Can resilience be built through micro-finance tools? A case study of coping and adaptation strategies to climate-related shocks in Piura, Peru

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ABSTRACT

This study focuses on the livelihoods of rural households in the region of Piura in northern Peru, who are either farmers or livestock holders. The livelihood systems of these farmers are exposed to and vulnerable to climate-related shocks like floods and droughts and the El Niño phenomenon. A particular emphasis is put on the analysis of the livelihoods and strategies of these households in order to examine the range of assets, their relations and interdependencies as well as the prevailing social, institutional, political, and environmental structures that are influencing the livelihoods. In addition, the coping and adaptation strategies of the farmers are investigated with a focus on the actions and available measures that the farmers take in anticipation of or during a natural phenomenon, and also to understand how they will act and adapt to these events in the future. Hence their understanding of climate change and possible measures of how to cope with it are assessed and recommendations concerning long-term adaptation strategies with regard to climatic events are made.

The second part of the research investigates what kind of protection local farmers need, which kind of financial services schemes are demanded and appropriate for the region, and determines the perception and understanding of insurance in order to design marketing strategies and programs to educate and inform the clients. This analysis also determines the ability of the market to support these micro-insurance and other financial services. It is very important to know the specific conditions of the area, with regard to institutions and actors involved in order to design appropriate financial instruments.

A particular emphasis is put on determining in which way micro-insurance or other financial services can play a role in fostering the resilience of these communities. It is particularly important to evaluate what conditions are necessary to make these mechanisms sustainable and accessible to local farmers. Investigating the possibilities for offering micro-finance services to agriculture in the area, e.g., especially bundled schemes such as micro-insurance coupled with micro-credit, are of particular interest. Moreover, the possibilities for climate-risk management insurance instruments, like area-based climate indexes, bundled schemes and others are evaluated.

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1 Introduction

"These are some of the strategies I use and know about in order to adapt myself and my crops to climate-related shocks, but in general I lack money and technical assistance to apply these and other measures to protect my crops".
Said by a farmer that participated in a
workshop in the highlands of the Piura River basin,
October 2007

1.1 Research problem and aims of the study

The above quote of a peasant from a village in the highlands of the Piura River basin communicates one of the biggest challenges that small peasants, especially the poorest, are facing, i.e., their limited capacity to cope with climate-related shocks such as floods and droughts that are caused by El Niño and other climatic risks. Their limited capacity to protect themselves from these shocks (ex ante) and to cope with the impacts (ex post) of the negative events results in a major impoverishment and greater vulnerability of these small farmers (Trivelli, 2005). One of the answers to these types of shocks is the development of agricultural insurance schemes. Notwithstanding the inherent problems of the insurance market and that it is not possible to respond to these shocks with alternative 'informal' systems, micro-insurance schemes are being discussed and tested in order to offer instruments to small peasants to protect them from these kinds of shocks and to avoid some of the problems of the traditional insurance market such as adverse selection (Mechler et al., 2006).

This study focuses on rural households in the region of Piura in northern Peru, who are either farmers or livestock holders[1]; most do not have access to financial and other extension services. First, this study seeks to identify the factors that cause local farmers to be vulnerable to climate-related events. Moreover, it is intended to determine some of the historical, political, economic, social and environmental conditions that have led to this increased vulnerability in recent years. A particular emphasis is put on the analysis of the livelihoods and livelihood strategies of these households using the Sustainable Livelihoods Approach (SLA), which views poor people as acting in a context of vulnerability where they have access to certain assets or other factors that allow them to reduce their poverty. The study examines the range of assets, their relations and

[1] Throughout the study, the term farmers or smallholders will be used to represent both agricultural and livestock activities and used interchangeably with the word households.

interdependencies as well as the prevailing social, institutional and political environment and structures that are influencing the livelihoods and strategies.

In addition, the livelihood or coping and adaptation strategies of the farmers shall be investigated. The focus is on the actions and available measures that the farmers take in anticipation of or during a natural phenomenon, such as floods and droughts caused by El Niño[2] and climate variability, and also to understand how they will act and adapt to these events in the future. In the context of this research, the focus is mainly on coping strategies, i.e., those strategies that rural households use in times of crisis. The purpose of investigating livelihood strategies of the poor is to define patterns that can be acted upon in order to improve the livelihood prospects of the poor in times of crisis and disaster. The more choice and flexibility that people have in their livelihood strategies, the greater is their ability to withstand or adapt to the shocks and stresses of the vulnerability context (DFID, 1999). For this reason, popular indicators used by farmers to predict climate are evaluated, and the specific coping strategies farmers use when facing a situation of water scarcity or water abundance and the effectiveness of these coping mechanisms are determined. Furthermore, their understanding of climate change and possible measures of how to cope with it are assessed and finally recommendations concerning long-term adaptation strategies with regard to climatic events are made.

In addition, risks that cause high levels of economic stress to local households are identified. Although most of the poor in developing countries often do not understand the concept of insurance, they are used to coping with risks. Their ways of coping include retaining risk (self-insurance), sharing risk (informal group-based mechanisms), and transferring risk (social protection) (Churchill et al., 2005). A special emphasis will be put on analyzing the effectiveness of these coping mechanisms and determining in which way micro-insurance (or other financial services) can play a role in fostering the resilience of these communities. Micro-insurance should complement rather than replace existing coping mechanisms, and hence products as well as insurance education should be based on local mechanisms and concepts (Churchill et al., 2005). Understanding existing coping mechanisms where poor people pool risks can reveal positive features of informal insurance systems that could be incorporated into the design of micro-insurance products.

[2] El Niño-Southern Oscillation (ENSO: commonly referred to as simply El Niño) is a global coupled ocean-atmosphere phenomenon. Throughout the study El Niño will be used to refer to this phenomenon.

The second part of the research investigates what kind of protection local farmers' need, which kind of financial services schemes are demanded and appropriate for the region, and determines the perception and understanding of insurance in order to design marketing strategies and programs to educate and inform the clients. Low-income clients, such as local farmers, have needs and preferences that may be as varied as in other markets, hence micro-insurance product design should be adapted to the client's cash flow. It is of crucial importance and a necessary condition to know the specific circumstances and demand in the region for ensuing micro-finance product development and its successful implementation and functioning. As there is very limited previous experience with insurance for low-income groups, it is hoped that the research will be useful for determining the demand for subsequent micro-finance and especially micro-insurance product development.

This analysis also determines the ability of the market to support these micro-insurance and other financial services. It is very important to know the specific conditions of the area, with regard to institutions and actors involved in order to design appropriate financial services and tools. The research covers an analysis of the demographic, geographic and economic characteristics of the market. The tools have to be adapted to the situation in the area in order to meet the demand of the local farmers. This is why an in-depth analysis of the actors, the institutions, and the capacity of the market and the private sector is carried out. More precisely, it will be important to identify potential delivery channels that fit clients, as well as structures and positive attributes of existing institutions that could support and incorporate such insurance delivery systems.

An emphasis is put on determining in which way micro-insurance or other financial services play a role in fostering the resilience of these communities. It is important to evaluate what conditions are necessary to make these mechanisms sustainable and accessible to local farmers. Investigating the possibilities for offering financial services in the area, e.g., especially bundled schemes such as micro-insurance coupled with other financial services such as micro-credit, loans and re-insurance, will be of particular interest. More specifically, the possibilities for climate-risk management insurance instruments, like area-based climate indexes, bundled schemes and others will be evaluated. The research will be useful for fostering the resilience of farmers through

improved coping and adaptation strategies as well as for the development of micro-insurance products and other financial services in the area.

Finally, the research seeks to determine whether the institutional set-up and market has the capacity to support and offer such tools to local farmers. Thereby it is hoped to determine the factors that are needed to set up and develop these micro-products for the region and if these can be met with the current market or whether, for example, a lack of demand or of the capacity, the market cannot support such schemes.

1.2 Research hypotheses

This study is based on four hypotheses:

a) Weak institutional arrangements and inconsistency in state-led politics in the agricultural sector create high vulnerability and inefficiency in the coping strategies of local farmers.
b) High risks and insufficient local adaptation strategies to climate-related shocks are a major factor inhibiting the resilience of local farmers.
c) Financial services can be a coping mechanism for extreme climatic events such as floods and droughts.
d) Pure micro-insurance service provision might not function in the region because of a weakly developed insurance culture and education. It is therefore most likely that households will need a combination of financial tools.

1.3 Placing the study in development geography

In development geography, spatial patterns of development are studied by trying to determine the social, political and economic factors that foster development. Thus, it is hoped to understand both the geographical causes and consequences of varying development. A particular emphasis is put on the study of sustainable development to understand how to meet the needs of the present without compromising the needs of the future generations. Development geography is considered, in this context, as a subject of social science, which attempts to explain the whole complexity of development and development deficits by applying interdisciplinary development theories (Köberlein, 2003).

In the last decades of the twentieth century, significant changes have occurred at a global scale, such as the appearance of a new socio-political and economic framework, i.e., globalization, accelerated population growth, and exacerbating environmental degradation accompanied by climate change. These issues and many more have a notable impact on economic, ecological and social developments of societies, and are leading to rapid socio-economic, demographic, environmental and political changes worldwide (Köberlein, 2003). The global environmental, social and economic changes indicate that the pressures on the globe have reached a new level because of the intensity and scale of human activities (Gunderson and Holling, 2002). These changes represent new opportunities especially in the political and economic spheres, which allow deprived actors to participate in the process of globalization. At the same time, these changes also indicate increased risks in the social and environmental spheres, especially for the poorest, who are exposed and vulnerable to new unexpected events that cannot be managed and could cause further deprivation and poverty.

As a result, unpredictable risks and man-made insecurities, which have emanated from the victories of modernity (i.e., development), characterize the *conditio humana* at the beginning of the 21st century (Beck, 2007). In many disciplines, such as sociology, political science, geography, economic and natural sciences, risks and security are increasingly being investigated; this is referred to as risk research. In Geography, risk research is mainly concerned with those risks that are affecting human livelihoods by making use of the concepts of vulnerability and resilience and the Sustainable Livelihoods Approach (SLA) (DFID, 1999). The SLA is a way to improve our understanding of the livelihoods of poor people. It draws on the main factors that affect poor people's livelihoods and the typical relationships between these factors. In this context, geographers play an important role in the discussion on susceptibility and criticality in the development process. Several theoretical and empirical studies have been conducted in development geography focusing on livelihoods and livelihood strategies in both rural and urban settings, contributing both theoretically and empirically to the enhancement of the analysis of poverty, vulnerability, livelihood security and most recently also resilience and adaptation to climate change (Bohle, 2001; Köberlein, 2003).

This study follows these conceptual and theoretical paradigms as well as the empirical case studies and seeks to contribute theoretically and empirically to the knowledge of how

people manage to secure a livelihood in rural areas of the region of Piura in Peru under harsh living and working circumstances that are conditioned by natural hazards and environmental risks. The particular aim is to provide information on how their living conditions can be improved and adapted to the natural hazards and environmental risks that affect them.

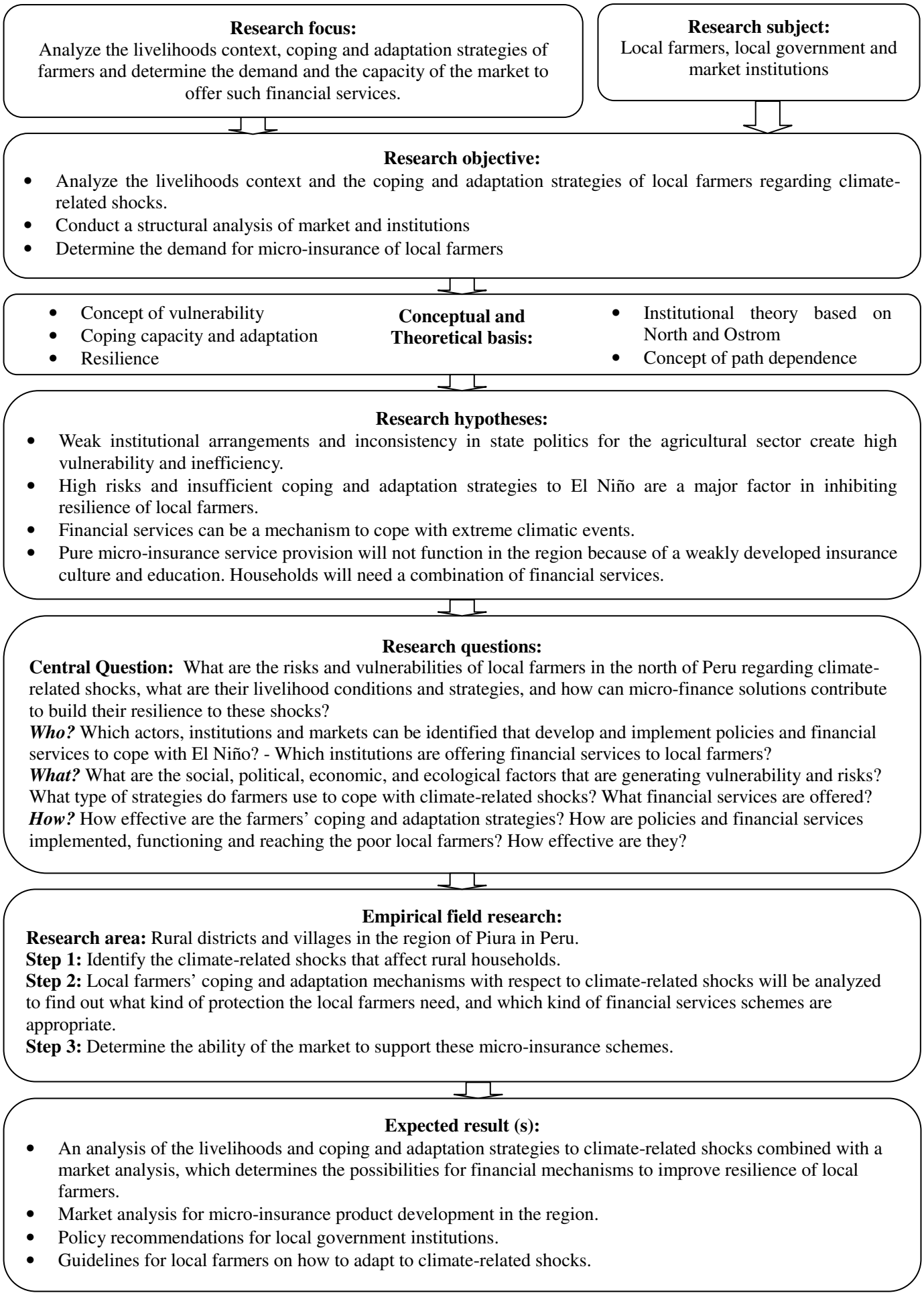
1.4 Research process

Beginning with a broad research focus on coping and adaptation of farmers with respect to El Niño and related climatic events, a preliminary analytical framework was developed (Figure 1). The research proceedings were not linear but rather a process in which assumptions, methods and procedures had to be adjusted in the field.

The thesis consists of 8 chapters. After an introduction into the research aims and process in Chapter 1. Chapter 2 provides insights into the conceptual and theoretical framework for the Peruvian socio-economic and political context with a main emphasis on the discussion of institutional theory and historical facts. The research methodology is outlined in Chapter 3.

The empirical findings are discussed starting in Chapter 4, where the focus is on the livelihood context of the surveyed households. The assets or so-called capitals are discussed along with a description of the vulnerability context and trends that farmers in Piura are exposed to. Chapter 5 presents the analysis of the farmers' coping and adaptation strategies to climate-related shocks. The structural analysis of the financial instruments market and institutions is discussed in Chapter 6 followed by a discussion in Chapter 7 on the necessary institutions, actors and actions for resilience-building. Conclusions, lessons learned and recommendations are presented in Chapter 8, along with a discussion on the implications of the findings for the private-sector development of financial instruments as well as public-sector development policy and practice in the context of adaptation to climate-related shocks and building the resilience of rural communities to these shocks.

Figure 1: Schematic overview of the research process



2 Conceptual and theoretical framework for the Peruvian context

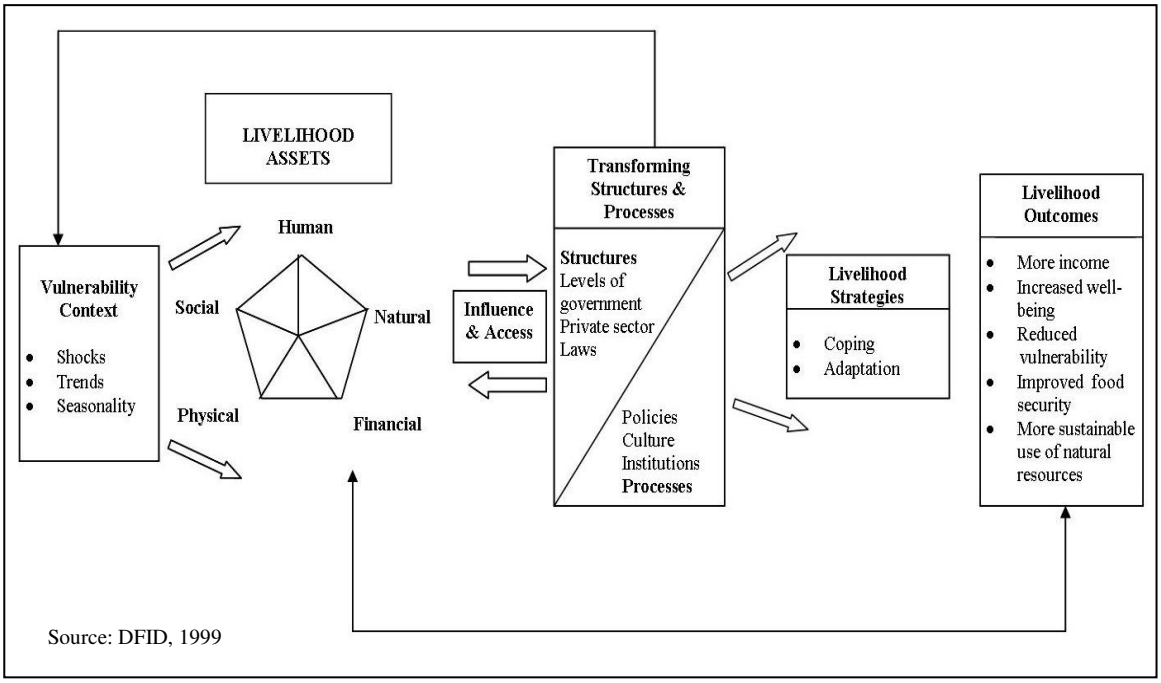
The aim of this chapter is to provide a general idea of the concepts used in disaster risk management and adaptation to climate change literature and practice, which are relevant for this research; further to present a background on institutional theory showing its relevance for analyzing the history of institutional arrangements in Peruvian agriculture, and to give a historical overview of the Peruvian socio-economic and political context and the ways in which it has influenced the current institutional environment and setting.

2.1 Research concepts

2.1.1 Livelihood approach

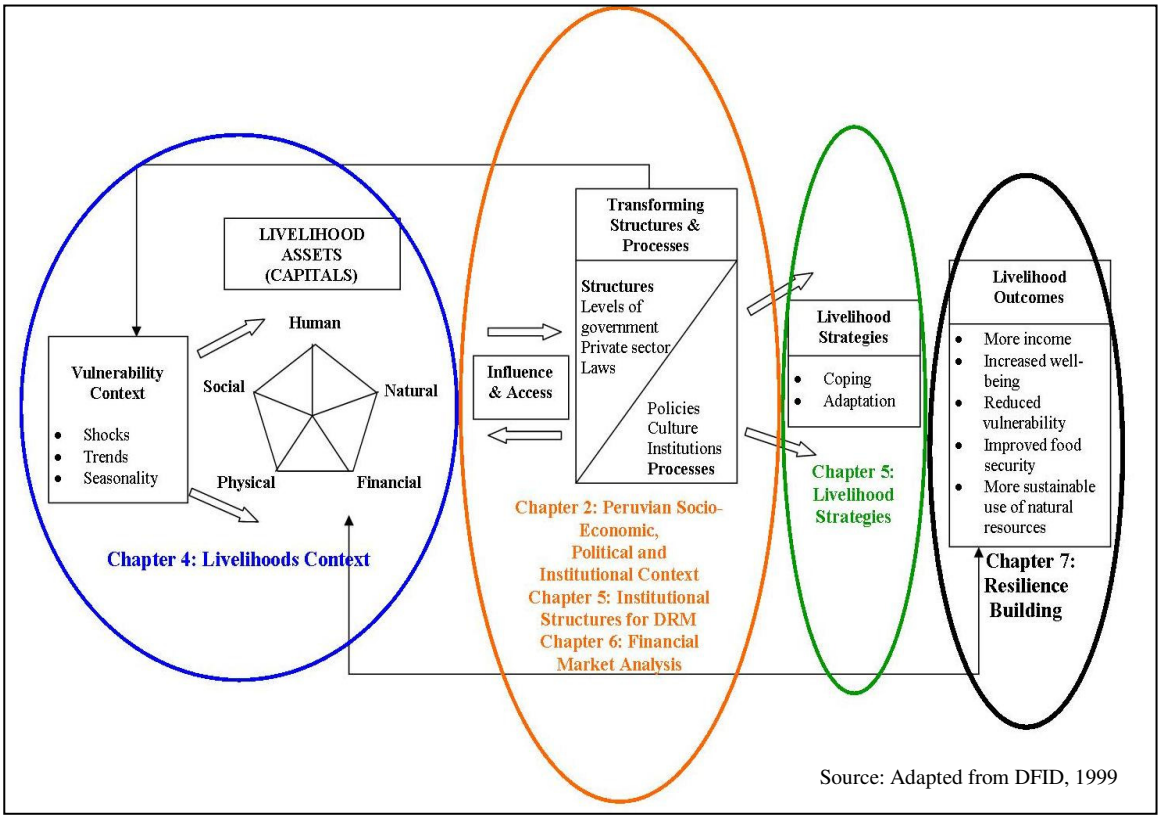
Understanding the concepts and their implications for disaster risk management is essential for the appropriate design of policies and management strategies for resilience building. An important part of this research is concerned with finding out about the livelihoods of the rural households. In this section a short and concise overview of the sustainable livelihoods framework and approach will be given, while the specific characteristics of the farmers' livelihoods in the region of Piura will be discussed in Chapter 4. The livelihoods framework is a tool to improve our understanding of the livelihoods of the poor. For this research, the framework seems of particular relevance because it shows the complexity of the livelihoods and provides an insight into the many factors that affect them (Figure 2).

Figure 2: Livelihoods framework



The framework provides the researcher or practitioner in development processes a picture of what comprises a livelihood, and the factors that influence the poor in their daily activities. The context of vulnerability, the shocks, trends and seasonality the poor are exposed to as well as the assets, comprised of human, natural, financial, physical and social capital, to which the poor have access to or not, depending on influence and access plays a central role in the livelihoods approach. Further, the livelihoods of the poor are conditioned through their own livelihood strategies and transforming structures and processes that affect them. Finally, there can be different livelihood outcomes depending on the interplay amongst the above-mentioned factors. The framework will be used to better understand rural households' livelihoods and their coping and adaptation strategies to climate-related shocks. The study is structured such that the general environment and vulnerability context of the rural households is depicted, followed by an in-depth view of the specific livelihood and coping strategies of these, and finally a market analysis of agricultural financial services and the possibilities for building resilience through these tools (Figure 3).

Figure 3: Livelihoods framework with reference to thesis chapters



2.1.2 Hazard, disaster, vulnerability and risk

Having provided a general picture of the livelihoods approach concepts, I will now define the disaster risk management concepts that are relevant for understanding the rural households' vulnerability context. First, the difference between a hazard and a disaster will be drawn. A hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation; each hazard is characterized by its location, intensity, frequency and probability (UNISDR, 2004; Thywissen, 2006). A disaster is the after-effect of a hazard on people, in such a way that their lives are directly threatened or their social and economic support structures are destroyed; a disaster is a socio-economic phenomenon (IFRC, 1993; Thywissen, 2006). Therefore, it is clear that there is no disaster without human beings and most importantly without their vulnerability. Vulnerability is determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards (UNISDR, 2004; Thywissen, 2006). Hence, for the purpose of this research, vulnerability is based on three elements: physical fragility or exposure, socio-economic fragility or sensitivity, and lack of resilience (Cardona, 2003). In other words, the notion that the vulnerability of a household or a community is reflective of the exposure and sensitivity of it to hazardous conditions and the ability or capacity or resilience of it to cope with, adapt to, and recover from the effects of those conditions (Smit and Wandel, 2006).

A disaster risk is a latent condition and represents a potential damage in the future. But it is clear that a risk exists only if there is vulnerability to the hazard posed by a natural or human-induced event (Garatwa and Bollin, 2002). This implies that the risk can be anticipated, allowing that society or households intervene ex-ante with prevention measures, mitigation, reduction and control, or preparatory measures. The disaster risk exists because of the interaction and relationship between the factors of the physical hazard and the human vulnerability in defined and determined spaces and territories (Cardona and Lavell, 2002). This implies that the risk can be reduced or controlled and the degree of exposure of society and households could be reverted by avoiding that natural resources are transformed into a hazard, through environmental degradation, as well as limiting the exposure of society to physical phenomena through retention structures such as dikes, terraces, contention walls, etc. This study is mainly concerned with

understanding how households are trying to control the risks that they are facing, and what their strategies and possibilities are.

2.1.3 Coping capacity and adaptation

This research is mainly concerned with the actions and available measures that smallholders in the region of Piura take in anticipation of or during a natural phenomenon, such as floods and droughts caused by El Niño and climate variability and change. Capacity is "a combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability" (UNISDR, 2004; Thywissen, 2006: 13).

Coping capacity is a term that similar to vulnerability has been overly defined in the risk management literature leading to a lack of conceptual clarity and disagreement amongst scientists. As a study concerned with the practice of disaster risk management the concept of coping used is the one used by the United Nations International Strategy for Disaster Reduction (UNISDR). In this definition coping capacity refers to "the means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards" (UNISDR, 2004; Thywissen, 2006: 13).

Another important distinction that needs to be made is between coping and adaptive strategies. According to Davies (1993, 1996; van Dillen, 2004), the former are short-term responses to a specific adverse shock, such as drought, while the latter have to do with long-term changes in behavior as a result of repeated shocks. While coping capacity is more directly related to an extreme event, adaptive capacity refers to a longer time frame and implies that some learning either before or after an extreme event is happening. The higher the coping capacity and adaptive capacity, the lower is the vulnerability of a system, region, community or household. Enhancement of adaptive capacity is a necessary condition for reducing vulnerability, particularly for the most vulnerable regions and

households (Peltonen, 2006). Following these views, coping strategies turn into adaptive strategies when they become part of the household's usual livelihood strategies.

In the climate change literature and discourse, adaptation is understood as the actions taken to help communities and ecosystems to cope with changing climate conditions, such as the construction of flood walls to protect property from stronger storms and heavier precipitation, or the planting of agricultural crops and trees more suited to warmer temperatures and drier soil conditions (IPCC, 2008). This notion has also been of considerable importance in the context of this research, because during focus-group discussions with the farmers, the concept was useful when asking the participants which specific actions, methods and strategies they would apply should increasing climate change affect their activities.

Another concept that is useful for this study is adaptive capacity in social systems, which refers to the existence of institutions and networks that learn and store knowledge and experience, create flexibility in problem solving and balance power among interest groups (Berkes et al., 2003; Folke et al., 2004). From an institutional perspective and when discussing resilience-building, this concept will be of importance. When talking about adaptation, this concept is used not only regarding climate change but rather forms part of the disaster risk management cycle, practice and discourse. This has also started to be done because as research has shown adaptive actions cannot be taken in light of climate change alone (see Chapter 7). There are numerous examples where climate change risks are being incorporated into existing policies, programs or decision-making processes related to resource management, community development, livelihood enhancements, coastal zone management, sustainable development and disaster risk management (Smit and Wandel, 2006). This research analyzes the adaptive capacity and adaptive needs of rural farming households in the region of Piura identifying particular adaptation measures and practices that can help to satisfy the needs of the farmers. More precisely, the focus is on describing the ways in which the community and rural farming households experience changing conditions, such as recurring natural hazards, as well as changes in decision-making processes and policies in order to determine specific adaptation measures or means of enhancing adaptive capacities.

2.1.4 Financial instruments

A special focus of the analysis is on the availability and access of smallholders to financial services. Financial services are defined as private and public institutions that offer insurance, credit, loans, disaster preparedness/recovery, banking, re-insurance and asset management services (Hoff et al., 2003). The research is concerned with the possible impact of financial services upon the building of resilience of smallholders to climate shocks.

An important concept is micro-finance, which means the provision of a variety of products, where 'micro' refers to products that are beneficial to and affordable by low-income individuals or groups, who lack access to traditional formal financial institutions. Emphasis is set on analyzing the offer of and demand for agricultural micro-credits and micro-insurance in the region studied. With the evolution of micro-finance and its revolution by the Nobel Peace Prize winner Muhammad Yunus in Bangladesh, its strengths and limitations in poverty reduction have come to be better understood. Increased attention has also been given to the potential role for micro-finance in strengthening the risk management capacity of the poor. Micro-insurance is defined as a financial service that uses risk-pooling to provide compensation to individuals or groups that are adversely affected by a specified risk or event (Hoff et al., 2003). It is hoped that agricultural micro-insurance can have positive impacts on smallholders' risk management behavior and resilience to disasters.

In the last years, increased attention has been given to the possible impact financial services can have on the disaster risk reduction strategies of rural households that are living in adverse conditions. Field research indicates that access to micro-finance services including credit, often savings, and less typically housing loans and micro-insurance, increases poor households' prospects of escaping poverty and at least stops them from falling further down the poverty line (Pantoja, 2002; Sebstad and Cohen, 2000). Micro-finance institutions (MFIs) face many risks that can adversely affect their long-term operational and financial sustainability. Some of the most serious risks pertain to the external environment in which the institutions operate, and include natural phenomena, economic crisis and war (Pantoja, 2002). Disaster risk is thus also an important factor when analyzing the behavior of MFIs, as it is a covariate risk that typically affects many

households in an area or across areas. For insurance companies, it is necessary to seek reinsurance, due to the high costs covariate risk events can cause.

It becomes clear that in particular agricultural lending is a risky and expensive business. When MFIs give credit to vulnerable farmers, the institution takes the risk that the farmer will be unable to repay the loan if there are crop losses, and it needs to be prepared for high administrative costs because of asymmetric information. Particularly in the case of agricultural insurance, common problems with micro-insurance such as moral hazard and adverse selection are more pronounced. Moral hazard refers to the deliberate change of behavior that increases disaster risk in order to receive indemnity payment from the insurance. Adverse selection refers to the situation where only high-risk individuals seek insurance, leading to high premiums that low-risk individuals are not willing to pay. Hence, this research seeks to analyze the importance and limitations of agricultural micro-credit and micro-insurance services for both the individual household and the MFIs.

2.1.5 Resilience

Having presented the conceptual framework, it becomes clear that these concepts have been defined differently by several disciplines and fields of study, including economics, sociology, geography, environmental science and disaster risk management (which is by itself multidisciplinary). Similarly, there has been a lively discussion on the concept of resilience in recent years, especially in natural sciences regarding the resilience of ecological systems and in social sciences regarding the resilience of social systems. At the beginning of the 21st century, the Resilience Alliance (RA), a research organization comprised of scientists and practitioners from many disciplines who collaborate to explore the dynamics of social-ecological systems, was formed and is supported by an international network of member institutions that includes universities, government, and non-government agencies. The body of knowledge developed by the RA encompasses the key concepts resilience, adaptability and transformability and provides a foundation for sustainable development policy and practice. According to scientists in the resilience alliance, a resilient system is therefore one capable of anticipating, adapting and coping with uncertainties and unexpected extreme events without loosing its stability, performance and regenerative ability (Ostrom, 1998; Lebel et al., 2006; Folke, et al., 2004).

This research has been influenced and inspired by the ongoing work and studies produced by the resilience alliance, but for the purpose of this research, an eclectic approach, closely related to the multidisciplinary Disaster Risk Management approach will be used, as for analyzing the livelihood, coping strategies and resilience of smallholders, various elements of their livelihoods need to be touched upon and considered. The analysis and discussion on resilience building will not focus on coupled social-ecological systems but rather on how resilience building can be achieved at the household level. The focus here will be mainly on social systems as used in the disaster risk management and adaptation to climate change literature.

In the definition of disaster vulnerability proposed by Cardona (2004) comprises three elements: physical fragility or exposure, socio-economic fragility or sensitivity, and lack of resilience. It becomes clear that "resilience is the flip side of vulnerability – a resilient system or population is not sensitive to natural hazards, climate variability and change and has the capacity to adapt" (Cardona, 2003; Thywissen, 2006: 23). More precisely, "resilience is the capacity of a system, community or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures" (UNISDR, 2004; Thywissen, 2006: 23).

2.2 Institutional and historical perspective: the concept of path dependence

Having understood the nexus between risk, vulnerability and resilience, this section seeks to establish a theoretical link to these concepts. This is done by introducing institutions as rules of the game (North, 1993) that facilitate the process of building adaptation capabilities and dealing with the uncertainties that result from hazards. Institutions in this study are perceived as values, norms, rules, legislation, policies, laws that govern human interaction as well as respective organizations that formulate and enforce norms and laws (Ostrom, 1998). The multifaceted nature of resilience makes room for institutions to serve as governors of human behavior hence contributing to building the immunity of a system.

Bohle (2001) introduces the discussion about an external (environmental) and internal (human) side of vulnerability, thus identifying ecological as well as social vulnerability as

important factors when focusing on building resilience. Anderies (2005) in his work on social-ecological systems reflects on the fact that these external and internal sides of vulnerability are induced by agents who possess a set of allowable actions related to their physical interactions with the system, which influence how the entire system reacts or responds during a hazard. In this context, these interactions contribute towards making the external as well as internal environment vulnerable if they are not well managed. This collective nature brings into the fore the concept of social-ecological resilience which, among others, requires the management of diverse and competing interests between various users, so that the common good of ensuring reduced risks and vulnerability in times of a hazard is achieved.

A resilient social-ecological system is, therefore, one capable of anticipating, adapting to and coping with uncertainties and unexpected extreme events without loosing its stability, performance and regenerative ability (Ostrom, 1998; Lebel et al., 2006; Folke, et al. 2004). To build resilience therefore requires the development of institutions that can generate the right incentives to enhance the adaptive capacity of social systems to anticipate, cope and regroup when faced with uncertainties, while maintaining a balance that does not restrain ecosystems from functioning in a sustainable manner (Adger et al., 2005). It will be argued here that financial services are indispensable for rural households if these want to make use of their adaptive capacity and anticipate losses by making use of advanced risk management strategies and behavior.

In this section, the theoretical foundations of this thesis are presented. Institutions are introduced as rules of the game in a society (North, 1993) that facilitate or impede the process of building resilience and deal with the uncertainties that result from climate-related risks. To understand institutions, one needs to know what they are, how and why they are crafted and sustained, and what consequences they generate in diverse settings; here the focus is on the agricultural sector. According to North (1993), institutions structure incentives in human exchange, whether political, social or economic.

Institutional change shapes the way societies evolve through time and is crucial for understanding historical change (North, 1990). North states in very general terms that ‘history matters’, which means that we can learn from the past but only because the present and the future are connected to the past by the continuity of a society's institutions.

The historical changes that were of relevance for the agricultural sector and the consequences these have brought with them are illustrated. Current and future decisions and choices are shaped by the past (North, 1990). Institutions are historically specific, and for this reason it will be necessary to illustrate the historical context in which they were formed. Much of the developmental path of societies is conditioned by their past, and even after revolutions or political crises, institution builders do not start off in a historical vacuum. At any moment in time, actions are constrained by customs, norms, religious beliefs, and many other inherited institutions. This brings us to a very important notion in the analysis of institutions and institutional change and that is the concept of path dependence. Many authors have used the concept of path dependence, but mainly use it without a very clear definition. The definition that will be used here is a narrower definition suggested by Levi: "Path dependence has to mean, if it has to mean anything, that once a country or region has started down a track, the costs of reversal are very high. There will be other choice points, but the entrenchments of certain institutional arrangements obstruct an easy reversal of the initial choice" (Levi, 1997: 28; Pierson, 2000: 252).

The analysis of institutions can take place at different levels, and much confusion in the literature can be eliminated if scholars are explicit about the analytical plane on which they are operating. The rules need to be differentiated from the players; institutions are the rules and organizations the players. The purpose of the rules is to define the way the game is played. But the objective of the team within that set of rules is to win the game - by a combination of skills, strategy, and coordination, by fair means and sometimes by foul means. Like institutions, organizations provide a structure to human interaction by formulating and enforcing norms and laws. However in this study, a crucial distinction is made between institutions and organizations. Indeed, when we examine the costs that arise as a consequence of the institutional framework, we see they are a result not only of that framework, but also of the organizations that have developed in consequence of that framework. It will thus be of particular importance to analyze the causes and effects in the historical evolution of institutions in Peru. More precisely, it is hoped to identify the causes of the implementation of certain kinds of institutions and thereby determine the effects of these on the formation of certain types of organizations. Both which organizations come into existence and how they evolve are fundamentally influenced by

the institutional framework. In turn, they influence how the institutional framework evolves.

Organizations include political bodies (political parties, a Senate, a city council, a regulatory agency), economic bodies (firms, trade unions, family farms, cooperatives), social bodies (churches, clubs, athletic associations), and educational bodies (schools, universities, vocational training centers). They are groups of individuals bound by some common purpose to achieve objectives. Separating the analysis of the underlying rules from the strategy of the players is a necessary prerequisite to building a theory of institutions. Modeling organizations means analyzing governance structures, skills, and how learning by doing will determine the organizations' success over time. In this study, the emphasis is on institutions that are the underlying rules of the game, and the focus on organizations is on their role as agents of institutional change; therefore, the emphasis is on the interaction between institutions and organizations (North, 1990).

In the next sections, the most important institutional changes in the agricultural sector in the last decades in Peru will be illustrated, and the effects and impacts of those for organizational development and civil society will be analyzed.

2.3 Political spaces

2.3.1 Agricultural reform 1968 and its consequences for agrarian institutions

Peruvian agriculture has passed from the Hacienda era to the era of cooperatives and from there to their fragmentation in less than thirty years. This change has coincided with great political, economic and social transformations in Peru and elsewhere, which have incubated new realities to which the productive activity has not been able to adapt itself completely. It is necessary to go back in time to the takeover of the military government under General Velasco Alvarado in 1968, where the country's democratically elected President, Fernando Belaúnde Terry, was deposed. During this period, some very important reforms, and most importantly the Agrarian Reform, were carried out and led to the consequences for the path that Peruvian and especially the Piuran agricultural reality have taken until today.

No country in Latin America, and few anywhere in the world, was the subject of more social science writing during the late 1970s and early 1980s than Peru. What inspired this

burst was not Peru's strategic significance, its demographic or economic weight, or its natural resources, but rather its experiment from 1968 to 1980 in military-directed change (Jaquette, 1987). Many of those who have analyzed this period of Peruvian history agree that it has been a decisive one, producing transcendental changes (Pásara, 1982).

One of the more dramatic acts of revolution, after the takeover of the oilfields of International Petroleum in the north, was the passing of a new government decree (No.17716), i.e., the Law of Agrarian Reform on June 24, 1969, and its immediate application for the transformation of Peru's agrarian social structure. The new law introduced some drastic changes, which allowed the revolutionary government to proceed to the immediate expropriation of the sugar estates and refineries of the coast and many efficient cattle estates in the central highlands and the north. It is important to point out here that the reason for applying the law in a forceful and speedy way in the initial stages of the revolution was to avoid the development of conflicts. The legal aspects of the transfers were solved in such a manner that the sugar refineries continued to function and the productivity of the cattle and agricultural estates did not diminish the flow of goods to the food market of the coast.

The expropriation of the estates was immediately followed by the granting of titles to the workers on the coast and to the peasants in the highlands. The government tried to control and organize the division of the land and its redistribution through popular organizations such as state-created cooperatives: Agrarian Production Cooperatives (CAPs) and Agrarian Social Interest Societies (SAIS). These were supposed to receive the technical and administrative support of the state, which would maintain and increase the productivity of the land and avoid the fragmentation and chaos that a simple distribution would have produced (Escobar, 1977). The military government created collective administrations of the nationalized feudal estates, a mechanism that was devised to avoid breaking up economically efficient enterprises rather than to modify the tenure institutions.

Craft unions, trade unions, and farmer and native communities were the focus of attention of the new politics of the state. These groups were receiving benefits through a number of measures ranging from the economic sphere, which was the redistribution of the lands from the large estates (latifundios), to the social with new laws for workers and to the political sphere, as the participation of these organized popular groups was favored. This

way, the military government seeked support for the pursued reforms; the government thus de facto legitimated itself through the consensus of a wide social base. The National System of Support for Social Mobilization (SINAMOS) was created in 1972 to mobilize participation through persuasion in direct conversation with the population and in which, while formal organization should be decentralized, all important decisions were made in a centralized and hierarchical manner (Escobar, 1977).

One of the most important works is by Fitzgerald (1979), in which he states that the social structure of the rural sector was fundamentally altered by the agrarian reform program that, by taking land away from the traditional landowner, made new social dynamics possible. He also notes that the state was strengthened and that a class consciousness developed within the labor movement. But the military's attempt to restructure the role of capital and to achieve economic development through industrialization could not succeed; it was doomed to fail, given the duality of the Peruvian economy caused by the economy's orientation towards the world market (Pásara, 1982).

