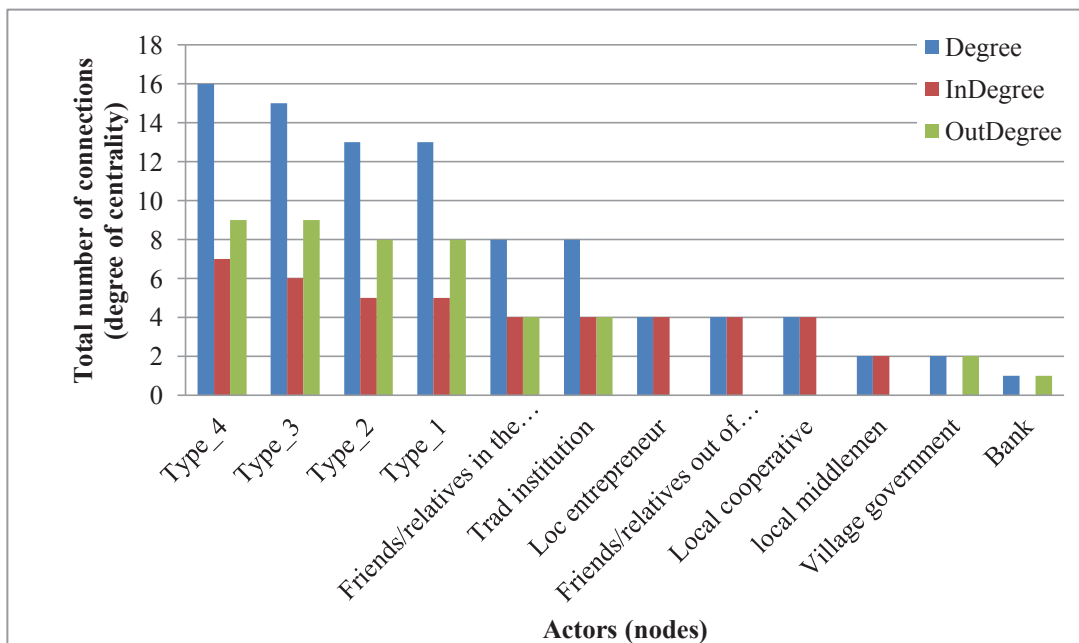
Figure 5.5 Degree of centrality during normal conditions.
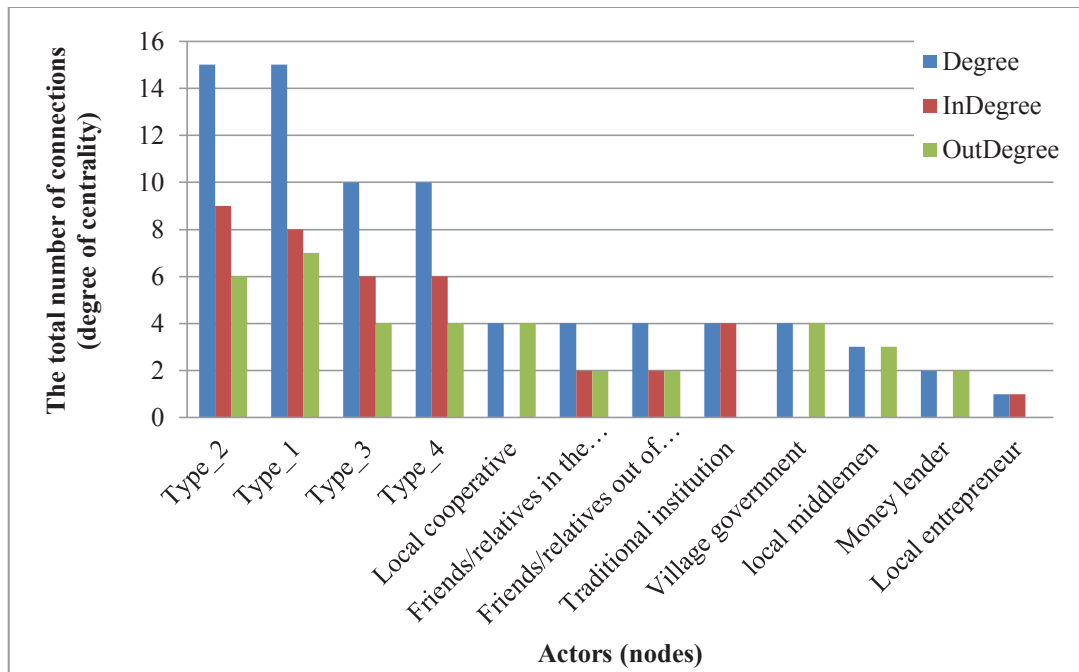
Figure 5.6 Degree of centrality during difficult times.

5.4.3 Network activities and responses

The underlying influence of social capital in determining asset differences and consequent coping strategies among households was discussed in Chapter 3. In the participatory network mapping, participants described different coping strategies used during normal and difficult conditions. These strategies were illustrated by the interactions in the network and the ways in which detailed activities differed, based on the objectives of each household type.

Table 5.2 shows an example of network interactions and responses based on network mapping and interviews. Each of the household groups responded differently in describing details of their activities. For example, respondents in Type 1 mentioned mutual assistance or helping each other as the most important strategy for them during periods of hardship. The mutual assistance link was also found in normal conditions. However, the forms of mutual assistance were different in both situations.

Participants recognised their mutual dependency as an important source of capacity which needed to be strengthened. However, they also acknowledged that the intervention from external institutions or actors was highly valued and created new livelihood options. Participants mentioned that current external development programs were not equally beneficial to all households; most projects favoured programs which were related to fishing and mariculture activities.

Table 5.2 Examples of activities in network interactions and responses.

Type/link	Activity in network interactions	Example of responses
Difficult times		
Borrowing money	• Borrowing money during times of crisis, for daily expenses	'I usually borrow money from my relatives outside of the village during extreme weather events.' (Type 1)
Labouring	• Exchange labour voluntarily • Working outside of the village for survival	'If the fishers cannot go fishing, I usually go to the nearest city as a construction labourer.' (Type 1)
Mutual assistance	• Helping each other in critical situations	'Collective funds and actions through Banjar (traditional institution) help me a lot, especially when I have difficulties.' (Type 2) 'We usually help other fishers to prepare their fishing gear and nets, especially when they want to go far out of the bay.' (Type 2)
Normal conditions		
Bartering	• Bartering marine commodities for rice and other products, lending money to farmers and exchanging it for rice	'In normal conditions, we give some money to our relative who is a farmer, and in turn we will get rice from them during extreme weather seasons.' (type 3)
Investment	• Investing money in lucrative businesses, Buying more land, *Keramba*, boats • Investing in other commodities	'We buy tobacco from farmers and sell it when the price is relative high. We also do this for different types of commodity.' (Type 4)
Labouring	• Working outside the village to generate more income	'During the day, we work as labourers on farms and go fishing during the night.' (Type 2)
Mutual assistance	• Information and skills exchange • Voluntarily selling assets	'We usually try to solve our problems through trial-and-error; then if it works, we spread the information to others.' (Type 4)
Saving	• Saving money for future expenses	'I put some of my money in the local bank for my children' education in the future.' (Type 4)
Support & project	• Receiving projects and support from development program	'Government tends to deliver programs and projects only for people with more assets and usually form different groups to the existing ones.' (Type 2)

5.5 Discussion

The results from Ekas Buana suggest that the general pattern of interactions and dependencies of households in the three villages has some commonalities. The commonalities are driven by culture, since these villages are all *Sasak,* the original ethnic group of Lombok. Even though the environments and communities' activities in the three villages differed from one to another, the social and cultural characteristics of Ekas Buana could represent a model of the social dynamic that might form the basis for climate change adaptation. The situation in Ekas Buana is clearly a special case; the people of this village have access to marine resources and the technologies for exploiting them that are not available to the people of Santong and Pandangwangi. The conclusions of the social network analysis presented for Ekas Buana may

be only partially relevant to conditions in other villages in Lombok, but they do provide some insights into how social capital might be a resource of importance in adapting to climate change.

5.5.1 Household type and network structure

This study underscores the important role of social networks in providing the fabric of social capital in Ekas Buana village (Aldrich 2010). Research findings demonstrated that bonding social capital among households, during normal and difficult conditions, was quite strong. The influences of asset differentiation among households were clear from the degree of centrality (including in-degree and out-degree centrality), both in normal and difficult times.

In the network structure, interactions between each household type and external actors (such as local co-operatives, banks and money-lenders) differed and depended both on the objectives of the interactions and on the variation of asset types. The interactions of households with external actors were an example of bridging and linking social capital in Ekas Buana (Pelling & High 2005). These connections were not investigated in detail; however the simple social networks found in this study were indicative of the potential capacity of households to adapt to climate change in the future.

Apart from being connected with different household types, the networks established in difficult times showed that asset limitation forced poor households to rely on being connected with actors such as money-lenders, relatives, friends and traditional institutions. Similar situations were also found in a study conducted by Sallu et al. (2010) in rural Botswana, where poor households were highly dependent on local institutions, and this determined their livelihood trajectory. Connecting to informal actors as a coping strategy occurred in Tokyo following the 1923 earthquake (Hastings, 1995 cited in Aldrich 2012b). At that time, informal financial institutions, such as pawn shops were the core of the local economy and poor people relied upon them. These observations are significant in establishing policies for helping people strengthen their ability to adapt to external shocks such as climate change.

Another important finding from this study was the connection among rich households during normal conditions. The productive activities of rich households provided positive impacts on other households. This potential bridging link could also benefit the poor households by providing labouring jobs (Borgatti 2006). In that way, social networks might provide 'trickle down' influences on people's ability to cope with adverse conditions. Opportunities to strengthen the networks through diversification of crops were one adaptation strategy facilitated

by this social network. Similar patterns have also been observed by García-Amado et al. (2012) while looking at social networks amongst forest communities in Mexico. *Ejidos*, community land forest management groups in Mexico, are co-operatives which enable poor peasants to profit from forest exploitation. The *Ejidos* is a local institution which enables farmers to engage in market chains and has improved their livelihoods.