Few observers see Peru's 12-year experiment as a success. It is important to note, however, that the military's core program of nationalist affirmation, economic modernization, anti-oligarchical reform, and systematic state building was actually implemented to a considerable degree. By 1975, Peru's military leaders had initiated reforms that were more numerous and substantial, and these changes had been undertaken in accelerated form, while in other Latin American countries these would take several decades of populist politics like in Chile or Brazil. Through some 4,000 laws and countless administrative actions, Peru's military elite tried to control an often resistant nation into revolution (Jaquette, 1987). The period from 1975 to 1980, the revolution's second phase, saw considerable change in the leadership, pace, and direction of Peru's military-directed experiments. General Velasco Alvarado, seriously ill since early 1973, was replaced in a bloodless military coup in August 1975 by the army chief of staff, general Francisco Morales Bermúdez, an experienced military politician who had served as minister of finance under both Belaúnde and Velasco. Although he proclaimed continuity with Velasco's policies and expressed his irreversible commitment to the revolution, he soon moved, under heavy internal and external pressure, to amend and to attenuate some of the reforms (Jaquette, 1987). From 1977 on, he laid the groundwork for the disentanglement of the armed forces from office and for the resumption of democracy in Peru in 1980.

By the time the armed forces relinquished power in 1980, Peru's political and economic landscape had been altered. Agrarian reform had dispossessed the landed oligarchy, even though it fell short of its goal of turning peasants into efficient cooperative farmers and consumers of industrial goods. Many analysts explain this retreat as the result of a profound discrepancy between the military's institutional norms and the requirements of genuine political participation. Military norms are hierarchical and emphasize loyalty. Political participation is pluralist and, almost by definition, conflictive. Hence, fear of genuine participation could explain the appeal of corporatist solutions such as SINAMOS and pro-government unions (Jaquette, 1987).

2.3.2 A new form of organization, product chains and producer organizations

At the end of the military government, Fernando Balaúnde Terry was elected president again, and his political economic actions sought to combat the crisis inherited from previous governments by unpacking progressively the economy; the free import of goods was liberalized and the control of prices cancelled. His government did not consider the reform as part of his political program, but actually implemented a series of measures to dismantle it. In 1979, a new constitution was set up, which initiated a process of change that continues until today. This new constitution saw the regionalization of the country as a means to decentralize the economy and public administration.

The first years of the 1980s brought about a number of changes in the economic and social environment in the country. The international debt crises imposed serious restrictions on developing countries like Peru, which further seriously impeded to the resolution of the economic crisis of those years. Inflation became a persistent and growing problem and in addition to these economic changes and crises, the increasing presence of the terrorist group Shining Path (Sendero Luminoso) seriously affected the security of the population mainly in rural areas (Trivelli et al., 2003). In addition to the economic and security crisis, in 1982-83 a mega El Niño phenomenon seriously affected agricultural activities and the economy as a whole.

After 1985, with Alan Garcia’s first government, new macroeconomic policies were implemented, and in the beginning the agricultural sector was favored through relative prices for agricultural goods, subsidized inputs (credits, fertilizers, etc.) and other policies to promote agrarian growth. However, as a whole the macroeconomic management of the

Garcia government was very poor, in 1987 the country entered a hyper-inflationary process and a deep economic crisis that continued until 1990, and between 1988 and 1992, the agricultural GDP experienced a 16.5 % drop (Trivelli et al., 2003). Interestingly, in spite of the recession, the smaller and poorer rural households did better, and their lack of market integration protected them from the crises through crop diversification and self-support (Trivelli et al., 2003). The populist policies of 1985 to 1990 increased aggregate demand and pushed up imports, triggering a fiscal deficit in 1988/89 and a balance of payments crisis that in turn caused hyperinflation and recession. The impact on agriculture was negative in this period, since that which had been gained in the first years of the government of Alan García was lost in the last two years, culminating in greater impoverishment than in 1985. Hence, at the beginning of the 1990s, nearly 80 % of the rural population was living below the poverty line, and there was almost no public or private investment in the agricultural sector, and no sectoral policies (Trivelli et al., 2003).

The Peruvian economy has changed dramatically since 1990, when a structural adjustment program was applied, which included the following simultaneous reforms: privatization, market liberalization, public sector reforms, etc. The consequences of these reforms were the end of a long high-inflation period and the improvement of most macroeconomic indicators, which led to a period of economic stability, and after 1993 to economic growth (Trivelli et al., 1999).

In response to pressures from the international community for a return to democratic rule following Fujimori's self-coup in April 1992, the constitution was drafted in November 1992 and enacted on December 31, 1993. This is Peru's fifth constitution in the 20th century and it replaced the 1979 Constitution. It is the supreme law of Peru and it is the only one of 15 Peruvian constitutions that has been approved by the people; it is said this constitution is shorter and most adapted to global changes. The constitution is based on free-market economic principles and reduces the role of the state. It also eliminates many congressional checks on the president, enhancing the already substantial powers of the executive. In 1999, Fujimori effectively overruled the constitution by passing an interpretative law allowing him to stand for a third term as president. Under the constitution, the Congress comprises a single chamber with 120 members, who are elected every five years through a multi-district system. Reforms have produced a number of important changes, including greater independence for the judiciary and media, more

congressional checks on the executive, and improvements to the accountability of the security services and armed forces to independent public bodies. The constitution was amended in October 2000 to prevent a president from sitting for two consecutive terms.

Decentralization is the other main focus of reform. Given the lack of administrative and technical capabilities and experience at the regional level, the government wants to devolve power and budgets slowly. Regional elections on November 17, 2002 created 25 new regional presidents, most with limited or no administrative experience, who face inflated local expectations and have little power and few resources. However, the institutional fragility of the state apparatus is limiting and slowing down the formulation of policies, implementation of strategies, and monitoring and evaluation of these.

During the 1990s and the beginning of the 21st century, there was an important production of norms and general frameworks for the formulation of policies, which promote the competitive development of the country on the basis of technological innovation and the conservation of natural resources and the environment with the aim of improving the standard of living of the population and reducing poverty. Nevertheless, public administration lacks efficient mechanisms to facilitate the implementation of norms, and of programs and projects. Additionally, mechanisms of inter- and intra-institutional coordination, principally in the public domain, are limited and generate costs for the involved economic agents. Further, processes of monitoring and evaluation of results are almost nonexistent.

The national normative framework that promotes the competitive and sustainable development of the country is expressed in the constitution of 1993, which recognizes equal treatment of national and foreign intervention (Art. 63), and sustainable use of natural resources (Art. 67). The National Agreement (2002) in the competitive component formulates policies for rural and agricultural development and foreign trade on the basis of a common effort between the state and the private sector, science and technology. All of these changes were made on the basis of an integral approach, where sustainable development and environmental management is a transversal component.

Agricultural politics have passed through a significant shift at the beginning of the 21st century, and are oriented towards the promotion of sustainable development in the sector,

while considering the economic, social and environmental dimensions. One of the most significant changes is the introduction of the production chain approach, which emphasizes the importance of technological innovation as a means for increasing competition. The importance of efficient coordination amongst the institutions to generate synergies and avoid duplicity of functions and contradictions that cause confusion and major costs for the economic agents involved in the sector has been increasingly recognized. Starting in 2002, a political-institutional framework was established to promote competition and the development of product chains, and to ensure that economic growth guarantees the conservation of natural resources and environmental quality with the aim to improve the standard of living of the population (Gómez, 2007).

2.4 Economic spaces

2.4.1 History of rural financial institutions

The principal characteristics of the agrarian reform were that it was of massive character, hence affecting not only large estates, but also medium and small properties. Further, the agricultural land market was eliminated, and it was established that agrarian properties are not transferable. The elimination of investment in profit enterprises in agriculture was, promoting the creation of associative firms, under a regime of collective property (Escobar, 1977). Finally, a collectivist regime was established in agrarian property, starting with the creation of Agrarian Social Interest Societies (SAIS) and Agrarian Cooperatives of Users (CAUs). For a long time, most credits for agriculture came from a state bank, the Banco Agrario (BA). Although the existence of this bank dates back to the end of 1931, only during the 1960s did the BA start to become the main financer of the agricultural sector. This tendency accelerated during the agrarian reform in 1969, and in 1980 the BA contributed about 90 % of the formal credit allocated to the agricultural sector. Credits given through the BA concentrated basically on short-term lending, and were granted in the form of loans for working capital for commercial crops (Alvarado, 1993). Credits for crops such as cotton, rice, yellow maize, sugar cane and potato comprised more than 60 % of the total loans paid out through the BA, and included marketing and capitalization credits. Credits of the BA were offered at subsidized interest rates that were lower than those charged by commercial banks. This was a factor of constant undercapitalization, which was aggravated when the hyperinflationary process 1988-90 was triggered, given that interest rates augmented at a much slower rate than the

price index. For instance in 1990, whilst the annual inflation rate was higher than 7000 %, the interest rate of the BA credits hardly reached around 260 % annually (Alvarado, 1993).

Furthermore, during the years of activity of the BA, agricultural credit was unevenly distributed, with the majority of farmers not having access to formal loans. A national rural household survey carried out in 1984 showed that only 7.6 % of the farmers had access to formal credit, among the coastal farmers this percentage reached 30.3 % whereas in the highlands it was only 2.8 %. This can partially be explained by the fact that coastal agriculture and large estates were favored. The first years of the García government in the 1980s tried to increment these credits especially to the farmers living in the highlands (Alvarado, 1993). At the end of the 1980s and at the beginning of the 1990s, the overall reduction of agricultural credit also explains the decrease of credits from the BA. During this period, the BA was very inefficient due to several legal and institutional restrictions that were constraining its financial management. Through the inflation, its resources were mainly provided through direct transfers from the Central Reserve Bank.

In its best years, the BA gradually displaced the commercial banks from their usual zones of operation instead of concentrating on areas that were not being attended to by any bank (Valdivia, 1995). Despite state intervention, available credit resources for the agricultural sector continued to be mainly allocated to the richest farmers, i.e., former clients of the commercial banks, and concentrated mainly on traditional coastal crops such as rice, sugar, cotton and maize. The decrease in the financing of the agricultural sector became dramatic from the 1950s to the 1980s, when it dropped from 68 % in 1955 to only 5 % in 1980 (Valdivia, 1995). This means that commercial banks almost completely disappeared as a source of financing for agriculture. This was due to a series of facts, many related to the agrarian reform, which eliminated the possibility of using owned land as a guarantee for credit, the leaving of the sector by many good clients, and the stagnation of the sector in general.

Taking a closer look at the population served by the BA, statistics show that only a few of these credits were given to the rural population. In general, only few farmers receive any kind of credit from any kind of source, and the poorest farmers were obliged to draw upon the informal sector, generally with burdensome conditions. Hence, the majority of the farmers that did not have access to formal credit resorted to informal loans from neighbors,

friends, intermediaries or employers and then repaid the loan through money, work or products.

2.4.2 Recent developments in rural financial institutions

Before implementation of the economic reforms to liberalize agricultural markets in the 1990s, the agricultural development model consisted of a strong intervention of the state in the financing of agriculture through state banks. However, the weak financial situation of the BA at the beginning of the 1990s, reflected in high default rates and negative profitability levels, led to distrust in state intervention in the agricultural credit markets. According to Aguilar (2004), the lack of success of the intervention through the state bank in the rural economy is due to a false interpretation of the changes that the agricultural sector has been facing in the last decades, and to the concentration on the symptoms rather than on the real causes of an inadequate offer of financial services. The traditional position was that the state needs to promote agricultural credit, as agricultural activity is undercapitalized. This is why farmers need to receive cheap credit to encourage them to adopt modern technologies (Aguilar, 2004). Similarly, it was argued that the level of poverty amongst farmers is so high that it is impossible for them to save, and they should thus receive credits at subsidized rates. These cheap credits provided by the BA have had a negative effect on the market and have caused a serious lack of credits from commercial banks to agriculture. This situation has forced many farmers to finance their activities through informal lenders and to pay high interest rates. More precisely, the failure of state banks in the advancement of agriculture is due to the fact that they are mainly based on the abuse of subsidized credit policies. This has given way to the development of a poor credit culture amongst the demanders, which has also created great dependence on subsidies and external donations, low rates of recuperation of the credits, inadequate diversification of the portfolio and the appearance of clientelistic relations amongst the bank personnel and the most influential farmers, which has prevented the access to credit of a large segment of smallholders (Aguilar, 2004).

Within the structural adjustment and financial liberalization program, the financial system was liberalized and opened to the global economy through the new Banking, Finance and Insurance Act of 1991, later modified in 1993 and 1996. The elimination of the Bank of Foment at the beginning of the 1990s, led to the disappearance of the BA in 1992, and with its disappearance an important source of financial resources for the agricultural sector.

The deactivation of the BA was only the recognition of a previous bank failure, as the bank had been practically bankrupt since the preceding agricultural campaigns in 1989-90, and it generated a huge vacuum in the rural financial system (Valdivia, 1995). Agricultural credit was supposed to come mainly from private formal lenders through new specialized intermediaries. However, as will be discussed later, private financial lenders were not able to provide enough credit, so the problem of lack of credit continued and probably even became worse (Trivelli et al., 2003). This was especially due to the fact that the consolidation of a new financial system took until 1994, which left most farmers exposed to a scarcity of formal rural finance from 1989 to 1994. The farmers that were most affected by these changes were the coastal ones, especially producers of cotton, maize, rice and sugar cane, which had made up the major part of credits in the past (Alvarado, 1993).

The government thus proposed the creation of a new rural credit system that not only needed to cover the vacuums left from the BA, but more importantly needed to correct the deficiencies that the previous system had shown, such as the low credit coverage in the highlands, the concentration of credits in commercial agriculture and the scarce catchment of savings. Hence, the deactivation of the BA gave way to the appearance of municipal savings and credit associations (CMACs), rural savings and credit associations (CRACs); and regulated NGOs for small and microenterprise development (EDPYMEs)[3], which constituted a new combination of financial intermediaries with very different characteristics than the commercial banks regarding the scale of operation and credit technologies. These new institutions are called Micro-finance institutions (MFIs), because they are specialized in small-scale credits (micro-credits), principally targeting the sector of small and micro-entrepreneurs (Aguilar, 2004). The proposed institutional scheme for the financing of agriculture is two tiered. The first tier is represented by the commercial banks and the second tier accounts for the formation of the above-mentioned MFIs (CMACs, CRACs and EDPYMEs). The commercial banks attending to modern agriculture, while the MFIs supply credit to the rural productive activities that cannot be covered through the commercial banks (Alvarado, 1993). A second-tier bank COFIDE

[3]CMACs : Cajas Municipales de Ahorro y Crédito
CRACs : Cajas Rurales de Ahorro y Crédito
EDPYMEs: Entidades de Desarrollo para la Pequeña y Micro Empresa

(Financial Corporation for Development) and rotational funds have been established for the development of smallholder agriculture.

Although these new institutions (except for the CRACs) were not exclusively dedicated to attend the segment of smallholders and micro-farmers, they succeeded in developing the micro-credit business in rural areas leading to a strengthening of the formal rural financial market (Valdivia, 1995). Despite the appearance of these new formal intermediaries on the rural credit market and of the important presence of informal intermediaries, the problem of scarce access to credit for the majority of rural producers is still unresolved (Aguilar, 2004). Consequently, during the electoral campaign 2000-2001, the presidential candidate for the APRA[4] party announced the creation of a state bank for the promotion of agriculture as a measure to overcome the crisis in the sector. The immediate reaction of the candidate from Perú Posible was the announcement that agriculture would have the highest priority during his government if he was to be elected. As part of the offers, he promised the creation of a specialized bank for agricultural credit. Hence, the proposal of Agrobanco as an institution emerges not from a real preoccupation with the situation of the agricultural sector of the presidential candidate Toledo at that time, but rather as a response to the challenge posed by the APRA candidate (Aguilar, 2004).

On December 21, 2001, the new state-led financial institution for the agricultural sector called 'Agrobanco' was created through Law 27603. According to the law, the social mission of the bank is to offer credits to the agricultural sector, as well as to facilitate the granting of credit lines through other firms of the financial system with private or public resources. The target market of Agrobanco is two-tiered, the first tier concerns direct credits to farmers; here the credit is given to each member of a product chain, who need to have individual properties from 3 to 50 ha. The second tier concerns credit that is given to an organization of agricultural producers, suppliers of inputs and traders (Aguilar, 2004). Additionally, a primordial prerequisite for being considered as credit worthy is that the producers must have current debts in the financial system or, with the disappeared BA, not debtor of any of the credit programs offered through the Ministry of Agriculture (MINAG). The second tier concerns financial institutions that are regulated by the Superintendent of

[4] APRA (Alianza Popular Revolucionaria Americana): Peruvian political party founded in the 1920s by Víctor Raúl Haya de la Torre and forming government for the first time in 1985-1990 under Alan García Pérez.

Banks, Insurance and Pensions (SBS) through which the funds for the agricultural sector are channeled and who is responsible for assuming the risks. Additionally, these institutions need to finance not only the short-term requirements of the agricultural producers, but also the medium and long-term.

In practice, Agrobanco's capacity to expand the access of credit to a broader set of borrowers in the rural areas is very limited, as it can only attend producers with the capacity to pay that do not have open debts with any institution of the formal financial system. This means that all those farmers that currently have debts with the financial system, amongst which there are debtors of the ex-BA, represent an elevated percentage of producers who need to receive financing. On the one hand, this rule guarantees a high probability of payment of the credits and major confidence in the financial sustainability of the institution, but on the other hand, it limits the effect of state intervention to a very small segment of rural producers. This shows clearly the difficulty to combine objectives of financial sustainability with greater credit coverage in a public institution (Aguilar, 2004). As a consequence of public intervention, the credit market is again experiencing major competition, which could be inefficient by concentrating the attention, benefits and resources in the richer segments of agricultural producers, which have always seen their financial necessities of financing being attended by the market, leaving aside a vast segment of smallholders and medium-size farmers, for whom the restrictions and access to financial resources have prevailed through history. Therefore, the tendency of the financial institutions to abandon credit business in rural areas could be increased by the presence of Agrobanco, as the competition for 'good clients' could become more difficult.

2.5 Social spaces

2.5.1 Rural institutions in Piura during the reform

In the presence of pressure from the regional peasantry and to avoid the outflow of capital from the country estates (haciendas), in 1969 the region of Piura was declared the application zone of the reform (Bonilla and Hünefeldt, 1986). In order to accelerate the administrative proceedings of expropriation, SINAMOS promoted the confiscation of lands and the creation of agrarian leagues. During its intervention, other radical political forces that had their own reform projects were appearing on the scene. Within two years, approximately 20 country estates were occupied in the Chira river valley and in the highlands of the Piura River.

The beneficiaries of the reform were peasant groups that organized into cooperatives. The land of the ancient haciendas formed the basis for the new agrarian associations, which needed to be constituted as self-managed peasant firms. Two models were established and promoted, one by the state and the other reformulated according to regional necessities: the Agrarian Production Cooperatives (CAPs) associated the former workers from the haciendas that participated as associates of the land properties, whereas in the Communal Cooperatives of Workers (CCTs), the land is the property of the community (Bonilla and Hünefeldt, 1986). The first cooperatives were localized in the Chira river basin and the highlands of the Piura river basin, followed by the lowlands of the Piura river basin. Parallel an alternative model of association emerged, namely the Communal Production Units (UCPs).

In Piura, the reform was not implemented onto a disorganized agricultural sector. Two large associations brought the farmers together. On the one hand, the Departmental Agriculture and Livestock League brought together the landowners and shareholders of agrarian societies, on the other, the Federation of Piuran peasants (FEDECAP), created during the first Belaúnde government, grouped together most of the peasants unionized since the 1950s. Although the reform succeeded in remodeling agrarian properties, it was not sufficient to elevate the farmers' income. The problem of the agricultural sector was not only the tenancy of the land but also the presence of a system of marketing and of prices controlled through different economic groups.

In addition to the legislative counter measures, the problems of prices and market, the lacking capacity of management of the new enterprises, and the administrative corruption caused the partitioning of the land amongst associates of the CAPs in the highlands, whilst in the Chira river basin, the cooperatives were reshaped and reformed into smaller cooperatives. However, the restructuring of the cooperatives did not only consist of the division of land, but also of the organized peasants who had developed alternative forms of tenancy and rights of using land. On the basis of the invasion of the cooperatives in the highlands in 1978 (Chulucanas, Morropón and Salital), peasant committees and Agrarian Cooperatives of Users (CAUs) were formed. These committees and the CAUs combine individual tenancy of land with the collective use of infrastructure, equipment (machinery) and agricultural credits (Bonilla and Hünefeldt, 1986). The generated variations through

of the state cooperative model to a community-based model had as a result that the CCTs and UCPs not only survived but are consolidated until today. Furthermore UCPs have expanded and been exported from the community of Catacaos to the community of Castilla. Similarly, in the highlands, peasant groups start to claim recognition as peasant communities, and hence these ancient forms of property and social organization, are being restructured and become more widespread in the region.

Although the agrarian reform achieved the remodeling of the agrarian property, this was not sufficient to elevate the farmers' level of income. The problem was not only the tenancy of land but also the presence of different economic groups controlling the marketing and prices of the agricultural products. Hence, most of the changes during the agrarian reform have not achieved the desired effects on society and institutions, or on the formation of organizations. Furthermore, agrarian production firms of associative character have not reached the desired level of efficiency. The majority of these firms have disintegrated, generating a massive process of individual fragmentation and excessive partitioning in favor of the associates of these firms, which has restricted productivity and efficiency.

2.5.2 Rural institutions in Piura from the 1980s until today

The government of Fernando Belaúnde Terry enacted the law of agrarian development (Legislative Decree No. 002), which amongst its most outstanding norms allowed the fragmentation of agrarian units in favor of individual peasants. Thus large areas of lands that had been assigned to associative firms during the agrarian reform were fragmented. A consequence was the fragmentation of the cooperatives and of the land amongst associates of the cooperatives as well as the creation of smaller cooperatives. As a result of this process agrarian property has changed dramatically, composed predominantly of smallholders and small-scale properties (Chirinos-Almanza, 1975), and thus the cooperative system could not be consolidated.

Despite individual fragmentation and excessive partitioning of cooperatives, the decade of the 1980s is marked by growth and development of the organized popular movement. Peasant rounds (Rondas campesinas), agrarian associations, mothers' clubs, community soup kitchens, neighborhood associations, etc., emerged in the face of the obvious incapacity of the state to attend to the necessities and demands of a population that was

becoming increasingly urban, facing explosive growth, and was better educated and had become very much aware of its rights. In the middle of the economic crisis, the people organized themselves to improve their living conditions or simply to survive. In Piura, this process was accelerated due to the problems caused by the El Nino phenomenon of 1982-83; many of the popular associations developed in this period. A few mothers' clubs and peasant rounds were strengthened in urban and rural areas thus that they achieved a strong local representation and were consolidated as developmental organizations. Apart from the popular movements, this decade is also marked by the increase in violent drug trafficking and the uprising of armed groups interested in destabilizing the constitutional government. The expansion and impunity of the acts against society together with the constant violations of human rights through terrorist groups (e.g. Shining Path) and the military forces revealed the weakness of the state and the lack of national integration around a common project.

Despite the many popular organizations that were formed during the 1980s, farmers associations and organizations in the 1990s are not well organized and coordinated. The vacuum caused by the closure of the BA, as well as the political and economic situation in the 1990s forced the smallholders to take their fate into their own hands. The lack of state support in the agricultural sector opened the way for the formation and also the consolidation of many producer organizations in the rural areas. Additionally, the end of the cold war and the beginning of globalization offered a wide range of opportunities and a reason for necessary changes in the sector in order to maintain efficiency and competitiveness.

From 1990 on, land property started to be liberalized through regulations oriented towards generating a land market and attracting investments and allowing the free transfer of properties. Moreover, during this period, several international NGOs and international organizations started to support the formation of producer, neighborhood and community organizations. In Piura, for instance, the producer association 'Program for the Development of Coffee' (PIDECAFÉ)[5] was created in 1993 and grouped together coffee producers of northern Peru to encourage the development of capacities, the implementation of good practices for the environment, and the generation of economic

[5] PIDECAFÉ: Programa Integral para el Desarrollo del Café

opportunities. It was oriented towards improving the access to markets and assuring the food security of the organized peasant families. PIDECAFE grouped and brought together several coffee-producing families that previously were isolated. PIDECAFE has thus become the largest exporter of ecological coffee and brown sugar in northern Peru. PIDECAFE is also associated with other producer organizations of other primary products such as mango and cocoa.

Summarizing, the liberalization of the economy in the 1990s in Peru has had several effects on the agricultural sector. The government dramatically reduced the number of personnel in the Ministry of Agriculture and withdrew from extension activities. The BA was closed and preferential loans for crop production were discontinued. The public corporations that controlled distribution of agricultural inputs and sale of rice were privatized or closed. Restrictions on land holdings were eliminated in order to improve the efficiency of the economy by leaving the distribution of resources to market mechanisms (Trivelli et al., 2003). The low productivity in Peruvian agriculture can be attributed to the high level of fragmentation of the property, i.e., small-scale land holding. About 70 % (a bit less than 1 million) of the farmers in the country manage less than 5 ha, the major part with low productivity, high unitary monetary costs, and great difficulties regarding innovation in products, processes or technologies, preventing them from reaching greater levels of efficiency and profitability (Trivelli et al., 2003). Additionally, large areas of land belong to peasant communities, which are mostly cultivated individually by their members such that the actual number of small-scale farmers could actually be higher than the above-mentioned percentage. Markets for inputs such as credit and logistic infrastructure hardly exist and as a consequence, the cost of distribution of agricultural products is very high; therefore, the prices farmers receive are very low.

3 Research methodology

The empirical data on which this study is based was collected during eight months of intensive fieldwork from September 2007 until April 2008 in Piura. A multi-method approach was applied to cover the broad research frame. The research comprised first, the identification of factors causing the local farmers' vulnerability and risks to climate-related disasters and the analysis of the farmers' coping and adaptation strategies. Second, a structural analysis of market and institutions was conducted to determine the demand for micro-insurance of the local farmers. Third, the capacity of the market to support and offer these financial tools and possible ways in which micro-insurance or other financial services can play a role in fostering the resilience of these communities was analyzed.

The Participatory Rural Appraisal (PRA) methods are considered to be most useful for gathering information and for achieving some developmental impact on the stakeholders participating in the research process. PRA can be described as a family of approaches, methods and behaviors that enable people to express and analyze the realities of their lives and situations, to plan what action they should take, and to monitor and evaluate the results. The methods have evolved from the Rapid Rural Appraisal (RRA) method. While PRA emphasizes processes that empower local people, RRA is mainly seen as a means for outsiders to gather information. PRA is for the analysis of local problems and the formulation of tentative solutions with local stakeholders. It makes use of a wide range of visualization methods for group-based analysis to deal with spatial and temporal aspects of social and environmental problems. It mainly deals with a community-level scale of analysis, but is increasingly being used to deal with higher level, systemic problems.

A combination of quantitative and qualitative methods was selected. The quantitative methods offer an understanding of the farmers' livelihoods and their coping and adaptation strategies through the study of a large number of cases; the large group size studied allows generalizations to be made from the sample to a larger unit, such as the region of Piura. In this study, the quantitative methods used are a farmer household survey preceded by a pilot survey to test and adjust the final survey. The qualitative methods used are focus-group discussions, interviews with key informants and a workshop with relevant institutions.

3.1 Research area

3.1.1 Region of Piura

The region of Piura is situated in the northern coastal and Andean highlands of Peru, covers an area of 36,000 km² and is the second most populated region after Lima. Piura occupies an important position in the national economy due to its great diversity of natural resources, which benefit from the two cold and warm ocean currents, the cold Humboldt current and the warmer El Niño current. The latter periodically disrupts the normal productivity of the cold current causing the appearance of other fish species and heavy rainfall leading to floods. Piura is thus a very important region both for the fishing and agricultural sectors of Peru. The region is the main producer of mangoes and limes at the national level, second in the production of cotton, rice and sweet potato, fourth in banana, and fifth in sugar cane. The region has a population of around 1.7 million (INEI, 2005) living in 8 provinces and 64 districts.

There are three river basins in the region. One of them is the Huancabamba river basin leading to the Amazonas and then to the Atlantic Ocean and shared by the regions of Piura, Lambayeque and Cajamarca. The other two, which we are concerned with in this study, lead to the Pacific Ocean, one being the bi-national river basin called Catamayo-Chira coming from Ecuador and the Piura river basin situated entirely in the region of Piura. The Piura river basin has been populated and has practiced irrigated agriculture since 200 B.C. Currently the river basin concentrates more than 50 % of the population of the region due to the fact that its area corresponds to approximately 30 % of the region. It covers approximately 12,000 km² and shows high volume of water only during the rainy period in the highlands, from January to April. In years with low precipitation or drought, the river is dry or only consists of small streams. The economically active population is principally dedicated to agriculture and livestock holding (37 %), followed by commerce (12 %), manufacture industry (8 %) and teaching (4 %) (CONAM, 2004). The river basin Catamayo-Chira covers approximately 17, 000 km², most of which lies in Ecuador (67 %) and only a third in Peru (33 %). About 60 % of the economically active population works in the primary sector agriculture, cattle raising, forestry, hunting, fishing and extractive activities.

The Peruvian meteorological and hydrological service indicates that the Río Piura is one of the most vulnerable river basins with respect to extreme climatic events in the Pacific,

where the El Niño Southern Oscillation (ENSO) is generated, also known as the El Niño phenomenon (CONAM, 2004). In Peru, since 1983, El Niño has been associated with ecological and socio-economic disasters, especially in the coastal areas of the country. These impacts have been mainly associated with torrential floods in northern Peru and devastating droughts in the south. The damages caused by the 1998 El Niño in Peru were equivalent to 5 % of the GDP (Hoff et al., 2003). The characteristics of La Niña are opposite to those of El Niño, for northern Peru this event causes colder temperatures than normal.

The impacts of El Niño on agriculture are a decrease in exports and in families' incomes, an increase in poverty, illnesses, in migration, unorganized urban expansion, and economic recession in agricultural and livestock activities. The development of agriculture in the Piura and Chira river basins are said to be extremely vulnerable to the consequences of future climate change, e.g., flooding, heavy rainfall, mud- and landslides, more frequent and intense El Niño, and more frequent and intense periods of drought (CONAM, 2005). It is specifically due to the impacts of El Niño on agriculture and the future vulnerability to climate change that the region was selected. The analysis of the coping and adaptation strategies with respect to floods and droughts can be done easily, as the farmers have long-term experience with these periodically recurring natural phenomena.

3.1.2 Selection of the research area and sites

The research focuses on local farmers' households in the Piura and Chira river basins in the region of Piura in northern Peru. The aim is to be able to generalize the results to the whole region. As is common in the region, four territorial spaces associated with different geographic and climatic characteristics can be defined: the higher, medium and lower Piura river basins and the Chira river basin. For the purpose of this study, the medium and higher Piura river basins are taken together as one area and will be called highlands. Hence, as geographically and economically different areas need to be defined for the region, it was decided to stratify the region accordingly.

The highlands of the Piura river basin range from 350 to 3, 600 m.a.s.l., while the medium Piura river basin ranges from 50 to 350 m.a.s.l. These areas are characterized by cultivation of corn, cocoa, coffee, sugar cane and beans that are sold at local, regional and national markets. The climate is semi-arid to rainy with moderate temperatures and

rainfall only during the summer months from January to April. These areas of the Piura river basin cannot count on a reservoir for regulating irrigation. The producers in this valley depend on the seasonal flow of the rivers, complemented in a few zones by deep wells.

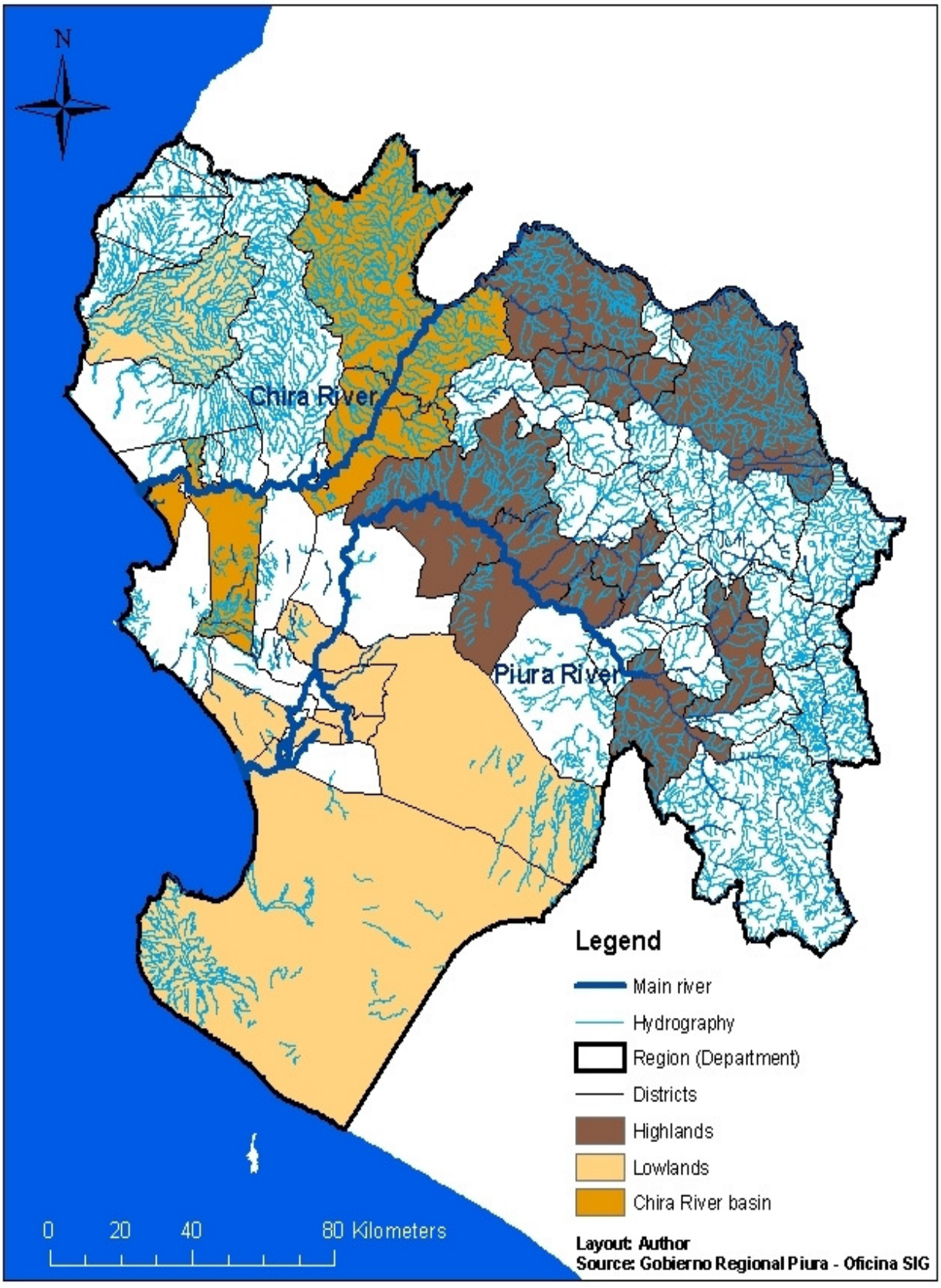
The lowlands of the Piura river basin range from 0 to 50 m.a.s.l. and are characterized mainly by the cultivation of cotton, rice and corn sold at national markets or exported complemented by livestock culture. The climate is arid with almost no rainfall during all seasons. The lowlands have approximately 35,000 ha of irrigable land whose irrigation water in certain districts is supplied by the Poechos reservoir and in other districts by the Piura River. The effective capacity of the Poechos reservoir is 750 million m³, but currently the reservoir only functions at half of its capacity because of lacking maintenance. The district of Pariñas in the province of Talara has been included in this geographical area because of its similarity in economic activities of the producers. Especially the livestock herders depend on the seasonal flow of the rivers, and temporary agriculture is practiced in the river bed, similar to some areas in the lowlands, where livestock herders are living in desert areas and only temporarily can practice agriculture.

The Chira river basin (the focus here is only on the part of the river basin in Peru) is characterized by cultivation of mangoes, bananas, limes sold at national markets or exported; the climate is arid and rainfall is low. The Chira river basin ranges from 0 to 1000 m.a.s.l. on the Peruvian side. This river basin comprises the Chira and San Lorenzo valleys, each with approximately 35,000 ha irrigable land. The San Lorenzo valley benefits from both the Poechos reservoir and the San Lorenzo reservoir, which has a capacity of 250 million m³ for irrigation of about 35,000 ha; the San Lorenzo rarely lacks water for irrigation.

Table 1: Household survey in region of Piura, October - December 2007

Geographical Area	Province	District	Population (INEI Census, 2005)	Number of Households
Highlands	**Piura**	Tambogrande	92.221	23
		Ayabaca	37.444	6
		Montero	7.665	4
		Paimas	9.761	3
	Ayabaca	Suyo	12.063	9
		Canchaque	9.242	20
	Huancabamba	Lalaquiz	5.300	21
		Chulucanas	77.880	20
		Morropón	14.729	19
		Salitral	8.454	21
		Sta Catalina de Mossa	4.512	4
	Morropón	Santo Domingo	8.010	25
	Subtotal		**287.281**	**175**
Lowlands		Sechura	30.817	20
		Bernal	5.798	22
	Sechura	Vice	14.455	23
		Catacaos	64.822	25
		Cura Mori	16.545	25
	Piura	El Tallan	4.934	20
	Talara	Pariñas	84.978	18
	Subtotal		**222.349**	**153**
Chira river basin		Pueblo Nuevo de Colán	12.298	23
		Amotape	2.250	24
	Paita	La Huaca	10.594	21
		Sullana	149.261	22
		Lancones	13.302	25
	Sullana	Querecotillo	24.038	23
	Subtotal		**211.743**	**138**
Total	**8**	**25**	**721.373**	**466**

Map 2 : Map of Region of Piura, Peru showing the 3 study areas



3.2 Field research methods

3.2.1 Pilot quantitative survey

A broad household survey for rural areas was developed, based on the guidance sheets of the Sustainable Livelihoods Framework and the Guidelines for Market Research on the Demand for Micro-insurance (DFID, 1999 and 2001; USAID, 2006).

The main objectives of the survey were to:

- Identify key risks facing local farmers and the impacts of these on them;
- Analyze existing coping mechanisms of local farmers with regard to recurring floods, droughts, crop diseases;
- Find out which kind of financial services schemes are demanded and appropriate for the farmers;
- Analyze the capacity of the market to support and offer these financial tools;
- Determine the perception and understanding of insurance and estimate the demand for agricultural micro-insurance.

As the objectives are very broad, it was important to first conduct a pilot study to test and accommodate the survey according to the needs. The main objectives of the pilot survey were to finalize concepts, definitions, sequence of questions, the appropriateness of language, format of the questionnaire, spacing between two questions, adequacy of space for writing answers, etc., and to obtain first estimates on the proportions that would make it possible to determine the final sample size, necessary to reach a chosen precision and confidence level.

It was possible to carry out the pilot study in a total of 20 randomly selected households in the three designated geographical areas of the region. The particular procedure for selecting the households was adapted from a method used for selecting households in rural areas developed by the United Nations' World Health Organization (WHO) for its Expanded Program on Immunization (EPI) surveys (Levy and Lemeshow, 1999). The major objective of these EPI surveys is to estimate the immunization coverage, but being a very inexpensive and quick method for surveying it has been adapted to meet other objectives. In this case, the aim was to estimate the demand of rural households for agricultural micro-insurance.

In a village, the first walk was to the market place (i.e. Plaza de armas), then randomly selecting a direction in which to walk using the randomization function of a pocket calculator indicating a number between 1 and 4, where 1 stood for north, 2 for east, 3 for south and 4 for west; this indicated the direction to go for selecting a household. The households lying in the direction from the starting point to the town boundary were counted. Depending on the number of households counted, a random number would be chosen, again using the randomization function of a pocket calculator, i.e., if there are 20 households, press the randomization function of the calculator times 19 + 1 and the result is the number before the comma, and this number is the selected household (RAN x 19 + 1). After having conducted the pilot survey, some questions were reformulated, others eliminated, and new ones integrated, according to the difficulties and experiences during the pilot study. Before carrying out each survey, the household was informed about the purpose, scope and duration of the survey.

Community-based field work and research in social sciences raises significant ethical concerns, which were addressed at each stage of the research, such that the benefits and difficulties of empirical social research were discussed with the households. Ethical guidelines were followed, and it was guaranteed to the interviewed that no personal information, e.g., their names or addresses, would be published or passed on to anybody. The objectives and aims of the study were explained, and it was emphasized that the research was not connected to any material, financial or other aid, but that it served purely academic purposes, aiming at gaining information on the livelihoods of farmers households, especially their coping and adaptation strategies with respect to recurring floods and droughts, as well as information on the farmers' experience with financial services such as credit and insurance.

3.2.2 Sample design

Based on the data collected in the pilot survey, a sample for the final household survey was designed according to the just mentioned method developed by the United Nations' World Health Organization (WHO) (Levy and Lemeshow, 1999). In a sample, the major statistical components are referred to as the sample design and include both the sampling plan and the estimation procedures (Levy and Lemeshow, 1999). In a stratified sample,

the sampling frame is divided into non-overlapping groups or strata, in this case a two-stage stratified sampling was used.

The first stratification consisted of the division of the region into three different geographical areas: the highlands, the lowlands, and the Chira river basin. This stratification was drawn proportional to population size and with the help of local experts and GIS maps. In this first stage, geographic stratification was judged most convenient because this way the characteristics and differences of the geographical areas with respect to the occurrence of natural phenomena and the handling of these would best come to the fore as well as the differing demand for agricultural micro-insurance per area. For the second stratification, the political divisions of districts were judged to be best, because thus comparison amongst districts could be made. This stratification resulted in 25 districts from all 8 provinces of the region (Tables 2 and 3 and Map 1). The sample size of the districts was drawn disproportionally, meaning that at least 20 households per district were surveyed in order to allow for comparisons amongst these.

The criteria used to define the number of districts that would be most representative for each of the chosen areas were the following:

- Type of agricultural activity in the district
- Historical occurrence of floods and droughts,
- Districts where the communities are organized and have received some form of financial service assistance,
- Districts that are rather remote and have not received these services in the past.

There are 123 questions in the questionnaire. The estimation for each of the respective parameters demands a specific final sample size to gain the specified precision and confidence. Concentrating on the percentage of farmers who would buy an insurance to protect their land and crops (question Q.6g); it was necessary to estimate this percentage accordingly for the final survey. From the pilot study, there is a first rough estimator (n=20) for this percentage (70 %). Using the calculator tool "Confidence Interval Analysis" by Gardner and Altman (2000), it can be concluded that the true percentage in the population is covered by the confidence level from 46 % to 88 % with 95 % confidence. When estimating this percentage with a specified precision and confidence three figures are

needed: 1) a rough estimate for the real parameter, 2) a specified precision, and 3) any specified confidence level.

As rough estimators the two confidence levels from the pilot study were used. When taking the smaller value (46 %) to be a first guess and a precision of ±5 percentage points (11 % relative precision) and a confidence of 95 %, then the necessary sample size would be 370. Then, taking the upper limit (88 %) to be the first guess, the necessary sample size would be 146 with a precision of ±5 percentage points (6 % relative precision) (Table 2). With respect to feasibility, precision and confidence, sample size was chosen to be around n=500[6], the confidence level to be the usual 95 %.

Table 2: Confidence interval, precision and true proportion for sample size

Example for Confidence Interval (%)	Precision (% of true value)	Estimated True Proportion (%)	SRS-Sample Size (at least)
46±5 = [41;51]	11	46	370
46±4 = [36;44]	9	46	557
46±3 = [37;43]	7	46	920
88±5 = [83;93]	6	88	146
88±4 = [84;92]	5	88	210
88±3 = [85;91]	3	88	582

How to read: If we want a confidence interval of ±5 percentage points around the true percentage (proportion), which would be a precision of 11 % of the true proportion and if the real proportion has a value around 46 %, then the total sample size for a simple random sampling (SRS) must be at least 370.

3.2.3 Final survey

Based on the pilot survey, the first-stage stratification of the 3 geographical areas was drawn proportional to population size, but due to financial and logistical constraints in the highlands 10 households less than expected (175) and in the lowlands 10 households (153) more than calculated were surveyed (Table 3). This means a sampling error of 2 %. The second-stage stratification of the districts was drawn disproportionately, making sure that in each district at least 20 households were surveyed. In most cases, even more than 20 households could be surveyed; only in 4 districts of the highlands this was not possible for logistical reasons. Concerning the 4 districts in the Ayabaca Province, the total of 20 households at the provincial level still allows comparisons. Geographically, the district of Pariñas in the Talara Province does not belong to the lowlands of the Piura river basin, but

[6] Due to financial restrictions, this theoretical sample size had to be limited to 466.

has been included in this stratum as its characteristics are comparable to the districts of El Tallán and Cura Mori in the Sechura Desert.

Table 3: Final sample size

Geographical Area	Province	District	Population (INEI Census, 2005)	Number of House-holds	Share of Total Popu-lation	Share of Sample
Highlands	**Piura**	Tambogrande	92.221	23		
		Ayabaca	37.444	6		
		Montero	7.665	4		
		Paimas	9.761	3		
	Ayabaca	Suyo	12.063	9		
		Canchaque	9.242	20		
	Huancabamba	Lalaquiz	5.300	21		
		Chulucanas	77.880	20		
		Morropón	14.729	19		
		Salitral	8.454	21		
		Sta Catalina de Mossa	4.512	4		
	Morropón	Santo Domingo	8.010	25		
	Subtotal		**287.281**	**175**	**39,8 %**	**186**
Lowlands		Sechura	30.817	20		
		Bernal	5.798	22		
	Sechura	Vice	14.455	23		
		Catacaos	64.822	25		
		Cura Mori	16.545	25		
	Piura	El Tallan	4.934	20		
	Talara	Pariñas	84.978	18		
	Subtotal		**222.349**	**153**	**30,8 %**	**144**
Chira river basin		Pueblo Nuevo de Colán	12.298	23		
		Amotape	2.250	24		
	Paita	La Huaca	10.594	21		
		Sullana	149.261	22		
		Lancones	13.302	25		
	Sullana	Querecotillo	24.038	23		
	Subtotal		**211.743**	**138**	**29,4 %**	**137**
Total	**8**	**25**	**721.373**	**466**	**100 %**	**466**

From the final survey, given the sample size (n=466) and the percentage of farmers who would buy an insurance to protect their land and crops (question Q.6g) being 74.2 %, the confidence interval using the calculator tool "Confidence Interval Analysis" can be determined (Gardner and Altman, 2000). It can be concluded that the true percentage in the population is covered by the confidence interval from 70.3 % to 78.2 % with 95 % confidence.

The survey was conducted during October and November 2007. This time of the year was chosen because it is a period where the farmers are not too occupied, as the main cropping season starts in December together with the rainy period. Hence, it was important to conduct the survey while the farmers had the time for interviews and before some districts would become inaccessible due to rainfall. For this purpose, 8 undergraduate students with experience in conducting surveys from the Faculty of Economics of the National University in Piura were hired. The assistants were made familiar and trained in conducting the survey, all questions were discussed, and it was emphasized that certain questions or topics needed to be explained to the household member.

For the survey, the team drove to the specific district in groups of five or six, and in each village an assistant was dropped to conduct the survey in one of the households. This way it was assured that the geographic diversity of each of the selected districts was covered. This could be reached in most of the cases. In some cases it was not possible to reach the desired number of households for constraints, i.e., Ayabaca, Montero, Paimas, Suyo and Santa Catalina de Mossa. As the people in northern Peru and especially in rural areas are very open, asking them for an hour of their time for conducting the survey was in most cases welcomed.

The household survey was divided into 6 thematic sections and consisted of a total of 123 questions, 105 closed-end and 18 open-end (see Appendix 11.1). These thematic sections were the following:

1) Socio-economic characteristics of the household (24 questions)
2) Characteristics of the agricultural land and crop production (32 questions)
3) Risks and vulnerabilities (7 questions)
4) Coping and adaptation strategies (31 questions)
5) Experience with credit services (20 questions)
6) Perception, demand and understanding of insurance services (9 questions)

The collected material was analyzed during the fieldwork period, and the data of the household survey were being entered into the program ‘Statistical Package for the Social Sciences’ (SPSS) with the help of 2 assistants. The closed-end questions were being systematized in SPSS while the open-end questions were being systematized in MS Word. This way, much time could be saved, and the first results of the survey could already be

presented at the workshop with international, national, regional and local experts in April 2008. Here feedback from national experts and researchers in agricultural financial services as well as from local farmers was positive. They stated that the reality of the farmers in the region was accurately depicted.

3.2.4 Focus-group workshops

Important and effective qualitative elements of the field research were the focus-group discussions that helped in the understanding of the range of perspectives that exist within the different communities regarding their coping and adaptation strategies with respect to climatic shocks, such as El Niño. Focus-groups are understood as a group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is subject of the research (Fünfgeld, 2007).

Two focus-group discussions were carried out and covered each of the three geographical areas. The first was held with representatives from irrigation committees of the highlands and the second with representatives from irrigation committees of the lowlands and the Chira river basin. The focus-group discussions comprised 10 to 15 participants. These discussions complemented the open-end questions of the household survey regarding local climate indicators and specific coping and adaptation strategies. It was possible to go deeper and more precisely into these topics by drawing tables with the participants that represented the different local climate indicators. The coping and adaptation strategies were mentioned with respect to the specific crop. The focus-groups also provided relevant information regarding the demand and availability of financial services.

The specific participatory method that was used is called the ‘Metaplan method’. This is a technique that has been developed in Germany in the 1970s by two brothers, Wolfgang and Eberhard Schnelle (1973) for facilitating large but also small management teams. The method has become a common procedure for participatory workshops, and can be used as a facilitation or communication method to develop a common understanding and to brainstorm around a specific topic. The particularity of the method is the use of specific communication tools and materials; these include rectangular cards of various colours, pens and display boards. The advantages of this method are that when the creative process is structured beforehand and some guidelines for conducting the workshop are available, it avoids the long drawn-out, inconclusive and time-wasting processes often found in

participatory methods. The disadvantage is that the specialized materials are costly, but since these were provided by the German Technical Cooperation (GTZ), this did not present a limitation.

3.2.5 Interviews at institutional level

Aside from the farmer households, the study focused on gathering information from relevant local and regional farmer authorities and from other key informants that were familiar with agricultural practices, coping and adaptation strategies with respect to El Niño, and the availability of financial services for agriculture in the area.

At the local level (district and provincial), the most important resource persons were staff of the water committees and irrigation commissions, who provided information on the organizations and on their role for making sustainable use for the water. Representatives of producer organizations who provided information on the type of financial services and technical assistance that farmers belonging to the specific association receive.

At the regional level, the municipal banks provided important information regarding the evolution of their agricultural credit portfolio and the previous cooperation with other institutions regarding possible insurance schemes. The logistic support during the fieldwork coming from the Caja Muncipal de Piura was highly appreciated and shows the profound interest of these institutions for insurance solutions to further develop their agricultural lending portfolio. Information regarding local history, and the political and economic development in the area could best be obtained from the regional research center, Center for Research and Promotion of the Rural Population (CIPCA)[7], but of equal value were discussions with local and regional government officials, representatives of the regional agricultural ministry and other relevant regional government bodies.

3.2.6 Workshop with experts

Another important qualitative method frequently used and applied in development practice, is the organization of a workshop with international and national experts and representatives of relevant local institutions. The program and organization of the workshop was planned during February and March 2008, and the workshop was held on

[7] CIPCA: Centro de Investigación y de Promoción del Campesinado.

the 2nd and 3rd of April 2008 with 50 participants. Almost all the invited speakers and participants attended, even though, as is usually expected for these events, none of the travel and accommodation expenses could be covered by this research. The expenses were covered by the relevant organizations. The GTZ office in Piura and the Caja Municipal de Piura institutionally represented the workshop and covered catering and logistical expenses.

The general aim of the workshop was to determine the possibilities for offering agricultural insurance schemes and to analyze the capacity of the market to support and offer financial instruments in the region. The specific objectives of the workshop were to:

- Establish a discussion space about financial instruments for the agricultural sector regarding disasters and climate change
- Identify the financial instruments offered in the region
- Provide a diagnosis of the possibilities for offering agricultural micro-insurance schemes and other related risk-transfer mechanisms.

It was judged that the best method for drawing together and compiling the necessary information for the above-mentioned objectives was the organization of an inter-institutional workshop. An essential starting point for the development of the workshop on the first day was the presentation of the legal framework for micro-insurance by the National Regulating Board, i.e., the Superintendent of Banks, Insurance and Pensions (SBS). This information was complemented by presentations on behalf of financial institutions working in the region regarding their experience with agricultural lending and their offer of other financial instruments. Later, regional producer associations presented their experience and offer of financial services and, if available at all, the types of technical assistance offered to their members. These presentations were followed by talks on disaster risk reduction, first by the author who reported on the field research and the results of the household survey regarding the local reality of the farmers in the region and then by a disaster risk management expert, who discussed common perceptions and misconceptions in disaster risk management. The second day, officials from the Ministry of Agriculture presented their objectives regarding a national agricultural insurance fund and the recent advances made. Further, an international expert in agricultural insurance matters from Mexico, being Consultant of the Ministry of Agriculture in Peru, presented

possible schemes as applied in different countries. Finally, a national insurance company presented first experiences with agricultural micro-insurance in a new pilot project in another region of the country.

In the afternoon sessions participants were grouped in order to gather specific information for the achievement of the workshop's objectives. While the first day covered an assessment of the offer of agricultural micro-credits, the second day was dedicated to the discussion of possible agricultural micro-insurance schemes in the region. The specific participatory method that was used was the Metaplan method, the same one that was used for the focus-group discussions.

Photo 1: Participants of workshop, April 2008

The results of the workshop were:

- Diagnosis of the financial instruments currently offered to farmers in the region;
- Criteria and orientation for offering financial instruments including insurance for the agricultural sector against disasters and climate change;
- Suggestions on possible financial schemes, in particular insurance schemes to be offered in the region in the future (see Appendix 11.2).

3.2.7 Secondary data

The above-mentioned research methods combined with secondary data such as local historical literature, combined with project reports and government grey literature have shed light on the impact of natural disasters on local farmers, their coping and adaptation strategies and the possibilities for using micro-insurance or other financial services to foster the resilience of local farmers.

Most of the secondary literature was collected in the libraries in Bonn, Lima and Piura as well as in the internet through access to certain journals. However, concerning the reality of farmers in Piura, it is important to highlight two excellent research centers in Piura and Lima, as these provided most valuable information for this study. The research centre in Piura is named the Center for Research and Promotion of the Rural Population (CIPCA), where important and relevant literature regarding the history of the region, the reality of the farmers and their access to financial instruments is available. Some of the documents can be downloaded from the internet (http://www.cipca.org.pe/), but most of their publications need to be consulted on the spot. Most of the literature concerning the livelihoods of smallholders as well as on the availability of credit for rural areas can be consulted at the Institute for Peruvian Studies (IEP), a research centre based in Lima. Most of the literature provided by IEP is also available online (http://www.iep.org.pe/biblioteca.htm). Moreover, a contact could be established with an expert, Carolina Trivelli, who had specifically researched some of these issues in the region and who participated of the workshop in April 2008. Other important information was gathered from local, governmental and non-governmental institutions.

3.3 Difficulties encountered during field research

3.3.1 Missing data

Unfortunately, the sample survey procedure with probability sampling is sensitive to missing data. It is very rare to obtain complete data from all of the units sampled. For some units, the sample survey may obtain no information at all, and for other units the survey may provide information on some but not all of the items ascertained (Levy and Lemeshow, 1999).

A common problem with random samples is the selection bias, i.e., meaning the inclusion of individuals in the study that are not representative of the target population. This might

occur because of inappropriate sampling frame or methods or because those sampled refuse to participate in the study. If the percentage of non-response is more than 5 %, the results of the study are likely to be biased. As the sampling frame and methods have proved to be appropriate, and the sampled population did not refuse to participate there is no selection bias in this study, and the sample design is stratified randomly, with less than 2 % missing data. So, the results of the survey show almost no missing data. This was been confirmed during the institutional workshop in April 2008. Expert researchers from the Institute for Peruvian Studies (IEP), farmers and other institutional representatives commented that the data presented reflected the reality of rural Piura.

3.3.2 Non-sampling errors

Common errors affecting surveys often are based on sampling errors. However, the validity of a survey can be affected by a variety of other errors, commonly referred to as non-sampling errors, i.e., errors that are not related to sampling. These non-sampling errors can be random or systematic. The former result from estimation and can usually be avoided if a large enough sample is used, while the latter tend to systematically accumulate throughout the entire sample and cannot be reduced by augmenting the sample size.

The study tried to overcome these types of errors in different ways:

- **Response errors:** These errors occur when data have been incorrectly given, asked for or documented and can be due to difficulties with the questionnaire, interviewer, respondent or survey process. For instance, households are usually reluctant to divulge their monthly income, and it is also very difficult for farmers to calculate their monthly income because they gain seasonal income. Therefore, in the final questionnaire the first question was 'what was your expenditure in the last month?', followed by 'what was your income in the last month?' Moreover, questions were asked on the seasonal expenditures for crop production and the income from seasonal crop production. This way it was possible to gain a more precise account of the actual monthly income of the farmers' households.

- **Interview bias:** Biases appear in research findings because of the social nature of the interview. There are three major sources of such bias: the interviewer (who may, for example, have prejudices or ask leading questions), the respondent (who

may wish to lie or evade questions), and the actual interview situation itself (especially the physical and social setting). Hence, the interviewer can influence how a respondent answers the survey questions, which might happen when the interviewer is either very friendly or distant to the interviewed. To avoid this type of error, only trained interviewers were hired and additionally they were trained in specific survey techniques, such as to ask the questions in a certain way by remaining neutral and respecting ethical guidelines.

- **Processing errors**: Processing errors can occur while coding, editing or entering the collected data into the statistical program SPSS. In order to avoid and minimize these types of errors, only professionals in coding and data entry were employed. Additionally, the coded and entered data were verified and checked several times after entering.

3.3.3 Difficulties during field research

Field research was unproblematic for the following reasons:

- First, familiarity with the area, culture, language and people existed beforehand, the author having lived and worked previously in the region for two years. The language in Piura is Spanish; even in the countryside there is no indigenous language, like Quechua, common in the southern regions of the country.
- Second, the political environment is currently peaceful in the research area. During the years of terrorist attacks of the Shining Path in the 1980s, field research would have been impossible. However, as the socio-political situation is calm, it was possible just to go into the different villages and to knock on the farmers' doors or to find them on their field and ask them if they had time for a questionnaire.
- Third, the farmers and their wives were usually very open and patient during the questionnaire, which took about one hour. Many started telling stories and provided details that were useful for the research but that were not asked for specifically in the questionnaire. This information was written down in a separate booklet.
- Fourth, the assistants hired for conducting the survey had been trained beforehand for two days, and as they were all experienced surveyors, all of the 466 questionnaires were valid.

3.4 Steps and tools for data processing and analysis

The farmer household survey in 466 households was the most time-consuming activity of data entry and processing. For this purpose, two assistants were hired to work on the data entry and processing into SPSS during approximately 2 months. Necessarily, these assistants had helped in conducting the household survey. The open-ended questions of the survey were entered into MS Word. After systematizing all comments, these were put into tables according to categories that were created along the similarity of the answers. This way it was possible to categorize and systematize the qualitative information from the open-ended questions.

Focus-group discussions were held making use of the Metaplan method, and the participants actively wrote cards and reflected about specific topics. Specific material and questions had been prepared beforehand for the focus-group discussion, and during the workshop these questions were asked and the participants responded by writing cards and pinning them on a board. An assistant was hired in order to help systematize the discussion and two other assistants helped in moderating the workshops.

Interviews were not transcribed word by word, but instead during the interview only a few notes were taken, selecting the most relevant comments and information. This way, only the most important information was systematized in a small notebook, which was carried along everywhere to take notes of ideas, comments and thoughts.

Finally, the institutional workshop was taped, thus the two days of presentations and group work could be documented. The same assistants were hired to type the information that had been recorded. The only inconvenience was that some moments of the recordings were not always of good quality, and due to a technical failure of the tape recorder, the discussion during the group work of the first day could not be systematized. The presentations, program and documentation of the workshop are available at the following website <http://www.riesgoycambioclimatico.org/tallerPiura/index.html> (see Appendix 11.2). This way the information is directly available to local participants, stakeholders and partners in the research process.

4 Livelihoods context: characteristics of rural households in Piura

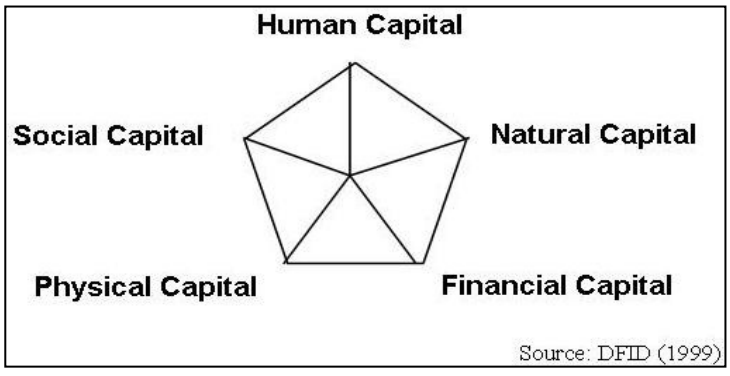
Since the 1990s, the concept of 'sustainable livelihoods' has become increasingly important in the development debate. This concept is based on the ideas of the capability approach developed by Sen (1985) focusing on what a person can do or can be, depending on what he/she has. Hence, the major focus of this approach is the realization that the poor do make use of different resources, even if they do not have access to the necessary financial resources through regular earnings or savings, to pursue their livelihood strategies. The livelihoods approach is concerned with these poor people and seeks to understand their assets and capital endowments and how they use different strategies to turn these into positive livelihood outcomes (DFID, 1999). Making use of the livelihoods approach (see Figures 2 and 3 in section 2.1.1), the livelihoods of the households in rural areas in the region of Piura are analyzed and the effectiveness of existing coping adaptation strategies are assessed.

The framework views poor people as acting in a context of vulnerability where they have access to certain assets or other factors that allow them to reduce their poverty. In the following, a short overview of the range of assets, their relations and interdependencies as well as of the prevailing social, institutional and political environment and structures that influence the livelihoods, strategies and outcomes of the rural households is given.

4.1 Livelihood assets

The asset pentagon depicts the five capitals or assets that make up a person's livelihood (Figure 4). The terms human, natural, financial, physical and social capital are used, although not all the assets are capital stocks as used in economics. The particularity of the pentagon is the importance of existing inter-relationships between the various assets. The heart of the pentagon represents no access to assets, while the outer limits represent maximum access (DFID, 1999).

Figure 4: Asset pentagon



4.1.1 Human capital: labor and education

Human capital refers to the skills, knowledge and good health that allow people to pursue their livelihood strategies in order to achieve their livelihood objectives. At a household level, this capital can be measured based on the amount and quality of labor available (DFID, 1999). In the rural context, the amount and quality of labor at the household level might be of greater importance for the immediate livelihood. This section will provide an overview of the human capital that was identified in the extensive household survey in 466 households. When talking about human capital, with reference to livelihoods a quantitative and qualitative dimension can be conceptualized. The quantitative dimension refers to the structure and composition of the household, whereas the qualitative dimension refers to the educational background, skills, health as well as age and gender of the respective household member.

Table 4: Position in household by sex

Position in household	Sex		Total
	Masculine	Feminine	
Head	73,0 %	5,4 %	78,3 %
Spouse	0,2 %	9,9 %	10,1 %
Child	7,9 %	1,7 %	9,7 %
Sibling	0,2 %	0,4 %	0,6 %
Nephew	0,2 %	0,0 %	0,2 %
Grandchild	0,2 %	0,0 %	0,2 %
Other member of the family	0,4 %	0,0 %	0,4 %
Other	0,4 %	0,0 %	0,4 %
Total	82,6 %	17,4 %	100,0 %

Regarding the structure and composition of the households, 82.6 % of the respondents were male and 17.4 % female (Table 4). In 78.3 % of the cases the surveyed person was the household head (male or female), in 10.1 % spouse and 9.7 % child. Generally the man is head of the household (73 %), but also a third of the female respondents (5.4 %) said they were head of their household, although this could be due to death of the husband or divorce, as only 0.2 % of the males said that they were the spouse of the head of the household.

Table 5: Age of household member

Age of household member	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 to 17	0,0 %	0,2 %	0,0 %	0,2 %
18 to 30	3,2 %	3,0 %	4,1 %	10,3 %
31 to 50	18,0 %	16,5 %	10,9 %	45,5 %
51 to 70	12,7 %	9,2 %	10,3 %	32,2 %
> 71	3,6 %	3,9 %	4,3 %	11,8 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Almost 90 % of the respondents were older than 31 years (Table 5). This is of importance for questions relating to experience with past natural phenomena such as El Niño and management of crops. As most of the

respondents were old enough to remember the economic activities of the household in the last ten years, the collected information of the survey is likely to be quite accurate.

Photo 2: Household size in rural areas

Human capital is generally measured based on the labor force in a household, which is dependent on the number of people that are working in the household. The average of 5 people per household confirms data from the 2005 census (INEI, 2005). In rural areas, most of the households (54 %) had 4 to 6 people in the same household, but surprisingly this large number is not involved in securing the household's livelihood income, as in 80 % of the cases, only 1 to 2 persons in a household worked. About 84 % of the households had between 0 and 2 children, and 15 % of the households had between 3 and 5 children that were younger than 14 years of age.

For the majority of households, the main economic activity is agriculture (84.3 %), about 6.4 % additionally practice another activity, only 1.7 % have livestock holding as a main activity, and 1.3 % are occupied as day laborers in the agricultural sector. The diversification of economic activity is very low; the results show that less than 7 % of the households pursue more than one economic activity (Table 6). The diversification of income-generating activities is higher in the Chira river basin and in the lowlands as in the highlands. This shows the extreme vulnerability of about 85 % of the households to natural phenomena as they solely depend on their land and agricultural products. In 44 % of the cases, only one household member worked and of the remaining 56 %, most

worked in agriculture (28.3 %) followed by agriculture and another activity (7.1 %), livestock holding (2.8 %), production of a local drink made of corn (Chichera) (2.1 %) and merchant (2.1 %) and other activities (Table 7).

Table 6: Main activity of household member

Main activity household member	Geographical Area			Total
	Highlands	Lowlands	Chira	
Agriculture	32,2 %	28,1 %	24,0 %	84,3 %
Agriculture & other activity	1,9 %	2,1 %	2,4 %	6,4 %
Livestock	0,4 %	0,6 %	0,6 %	1,7 %
Day laborer in agriculture	0,4 %	0,0 %	0,9 %	1,3 %
Professor	0,9 %	0,0 %	0,0 %	0,9 %
Merchant	0,2 %	0,0 %	0,0 %	0,2 %
Other	0,9 %	1,9 %	1,5 %	4,3 %
No answer	0,2 %	0,0 %	0,2 %	0,4 %
Not applicable	0,4 %	0,0 %	0,0 %	0,4 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Table 7: Main activity of second member

Main activity of second household member	Geographical Area			Total
	Highlands	Lowlands	Chira	
Agriculture	11,4 %	8,2 %	8,8 %	28,3 %
Agriculture & other activity	3,6 %	1,1 %	2,4 %	7,1 %
Livestock	1,3 %	0,9 %	0,6 %	2,8 %
Production of a local drink (Chichera)	0,2 %	1,9 %	0,0 %	2,1 %
Merchant	1,1 %	0,2 %	0,9 %	2,1 %
Day laborer in agriculture	0,2 %	0,2 %	0,6 %	1,1 %
Mason	0,2 %	0,2 %	0,6 %	1,1 %
Storekeeper	0,4 %	0,4 %	0,2 %	1,1 %
Professor	0,6 %	0,2 %	0,2 %	1,1 %
Other	2,1 %	4,3 %	1,9 %	8,3 %
Not applicable	15,9 %	14,8 %	13,1 %	43,8 %
Missing	0,4 %	0,4 %	0,2 %	1,1 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Generally, scholars argue that education is an important precondition to cope with vulnerability and for escaping the poverty trap. With regard to the actors in the Piuran countryside, it can be said that formal education does not necessarily signify an essential asset in pursuing their livelihoods. Gaining expertise and knowledge in pursuing agricultural activities can be gained through superior education but also through experience and practice, such that formal education does not show a clear advantage for a better livelihood. However, education can offer more opportunities for working in other areas and can facilitate a greater diversification of income-generating activities.

Table 8: Level of education

Education level	Geographical Area			Total
	Highlands	Lowlands	Chira	
Illiterate	2,8 %	1,3 %	2,1 %	6,2 %
Only read and write	0,6 %	0,4 %	1,1 %	2,1 %
Incomplete primary	10,5 %	11,8 %	12,4 %	34,8 %
Complete primary	8,2 %	8,4 %	6,2 %	22,7 %
Incomplete secondary	3,9 %	4,9 %	3,6 %	12,4 %
Complete secondary	8,2 %	3,4 %	2,8 %	14,4 %
Higher education	3,4 %	1,5 %	1,1 %	6,0 %
No answer	0,0 %	1,1 %	0,2 %	1,3 %
Total	37,6 %	32,8 %	29,6 %	100 %

Table 9: Education level by sex

Education level	Sex		Total
	Male	Female	
Illiterate	3,4 %	2,8 %	6,2 %
Only read and write	1,5 %	0,6 %	2,1 %
Incomplete primary	29,0 %	5,8 %	34,8 %
Complete primary	18,9 %	3,9 %	22,7 %
Incomplete secondary	11,2 %	1,3 %	12,4 %
Complete secondary	12,2 %	2,1 %	14,4 %
Higher education	5,4 %	0,6 %	6,0 %
No answer	1,1 %	0,2 %	1,3 %
Total	82,6 %	17,4 %	100,0 %

The lack of formal education does not show any disadvantage regarding agricultural activities and higher education is not a guarantee for higher earnings. The survey shows low education levels of the households, where most of the members did not complete primary education (34.8 %), followed by those that have completed primary school (22.7 %), and only 6 % have pursued superior education (Table 8). It can be highlighted that amongst the household members, the number of illiterate women was far higher than that of men, and with respect to higher education far less women had reached this level compared to their male counterparts (Table 9). Furthermore, it is interesting to note that, especially in the highlands a high percentage (3.4 %) of household members have higher education, and a higher percentage of people have completed their secondary education than in the other two geographical areas (8.4 %). A generally known fact is that, due to the geographic remoteness of the area, some families are keen on sending their children to university in the regional capital Piura. Education is seen as a means to move away from rural areas and to achieve a higher standard of living. The lack of education can be a handicap when people wish to switch from agriculture to another professional sector, or if they wish to pursue additional activities besides agriculture. It is more the experience in the management of crops, especially with regard to periods of water scarcity and water abundance, than formal education that helps the people to improve their economic situation in the agricultural sector. In contrast to formal education, a healthy body is seen

as a necessary precondition to be successful in the agricultural sector, as the work in the field is an almost exclusively physical activity.

Summarizing, human capital in terms of labor resources of a household and physical health plays a crucial role in the pursuit of a secure livelihood. The higher the number of earners in a household and the better their health, the higher is their livelihood security. The vulnerability of the surveyed households is expressed in the low diversification of income-earning activities, as explained earlier; most of the households pursue only one activity, mainly farming, to gain an income. Additionally, the vulnerability to external shocks is increased due to the fact that in most households only one or two members are earning an income, and hence the diversification is also low in terms of labor force. Agricultural activities are highly dependent on climate, and thus are exposed to high risks. This will be discussed when talking about climate-based shocks, seasonality and the vulnerability context of the households.

4.1.2 Financial capital: household incomes and savings

Financial capital represents the financial resources that people use to achieve their livelihood objectives. The term means both flows and stocks of financial capital that can contribute to the households' consumption or production. It represents an important part of sustainable livelihoods, namely the availability of cash or credits that make it possible for people to pursue different livelihood strategies. According to the DFID sustainable livelihoods guidance sheets (1999), there are two main sources of financial capital. First, available stocks or savings, e.g., cash, bank deposits or liquid assets such as livestock and other valuable goods, and second, regular inflows of money, such as earned income, pensions or other transfers form the state or remittances.

Information regarding income is difficult to gather in the countryside, because especially farmers gain their income seasonally from the sale of the crops, and from this sum they reduce what has been invested in inputs and in the production of the crops. Not all farmers' households are accustomed to taking account of their earnings and expenses, but as they generally live from the farming activity alone, their income can be determined by asking them how much they gain from the sale of their crops each season. Another way to double-check the approximate monthly income information is to ask for the monthly

expenses[8] of the household. Around 90 % of the households were able to give an idea of their monthly income and expenses (Tables 10 and 11).

Table 10: Monthly income

Monthly income in US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 - 100	18,5 %	8,6 %	6,0 %	33,0 %
101 - 200	9,9 %	12,9 %	15,2 %	38,0 %
201 - 300	4,3 %	3,2 %	4,7 %	12,2 %
> 301	1,3 %	3,0 %	1,3 %	5,6 %
No answer	2,8 %	3,0 %	1,3 %	7,1 %
Not known	0,2 %	2,1 %	0,2 %	2,6 %
Missing	0,6 %	0,0 %	0,9 %	1,5 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Table 11: Monthly expenses

Monthly expenses in US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 - 100	16,7 %	9,7 %	5,6 %	32,0 %
101 - 200	18,7 %	18,2 %	19,7 %	56,7 %
201 - 300	1,3 %	3,2 %	3,4 %	7,9 %
> 301	0,4 %	1,3 %	0,4 %	2,1 %
No answer	0,0 %	0,2 %	0,2 %	0,4 %
Not known	0,0 %	0,2 %	0,0 %	0,2 %
Missing	0,4 %	0,0 %	0,2 %	0,6 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

The results confirm that most of the households in the highlands are in the lowest income category (i.e., less than US$ 100 a month), while most of the incomes in the lowlands and the Chira river basin are in the second category (US$ 101 - 200). Comparing the income with the expenses (Tables 10 and 11), a typical household earns and spends between US$ 100 - 200 a month. However, about 30 % of the households earn and spend less than US$ 100 a month. This confirms the data from regional studies (Fort et al., 2001) and statistical information provided by the National Institute for Statistics and Informatics (INEI, 2005). Other sources of monetary inflows, such as subsidies or allocations from social funds were not mentioned by the surveyed households. Only in very few cases were pensions and remittances from family members mentioned as regular inflows of cash; these were included in the calculation of the monthly income.

The income gained from crops during the two main cropping seasons (December to June and July to November) were compared. The data show that in many cases the costs for crop production are higher than the income received (Tables 12, 13, 14 and 15). This is due to several factors, such as low prices for the products, and high costs for inputs and labor.

[8] Monetary values are expressed in US$, i.e., 1 US$ corresponds to approximately 3 Nuevos Soles (national currency).

Table 12: Income from crops (Dec.-June)

Crop Income in US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 - 300	9,3 %	3,0 %	3,0 %	15,3 %
301 - 600	3,4 %	3,4 %	0,9 %	7,7 %
> 601	12,0 %	10,9 %	6,7 %	29,6 %
No answer	1,9 %	4,3 %	2,6 %	8,8 %
Not applicable	9,4 %	10,5 %	15,7 %	35,6 %
Not known	1,5 %	0,6 %	0,8 %	3,0 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Table 13: Costs for crops (Dec.-June)

Costs for crops in US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 - 300	12,7 %	1,7 %	3,0 %	17,4 %
301 - 600	5,8 %	2,4 %	1,9 %	10,1 %
> 601	9,2 %	16,5 %	8,2 %	33,9 %
No answer	1,5 %	1,3 %	0,0 %	2,8 %
Not applicable	7,7 %	10,3 %	15,9 %	33,9 %
Not known	0,6 %	0,6 %	0,6 %	1,9 %
Total	37,6 %	32,8 %	29,6 %	100 %

Table 14: Income from crops (July-Nov.)

Crop Income In US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 - 300	4,5 %	5,8 %	3,9 %	14,1 %
301 - 600	1,1 %	3,2 %	2,8 %	7,1 %
> 601	1,5 %	3,9 %	4,9 %	10,3 %
No answer	1,3 %	3,0 %	2,1 %	6,4 %
Not applicable	28,1 %	17,0 %	15,2 %	60,3 %
Not known	1,1 %	0,0 %	0,6 %	1,7 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Table 15: Costs for crops (July-Nov.)

Costs for crops in US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 - 300	3,0 %	3,0 %	3,4 %	9,4 %
301 - 600	1,9 %	4,3 %	3,6 %	9,9 %
> 601	3,0 %	7,1 %	6,9 %	16,7 %
No answer	1,3 %	2,1 %	0,2 %	3,6 %
Not applicable	27,5 %	16,3 %	15,0 %	58,8 %
Not known	0,9 %	0,0 %	0,6 %	1,5 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

In-kind savings, i.e., in cash, are very rare in rural areas as people are not used to having enough money to put aside and save. The rule is to live day by day. People mostly laughed when asked how much they had saved, or they would ask the interviewer to repeat the question. In the region in general and especially in rural areas, no real saving culture has developed; 80.5 % of the households affirmed not to have any savings and only 11.6 % claimed to have no more than US$ 30 (Table 16).

Table 16: Cash savings per household

Cash savings in US$	Geographical Area			Total
	Highlands	Lowlands	Chira	
0-15	2,4 %	0,4 %	1,3 %	4,1 %
16- 30	4,7 %	2,6 %	4,3 %	11,6 %
> 30	1,3 %	1,3 %	1,3 %	3,9 %
No savings	29,2 %	28,5 %	22,7 %	80,5 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

However, it is assumed that the number of people having cash savings is higher, as many households were reluctant to provide this information and understated the amount or simply denied having any savings. In any case, the households with farming as their main activity need to have a certain amount of cash

for the next cropping season. But this cannot really be considered as savings, because it is money that is put aside in order to be reinvested in the next season. Interestingly, the households in the highlands have more savings than the households in the other geographical areas.

Other types of savings include assets and livestock. The assets owned by the surveyed rural households were divided into three categories: general household assets, crop management assets, and means of transportation (Table 17). These assets are a form of saving, especially if they are of high value, i.e., a car or refrigerator. The more assets the households own, the higher their income and the higher their living standard.

Table 17: Assets owned by household

Type of Asset		Geographical Area			Total (N=466)
		Highlands (N=175)	Lowlands (N=153)	Chira (N=138)	
General household assets	Charcoal or wood stove	33 %	30 %	26 %	89 %
	Gas or electric cooking stove	9 %	5 %	9 %	22 %
	Refrigerator or freezer	5 %	5 %	5 %	16 %
	Sewing machine	5 %	4 %	3 %	12 %
	Motor for electricity	1 %	2 %	1 %	4 %
	Radio or music system	31 %	27 %	24 %	82 %
	TV	22 %	22 %	23 %	66 %
	Telephone	6 %	6 %	6 %	19 %
Crop management assets	Cart/wagon	10 %	21 %	12 %	43 %
	Fumigation machine	11 %	15 %	13 %	39 %
	Plough	7 %	15 %	6 %	28 %
	Pump	1 %	3 %	2 %	6 %
	Tractor	1 %	1 %	0 %	2 %
	High pressure motor	1 %	0 %	0 %	1 %
Means of transportation	Bicycle	13 %	10 %	11 %	33 %
	Motorbike	3 %	3 %	3 %	9 %
	Car	2 %	2 %	1 %	5 %
Other	Other assets	2 %	0 %	1 %	3 %

There is no great difference in the ownership of general household and transport assets. However, the households in the lowlands are better equipped regarding crop management assets than the other regions. This might be due to historical reasons. In the past, the lowlands were administered as haciendas and had advanced equipment. The land is now divided into several peasant communities and owned by the community; each peasant has a certificate for his share.

Another important type of saving and asset is livestock (Table 18). A common and widespread coping strategy is to sell an animal in difficult times (see Chapter 5). Livestock is important for quickly obtaining cash but also for self-consumption. When

owning livestock, more than 50 % of the households had no livestock at all, and about 30% of the households had at least a male and a female animal to ensure reproduction.

Table 18: Number of livestock owned by household and geographical area

Livestock	Number	Geographical Area			
		Highlands (N=175)	Lowlands (N=153)	Chira (N=138)	Total (N=466)
Cattle	1 - 5	12 %	9 %	5 %	26 %
	6 -10	4 %	1 %	0 %	5 %
	> 11	2 %	1 %	0 %	3 %
	None	20 %	23 %	23 %	66 %
Horses	1 - 5	11 %	17 %	9 %	37 %
	6 -10	0 %	0 %	0 %	0 %
	> 11	0 %	0 %	0 %	0 %
	None	26 %	16 %	20 %	62 %
Donkeys	1 - 5	18 %	16 %	11 %	45 %
	6 -10	0 %	0 %	0 %	0 %
	> 11	0 %	0 %	0 %	0 %
	None	20 %	17 %	19 %	55 %
Sheep	1 - 5	3 %	5 %	4 %	12 %
	6 -10	3 %	3 %	3 %	10 %
	> 11	2 %	2 %	3 %	6 %
	None	29 %	23 %	20 %	72 %
Pigs	1 - 5	14 %	13 %	10 %	38 %
	6 -10	2 %	2 %	0 %	4 %
	> 11	1 %	0 %	0 %	1 %
	None	21 %	17 %	19 %	58 %
Goats	1 - 5	3 %	4 %	3 %	10 %
	6 -10	1 %	2 %	1 %	5 %
	> 11	2 %	4 %	4 %	10 %
	None	31 %	23 %	22 %	76 %
Chickens	1 - 5	12 %	12 %	9 %	33 %
	6 -10	10 %	9 %	8 %	26 %
	> 11	7 %	8 %	4 %	18 %
	None	8 %	5 %	9 %	22 %
Turkeys	1 - 5	6 %	9 %	5 %	20 %
	6 -10	2 %	3 %	2 %	8 %
	> 11	0 %	2 %	1 %	3 %
	None	29 %	18 %	22 %	69 %
Ducks	1 - 5	5 %	5 %	6 %	16 %
	6 -10	2 %	2 %	3 %	6 %
	> 11	1 %	2 %	1 %	5 %
	None	30 %	24 %	19 %	73 %

Summarizing, the monthly income hardly is sufficient to cover the households' monthly expenses. The situation is similar regarding the expenses for inputs and production of the crops, where these outweigh the income from the sale of the crops. Moreover, considering in-kind savings, it can be said that they are practically nonexistent. Finally, with regard to other types of savings, the households own some basic assets and livestock, and especially the sale of livestock is considered as a quick means to get to some money in difficult times.

4.1.3 Social capital: social ties and networks

The concept of social capital has been discussed intensely by social scientists in recent years, and there is much debate around the term. In the context of the sustainable livelihoods framework, its meaning concerns the social resources that people make use of in pursuing their livelihood objectives. These consist of networks and connectedness, membership in formalized groups, and adherence to common rules, norms and sanctions as well as relationships of trust, reciprocity and exchange (DFID, 1999). For the purpose of this study, social capital implies both personal relationships with family, friends and neighbors, and other informal and formal memberships in organizations or associations.

Table 19: Social ties and networks

Social ties & Networks	Geographical Area			Total
	Highlands	Lowlands	Chira	
Family, friends, neighbors	24 %	15 %	17 %	55 %
Peasant community	10 %	12 %	7 %	28 %
Mutual help association	0 %	0 %	1 %	1 %
Other	2 %	0 %	0 %	3 %
No answer	1 %	1 %	0 %	2 %
Not applicable	2 %	5 %	5 %	11 %
Total	38 %	33 %	30 %	100 %

The results of the survey show that the households' social ties and networks are as follows: 55 % rely on family, friends and neighbors and 28 % on the peasant community (Table 19). Interestingly, the social ties and networks of the households in the highlands and in the Chira river basin are family and friends, while the households in the lowlands rely on the peasant community.