Transmission of information was also an important function of social networks in Ekas Buana. Information was communicated about mariculture options and fishing methods. This was part of a collective learning process which may trigger innovation among households in their livelihood activities (Newig, Günther & Pahl-Wostl 2010; Schiffer, Hartwich & Monge 2010).

Usually, households with more assets tended to have better access to new information from external sources because they were the first point of contact for outside project interventions. In this case, asset segregation was a constraining factor in knowledge transformation. However, other households (Types 2 and 3) were also able to tap into this new knowledge through their contacts with the elites. Social structures in Ekas Buana, with strong social connectivity, prevented elites from having exclusive access to innovations.

5.5.2 Social networks and capacity

Social network analyses in Ekas Buana have shown that the dependencies and interactions among household types were high in both normal and difficult conditions. The reciprocal connection and trust among household types in different situations showed the dynamic nature of interactions between households in achieving network goals (Kelman & Mather 2008; Tobin 1999). The strong ties of interaction allowed the poor households to recover from difficult situations. Similar observations were made by Wetterberg (2005) in an investigation of the role of village social ties in Indonesia, during the 1998 financial crisis. She found that 'certain types of social ties are indeed a sort of capital for the poor, who are able to use their relationships as a way of improving their well-being' (Wetterberg 2005, p. 1).

In Ekas Buana, households with few assets tended to have more social interaction than the rich households during difficult times. In this case, social capital was essential for sustaining their livelihoods (Cannon 2008). Studies have shown that households with strong social ties recovered better after earthquakes in India and Japan (Aldrich 2012b; Nakagawa & Shaw 2004)

Strong ties within social networks should be considered as one source of capacity in dealing with natural hazards and potentially for adapting to climate change. My study produced evidence that the interaction between households led to knowledge-building and the sharing of new information and resources, especially during normal times. Stakeholder analyses and social network studies conducted by Prell et al. (2009) demonstrated that strong ties in natural resources management occurred when active communication occurred. Strong ties also enabled household members to engage in more complex tasks than was possible for those with weak ties.

In this study, each household type had a different position in communicating with external actors. However, households had similar roles in achieving mutual benefits which strengthened their network structure (García-Amado et al. 2012). Rich households (Type 4) could not sustain their activities without getting help from asset-poor households. The conclusions of this study of social networks in Lombok are consistent with the findings of scholars who have studied these phenomena in other parts of the world (García-Amado et al. 2012; Wu & Pretty 2004)

However, strong networks and dependencies among household alone would not be sufficient without interventions from external actors and institutions. The limitations of traditional knowledge and any weakening of local institutions might impede the ability of households to deal with pressures. Cannon (2008) has argued that members of a community do not always behave in ways that are favourable to their social networks. Households may have conflicting interests which could weaken their social cohesion. More importantly, networks which are composed only of 'bonding social capital' could also limit the building of resilience, as actors would have similar backgrounds and knowledge (Newman & Dale 2005). Nevertheless, apart from these limitations, strong social networks and dependencies can be potentially valuable as sources for adaptation and sustainability of livelihoods.

5.6 Chapter Summary

This study highlights the important role of social networks in strengthening social capital. Social network analysis was used to diagnose the social connections and dependencies among households with different asset endowments in Ekas Buana village. Using asset differentiation and network interactions of households, both in normal and difficult conditions, my research showed the importance of intra-community variation, which is often neglected in development programs and in formulation of adaptation policies. Strong interactions among household types demonstrate a strong capacity to achieve social cohesion. However, interventions are needed to ensure this cohesiveness is not eroded by exogenous vulnerability factors. The degree of

centrality shown at times of normal and difficult conditions resulted in poor households being more connected during difficult times. External actors were linked to different household types based on their needs and asset capabilities, but traditional institutions and village governments were mostly connected under all conditions.

All links in social networks have potential for development and adaptation to deal with future stresses; I will be exploring the use of networks on each household type in Chapter 6.

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In Chapter 5, households were shown to be interconnected and interdependent with each other. The links or purposes of the interaction were varied among household types. Connections to external actors also showed different pattern of interactions. Poor households (Types 1 and 2) tended to have more connection for assistance during difficult times, while richer households (Types 3 and 4) built more productive networks in normal conditions. In the next chapter, I will compare current development programs with adaptation needs (from questionnaire data) to examine the benefits to each household. I then further analyse the results from social networks to formulate recommendation for development policies that take into account differences amongst households (Objective 4).

CHAPTER 6: COMPARING DEVELOPMENT INTERVENTIONS WITH HOUSEHOLD ADAPTATION NEEDS

6.1 Introduction

The relationship between economic growth, development and adaptation is contested (Cannon & Müller-Mahn 2010). In the 1970s and 1980s, development debates clearly distinguished between the principles of development and economic growth. Proponents of growth proposed the 'trickle-down theory of development' (Cannon & Müller-Mahn 2010; Wisner 2003), which led to benefits that maximised the wealth of rich groups. Consequently, this was expected to benefit the poor through enhanced economic activity, which would create employment and improve income. However, many scholars have proven this theory to be false in term of its implementation. Economic growth focuses on maximising profits from the maximum use of available resources (Simms, Johnson & Chowla 2010). In many cases, economic growth can create and increase inequality, social gaps, environmental degradation and other negative impacts that outweigh its positive benefits (Simms, Johnson & Chowla 2010; Wisner 2003; Woodward, Simms & Murphy 2006).

According to data from the World Bank (World Bank 2013), almost 25 percent of people in developing countries live on less than US$1.25 per day and almost one-third live on less than US$4.00 per day, while the rest are considered to be well-off. This suggests that the poor or near-poor could easily become vulnerable and fall into deeper poverty when they experience negative shocks to their livelihoods. Meanwhile, increased income due to economic activities, benefits small numbers of people who have access to resources provided by development programs.

Sustainable development has a different goal (Cannon & Müller-Mahn 2010; Sachs 2012). This form of development aims to achieve positive improvements in people's lives (e.g. reducing poverty, and improving education, health and livelihoods) and creating equality or social justice for all people in sustainable ways (Brooks, Grist & Brown 2009; Rist 2008). Ideally, development should bring significant progress in improving societies' well-being, while at the same time reducing vulnerability to any potential shocks to livelihoods. As such, development can simultaneously contribute to adaptation by enhancing poor people's adaptive capacity and resilience (Brooks, Grist & Brown 2009; Schipper 2007).

In Indonesia, since decentralisation began in 1999, there has been a tendency for Provincial and District governments to aim to maximise economic growth by exploiting their resources and

physical assets in the name of poverty alleviation (Firman 2009). This exploitation often neglects the local contexts and variations existing in a community. Some development programs have pre-determined objectives, guidance and goals set before their implementation. This has occurred particularly in national government programs in the agriculture, fishery and forestry sectors. Since 2004, development planning increasingly has been based on bottom-up principles, whereby communities are provided opportunities to participate in the planning processes from village- to national-levels (Sopanah 2012). However, this process is often accused of being merely a ceremonial process for public consumption that lacks transparency (Aswad, Heywood & Susilawati 2012). Development planning mechanisms have tended to become top-down processes, with government plans super-imposed on communities' proposals.

In a decentralised system such as in Indonesia, community participation in development planning provides a type of social relationship which can improve social justice in development outcomes (Aswad, Heywood & Susilawati 2012). However, community participation in development planning is a long and complex process and it takes a long time to achieve the balance between empowerment and 'output-based' planning (which focuses on output over the process, with very rigid standards showing top-down spirit) (Purba 2011). Social capital is critically important in this process because strong social networks within a community are positively correlated with community development outcomes (Beard 2005; Narayan & Pritchett 1999). Social networks that exist within the community are a source of adaptive capacity, which is an essential element in developing adaptation policies (Brown et al. 2010; Roth et al. 2010). As revealed in Chapter 5, linkages between groups exist in communities, and development interventions must avoid unintended consequences that can result from knock-on effects on households with few assets.

Therefore, this chapter examines whether current development programs are benefitting all household types, or whether they only provide positive impacts to wealthier household types. This chapter applies the results of social network analysis in Ekas Buana (Chapter 5), and compares the household types' adaptation priorities with current and planned development programs.

I tested the hypothesis that: *Following the economic growth paradigm (which focuses on maximising profits from the maximum use of available resources (Simms, Johnson & Chowla 2010)) means that current development programs do not adequately consider variation in household types and capacities in their design; therefore development programs favour rich households over poor and do not benefit all households equally.*

The objectives of this chapter are to:

(i) Identify what strategies are perceived as necessary by different household types.

(ii) Analyse the compatibility between development programs and household asset types and their capacities.

(iii) Examine whether the 'trickle-down theory of development' leads to benefits at the bottom.

The analyses reveal the relationship between governance, social networks and livelihoods, as framed in the conceptual framework of vulnerability (Chapter 1).

6.2 Methods

6.2.1 Data collection

Questionnaire

Detailed explanations of the study village (Ekas Buana), sampling strategies and the questionnaire survey are provided in Section 2.4.4 (see also Appendix 2). For the purpose of this chapter, questions were related to the household types' adaptation priorities and their required development assistance.

Interviews

General information on semi-structured interviews has been given in Chapter 2. I conducted interviews in two phases. First, I interviewed all household types in Ekas Buana from July to October 2013. On all occasions, I interviewed the head of households, but often other household members also joined in the discussion. The focus of interviews were perceptions of community capacities, coping strategies used by each household, and development programs that benefited their livelihoods. The second phase of interviews was conducted with four local government officers from fishery, food security, agriculture, and development planning departments, and one local NGO officer. The interviews covered issues related to planning, implementation and community involvement in development programs. These also included questions on how each program was delivered in the community.

Focus Group Discussions

After the questionnaire survey and interviews, eight Focus Group Discussions (FGDs) were conducted in October 2013 with ten participants in each focus group (Section 2.4.4). FGDs were attended by representatives from all four household types (Chapter 3). The exercise investigated how development programs and assistance from government and other institutions

provide benefits to each household type. Participants were asked to list the programs that were relevant to their needs and livelihood assets.

6.2.2 Data Analysis

Data analysis methods have been explained in Section 2.4.4. Questionnaire data were analysed using cross-tab and chi-square in order to examine the significance of correlations between household types and the respondents' perceptions. Coding and thematic analyses were used to analyse qualitative data from interviews and FGDs (Bazeley & Jackson 2013; Ezzy 2002; Neuman 2005). This analysis enabled a categorisation based on a coding process (Joffe 2004).

To compare the compatibility of households' adaptation priorities and current development programs, a 'heat map' matrix analysis was employed for each household type. Heat maps were originally developed for measuring anthropological artefacts (Petrie 1899), but have since been developed further for different disciplines and applications (Climer & Zhang 2006; Dunstan et al. 2012; Wilkinson & Friendly 2009). In the context of this research, I modified the heat map analysis developed by Wise et al. (in review), who also applied the method in multi-stakeholder participatory processes, to examine the compatibility between development programs and climate-compatible development strategies in West Nusa Tenggara Province.

FGD participants were asked to list the current development programs most relevant to their livelihoods. These lists were later input to a heat map matrix according to household type, for comparison with each type's adaptation priorities. In addition to the approach taken by Wise et al. (in review), scores were given to each cell in the matrix, as follows:

- High compatibility between development program and adaptation needs: score = 2
- Indirect or medium compatibility between development program and adaptation needs: score = 1
- No benefit from development program for adaptation needs: score = 0.

The results of the compatibility analysis were then compared with the social network results presented in Chapter 5. This analysis focused on linkages between household types for labouring and mutual assistance, to analyse the potential trickle-down benefits occurring from development programs.

6.3 Results

6.3.1 Development programs and their beneficiaries

Most government levels in Indonesia (i.e. national, provincial and district) deliver development programs based on several funding sources, such as the national government budget, international aid that is channelled through national government, and local tax revenues. The implementation of these programs is complicated because each has different guidelines and evaluation systems. In Ekas Buana, 13 programs undertaken by nine government organisations or NGOs were nominated by interviewees (Table 6.1).

Table 6.1 Current development programs in Ekas Buana and their targeted beneficiaries, nominated by interviewees.

Organisation	Program	Beneficiaries
Ministry of Social Work, National Government	1. Family Hope Program (PKH)	• Poorhouseholds (most with no assets) based on the criteria developed by the Ministry of Social Work in Ekas Buana.
National Program for Community Empowerment (PNPM)	2. Integrated Health Centres 3. School assistance 4. Revolving fund for women group (PNPM) 5. Tortilla chips training	• Community • Students from poor families • Womens' groups with small businesses • Womens' groups
Marine and Fisheries Department, NTB Provincial Government	6. Mixed farming training (for abalone and seaweed, grouper and lobster, lobster and seaweed)	• Fisher groups with *Keramba,* boats, and seaweed farms
Department of Public Works, NTB Provincial Government	7. Create rice paddy fields	• Fisher groups with *Keramba,* boats , and dryland gardens
Department of Marine and Fisheries, East Lombok District Government	8. Fishing equipment support 9. Seaweed seeds subsidy	• Fisher groups with *Keramba,* boats, and seaweed farms
Department of Agriculture and Horticulture, East Lombok District Government	10. Maize planting	• Fisher groups with *Keramba,* boats , and dryland gardens
Department of Education and Sport, East Lombok District Government	11. School development	• Community
United Nations World Food Program	12. Mangrove planting	• Community
State Electricity Company	13. Electricity installation	• Community

Two national programs contributed to improving basic needs for households: (i) the National Program for Community Empowerment, or *Program National Pemberdayaan Masysrakat* (PNPM) and (ii) the Family Hope Program or *Program Keluarga Harapan* (PKH).

PNPM was developed in 2006 as a policy and operational umbrella for alleviating poverty through community empowerment (World Bank 2012a). Initially, its emphasis was infrastructure development, but it now focuses on developing different programs, such as training, school fee assistance and community health empowerment. PKH is a form of conditional direct cash transfer, which aims to help very poor communities obtain health and education services (World Bank 2012b). Other programs included provincial and district government initiatives, plus one from an international NGO, the United Nations World Food Program (WFP).

6.3.2 Households Adaptation Priorities

In the questionnaire (for actual questions, see Appendix 2), respondents were provided with five options for adaptation strategies (Figure 6.1), which were generated from the FGDs. The predominant adaptation for all household types was 'commodity diversification', which was identified by more than 50 percent of respondents from each type. Respondents in Type 4 had equal preference for 'diversifying source of income' and 'commodity diversification', because they had assets and capabilities to generate and diversify their income sources themselves. Clearly, members of all household types regard commodity diversification as a key factor in their development. This has strong implications for development interventions.

Respondents with few assets (i.e. Types 1, 2, and 3) chose 'investing in education and knowledge', and 'cultivating climate-resistant commodities' as adaptation priorities after 'commodity diversification', but none of the Type 4 respondents identified these strategies.
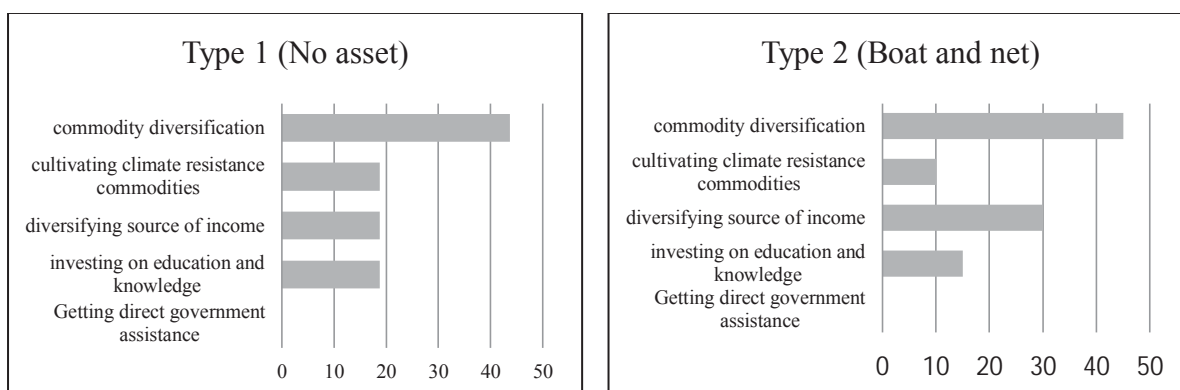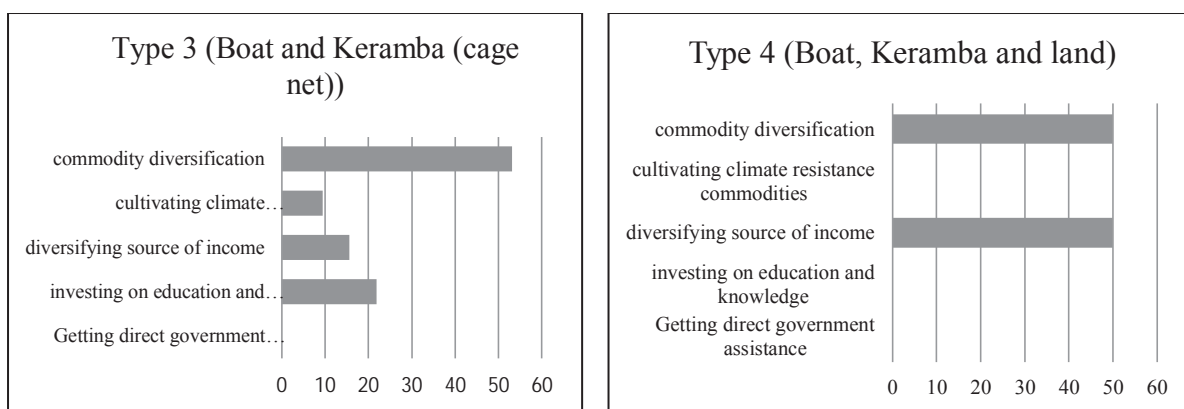
Figure 6.1 Adaptation priorities identified by each household type in Ekas Buana, as a percentage of respondents from Type 1 (n = 16), Type 2 (n = 20), Type 3 (n = 32) and Type 4 (n = 12) households.

6.3.3 Compatibility Analysis

Overall, the total compatibility score for each household type followed their asset rankings (Tables 6.2A-D): Type 4 had the highest score (50), followed by Type 3 (42), Type 2 (32) and Type 1 (30).

For Type 1, benefits came from direct cash transfer programs for health, education, and commodity diversification training for income generation (Table 6.2A). The highest score was for school fee assistance from the PKH and PNPM. In Ekas Buana, 33 Type 1 households received PKH benefits in 2013. Other programs that were beneficial to Type 1 households were PNPM program packages, such as revolving funds; and tortilla chip processing training. Although the priority adaptation strategy for this type was commodity diversification, none of the current development programs supported this.

Similar patterns were evident for Type 2 households (Table 6.2B). None of the current development programs provided assistance with commodity diversification. The greatest benefits came from direct cash payment programs for education and health under PKH. These households benefitted from the NTB Government's fishery improvement program, including direct assistance for fishing equipment. By comparison, the adaptation priorities for household Types 3 and 4 benefitted most from current development programs, in particular those programs concerned with commodity diversification (Tables 6.2C and 6.2D), such as creating paddy fields, and mixed farming training schemes.

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Tables 6.2 A-D: Compatibility analyses comparing adaptation priorities and current development programs among household types. Table 6.2A: Type 1 households; 6.2B: Type 2 households; 6.2C: Type 3 households and 6.2D: Type 4 households. Colour codes are: green = high compatibility (score = 2); yellow = indirect or medium compatibility (score = 1); red = no compatibility (score = 0).