Table 20: Functioning of social ties

Functioning	Geographical Area			Total
	Highlands	Lowlands	Chira	
Well	16 %	12 %	16 %	44 %
Normal	14 %	12 %	6 %	32 %
Badly	5 %	3 %	2 %	10 %
No answer	0 %	1 %	0 %	1 %
Not applicable	2 %	6 %	5 %	13 %
Total	37 %	33 %	30 %	100 %

For this study, it was of interest to know how these networks have functioned during past natural disasters such as El Niño or droughts: most people answered between well (44 %) and normal (32 %) (Table 20). In most cases, personal and family links are the networks that function well in disaster times (Table 20). Belonging to formal organizations was also quite high (44 %). However, when asking about the name of the organization, in 50 % of the cases a peasant community was mentioned. This means that these are the most common formal organizations.

Table 21: Support in difficult times

Strategy used when facing financial problems	Geographical Area			Total
	Highlands	Lowlands	Chira	
Ask for money from family or friends	18,0 %	13,1 %	10,9 %	42,1 %
Sell an animal/livestock	6,7 %	8,8 %	6,0 %	21,5 %
Ask for credit / lend money	5,6 %	5,6 %	6,4 %	17,6 %
Do extra work	1,7 %	0,6 %	0,6 %	3,0 %
Get help from Church or NGO	0,4 %	0,4 %	0,2 %	1,1 %
Reduce expenses for food	0,6 %	0,0 %	0,2 %	0,9 %
Ask for money from employer	0,0 %	0,2 %	0,2 %	0,4 %
Reduce other expenses	0,2 %	0,0 %	0,0 %	0,2 %
Be late in paying bills	0,0 %	0,0 %	0,2 %	0,2 %
Nothing	1,9 %	1,3 %	2,8 %	6,0 %
Other	2,4 %	2,8 %	1,9 %	7,1 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

When experiencing financial difficulties at the family level due to illness, death, etc., most households again rely on family, friends or neighbors, a majority of which are in the highlands. In many cases, this involves a big community party in the village where each participant contributes an amount of cash for the family in need. The next most widespread strategy for coping with an emergency situation is the sale of livestock, followed by lending of money, mostly from an intermediary. Only 1 % of the households ask for help at the church, or from other organizations (Table 21).

Table 22: Product chain

Belong to a product chain	Geographical Area			Total
	Highlands	Lowlands	Chira	
Yes	9 %	8 %	6 %	23 %
No	22 %	17 %	19 %	58 %
No answer	1 %	1 %	0 %	2 %
Not applicable	6 %	6 %	5 %	17 %
Total	38 %	32 %	30 %	100 %

In the past, negative experiences have been made with respect to the creation and management of cooperatives (see Chapter 2). It is therefore not surprising that only 23 % of the households form part of a product chain (Table 22). This confirms the well-known problem in the region of unassociated and highly dispersed smallholdings. Most of the farmers sell their crops to an intermediary, who frequently provide credit at a very high interest rate or buy the product at a very low price. Most households have to rely on these middlemen to sell their products as these come directly to the house and also give cash in advance for an expected crop. In many cases, farmers would not need to depend on these middlemen, if formal credit were to be offered to the households for each cropping season. This would allow the farmers to have the necessary means for the production of crops, and at the same time to have access to the necessary financial means needed for the household.

In emergency situations and disaster times, only 25 % of the households said to have received help from the government in the past. Trust in governmental bodies is very low and not much is expected from them in terms of support and assistance. The same applies to governmental support for the purchase of inputs for the production of crops. In less then 1 % of the cases did the farmers receive subsidized inputs or other support related to the purchase of inputs.

To recapitulate, in difficult times, the social ties and networks that rural households rely on are personal and informal relationships such as kinship ties, neighbors and friends. Formal organizations and networks are not very common, except the peasant community, and only 23 % belong to a formal product chain. Support from and trust in governmental bodies as an effective manager in times of emergencies or disasters is very low.

4.1.4 Physical capital: basic infrastructure

Physical capital refers to basic infrastructure and producer goods that are needed to support the livelihoods of the poor (DFID, 1999). Infrastructure consists of secure shelter and buildings and other changes in the physical environment that help people to meet their basic needs and be more productive. Producer goods refer to specific equipment that allows the people to be more productive. Physical capital is conceptualized as productive assets that denote basic services and infrastructure, housing, as well as other assets and tools available to the farmers for pursuing their income generating activities.

With regard to shelter, 96 % of the households have their own house or live in an inherited one, and only 2 % rent their shelter (Table 23). Considering the provision of basic services, the results show that 75 % of the surveyed households have access to the most basic services such as drinking water and electricity, but less than 10 % have access to drainage and telephone services (Table 24). It is particularly interesting to note that more households in the highlands benefit from electricity and drinking water in comparison to the other geographical areas. The results show that most households benefit from the most basic services and infrastructure necessary for a decent livelihood, such as housing, drinking water and electricity.

Table 23: Type of house

Type	Geographical Area			Total
	Highlands	Lowlands	Chira	
Own	35 %	31 %	27 %	93 %
Inherited	1 %	1 %	1 %	3 %
Rented	1 %	1 %	0 %	2 %
Other	0 %	1 %	1 %	2 %
Total	38 %	33 %	30 %	100 %

Table 24: Access to basic services

Services	Geographical Area			Total
	Highlands	Lowlands	Chira	
Drinking water	30 %	26 %	20 %	75 %
Drainage	1 %	3 %	3 %	7 %
Electricity	29 %	18 %	23 %	70 %
Telephone	3 %	2 %	1 %	6 %

Looking more closely at the quality of the housing, it can be observed that most of the houses are not made of material that is resistant to heavy rainfall, floods and winds. The material used depends on the geographical area. In the highlands, the preferred material is adobe, and the roofs consist mainly of corrugated iron or tiles. In the lowlands, most houses are made of bricks or reeds and the roofs of corrugated iron. In the Chira river basin, the materials are more varied, the houses are made of adobe, bricks, bamboo, and the roofs of corrugated iron, cement or tiles (Tables 25 and 26).

Table 25: House building material

Material	Geographical Area			Total
	Highlands	Lowlands	Chira	
Adobe	31 %	5 %	11 %	46 %
Bricks	5 %	14 %	8 %	27 %
Reeds	0 %	10 %	5 %	15 %
Bulkhead	1 %	2 %	4 %	7 %
Wood	0 %	2 %	2 %	3 %
Concrete	1 %	0 %	0 %	1 %
Other	0 %	0 %	1 %	1 %
Total	38 %	33 %	30 %	100 %

Table 26: Roof material

Material	Geographical Area			Total
	Highlands	Lowlands	Chira	
Corrugated Iron	17,4 %	18,5 %	21,0 %	56,9 %
Cement	3,6 %	9,2 %	5,6 %	18,5 %
Tiles	15,9 %	0,2 %	2,1 %	18,2 %
Loam/Clay	0,0 %	0,0 %	0,6 %	0,6 %
Other	0,4 %	4,9 %	0,2 %	5,6 %
Missing	0,2 %	0,0 %	0,0 %	0,2 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

The materials used can be explained both by their availability in the area and the available financial capital of the households. For instance, in the highlands, households generally need stronger materials that are more likely to resist rainfall, while this is not necessary in the lowlands due to the desert climate and absence of rainfall in most years (Photo 3). Nevertheless, although the materials used in the highlands are stronger and more resistant to regular heavy rainfall, they might not be sufficiently strong to withstand constant and heavy rainfall such as during an El Niño phenomenon.

Photo 3: Typical houses in the highlands, lowlands and Chira river basin



Summarizing, the majority of the surveyed households have their own shelter and access to the most basic services. The quality and value of housing is not very high, and the houses also very vulnerable to heavy rainfall and floods. Most households claim to live in a flood-prone area, and in most cases there is no appropriate infrastructure for protection against floods and droughts.

4.1.5 Natural capital: own land and crops

Natural capital is the term used for the natural resource stocks from which resource flows and services useful for livelihoods are derived. As this study is concerned with rural households and especially those that pursue agriculture as their main activity, natural capital for a livelihood is of prime importance, as this is the main means of living of most of the surveyed households. According to the survey, 77 % of the households own land, 9 % have inherited land, 6 % rent it, and only 4 % do not own any land.

Table 27: Hectares owned per household

Hectares owned	Geographical Area			Total
	Highlands	Lowlands	Chira	
0 – 1 ha	10 %	14 %	11 %	35 %
1.01 - 2.5 ha	12 %	8 %	9 %	30 %
2.51 - 5 ha	10 %	6 %	5 %	21 %
5.01 - 10 ha	3 %	1 %	2 %	6 %
> 10.01 ha	2 %	1 %	0 %	3 %
Does not possess	0 %	2 %	2 %	4 %
Total	38 %	32 %	30 %	100 %

Historically, Piuran coastal agriculture was characterized by medium and large haciendas, of which a few exceeded 10,000 ha. As explained in Chapter 2, the Agrarian Reform in 1969 radically altered this agrarian scenery by expropriating the

owners of the haciendas and converting them into state-led cooperatives. In the years after the military government, the cooperatives that were not functioning well were dissolved, a process called fragmentation, which led to changes that were even more radical than the reform. While the agrarian reform tried to maintain the operative scale of the haciendas through cooperatives, the process of fragmentation created a new massive sector of smallholders (Fort et al., 2001). Hence, smallholders (86 %) are prevailing and most of them own only 0 to 1 ha (35 %), followed by 1.01 to 2.5 ha (30 %) and 2.51 to 5 ha (21 %) of land (Table 27). Less than 10 % own more than 5 ha; most of these live in the Chira river basin and in the District of Tambogrande (here included in the highlands).

Regarding financial services for the poor, it is known that the most common guarantee for obtaining a credit at a formal credit institution is the land title. When asking about the possession of a land title, the impression was that in most cases the respondent felt uncomfortable with the question. It seems that the people were not honest, as the result shows that 62 % have a title, which is surprising (Table 28). Furthermore, it also seems as if the respondents were confused about the difference between a land title and a certificate of possession.

Table 28: Land title

Possession of Land title	Geographical Area			Total
	Highlands	Lowlands	Chira	
Yes	23 %	22 %	17 %	62 %
No	11 %	6 %	6 %	23 %
Certificate	1 %	1 %	2 %	4 %
No answer	1 %	0 %	1 %	2 %
Not applicable	2 %	3 %	5 %	9 %
Not known	0 %	0 %	0 %	1 %
Total	38 %	32 %	30 %	100 %

Hence, probably many of the respondents that said that they had a land title but in reality only had a certificate of possession. In the case when the land belongs to a peasant community, the farmers have a certificate for their individual share of the communal property. The difference between a title and a certificate is that the former is registered in the official state public agency (PETT or COFOPRI[9]), while the latter is only registered at the local level (Municipality). For obtaining a credit at a formal credit institute, the official title is usually asked for.

[9] PETT: Proyecto Especial de Titulación de Tierras y de Catastro – Peruvian Government's Special Land Titling Program
COFOPRI: Organismo de Formalización de la Propiedad Informal – Organism for the Formalization of Informal Property

With regard to water abundance, 64 % of the households claimed that their lands were in a flood-prone area, of which 27 % are in the lowlands (Table 29). Looking at water scarcity and drought proneness of the land, it is surprising that 77 % of the households stated that their land was situated in a drought-prone area and that they experienced water scarcity quite frequently (Table 30). As explained briefly in Chapter 3, mainly the lowlands and the Chira river basin experience very little rainfall, and thus water scarcity is a well-known problem, especially during long periods of time without the occurrence of an El-Niño phenomenon. However, interestingly, most households that stated that their land was situated in a drought-prone area were in the highlands. This can be explained by the fact that these households are not used to frequent water-scarcity periods and thus are more affected by these shocks.

Table 29: Flood-prone area

Land in flood-prone area	Geographical Area			Total
	Highlands	Lowlands	Chira	
Yes	17 %	27 %	20 %	64 %
No	20 %	4 %	8 %	32 %
Not applicable	0 %	2 %	2 %	4 %
Total	37 %	33 %	30 %	100 %

Table 30: Drought-prone area

Land in drought-prone area?	Geographical Area			Total
	Highlands	Lowlands	Chira	
Yes	32 %	26 %	19 %	77 %
No	5 %	4 %	9 %	18 %
Not applicable	1 %	2 %	2 %	5 %
Total	38 %	32 %	30 %	100 %

The main crops cultivated by the surveyed households in the three geographical areas were determined (Table 31). Traditionally, the lowlands used to be one of the most important cotton producing valleys in the country. However, the production of the famous pima cotton has been decreasing in the last 20 years. Other producers, such as USA, have become the major producer of this type of cotton and as a consequence the price is very low. In Peru, cotton production is commercialized by a monopoly called the Romero Group. This means that the price for cotton is relatively low, and most of the surveyed farmers who stated that cotton was their main crop added that they would change to another crop in the following year as cotton was no longer profitable. Cotton is also very vulnerable to diseases, which means that inputs for production and treatment of infested crops are generally quite expensive. Hence, in the lowlands the production of cotton is followed by the production of maize and rice, but this could significantly change in the coming years. In the Chira river basin, mainly maize, cotton, banana, and rice are cultivated. In the highlands, a greater variety of crops is found. Traditional crops there are

coffee, cocoa, sugar cane, and beans, while mango, banana, maize and rice at lower altitudes.

Table 31: Main crop

Crop	Geographical Area			Total
	Highlands	Lowlands	Chira	
Cotton	0 %	15 %	6 %	21 %
Maize	6 %	7 %	8 %	21 %
Rice	8 %	5 %	5 %	18 %
Banana	2 %	0 %	5 %	7 %
Mango	5 %	0 %	1 %	6 %
Coffee	5 %	0 %	0 %	5 %
Cocoa	3 %	0 %	0 %	3 %
Sugar cane	3 %	0 %	0 %	3 %
Beans	2 %	1 %	0 %	3 %
Lime	1 %	0 %	2 %	3 %
Sweet potato	1 %	0 %	1 %	2 %
Onion	1 %	0 %	1 %	2 %
Other	0 %	0 %	1 %	1 %
Not applicable	0 %	3 %	1 %	5 %
Total	38 %	33 %	30 %	100 %

Natural capital is the term used for the natural resource stocks from which resource flows and services useful for livelihoods are derived. Consequently, natural capital is very important for those who derive all or part of their livelihoods from resource-based activities (farming, fishing, gathering in forests, etc.). However, its importance goes well beyond this, as no human being would survive without the help of key environmental services and food produced from natural capital (DFID, 1999). Knowing that farmers and livestock herders highly depend on natural capital, it was of interest to know the aims of these with regard to cultivating crops, grassland and forests on their land. The aim of cultivating crops is to sell them to the market as well as for subsistence purposes. With regard to grassland and forests, it was of interest to know if conservation was actually practiced by farmers, as there is a general problem of water scarcity which has been exacerbated through constant deforestation in the region. According to the survey, only 2 % of the households claim to actively practice conservation measures on their land, and this only in the highlands. Although low, the percentage is important, as currently the creation of conservation areas are planned by the regional government and NGOs.

However, until now only a few projects have yet been implemented in the region, and thus not many farmers are familiar with conservation measures.

4.2 Vulnerability context

The vulnerability context as is commonly used in the sustainable livelihoods approach describes the environment in which people exist. According to this approach, people's livelihoods and assets are conditioned by climate-related shocks and trends, which they cannot influence or control. The factors that make up the vulnerability context of the poor are important because they can have a direct impact upon people's asset status and the options that are open to them in the pursuit of favorable livelihood outcomes (DFID, 1999). Shocks can be of different origin, e.g., poor human health, natural and economic disasters, conflicts or the health of crops and livestock. They can destroy assets directly (floods, storms and droughts), or can force people to abandon their home and land. Trends can include resource trends or conflicts, national or international economic trends, trends in governance as well as technological and population trends.

4.2.1 Shocks: El Niño, water scarcity and abundance

Analyzing the environment in which rural communities in Piura exist, it is important to reflect upon the natural climatic phenomena and hazards existing in the region that potentially affect the farmers' livelihoods. The region of Piura is of great importance to the Peruvian economy, and it has a great potential for agricultural exports, fisheries, and touristic development, generating important income for the country. However, the region has been exposed to extreme climatic events, such as El Niño and recurrent droughts, and also has a high vulnerability to the impacts of future climate change (CONAM, 2004).

In Peru, El Niño has been associated with great ecological and socio-economic disasters, especially in its coastal areas. These impacts have been primarily associated with torrential floods in northern Peru and devastating droughts in the south. The damages caused by the 1982-83 and 1997-98 El Niño in Peru were equivalent to 7 % and 5 % of the GDP respectively (Hoff et al., 2003). La Niña events cause cooler temperatures and droughts. The years in between El Niño events are usually dry and characterized by water scarcity, especially in the lowlands.

The impacts of El Niño on agriculture are: a decrease in exports and in families' incomes, and an increase in poverty, diseases, migrations and unorganized urban expansion, as well as economic recession in agricultural and livestock activities. The development of agriculture in the Piura river basin will be vulnerable to the consequences that climate change might cause, e.g., flooding, heavy rainfall, mud and landslides, biological events, more frequent and intense El Niño, and more frequent and intense periods of drought (CONAM, 2005).

Being concerned with the impact of floods and droughts on the farmers' livelihoods, several questions were asked during the survey concerning the experience and impact of these events on the economic situation. The first appraisal obtained from the information is that the households are frequently suffering from climatic shocks (Photo 4). Furthermore, they are aware of the presence, unpredictability and impact of these climatic shocks. About 60 % of the households had experienced floods on their land, with 55 % declaring the losses to have been serious. More than 60 % suspect that heavy rainfall or flooding is likely to affect their crops and land in the future. Regarding water scarcity and drought, only 30 % of the households had experienced this and 20 % assed the losses as serious. Interestingly, more than 70 % expect water scarcity and drought to affect their land and crops in the future. Looking at crop diseases, only 9 % of the farmers claimed to have experienced these kinds of problems in the past, and only 6 % of those qualify the loss caused as serious, however more than 85 % expect to experience problems with plagues and illnesses in the future.

Table 32: Reasons for losses in crop production

Reasons for losses	Geographical Area			Total
	Highlands	Lowlands	Chira	
Heavy rainfall, El Niño	16,1 %	24,2 %	19,7 %	60,1 %
Water scarcity, drought	8,4 %	1,5 %	2,4 %	12,2 %
Crop diseases	3,9 %	2,8 %	2,8 %	9,4 %
Cold wave	0,4 %	0,2 %	0,4 %	1,1 %
Heat wave	0,2 %	0,2 %	0,0 %	0,4 %
Prices	0,6 %	0,0 %	0,0 %	0,6 %
Other (Winds, etc.)	0,4 %	0,0 %	0,0 %	0,4 %
Not applicable	7,5 %	3,6 %	4,1 %	15,2 %
No answer	0,0 %	0,2 %	0,2 %	0,4 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Further, it was important to know if and how the mentioned shocks and climatic events affect the households' livelihoods. A first concern was to find out if farmers had experienced losses in the production of their crops and if so, what the reason of the loss was. The results from the survey show that 81 % of the households had

experienced losses in the past, and in 60 % of the cases losses were due to heavy rainfall (most of which were in the lowlands) and 12 % due to water scarcity (most of which in the highlands), followed by 9 % caused by crop diseases and 1 % by cold weather (Table 32 and Photo 4). The losses are quite high, as generally the farmers claim to loose between 70 and 100 % of the production when confronted with the above-mentioned events.

Photo 4: Water scarcity and water abundance

Waiting for daily water quota in the Chira river basin

Rice production in the lowlands

Puente Independencia in the lowlands, Oct.2007

Puente Independencia, Feb.2008

When asking the farmers which of the mentioned events have a greater negative impact on their livelihood, 65 % of the farmers said that all three events: floods, droughts and crop diseases equally negatively affected their livelihood. These have a negative effect on the economic situation of the households, due to losses in the production of the crops. Additionally, in the case of crop diseases, large amounts of money frequently have to be invested in the treatment of the crops. Of particular significance is the fact that between 60 and 85 % of the households expects these events to occur again in the future.

Another way to find out about the shocks and economic situation that the households actually experienced was to ask the people how they would qualify each of the last ten years with regard to their economic well-being and livelihood (Table 33). In general, it can be said that the most common response is normal. More precisely, it looks as if the

households are used to very low incomes, high crop production and input prices, low selling prices as well as to water scarcity and abundance, such that they have to cope with these factors regularly. Hence, the economic situation is always difficult and the respondents classified this as 'normal'. Only if a factor led to an extremely negative impact was a year classified as 'bad', and similarly only if a factor led to an extremely positive impact was the respective year classified as 'good'. For instance, the years with so-called mega-El Niños (1982/83, 1997/98) were classified as 'bad' years.

Table 33: Economic well-being

Year/ Economic well-being	Good	Normal	Bad	Not Responded	Not Applicable	Not known	Missing	Total
2007	12,0 %	68,7 %	19,3 %	0,0 %	0,0 %	0,0 %	0,0 %	100 %
2006	9,7 %	70,8 %	19,5 %	0,0 %	0,0 %	0,0 %	0,0 %	100 %
2005	5,6 %	75,1 %	19,3 %	0,0 %	0,0 %	0,0 %	0,0 %	100 %
2004	6,0 %	79,6 %	14,2 %	0,0 %	0,0 %	0,0 %	0,2 %	100 %
2003	4,3 %	81,8 %	13,3 %	0,2 %	0,0 %	0,2 %	0,2 %	100 %
2002	3,9 %	81,1 %	14,4 %	0,2 %	0,0 %	0,2 %	0,2 %	100 %
2001	1,2 %	85,8 %	12,4 %	0,2 %	0,0 %	0,2 %	0,2 %	100 %
2000	3,0 %	84,4 %	12,0 %	0,2 %	0,0 %	0,2 %	0,2 %	100 %
1999	6,9 %	77,5 %	14,8 %	0,4 %	0,0 %	0,2 %	0,2 %	100 %
1998	8,0 %	39,1 %	52,1 %	0,4 %	0,0 %	0,2 %	0,2 %	100 %
1997	4,3 %	74,2 %	20,2 %	0,9 %	0,0 %	0,2 %	0,2 %	100 %
1983	3,0 %	2,0 %	12,2 %	9,0 %	73,8 %	0,0 %	0,0 %	100 %

The farmers were asked to give reasons for their degree of economic well-being in a specific year. The year 1998 presents a very interesting case, because it becomes clear that El Niño had many positive aspects (Table 34), i.e., almost as many positive as negative comments were made. More precisely, it is revealed that in Piura, a region characterized by water scarcity and desert climate, the periodical El Niño provides the region with the necessary water resources and allows the trees in the dry forest to recover from the dry years and new ones to grow. In 1997, the government sowed carob tree seeds in the most desertified parts of the dry forest, which allowed for reforestation with the following El Niño. Furthermore, livestock herders that live in the Sechuran desert profit from the rainfall, which results in sufficient grass and pasture for their animals. In dry years, the livestock frequently suffers, and herders are often obliged to sell their cattle at a very low price to herders from other regions that have a different climate, i.e., Lambayeque and La Libertad. Moreover, looking at 'bad' year 1998, most comments were related to the loss of crops due to heavy rainfall and flooding, followed by concern for the destruction of

infrastructure such as dams, canals and irrigation systems. From a disaster risk management and environmental perspective, this means that if appropriate prevention measures were taken flood-protection infrastructure built, flooding and destruction of crops as well as of infrastructure could be avoided, and El Niño would bring positive effects.

Table 34: Economic well-being in 1998

Year	Good	Normal	Bad
1998	• Sufficient water to grow crops • Price of product was good • Rainfall was sufficient • Abundance of water for livestock and crops • Reservoir was filled with water and allowed crop irrigation • A lagoon was formed in the desert of Sechura which allowed fishing • A lagoon was formed in Colán and led to a shrimps boom	• Beginning of rainfall and good prices for products • Humidity affected sowing, due to El Niño • El Niño did not affect crops because of land at higher altitude • A lot of water • Better income	• Crops were lost due to the heavy rainfall and floods • Canals overflowed due to heavy rainfall • Dam broke • Could not sow anything due to wet soil • Collapse of irrigation system • Low price of products • No transport available for moving the products • Livestock became ill • Needed to be relocated

In 2001, a year was said to have been 'normal' by most households shows that for the farmers, a normal year means in general low income, low output and normal to low prices of the products. Some farmers experienced drought, others crop diseases while others again experienced water abundance during this year (Table 35). Hence, the qualification of economic well-being always depends on the geographic location of the households.

Table 35: Economic well-being in 2001

Year	Good	Normal	Bad
2001		• Low income • Low output • Normal production and acceptable prices	• Drought • Low price of product • Presence of crop diseases • Economic loss due to flooding

For most households, the year 2007 was classified as normal, but 12 % also said that it was a good year. Looking at the qualitative comments from the farmers, the reasons for

judging the year as 'good' were that the climate for crop production and the prices for the sale of the products were satisfactory, and other positive factors such as the construction of a well and technical support from the municipality (Table 36). Reasons for classifying the year as 'normal' were low prices for the sale of products and high input prices for crop production as well as regular income. Those households that said that the year was bad named financial problems, low prices for the products, drought as well abundance of water.

Table 36: Economic well-being in 2007

Year	Good	Normal	Bad
2007	• Temperate climate • Major production of crops • Better income • Good price of product • Technical support from municipality • Construction of a well to supply water • Higher income	• Hail storms • Sufficient water to sow • Sufficient work • Few crop diseases • Construction of a tunnel to receive water by gravity • Low prices and low yields • Regular income • Little frost • Low yields due to strong winds • Had a credit for crops • Prices of inputs went up	• Drought • Not enough financial resources to invest in inputs (fertilizers, etc.) • Low price of product – high competition • Abundance of rainfall • High price of inputs • Low production yields • No production • High supply – low price • High cost for inputs and low price for product

In brief, it can be confirmed that the households frequently suffer from climatic shocks, and although being aware of their presence, unpredictability and impact, they cannot prevent or cope with them appropriately. The specific coping and adaptation strategies of farmers regarding water scarcity and water abundance will be discussed in the following chapter.

4.2.2 Trends: globalization and climate change

Trends may or may not be more benign than shocks, but they are more predictable. Trends have a particular influence on rates of return to livelihood strategies (DFID, 1999).

Globalization

Globalization is a term used to describe the way countries are becoming more interconnected both economically and culturally. This process is the development of an

increasingly global economy market marked especially by free trade, free flow of capital, and the tapping of cheaper foreign labor markets (Merriam-Webster Dictionary). In the context of this study the term refers exclusively to economic globalization.

In Peru, as in most countries, globalization offers new opportunities but also has negative consequences. Here special attention is given to the agricultural sector. On the positive side, globalization is considered as an opportunity because it allows elevating the technical level of the sector while increasing competitiveness in order to participate in international agricultural markets. Globalization allows for the creation of major possibilities to produce products of high profitability and quality oriented to the export markets. This allows an increase in foreign currency for the country and consequently in the standard of living. The economic policies of globalization are mostly of neoliberal origin, where the free market is the fundamental means of exchange searching for major efficiency in the production of food and seeking to satisfy the necessities of an exponentially growing population. Trying to take advantage of opportunities given through globalization, the necessity for farmers to be more competitive is leading to an increasing number of farmers joining organizations and product chains in order to be stronger as a group and thus to access new markets and achieve better prices, although the latter might not always be higher than at the local or national market level.

On the negative side, globalization presents social, political, economic and cultural disadvantages. As a consequence of globalization, certain social problems emerge such as the increase in poverty due to neoliberal policies that seek to find the cheapest labor force in the world. Prices for agricultural products are constantly decreasing, which means very low profits for the farmer, as the prices of inputs are increasing, and the rate of return is decreasing. The rate of return is the amount of money gained or lost on an investment relative to the amount of money invested. Generally, farmers invest considerably in the production of their crops, i.e., approximately US$ 1000 per ha, while returns are low. Furthermore, it is very difficult for farmers to enter into niche markets and be more competitive by producing organic products, as the costs of certification are too high. Especially problematic is the situation in the agricultural sector in Peru, as most of the farmers are unassociated smallholders, meaning that they do not belong to a product chain or producer association. They thus cannot sell their products directly to the chain or organizations. The majority generally sell their products to a middleman. This way, most

farmers usually receive a very low price for their product. It thus becomes clear that trends can have an influence and may condition the farmers' livelihoods. However, farmers often blame the government for high input prices and low product prices and are not aware of the fact that these costs are dependent on the world market. For instance, in 2008 the prices of basic food products such as wheat, milk, potato, etc., have risen due to the worldwide economic crisis, but the people blame the national government for this.

Governance trends in Peru are closely related to globalization trends, i.e., since the 1990s, when globalization and economic structural adjustment programs had just begun, the economic policies of the two Fujimori governments (1990-2000), followed by the Toledo government (2001-2006) and now of the government of Alan García have been to open up the Peruvian economy to the world and to try to integrate Peru into the globalized economy. However, while at the governmental level there is a trend for policies marked by free market and free commerce, at the civil society level protest and peasant movements can be observed. The former has resulted in the signing of various free trade agreements such as with Chile, USA and possibly China. The movements and protests demand that the governments pay more attention to domestic issues, e.g. support of farmers, peasant communities and organizations in the modernization of agricultural management techniques and in organization and efficiency. As of now, only the farmers that are organized into producer associations and those that own and manage medium- to large-size lands are sufficiently competitive to be able to participate in export markets. The majority of the farmers does not, however, belong to any producer association or product chain, and due to low organization and productivity levels, are not able to participate in these markets. Technical and financial assistance is basically missing for these groups.

Climate change

The current world-wide concern about the impacts of global climate change on the economy and human health has its origins in the insistent warnings formulated a long time ago by the scientific community. The concern has been deepened in recent years due to the observation that many of the current disasters such as extreme flooding, extremely hot summers and cold winters, retreat of the glaciers, reappearance of endemic illnesses previously almost under control, loss of species, etc., can be attributed to the rise in average temperature as a result of the accumulation of greenhouse gases in the atmosphere.

There is increasing evidence that the climate and environmental changes are not solely due to the earth's natural cycle but are enhanced by human activities and emissions. In order to provide decision-makers and others interested in climate change with a scientific basis about the causes of climate change, its potential environmental and socio-economic consequences and the adaptation and mitigation options to respond to it, the Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and by the United Nations Environment Program (UNEP). The IPCC is a scientific body that provides information based on scientific evidence and reflects existing viewpoints within the scientific community. The richness of the scientific content is achieved through contributions from experts in all regions of the world and all relevant disciplines including, where appropriately documented, industry literature and traditional practices (IPCC, 2001).

In Latin America, Peru is one of the countries most vulnerable to climate change in terms of water scarcity due to the retreat of the Andean glaciers. Some of the principal findings of the Third Assessment Report (TAR) (IPCC, 2001) that are relevant for this study are that the glaciers in Latin America have retreated drastically in the past decades, and many of them have disappeared completely. The regions that are most affected by climate change are the Peruvian Andes, the south of Chile and Argentina. Peru, with its 20 mountain ranges with glaciers, has lost 22 % of its glaciers during the last 27 to 35 years. This implies loss of water resources equivalent to 7,000 MMC, and the subsequent loss of hydroelectric energy (non-pollutant) generation capacity (around 60 % of energy generated in the country) (CONAM, 2008). The melting of glaciers can also have contributed to the reduction in the water volume and flows of the rivers in the country. The sea-level rise will affect the mangrove ecosystems, negatively impacting fishing activities in many parts of Latin America. The flooding and costal erosion resulting from the sea-level rise in combination with river overflows will affect the availability and quality of water. The intrusion of marine water will reinforce socio-economic and health problems in these areas. Further, many illnesses such as malaria and dengue fever in Latin America are related to the warm and humid environments in which they develop. Climate change could influence the frequency of outbreaks of these illnesses if the variability of its principal control phenomenon, i.e., El Niño, changes.

In particular, the impact of climate variability related to El Niño on the agricultural sector has also been extensively documented in TAR (IPCC, 2001). Projected impacts of climate change include an increase in magnitude and frequency of strong El Niño events, as well as extended periods of drought and, on the other hand, loss of soil fertility and degradation as a result of increased precipitation, both of which will negatively impact on agriculture and food security. Further, the findings include a shortening of growing cycles for cotton and mango on northern coastal regions of Peru during El Niño due to the increase in temperatures (IPCC, 2001). Various fungal diseases in maize, potato, wheat and kidney beans during El Niño years will also increase, due to an increase in temperature and humidity.

It follows that in Latin America, even without climate change, countries face regular climate risks including variable rainfall, droughts, floods, and windstorms. Climate variability is associated with both El Niño and hurricanes, which are common in the region. The vulnerability of Peru in relation to climate change can be estimated by the impacts of El Niño, a clear example of how climate variability affects the country's capacity to reach sustainable development. In 1998, El Niño caused losses and damages estimated at US$ 3,800 million (CAF, 2000), equivalent to 4.5 % of the national GDP. These losses may be even higher in the future, if measures to reduce the vulnerability and to encourage adaptation strategic measures are not taken (CONAM, 2008).

Concerning northern Peru and especially the region of Piura, much research has been conducted on the analysis of the causes and effects of El Niño, especially by the National Council for the Environment (CONAM), which in May 2008 became the Ministry of Environment (MINAM). For instance, the study concerning the country's vulnerability with respect to climate change related to the experiences during the two mega-El Niños 1983 (Marticorena, 1999). Amongst others, Michael Glantz (1996, 2000) looked at the impacts of El Niño and La Niña on climate and society, Juan Tarazona (2001), was concerned with the biological and social impacts of El Niño in Latin America. Eduardo Franco (2007) studied the social responses to El Niño and climate change.

5 Coping and adaptation strategies

The main concern of this study is on the actions and available measures that farmers in the region of Piura take in anticipation of or during natural phenomena, such as floods and droughts, as well as to find out how the farmers will act in the future and adapt to these recurring events. The purpose of investigating coping strategies of the rural households is to seek patterns that can be acted upon in order to improve the livelihood prospects of the poor in times of crisis and disaster. It is assumed that the more choice and flexibility that people have in their coping or livelihood strategies, the greater is their ability to withstand or adapt to the shocks and stresses described in the vulnerability context (DFID, 1999).

It is expected that with climate change, stronger and more frequent El Niño's will occur and affect agricultural activities in the region (see section 4.2.2). These climatic events are already being evidenced by farmers and others and are expected to intensify in the coming decades. This uncertainty makes long-term climatic predictions difficult and complex. The scientific community is making great efforts to adapt climatic models to Peruvian conditions in order to improve the prediction systems in the long term. However, most of these models have not yet been adapted to the Peruvian reality. In Peru, the famers have their own way of climatic prediction, through so-called popular indicators, which are not considered by Peruvian science. Especially in the highlands, farmers know about the behavior of specific wild plants, which can be observed in the phenological phases before the occurrence of certain climatic conditions. This allows them to perform forecasts with a high degree of confidence, although there are not accepted by the scientific community.

In this chapter, these popular indicators used by farmers to predict climate are analyzed, then the specific coping strategies farmers use when facing a situation of water scarcity and water abundance are determined, further their understanding of climate change and possible measures of how to cope and adapt their crops to these changes are evaluated, and finally long-term adaptation strategies with regard to climatic events are analyzed.

5.1 Climate prediction by farmers

The risk of severe weather events presents a serious limit to growth and investment in agriculture and the rural economy. Rural livelihoods in the region of Piura are heavily dependent upon and vulnerable to climate risks. In a focus-group workshop with presidents of the irrigation committees from the highlands, the latter referred to 'ancient

rules' for predicting the climate each year, e.g., 'when the bird Angapila sings on top of the mountain, it will be a dry year and when he sings close to the river it will be a rainy year'. The younger generations and many old people no longer believe in these rules, as they feel that the climate has changed and become unpredictable. Climate predictions from meteorological services are also not trusted, i.e., in 2006 a moderate El Niño was announced for 2007 based on a predicted 2°C increase in sea temperature, but the year turned out to be dry and some farmers suffered from the effects of drought.

In Piura, it is commonly known that farmers make use of signs or indicators in nature to foresee the climate for the next year and prepare for the coming cropping season. This information has developed over centuries and is based on the long-term observations of the biotic and abiotic environment, while others are rooted in community-specific belief systems and superstition. Information provided through official channels, e.g. the government or the national meteorological service (SENAMHI), is often not trusted. Only during the past few decades have climate forecasts through radio, newspapers, and almanac (see 5.1.1), etc. become more frequently used. The interviewed farmers used different methods for trying to foresee the climate for the coming year and cropping season (Table 37).

Table 37: Climate prediction by farmers

Method/Indicator	Dry Year	Rainy Year	El Niño Year
Forecast (radio, television, newspaper, almanac, etc.)	40,8 %	36,5 %	39,9 %
Plants	18,0 %	20,2 %	1,1 %
Birds	8,2 %	12,7 %	1,7 %
Climate forecast and plants	9,0 %	8,2 %	3,6 %
Information from the government, NGO, etc	3,4 %	3,0 %	6,2 %
Animals	1,1 %	2,8 %	0,6 %
Other (astrology, local sayings, environment)	3,2 %	5,2 %	3,4 %
No answer	0,8 %	0,4 %	0,6 %
Not known	15,5 %	11,0 %	42,9 %
Total	100,0 %	100,0 %	100,0 %

About the same percentage of farmers used official climate forecast information as biological indicators (plants, birds or animals). The most important medium for official climate information is the radio (owned by 82 % of the households) followed by television (owned by 66 % of the households). With regard to traditional indicators, the population of the highlands makes more use of these than the population of the lowlands and Chira

river basin. For predicting extraordinary years such as El Niño, most households refer to official forecasts through the radio, television, newspapers and almanac, and only very few households mentioned indicators such as the rising of sea surface temperature in October as an indicator for a coming El Niño. Mostly fishermen use this indicator and only the farmers living close to the coast practicing both fishing and agricultural activities mentioned it.

5.1.1 Forecasts

- Almanac: A Latin American almanac, called Bristol provides information about religious holidays, climate and stars during a calendar year. Most of the farmers buy this booklet every year and follow the predictions in order to know when to sow. This booklet provides weekly weather information and is issued. However, many also mentioned that they did not believe in these forecasts anymore, as these did not correspond to reality.

- National Service of Meteorology and Hydrology (SENAMHI): Most of the farmers are now used to listening to weather and climate forecasts from the National Meteorological Institute through radio or TV broadcasts or read them in the newspapers. There is no differentiation made between the accuracy of weather and climate forecasts, and trust in the forecasts is generally low (Sperling, 2008). Interestingly, the radio stations and specific presenters, such as Abraham Levy from the Peruvian Radio Program 'Radio Programas del Peru (RPP)', receive more attention than government agencies from where the information is derived (Sperling, 2008). Farmers tend to believe less and less in forecasts from governmental sources. However, for El Niño years, the farmers are lacking signs that indicate these types of phenomena, and hence they rely mostly on information provided by official means. The trust of the farmers in official forecasts from SENAMHI is very low, as these are, frequently not correct.

5.1.2 Physical environment

- Springs and brooks: In the highlands, the population is accustomed to observe the increase in springs and brooks from October to December. If these do not increase, the year is going to be dry and if they do, the year is going to be rainy.

- Rainbows: When two rainbows appear in the sky, crossing one another or one above the other, it means that the year is going to be dry with scarcity of water. When it is going to be a water-abundant year, the rainbow appears between 5 and 6 pm.
- Temblor: A strong seismic movement after a strong rainfall is a sign for the end of the rainy period or the end of rainfall.
- Whirlwinds: Whirlwinds in November and December are a sign for rain, while whirlwinds in September and October indicate drought.
- Wind: Strong winds in October and November announce a dry year.
- Heat: Exceptionally high temperatures in November and December are signs for extremely abundant rainfall from January to March (i.e., El Niño).
- Sea-surface temperature: Households living close to the coast commented about the fact that when the sea-surface temperature of the Pacific is extremely high in October and November, it indicates the coming of El Niño.

5.1.3 Plants

- Fruit trees: It is said that when fruit trees such as mango, guabo, chirimoya, orange, and mulberry blossom less and the production of fruits is low, the year is going to be dry. Inversely, the year is going to be wet, when the fruit trees flower abundantly, the production of fruits will then be high.
- Ceibo Tree: Early and abundant blossoming of ceibo and carob trees indicates a rainy year.
- Chinchin (Dunalia campanulata): The Chinchin, a plant with yellow fruits which the birds eat, appears when the harvest begins, after the rain. This is a sign for the end of the rainy season.
- Other plants the palo santo tree (*Swietenia macrophylla*), tamarindo (*Dialium guianense*), maize and coffee were mentioned.

5.1.4 Birds

- Angapila: This bird is typical of the highlands. It is said that in October when it sings on top of the mountain the year is going to be dry, and when it sings down at the river the year is going to be rainy.
- Zoña: This bird builds its nest in lemon trees. In dry years, they build up to four nests, while in rainy years they do not build any.
- Chilalo (*Furnarius rufus rufus*):

    - When the Chilalo makes its nest with the beak looking straight ahead, the year is going to be dry. When it makes its nest with the beak looking down, the year is going to be rainy.
    - When the bird starts making holes into the different plants in March and works the loam to make its nest, a very rainy year can be expected.
    - Other said it is the singing of the Chilalo that changes: in water-scarce years it sings in the morning, while in rainy years it sings at night.
    - Again others said that when the Chilalo nests in the highest places, it will be a rainy year.
- Chiclón: In the afternoon, this bird walks around and sings at the feet of the farmer when the year will be rainy. When the year is going to be dry, it flies around the trees.
- Tordo Negro fino (*Dives warszewiczi*): To announce a rainy year, this bird sings in the months of October and November. When it does not sing during these months, the year is going to be dry.
- Turkey Buzzard: When this bird stands on one foot only, it announces a dry year and means that the bird is sad because it just has enough food to keep alive.
- Heron: In dry years, herons from the coast come to the highlands.
- Other birds such as Peruvian thick-knees, swallows, eagles were mentioned as climate indicators.

5.1.5 Insects and animals

- Crickets: The presence of crickets announces the end of summer and with it the end of the rainy period, in March or April.
- Ants: Ants are a sign for rain, as they live in humid environments. When there are many ants, the year is going to be rainy. If there are no ants, the year is going to be dry.
- Worms (Gusano Rosador): This worm comes out in August and attacks the leaves and branches which announces a rainy year.
- Squirrels: Squirrels are a sign for a dry year. In dry years, they come down from the trees to the plantations (coffee and mango), and in very dry years go further down from the highlands to lower plantations in the middle lands (passion fruit).
- Frogs: Abundance of frogs in November and December announces a rainy year.
- Other insects and animals such as anteater, white fox, spiders, frogs, butterflies, bees and seals were mentioned as climate indicators.

5.1.6 Astrology

- Sun: In the district of Santo Domingo, people predict rain by looking at the position of the sun. They know that in January, it is situated above one of the highest hills in the district. When the years are dry, however, they say that the sun comes down and can be observed on one side of the hill called Pilon.
- Stars:
    - The lazy star ('El Lucero Flojo') is a star that comes out at 4 am at the crack of dawn, when it is supposed to indicate a rainy year. However, in the last three years, the star could only be observed at 5 am, and according to the logic of the farmers, this means that there is nothing to do, and the farmer does not need to get up yet.
    - Plough: Some farmers mentioned this constellation of stars as an indicator for climatic behavior. When the plough is in a normal position, it is a sign for coming rainfall, beginning of sowing and for good production. However, when the plough has tumbled down, there will be no rain and subsequently no production.
    - Milky Way (El Río Jordan): The 'Río Jordan', an accumulation of stars of continuous configuration in the form of a river in the Milky Way, in orientation northeast-southeast. It can be observed in many parts of the highlands of Piura. The observation is mostly carried out during the night or dawn hours during winter solstice and spring equinox in the southern hemisphere when there are fewer clouds in the region. The indicator that describes the behavior of rainfall during the next season is the brightness of the stars and especially the orientation of the Río Jordan. When the Río Jordan appears from the south to the east and the cloud of stars forming it is dense and bright, it means that the year will be very rainy. If there are only a few lines of stars, it means that the river is low in water and the year will be dry.

5.1.7 Local sayings

- After seven dry years comes one rainy year.
- Bottle of spirits: In the Church of Ayabaca, a bottle is filled with water, when the year is going to be rainy. The bottle is empty when the year is going to be dry.
- No rain on January 20, or March 19, means that the year is going to be dry.

- Good Friday: While Jesus was suffering. Joseph left the water running to ease his son's pain. This means that Good Friday is usually a rainy day.
- Last Sunday in the month of Easter: If this date passes without rain, it means that there will be no more rain in that year.

In recent years, the interest in traditional local indicators used by farmers and people living in rural communities is increasing. In Piura, a study on 'Ethno-climatic Prediction Tools in Piura' was conducted and published in January 2008 on behalf of a Peruvian NGO called Peruvian Central for Services (CEPESER). The information presented in the report is the result of a pilot project developed in Piura and shows an alternative to official climate prediction, in which traditional local knowledge (ethno- climatology) is integrated with scientific knowledge to improve climate prediction. The research focuses on the importance of reactivating traditional knowledge regarding biotic and astronomic indicators that farmers use to predict the climate in the sub river basin Yapatera in the highlands, and more specifically in the provinces of Ayabaca and Morropón. Integrating traditional indicators into modern scientific prediction is supposed to allow improving local climate predictions. The method used in the study makes use of maximum and minimum temperatures in a specific location combined with characteristics of biotic indicators such as plants or birds as well as abiotic or astronomic indicators (Table 38). The model used is a very general one, which can be applied to the whole region, and the information regarding popular indicators can be adapted according to the specific indicators in each geographical area.

The above information and the interviews with the farmers show that there are no precise indicators for predicting El Niño. One of the signs for a coming El Niño is the extremely high sea-surface temperature detected mostly by fishermen in coastal areas of Piura. This coincides with the method used by science. However, in recent years it has become clear that using sea-surface temperature as an indicator for El Niño is no longer sufficient. For example, in 2006, a moderate El Niño was predicted for 2007 due to a rise in sea-surface temperature by 2°C, but the year turned out to be dry and some farmers suffered from drought. Hence, it would be interesting to investigate further physical, biological, and other indicators during an officially forecasted El Niño year.

The results clearly show that the population in rural areas in the region plan sowing and production based on traditional knowledge and customs, and on physical, biological and other indicators. However, most of the household members who were older than 40 years remembered these signs, rules or indicators best. One of the younger farmers said: "*my father used to know these signs, I cannot remember any and do not believe in them. I mostly just plan according to official climate forecasts. However, these do not apply either; hence I just wait to see what is coming, which is the will of God"*. Hence, these signs are getting lost with time, and if they are not documented they might disappear soon.

Table 38: Monthly climate prediction tool integrating local and scientific knowledge

Day	Meteorological variables			Biological, astronomic and other indicators												Additional observations
				Dry Year						Rainy Year						
				Garza	Fruit Trees	Birds Chilalo	Ants	Río Jordan	Springs	Chichin	Fruit Trees	Birds Chilalo	Ants	Río Jordan	Springs	
	T° Max (℃)	T° Min (℃)	PP (mm)	Abun-dant	Few blossoms	Beak straight	Few	Bright	Low	Abun-dant	Many Blossom	Beak down	Abun-dant	Shining	Abundant	
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Source: Author adapted from CEPESER (2008)

5.2 Coping strategies

This section presents the strategies that the rural population uses during disasters or after the hazard to mediate its specific impacts. The range of options available to anticipate risks, take risk-mitigating measures, and to reduce the impact of a given extreme event will influence the asset base and opportunities for advancement of households. When talking about climate risks, it is important to distinguish between coping strategies, which are focused at moderating the impact of a hazard during or after it has occurred, and adaptation strategies, which are focused on the long-term and systematic reduction of underlying vulnerabilities to hazards with the goal of avoiding negative or disastrous impacts. Further, it is important to know about the understanding of the population with regard to climate change and its future impacts.

5.2.1 Coping with floods and droughts

Coping strategies of farmers in rural Piura are influenced by the socio-economic conditions of vulnerability as well as driver effects of environmental degradation. Coping capacity is a term that, similar to vulnerability, has been overly defined in the risk management literature leading to a lack of conceptual clarity and disagreement amongst scientists (Chapter 2). As a study concerned with the practice of disaster risk management, the concept of coping used here is the one used by the United Nations International Strategy for Disaster Reduction (UNISDR). In this definition, coping capacity refers to "the means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards" (UNISDR, 2004, Thywissen, 2006: 13)

While carrying out the household survey in the rural communities of Piura, an important question was the ability of the households to cope with extreme events such as water abundance and scarcity as well as crop diseases. More than 50 % of the households cope badly with water abundance and scarcity, while crop diseases can be managed and controlled more easily (Table 39).

Table 39: Ability of farmers to cope with extreme events

Ability to cope/ Event	Water abundance Heavy Rainfall Flooding	Water scarcity Drought	Crop Diseases
Well	13,1 %	10,1 %	20,2 %
Normal	31,8 %	27,9 %	56,4 %
Bad	53,9 %	58,6 %	20,4 %
No answer	0,6 %	1,9 %	1,7 %
Not applicable	0,6 %	0,9 %	1,3 %
Missing	0 %	0,6 %	0 %
Total	100 %	100 %	100 %

With regard to droughts the majority of surveyed households were not able to cope with droughts (58.9 %), and they commented that they could do anything because they cannot sow then. Depending on the geographical area, some did not suffer from droughts, others close to a reservoir had a regular supply of water, others borrow a pump in order to be able to irrigate, and a few others can use a deep well. A few households consider that the supply of water to irrigate the crops generates conflicts amongst farmers.

When trying to manage and control heavy rainfall and floods, the households mentioned the presence of drains, as well as the cleaning of ditches or cultivating alternative crops as strategies that help them to cope with and manage such events better. Depending on the geographical area, some farmers do not consider flooding as a problem, while others are affected by flooding cannot do anything against it; they sometimes leave the place and migrate somewhere else. Especially those people that live in desert areas say that rainfall is good, because it leaves pasture for the cattle and they can sow crops in these years.

Considering crop diseases, most households said they were able to manage them, as they apply pesticides, while others seek technical help to combat crop diseases. However, it was mentioned that lack of money for the necessary insecticides is a restricting factor. They said that with the necessary financial means they could buy the products and manage crop diseases more easily.

The coping strategies used in times of water scarcity and abundance do not depend on the type of event (drought or flood), as the percentages show great similarities (Tables 40 and 41). The most widespread strategies are to ask help from family and friends, to reduce

expenses, or to ask for a credit. Interestingly, the households from the highlands rely much more on family members and friends in difficult times than the households in the other geograohical areas, whose strategies are diverse.

A high percentage of households claimed not to do anything, as they say that nothing can be done when there is no water for irrigation or when the fields are flooded. Doing extra work is also widespread, but this is subject to unfavorable working conditions and low-wage jobs, as most household members have little education and few marketable skills. In many cases, however, doing extra work is the only option to make up for the losses and to ensure food security during disaster times.

Table 40: Coping in water-scarce times

Coping strategy in water-scarce times	Geographical Area			Total
	Highlands	Lowlands	Chira	
Ask help from family and friends	15%	9%	6%	30%
Do nothing	6%	5%	4%	15%
Reduce expenses for food	3%	6%	3%	12%
Do extra work	3%	4%	4%	11%
Ask for a credit/ borrow money	4%	3%	3%	10%
Sell livestock	2%	1%	2%	5%
Ask help from church, NGO, etc.	1%	1%	1%	3%
Be late in paying bills	1%	0%	1%	2%
Reduce other expenses	1%	0%	0%	1%
Ask help from the government	0%	1%	0%	1%
Ask help from employer	0%	0%	0%	0%
Others (migrate temporarily, etc.)	2%	3%	0%	5%
Not applicable	0%	0%	5%	5%
Not known	0%	0%	0%	0%
Total	38%	33%	29%	100%

Table 41: Coping in water-abundant times

Coping strategy in water-abundant times	Geographical Area			Total
	Highlands	Lowlands	Chira	
Ask help from family and friends	14%	8%	6%	29%
Do nothing	8%	6%	5%	19%
Reduce expenses for food	2%	5%	3%	11%
Do extra work	2%	2%	4%	8%
Ask for a credit/ borrow money	4%	3%	3%	11%
Sell livestock	2%	2%	3%	6%
Ask help from church, NGO, etc.	1%	1%	1%	3%
Be late in paying bills	1%	0%	1%	2%
Reduce other expenses	1%	1%	0%	2%
Ask help from the government	0%	0%	0%	1%
Ask help from employer	0%	0%	0%	1%
Others (migrate temporarily, etc.)	2%	3%	2%	7%
Not applicable	0%	0%	0%	1%
Not known	1%	0%	0%	1%
Total	38%	33%	30%	100%

Further, the households do not own many assets, and mostly livestock is sold in difficult times to obtain food supplies and buy seeds for the planting season (Chapter 4). Monetary resources are mostly immediately spent on food and education. If there is a surplus, it will most likely be used to improve housing conditions, obtain livestock or diversify activities (Sperling, 2008). It can thus be argued that the possession of livestock represents some form of insurance to households, when harvests fail and investments are required for survival and recovery (Sperling, 2008). However, because many community representatives employ this coping strategy at the same time, there is a high supply of animals, which in times of water abundance or water scarcity are often malnourished due to lack of pastures and water, making it respectively difficulty for the households to sell their livestock at an appropriate price.

Other strategies include migration to other geographical areas. In most cases, migration is temporary and farmers search for jobs as day laborers on other people's fields in areas that are not affected by climatic disturbances. In other cases, migration was forced by the government as a consequence of the 1998 El Niño, as a dike broke in the districts of Cura Mori and El Tallán in the lowlands. Several villages were relocated to a new site. Nevertheless, the old villages are still populated, and the population that continues to live there refuses to move and migrate to the new villages. In the survey, the people in these old villages claimed that they had their house and land there, and although they knew that the area was in high risk of being flooded in the case of El Niño, they would not move away. The other relocated villages lie in a desert area close to the main road Panamericana, but to go back to their fields, the farmers have to ride on a donkey through the desert for at least two and up to four hours. In the new villages, there is no possibility for cultivating crops nearby and thus the households prefer to stay in the old villages and take the risk of being flooded again.

Another question that was asked was if the coping strategy covers the total loss incurred, in 76 % of the cases the households said 'no' and only 14 % gave a positive answer, and the remaining 10 % said 'don't know' or did not answer the question. Hence, it can be assumed that, in general, the coping strategies of local farmers remain weak because of lack of money, know-how and technical assistance as well as non existing culture of protection or insurance. Only a few farmers, i.e., mainly medium size and belonging to

product chains, receive credit as well as technical assistance and therefore seem to be prepared for future climate-related shocks.

5.2.2 Farmers' understanding of climate change

As has been explained in previous chapters, the poor and rural population of Piura is already vulnerable to the climate, especially to the effects of El Niño. Climate change as is widely known will worsen this situation, with changes in temperatures and rainfall, and an increasing frequency and severity of El Niño. The most concerning aspect of climate change for the region of Piura is the predicted increase in magnitude and frequency of strong El Niño events. This is likely to result in drier conditions across the northeast of Latin America from July to March, wetter conditions along the west coast of Ecuador and Peru, and high temperatures along the western coast of Ecuador and Peru. Alongside increased El Niño conditions, there will also be gradual changes related to rainfall and temperature. The poor are already finding it difficult to cope with the effects of El Niño. For instance after the 1997-98 El Niño, most households lacked the necessary savings to draw from, and also had no access to alternative employment. Moreover, the ability of the poor to cope with the climate is being eroded by economic changes, increasing urbanization, increased population densities along the coasts, and environmental destruction.

While conducting the household survey, it was important to ascertain the general understanding of the rural population regarding global climate change. The fieldwork substantiates that the great majority of households has a fairly good understanding and is well informed about climate change and its global consequences and impacts. When asking the households: 'Do you think that the climate has been changing in the last 20 years', 91 % of the households replied 'yes', 7 % replied 'no' and 2 % 'don't know'. The households were also asked what they thought 'climate change' meant. Most of the households stated that they felt the changes on their own land, with abrupt and unusual temperature changes, but also many said they were informed through the radio. Especially the radio program (RPP) provides the households with important and up-to-date information on global environmental and climate change and its impacts on agricultural activities in Peru and other countries. Other households, however, understood the change of season as climate change, and then, the team explained what is meant by climate change, i.e., climate change is induced by humans and CO_2 emissions, which are causing

a global warming. While explaining climate change in a simplified manner to the households, most of them said that they had already heard about this. They even started talking about environmental degradation in their area and the effects on their livelihoods. For instance, in the region of Piura, the permanent water scarcity problem is being aggravated through illegal logging, especially in the highlands with consequences felt in the lowlands.

Furthermore, it was of particular interest for the study to find out in which way the change of climate is affecting the crops of the farmers. In most cases, the crops are affected by crop diseases, followed by problems of growth and production as well as the total destruction of the crops (Table 42). Interestingly, the farmers in the lowlands and the Chira river basin were more affected by crop diseases than the households in the highlands, who where suffering from reduced crop growth and yield.

Table 42: How does the change of climate affect your crop?

Effect of change of climate on crop	Geographical Area			Total
	Highlands	Lowlands	Chira	
Crop diseases	7,5 %	12,0 %	11,2 %	35,3 %
Crop does not grow and yield normally	11,4 %	7,5 %	5,4 %	28,8 %
Destroys the crop	6,9 %	6,9 %	5,8 %	19,5 %
Other	1,5 %	0,6 %	0,4 %	2,6 %
No answer	1,1 %	2,6 %	0,9 %	4,5 %
Not applicable	2,6 %	1,9 %	4,5 %	9,0 %
Not known	0,0 %	0,0 %	0,2 %	0,2 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

There was a concern about observed climatic and environmental changes, such as an increase in daily maximum temperatures and a decrease in night temperatures. While dry conditions are the norm in the region, most people surveyed said that the droughts in the past years had been unusually long and pervasive. Moreover, extreme and abrupt changes in temperatures were experienced more frequently.

It was also of interest to know if the farmers thought that anything could be done to adapt their crops to climate change. Surprisingly, 54 % were of the opinion that something could be done, while 36 % thought nothing could be done, and 10 % did not know or did not answer. However, when the households were asked which measures they would take to

adapt their crops to climate change, 44 % said that they would 'do nothing'. This can be due to the fact that they had answered 'no' to the previous question, meaning that 'nothing can be done to adapt my crops to climate change' and hence the measures taken would be to 'do nothing', or this can also be related to the fact that they do not know what can be done and which measures could be taken. However, regarding those that replied that something can be done, the suggested measures were the following: to change the cropping time or season, treat the crop, change the crop or switch to more resistant varieties. Interestingly, the households in the highlands favored changing the cropping time or season, the households in the lowlands proposed treating the crop or changing to more resistant crop varieties, and the households in the Chira river basin preferred to treat the crop (Table 43).

Table 43: Which measures would you take to adapt your crop to climate change?

Measures	Geographical Area			Total
	Highlands	Lowlands	Chira	
Change cropping time or season	14,6 %	5,2 %	3,4 %	23,2 %
Treat the crop (fertilizers, pesticides etc.)	7,1 %	7,3 %	7,5 %	21,9 %
Change crop/ more resistant varieties	1,5 %	4,7 %	1,7 %	7,9 %
Other	0,0 %	0,4 %	0,0 %	0,4 %
Do nothing	13,1 %	14,6 %	16,5 %	44,2 %
No answer	1,1 %	0,6 %	0,2 %	1,9 %
Not known	0,0 %	0,0 %	0,2 %	0,2 %
Missing	0,2 %	0,0 %	0,0 %	0,2 %
Total	37,6 %	32,8 %	29,6 %	100,0 %

Succinctly, it can be argued that the households have a fairly good understanding of current environmental changes such as global warming and climate change. Most households said they had these changes in the last two decades with prolonged periods of drought and two very intense El Niños in 1982-83 and 1997-98. Many said that already these adverse and extreme conditions had forced them to rethink their cropping patterns and periods, and some had already started to adapt to the new conditions. For instance, a medium-size farmer and client of the Caja Piura in Tambogrande in the highlands said: *"I have lived through the last 2 mega - El Niños (1982-83 and 1997-98), I feel prepared for future floods. Every year before the rainy period comes, I clean the drains and open the circles around my mango trees to allow the water to flow. Due to a credit, I have sufficient capital to apply calcium, potassium and marine algae to the mango flowers to protect them from abrupt temperature changes. There is no water scarcity in my area,*

because there is a reservoir and during low water availability, fruit trees have priority over other crops". It becomes obvious that due to great vulnerability to climate, especially the effects of El Niño, the population in the area is already used to these changes. Nevertheless, it is most likely that not all of the households are as well prepared as this medium-size farmer.

5.3 Adaptation strategies

A distinction needs to be made between coping and adaptive strategies (Chapter 2). According to Davies (1993, 1996; van Dillen, 2004), the former are short-term responses to a specific adverse shock, such as drought, while the latter have to do with long-term changes in behavior as a result of repeated shocks. While coping capacity is more directly related to an extreme event, adaptive capacity refers to a longer time frame and implies that some learning either before or after an extreme event is taking place. This means that "adaptation is considered as a planned response that should ideally lead to sustained vulnerability reduction of the household and the community" (Sperling, 2008:41). The higher the coping and adaptive capacity, the lower is the vulnerability of a system, region, community or household. Enhancement of adaptive capacity is a necessary condition for reducing vulnerability, particularly for the most vulnerable regions and households (Peltonen, 2006). According to these views, coping strategies turn into adaptive strategies when they become part of the household's usual livelihood strategies.

As explained previously, many households in the region are used to coping with recurrent climatic phenomena such as water scarcity and abundance and El Niño, and the households were asked what they do to prepare for a dry year and for a water abundant year. To prepare for both water-scarce and water-abundant years, the most common strategy is to store food followed by not doing anything (Tables 44 and 45). Interestingly, in the highlands most households replied not to do anything to prepare for water-scare years in the house.

Table 44: Farmers' preparatory strategies in water-scarce years

Preparatory strategy in the house in water-scarce times	Geographical Area			Total
	Highlands	Lowlands	Chira	
Store food	17%	18%	12%	47%
Do nothing	14%	5%	5%	23%
Store food and save money	2%	3%	2%	7%
Store water and food	3%	4%	4%	11%
Store water	1%	2%	2%	4%
Save money	2%	1%	1%	4%
Sell livestock and other goods	0%	0%	1%	1%
No answer	0%	1%	0%	1%
Not applicable	0%	0%	2%	2%
Total	38%	33%	29%	100%

Table 45: Farmers' preparatory strategies in water-abundant years

Preparatory strategy in the house water-abundant times	Geographical Area			Total
	Highlands	Lowlands	Chira	
Store food	24%	22%	16%	62%
Do nothing	6%	3%	6%	15%
Store food and save money	4%	5%	4%	12%
Store water and food	2%	3%	2%	6%
Store water	0%	0%	1%	1%
Save money	1%	0%	0%	1%
Sell livestock and other goods	0%	0%	0%	1%
No answer	1%	0%	0%	1%
Not applicable	0%	0%	0%	1%
Total	38%	33%	29%	100%

With regard to crop management, the households were asked what they would do better next time, already knowing the adverse consequences of certain natural phenomena. Of the households that thought that it was possible to adapt their crop to climate change 54 % said 'yes'. The question was then to know how they adapt and prepare their crops for a water-scarce or -abundant year. In most cases, the farmers indicated that they would not grow anything new and continue business as usual (Table 46 and 47). Interestingly, in the highlands the farmers indicated to diversify crops in times of water abundance (Table 47). This shows that the households are not taking a pro-active approach but have rather a fatalistic attitude, meaning that many people think that they are powerless to do anything other than they actually do, arguing that it depends on nature and the will of God. Nevertheless, in addition to the above-mentioned strategies, a quite remarkable number of households mentioned other interesting strategies that can be classified as adaptation to climate change strategies, such as diversification of crops and changing to more resistant crops.

Table 46: Adaptation strategy in water-scarce times with respect to farming activities

Adaptation strategy in water-scarce times with respect to farming	Geographical Area			Total
	Highlands	Lowlands	Chira	
Do not grow anything	18%	17%	8%	43%
Do not change anything	4%	3%	8%	15%
Diversify crops	3%	4%	4%	11%
Change to more resistant crops	2%	2%	1%	5%
Look for a new job	2%	2%	3%	7%
Accumulate food & other goods	1%	1%	1%	3%
Migrate to another area temporarily	1%	0%	1%	2%
Other	4%	1%	1%	6%
No answer	1%	0%	1%	2%
Not applicable	1%	2%	3%	6%
Total	37%	32%	31%	100%

Table 47: Adaptation strategy in water-abundant times with respect to farming activities

Adaptation strategy in water-abundant times with respect to farming	Geographical Area			Total
	Highlands	Lowlands	Chira	
Do not grow anything	3%	8%	4%	15%
Do not change anything	8%	6%	9%	23%
Diversify crops	13%	4%	3%	20%
Change to more resistant crops	5%	5%	2%	12%
Look for a new job	1%	1%	3%	5%
Accumulate food & other goods	1%	2%	2%	5%
Migrate to another area temporarily	0%	1%	0%	1%
Other	7%	2%	4%	13%
No answer	1%	0%	1%	2%
Not applicable	0%	2%	1%	3%
Total	38%	33%	30%	100%

A few households mentioned that they would look for a new job as a means to adapt to these adverse circumstances, which brings us back to the diversification of income activities. The diversification of income activities is very low in the region (see Chapter 4), but is a crucial factor in reducing vulnerability to climatic risks. However, this is not commonly practiced in the region, only in some coastal villages, such as in the districts of Sechura and Vice in the lowlands, where the main occupation is fishing and farming is an additional activity. In the communities of Chulucanas in the highlands and Catacaos in the lowlands, agricultural activities are complemented by handicrafts and ceramics production.

While discussing the coping strategies that the surveyed households use, livestock was highlighted as an important coping strategy in times of water scarcity or abundance. In

most cases, the sale of livestock during climatic crises is a measure that helps the household to cover its basic necessities to overcome the difficult period and to avoid a greater poverty. In a few cases, the possession of livestock can become an adaptation strategy, for instance when the household owns enough animals to later augment its livestock numbers. As has been pointed out in the previous chapter, for some households El Niño has positive effects, such as for those communities living in the Sechura Desert whose main activity is livestock farming. These households generally have a considerable number of animals which allows them to sell some during crises and to increase the size of their herds afterwards. Most of these herder households consider El Niño as a benefit. In the case of El Niño, livestock can be considered as an adaptation strategy for these households. However, in recurrent and prolonged drought periods, even these households suffer as the price of livestock is then low and the animals suffer from malnutrition and lack of pastures. Some households can maintain livestock throughout extreme climatic events, and are thus able to sell animals in an anti-cyclical manner at times when there is greater demand and hence better prices. Livestock products such as milk and cheese can further supplement diet and income in these times (Sperling, 2008).

Another important concern when talking about adaptation strategies to climate change in the agricultural sector is the way that farmers learn from past events and try to adapt to new realities. During focus-group discussions and workshops, the participants mentioned several mechanisms for adapting to floods, droughts, cold waves and crop diseases (see Appendix 11.2.2). They argued that the changing climate requires that even traditional crops need to be subjected to special treatments for them to resist the climate changes. For instance, switch to more resistant crops, protect crops through fertilizers, herbicides and pesticides, for temporal crops switch to other growing periods, build drains in the plantations to avoid flooding, etc. The farmers mentioned the difficulty in applying preventive measures without sufficient capital, lack of technical assistance and information on how to adapt to climate change. One farmer said: "*These are some of the strategies I use and know about, but in general I lack money and technical assistance to apply these and other measures to protect my crops*".

Table 48: Preparation for future climatic events

Will farmers prepare for future extreme climatic events?	Water scarcity/ Drought	Water abundance/ Flood
Yes	16 %	13 %
No	63 %	68 %
No answer	4 %	4 %
Not known	16 %	12 %
Not applicable	1 %	3 %
Total	100 %	100 %

The households were also asked if they would change their strategies the next time that a flood or drought occurs. The majority of the households argued that they would maintain the same strategies they used before (Table 48). This might be due to the fact that they do not know of other appropriate strategies. Many farmers mentioned that they would like to receive information, technical assistance and advice from professionals regarding crop management and preparation for specific events. The farmers said that the next time they would consult engineers and institutions regarding better crop management techniques in the case of water scarcity or abundance (Table 49).

Table 49: Type of strategy for next time

Strategy/Event	Water scarcity/ Drought	Water abundance/ Flood
Cultivate appropriate crop varieties	☒	☒
Apply for credits with low interest rates	☒	☒
Technical assistance and capacity-building	☒	☒
Improving the distribution and disposal of water	☒	
Ask for help from the government	☒	☒
Construction of deep wells and respective electrification	☒	
Improving the pumping system.	☒	
Increase pasture area		☒
Construct channels, dikes and reservoirs		☒
Clean drains		☒
Save money	☒	☒
Store food	☒	☒
Work in a different place	☒	☒
Reduce expenses for the household	☒	☒

As shown in Table 65, the farmers know of many strategies that might help them cope with events such as water scarcity and abundance. For instance, strategies to manage both droughts and floods are to change to more resistant crops, to apply for credit with low interest rates, to build capacities by consulting engineers and institutions, to ask for help from the government, to save money, to store food and to look for work in a different place (temporary migration). For water scarcity only, farmers said that the construction of deep wells and their respective electrification, improving the distribution and disposal of water for all as well as enhancing the pumping system could facilitate their activities.

Regarding water abundance, construction of channels, dikes, and cleaning drains could ease and prevent flooding.

In addition, specific crop management adaptation techniques were discussed during focus-group discussions and workshops. Detailed information was documented for the following crops: coffee, lime, mango, banana, cotton, maize, sugar cane, and rice (Appendix 11.2.2). After the workshops, the information was distributed to the participating farmers. It is hoped that by complementing missing information, a complete guide for each crop can be published on an information website; guidance sheets can be made available to farmers at their local irrigation committees and agrarian agencies. These guidance sheets could provide useful information for the farmers on how to adapt their crops to climate variability and change.

Taking a closer look at all these strategies, however, it becomes clear that most of these require some kind of investments and funds. The farmers have suggested many options but as they claim themselves, they are lacking the necessary funds to implement the proposed strategies, such as advanced crop mechanisms and more resistant crop varieties and especially infrastructure, such as deep wells, dikes, reservoirs and drains. It is thus necessary to coordinate the efforts and intentions of local farmers with the regional and national level strategies and policies, which will be discussed in the following.

As has been explained before, the limited ability of farmers to protect themselves from the climatic shocks and to cope with the impacts results in major poverty and greater vulnerability. The farmers that suffer from the consequences of recurrent climatic events and do not receive credits or have the necessary financial means to protect themselves see themselves confronted with losses in yields, livestock, housing and other infrastructure, machinery and equipment, etc., which leads to impoverishment and a even greater vulnerability to these types of events. Farmers that receive credit can cope better with the direct effects of these climatic phenomena than those that do not have the financial means, but they are still confronted with the indirect effects such as loss of income and deterioration of their standard of living. When combining insurance products with credits offered by commercial banks, municipal banks or producer associations, farmers could be better protected from the effects that disastrous climatic phenomena have on the offer of financial products to the agricultural sector. Insurance can help to spread the risk

associated with climatic shocks and provide access to essential funds in the event of a disastrous climatic phenomenon.

5.4 Institutional structures for disaster and climate risk management

Rural households' adaptation strategies need to be supported by macro-level policies, institutions and mechanisms that should be reflected in development planning. Over the last five years, there has been an increasing shift away from a reactive approach predominantly focused on disaster mitigation and toward building an integrative framework that also strongly focuses on disaster prevention, by identifying risks and vulnerabilities. This has especially been due to the advice from international organizations such as the World Bank, the United Nations Development Program (UNDP) and the German Technical Cooperation (GTZ). Peru has started to effectively integrate climate risks into planning processes by conducting necessary risk identification to understand the hazards, vulnerabilities and capabilities and then estimate the risks and impacts.

5.4.1 National Civil Defense Institute (INDECI) and regional level activities

In 1972, the Law for the Civil Defense System (Decreto Ley Nº 19338) was approved, with the aim of protecting the population, preventing damages, providing adequate and appropriate help and ensuring rehabilitation in case of disasters of all nature, whatever their origin.

The National Plan for the Prevention and Attention to Disasters was approved in 2004. It includes objectives and identifies specific strategies, aimed at improving risk assessment, vulnerability reduction and integration of risk management into public planning, strengthening institutions and the participation of communities. However, there are currently no clear definitions of the responsibilities of the individual institutions and their specific operational roles (Sperling, 2008). Besides the National Plan, sectoral and regional plans exist.

In each region there exists a 'Regional Plan for the Prevention and Attention to Disasters'; in Piura the last one was formulated for the period from 2004 to 2010. This plan constitutes a long-term frame of procedures, strategies, programs, subprograms, projects and actions that have to be carried out by the different public and private institutions, local government and civil society as the principal actors of development in the region. The

principal instrument at the local and regional level is the Regional Committee for Civil Defense (COREDEC). It consists of a group of public and private institutions that according to their competences or activities are responsible for different fields of activities and committed to the prevention of and attention to disaster tasks. However, the responsibilities of the individual institutions and their specific operational roles are not defined in practice.

To be brief, institutions and plans exist and relevant information is regularly updated. However, inter-institutional meetings, trainings and coordination are virtually absent[10]. It follows that in situations of emergency, no clear responsibilities are set and hence appropriate actions are often not taken at the right moment.

5.4.2 National study of the El Niño phenomenon (ENFEN)

Disaster preparedness efforts focused on ENSO events are coordinated by a multi-sectoral National Committee for the National Study of the El Niño Phenomenon (ENFEN) consisting of six national institutions:

- The Peruvian Marine Research Institute (IMARPE);
- National Service of Meteorology and Hydrology (SENAMHI);
- Hydrographic and Navigation Office of the Navy (DHN);
- Peruvian Geophysics Research Institute (IGP);
- National Natural Resources Institute (INRENA);
- National Institute of Civil Defense (INDECI)

ENFEN is the national component of the Regional Study of the El Niño phenomenon (ERFEN). It was established in 1974 as a program by the Permanent Commission for the South Pacific (CPPS) to study the physics of El Niño and its impacts on fisheries and other biological resources of the region. CPPS is a regional program with Peru, Chile, Colombia and Ecuador as members.

The institutions most directly engaged in the dissemination of climate information are SENAMHI, INDECI, and INRENA. SENAMHI as the national meteorological service monitors climate and weather changes for the entire country. The General Directorate for

[10] According to personal experience while working in a GTZ disaster risk management project from 2004-06.

Agro-meteorology (GDA) within SENAMHI focuses on the generation of agro-meteorological forecasts. Relevant data on crop productivity are collected on a weekly basis by a locally recruited agent, who is usually a local farmer trained by SENAMHI (Sperling, 2008). Agro-meteorological monitoring is carried out by the GDA with the objective of supplying updated and reliable information about the effects of meteorological conditions on agricultural production in order to be able to formulate and efficiently develop plans and orient policies in the agrarian sector.

This monitoring is based on the data from 150 meteorological and phenological stations located at the national level. The aim is to develop an information and agro-meteorological warning system at national, regional and local levels, based on the analysis of the state of the crops, weather, climate and use of water resources and on agro-meteorological models of crop yields. Most of the information is available through bulletins at regional directorates, and some more detailed agro-climatic information is only available online. The aim is to provide this information to farmers and authorities. The main user of the system is the Ministry of Agriculture (MINAG), as many farmers do not know how to use the internet and do not have access to these means of communication. A pilot project has been launched by SENAMHI and MINAG in the Cañete Valley of Peru to assist farmers with internet access to utilize this information for improving crop production. In general, however, the distribution channels of these climate forecasts are still limited, as this requires adequate literacy and access to a computer (Sperling, 2008). As mentioned earlier, the main communication of climate information thus occurs through radio broadcasts, which receive the information and updates from SENAMHI.

MINAG combines statistical agricultural production data with climate information from SENAMHI. The agricultural data are collected from agrarian agencies at the district level. The data are analyzed and processed by MINAG and then passed on to the agrarian agencies at the provincial and district level. Due to bottlenecks and inefficiency in the distribution path, the information does not always reach the agrarian agencies and if so mostly with a time lag of three weeks. Consequently, the forecasting aspect for the farmer may be lost and thereby also limit the practical relevance of the information in guiding strategies aimed at the reduction of vulnerability or disaster prevention (Sperling, 2008).

5.4.3 Ministry of environment: national climate change strategy

The institutional landscape for managing environmental and natural hazards in Peru has been undergoing change. The country set up for the first time a Ministry of Environment in May 2008 (Legislative Decree NO. 1013). Most of the efforts to manage environmental issues as well as those concerned with mainstreaming climate change into national development have been led by the National Council for the Environment (CONAM).

The legal basis for the national and regional climate change strategy is founded on the United Nations Framework Convention on Climate Change (UNFCCC, 2006)) and the Kyoto Protocol (UNISDR, 2005). At the national level, the legal basis for the strategy is grounded on the following laws: General Law of the Environment (Law No. 28611), Law of Decentralisation (Law No. 27783), Modification to the Organic Law of Regional Governments (Law No. 27902), Framework Law for the National System of Environmental Management (Law No. 28245), Organic Law of Regional Governments (Law No. 27867), Law of Creation of the National Council for the Environment (Law No.26410), Organic Law of Municipalities (Law No. 27972), and the Regulation of the Framework Law for the National System of Environmental Management (Supreme Decree: D.S.008-2005-PCM).

The elaboration of the national climate change strategy has been a long process and was finally approved in 2002. The general objective of the strategy is to reduce the adverse impacts of climate change through integrated studies of vulnerability and adaptation that will identify vulnerable areas and sectors where adaptation projects should be implemented. The national climate change strategy is a tool to orient actions that need to be taken in a multi-sectorial manner to reduce the adverse impacts of climate change. Various aspects of this strategy have been implemented through the 'National Program to Strengthen Capacities to Manage Climate Change and Air Pollution' (PROCLIM) coordinated by CONAM.

PROCLIM is an activity program that is the result of a national initiative including the joint effort of several institutions. These institutions have contributed their resources and experiences from its conception until the current execution of the program. This important multi-institutional and multi-disciplinary initiative was formed in 2002 with the

participation of different governmental and non-governmental sectors in order to face climate change problems and their impact in the country in a joint and arranged manner. It searches for synergies and promotes capacities of the 14 specialized institutions that constitute PROCLIM. CONAM is the institution in charge of PROCLIM's general coordination and execution (CONAM, 2008).

PROCLIM has set a special focus in the topic of vulnerability and adaptation in the Piura river basin, as this is said to be one of the river basins most vulnerable to climate change and the El Niño. According to research conducted by PROCLIM, the greatest problem of this basin is related to the low incomes of most of its inhabitants. These incomes mainly come from their primary low-profitability activities, which directly interact with the natural resources such as water, land and vegetation. El Niño frequently causes serious damage to the basin, and it affects people's health, food production, incomes, as well as socio-economic and development processes.

5.4.4 Regional climate change adaptation strategy

The Regional Government of Piura (Gobierno Regional Piura-GRP) recognizes as one of its priorities in its environmental politics the adaptation and mitigation of climate change. In 2005, a regional decree was issued (Decreto Regional NO. 014-2005/GRP-PR) that approves and promotes the public and private use of the studies carried out in the frame of PROCLIM for the evaluation and adaptation to climate change (CONAM, 2004), and at the same time, actions for the diffusion and implementation of corresponding adaptation and mitigation measures have been initiated. These measures are included in the National System for Public Investments (SNIP) and are considered in the investment budgets.

The Regional Government of Piura and the Autonomous Authority of the Chira and Piura river basins (AACHCHP)[11], with the support of PROCLIM under the direction of CONAM, have elaborated a first version of the 'Climate Change Adaptation Strategy for the Piura river basin 2005 – 2015'. Its main strategies and action lines are the promotion and development of information and sensitizing actions for leaders and the general population on climate change, its characteristics, threats and impacts. Furthermore, to

[11] AACHCHP: Autoridad Autónoma de Cuenca Hidrográfica Chira Piura is a public institution in charge of administering and promoting the rational use of natural resources in the region.

promote the participation of these actors in the specific tasks that are necessary for the adaptation process, such as educating the new generations to live in this new context and promoting the application of the strategy in coordination with private and public investment efforts. Furthermore, it is expected to incorporate the climate change adaptation strategy into the system of strategic planning of the regional and local governments.

6 Financial services for agriculture: supply and demand

6.1 Legal framework

6.1.1 Financial and insurance sector

In 1996, a financial reform was finally successfully implemented after having started in 1991. The main goal was to strengthen the financial system and the supervision of banks, incorporating the main principles from the Basel Accords, which draw together a wide consensus about the requirements for an effective regulation and supervision of the financial system. Additionally, many of the regulations approved by the Superintendent of Banking, Insurance and Pensions (SBS) have been adapted to these requirements allowing for a coherent and modern system of rules and regulations (Trivelli et al., 2002).

The SBS is an institution of public law whose functional autonomy is recognized in the Peruvian constitution. As explained by a member of the SBS during a workshop in April 2008 (Oft, 2008), especially since the late 1990s, great support has been given to the development of financial services for the poorest strata of society, the so-called micro-finance sector. The SBS's objectives, functions and attributions are established in the general law of the financial (including micro-finance) and insurance system that was published in 1996 (Law No. 26702). In 2000, the Law 27328 was issued and widened the action frame of the SBS to the system for private pensions (SPP). Its main objective is to preserve the interests of depositors, insured as well as of those affiliated to private pensions.

The above-mentioned financial reform has also created a favorable environment for the development of micro-finances. Additionally, the regulations currently in force have allowed the setting up of a series of non-bank financial institutions, such as the formation of three types of micro-finance institutions (MFIs): municipal savings and credit associations (CMACs), the rural savings and credit associations (CRACs), and the regulated NGOs for small and microenterprise development (EDPYMEs). The then established rules and regulations have thus created a favorable context for micro-credits. Specific rules for the evaluation and classification of the debtor have been established, including the possibility to simplify the documentary requirements for the evaluation of the credit (Trivelli et al., 2002).

More recently, several regulations relevant for the insurance sector have been implemented, such as the regulation of policies (Resolution SBS No. 1420-2005), the marketing of insurance (Resolution SBS No. 510-2005) and the payment of insurance premiums (Resolution SBS No. 225-2006). These regulations provide the rules for the interactions amongst the different institutions and stakeholders involved in financial and insurance transactions. The regulation for micro-insurance services (Resolution SBS No. 215-2007) came into force in February 2007. It determines that micro-insurance should be a product that is designed for the protection of people with low incomes from risks related to death, health, disability, property and natural phenomena. If an insurance company decides to develop a new (micro-) insurance product, it needs to present this product to the SBS for approval, because according to the general law, the SBS must previously be informed about the products that will be commercialized.

The objectives of the SBS are to further develop financial and insurance markets, including the sectors that do not have access to these markets. Hence, in order to develop these new markets for micro-insurance, several changes in the existing rules for insurance had to be made, e.g., establishing major transparency in policies by establishing a minimum content. In general, the changes made in the rules and regulations were meant to simplify insurance policies. Low-income households, often with a low educational level, find it difficult to understand an insurance policy with all its clauses. For this reason, many aspects of the insurance process were simplified and thus made accessible to a broader public.