Table 6.2A. Type 1 households

Current development programs	Adaptation priorities					
	Commodity diversification	Investing in education & knowledge	Diversifying income sources	Cultivating climate-resistant commodities	Govt assistance	Total
Family Hope Program (PKH)	0	2	1	0	2	5
Integrated Health Centres (PNPM)	0	0	0	0	2	2
School assistance (PNPM)	0	2	0	0	2	4
Revolving fund for women's' groups (PNPM)	0	1	2	0	1	4
Tortilla chips training (PNPM)	0	2	1	0	1	4
Mixed farming training	0	0	0	0	0	0
Creation of paddy fields	0	0	0	0	0	0
Fishing equipment support	0	0	0	0	0	0
Seaweed seeds subsidy	0	0	1	0	0	1
Maize planting	0	0	0	0	0	0
School development	0	2	0	0	2	4
Mangrove planting	0	0	1	1	0	2
Electricity installation	0	2	0	0	2	4
Total	0	11	6	1	12	30

Table 6.2B. Type 2 households

Current development programs	Commodity diversification	Investing in education and knowledge	Diversifying income sources	Cultivating climate resistant commodities	Govt assistance	Total
Family Hope Program (PKH)	0	1	2	0	2	5
Integrated Health Centres (PNPM)	0	0	0	0	2	2
School assistance (PNPM)	0	0	2	0	2	4
Revolving fund for womens' groups (PNPM)	0	2	0	0	1	3
Tortilla chips training (PNPM)	0	1	2	0	1	4
Mixed farming training	0	0	0	0	0	0
Creation of paddy fields	0	0	0	0	0	0
Fishing equipment support	0	0	2	0	0	2
Seaweed seeds subsidy	0	1	1	0	0	2
Maize planting	0	0	0	0	0	0
School development	0	0	2	0	2	4
Mangrove planting	0	1	0	1	0	2
Electricity installation	0	0	2	0	2	4
Total	0	6	13	1	12	32

Table 6.2C. Type 3 households

Current development programs	Commodity diversification	Investing in education and knowledge	Diversifying income sources	Cultivating climate resistant commodities	Govt assistance	Total
Family Hope Program (PKH)	0	0	0	0	0	0
Integrated Health Centres (PNPM)	0	0	0	0	2	2
School assistance (PNPM)	0	0	0	0	0	0
Revolving fund for womens' groups (PNPM)	0	0	2	0	2	4
Tortilla chips training (PNPM)	0	2	2	0	2	6
Mixed farming training	2	2	2	2	0	8
Creation of paddy fields	0	0	0	0	0	0
Fishing equipment support	2	2	2	0	0	6
Seaweed seeds subsidy	2	1	1	2	0	6
Maize planting	0	0	0	0	0	0
School development	0	2	0	0	2	4
Mangrove planting	0	0	1	1	0	2
Electricity installation	0	2	0	0	2	4
Total	6	11	10	5	10	42

Table 6.2D. Type 4 households

Current development programs	Commodity diversification	Investing in education and knowledge	Diversifying income sources	Cultivating climate resistant commodities	Govt assistance	Total
Family Hope Program (PKH)	0	0	0	0	0	0
Integrated Health Centres (PNPM)	0	0	2	0	0	2
School assistance (PNPM)	0	0	0	0	0	0
Revolving fund for womens' groups (PNPM)	0	2	2	0	0	4
Tortilla chips training (PNPM)	0	2	2	2	0	6
Mixed farming training	2	2	0	2	2	8
Creation of paddy fields	2	2	0	0	0	4
Fishing equipment support	2	2	0	2	0	6
Seaweed seeds subsidy	2	1	0	1	2	6
Maize planting	2	2	0	0	0	4
School development	0	0	2	2	0	4
Mangrove planting	0	1	0	0	1	2
Electricity installation	0	0	2	2	0	4
Total	10	14	10	11	5	50

6.3.4 Interviews

Interviews with the district government and NGO officers revealed several important issues regarding program implementation and community involvement. District Government officers claimed that they *had* been doing enough to support community livelihood activities. However, they also admitted that not all households in Ekas Buana were benefitting from the programs. In many cases, fishers were required to form a group as a prerequisite for funding, especially for physical assistance, such as provision of mariculture equipment and fishing equipment. However, this condition favoured access to programs for existing groups and created social conflict with those who did not benefit.

'We had a limited budget for our programs, therefore we delivered projects to the existing groups in the community. We hope that there will be no friction among them' (East Lombok District Government Officer).

The complex process of implementing programs in the community was also noted by respondents from local NGOs. It was common that NGO programs aligned well with community needs and problems, but they could not be sustained because local government planning did not support the initiatives at the time of program implementation. Mangrove planting and supporting alternative livelihoods by the WFP was one example of this. The mangroves in Ekas Buana contribute to livelihood activities for daily consumption. During difficult times mangrove areas also provide alternative food such as mussel, shrimps and other edible marine organisms. But during implementation the local government had a different program that was not in line with the mangrove planting program. Instead, the government development program focused on aquaculture commodity improvement, by giving out tools and technical assistance which only benefitted households with aquaculture assets.

During household interviews several respondents argued that development programs often benefitted people who were not in need. The most frequent complaints were about 'mis-targetted recipients', 'inappropriate programs' and 'discontinuity' One Type 3 respondent stated, 'It was quite often that projects were only delivered to particular groups without any consideration to involve others who were really in need. The [government] officers usually selected those who were close to them and easy to work with.'

They also asserted that some programs, for example, those from the NTB Marine and Fishery Department, were only replicating what fishers had already done. In some cases the government provided training and technical assistance to improve their fishing and mariculture activities,

but it was expensive to implement and could only be afforded by the wealthier households. This situation did not bring any significant innovative solutions to community problems.

One respondent gave an example of a lobster disease outbreak in 2010, for which the government did not provide any assistance. Instead, fishers used trial-and-error to solve the problem themselves:

> For lobster disease, we tried a new technique that we had never tried before. It involved taking the infected body part and throwing it out in to the open sea. By doing this, we hope that it will not infect other healthy lobsters. We do not know whether this technique is acceptable or not because we could not get any help from the government (Type 4 householder)

However, despite these complaints, most of the household respondents agreed that a labour-intensive commodity, such as seaweed farming was one successful example of a livelihood improvement programs. Figure 6.3 shows activities of current seaweed farming in Ekas Buana. A downturn in seaweed production in 2008 significantly reduced people's income and ancillary activities (Section 2.3.1), and currently seaweed is only cultivated by a few fishers for local markets. In this regard, some interviewees mentioned the need for commodity diversification.

Figure 6.3 Seaweed farming activities in Ekas Buana

6.3.5 Social networks and linked benefits

Social network analysis (Chapter 5) revealed some evidence that households in all types were highly connected to each other during both normal situations and difficult times. The two most common links in the social networks for Ekas Buana were labouring and mutual assistance.

Figure 6.4 shows that poorer households (Types 1 and 2) relied upon wealthier households (Types 3 and 4) and external actors during difficult times. Households in Types 1 and 2 usually worked on *Keramba* to feed lobsters and groupers in the morning, and worked as labourers in agriculture in the afternoons. Respondents explained that Types 1 and 2 fishers often could not go to sea during the rainy season (December to February) because strong winds and high waves prevented them from fishing. However, Types 3 and 4 households practicing rain-fed agriculture usually started land preparation for planting during this time, providing employment for labourers.
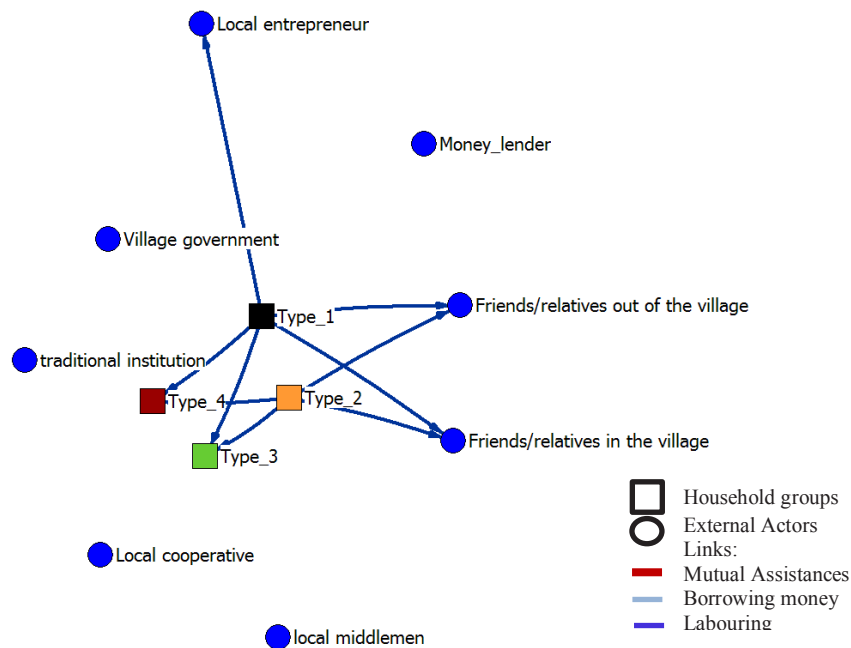
Figure 6.4 The interaction of each household types based on 'labouring' link during difficult time

As one example from the 13 development programs, the East Lombok District Government's Seaweed Seed Subsidy Initiative illustrates the potential trickle-down benefits through the labouring network. The primary beneficiaries of this program were Types 3 and 4 households who cultivated seaweed as part of their aquaculture activities. In this program, the government provided and distributed seaweed seeds to these selected wealthier households. Interviews revealed that the program generally helped increase production and demand for labour, providing indirect benefits for Types 1 and 2 households.

A second example is relevant to mutual assistance, which tightly links all household types in Ekas Buana. The 'Sabi' system is a voluntary arrangement whereby individuals without boats or nets can offer to help with fishing, and they then receive a share of the catch.

In this context, the East Lombok District Government's program of providing fishing equipment offered some trickle-down benefits by enhancing the Sabi system. Fishers who received boats and nets from the program were able to support less wealthy individuals by sharing these assets on a more regular and wider basis. However, during the FGDs, participants claimed that this program was not meeting their needs, since it was based on supplying equipment to fishing groups, and the equipment was only suitable for use in certain types of fishing grounds. Quite often the use of government-supplied boats and nets triggered conflicts amongst the members of the fishing groups, due to weak rules involving responsibilities for boat maintenance.