In 2003, a committee for the development of agricultural insurance was formed, and the SBS forms part of it. It was determined that the regulations of the General Law (Law No. 26702), such as policy, content and rate, should all apply also to agricultural insurance. New policies need to fulfill the rules of the SBS's regulation of policies (Resolution SBS No. 1420-2005), which are general rules. If an agricultural micro-insurance is to be issued, these are regulated by the specific rules for micro-insurance. Other new insurance schemes, such as index-based and credit-based insurance, in which there is not necessarily a loss for the payment of the compensation, have already been taken into consideration by the SBS, and possible new modalities are currently being worked out.

Amongst the intermediaries for micro-insurance, an interesting and internationally used distribution model could be the partner-agent model, where the partner is the insurance company and the agent represents the entity that is in touch with a large number of members, such as financial entities, cooperatives, community organizations, etc. Internationally, this model has been the most successful for reaching the lowest strata of society through low costs, as no new structures for the distribution of these services need to be created. It is thus not necessary to invest in the development of new distribution channels and schemes, as in Peru all these organizations exist, i.e., micro-finance institutions, cooperatives, producer organizations, community-based organizations, etc. It will now be necessary to bring together the existing organizations with the insurance companies.

Analyzing the recent institutional changes in Peru with regard to the regulation of the finance and insurance sectors, it becomes clear that many mechanisms have been created and are functioning for the support of the lowest classes in society. Having worked together with financial institutions and insurance companies from the local to the international level, the author found that the cooperation, capacity and flexibility of the SBS can be judged in most cases as very fruitful. The recent changes and the new general law have helped to contribute to these changes.

Nevertheless, it seems of vital importance that public and private institutions as well as institutions of international cooperation provide stronger support to these MFIs by providing adequate capacity building and technical assistance in the development of new financial services for the bottom of the pyramid market (Prahalad, 2004). Especially considering the future development of agricultural micro-insurance products, it seems inevitable to assist the institutions in carrying out this new and complicated task.

6.1.2 Agricultural sector

For almost ten years, possibilities for an agricultural insurance scheme and protection mechanisms for poor and vulnerable farmers have been discussed at the national Peruvian government level. In December 2006, Law No. 28939 authorized supplementary credit, disposing (Article 4) and created a Guarantee Fund for agricultural insurance. The aim of the fund is the protection of poor and vulnerable farmers from climatic and other catastrophic events. In Law No. 28995, the aims of the fund are expanded to also

guarantee the credits granted to organized small- and medium-size farmers, whose activities are oriented towards dynamic national and international markets. The fund also includes financing mechanisms for agricultural insurance through the insurance system, destined to reduce the exposure of agricultural producers as well as rural communities to climate risks that negatively affect their production and profitability. Finally, on December 12th, 2007, the details regarding the implementation and functioning of the guarantee fund were established through Law No. 29148. The aim of the agricultural insurance fund is to co-finance agricultural insurance policies. The fund of approximately US$ 12 million will be administered by the Financial Corporation for Development (COFIDE), as a trust fund. Details regarding the conditions for the five specific agricultural and three livestock insurance schemes were determined through ministerial resolution No. 0720-2008-AG on August 20th, 2008.

The above-mentioned changes and new regulations have been pushed forward by the Ministry of Agriculture since 2007, when the Unit for Capitalization and Agricultural Insurance was established as a sub-section within the ministry. In a presentation by the Ministry of Agriculture during the workshop in April 2008 (see Appendix 11.2.1), Mr. Javier Montero explained that in order for the ministry to determine the management and operative procedures of the fund as well as the co-financing of the policy, a Mexican consulting firm Latin Risk was contracted. Mr. Oscar Ramirez, the consultant for Latin Risk, worked closely together with the ministry from April to August 2008 in order to design an agricultural insurance scheme for the country. In September 2008, the government officially announced the functioning of the insurance fund and scheme (see section 6.2.2 and the website of the Ministry of Agriculture <http://www.minag.gob.pe/seguro-agropecuario/agro-protege.html>).

Finally, after many years, an important step towards greater protection of agricultural activities has been achieved by implementing this new scheme through the Ministry of Agriculture. These types of insurance schemes through private insurance companies can now be provided as the necessary regulatory framework has been put in place. Now it is up to the insurance companies to design schemes for the agricultural sector. A first pilot project led by La Positiva Seguros is currently being carried out in the Province of Pisco in the region of Ica (see section 6.2.2).

6.2 Financial services for the agricultural sector

Since the closure of the BA in 1992 until the recent creation of a new Agrarian bank called Agrobanco in 2001, many changes in financial institutions, especially those active in rural finance, have occurred (see Chapter 2). It appears as if neither the state-led BA nor the private financial sector have succeeded in attending to the needs of the rural communities and clients in the way these need (Trivelli et al., 2004). The inefficient and unsustainable management of the BA made it dependent on transfers from the Central Reserve Bank. This first experience with the intervention of the state in the agricultural credit market as a direct moneylender had negative consequences for the reputation of public financial institutions. Especially the reduced capacity of the state to collect debts and its inclination to remit them has a negative effect on the credit culture of the clients.

Due to the heavy burden the BA presented to the financial state of the government, the Fujimori government liquidated it in 1992. Since then, financial intermediaries, institutions, actors, clients, as well as rules and regulations of the financial environment have been modified but have not been able to cover the demand that the closure of the BA had provoked. It was said that the former BA had around 230,000 clients a year, whereas in the year 2000, the agricultural and livestock clients of the private financial system accounted for less than 23,000 (Bancos de Desarrollo, 2008). These numbers show the serious problems that exist in the formal rural financial system in Peru.

6.2.1 Supply of agricultural micro-credits in Piura

Agricultural lending is a risky business, and when financial institutions give credits to vulnerable farmers, the institution takes on the risk that the farmer will be unable to repay the loan if there are crop losses (GlobalAgRisk, 2006). There are various institutions involved in agricultural lending in Piura, i.e., banks, municipal savings and credit associations (CMACs), rural savings and credit associations (CRACs), regulated NGOs for small enterprise development (EDYPYMEs), as well as producer organizations offering credit to their members through savings and credit cooperatives.

As a result of the international crisis and the El Niño phenomenon in 1997-98, there was an economic recession in Peru until 2001, and many financial institutions redefined their strategies, especially those related to the agricultural sector. Historical data show that

during El Niño in 1997-98, default rates for loans by MFIs in Piura increased by about 10 percentage points (GlobalAgRisk, 2006). However, the policies and governmental responses to El Niño were not favorable to lenders and to a proper environment for sustainable lending to the agricultural sector, as the government had allowed many farmers to simply write off their loans after El Niño. "Government programs to write off loans create a precedent for government bailouts and erode the responsibility that borrowers have to repay their loans and that lenders have to recover them. These interventions in the market through subsidies and bailouts are well intentioned by the government but can crowd out the market" (GlobalAgRisk, 2006: 1). Hence, it was most likely a combination of extreme problems in loan repayment and government response that caused a reversal in agricultural lending trends after El Niño (GlobalAgRisk, 2006).

Between 1995 and 1998, placements to the agricultural sector of all financial institutions increased, while the reduction of agricultural credits after 1998 is mainly associated to reductions of credits from banks, which focus their resources on a few clients (Table 50). While lending by MFIs increased more than threefold between 1998 and 2003, agricultural lending remained stagnant, which was a protectionist strategy for reducing exposure to risks related to agriculture (i.e., climate and prices). In 1998, agricultural lending represented 30 % of the total lending portfolio of the MFIs, in 2003 it accounted for less than 10 % of total lending (GlobalAgRisk, 2006).

Table 50: Development of credit for the agricultural sector 1994 – 2006 according to financial institution (in millions of US$)

Type of financial institution / Year	1994	1998	2002	2004	2005	Apr. 2006
Banks	202.7	441.0	333.3	320.2	370.6	364.0
MFI	3.3	49.4	47.9	59.6	70.7	74.3
CMAC	0.8	12.0	16.8	24.1	30.0	33.2
CRAC	2.5	36.8	29.9	28.9	33.4	34.6
EDPYME	-	0.6	1.2	6.6	7.4	6.5
Agrobanco	-	-	-	6.5	10.0	13.9
Total	208.0	495.2	383.8	386.3	451.3	452.2

Source: adapted from Bancos de Desarrollo (2008)

Within the frame of this study, it was not possible, and also not intended to provide detailed information about all the financial institutions lending to the agricultural sector in Piura. The emphasis here is put on those MFIs that are most important in Piura, i.e., Caja Piura and Caja Sullana. Additionally, information on Agrobanco is provided as well as on semi-formal institutions such as the savings and credit cooperative: COOPAC Norandino

and informal mechanisms. Large commercial banks are not taken into consideration as the interest is primarily in micro-finance institutions.

CAJA PIURA

Caja Piura was the first municipal bank and started operation in 1982. In 1985, it signed a cooperation agreement with the German Technical Cooperation (GTZ) and the German Savings Banks Alliance. The aim of the cooperation agreement was to contribute to the development of the Caja Piura, taking as a model the German savings bank (Sparkasse). Selected members of the staff were sent to Germany and learnt in a German Sparkasse; furthermore a training centre was set up in Piura in order to train staff from all savings banks in the country. Amongst other factors, it can be argued that this special cooperation with the German savings banks and Caja Piura has contributed to the latter's great success, and it is now the leading savings bank in Peru. Caja Piura currently has 58 offices in the coastal highland and Amazon areas. In March 2008, it also acquired the most important rural savings and credit association (CRAC) in the northern Peruvian Amazon region, called the 'Caja Rural San Martin'.

With regard to placements in the agricultural sector, the Caja Piura does not show the best numbers since the last mega-El Niño in 1997-98. While the total amount of placements has increased from US$ 45 million in 2000 to US$ 200 million in 2007, placements in the agricultural sector have decreased from US$ 5 million to US$ 2.8 million. More precisely, the placements in the agricultural sector have decreased from 10 % of the total placements in 2000 to nearly 1 % in 2007. According to the directors and staff, this is due to the high risks associated with agricultural activities, meaning the insecurities related to water availability as well as to climatic and price risks that are inherent in agriculture. Despite the decrease in the offer of agricultural credits, Caja Piura is interested in expanding its activities in the sector. Through the Caja Rural San Martin it hopes to further spread out in rural areas and especially for agricultural activities. Moreover, the interest on behalf of Caja Piura for an insurance scheme that could be combined with micro-credits is quite high. For this reason, Caja Piura has been very cooperative and supportive in the execution of this research.

Requirements and clients

Farmers can apply for agricultural credit at the Caja Piura if they own ≥1 ha of land, with a property title. The farmer is not allowed to have debts with other financial institutions. For clients with excellent financial and payment history, profitable and competitive businesses, as well as solid guarantees, there are preferential interest rates. The low culture of credit and payment, the low education and literacy levels in rural areas, as well as the high debts of many agricultural producers due to the collapse of the Agrarian Bank - BA make it quite difficult for the Cajas to reach out to more clients in the agricultural sector.

Typical financial products

The amount of credit given to clients is subject to evaluation and is based on the payment capacity of the lender, his credit history, qualification in the financial system and level of coverage of guarantees. With a favorable profile, the client can receive up to 100 % of the investment. Generally, in the case of temporary crops, a share of the production costs is financed, e.g., for mango a maximum of US$ 1,200 per hectare etc. The finance limit is set, as the total amount of credits given to one client should not exceed 5 % of the effective capital assets of the Caja Piura. The duration of the credit is dependent on the activity and on the destination of the financing as well as on the periods of sale of harvest and products. In general, for crops the duration does not exceed one year, e.g., in the case of mango, the duration is 12 months, while for rice it is 8 months and for beans only 6 months. The interest rate depends on the amount of the credit and ranges from 27 % to 33 % annually. For long-term credits in fixed assets, the duration can be up to 7 years as well as for all types of investments in the agricultural sector, e.g., installation of permanent crops, purchase of machinery and agricultural equipment, irrigation equipment and agricultural land.

Risk management

Climate risks

Facing natural phenomena and risks such as excessive rainfall, El Niño, water scarcity or La Niña, the following strategies are carried out to manage these risks. For instance, credits are only given to people that own land, which is not vulnerable or situated in an area that is exposed to flooding and where there is a diversification of crops and livestock.

The risk management strategy further includes a thorough monitoring of meteorological reports and statistics with regard to rainfall, river streams, etc.

Market risks

Regarding the reduction of prices for the products and variations in exchange rates; the Caja monitors the prices of the products on the field, comparing them to the market prices in Lima. The credits are given mainly in national currency and various forms of repayment of the credit are proposed in accordance with the client.

Future expansion of activities in the agricultural sector

Caja Piura is very interested in expanding its activities in the agricultural sector, but several conditions need to be fulfilled. First, due to the high risks associated with climatic events, the Caja Piura judges it necessary and convenient to design and implement an agricultural insurance scheme. Furthermore, given the complexity of agricultural credit and its high risks it is necessary to share risks with other agents involved in the production chain. However, government politics are still missing that bring together farmers in producer organizations, necessary to develop a modern and competitive agricultural system.

CAJA SULLANA

Caja Sullana was created in 1986 in the province of Sullana in the region of Piura with support of the German Technical Cooperation (GTZ). As for the other Cajas, it was established with the aim of promoting decentralized development and propelling economic and regional growth. The growth of Caja Sullana has been dynamic in the past years, following the tendency of the majority of MFIs in Peru. The agricultural portfolio has also experienced considerable growth in this period, in contrast to Caja Piura. This can, however, be explained by the fact that the most common business in the city and province of Sullana evolves mainly around agriculture. In the previous years, during and after the 1997-98 El Niño, the percentage of placements in the agricultural sector accounted for up to 33 % of the total portfolio. Since the year 2000, a limit of 20 % of the total portfolio has been set to the agricultural portfolio. In the last few years, the portfolio accounted for 10 - 15 % of the total.

Requirements and clients

Similar to Caja Piura, Caja Sullana maintains a policy of requiring ≥ 1 ha for financing a client. Although the crops that are financed are diverse, Caja Sullana focuses on rice and fruit trees. Caja Sullana started operating in the agricultural sector in 1993, and the first credits were given to medium-size and consolidated clients owning 6 to 7 ha, while now the majority of clients own between 1 and 2 ha (Trivelli et al., 2007). The requirements are to have own land with a property title, or to legally rent land and to have at least one year of experience in the agricultural activity, type of crop and the farmer has to provide a plan of crops and risks. Further, he has to have a good financial qualification.

Typical financial products

A typical and average agricultural credit from Caja Sullana is approximately US$ 1,800, with an average interest rate of 36 % annually. When comparing this typical agricultural credit to the typical credits offered to an urban micro-entrepreneur, where the interest rate is of only 22.5 % annually, it reflects the greater risks of the agricultural sector and the greater competition in this sector. The interest rate for agricultural credits ranges from 24 to 36 % annually according to the amount. The duration for crop credits is dependent on the type of crop; additional time for the sale of the crop is given, in general between 6 and 12 months. The average client of Caja Sullana owns between 4 and 5 hectares.

Risk management

The strategies to manage risks include an adequate credit technology, terms and amounts that are adapted to the type of crop as well as partial payments. The limit of the agricultural portfolio is set at 20 % of the total portfolio. Caja Sullana has a high geographical and crop diversification. Furthermore, if no plan for crop and irrigation is approved by the Irrigation Committee, Caja Sullana will not grant a credit. A permanent monitoring of water resources, climate, and prices is carried out.

Caja Sullana is also active in the search for tools to share or mitigate risks, such as through agricultural insurance schemes. It is the only Caja that has access to a specific insurance fund provided by the Development Credit Authority (DCA) of the United States Agency for International Development (USAID), which covers 50 % of the declared portfolio (specific amount determined), i.e., in case of problems for recuperation of credits, USAID would assume 50 % of the portfolio of the Caja Sullana. The total amount of the

cooperation is US$ 6 million for 5 years and a flat commission of 1 % of the maximum amount that USAID can grant, with an additional 1 % of the used budget. This cooperation agreement with USAID is of advantage to the Caja Sullana, as the latter can try out new clients with greater risk profiles but economically viable projects (Trivelli et al., 2007).

Future expansion of activities in the agricultural sector

Caja Sullana judges the lack of accessible insurance and risk transfer mechanisms in Piura and Peru as a serious impediment for further expanding the lending portfolio of the agricultural sector. Additionally, Caja Sullana wants to extent its agricultural placements to other regions and agencies in order to diversify the concentration geographically and crop-wise. A future expansion of activities in the agricultural sector could also be combined with the use of new technologies for improving efficiency as well as offering other types of services and financial products to the rural clients (micro-insurance, leasing, etc.) (Trivelli et al., 2007).

THE NEW AGRARIAN BANK: AGROBANCO

The reactivation of the Agrarian Bank was an electoral strategy for Toledo to become President (2001-2006) and not based on a dedicated willingness to support the agricultural sector. In 2001, the new state-led financial institution for the agricultural sector called 'Agrobanco' was re-launched through Law No. 29064. Agrobanco started operating in 2003, although it already had had the authorization to do so as a second-tier bank since June 2002. When designing the new Agrobanco, a main role as a second-tier institution was proposed. However, as established through the Law of Creation of Agrobanco (Law No. 27603), it should also serve with direct placements to organized farmers, preferably those belonging to product chains. The bank was supposed to be made up of public and private shareholders; however, due to the complete disinterest of the private sector in a national and international participation in this credit business in cooperation with Agrobanco, the institution had to rely on the public sector only. Hence, Agrobanco is a private bank whose capital comes to 100 % from the public sector. In Piura, there is a regional office, which serves more than 2000 producers of different crops.

Requirements and clients

Indirect, second-tier operations developed quite rapidly and the objectives were twofold. On the one hand, to encourage private sector institutions to make placements in the agricultural sector and, on the other, to place funds in secure financial institutions, which would imply a guaranteed return at low operational costs. First-tier, direct activities, however, took a long time to get going. This was due to several reasons, but mainly due to the specific conditions and characteristics that the clients had to fulfill. For instance, the clients should own at least 3 ha (thereby excluding smallholders and the poorest farmers, who own between 0.25 and 2.5 ha and make up >80 % of the farmers in Piura; see also Chapter 4), should not have any debts, and should be part of a product chain (only 20 % of the farmers in Piura belong to a product chain, see Chapter 4). Second-tier clients are financial institutions regulated by the SBS and are selected after respective evaluations. Considering these requirements, it becomes clear that clients at the bottom of the pyramid market (Prahalad, 2004), who are of interest for this study, are not included in the first-tier clients of Agrobanco.

Typical financial products

Credits of Agrobanco are direct, short-term credits offered to a group of agricultural producers that are organized in product chains. It is not an individual credit, but one to an organization of producers including input providers and those marketing the products. The product chains need to be orientated towards the production, transformation and marketing of a specific agricultural product. The first-tier credit products are up to US$ 15,000; the interest rate is subject to evaluation and depends on the type of crops and the term of the credit, which is limited to a maximum duration of one year. Second tier credit lines range from medium- to long-term, the amount and interest rate are subject to evaluation, the duration of the loan is not defined in the law. The average interest rate is 6.3 % annually.

Risk management

Interestingly, according to the study carried out by Trivelli et al. (2004), the rate of recuperation is 100 %, considering both credits to product chains and financial institutions. This is due, according to information obtained from the bank, to the good selection of clients followed until now. Hence, it can be argued that the risk management strategy used

by the bank is to provide credits only to those clients that belong to product chains as well as to those that do not have any debts in the formal financial system.

Future expansion of activities in the agricultural sector

In practice, Agrobanco's capacity to expand its activities to a wide range of borrowers, especially small and poor farmers, is quite low, attributable to the fact that it only accepts those producers having a high capacity of payment, owning at least 3 ha and without debts with institutions in the financial system or with the previous BA (Trivelli et al., 2004). Furthermore, it is not sure if Agrobanco will be able to expand its activities, as there are great financial constraints for the institution caused by the lack of private shareholders that contribute to its financing. Moreover, the participation of Agrobanco in the credit market can become inefficient as the richest clients are favored and have access to credit in the formal system anyways, while a wide segment of small- and medium-size producers, who have difficulties in accessing financial services in the formal system, are being excluded. In general, the system of operations of Agrobanco seems highly unsustainable, and it is questionable if in the long term the bank's activities will persist. An interest rate scheme that is below the market average will not allow the bank to reach sufficient cost-effectiveness in the long run.

SEMI-FORMAL CREDIT

COOPAC NORANDINO LTDA.: COOPERATIVA DE AHORRO Y CRÉDITO

In October 2005, representatives of smallholders, officials from agrarian producer organizations (CEPICAFÉ in Piura, CENFROCAFÉ in Cajamarca and Oro Verde in San Martín as well as several support NGOs) came together in Jaen with the aim of identifying an alternative to formal financing for the agricultural sector, with foundations of cooperation and solidarity. It was decided to establish the Credit and Savings Cooperative 'NORANDINO'. This was a decisive step, as it is commonly known that there are several cooperatives active in the country but mainly in urban areas. COOPAC Norandino has more than 2000 associates and more than 800 of these are borrowers. The placements are primarily (98 %) in the agricultural sector.

Requirements and clients

The aim of COOPAC Norandino is to offer financial services to its member families that normally do not have access to the formal financial system. The requirements are the

personal ID card of the applicant, original document of land owned (land title or possession), and own fixed term savings of a minimum of 10 % of the amount of the credit. Furthermore, the client should not have any outstanding debts with any financial institutions, CEPICAFE or other organization. The client is subject to evaluation for determining eligibility. Rural clients are dispersed, their agricultural activities are in different and often remote local areas, and their agricultural activities are seasonal and in most cases not continuous.

Typical financial products

COOPAC Norandino offers various credit and savings products. Average savings are around US$ 1018, while an average credit is US$ 648. The interest rate is quite low and ranges from 19 to 27 % annually. The terms of the credits depend on the type of crop and other conditions. The following types of credits exist: credit for maintenance, i.e., maintenance of crop and subsistence of the family, pre-harvest credit to finance the payment of the day laborers, etc., capitalization credit to buy land or machinery, cooperative or emergency credits, to be used for any kinds of immediate needs such as health, education etc., and finally there is the super credit, backed up by the savings in guarantee; this credit can be given to a member of the cooperative at any time of the year and to an amount that is as high as double the savings owned. The interesting factor about the credits offered by the cooperative is that they have a free repayment policy, adapted to the member's needs, and the repayment is made at harvest. It is thus possible for the borrowers to make their payments in cash or in agricultural products.

Risk management

Linking credit to fixed-term savings of the farmers allows the institution to be backed up against non-payment of credits. Local leaders allow for a sense of belonging and a wish to progress and grow economically, favoring thereby a culture of repayment. The marketing of the products through the cooperative ensures successful sales and good prices. Technical assistance as well as capacity-building offered through the cooperative contributes to both ensuring that the products are sold and to the improvement of farmers' risk management strategies.

Future expansion of activities in the agricultural sector

The creation of COOPAC Norandino has particular relevance for contributing to the further expansion of agricultural credit in Piura and other regions of the country. Especially the fact that credits are given to farmers that do not have access to formal financial institutions is relevant and contributes to their success. The cooperative is interested in and seems to be on a good way for extending its services to new clients and members.

INFORMAL CREDIT

There are many studies in the empirical literature on rural credit in Peru showing the existence of a series of non-formal credit sources (Trivelli et al., 2004; Alvarado et al., 2001; Fort et al., 2001). For many people in rural areas, small informal credits usually are provided through friends, family, landlord, bodegas and local committees. These informal lenders are of special importance due to their great coverage in rural areas, but also the most complex to analyze and to methodologically integrate into the formal system (Alvarado et al., 2001). Another type of informal credit is provided through more specialized lenders or 'intermediaries', for whom the provision of credit is only a secondary activity, while the main occupation is commerce, agro-exportation or agro-industry. Most of the farming households mentioned that the 'intermediaries' that come and buy their product to sell it on the market are the ones providing them with credit for sowing, and the credits are mostly paid back in the form of agricultural products. For many rural and especially remote areas, these means of financing represent the only source of funding for agricultural activities.

Requirements and clients

The characteristics of the clients that make use of informal financial services are in most cases that they live in rural or very remote areas. As a general rule, informal credit has much higher interest rates than formal credit; according to the survey and interviews, the annual interest rate ranges from 101-792 % (see also Alvarado et al., 2001). The high interest rates are quite counterproductive for the borrowers, because they produce a situation of dependence on the intermediaries. Even those borrowers who could qualify for formal credits know that the terms of informal credits are worse than those offered by formal institutions. However, they prefer to continue with the same lenders because there

is trust, an in-house service and often a secondary service such as marketing of the agricultural products.

Typical financial products

In general, the terms of informal credits are shorter than formal credits, especially those used for consumption or other personal purposes. But if the credit is used for agricultural activities, the terms are set according to the production time and generally recuperated at harvest time.

Risk management

The risks related to these types of credits are generally higher than for their formal counterparts, due to the absence of formal contracts that clearly establish the credit terms. However, sometimes enforcement mechanisms used for recuperating informal credits are more effective as those used in the formal system. Especially the closeness of the intermediary to the borrower facilitates the lender to seize goods and thereby recuperate the loaned amount (Alvarado et al., 2001).

Future expansion of activities in the agricultural sector

If there is no major expansion of appropriate formal financial mechanisms, informal financial mechanisms explained above are expected to grow in the future. It is necessary to provide an attractive offer of formal and semi-formal financial services to rural and especially very remote areas in order to prevent the excessive expansion of informal credits. The surveyed households mostly claimed that they were interested in formal or semi-formal financial services with lower interest rates, but often they are afraid of approaching a formal institution as they have little education and might not understand the terms of the credit or fulfill the requirements. Hence, the main reasons for not borrowing in the formal sector are the high interest rates and transaction costs as well as the fear of loosing their guarantee (GlobalAgRisk, 2006), i.e., in many cases households in rural areas that did not pay back their credit lost their land or house. It can thus be argued that informal credits are going to expand in rural and remote areas, especially if there is no major development of formal financial services accompanied by capacity-building components.

6.2.2 Agricultural insurance services

As explained in the previous section, currently only a few financial institutions are offering credits to farmers, and none is offering agricultural insurance against disasters. According to Mirla Barretto from the SBS (Oft, 2008), the main problem affecting the development of agricultural micro-insurance is the almost total absence of these products for the lowest sectors of society. There is, however, great interest on behalf of the MFIs and producer organizations that are lending to agriculture for an insurance scheme that could be combined with credits.

PRIVATE INSURANCE COMPANIES

PACÍFICO-PERUANO SUIZA

About a decade ago, private entities offered agricultural insurances in Peru. In 1997-98, the insurance company 'Pacífico-Peruano Suiza' offered agricultural insurance in Piura and in four other coastal departments. The scheme was designed to cover damage due to the absence of or excessive rainfall, high or low river levels and droughts. The agricultural insurance scheme covered the crops: rice, mango, citrus fruits, asparagus, sugar and grapes (Pérez Mickle, 2002). The low acceptance and failure of the insurance scheme can be explained by the fact that it was offered just prior to El Niño, whose magnitude was already known by then. The calamity of the scheme reached a 100 %, a level that, according to technicians of the company, had been estimated previously. Due to the total loss 'Pacífico-Peruano Suiza' stopped offering agricultural insurance altogether. Nevertheless, a couple of years later in 2000, the company put on the market an all-climatic risk insurance product for rice to be offered in selected valleys of most northern regions including Piura, as well as in the southern region of Arequipa. The insurance offered coverage from 50 - 75 % of the yields, which is equivalent to the average historical yields in the region or of the insured, if this information was available. The insurance would indemnify the producer if any of the covered risks caused the production to fall below the insured sum. The indemnity is equivalent to the yield reduction multiplied by the price arranged previously. The commercial premium fluctuated between 2.5 % for Arequipa and 5.0 % for Tumbes. It seems, however, as if this scheme has not had much success, as it is not offered anymore and only very few of the people interviewed said to have heard about it or to have purchased it.

LA POSITIVA SEGUROS

A pilot project was started in July 2008 to offer agricultural insurance for cotton coupled to micro-credits in the region of Ica, and more specifically in the Pisco valley. The pilot project is a joint effort between the Peruvian insurance company La Positiva Seguros, the Municipal Bank 'Caja Señor de Luren', the Universities of Wisconsin and California and the Institute for Peruvian Studies (Instituto de Estudios Peruanos - IEP). The insurance scheme is based on the average yields in the valley. The producer will be compensated in the case that his yield falls below the average, no matter what was the cause of the fall in yield. In order to reduce transaction costs, the area-based yield insurance product (offered by the insurance company) is sold as an add-on to working capital crop loans offered by rural Cajas, in this case the Caja Señor de Luren, the MFI most active in the region. The indirect marketing of the insurance product allows the insurance company to considerably save costs, as the presence of the Peruvian insurance industry in rural areas is still very limited. Further, the pilot project involves practical financial education games that will help to foster a culture of insurance and financial products (Carter et al., 2007).

PUBLIC INSURANCE: MINISTRY OF AGRICULTURE

PROPOSAL PERFORMA RISK MANAGEMENT (PRM)

In 1999 under the Fujimori government, the risk administration (PRM) put forward an initiative that was positively received by the Ministry of Agriculture without achieving any formal character. This initiative proposed an integral canalization scheme of credits for the agricultural sector using the administered risk criteria, which implies that it is an agricultural insurance, but with last instance protection in critical out of control scenarios. This new risk administration concept was to have a new function in orienting the producer about which products should be cultivated, based on the local market and production possibilities and conditions. This proposal even counted with international reinsurance and with the participation of Peruvian insurance companies. However, the proposal never came to be implemented and formalized (Pérez Mickle, 2002)

AGROPROTEGE

The agricultural and livestock insurances of the Ministry of Agriculture are financial support instruments, through which an insurance company offers protection for the investments made in rural areas facing climate risks to which the activity is exposed and allowing this way to reach the continuity of the productive process (MINAG, 2008). The

insurance applies to almost all agricultural crops and livestock species of all regions in the country.

This insurance scheme is called AgroProtege and further information about it can be found on the internet page of the Ministry of Agriculture <http://www.minag.gob.pe/seguro-agropecuario/agro-protege.html>. AgroProtege can be contracted by farmers owning only a few hectares. The state shall subsidize to a 100 % the cost of the policy for the poorest and most vulnerable farmers that live on a subsistence level. In this case, the scheme functions through the regional governments; who make a demand to the insurance companies for the poorest farmers. From the insurance companies, the request is transferred to the Ministry of Agriculture, who decides about the 100 % financing of the schemes. Agricultural producers and livestock holders with commercial activities can directly demand an insurance scheme for their activities at the insurance companies. In some cases, a part of the cost of the insurance policy can be subsidized by the state. AgroProtege policies are offered through private insurance companies and backed up by the Guarantee Fund. The Guarantee Fund for agricultural insurance approved by Law No. 28939 amounts up to US$ 12 million and shall be increasing in accordance with an increase in coverage and placements of policies offered through private insurance companies (MINAG, 2008).

AgroProtege distinguishes between subsistence and low-production versus commercial activities. For the former, the catastrophic insurance covers basic crops, fruit trees, vegetables and forage through a fixed insured sum per hectare (US$ 23/ha/cropping campaign) and is free of charge for the poorest farmers. For the latter, the commercial insurance applies and covers the expenses per hectare during a cropping campaign, and in certain cases it can also cover the expected output. The risks covered by AgroProtege include drought, excess humidity, frost, low temperatures, flooding, hail, fire, strong winds, high temperatures, and crop diseases. With regard to livestock insurance, it covers the risk of death through illness, accident, forced sacrifice and loss of function.

The recent changes just mentioned in the domain of agricultural insurance schemes have contributed to the development of agricultural insurance schemes that are still in their initial phases. All these products will be tested in the coming years such that supply and coverage will most likely increase. It is too early to be able to comment on the functioning

and future of these products. It can, however, be expected that national and international insurance companies will gain interest and contribute to a varied offer of insurance products in the future.

Informal insurance arrangements

Possible informal insurance arrangements consist of one household helping the other household, with the opposite being expected later in case of necessity. The most common coping strategy when the household is in a difficult situation in Piura is to ask help from family and friends (see Chapters 4 and 5). Rotating savings and credit associations (Roscas) are also a form of insurance. Farmers that usually receive earnings only once or twice a year can insure themselves either by buying physical assets they do not really need in order to be able to sell them in case of necessity, or in case such is available, put their earnings in a savings account that can be used later when needed (Mommens, 2006). Further, small farmers may diversify their crops and/or have non-farming revenues if possible.

6.3 Demand for financial services

While describing the offer of financial services for the agricultural sector in the previous section, it became clear that this is a complex task, as information is difficult to obtain and to aggregate, but this is even more so regarding the demand for financial services. On the one hand, it could just be sufficient to describe the actual demand expressed in the current credit requests, but one the other hand, it is always interesting to know about the potential demand, which in the case of Piuran agriculture seems to be quite high. With regard to agricultural insurance mechanisms, it will be very difficult to determine the demand, as most of the farmers do not necessarily know about these schemes, but if they knew and understood how they function, the demand could be greater and effectively determined through a more specific survey. During this survey, it was important to ask the households what they know about the functioning of an insurance policy.

6.3.1 Demand for agricultural micro-credit in Piura

The uncertainty of agricultural activities as well as the asymmetric information amongst moneylenders and lenders can imply diverse conditions of offer for the many heterogeneous producers (Fort et al., 2001). Some producers might be offered a variety of credit contracts with differing terms and conditions, while other producers might not

qualify for formal credit and thus face limited choice and alternatives. It is clear that the effective demand for agricultural credit could be approximated by calculating the number of hectares that are used for productive activities. However, particularly when producers are most risk adverse and do no have access to the insurance market, it is not sure how attractive a formal credit contract is for them. Thus, it depends not only on the expected return but also on the risk that such a contract implies.

Of the surveyed households, only 20 % stated to have credit at that moment, i.e., 8 % in the highlands, 7 % in the lowlands and 5 % in the Chira River basin, while 80 % said not to have any credit at that time, i.e., 30 % in the highlands, and 25 % in both the lowlands and the Chira River basin. This value seems to be quite low, but can be related to the fact that the time between October and November is not a cropping season, and for agricultural productive activities credits are generally given just previous to the cropping season, i.e., in December. When asking about the past, 48 % had had a credit, while 52 % had never received a credit before. This amount seems to be quite high and can possibly be linked to the fact that informal lending is included. Moreover, this value can be explained by the fact that cotton production in the lowlands in Piura has received preferential treatment from the former BA, and now from the regional government and the new Agrobanco.

The households provided information on where they had borrowed in the past and where they would like to get a credit from in the future, respectively (Tables 51 and 52). Interestingly on both sides Agrobanco (for the past also BA - Banco Agrario) was the most important. When asking about credit in the past, most farmers refered to the former BA. BA and Agrobanco were put together, as it was not of specific interest to know the exact percentage for each institution, but rather the behaviour of the interviewed with regard to the state-led institution. It becomes obvious, however, that the farmers do not know what the terms and conditions of the new bank are and still associate to the new Agrobanco the role it had before. In a sense, it is true that Agrobanco still offers the most attractive credits, as it has the lowest interest rates compared to all the other institutions. Otherwise it is not surprising to find the second highest percentage in the past occupied by informal lenders and in the future these only represent 1 %. This means that if the households do not have to lend from informal sources, they seem to prefer the formal system. Some of the main reasons for borrowing and as well for wishing to borrow from

formal institutions are low interest rates, few requirements, the bank staff come to the house to promote their products, the only institution they know of that lends to farmers, they have known the person/informal lender for a long time, etc. Those households that borrowed from informal sources mostly gave as a reason not to qualify for the formal system as well as habit.

Table 51: Credit institution used in the past

Credit institution	Geographical Area			Total
	Highlands	Lowlands	Chira	
Agrobanco and BA	3 %	4 %	3 %	10 %
Informal lender	2 %	2 %	4 %	8 %
Regional/ local government	1 %	4 %	2 %	6 %
Caja Municipal Piura	3 %	2 %	2 %	7 %
Caja Municipal Paita	2 %	1 %	2 %	6 %
Caja Municipal Sullana	2 %	0 %	2 %	4 %
Edyficar	2 %	1 %	1 %	4 %
Banco de la Nación	0 %	0 %	0 %	1 %
Cooperative	1 %	0 %	0 %	1 %
Other	3 %	5 %	3 %	10 %
No credit	19 %	14 %	12 %	45 %
Total	38 %	33 %	30 %	100 %

Table 52: Credit institution in the future

Credit institution	Geographical Area			Total
	Highlands	Lowlands	Chira	
Agrobanco	9 %	5 %	3 %	17 %
Informal lender	0 %	0 %	0 %	1 %
Caja Municipal Piura	2 %	5 %	1 %	7 %
Caja Municipal Sullana	2 %	1 %	4 %	7 %
Caja Municipal Paita	1 %	2 %	3 %	6 %
Edyficar	4 %	1 %	1 %	6 %
Banco de la Nación	2 %	0 %	1 %	3 %
Other (Cooperative etc.)	7 %	6 %	4 %	17 %
No answer	2 %	1 %	2 %	5 %
Not applicable	9 %	11 %	11 %	32 %
Total	38 %	33 %	30 %	100 %

Table 53: Use of credit

Use of credit	Geographical Area			Total
	Highlands	Lowlands	Chira	
Production of crops	13 %	17 %	14 %	44 %
Illness/death	1 %	0 %	1 %	2 %
Daily expenses	1 %	0 %	1 %	2 %
Marketing	0 %	0 %	1 %	1 %
To build a house	1 %	0 %	0 %	1 %
To pay another credit	1 %	0 %	0 %	1 %
Other	2 %	1 %	1 %	4 %
Not applicable (No credit)	19 %	14 %	12 %	45 %
Total	38 %	32 %	30 %	100 %

When asked about the use of the credit, the main reason was for the production of crops (Table 53). This is due to the fact that the households were necessarily involved in agricultural activities, even though these were not the main economic activity of all. Most of the other reasons, such as illness, daily expenses

and to pay another credit referred to, when the households needed the additional financial resources from a production credit for other expenses.

40 % of the households did not experience any difficulties in paying back the credit, while 12 % said they did, 14 % said they worried about debts, 70 % were not worried. Many of those that did have problems mentioned very bad production years, due to droughts or El Niño (1982-83 and 1997-98), as well as illnesses, death or other problems in the family. However, for most of the borrowers, the politics of government bailout during the last El Niño must have been favorable, as most of the farmers that had borrowed could write off their loans. Hence, the low percentage of people with repayment problems can be associated to the government programs. This has most likely[12] contributed to creating a bad payment culture in rural communities and an increased desire to have access to loans provided by state-led institutions.

In several focus-group discussions and workshops, the discussion on the demand for micro-credit services would always be about low interest rates, few requierements, subsidies for export products, and the need for technical assistance and capacity-building for the successful management of the productive activities and further marketing and export of their products. Furthermore, agricultural insurance tools to protect their production and crops were mentioned as necessary mechanisms for a more secure income form productive activities as well as for contributing to the reduction of poverty and greater sustainability of their livelihoods.

6.3.2 Demand for agricultural insurance services

One very important problem, if not the main problem, affecting the development of micro-insurance services is the lack of insurance culture and financial literacy that is most prominent in rural areas in developing countries. This applies to all kinds of insurance products. The reasons are that financial markets in rural areas are little developed, and insurance products are generally not widespread in developing countries. Recently, in Asian and many Latin American countries, including Peru, a wider spread of these products, especially related to death/life and illness insurance have been registered.

[12] This has been analyzed and shown in many studies by Carolina Trivelli and other researchers from the Institute for Peruvian Studies (IEP) and other research institutes in Peru.

When the surveyed person was asked if he/she understands how insurance works, 55 % said 'yes' and 45 % 'no'. This value is, however, highly questionable as when prompted to explain, most interviewed referred to a medical insurance that covered a visit to the local health station, or many confused the question with a monthly pension. Hence, in many cases it was necessary to provide some further explanation on what insurance is and how it functions. After the explanation, the people then mentioned that they understood what insurance is. During focus-group discussions, workshops and the survey, most farmers defined insurance similar to this statement given by one farmer: "*I pay a quota/ premium and when something happens (illness, death), the expenses are covered. In case of agricultural insurance, this would mean that I pay a monthly or seasonal premium according to the number of hectares, and if production is lost, I receive an indemnity payment"*.

The survey showed that 55 % find the use of insurance good and only 5 % perceive the use of insurance as bad. 30 % say they have had an insurance scheme in the past and 70 % had no experience with insurance schemes. Hence, it becomes clear that the number of people that know how insurance schemes function is probably less than the 55 % mentioned above. Of those who did have an insurance scheme in the past, the majority mentioned illness, followed by accident and life insurance (Table 54). 1 % claimed to have benefitted from agricultural insurance schemes in the past, 20 % had relatively good experience with insurance, while 5 % said to have had negative experience.

Table 54: Insurance type

Insurance type	Geographical Areas			Total
	Highlands	Lowlands	Chira	
Health/ illness	7 %	5 %	9 %	21 %
Accident	1 %	2 %	1 %	4 %
Life	0 %	1 %	1 %	2 %
Agricultural	1 %	0 %	0 %	1 %
Other	1 %	1 %	0 %	2 %
Not applicable	27 %	24 %	18 %	70 %
Total	38 %	33 %	29 %	100 %

When asked if they would buy an insurance to protect their crops and land from natural phenomena, 74 % would while 20 % said they would not; of the 74 % that said yes, 31 % were from the highlands, 24 % from the lowlands and 19 % from the Chira river basin. It seems as if the demand is proportionally distributed across

the three geographical areas. When asked about a type of community-based insurance fund for the whole village, producer organization, cooperative, irrigation committee or peasant community, 85 % judged this to be a good idea, of which 32 % were from the highlands, 27 % from the lowlands and 26% from the Chira river basin, 6 % had no opinion, and 3 % judged it to be a bad idea, as there is not sufficient trust amongst the parties. Interestingly, many farmers also mentioned that they would rather buy an agricultural insurance for their crops, as all their investment was in the field, than an illness or life insurance for themselves, because according to the farmers, problems of health and death can be coped with more easily than the loss of the whole yield.