6.4 Chapter Summary

This chapter elaborates on the extent of current development programs that are favouring the livelihood system of all household types. Compatibility analysis using heat map matrix was conducted to compare adaptation strategies and current development program. The result from this comparison was then applied to social network analysis to see the possibility of developing intervention to formulate adaptation policy. In general, members of all household types nominated commodity diversification as an important strategy for adaptation. Interestingly, my research also found that the current development programs were not compatible with preferred adaptation strategy.

The research finding demonstrated that the economic growth provision has failed to equally address the real needs of all household types for adaptation. To minimise the inequality, adaptation policy should utilise social network within households in order to maximise the benefits of development program and improve adaptive capacity.

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                    │ Introduction        │
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                    │ Study area and      │
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│ An examination of the heterogeneity of vulnerability amongst rural │
│ communities in Lombok Island, Indonesia, and considers implications│
│ for adaptation policy interventions.                               │
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Chapter 3 Household Typology	Chapter 4 The Role of Institutions Mediating Household Vulnerability and Adaptation	Chapter 5 Mapping Social Networks: Examining Inter-dependencies amongst Households	Chapter 6 Comparing Development Interventions with Household Adaptation Needs

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                    │ Chapter 7           │
                    │ Synthesis and general│
                    │ discussion          │
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In Chapter 6, I identified the household typology of three villages based on their livelihood asset differences. I then examined among other things the roles of institutions for each household type by referring to vulnerability components, mapping household types' social networks and inter-dependency, and comparing the adaptation needs with current development programs by maximising the results from social networks. In Chapter 7, I will synthesise my key findings from the four data chapters and discuss the implications of my study on adaptation and development in Indonesia particularly, and developing countries in general. I discuss the limitations and contributions of this study and propose several potential issues for future research. The vulnerability components framework is also revisited to develop recommendations for the future.

CHAPTER 7: SYNTHESIS AND CONCLUSION

7.1 Meeting the aim of the research: Understanding community diversity as a factor in locality-specific adaptation

Formulating adaptation policy at the local-scale cannot be separated from local contexts and the existence of diversity within a community (Roth et al. 2010). My study has elaborated on household asset differences of three villages on Lombok island. The asset differences were found to significantly influence the villagers' livelihood vulnerability and adaptive capacity. Asset differences influenced the ability to deal with environmental and other forms of change. In particular, I examined the influence of household types using vulnerability criteria. Household types have different adaptive capacities and this needs to be taken into account when formulating adaptation strategies.

In order to address the overall objectives of my research I identified and analysed the livelihood asset differentiation among households in the three villages. The structure of the analysis is described in Chapter 3. I investigated the role of local institutions in mediating livelihood activities and presented the results in Chapter 4. The social networks and dependencies among household types are described in Chapter 5. Last, in Chapter 6, I examined the connection of current development programs with adaptation preferences for different household types. Using the social network results from Chapter 5, I examined the potential of future adaptation strategies. I examined the interactions and dependencies amongst households that might lead to maladaptive actions in policy-making. In this concluding chapter, I shall briefly synthesise my main findings and discuss their implications for developing adaptation policies, particularly for eastern Indonesia, and more generally for developing countries.

7.2 Synthesis of results and findings

Community structures are complex and are highly dependent on different asset endowments (Chapter 3). Differentiations were determined by several variables including number of commodity crops, main occupation, income and household-size. Livelihood asset differentiations significantly influenced the perception of vulnerability drivers and the adaptive capacity of individual households to overcome unforeseen natural hazards and socio-economic pressures (e.g. financial crises and unstable prices) (Bebbington 1999; Moser 1998).

The community in the coastal area (Ekas Buana) was significantly different from the other two villages. Data from interviews revealed that each household type ascribed specific drivers that had the potential to threaten their livelihood system; such drivers included social and institutional changes and climate issues. Interestingly, households with few assets (Types 1 and 2) perceived 'social and institutional changes' as dominant drivers of their livelihood vulnerability, especially in Ekas Buana (coastal community) and Pandanwangi (rain-fed agriculture community).

In contrast, households with many assets (Types 3 and 4) tended to be more concerned about climate issues, and crop production and crop prices. Data from the questionnaire survey also revealed the variation in coping strategies for each household type. The dominant coping strategy mentioned by the respondents in the three villages was 'getting help from friends and relatives'. This demonstrated that these three rural communities in Lombok were highly dependent on social cohesion as their first strategy for coping with short-term pressures.

Following the results from Chapter 3, I examined the relevance of local institutions in determining vulnerability and adaptation for each household type (Chapter 4). Using Ekas Buana village as a detailed case study, I found that degradation of local traditional institutions was considered to be an important factor in increasing livelihood vulnerability. In fact, these local institutions were regarded as vital for mediating poor households that were facing pressures and disturbances in their livelihood systems.

I identified several types of institutions that were relevant to each household type. In general, poor households were closely linked to informal local institutions, such as the *Banjar,* a sub-village organisational unit, *Ijon,* a traditional financial institution, religious groups, *Besiru,* a system for collective action, and *Gubuk,* a neighbourhood network. In contrast, rich households were mostly linked to *Awig awig* (traditional regulations) which is related to natural resource management, for instance, the regulation of fishing and locating the *Kerambas*.

Given the dynamic nature of social connectedness in communities described in Chapters 3 and 4, I examined social networks and interdependency within households. I found that household types were interdependent, and this influenced their ability to cope with, and adapt to future changes (Chapter 5). The interactions between household types were quite high, during both normal conditions and at difficult times. For this study, 'normal conditions' referred to the weather conditions that approach the long-term average and 'difficult times' describe conditions experienced as a result of floods, droughts and other exceptional weather events. Some traditional institutions such as *Banjar, Ijon*, and *Gubug* were linked to all household types,

especially during normal conditions. Therefore, social networks and mutual assistance were important for maintaining livelihood activities.

In Chapter 6, I analysed the connection between development programs and the adaptation needs of different household types, using Ekas Buana as a case study. I used these results to inform adaptation interventions. I utilised social network analysis to determine capacity to adapt to external shocks (see Chapter 5).

Heat map analysis showed that current development programs benefit rich households, and do not address adaptation needs for poor households. This evidence suggests that networks and dependencies among household types may be used as indicators of adaptive capacity. This finding implies the need for a more equitable distribution of development benefits to all households, a more egalitarian approach to enhancing adaptation (Brooks et al. 2011).

7.3 Challenges for adaptation policy and development in Indonesia: an egalitarian or utilitarian approach?

A. Community variation and local institutions

In Chapter 1, I described climate change adaptation policies in Indonesia. Since the National Action Plan on Climate Change (NAPCC) was formulated, it became mandatory for all provincial governments to establish regional climate change strategies. For example, in the West Nusa Tenggara province, a regional Action Plan was formed in 2010 with the aim of strengthening community level capacity for adaptation. The Action Plan aimed to integrate climate change adaptation measures into all relevant development sectors (Bappeda NTB 2010a). However, the Plan has not yet been fully integrated into district and municipality development plans. Most of the contents of the Action Plan are sector-focused.

There is a substantial gap between the fundamental vulnerability drivers impacting on local communities, and top-down plans that have been established by the provincial government. This research addresses the important issue of understanding different community perspectives of livelihood vulnerability, among contrasting household groups. Differences in livelihood assets among communities are often neglected in development programs and projects. Assets are more than possessions (Bebbington 1999); they are also a source of social identity and enable people to access development benefits from within their social networks.

The most significant finding of my research was the over-riding importance of local institutions such as those that enable mutual assistance (Agrawal, Mearns & Norton 2010; Christoplos et al. 2009). Network interdependencies (Butler et al. 2014) are fundamental to adaptive capacities among household types. Externally conceived adaptation strategies must recognise that interventions will have different consequences for different types of households.

In the social network analysis of Ekas Buana (Chapter 5), I found productive interactions of poor households (Types 1 and 2) in supporting the livelihood activities of rich households (Types 3 and 4). For example, mutual assistance links under normal conditions were not only providing social benefits among groups, but also creating space for the local economy to become more developed. I also witnessed the same patterns in the Santong forest community and the Pandanwangi rain-fed agriculture community. In both of these communities social connectedness and local institutions were essential for sustaining livelihood activities (Satria & Adhuri 2010).

My research in Lombok has implications for developing adaptation strategies for other poor regions of Indonesia. My research demonstrates the significance of household diversity and the multiplicity of vulnerability drivers (Christoplos 2010). Recognising the significance of local social networks in strengthening adaptation capacities (Chapter 6) would counter the frequent complaint that development does not target the right recipients, supports inappropriate programs and is discontinuous (see Section 6.3.3). Social network analysis increases understanding of specific interactions and power relationships within a community or village (De Haan & Zoomers 2005; Leach, Mearns & Scoones 1999). Participatory approaches are the only way to map social networks and need to become standard procedures in developing adaptation plans. Appropriate and consistent use of participatory techniques is essential if local governments are to create programs that deliver benefits for all household types.

B. Vulnerability is determined by components of systems

Over the past five years, there have been many projects and aid programs related to vulnerability assessment and adaptation strategies throughout Indonesia but especially in the eastern provinces. External assistance has attempted to support local development programs, especially at the local government-level. Currently, local governments in Indonesia have limited capacity to address integration across sectors – interventions from the centre are dominated by sectoral institutions. A 'vulnerability components framework' could be used to integrate across sectors at a more local level (Cannon 2008). Vulnerability frameworks could be adjusted for specific local conditions and contexts.

Figure 7.1 summarises possible measures that could be implemented for each of the components of vulnerability. They include: (i) identification of relevant local institutions for each household type, (ii) determination of the ability of poor households to access development programs, (iii) analysis of the social network systems and interactions among household types and (iv) examination of livelihood connections and performance within a community. Each of these steps is connected to a vulnerability component (see also Figure 1.6).
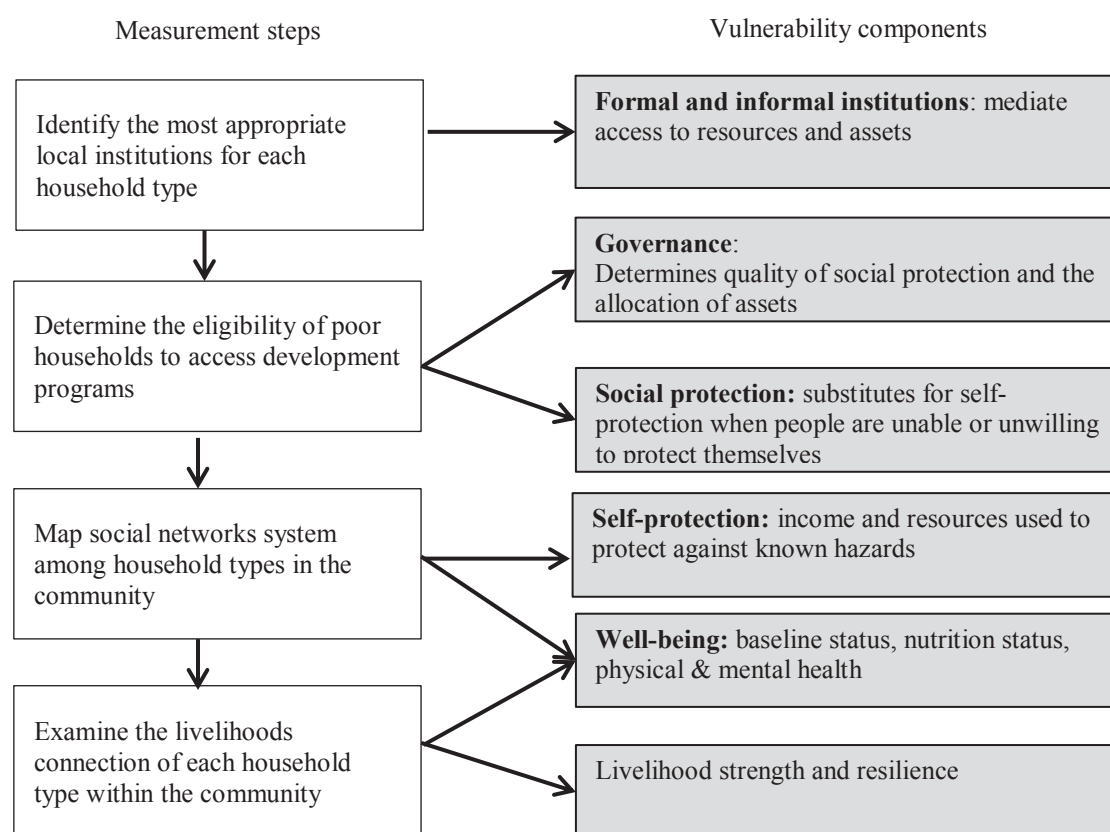
Figure 7.1 A proposed vulnerability components framework for use in identifying the focus of interventions targeting particular groups in the community (adapted from Cannon (2008))

C. Economic growth and social capital: some reflections

In Ekas Buana the poorest households (Types 1 and 2) in the village relied heavily on collaboration among community members to survive hard times, whereas wealthier households were, to some extent, buffered by the diversity of the sources of their incomes. In contrast, improvements in economic development and market access within the village had the effect of eroding social cohesion and other traditional institutions upon which the poor households were dependent. Results from interviews revealed that people tended to be pragmatic and money-oriented when they had to participate in development programs. Respondents mentioned the loss of leadership and absence of role models within the village. Leadership and role models

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were the basis for the functioning of local institutions and the strengthening of social cohesion among community members.

Government planners and their partners from aid agencies are confronted with a dilemma. Economic gains provide the richer households with assets that enable them to adapt to external shocks such as those anticipated from climate change. However this economic progress for the rich often undermines the social cohesion and weakens the local institutions that are fundamental to the adaptation strategies of the poor. It remains unclear how external assistance can drive economic progress in ways that will allow the perpetuation and revitalisation of the local institutions that underpin the livelihoods of the poor. There is an inherent conflict between measures that enhance local economic development and interventions that might strengthen local institutions. The concentration of wealth and influence in more favoured households seems inevitably to undermine the ability of the poor to deal with external shocks. Some development programs such as the National Program for Community Empowerment (PNPM) placed much greater emphasis on broad participation of communities in determining local development interventions. The PNPM program is viewed by many as exemplary in the ways it has addressed the real needs of all household types through education, promotion of local socio-economic activities and support for gender-sensitive programs.

Empowerment is fundamental to development and any programs to empower local people must be based on explicit recognition of community needs. However the economic gains that flow from many development interventions are captured by elites and run counter to the need to promote equity and to motivate the poor and vulnerable. *Sawen,* the traditional resource management practice described in Chapter 4, is an example of a local initiative that revitalised a local institution in circumstances where the communities' needs aligned with the enabling political and environmental situation. The community in this case took the initiative to reduce over-exploitation of resources when the government agencies failed to achieve this objective.

The revitalisation of the *Sawen* system provided opportunities for the local stakeholders to strengthen equality and justice in natural resources management on the basis of local knowledge and institutions. The links between local institutions and those community livelihoods dependent on natural resources utilisation was a source of strength in this revitalisation process. The revitalisation process of *Sawen* provided three important lessons. First, that local institutions must be equitable and fair for all households and must not discriminate between gender and generations. Second, that development programs must support the conditions that will enable the revitalisation of local institutions. Last, that participation of all community members should be a priority.

7.4 Insights for developing countries

Climate change adaptation initiatives in developing countries are the focus of many international organisations and agencies (Conway & Mustelin 2014). Numerous financial and technical mechanisms have been developed or at least proposed to help developing countries deal with climate issues. Some scholars have advocated specific interventions to support adaptation depending on their stage of development and availability of resources (Adger et al. 2003; Huq, Reid & Murray 2006; Mertz et al. 2009). However, significant challenges remain in addressing the highly diverse needs of the poor households who are the most vulnerable to climate change.

Apart from the proliferation of international concerns on climate adaptation initiatives, there are ongoing arguments about how adaptation needs can best be integrated into and mainstreamed in development policies and practices (Huq & Reid 2004; Klein et al. 2007; Klein, Schipper & Dessai 2005). Many current adaptation policies are unrealistic and do not give clear direction on how they could be integrated into community development and natural resource management policies, and whether integration is enough to achieve sustainable development. Adaptation policy needs to apply the learning from past experiences of development practices, and identify appropriate scales for interventions (Conway & Mustelin 2014). All interventions must be based upon an in-depth understanding of current conditions and capacities that exist in a community (Cannon & Müller-Mahn 2010). By focusing on household differences, my research shows how adaptive capacity within a community can be enhanced by appropriate sustainable development interventions. Social networking among households can be exploited to minimise deficiencies of development programs.

During an International Symposium on Climate Change Adaptation in Jakarta, Indonesia, in July 2013, I found that there was a high level of recognition from many scientists that more attention had to be given to measures to enhance existing local capacity to deal with external shocks. There is now broader recognition that community-based adaptation to climate change in Asian countries needs to consider the diversity of livelihood assets of targeted populations (Sabates-Wheeler, Mitchell & Ellis 2008). In Chapter 3, I explored the influence of assets on individual household perceptions toward vulnerability drivers (Moser 1998; Moser & Ahmad 2008). Assets determine a household's coping decisions and strategies (Siegel & Alwang 1999). Therefore, by exploring the impacts of variations within a community, my study suggests some new perspectives on the inter-dependence of climate change adaptation and development.

7.5 Research contributions to the climate change and adaptation discourse

My research contributes to the broader discipline of livelihood and vulnerability studies, particularly by emphasising household asset differences. My contribution provides a different perspective on the multiplicity of factors influencing both vulnerability and adaptive capacity in dealing with livelihoods and disasters. Climate change is just one driver of external shocks to which communities have to respond and the means by which they will have to do so are not inherently different from the ways that they deal with any other external shock.

In terms of adaptation science, my study contributes to the emerging body of knowledge on 'asset-based approaches' (Prowse & Scott 2008). I have further developed the 'vulnerability asset framework' (Moser 1998) and 'asset-based social risk management approaches of (Siegel & Alwang 1999). In this study, I described the role of assets in shaping the vulnerability perceptions and coping decisions of different households. The use of social network mapping to describe interactions in the community has the potential to enrich the understanding of the role of social capital for adaptation in times of disasters and improve the elements for strengthening resilience in the community (Aldrich 2012a).

In addition, my research has emphasised the need to go beyond the general assessment of vulnerability and livelihood for adaptation. In fact, there is potential for promoting the role of assets, including social connectedness, as an important adaptive capacity in gaining sustainable livelihoods.

7.6 Limitations of study

My research has not attempted to fully analyse the linkages among household adaptation preferences and impacts in the different environments of the three villages. Integrating the concepts of vulnerability, ecosystem services and sustainable livelihoods would give a broader picture on how future adaptation strategies might influence the ability to manage natural resources in the long term (Reed et al. 2013). In fact, the critical findings of my study only focused on the social aspects of livelihood vulnerability and adaptation within three communities. The key reason for not combining 'the ecosystem provision approach' (Carpenter et al. 2009) was due to inadequate resources and the time that would have been required for such interdisciplinary research. Therefore there is potential for future research that combines different concepts, with an emphasis on household differences within different ecosystem contexts.

7.7 Future scope of research

Further research on my study locations could give more attention to ecosystem service provisions. These services include provisioning services (such as providing food, timber, fibre and water), regulating services (such as regulation of water quality, floods and coastal erosion), cultural services (such as offering recreational activities, spiritual beliefs and aesthetics), and supporting services (such as photosynthesis, nutrient cycling and nursery grounds for fishes in mangrove ecosystems) (Carpenter et al. 2009). Using three different study locations, future studies could investigate different links and interactions for each household type. This investigation could increase understanding about which services are particularly important to each household type. Analysis of livelihood vulnerability in the three different villages of this study would increase our understanding of the risks to and sensitivity of livelihood components and of the social learning process of a community (Reed, Fraser & Dougill 2006; Reed et al. 2013).