When combing answers such as if the household had yield losses in the past related to the willingness to buy an insurance, it was found that 63 % of those that had losses in the past would buy an insurance, while 16 % had losses but would not like to buy an insurance. The remaining 9 % did not have losses in the past but would buy an insurance, while 4 % neither had losses nor would buy an insurance. With respect to having experienced floods in the past the situation is clear, while 46 % have experienced floods and 27 % did not experience floods in the past; both would like to buy an insurance. Of those who did not want to buy insurance, 12 % experienced floods and 4 % did not. The situation is even more convincing when looking at the high willingness to buy an insurance of those households that have experienced (21 %) or never experienced (51 %) droughts or water scarcity in the past. Of those that did not want to buy an insurance, 15 % had never experienced drought or water scarcity while 5 % had. This confirms the high awareness of risks that are inherent to the agricultural activities and are especially pronounced in the region during water-scarce years. Regarding crop diseases, only a few households had experienced these before, such that 65 % had no experience and 8 % did, but all these would like to buy an insurance, compared to 2 % that did have experience and 18 % that did not but would not like to buy an insurance. These results show that the occurrence of extreme events is seen as a major threat for the sustainable development of the livelihoods of the households.

6.4 Review of agricultural insurance schemes

There is a great variety of insurance schemes (see section 6.2.2). On the one hand, there is livestock insurance and on the other crop insurance. Specific and appropriate schemes are

designed according to the type of animal or crop and the types of risks they are exposed to. There are a large number of problems regarding the development of agricultural insurance schemes associated with common problems in micro-insurance and also specific to the agricultural sector. Common problems in micro-insurance are adverse selection and moral hazard resulting from the little knowledge insurers have of the risks that the insured are facing. Adverse selection thus means that it is very difficult and expensive to distinguish between clients that are very risk adverse and the ones that are less risk adverse, while moral hazard refers to the situation where the granting of insurance contract can lead clients to reduce their use of good risk and crop management practices resulting in higher loss claims (Skees and Hazell, 2005; Levin and Reinhard, 2007). These problems are common in insurance markets, but more pronounced in the agricultural sector, where information on a client's risk exposure and risk management practices is more time consuming and costly to obtain.

Agricultural insurance is also complicated, as it needs to cover both idiosyncratic and correlated risks. Correlated risks are those that are spatially correlated, such as large weather events like floods and droughts that affect a large number of farmers over a widespread geographical area. For the financial viability of the financial institution, it is therefore necessary to diversify the risk portfolio as well as to work with reinsurance companies and international financial markets to which part of the risk can be transferred. Furthermore, it needs to be considered that the introduction of agricultural micro-insurance as a risk management tool is a great challenge, as it is hard to gain trust and understanding for insurance schemes when people previously did not have access to financial services (Levin and Reinhard, 2007).

6.4.1 Animal insurance

Livestock insurance

Livestock insurance generally covers losses of a single animal or herd resulting from death, diseases and accidental injuries. These events can also be the result of extreme climate variability. In most cases, insurances are taken for herds, as the policies for individual animals are generally quite expensive (Levin and Reinhard, 2007).

An example of index-based livestock insurance is being implemented by the Government of Mongolia and was developed with the support of GlobalAgRisk. The indemnity is

based on a mortality rate index that pays all herders in the same region or province the same indemnity payment should the regional mortality rate be higher than a certain predetermined extreme threshold (Hazell and Skees, 2005). Hence, the incentive for herders to take care of their animals during extreme weather is maintained, and at the same time some kind of competition amongst herders can take place to achieve lower than average mortality rates. The contracts are offered according to species, e.g., cattle, yak, sheep, goats, and horses. Further, the index is based on the correlation of weather mortality with reliable historical data in Mongolia.

Fishery and aquaculture insurance

Similarly, there is great interest in the development of new fishery or aquaculture insurance instruments. In the case of fisheries, a possible El Niño insurance could be developed. For aquaculture, the insurance covers losses that result from death or loss of fish stock due to climatic events, diseases, etc.

6.4.2 Crop insurance

Agricultural producers insure themselves against damage to their crops and products through climatic events such as floods, droughts, hail, storms or the loss of income due to a fall in prices. Crop insurance is not easily determined, as there are very different factors that will influence the final production (Mommens, 2006). The different types of crop insurance will be discussed in the following.

Yield-based or multiple peril crop insurance

This type of crop insurance usually covers perils such as drought, flood, cold, frost, wind, insects, disease, etc. In this class of insurance, the perils are often bundled together in a single policy, called a multi-peril crop insurance (MPCI) policy. MPCI coverage is usually offered by a government insurer, and premiums are usually partially subsidized by the government. The insurance generally guarantees the yield of the insured based on the producer's actual production history. If the actual production is less than the average insured yield, the insured will be paid indemnity. This is the so-called traditional agricultural insurance, which is not so widespread and common in developing countries, as it has high administration costs. Crop insurance usually requires the assessment of the degree of damage to the insured crops by an expert, and to his/her fee are added costs for travelling and dealing with the claims procedure (Levin and Reinhard, 2007). Also, the

danger of fraud is higher, as the insured can easily induce the fall in production. Hence, problems of moral hazard and adverse selection are exacerbated in countries with high numbers of smallholders, weak institutional capacities, as well as weak infrastructures, lack of information and culture of insurance (Wenner and Arias, 2003). In many developing countries, the high administrative costs make it necessary for governments to subsidize these agricultural insurance schemes so that farmers can afford these policies.

Revenue- or income-based insurance

This type of scheme guarantees the farmer a fixed level of income independent of the yield generated from the crops. In general, it covers both the fluctuation of market prices and yield risks. Revenue insurance covers the decline in price that occurs during the growing season. It does not cover declines that may occur from one growing season to another. That would be called 'price support', and would raise a series of complex agricultural-policy and international-trade issues.

Index-based schemes

Index-based insurance pays for losses based on an independent and objective measure that is highly correlated with the crop losses. The insurance becomes due if a certain value or predetermined trigger is met or passed within a specific period of time. There is no individual claims settlement, but all parties insured are paid by the insurance once the threshold is passed (Levin and Reinhard, 2007). To be effective, the indexed measure must be highly correlated with the losses, and the insured should have an insurable interest to purchase index insurance. The most common indexes for agricultural insurance are area-based yield and weather indices. Index-based schemes are highly favored and discussed especially for developing countries; however, frequently the necessary data are missing, e.g., for area-based yield sufficient historical yield data, for weather indices, sufficient weather stations and historical statistical data.

a) **Area-based yield index insurance**

The indemnity is based on the realized average yield of an area such as a valley, province or district and is paid when the realized yield for the area in a given season is below a certain percentage of the expected area yield (regardless of the actual yield on a policyholder's farm) (Skees et al., 2008). This type of index insurance requires historical area-yield data, which in many developing countries are not always available. Area-based

yield insurance is thus a form of multiple peril crop insurance, since it only matters if yields fall below the threshold and not which peril has caused the fall in yield.

However, area-yield insurance offers indemnity that does not depend on farm-level yield. It thus not only avoids problems of moral hazard, adverse selection, and high transaction costs, but also creates incentives for improving productivity at higher levels than the average area yield in order to benefit from further payout by the insurance (Wenner and Arias, 2003). It follows that competition as well as the use of risk reduction measures to reduce adverse effects on farm-level yield amongst producers is encouraged. In order to design such insurance contracts, accurate country yield history is necessary, which is not always available.

In Peru, a first pilot project is being carried out in the Pisco valley of the region of Ica to implement a first area-based yield insurance for small- and medium-size agricultural producers. The project is being implemented by one of Peru's largest insurance companies, La Positiva Seguros, working in cooperation with the MFI Caja Señor de Luren. The latter already markets life insurance products for La Positiva to their clients and supports the idea of bundling the proposed area-based yield insurance with their agricultural loans. The project has the technical and scientific support of the BASIS Research Program of the University of Wisconsin working in collaboration with the Institute for Peruvian Studies (IEP) and the University of California; funding is provided by USAID. This includes further the design and implementation of a yield measurement survey and a simulation game-based training material for potential area-based yield insurance clients. This game shall help to foster and develop a culture of finance and insurance (Carter et al., 2008).

b) <u>Weather index insurance</u>

The indemnity is based on measurements of a specific weather parameter calculated over a pre-specified period of time at a particular weather station (Skees et al., 2008). The insurance can define an index value where crop losses are to be expected. Most of the time, these are based on a statistical analysis of past historical data, showing at which levels losses occurred in the past. For instance, an insurance scheme can be structured to protect from the effects of periods of water scarcity and water abundance. This is especially relevant for the region of Piura. More precisely, the indemnity is paid to the insured farmer whenever actual rainfall within a given period of time is less than (water

scarcity) or exceeds (water abundance) the predetermined index or threshold. The payment is calculated based on a predetermined sum insured per unit deviation of the actual value from the threshold value (Skees et al., 2008). Weather index insurance is generally only applicable for the specific peril that determines the index, such as rainfall or temperature. This type of index insurance seems to be quite promising for developing countries, as mostly meteorological stations and historical data are available and the administration costs for determining indemnity payments are quite low. These types of weather indexes could be further developed and be of advantage for possible future climate change, El Niño or Monsoon index insurance schemes.

c) Bundled schemes: coupling micro-insurance to micro-credit

The coupling of agricultural micro-insurance to agricultural micro-credit is especially important for the poorest and most vulnerable farmers, because without credit they do not have enough resources to buy an insurance policy and make appropriate use of risk management and advanced crop management techniques, such as the use of more resistant crop varieties. Combining agricultural micro-insurance with agricultural micro-credit can help the insurance companies to save administration costs and to reach out to remote areas. This way agricultural micro-insurance can also help to foster access to credit and provide incentives for risk management. It is argued that once farmers get access to formal loans, they will have the necessary financial resources in order to buy an agricultural micro-insurance, as well as take necessary measures to be less risk adverse, by making use of more profitable and more resistant crop varieties or using appropriate agricultural practices. In general, the impacts on small farmers are a stabilization of their incomes due to the agricultural micro-insurance and greater availability of agricultural micro-credits with lower interest rates, allowing them to invest and apply necessary crop and risk management techniques. At the market level, the provision of agricultural micro-insurance should facilitate an expansion of the MFIs' agricultural micro-credit portfolio.

The above pilot project is a good example of how these types of index-based schemes function. In this case, the index is based on average area yield. Also, for the region of Piura, a bundled scheme would be of interest in order to revitalize and expand rural finance, which has been decreasing since the last El Niño (see section 6.2). The appropriateness and feasibility of different indices from area yield and weather indices

(rainfall) could be tested to develop appropriate insurance schemes for extreme events such as El Niño but also for the less intense but more frequent and short drought periods.

An interesting study was carried out by GlobalAgRisk in Peru in 2006 using sea-surface temperature in the Pacific off the coast of Peru as an index (GlobalAgRisk, 2006). Abnormal increases would indicate an El Niño weather pattern. It has been proposed that indemnity could be paid when the index exceeds the value 2 during the rainy (January to March) period with a maximum payout when it reaches the value 3. Here the idea is to offer index insurance instruments directly to the MFIs in order to protect their loan portfolio, which might contribute to the expansion and sustainability of rural finance and a reduction of the risks for the MFI portfolios and individual micro-credits (Skees et al., 2007).

6.4.3 Insurance funds (Fondos de aseguramiento)

Fondos are a special insurance scheme commonly used in rural areas in Mexico, especially in remote areas where commercial insurance companies are not active. The fondos are civil non-profit associations or cooperatives constituted by farmers, who through this instrument decide to form part of an association and thereby grant themselves the service of agricultural insurance. The fondos comprise producers from the social or private sector and the major aim is to protect their investments in crops and livestock from the adverse effects of climatic and environmental risks. The aims of the fondos are to offer insurance to all their members, to administer insurance policies, to contract reinsurance to cover all the risks, as well as to apply measures to improve the insurance services and strengthen the capitalization of the fund and of its members. The advantages of the fondos are that the service is quick and usually in the place where the member carries out his productive activities. Furthermore, the members are self vigilant, and the operation of the fondo generates regional employment and contributes to the fostering of trust and cooperation amongst farmers. The technical operation of the fondo is similar to the work of a private insurance company, meaning that production, climate and risk-related statistics have to be collected and analysed, the insurance schemes have to be analysed and adapted to the specific situation, and the damages have to be evaluated and indemnity to be paid. The social fund constitutes a source of investment for projects, i.e., if no natural phenomenon or risks have affected the farmers belonging to a specific fund for several years, the general assembly can decide to invest in increasing technical reserves,

reduce the amount of future policies, and provide technical assistance and capacity building to its members (Ramirez, 2007).

6.5 Possible schemes, necessary conditions and institutions

Next to the problems with agricultural insurance schemes, there are also a number of positive benefits that these can offer to rural households for mitigating risks of natural phenomena and positively influencing their access to agricultural credit schemes.

6.5.1 Advantages and challenges of index-based schemes

In general, index-based schemes offer many advantages in comparison to traditional forms of agricultural insurance. For instance, moral hazard and adverse selection problems can be avoided with index insurance schemes, as the indemnity does not depend on the individual producer's yield and on individual yield information. Hence, it could rather foster risk management behaviour, as the insured will try to have a good yield but to obtain a payout even without having losses in case the threshold is reached. Other advantages of index insurance are the low administrative costs, because there is no individual claims settlement and it is not necessary to do any farm inspections, as the indemnity payment is given once the threshold is exceeded. Furthermore, index-based insurance contracts on the one hand have a standardized and transparent structure, which facilitates risk transfer and portfolio diversification, and on the other hand can be adapted to specific needs of the different geographical areas (Hazell and Skees, 2005; Levin and Reinhard, 2007). Index-based weather insurance can also be sold to other sectors than agriculture that might be affected by weather events. Especially during El Niño events, also traders, labourers and artisans are affected and could buy such a policy.

The major problem with index-based schemes relates to the low insurance culture that is prevalent in rural areas in Piura. Hence, it will to be difficult to convince farmers of the use of index-based agricultural insurance as a risk management tool. In particular, the problem lies with the basis risk, i.e., if there is no risk correlation, the farmer could have severe losses without the threshold being reached and hence no indemnity will be paid. It is thus necessary to choose an index that is highly correlated with historical loss data. On the other hand, if the index is adequately correlated and additional good risk and crop management practices are used by the farmer, the latter can highly benefit from this type

of insurance and be compensated without having incurred losses (basis chance) (Hazell and Skees, 2005). Although index-based insurance contracts are much simpler than traditional agricultural insurance contracts, it is necessary to foster education and capacities for building an insurance culture and understanding for these types of schemes that function very differently.

6.5.2 Linking insurance schemes to micro-credit

According to the surveyed households and members of producer organizations, linking micro-credit schemes to insurance policies is highly appreciated. Especially index-based schemes are easily linked to individual loans in the micro-finance sector but also to the portfolio of MFIs and banks. The combination of these financial instruments can lower interest rates for micro-credits and allow for a greater expansion of agricultural credit products. This can, however, also allow for the development of traditional agricultural insurance schemes. The on-farm inspections could be carried out by the MFI that needs to check the farm for the financial services that are offered, and this could also be combined with technical assistance. For the development of the agricultural sector and especially the sustainable livelihoods of the smallholders in the region of Piura, it is crucial to link agricultural insurance schemes to micro-finance so that MFIs can further expand their financial services to this sector.

6.5.3 Insurance funds (Fondos de aseguramiento)

With regard to the problems of index-based insurance products in dealing with the basis risk, the concept of mutual insurance funds (fondos) offers the opportunity to pool risks across farmers and to indemnify heavily affected farmers more adequately. Additionally, the concept of fondos can be particularly useful to already existing producer associations or cooperatives. Most of the discussions with representatives of these organizations showed particular interest for these types of risk transfer mechanisms. Positive effects could be reached by promoting these fondos also as a new form of institutional arrangement amongst producers. This would provide a new incentive for farmers to work together, associate themselves and increase trust amongst one another. Positive spill-over effects of being associated could be the formation of production chains, availability of technical assistance and access to credits. However, the prevalence of independent smallholders and lack of trust could mean major challenges to the development of these

associations in rural areas in Piura. The majority of the surveyed households said that they are in favor of these types of fondos, but argued that there is not sufficient trust and agreement amongst farmers to allow for such constellations to be successful. If the incentive is not fostered by outside private sector actors, such as insurance companies and MFIs, or also public institutions such as Agrobanco, will the farmers not have sufficient trust in one another and thus not be willing to change their path-dependent behaviour resulting from the malfunctioning of the cooperatives in the 1970s.

6.5.4 Necessary conditions and institutions

a) Pilot projects

The development of agricultural insurance products, especially index-based schemes, is still in its initial phase. In order to develop sound agricultural insurance schemes for poor farmers, it is necessary to carry out pilot projects such as the one started by La Positiva Seguros in cooperation with several research institutes in the Pisco valley, in order to test the products and their applicability. Especially combining applied research throughout the actual implementation of the projects is necessary to improve index-based schemes and assess the degree of market penetration for tailoring them to the needs of the poor.

Although such a new topic, the literature provides a great amount of information on studies and projects that have tested different kinds of agricultural insurance schemes in developing countries (GlobalAgRisk, USAID, Provention Consortium, World Bank, Inter-American Development Bank (IADB), Mexican National Insurance Institution (AGROASEMEX), Micro-insurance Innovation Facility of the International Labor Organization (ILO-MIF), Consultative Group to Assist the Poor (CGAP) Working Group on Microinsurance, Munich Re Foundation, etc.), such that these can serve as a basis for developing or replicating some of the pilot projects in other settings. It is necessary, however, to carry out projects that provide incentives for micro-finance tools to foster better risk management behaviour and advanced crop management.

b) Capacity building and education

Especially offering index-based agricultural micro-insurance schemes needs to be accompanied by capacity building and training in financial literacy. If farmers do not understand the functioning of index-based schemes, the disappointment related to basis risk could lead to the failure of such schemes. Farmers could easily loose trust and

confidence in insurance companies, which could have a detrimental effect on these and spread to MFIs in the case of bundled products. Past governmental policies of writing off debts after the last El Niño as well as public disaster assistance have contributed to creating a poor credit culture, especially with regard to the poorest and most vulnerable farmers, who mostly need capacity building and education.

The method used for explaining index insurance in the pilot project in the Pisco valley is an experimental economics game for financial education. Participants receive a payout based on their financial outcomes in the game and their decision whether or not to buy insurance (Carter et al., 2008). The game goes on for several production cycles, seasons and years, and in the end, farmers are able to analyse and determine if an insurance scheme is of advantage to them. It is crucial for farmers to understand the specific workings of insurance products for a real and effective development of demand for these instruments.

c) Institutional structures and legal matters

Existing institutional arrangements such as producer organizations or water users' associations (Juntas de Usuarios) can be used as a basis for developing a fondo-type insurance mechanism. Also, new independent institutional arrangements for the management of insurance mechanisms could be formed, such as the civil associations. These associations could also be organized along crop characteristics or product chains. The success of existing or newly created institutions and producer organizations or associations will depend on the ability and will of the farmers to turn around their path dependence and engage in new forms of organization.

Each newly designed financial and insurance product for the agricultural sector in Peru needs to be embedded into the existing national legal and regulatory framework. Concerning the creation of associations, specific general rules for the constitution, operation and functioning of the agricultural insurance funds need to be determined. These can be adapted by taking as an example the Mexican fondos and the prevailing regulations in Peru. New laws and regulations might need to be developed according to the specific financial products, and the supervisory authority, SBS in Peru, will need to develop new regulatory standards and norms. However, legal and regulatory certainty is almost impossible to achieve because the development of any type of financial instrument

holds a certain legal and regulatory risk (GlobalAgRisk, 2006). It is clear that index-based schemes might carry a higher risk than traditional insurance products; according to Skees et al. (2002), the acceptance of these schemes will depend on the extent to which capital markets trust the data for climate indices in developing countries. If sound indices and reliable climate data are available, it may be possible to create efficient and affordable risk-sharing instruments for the agricultural sector and other purposes.

6.6 Can financial mechanisms provide incentives for risk reduction?

The vulnerability of the rural households in Piura to El Niño events will certainly increase with future climate variability and change. The strategies and responses used by households to adapt to climate variability, droughts, floods and other climate-related risks are described as their coping and adaptation strategies (see Chapter 5). Having provided a short overview of possible new and innovative agricultural insurance schemes, it becomes clear that these instruments can offer a method of transferring the risks associated to climate-related shocks and, especially when combined with micro-credit, can provide the farmers with the necessary financial means to carry out their agricultural activity and cope with the climate shocks.

Weather insurance through index-based or other insurance instruments for farmers and for local and national governments appear to be increasingly important, but these are not a wonder cure. It needs to be considered that especially changes in climate and uncertainty about future climate change can make insurance products more expensive and less appropriate for compensating losses and mitigating risks. Furthermore, the low level of financial literacy and the almost complete lack of a culture of insurance in rural areas in Piura may be difficult for developing such products at an affordable price.

Many studies show that poor households in rural areas will require life or health insurance before any other form of insurance. In the case of Piura, however, the surveyed households argued that on the one hand the poorest (who represented the majority of the interviewed) had a health insurance granted by the government, so they would not require this type of insurance and on the other hand they would rather invest their money in a crop insurance that would protect their year-long investments or savings that could otherwise be destroyed by a climate-related shock. Hence, the survey shows that farmers in rural areas in Piura are aware of the financial burden that yield losses would cause and thus are

more inclined to purchase agricultural insurance as compared to life or health insurance products.

However, if access to savings is available many will favor these, as they are more effective in reducing the vulnerability to more frequent economic stresses and losses, while insurance is more appropriate for higher losses that occur less frequently. In highly developed insurance markets in industrialized countries, insurance is used as a complement to savings and credit in protecting against risks. It is argued that especially for low-income rural households, these financial instruments should form part of a common strategy. This means that when considering the use of rural micro-insurance, its adequacy and price for rural households should be analyzed in comparison to other solutions such as savings and risk management. In the case of Piura, the selection of the types of schemes and instruments presented above seem promising for reducing the vulnerability of rural households in the long term and for fostering their resilience against climate-related shocks in the future. However, it is necessary to include specific conditions that foster risk reduction measures in the insurance policy and contract. Hence, the implementation of pilot projects, the building of capacities and education as well as offering insurance instruments should not be carried out in a vacuum but should form part of an integrated disaster risk management strategy.

7 Discussion on resilience-building

The discussion on resilience is based on recent international efforts that are embodied in the Hyogo World Conference on Disaster Reduction held in 2005 in Kobe, Japan and in the resulting Hyogo Framework for Action, which identified the need for and ways to build resilient communities by 1) integrating disaster prevention, mitigation, preparedness, and vulnerability reduction perspectives into sustainable development policies, 2) increasing local capacity (institutions and mechanisms) for building resilience, and 3) incorporating risk reduction into the design and implementation of emergency preparedness, response, recovery, and reconstruction programs in affected communities (UNISDR, 2005). In the following, an example is presented with a focus on how resilience can be built on the Piuran case.

7.1 Conceptual framework for resilience

This section renders an overview of the concept of resilience by placing it within the broader context of vulnerability, hazard and risk literature. First, the concept of vulnerability is discussed, frameworks are presented to show that in the context of this research they fall short of being able to analyze what the concept of resilience is trying to provide.

7.1.1 Vulnerability frameworks

Numerous vulnerability frameworks have been developed in recent years of these, three are the most frequently cited and discussed conceptual models for analyzing vulnerability. First, 'The Double Structure of Vulnerability' developed by Bohle (2001). This model dictates which theories can serve for vulnerability analysis and provides an analysis of the external (environmental) and internal (human) side of vulnerability, thus identifying ecological as well as social vulnerability as important factors when focusing on building resilience. The model also provides insights into the causal structures of vulnerability, yet it fails to give a more profound insight into the relationship of the concepts to the theories. Second, 'The Pressure and Release Model' from Blaikie and Wisner (2004) serves for analyzing the progression of vulnerability from root causes to dynamic pressures to unsafe conditions. However, it falls short of linking the concept and framework to the discussion on coupled human–environment systems (Cutter et al., 2008). Third, Turner et al. (2003) presents a vulnerability/sustainability framework that locates local vulnerability within the

broader contexts that influence it but does not succeed in providing a temporal dimension to the evolution of vulnerability.

It is argued here that it is particularly the concept of resilience that has prompted a new way of conceptualizing hazards and their consequences, as it suggests focusing on building something up rather than just reducing something, which is the case when talking about poverty or vulnerability reduction (Manyena, 2006). The concept of resilience helps us to obtain a complete understanding of risk and vulnerability by focusing on resilience directly. "Disaster resilient activities can lead to actions such as enhancing community coping capacity and livelihoods, allowing communities to make appropriate choices within the context of their environments" (Manyena, 2006: 436).

7.1.2 Resilience frameworks

Although the concept of resilience has been much discussed in the literature, it is still not clear what is needed to build resilient communities such that they are not vulnerable to climate-related shocks and disasters. It is particularly the multidimensional nature of resilience and its different component parts that make up its complexity, and it is necessary that a broad model be tested empirically at the community level (Cumming et al., 2005). However, such a model would be very costly and time-consuming to test empirically, as it would need to include the physical, social, institutional, economic and ecological dimensions of resilience. The focus here is on providing ideas on how resilience can be fostered at the community/household level.

There are several aspects of resilience that are discussed in the literature and which require different forms of analysis and measurement. Cutter et al. (2008) have compiled these dimensions of resilience and their measurement variables. Community resilience indicators are proposed based on the following dimensions: ecological, social, economic, institutional, infrastructure and community competence. In a sense, this research touches upon all these dimensions. However, the emphasis is on the social, economic and institutional dimensions and on the community's competence, i.e., the coping and adaptation strategies of local farmers to climate-related risks.

The most complex and maybe also the most complete conceptual framework for resilience is the Panarchy framework, where human and natural systems are linked in non-stop

adaptive cycles of growth, accumulation, restructuring and renewal (Gunderson and Holling, 2002). The argumentation and perspective is holistic in the sense that the dynamics of the system at a particular scale of interest cannot be fully understood without the dynamics of other scales and influences. To foster resilience and sustainability within a system it is necessary to understand adaptive cycles within the coupled human-environmental system and interactions at the different scales (Cutter et al., 2008).

In this research resilience is defined as "the capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures" (UNISDR, 2005; Thywissen, 2006: 23).

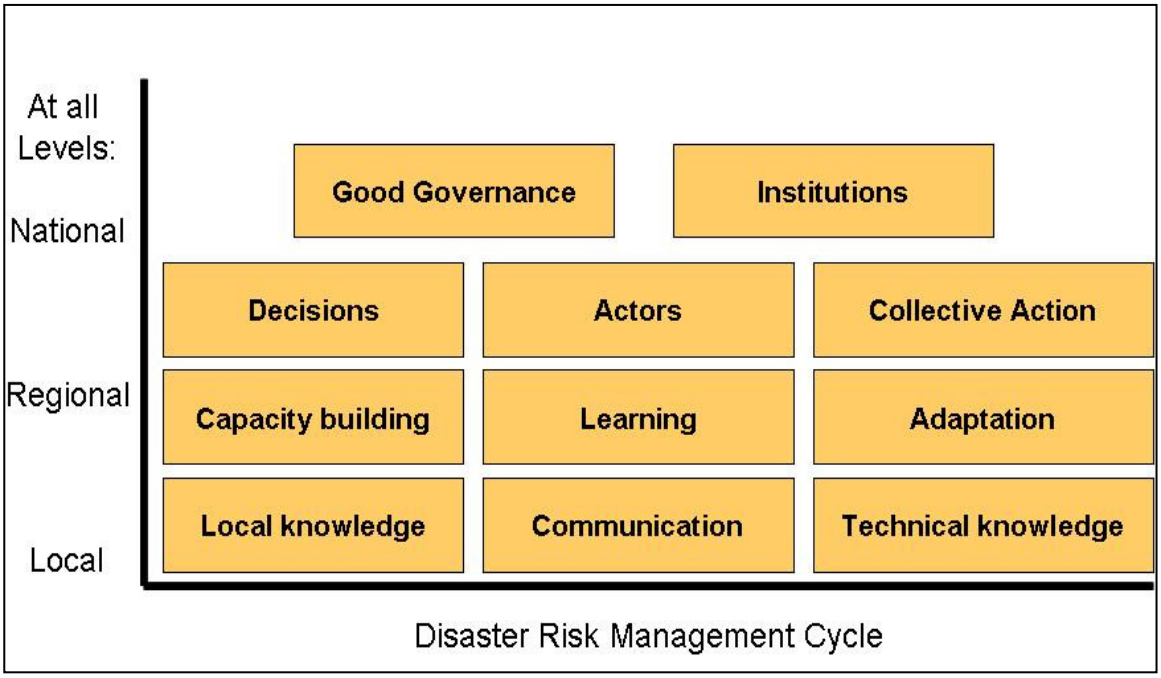
As stated earlier (Chapter 2), a multidisciplinary DRM approach is used, as for analyzing the livelihood, coping strategies and resilience of farmers, various elements of their livelihoods need to be touched upon and considered. The analysis and discussion on resilience-building does not focus on coupled social-ecological systems but rather on how resilience-building can be achieved at the rural household level.

7.2 Building blocks of a resilient system

Following the Hyogo Framework for Action 2005-2015 and the International Strategy for Disaster Reduction, this research seeks to make a contribution to how the 'Resilience of Nations and Communities to Disasters' can be built and fostered (UNISDR, 2005). For some, the entrance of the term resilience into disaster discourse is seen as the birth of a new culture of disaster response, while others see it more as an expression that complements the use of other terms such as risk or vulnerability (Manyena, 2006). In the following, a framework is provided for building resilience in systems, i.e., nations or communities, etc. (Figure 5). The elements that are needed to build resilience are represented as building blocks in order to make clear that a society's capacity to manage resilience resides in many aspects that need to be built up with time. Here, building blocks that contribute to improve risk reduction measures of local farmers and the disaster risk management capacity of the actors and institutions in the region of Piura are described.

These building blocks are disaster risk management, local and technical knowledge, governance and institutions, decisions, actors and collective action and capacity building.

Figure 5: Building blocks of a resilient system



7.2.1 Disaster risk management, knowledge and communication

Disaster risk management (DRM) is the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards (UNISDR, 2004).

Hence, DRM refers to all actions (policies, programs, plans, projects and/or measures) and instruments expressly aimed at reducing disaster risk in endangered regions, and mitigating the extent of disasters (Garatwa and Bollin, 2002). DRM can be divided into three activities:

1. **Pre-disaster** activities, which comprise risk assessment, risk reduction, prevention, preparedness and early- warning.

2. **Disaster response** activities, which comprise warning, evacuation, saving people, providing immediate assistance, mitigation and assessing damage.

3. **Post-disaster** activities which comprise ongoing assistance, restoration of infrastructural services, reconstruction (resettlement/relocation), economic and social recovery and rehabilitation, ongoing development and planning activities, risk assessment, mitigation and prevention.

Effective DRM depends, among other aspects, on how well technical, scientific knowledge as well as communication is embedded into each of the disaster risk management cycles. Therefore, DRM needs to be integrated into local, regional and national level information systems, planning departments and research institutes. Combinations of both local and scientific knowledge and information about natural hazards should be fed into each disaster risk management cycle as well as at each intervention level. This helps facilitate policy formulation and early-warning as well as rapid response. More precisely, technical knowledge for flood control, for example, should combine remote sensing, decision support systems, geographic information systems knowledge, and other geological mapping methods. These methods then need to be processed to inform policy makers as well as to alert the population to prepare or respond. These kinds of knowledge systems can monitor vulnerabilities and risks as well as inform policy makers and population about floods.

The knowledge and information must combine scientific, social and ecological information on risks, hazards and vulnerabilities. Interdisciplinary research is crucial for effective disaster risk management and building resilience against disasters. Natural resource management practices need to be established to secure local ecological knowledge and skills, reduce vulnerability and strengthen the user's capacity to respond and adapt. Therefore, disaster risk management should go hand in hand with integrated natural resource management. Moreover, a reasonable scientific basis for predicting and communicating disasters is required, such that useful knowledge about risks for effective preparation and response can be received. If building resilience, however, can only be achieved once integrated into sustainable disaster risk management and governance (Lebel et al., 2006; Ostrom, 1998), it will be of particular interest to analyze the importance of governance and institutions.

7.2.2 Governance and institutions

Governance refers to the structures and processes by which societies shape individual and collective actions (Lebel et al., 2006). It includes laws, regulations, discursive debates, negotiation and mediation, conflict resolution, elections, public consultations, protests and other decision-making processes. Governance emerges from the complex interactions of many actors at different levels, not only governmental, but also the private sector and non-governmental organizations (NGOs). For governance to contribute to the building of resilience, integrated DRM should be embedded in multi-level and polycentric governance (Olsson et al., 2004). Multi-level governance that upholds social justice improves the fit between knowledge, theory, action and socio-ecological systems allowing societies to respond adaptively.

Building resilience means putting in place institutions that can contribute towards building an adaptive capacity of social systems to be able to anticipate, cope and regroup when faced with uncertainties while maintaining a balance that does not restrain ecosystems from performing their function in a sustainable manner (Ostrom, 1998; Adger et al., 2004). Important for resilience-building are integrated institutional interactions embedded in multi-layered cooperation between expert and local knowledge (UNISDR, 2005; Thywissen, 2006). Multiple, independent centres of authority create opportunities for local institutions to evolve (Berkes and Folke, 1998) and empower local communities through allowing space for non-state actor involvement in DRM (UNISDR, 2005).

Power dynamics in terms of interest in certain resources and building robust resilient systems for certain sections of the ecosystem should be well understood and factored in DRM strategies (Anderies, 2005). Resilience is built by understanding the dynamic processes, structures and laws by which societies share power and shape individual as well as collective action. Participatory resource and risk mapping, collaborative management as well as deliberative processes of governance and decision-making are incentives for collective action and resilience building. It will thus be of interest to analyze the importance of decisions, actors and collective action in building resilience.

7.2.3 Decisions, actors and collective action

Disasters need to be understood as the product of cumulative decisions taken over long periods, because then the processes by which these choices are made become a focal point

for potential change (Comfort et al., 1999). Decisions taken in response to a specific disaster become defining elements for the (temporary) resolution of that crisis, but also likely steps toward the creation of the next crisis (Comfort et al., 1999). Building resilience against floods relies on practical and effective decisions and actions for disaster mitigation, preparedness, response and recovery. Maps of the decision processes for disaster mitigation, response and recovery help to identify critical actors at each jurisdictional level, their risk assumptions, their different types of information needs, and the design of an information infrastructure that would support their decisions. Only through the help of such devices and environmental risk management tools will it be possible to transform the destructive spiral of disaster into a learning process for building resilience and responsible disaster risk management (Comfort, 1993).

Affected populations that face hazards should be enabled, through assistance, to manage their own environments more responsibly and equitably over the long term by joining a global structure that supports informed, responsible, systematic actions to improve local conditions in vulnerable regions (Comfort et al., 1999). Resilience can be built through providing a voice to the vulnerable and powerless victims (Thompson, 1995). As local communities are mobilizers of resources, voluntary collective action through building trust and reciprocity is a stimulant for accountability and social justice. The ability to organize social systems depends on local networks and their strengthening to facilitate re-organization during and after shocks. Collective action allows for mobilization of diverse interests, building social networks as in safety coping nets (Anderies, 2004). The institutionalizing or organization of collective action can be made through the formation of Community-based Organizations (CBOs) or NGOs (ISDR, 2005). Collective action provides a platform for collective horizontal and vertical learning and building and exchange of knowledge from diverse context-specific experience (Lebel et al., 2006; Ostrom, 1998).

In building resilience in socio-ecological systems, the important elements are institutions, decisions and collective actions, which enhance the capacity for local re-organization, decision-making and action before, during and after disasters. It is important that communities understand their risks and are able to organize themselves to take action. It is therefore necessary to enhance social capital to build networks for collective action by

empowering communities in participating and taking collective responsibility when tackling socio-ecological uncertainties.

7.2.4 Capacity building and awareness raising: learning and adaptation

Disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities (UNISDR, 2005). Multi-way information exchange systems can increase the capacity of communities to engage in coordinated actions by making available and sharing timely accurate information about risk. Such systems lead to self-organization of disaster risk management (Comfort et al., 1999). Informed action at the local level, e.g., for instance local initiatives to reduce vulnerability and increase community participation, may be facilitated by training, capacity building and resource transfers (Comfort et al., 1999).

Resilience is embedded in building the capacity of a risk-aware community as a tactic for maintaining re-organization, thus strengthening networks that can be triggered into action during crisis (Lebel et al., 2006; UNISDR, 2004). Capacity building for learning and adaptation needs to start at the local level. It is at this level that disasters, vulnerabilities and risks are felt. This means that building resilience involves context-specific measures and not a one-size-fits-all approach. Natural phenomena are locally based and depend on the characteristics of local ecosystems. Nevertheless, this means that a plan of action for the protection and security of the population is necessary that is integrated into a multi-level DRM and governance strategy. Capacity building should take into consideration traditional natural resource governance mechanisms and local knowledge regarding flooding seasons, cropping, forestation, etc., and strengthen and integrate these capacities into a broader and comprehensive DRM framework. Easily understandable information on disaster risks and protection options are important for citizens in high-risk areas in order to encourage and enable them to perform actions that reduce risks and build resilience (UNISDR, 2005). This information should incorporate traditional and indigenous knowledge and cultural heritage and be tailored to different target audiences, taking into account cultural and social factors.

Finally, it is necessary to build up capacities through the inclusion of disaster risk reduction knowledge in relevant sections of school curricula at all levels and through the use of other formal and informal channels to reach youth and children and thereby promote the integration of disaster risk reduction as an intrinsic element of the United Nations Decade of Education for Sustainable Development (2005–2015) (UNISDR, 2005). Furthermore, it is necessary to promote the implementation of local risk assessment and disaster preparedness programs in schools and institutions of higher education and targeted at specific sectors, such as agriculture, is recommended.

7.3 Assessing policies, institutions and organizations on resilience

7.3.1 Building an enabling environment

It is recognized that political, economic and social development need to be understood as processes that evolve over time. Further, many current political, economic and social implications of these processes are embedded in institutions, whether formal rules, policy structures, or norms (Pierson, 2000). Providing a historical background to the political, economic and social changes carried out during the last decades in the agricultural sector in Peru, highlights the important transformations and their consequences for the development of the sector today. It becomes clear that recent Peruvian history has undergone important political and economic changes that have been conditioned by global changes and economic conditions. It can be said that despite massive political, economic and social changes over time, "self-reinforcing dynamics associated with collective action processes mean that organizations have a strong tendency to persist once they are institutionalized" (Pierson, 2000: 259).

The technological revolution in communications and the reduction of barriers to access to markets has facilitated the mobility of factors of production (i.e., manpower, capital), financial flows, and information. The economic opening and the liberalization of markets generate opportunities for participating in emerging markets. Globalization has favored the increase in international competition, but the participation in this new international market also requires augmenting the efficiency in productive, distributive and sales processes. To that end, technological innovation is crucial because it permits augmenting the productivity of the production factors. However, the magnitude of investment to make use of economies of scale restricts the participation of farmers, who have limited capital and are poorly organized.

It follows that the most recent and flagrant political and economic transformation to which polities, economies and societies have to adapt is globalization. Globalization is a generalized process that promotes the interdependence of societies and has generated changes in the political, economic and social spheres. Globalization is characterized by a great number of winners but also losers. Only the most productive, fastest and reliable producers succeed. What does that mean? That the process of globalization presents different chances of success, it presents great opportunities for some and great threats for others. This means that with globalization there are great chances for specific regions in a country to be integrated into the global system of exchange, but also there are great threats as to the exclusion of entire regions or even countries due to their lack of competitiveness and adaptation to these political, economic and social changes.

The Peruvian economy has been growing steadily since the beginning of globalization with the Fujimori governmental periods (1990-2000) but more so since the Toledo government (2001-2006) and now under the Garcia government (2006-2011). Although the economy has been growing, poverty has not greatly decreased, especially in rural areas, but at least it dropped from 69.3 % in 2006 to 64.6 % in 2007 (INEI, 2007). In the last years, a debate developed around the impact the recently signed Free Trade Agreement (FTA) with the USA could have on Peruvian agriculture and especially on those farmers that live on a subsistence level. The long time that the agreement took to be signed could have been used by the government to prepare the agricultural producers for improving their competitiveness and productivity and to support and foster the formation of product chains and export associations. Instead, the government continues its agrarian politics without linking these to a rural development strategy (Escobal, 2007).

It is true that such a treaty can have many benefits, but these are mostly concentrated at the macro-economic level, as it can allow for economic growth in the urban commercial activities. However, at the micro-economic level in rural areas, there should be a willingness to promote policies that transfer the capacities, public services and technical assistance that the agricultural sector needs for participating in the benefits of such a treaty. Government should recognize public expenditures directed at the agricultural sector as a principal mechanism for equaling the opportunities of all smallholders and farmers (Escobal, 2007).

This context makes clear that it is necessary for the government to build an enabling environment and especially for the Ministry of Agriculture to design, implement and monitor policies and processes that generate the appropriate incentives to the agricultural producers such that these can take advantage of the commercial opportunities.

7.3.2 Fostering institutional change

The approach adopted here for assessing institutional change and performance is adapted from Arthur's economic discussion of increasing returns for technological change (Arthur, 1994). This argument has been adapted by North in the study of institutional change (Pierson, 2000). Arthur (1994) argues that four features of a technology and its social context generate increasing returns: large set-up and fixed costs, learning effects, coordination effects, and adaptive expectations. North (1990) argues that the features identified by Arthur can be applied to institutions. In contexts of complex social interdependence, new institutions often entail high fixed or start-up costs, and they involve considerable learning effects, coordination effects, and adaptive expectations. North emphasizes that also institutional arrangements induce complementary organizational forms, which in turn may generate complementary institutions.