The analysis of social network governance for adaptation would repay further study. We still have limited understanding of ways in which we can nurture appropriate local institutions which will enable different household types to integrate into broader-scale natural resource management. A combination of a 'market incentives approach' (Grafton et al. 2006) and a 'Territory Use Right in Fishery (TURF) approach' (Afflerbach et al. 2014; Christy 1982) might provide an example of emerging research on social network governance, with applications to climate change adaptation. Market incentives focus on the implementation of transparent pricing in order to avoid low buying prices and delays in payment. Meanwhile, the TURF approach focuses on the spatial boundary of property rights that are exclusively granted to individuals or groups of fishers to harvest marine resources within a specific geographic area (Christy 1982). Combining these approaches allows communities to build networks of local institutions in order to gain more economic benefits (Adhuri et al. 2015). Future research could incorporate household difference analyses in order to understand the equitability of the benefits of these approaches.

Numerous future research options may allow testing of, and lead to improvements in, adaptation models. The 'landscape approach' could provide a framework for engaging households with processes at larger spatial scales and in different ecosystem settings (Sayer et al. 2013). Cost-benefit analyses might be applied to further examine the possible impacts of different adaptation preferences that are claimed by each household type. Such studies would inform governments and development practitioners of potential impacts of adaptation strategies.

7.8 Concluding remarks

Through this research, I have attempted to examine the heterogeneity of vulnerability amongst three rural communities in Lombok, Indonesia, as it influences adaptation policy interventions. I used component vulnerability as a theoretical framework. The utilisation of the framework was required to deal with the complex nature of vulnerability among household types and the contested notion of adaptation and development. All evidence and findings in my research confirmed that there was a strong connection between livelihood asset differences, vulnerability perceptions, and the ability to cope and adapt to unpredictable changes. I conclude that adaptation interventions need to consider the diversity of socio-economic dynamics and linked asset structures, along with the utilisation of social networks and local institutions as being integral to adaptive capacity.

Revitalisation and strengthening social networks and local institutions, in combination with livelihood improvement programs, are needed to enhance community resilience. Due to the locality specific characteristics of the villages, development and adaptation policies need to provide space for accommodating household asset differences, participation and collaborative processes which could generate multiple benefits from all development programs for poor household types. These strategies would minimise and reduce the inherent contradiction that mainstream development benefits are captured by elites and this process leads to the erosion of local institutions and networks.

Interventions by government agencies and aid programs will never be able to target individual households in ways that prevent discrimination between households with different asset endowments. This means that aid which directly targets climate change adaptation through building dependence on asset endowments will rarely work. Thus, aid to address climate change should intervene in ways which will at least do no harm to local institutions and social capital. Economic growth and the specialisation that it inevitably brings may threaten many of the institutions of the poor. Climate change adaptation measures should avoid the temptation to micro-manage local communities and should use care in detailed planning of interventions. Ultimately, local initiative and innovation will determine how people deal with climate change. Education, health, infrastructure and markets can provide space for local innovations and excessive government intervention beyond the provision of these basic services may be counter-productive. Above these basic requirements for livelihood development, the over-arching need is for better governance and the ability to acquire and defend property rights. The ability of the state to provide these fundamental services will determine people's ability to deal with climate change.

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Appendix 1 Questionnaire for Santong (forest community) and Pandanwangi (rain-fed agriculture)

Village / Town Name:

Male ☐   Female ☐   Age:………………..years

Level of education:

1=No formal education	2= Finished/unfinished elementary school	3=Junior high school	4=Senior high school	5=Tertiary education

A. RESPONDENT VARIABLES

1. Number of family members:

Male: Female: Children:

2. How long have you been living in this village?

3. How much is your total income (Indonesian currency: *Rupiah/Rp*) per month?

1 = < 625,000Rp	2 = 650,000-1,150,000Rp	3 = 1,175,000-1,675,000Rp	4 = 1,700,000-2,200,000Rp	5 = > 2,225,000Rp

4. What is your primary occupation (occupation contributing most of your household income)?

5. Do you have a secondary occupation (occupation supporting your household income),? Please   rate the importance of its contribution to household income: *Scale: 1=not important, 2=moderately important, 3=very important*

Occupations	Scale

6. Do any of your household members work to support family income? (Yes/No)……

B. HOUSEHOLD INFORMATION

7. Do you have private land (e.g. community forestry, paddy field or plantation)? (Yes/No)………

If yes, what is the size of your private or rented land?

Type	Privately owned	Rent	Community forestry
Community forestry land			
Paddy field			
Plantation			
Other, please specify……			

8. How many types of crops or commodities do you cultivate? What percentage do you use for personal consumption and/or sell?

Type of crop	Personal consumption (%)	Sell (%)

9. Are there any local organisations and collective actions in your area? (Yes/No)……….
10. Do you involve the local institutions in activities? (Yes/No)……….
11. If yes, what kind of organisation and collective actions are you associated with?

	Institution	
	Non-Governmentl Organisation/community group	1
	Micro-finance groups	2
	Political organisations	3
	Informal networks (e.g. *Banjar, besiru*)	5
	Religious organisations	6
	Others, specify…..	7

12. Are you an active member? (Yes/No)…….
13. What are the benefits of joining the organisation?

	Institution	
☐	Networking	1
☐	Financial help	2
☐	Technical know- how/nursery/fertilisers	3
☐	Representation in higher political bodies	4
☐	Religious knowledge	5
☐	Others, social relations…..	6

14. Do you have livestock? (Yes/No)….

If yes, please mention what kind of livestock and how many of each you own?

Type	Owned	Looking after other people's livestock

15. How do you perceive your current assets compared with past conditions, and is this trend likely to continue into the future?

Type	Past condition (scale)	Current condition (scale)	Future condition (scale)	Reason for changes (scale)
Financial asset				
1. Income, savings				
2. Access to financial institutions				
3. Other……….				
Human asset				
1. Quality of household health				
2. Level of education				
3. Practical knowledge for supporting your job				
4. Other……….				
Physical asset				
1. Quality of your house and basic sanitation (e.g. clean water, toilet)				

2. Infrastructure (e.g. local roads, drainage, electricity)				
3. Availability of public facilities and services (e.g. school, health centre)				
4. Availability of local market				
5. Other……….				
Social asset				
1. Neighbourhood networks and interactions				
2. Collective action (*besiru, arisan* etc)				
3. Local participation in common public interests (e.g. local development planning initiative, *gotong royong*)				
4. Availability of religious institutions for your social benefits				
5. Availability of non-religious institutions for your social benefits (e.g. Community forestry or farmers or fishers group)				
6. Other……….				
Natural asset				
1. Quantity of farming, plantation and forest products				
2. Quality of forest (e.g. tree density, biodiversity)				
3. Availability of clean water for irrigation				
4. Other……….				

*Scale 1= highly improved, 2 = improved, 3= indifference, 4= not improved, 5= highly decreased

16. Could you list the five biggest threats to your own livelihood at this moment?

Livelihood threats	Reason for selection (Why)	Strategy to cope
1.		
2.		
3.		
4.		
5.		

C. PERCEPTION AND KNOWLEDGE ABOUT CLIMATE CHANGE (VARIABILITY) ADAPTATION

17. Do you know about climate change? :   yes/no

If yes, how:

Criteria	Put √ mark	Comments
By hearing from others		
By media		
By observations		
By practical experiences		
Others		

18. If we compare with the past, what changes have you found in the following?

Climate components	Increase*/early	Decrease/late	Same	Comments
Temperature				
Rainfall				
Droughts				
Sea level rise				
Natural calamities (e.g. cyclones, storm surge, floods)				
Seasonal changes				

*Code 1 = strongly agree, 2 = agree, 3 = indifference, 4 = disagree, 5 = strongly disagree

D. PERCEPTION ON CLIMATE THREATS AND COPING STRATEGY

19. Which climate factors would you list as the biggest threats to your livelihoods and family?

Climate threats	Reason for selection (why?)	Strategy to cope
1.		
2.		
3.		
4.		
5.		

20. Have you received advice/programs from Government, NGOs or other external organisations within the last 5 years? Yes/No …….

If yes, please list the programs that you think are the most important with assisting your livelihood, or helping you to cope with climate variability.

Development Program (initiated by…)	Did this program benefit your livelihood? Y/N	If Y/N, why/how?	Did this program help you to cope with climate issues? Y/N	If Y/N, why/how?

21. What factors could bring changes in your livelihood and occupation, based on your priority and scale of importance?

Factor	Priority ranking	Reason
1. Education and technical skills		
2. Financial support		
3. Given new land and improving additional land (CF and non-CF)		
4. Government assistances		
5. Working overseas		
6. Others…….		

22. If there is a drought/high rainfall/harvest failure for the next 12 months, what will be the most important strategy for your livelihoods?

	Strategy	Priority
	Try to survive with present assets/saving and capabilities	
	Help from family and friends	
	Sell assets (e.g. land, livestock, etc.)	
	Obtain food from government	
	Work in other sector or outside of the village	
	Others…….	

23. What are the most important things that could be done to adapt to climate change and other future disturbances (e.g. socio-economic and environment)? Please mention three priority strategies based on your livelihood condition.

Options	Strategy
	Change commodity
	Cultivate climate change-resistant commodities
	Plant more trees
	Diversify own businesses
	Work on non-agriculture/fishery jobs
	Get help from government
	Others…….

Appendix 2 Questionnaire for Ekas Buana (coastal community)

Village / Town Name:

Male ☐   Female ☐   Age:………………..years

Level of education:

1=No formal education	2= Finished/unfinished elementary school	3=Junior high school	4=Senior high school	5=Tertiary education

C. RESPONDENT VARIABLES

1. Number of family members:

Male: Female: Children:

2. How long you have been living in this village?
3. How much roughly total income (Indonesian currency: *Rupiah/Rp*) do you earn per month?

1 = < 625,000Rp	2 = 650,000-1,150,000Rp	3 = 1,175,000-1,675,000Rp	4 = 1,700,000-2,200,000Rp	5 => 2,225,000Rp

4. What is your primary occupation (occupation contributing most of your household income)?
5. Do you have secondary occupation (occupation supporting your household income), please mention if you have? Please give the scale of importance to contribute to household income: *Scale: 1=not important, 2=moderately important, 3=very important*

Occupations	Scale

6. Do any of your household members work to support family income? (Yes/No)……

D. HOUSEHOLD INFORMATION

7. Do you have private land (e.g. community forestry, paddy field, and plantation)? (Yes/No)………

If yes, what is the size of your private or rented land?

Type	Private owned	Rent	Community forestry
Community forestry land			
Paddy field			
Kebun/plantation			
Others, please mention……			

8. How many types of crops/commodities do you cultivate? What percentage do you use for personal consumption and/or sell?

Type of crop	Consumption	Sell

9. Are there any local organisations and collective actions in your area? (Yes/No)……….

10. Do you involve the local institutions activities? (Yes/No)……….

11. If yes, what kind of organisation and collective actions are you associated with?

	Institution	
	Non-Governmental Organisations/community group	1
	Microfinance groups	2
	Political organisations	3
	Informal networks (e.g. Banjar, besiru)	5
	Religious organisations	6
	Others, specify…..	7

12. Are you an active member? (Yes/No)…….

13. What are the benefits of joining the organisation?

	Institution	
	Networking	1
	Financial help	2
	Technical knowhow/nursery/fertilizers	3
	Representation in higher political bodies	4

	Religious knowledge	5
	Others, social relation…..	6

14. Do you have livestock? (Yes/No)….

If yes, please mention what kind of livestock and how many of each you own?

Type	Owned	Looking after other people's livestock

15. How do you perceive the change of your current assets compared with past conditions, and is this trend likely to continue into the future?

Type	Past condition (scale)	Current condition (scale)	Future condition (scale)	Reason for changes i (scale)
Financial asset:				
1. Income, saving, etc				
2. Access to financial institutions				
3. Others……….				
Human asset:				
1. Quality of household health				
2. Level of education				
3. Practical knowledge for supporting your job				
4. Others……….				
Physical asset:				
1. Quality of your house and basic sanitation (clean water, toilet, etc)				
2. Accessibility and utility (local roads, drainage, electricity, etc)				
3. Availability of public facilities				

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and services (school, health centre, etc)				
4. Availability of local market				
5. Others……….				
Social asset:				
1. Neighbourhood networks and interactions				
2. Collective action (*besiru, arisan* etc)				
3. Local participation on common public interests (local development planning initiative, *gotong royong* etc)				
4. Availability of religious institutions for your social benefits				
5. Availability of non-religious institutions for your social benefits (e.g. Community forestry or farmers or fishers group)				
6. Others……….				
Natural asset:				
1. Quantity of farming, plantation and forest products				
2. Quality of forest (tree density, biodiversity, etc.)				
3. Availability of clean water for irrigation				
4. Others……….				

*Scale 1= highly improved, 2 = improved, 3= indifference, 4= not improved, 5= highly decreased

16. Could you list the five biggest threats to your own livelihoods at this moment?

Livelihood threats	Reason for selection (Why)	Strategy to cope
1		
2		
3		
4		
5		

D. PERCEPTION AND KNOWLEDGE ABOUT CLIMATE CHANGE (VARIABILITY) ADAPTATION

17. Do you know about climate change? :   yes/no

If yes, how:

Criteria	Put √ mark	Comments
By hearing from others		
By media		
By observations		
By practical experiences		
Others		

18. If we compare with the past, what changes have you found in the following?

Climate components	Increase*/ early	Decrease /late	Same	Comments
Temperature				
Rainfall				
Droughts				
Sea level rise				
Natural calamities (cyclones, storm surge, floods etc.)				
Seasonal changes				

*Code 1 = strongly agree, 2 = agree, 3 = indifference, 4 = disagree, 5 = strongly disagree

D. PERCEPTION ON CLIMATE THREATS AND COPING STRATEGY

19. Which climate factors would you list as the biggest threats to your livelihoods and family?

Climate threats	Reason for selection (why?)	Strategy to cope
1		
2		
3		

20. Have you received advice/programs from Government, NGOs or other external organisations within the last 5 years? Yes/No …….

If yes, please list the programs that you think are the most important with assisting your livelihood, or helping you to cope with climate variability.

Development Program (initiated by…)	Did this program benefit your livelihood? Y/N	If Y/N, why/how?	Did this program assist you to cope with climate issue? Y/N	If Y/N, why/how?

21. What factors could bring changes in your livelihood and occupation based on your priority and scale of importance?

Factor of changes	Priority ranking	Reason
1. Education and technical skills		
2. Financial support		
3. Given a new land and improving additional land (CF and non-CF)		
4. Government assistances		
5. Working overseas		
6. Others…….		

22. If there is a drought/high rainfall/harvest failure for the next 12 months, what will be the most important strategy for your livelihoods?

	Strategy	Priority
☐	Try to survive with the present assets/saving and capabilities	
☐	Helps from family and friends	
☐	Sell assets (e.g. land, livestock, etc.)	
☐	Food from government	
☐	Work on other sector or outside of the village	
☐	Others…….	

23. What are the most important things that could be done to adapt to Climate Change and other future disturbances (e.g. socio-economic and environment)? Please mention three priority strategies based on your livelihood condition.

Options	Strategy
☐	Changing commodity
☐	Cultivating climate change resistance commodities
☐	Planting more trees
☐	Diversifying own businesses
☐	Working on non-agriculture/fishery jobs
☐	Getting help from government
☐	Others…….

Appendix 3 The results of stepwise analysis

Appendix 3, Table 1 Stepwise results of selecting significant variables*

Village	Step	Entered	Wilks' Lambda (λ)								
			Statistic	Exact F				Approximate F			
				Statistic	df1	df2	Sig.	Statistic	df1	df2	Sig.
Santong	1	Main_job	.129	171.000	3	76.000	.000				
	2	commodity	.074	66.661	6	150.000	.000				
	3	income	.066					41.216	9	180.247	.000
Pandan Wangi	1	Main_job	.558	22.747	3	86.000	.000				
	2	commodity	.498	11.820	6	170.000	.000				
Ekas Buana	1	commodity	.365	44.160	3	76.000	.000				
	2	Main_job	.187	32.807	6	150.000	.000				
	3	income	.142					24.583	9	180.247	.000
	4	household_size	.116					20.232	12	193.431	.000

*At each step, the variable that minimises the overall Wilks' Lambda is entered. a) Maximum number of steps is 12.
b) Maximum significance of F to enter is .05. c) Minimum significance of F to remove is .10.

Appendix 4 A comparison of word cloud analysis between government documents and vulnerability drivers perceived by respondents in three study locations

Using data and information from interviews, I analysed and compared the focus of climate change developments from two government documents (Indonesian Climate Change Sectoral Roadmap (ICCSR) and Provincial Plan on Climate Change Action) and the vulnerability drivers mentioned by respondents. The language used on each object of comparison was varied, ICCSR used English for all contents while provincial plan and interviews data were all in *Bahasa*. The selection words method was constrained to 1000 most frequently used words with a minimum length of three letters, using *NVivo* version 10. The most frequently used words appear based on their size.

Based on the result from the word clouds, I found that the three most frequently used words in the ICCSR were related to development, emissions, and mitigation (Figure 1). The central focus of climate change in the document was mitigation programs in development. Out of the three words, several words that focus on sectoral mitigation also appeared, such as transportation, industry and agriculture. Similarly, word clouds in provincial plans on climate change action were also dominated by sectoral focus for example '*dinas*' (department), '*pengembangan*' (improvement), '*air*' (water), and '*pertanian* (agriculture)'.

In contrast, from three villages, the most frequently used words that appeared were quite diverse and related to their livelihoods system, climate, knowledge, local institutions and prices (see Figures 3, 4, 5, and glossary). In Santong, land, employment, weather, water, price and rain were the most frequent words mentioned by the respondent. These words indicated problems that were associated with their livelihoods. Meanwhile in Pandangwangi, some words were similar with Santong such as land, weather and price. But the respondent also focused on their local institution (*Banjar*), knowledge and seasonal changes. Lastly, in Ekas Buana, climate, rain, strong wind, employment, institution and sea were most frequently identified by the respondent as livelihood vulnerability drivers. Climate-related issues were commonly mentioned in the interviews.

In summary, the evidence from word cloud analysis showed that there is a significant gap between development planned by the government and community perceptions toward climate change. Focus on only mitigation and business as usual development would diminish the root causes and underlying vulnerability in community livelihoods. Any actions that were taken

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without understanding the local context of community would create maladaptation which would make people more vulnerable. Therefore, the combination of local capacity (including institutions) would increase resilience to any future shocks and stresses faced by all households.

Appendix 4, Figure 1. Word cloud for Indonesia Climate Change Sectoral Roadmap (ICCSR)

GLOSSARY
Dinas = government department
Air = water
Masyarakat = people/community
Hutan = forest
Iklim = Climate
Pertanian = Agriculture
Kelautan = fishery

Appendix 4, Figure 2 Word cloud for Provincial Plan in Climate Change Action Plan

GLOSSARY
Harga = price
Lahan = land
Air = Water
Iklim = Climate
Cuaca = Weather
Nelayan = Fishers
Kelautan = fishery
Pengetahuan = Knowledge
Kebutuhan dasar = Basic needs
Pekerjaan = employment
Panen = harvest

Appendix 4, Figure 3 Word cloud for Santong livelihood vulnerability drivers

GLOSSARY
Harga = price
Lahan = land
Iklim = Climate
Cuaca = Weather
Nelayan = Fishers
Kelautan = fishery
Pengetahuan = Knowledge
Kebutuhan dasar = Basic needs
Pekerjaan = employment
Banjar = local institution

Appendix 4, Figure 4 Word cloud for Pandanwangi livelihood vulnerability drivers

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GLOSSARY
Tembakau = Tobacco
Masalah = Problems
Masyarakat = people/community
Harga = price
Iklim = Climate
Cuaca = Weather
Hujan = rain
Petani = Farmer
Kelautan = fishery
Pengetahuan = Knowledge
Kebutuhan dasar = Basic needs
Pekerjaan = employment
Institusi = Institution

Appendix 4, Figure 5 Word cloud for Ekas Buana livelihood vulnerability drivers