Recognizing path-dependent processes is mostly done at a macro level involving complementary organizations and institutions or, as North calls it, "the interdependent web of an institutional matrix" (1990: 95), and not at the level of one singular institution or organization. According to this theory, economic performance and development of a country can be explained and traced back to its path-dependent development. The poor performance of the BA and the write off of debts in El Niño years have contributed to a low responsibility and culture of repayment on behalf of the borrowers. These factors contributed to the creation of an unfavorable environment for the agricultural sector.

The new agrarian bank Agrobanco has given rise to false expectations in many clients. Agrobanco is different to the former BA and has taken a new, innovative path of fostering the creation of product chains and offering technical assistance. This newly designed credit technology was intended to work with clients that have a certain development perspective and not only financial. More precisely, this means that the credit offered by Agrobanco was to be accompanied by additional benefits such as a formalization process of the clients, a practical process of association (which for most is very costly, but key for

the development of smallholder agriculture - the major segment of Peruvian agriculture) and possible access to technical assistance through the product chain. Ideally, these complementary services and benefits would be supported by the Ministry of Agriculture and, e.g., the regional agrarian agencies, the specialized program for land titling (PETT), the sub-sectoral irrigation program (PSI) and the national institute for agricultural research (INIA). These institutions were supposed to be allies, through which the creation of product chains would be supported. However, little or nothing of this happened. The poorest farmers with the smallest area of land do not have access to these services, due to strict selection criteria (at least 3 ha of land and no past debts with any financial institution). This means that the agricultural development bank Agrobanco is fostering medium- and large-size productive activities in the agricultural sector offering the lowest interest rates to clients that can easily have access to credit, while those that have difficulties in accessing financial services are excluded from these benefits. Furthermore, as the institution recognizes, the transaction costs in trying to obtain a credit from Agrobanco are high. The approval of a credit takes approximately 90 days, and 30 days more to get the payout, i.e., a total of 4 months have to be calculated if one wants to apply for a credit. In addition to the high transaction costs, the applicant needs to deliver extensive documentation (i.e., information on mortgages, copies of the applicants' and partners' documents, etc.) and also needs to form a product chain, which implies looking for possible partners and deliverers, signing contracts and defining a business plan and aims (Bancos de Desarrollo, 2008).

Given the above-mentioned context, the re-structuring of this institution has not opened up more possibilities for smallholders living in remote rural areas in Peru, and has thus not contributed to the reduction of the widespread problem of access to formal credit in rural areas. Especially the poorest and most vulnerable farmers owning very small plots of lands are excluded from formal credit mechanisms so that they have to borrow money from informal intermediaries at very high interest rates. This means that they remain poor and at a high risk of a further deterioration of their situation when climate-related shocks occur.

The system of municipal and rural banks (CMACs and CRACs) has not been able to fill these gaps and to reach out to the poorest and most needy farmers. Due to the absence of international re-insurance policies and products linked to these local banks, many of these

institutions have been reluctant to extent their loan portfolio to the agricultural sector. In the region of Piura, it is particularly Caja Sullana that has extended its loans to this sector, and it is also the only one that has insured its agricultural loan portfolio. The need for a greater variety and offer of such financial protection and insurance mechanisms could not be emphasized enough by representatives from this institution. It is thus still necessary that a market for such products be developed. Especially access to insurance and reinsurance services for MFIs and their clients could allow the fostering of a more constant and resilient offer of financial services to the agricultural sector.

The regulatory environment, mainly the SBS, seems to be much more efficient compared to Agrobanco. However, the problem here, as with insurance in most countries, is the right level of supervision. The challenge is not to have too lax rules so that the sector is controlled firmly as much as regulations that are not excessive as to burden the stakeholders and hinder innovation or there is "imperfect enforcement of rules, laws and norms all the time, but the degree of imperfection plays a big part (…)" (North, 2003).

Summarizing, the rules of the game institutions and conditions for obtaining an agricultural credit from Agrobanco are not supportive of poor farmers' livelihoods. The most appropriate for integrating smallholder agriculture into world markets would be to change Agrobanco's rules and regulations as well as those of financial organizations with access to insurance and risk transfer mechanisms. It seems as if the policy and institutional environment is not conducive to assisting the rural poor in achieving a sustainable livelihood. A stronger integration of private and public organizations offering financial services and public sector agricultural development policies could allow for building resilient livelihoods in rural areas.

7.3.3 Resilience-building in coping and adaptation strategies

This research tries to show that people's abilities to make choices are constrained by the path-dependent patterns in their heritage, i.e., the combination of beliefs and institutions that evolved over time and survived. Here, cultural heritage refers to the beliefs inherited from the past complemented by new experiences including schooling, family background, etc., which modified that belief system. It is argued that the government's policies, institutions and processes with respect to access to credit for agricultural activities have

created path-dependent patterns, expectations and a paternalistic attitude of the farmers towards the state. The state-led development of the agricultural sector practiced during the years of the agrarian reform trying to control and organize the peasants, left them alone for a while and then again offered credits but not to all. In the case of the development of Piuran agriculture, consisting mainly of smallholders since the agricultural reform, it can be said that their maintenance of a paternalistic attitude towards the state is counterproductive and impedes improving competiveness.

Institutions influence people's social capital. Households in rural areas in Piura mainly rely on informal relationships, family ties and peasant communities in difficult times (55 %) (see Chapter 4). About 44 % belong to a formal organization, including peasant communities, irrigation committees, and water-user associations. It follows that those households that are able to engage in formal institutional arrangements and have access to formal financial services benefit from relative power within a community. Globalization and increasing competition on world markets means a dilemma and difficult position for the farmers. They need to learn how to organize themselves; of the surveyed households only 23 % belong to a formal product chain. Most do not know how to improve the productivity and quality of their products in order to be able to export these and thus to become part of the globalization process. In general, technical knowledge, capacities and financial means to increase their competitiveness and upgrade their productive activities are lacking. In most of the surveyed cases, the farmers belonging to a product chain, producer associations or those having several sources of income and economic activities are generally in a better economic position.

With regard to the most common coping strategies used in times of water scarcity and water abundance, the most widespread strategies are to ask help from family and friends, reduce expenses, sell livestock, lend money, do extra work or migrate temporarily. Interestingly, a very high percentage of households claimed not to do anything, as they say that nothing can be done when there is no water for irrigation or when the fields are flooded. On the one hand, they maintain a very fateful relation to natural phenomena such as droughts and floods and think that nothing can be done, but on the other hand the diversity of strategies used to cope with these phenomena and to adapt to them are a form of institution. These strategies are informal norms of behaviour that should be built upon

in order to foster preventive and adaptation capacities in rural households and to ensure food, financial and human security during climate-related shocks and disasters.

At the time of the survey in October – November 2007, only 20 % of the households said to have a credit, while 48 % said to have had a credit in the past. This includes formal and informal sources of credit. Especially for the farmers living in remote rural areas, informal lenders represent the main means of financing for their productive activities. The lack of access to formal credit mechanisms for these farmers can be associated to several factors and is a main hindrance to their sustainable development. It is argued that, particularly for poor farmers, financial mechanisms such as micro-credit and micro-insurance schemes for the agricultural production as well as technical assistance and capacity building are important means for fostering the resilience of these households.

7.4 Financial mechanisms, resilience building and adaptation to climate change

As has been analyzed in the preceding chapters, weak social capital as well as inconsistent economic and financial politics with regard to micro-credit schemes to the agricultural sector has produced high vulnerability and inefficiency of the farmers in Piura. High risks and insufficient local adaptation strategies to climate-related shocks are a major factor in inhibiting resilience of local farmers, especially in regions that are highly exposed such as Piura. This section will argue for financial services as a coping mechanism to extreme climatic events, like floods and droughts and as a means to build resilience.

7.4.1 Financial mechanisms for building resilience

The Bali Action Plan (UNFCCC, 2007) specifically calls for a "consideration of risk sharing and transfer mechanisms, such as insurance as a means to deal with loss and damage in developing countries particularly vulnerable to climate change" (Decision 1/CP.13, Bali Action Plan; Linneroth-Bayer et al., 2008). The plan strengthens the mandate to consider insurance instruments, as set out by the Article 4.8 of the UN Framework Convention on Climate Change (UNFCCC) and Article 3.14 of the Kyoto Protocol (Linnerooth-Bayer et al., 2008). For governments, insurance can compensate for the costs of reconstruction and recovery. Insurance payouts can provide immediate cash flow and avoid further debt accumulation. Furthermore, after a disaster, the payouts could be attached to certain conditions in the policy, such as investment and development of

climate or earthquake-proof housing design and other adaptation techniques. The benefits of these financial mechanisms at the regional and national level are not discussed here, but there are several examples of such tools recently being expanded in developing countries, and many governments of risk-prone nations are investigating and implementing various practical and new approaches including insurance mechanisms to reduce vulnerability and to help households to quickly recover form shocks and disasters. For instance, some Caribbean states have formed a catastrophe pool covering their flood and hurricane risks, and transferred part of their collective risk by purchasing reinsurance and issuing a catastrophe bond (Linnerooth-Bayer et al., 2008).

The focus in this study is on the need for financial risk transfer mechanisms to help rural households minimize losses and provide safety nets against climate-related shocks. There are already many recent initiatives in developing countries (Malawi, Mongolia, Mexico, etc.) that have shown the potential benefits of a broad range of financial products, from traditional disaster insurance to newer products, which can be combined and adapted to different geographical settings and at various levels. Currently, micro-insurance and weather-based derivatives appear to offer the greatest potential for disaster risk management in developing countries. The successful application of these products is dependent upon the active involvement and investment of the private insurance sector.

Micro-finance instruments, such as micro-credit and micro-insurance for the agricultural sector have many benefits and can help break the cycle of poverty by providing low-income households, farmers, and businesses with access to liquidity to secure their livelihoods during and after shocks. It allows them to rehabilitate crops and businesses with the minimal possible disruption. Financial mechanisms act like a buffer that moderate the losses for smallholders and protect them from falling further into poverty after a flood or a drought. This is what makes the poor more resilient to disasters, because "disaster resilience is seen as the shield, shock absorber or buffer that moderates the outcome to ensure benign or small-scale negative consequences" (Manyena, 2006: 436).

Particularly, the combination of micro-credit and micro-insurance allows the poor to have access to capital in order to invest in their productive activities and if possible improve their crop management mechanisms. Combined with micro-insurance, households and farmers additionally have access to financial resources during and after the disaster

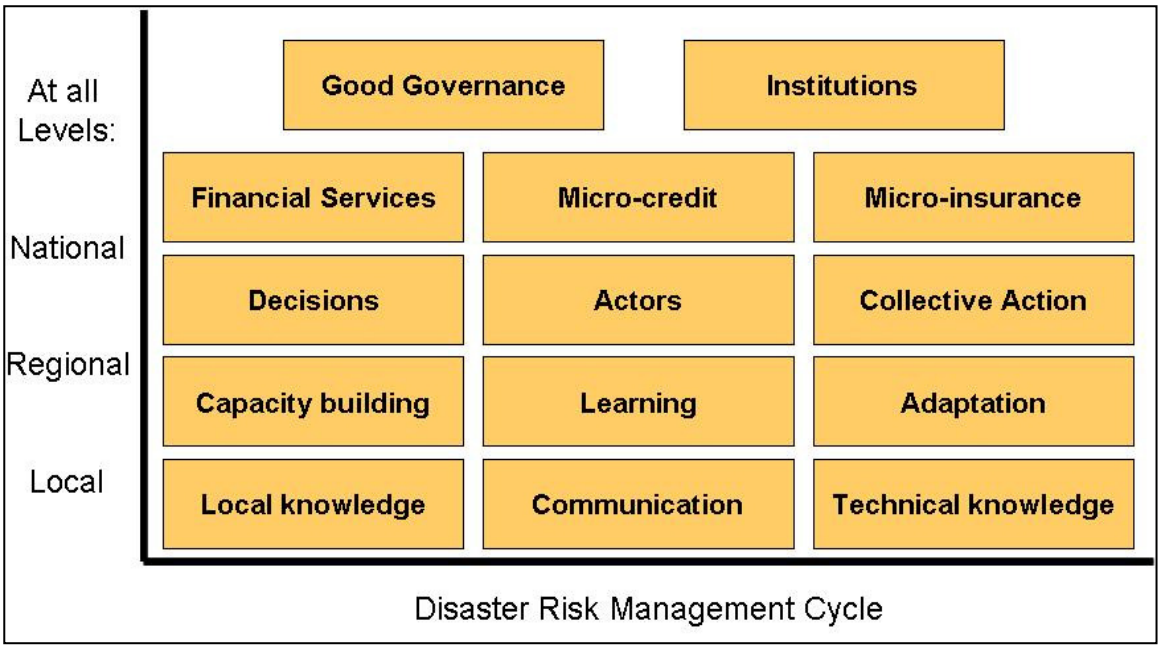
allowing them to recover more quickly. Access to insurance makes households more creditworthy, and riskier investments in productive assets and higher-risk/higher-yield crops can be produced (Mechler et al., 2006). Furthermore, especially climate-related shocks provide covariate risks which might pose capacity and solvency challenges for micro-insurance and micro-finance institutions, which can be addressed with insurance backing through the global market. Moreover, micro-insurance can encourage investment in prevention measures if insurers offer lower premiums to reward risk-reducing behavior. Thus, arguably, micro-insurance can be seen as an effective risk transfer mechanism and an integral part of an overall disaster risk management strategy (Mechler et al., 2006).

As can be seen in the case of Piura, the lack of formal credit and insurance mechanisms for farmers and the offer of informal financial mechanisms prevent these households from improving their standard of living. This research provides insight into where the farmers are now in terms of coping and adaptation to climate-related shocks and how they can progress in the future. It is argued that farmers in Piura need a wider offer of formal financial services including micro-insurance tools to protect them from seasonal shocks and El Niño/La Niña events. These services can be provided by different types of organizations such as producer organizations, cooperatives or micro-finance institutions (MFIs) providing the insurance sector access to low-income clients in remote rural areas. These groups, through self-management and self-regulation, are able to address the challenges of moral hazard and adverse selection, while pooling clients and thus lowering administrative costs for insurance partners. Capacity building would need to be carried out using insurance products to reduce and manage disaster risk. Partnerships are thus necessary for the implementation of insurance for disaster risk management in developing countries.

Financial mechanisms help to enhance the capacity of households exposed to climate-related shocks to adapt and maintain an acceptable level of functioning and structure (UNISDR, 2004). In the following, the building blocks of a resilient system of rural households are represented including financial mechanisms at national, regional and local level as well as during the entire disaster risk management cycle (Figure 6). There are certainly several other elements that are needed to build resilience in rural households for which further research is needed. This study shows that a system's capacity to manage resilience resides in many aspects that need to be built up with time. Hence, the decision

was to depict the process of resilience-building as an ongoing process of construction for which many building blocks are needed and can be added with time. Financial services can be a mechanism for coping with extreme climatic events, before, during and after the event has ocurred. A combination of financial instruments is recommended, as it is claimed that pure micro-insurance service provision might not function in the region because of a weakly developed insurance culture and education. Although, financial mechanisms are only one element of the building blocks for a resilient system of rural households, it is argued that access to micro-credit and micro-insurance services for the agricultural sector in Piura can help foster the resilience of farmers in the region.

Figure 6: Building blocks of a resilient system of rural households



However, it is not always appropriate to provide the poor with insurance mechanisms. It is necessary to first make a calculation of the costs and benefits. Insuring covariant risks (those that hit many households at the same time) is extremely costly and often needs to be subsidized by the state. Particularly with index-insurance, the risk that individuals pay substantially more than their expected losses over the long term are high. Moreover, badly designed insurance contracts that do not reward risk-reducing behavior can also lead to moral hazard, which means that individuals do not take measures to reduce their risks because they are insured (Provention Consortium, 2004).

Current risk-reducing strategies (see Chapter 5) used by rural households and farmers in Piura including informal insurance arrangements that involve reciprocal exchange, such as kinship ties, community self-help, as well as remittances, micro-credit and savings, work quite well despite their limitations. These mechanisms seem especially appropriate for less severe and frequently recurring events as they make use of proper risk reduction measures. However, as most of the surveyed households do not even have access to formal micro-credit schemes, a combination of micro-credit and micro-insurance schemes in high risk areas such as Piura is recommended.

A lack of a culture of risk reduction and thus an understanding of the uses and benefits of insurance hampers insurance development and private sector involvement in Peru. Client education and capacity building are essential for the creation of appropriate and realistic demand, and also to allow clients to express their needs such that insurance products that address their specific situation can be developed. As experience in many countries show and also the household survey indicates, poor households demand insurance and related financial services, but it needs to be recognized that premium payments or contributions to mutual insurance funds can often not be paid due to more serious or more immediate livelihood demands for these peoples' limited resources (Provention Consortium, 2004).

The time in Peru seems ripe for the successful implementation of such financial mechanisms and insurance schemes; however, these need to be accompanied by political will and by establishing local insurance expertise. It is clear that without the political will to establish such structures, possibly enhanced by sponsors or champions of insurance within the public sector, an appropriate environment will not be created. In Peru, the political will on behalf of the Ministry of Agriculture has been shown in the last two years; it is now up to the private sector insurance companies to enter in touch with MFIs and to develop appropriate products, as in the case of the insurance company La Positiva Seguros and the Caja Señor de Luren in Pisco. Furthermore, a close link to the SBS needs to be established in order to develop necessary rules and regulations.

It follows that financial tools are an important element that can contribute to build resilience. Financial mechanisms, such as micro-credit and micro-insurance, are not a building block per se but form an important element of the resilience-building process at

national, regional and local level as well as during the entire disaster risk management cycle (Figure 6).

7.4.2 Financial mechanisms to facilitate adaptation to climate change

Before turning to the discussion on the link between disaster risk management, adaptation to climate change and fostering resilience; the link between financial instruments and adaptation to climate change will briefly be touched upon. In the context of climate-related shocks due to weather variability and extremes, adaptation refers to risk-reduction measures that ensure for security of livelihoods, assets, property, and lives (Linnerooth-Bayer et al., 2008). In the context of Piuran agriculture, this is not really new, but involves strategies that most of the poorest households cannot carry out mostly due to lack of financial means. In the agricultural sector, adaptation to climate change basically refers to instruments such as improved soils, land management, better water management and use efficiency, risk-resistant crops, risk diversification, post harvest practices, pest and disease control, and energy saving. Adaptation builds upon current coping strategies and the development of these into long-term adaptation strategies. This means that adaptation to climate variability and change is related to disaster risk management by reducing risks to climate-related shocks. This way, a sustainable livelihood can be secured. Building adaptive capacities for the agricultural sector and for local smallholders is part of the process of resilience building. When talking about building resilient rural households, adaptation to climate change is included.

In Piura, expected impacts of climate change include on the one hand, an increase in magnitude and frequency of extreme El Niño events, as well as extended periods of drought and, on the other hand, loss of soil fertility and degradation as a result of increased precipitation, both of which will negatively impact on agriculture and food security. Furthermore, a shortening of growing cycles for cotton and mango along the northern coasts of Peru during El Niño due to the increase in temperatures is predicted (IPCC, 2007), as well as an increase in fungal diseases in maize, potato, wheat and kidney bean during these years due to an increase in temperature and humidity (see Chapter 4). This research analyzes the local farmers' current coping strategies and future adaptation strategies. Good or even best practices cannot be shown yet. It is necessary to build upon current practices used by local farmers and households when facing climate-related shocks to learn from them and start developing newer and better practices that will lead to

better adaptive capacities and foster resilience against these shocks and future events related to climate variability and change.

The awareness and understanding of climate change and its impacts on the livelihoods of households in rural areas is well understood in Piura (see Chapter 5). 54 % of the households think that it is possible to adapt their crop to climate change and mentioned some interesting strategies that can be classified as adaptation to climate change strategies, such as crop diversification and use of more resistant crops. A few households also mentioned that they would look for a new job as a means to adapt to these adverse circumstances, i.e., diversification of income activities. The diversification of income activities is, however, very low in the region (see Chapter 4) but is a crucial factor in reducing vulnerability to climatic risks.

Skees et al. (2008) affirm that weather index-insurance can facilitate access to credit that is needed for adaptation techniques and also the use of new drought-resistant varieties and better crop management. In the case of Piura, this is particularly relevant, because MFIs and other financial institutions have heavily reduced lending to the agricultural sector since the last El Niño in 1997-98. According to Linnerooth-Bayer et al. (2008), well-designed insurance is not an alternative to adaptation measures, but is in itself an adaptation measure, as it can provide strong incentives for physical interventions such as flood defenses or early-warning systems or changes in livelihood strategies such as better crop and water management techniques, relocation, and capacity-building, etc. In line with Skees et al. (2008), it seems necessary to integrate weather (index) insurance or bundled schemes into a broader adaptation strategy, because insurance by itself is not a sufficient adaptation strategy, especially for the agricultural sector, but for other sectors that are affected by climate-related shocks such as tourism, transport, etc., it can also provide great benefits.

However, poorly designed insurance schemes can mean disincentives for risk-reductive behavior and even promote moral hazard or ‘mal-adaptation’ (Linnerooth-Bayer et al. 2008). If the selected index or premiums do not reflect the risks, they may maintain vulnerability and risk. It is to be expected that with future climate change the cost of weather insurance might dramatically increase. External or government support in the form of subsidies can be counterproductive and promote mal-adaptation by changing the

price signal and can lead to disincentives for risk reduction (Skees et al.; 2008; Linnerooth-Bayer et al. 2008). Consequently, badly developed indices and insurance policies, improper subsidies and assistance as well as lacking risk-reduction behavior of the insured can lead to mal-adaptation.

7.5 Link between risk reduction, adaptation to climate change and resilience

Disaster risk management (DRM) refers to all actions (policies, programs, plans, projects and/or measures) and instruments expressly aimed at reducing disaster risk in endangered regions, and mitigating the extent of disasters (see section 7.2.1). DRM is concerned with trying to achieve effective disaster risk reduction and response through multi-level, multi-dimensional and multi-disciplinary cooperation and collaboration. Effective DRM depends on, among other aspects, on how well technical, scientific knowledge as well as communication is embedded into each of the disaster risk management cycles. Since the 1970s, the disaster risk management community has refined its practical and conceptual approach from managing disasters by addressing the hazards to understanding and addressing the underlying factors and vulnerabilities that turn hazards into disasters, culminating in the disaster risk reduction framework (GECHS Report, 2008). It becomes clear that disaster risk reduction forms part of disaster risk management and, according to the definition by UNISDR, refers to a conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development (UNISDR, 2008)

In the adaptation to climate change literature and discourse, adaptation is understood as the actions taken to help communities and ecosystems cope with changing climate conditions, such as the construction of flood walls to protect property from stronger storms and heavier rainfall, or the planting of agricultural crops and trees more suited to warmer temperatures and drier soil conditions (UNFCCC, 2006). Compared to DRM, climate change adaptation only emerged in 1992 with the United Nations Framework Convention on Climate Change (UNFCCC). However, the UNFCCC and the Kyoto Protocol predominantly addressed climate change mitigation and policies and measures to reduce the emissions of greenhouse gases, and it is only quite recently that adaptation has become a key concern and discourse within the UNFCCC.

The above-mentioned methodologies used in disaster risk management when working with community-based initiatives are crucial for building resilience of these households. These methods are complementary and sometimes overlapping with those used for adaptation to climate change. At the same time, the climate change community offers an overwhelming body of research on adaptation as a social process, with an emphasis on strategies to reduce vulnerability and enhance the capacity to adapt to shocks and stressors, but includes only a few practical initiatives aimed at building resilience through community-based adaptation (GECHS Report, 2008). Despite overlapping and complementary actions, research, and strategies, disaster risk reduction and climate change adaptation have until now evolved largely in isolation from each other through different conceptual and institutional frameworks (GECHS Report, 2008).

With increased attention to climate change and associated impacts within the disaster risk community, and growing recognition of the links between disaster risk reduction and adaptation within the climate change community, there is now both a need and an opportunity to learn from the experiences of both the disaster risk and climate change research and practice (GECHS Report, 2008). Disaster risk reduction and management need to go hand in hand with adaptation to climate change and must be addressed within the broader vulnerability context. Adaptation, as the results of this study show, is a reiterative learning process, i.e., learning should be build upon what already exists (FAO at COP 14, 2008). A close cooperation is needed between scientists and practitioners in disaster risk management and adaptation to climate change. "Important lessons can be drawn from such an assessment, which can be used to better inform society on how to adapt to a changing climate, and to better integrate and coordinate adaptation and disaster risk reduction across different levels of governance" (GECHS Report, 2008:3).

However, adaptation in this study is used not only regarding climate change but rather as forming part of the disaster risk reduction and management cycle, practice and discourse. It is clear that these aspects belong together, as climate change can cause disasters. When communities adapt to climate change this means to reduce their risks facing future natural hazards that can potentially turn into a disaster. The literature also shows that adaptive actions cannot be taken in light of climate change alone. There are now numerous examples of climate change risks and "adaptation measures that are being incorporated into existing policies, programs or decision-making processes related to resource

management, community development, livelihood enhancements, coastal zone management, sustainable development and disaster risk management" (Smit and Wandel, 2006: 286).

Furthermore, it is argued here that it is particularly the concept of resilience that has prompted a new way of conceptualizing hazards and their consequences, as it suggests focusing on building something up rather than just reducing something, which is the case when talking about poverty or vulnerability reduction (Manyena, 2006). Generally, resilience has been defined as a desired outcome or a process leading to a desired outcome, but in recent years it is being conceptualized away from an outcome-oriented to a more process-oriented approach. "Resilience depends on the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures" (UNISDR, 2004, Thywissen, 2006: 23), such that successful adaptation to climate change and effective disaster risk reduction strategies contribute to building resilience. Hence resilience, adaptation and risk reduction are reiterative learning processes, which need to build upon experiences that have been made in the past. This way successful adaptation and risk reduction can be achieved and resilience is built.

The results of this study show that institutional dynamics can play a role in building resilient systems to cope and anticipate natural hazards and prevent their escalation into disasters; however these systems need to be integrated into multi-level and polycentric governance and form part of an integrated disaster risk management system. Linking local, regional and national level institutions is necessary to achieve multi-level governance that contributes to building resilience. The challenges for multi-level governance are that it represents an extremely expensive process, which requires high annual budget allocations and maintenance.

Main lessons can be drawn from the fact that training, capacity building and communication is essential for re-orienting and transforming public institutions as well as equipping the communities and individual farmers with knowledge and techniques to enable them to effectively reduce their risks with respect to common natural hazards and future climate change. Finally, one needs to be careful not to streamline the concepts of resilience and adaptation to climate change. More precisely, resilience and adaptation to

climate change is to be seen as a quality, characteristic or result that is generated or developed by the processes (disaster risk reduction/management) that foster or promote it. It follows that both resilience and adaptation to climate change are desired outcomes of disaster risk reduction measures.

8 Conclusions and outlook

The study analyzes and provides insights into three important aspects of rural household livelihoods in Piura, namely the general livelihoods context, the households' coping and adaptation strategies to climate shocks, and a structural analysis of the market for financial services. Taking a historical and institutional perspective and making use of the concept of path dependence was helpful for providing a comprehensive impression and understanding of the regional dynamics, problems and opportunities in rural areas in Piura. The analysis was set at the regional level in order to provide useful information for financial institutions such as MFIs and insurance companies that might be interested in the market for possible development of innovative financial products.

8.1 Vulnerability or resilience

Many factors contribute to the vulnerability of rural farmers' households and the climatic risks they have been exposed to for many centuries. The livelihoods and vulnerability context in which rural households in the region of Piura live was analyzed. A main emphasis was set on the description of households' assets and access to these and the trends, shocks and seasonality they have to live with.

8.1.1 Socio-economic characteristics of the households

With regard to human capital, it is generally said that the higher the number of earners in a household and the better their health, the higher is their livelihood security. The vulnerability of the surveyed households can mainly be related to the low diversification of income-earning activities, as most of them only practice one activity, namely agriculture. Additionally, the vulnerability to external shocks is increased due to the fact that agricultural activities are highly dependent on climate.

Regarding financial capital, in most cases surveyed, the monthly income does not cover the households' monthly expenses. The situation is similar with the costs for inputs and production of the crops, where these outweigh the income from the sale of the crops. Moreover, considering in-kind savings, it can be said that these are practically non-existent. Finally, with regard to other types of savings, the households have some basic assets and especially the sale of livestock is considered as a quick means to get to some money in difficult times.

Considering social capital, in difficult times, the social ties and networks that rural households rely on are personal and informal relationships such as kinship ties, neighbors and friends. Formal organizations and networks are not very common except the peasant community and formal product chains. Support from and trust in governmental bodies, as an effective manager in times of emergencies or disasters, are very low. Furthermore, trust in neighbors and other village members also is very low, especially related to finance. When asked about a community insurance fund, most of the surveyed households liked the idea, but said that it would not function due to lack of trust.

Regarding physical capital, the majority of the surveyed households have their own shelter and access to the most basic services. The quality of housing is not very high, and the houses are very vulnerable to heavy rainfall and floods. Most households claim to live in a flood-prone area, and generally there is no appropriate infrastructure to protect from floods and droughts, which augments the exposure of the households to these events.

Concerning natural capital, most of the surveyed households have access to land; however, in most cases this is exposed to natural phenomena such as problems of water abundance or scarcity. There is generally no infrastructure to protect from water abundance or to circumvent water scarcity. Finally, most of the farmers cultivate crops for sale at the market as well as for their own consumption, and very little conservation is practiced in the region.

The results show that there are many factors that determine the vulnerability of each household. However, it was beyond the scope of this study to analyze each household individually.

8.1.2 Vulnerability context and trends

The vulnerability context was used to describe the external environment in which people live, and thereby describing the trends, shocks and the seasonality affecting the rural population under study. It was important to understand this context because of the possible direct impact upon the people's assets and access to options that might lead to beneficial or unfavorable livelihood outcomes. The study demonstrates that farmer households are highly exposed to and frequently suffering from climatic shocks. Although being aware of their presence, unpredictability and impact, they can not prevent or cope

with them appropriately. This can be explained by factors such as low social capital, low education level, high exposure to the hazards, few assets and protection mechanisms as well as limited access to financial services.

The research shows the overwhelming amount of non-scientific information regarding climate prediction that exists in the region. Very little research has been conducted in this area, but it could be of great relevance in view of future climate change and the necessity to have reliable information for climate prediction. However, it is not clear that these indicators will still be useful with future climate variability and change. It would be interesting to conduct further research in this area and to extend the work that has already been conducted to other river basins in the region.

Furthermore, it can be stated that the surveyed population has a fairly good understanding of current environmental changes such as global warming and climate change. Most households say to have felt these changes in the last two decades with prolonged periods of drought and two very intense El Niños in 1982-83 and 1997-98. Many say that already these adverse and extreme conditions have forced them to rethink their cropping patterns and periods and some have already started to adapt to the new conditions. It becomes obvious that due to great vulnerability to climate, especially the effects of El Niño, the population in the area is already used to cope and live with such changes.

8.1.3 Coping and adapting to recurring climatic shock

Given the high exposure to extreme natural hazards, a main concern was to know how the households deal with these shocks, and what their coping and adaptation strategies are. The results confirm that the households are almost equally affected by all three events (floods, droughts and crop diseases) and that the strategies do not depend on the type of event. The most widespread strategies are to ask help from family and friends, to reduce expenses, or to ask for a credit. Interestingly, a high percentage of households claimed not to do anything, as they said that nothing can be done, when there is no water for irrigation or when the fields are flooded. The strategy of doing extra work is also widespread but subject to unfavorable working conditions and low-wage jobs, as most surveyed household members have a low education level and few marketable skills. In many cases, however, doing extra-work is the only option to make up for the losses and to ensure food security during disaster times. Hence, it can be asserted that in general the coping

strategies of local farmers remain weak because of lack of money, lack of know-how and technical assistance as well as a lacking culture of protection or insurance. Only a few farmers, mainly medium size and belonging to product chains, receive credit as well as technical assistance and therefore seem to be prepared for future climate-related shocks.

When taking a longer term view and analyzing the households' knowledge of climate change and global warming as well as their possible adaptation strategies to these events, the results illustrate that in most cases the households know about these events and their possible impacts on their livelihood. Nevertheless, the survey indicated that farmers in many cases do not adapt and prepare their crops for a water-scarce or -abundant year in the field, because they either stop growing for that season or continue business as usual, i.e., do not change anything. This shows that most households are not taking a pro-active approach but rather a fatalistic attitude, meaning that many people think that they are powerless to do anything other than they actually do, arguing that it depends on nature and the will of God.

Nevertheless, in addition to the above-mentioned strategies, a quite remarkable number of households mentioned other interesting strategies that can be classified as adaptation to climate change strategies, such as diversification of crops and changing to more resistant crops. A few households also mentioned that they would look for a new job as a means to adapt to these adverse circumstances and this brings us back to the diversification of income activities. It is necessary, however, to point out that although these strategies can be classified as adaptation to climate change, they build upon decades' and centuries' experience with climate-related shocks.

However, it becomes clear that most of these strategies require some kind of investments and funds. The farmers have suggested many options but as they claim themselves, they lack the necessary funds to implement the proposed strategies, e.g., making use of advanced crop mechanisms and more resistant crop varieties, and more so the infrastructure, e.g., deep wells, riverside defense, reservoirs and drains need to be constructed. It is thus necessary to coordinate the efforts and intentions of local farmers with the local, regional and national level institutional structures, initiatives and policies for disaster and climate risk management in order to build resilience and complement the strategies of the farmers.

8.2 Is the market appropriate and ready?

The study provides a structural analysis of market and institutions in order to determine the demand for micro-insurance and related risk-transfer mechanisms of local farmers, and analyzes the capacity of the market to support and offer these financial tools. It becomes clear that in the region of Piura, there are many factors that have contributed to a serious lack of these services especially in the last decade since the El Niño in 1997-98. The results also show that there is a high demand for micro-credit services with low interest rates and few requirements. Moreover, the farmers mentioned that they would need subsidies for export products as well as technical assistance and capacity building for the successful management of their crops and the further marketing of their products. It seems there is a general reluctance of some farmers to borrow from formal institutions, due to lack of education, lack of guarantees and fear of losing the collateral.

With regard to agricultural insurance mechanisms, it was difficult to determine the demand as most of the farmers do not necessarily know about these schemes. Hence, one very important problem, if not the main problem, affecting the development of micro-insurance services is the low insurance culture or low financial literacy prominent in rural areas in Piura. This applies to all kinds of insurance products. The reasons are that financial markets in rural areas are little developed and insurance products are generally not very much spread. Weather insurance through index-based or other insurance instruments for farmers and for local and national governments appear to be increasingly important. However, it needs to be considered that especially changes in climate and uncertainty about future climate change can make insurance products more expensive and less appropriate for compensating losses and mitigating risks. Furthermore, the low level of financial literacy and the almost complete lack of a culture of insurance in rural areas in Piura make it difficult to develop such products at an affordable price.

Nevertheless, the selection of schemes and instruments that have been described for the region of Piura, especially bundled credit insurance schemes as well as fondos seem promising for reducing the vulnerability of rural households in the long term and fostering their resilience against climate-related shocks in the future. However, the inclusion of specific conditions that foster risk reduction measures in the insurance policy and contract is recommended. For this reason, implementation of pilot projects, building of capacities

and education, and offer of insurance instruments should form part of an integrated disaster risk management strategy.

8.3 Can resilience be built?

The study focuses on the concept of resilience mainly to provide the local institutions in the region with ideas on how to build resilience by determining how a system can organize itself in order to increase its capacity for learning from past disasters for better future protection and to improve risk-reduction measures. Building resilience depends on many factors, i.e., disaster risk management, knowledge and communication, good governance and institutions, correct decisions and actors, and capacity building, etc..

The study describes the many institutions and organizations that exist. Several initiatives, different measures and specific strategies for risk reduction and climate-risk management are already being taken at different levels, i.e., national, regional, and local. However, these initiatives and strategies are mostly taken in isolation from one another. The importance of efficient coordination amongst the institutions to generate synergies and avoid duplicity of functions and contradictions that cause confusion and major costs for the economic agents involved in the sector are increasingly recognized but still not effectively acted upon. Hence, it is necessary to foster syneries and cooperation amongst these institutions and organizations at all levels in order to build resilience. The creation of a multi-sectoral round-table with a representative from each institution and interest group is recommened.

Resilience-building is a long-term process that needs to be fostered, analyzed and monitored over years and centuries. For this reason, it is suggested that further research be conducted by carrying out a pilot project that monitors the livelihoods' context, coping and adaptation strategies and risk-reduction measures of rural farmers before and after these receive agricultural micro-credits and micro-insurance services. This way, it could be possible to determine in which way financial mechanisms contribute to building the resilience of these households.

9 Acronyms and abbreviations

AACHCHP	Autonomous Authority of the Piura and Chira River Basins
AGROASEMEX	Mexican National Insurance Institution
BA	Banco Agrario
CAP	Agrarian Production Cooperative
CAUs	Cooperatives of Users
CCTs	Communal Cooperatives of Workers
CEPES	Peruvian Center for Social Studies
CEPESER	Peruvian Central for Services
CGAP	Consultative Group to Assist the Poor
CIES	Consortium for Economic and Social Research
CIPCA	Centre for Research and the Promotion of Peasantry
CMACs	Municipal Savings and Credit Associations
COFIDE	Financial Development Corporation
CONAM	National Council for the Environment
CONCYTEC	National Council for Science and Technology
COP 14	United Nations Climate Change Conference in Poznán
COREDEC	Regional Committee for Civil Defense
CPPS	Permanent Commission for the South Pacific
CRACs	Rural Savings and Credit Associations
DFID	UK Department for International Development
DHN	Navy's Hydrographic and Navigation Office
DRM	Disaster Risk Management
EDPYMEs	Regulated NGOs for small enterprise development
ENFEN	National Study of the El Niño phenomenon
ENSO – El Niño	El Niño Southern Oscillation
ERFEN	Regional Study of the El Niño phenomenon
FAO	Food and Agriculture Organization
FEDECAP	Federation of Piuran peasants
FTA	Free Trade Agreement
GECHS	Global Environmental Change and Human Security
GRADE	Analisis Group for Development
IADB	Inter-American Development Bank
IDE-JETRO	Institute of Developing Economies Japanese External Trade Organization
IEP	Institute for Peruvian Studies
IGP	Peruvian Geophysics Research Institute
IHDP	International Human Dimension Program on Global Environmental Change
ILO-MIF	Micro-insurance Innovation Facility of the International Labor Organization
IMARPE	The Peruvian Marine Research Institute
INDECI	National Institute of Civil Defense
INRENA	National Natural Resources Institute
IPCC	Intergovernmental Panel on Climate Change
MEF	Ministry of Economy and Finance

MFIs	Micro-finance Institutions
MINAG	Ministry of Agriculture
MINAM	Ministry of Environment
NGO	Non-governmental Organization
NOAA	National Oceanic and Atmospheric Organization
OECD	Organization for Economiy Cooperation and Development
PIDECAFÉ	Integral Program for the Development of Coffee (Local NGO)
PRA	Participatory Rural Appraisal
RA	Resilience Alliance
RPP	Radio Programs of Peru
RRA	Rapid Rural Appraisal
SAIS	Agrarian Social Interest Societies
SBS	Superintendent of Banks, Insurance and Pensions
SENAMHI	National Service of Meteorology and Hydrology
SINAMOS	National System of Support for Social Mobilization
SLA	Sustainable Livelihoods Approach
UCPs	Communal Production Units
UNDP	United Nations Development Program
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
UNU-EHS	United Nations University Institute for Environment and Human Security
USAID	United States Agency for International Development
WMO	World Meteorological Organization

10 References

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11 Appendices

11.1 Household questionnaire

Encuesta sobre estrategias locales de adaptación a inundaciones, sequías y al cambio climático y mecanismos financieros*
(*Micro-créditos, micro-seguros, fondos de aseguramiento agrarios etc.).

Buenos días, mi nombre es _____. Soy miembro(a) de un equipo de investigación que está realizando un estudio sobre estrategias locales de adaptación a inundaciones, sequías y al cambio climático, crédito y producción agrícola en el Alto, Medio y Bajo Piura. Una investigadora de la Universidad de Bonn en Alemania está dirigiendo el estudio para su tesis de doctorado y contamos con el apoyo de las instituciones locales que otorgan créditos o trabajan con los agricultores como: la Caja Municipal de Piura, la Cooperación Técnica Alemana (GTZ), la Universidad Nacional de Piura, CIPCA, Juntas de Regantes y otros. Ud. es uno de los aproximadamente 500 miembros de hogares o agricultores a quienes estamos visitando en el Alto, Medio, Bajo Piura y El Chira. Su hogar/chacra fue seleccionado(a) al azar.

El principal objetivo de la investigación es determinar los riesgos y las vulnerabilidades de pequeños y medianos agricultores frente a inundaciones, sequías y al cambio climático en el Norte del Perú así que determinar las estrategias locales de adaptación a estos eventos. La investigación consiste en conducir un análisis estructural del mercado y de las instituciones con un énfasis particular en las condiciones locales del Departamento de Piura. Se espera determinar la demanda para micro-seguros y mecanismos de transferencia de riesgos relacionados, así como analizar la capacidad del mercado para ofrecer esos instrumentos financieros.

Todos los datos que Usted nos proporciona son exclusivamente para fines académicos y siempre se mantendrán confidenciales.

Le agradecemos el tiempo y la paciencia que nos está proporcionando.

Nombre del encuestador:	**Fecha de la encuesta:**	**Código de la encuesta:**	**Nombre del encuestado:**
Hora de inicio de la encuesta:	**Hora de fin de la encuesta:**	**Dirección del hogar:**	
Provincia:		**Nombre de la Ciudad/Pueblo/Comunidad:**	
Distrito:		**Ubicación de la chacra:**	

I. CARACTERISTICAS SOCIO – ECONOMICAS DEL HOGAR					
P. 1a		**¿Qué función tiene Usted en el hogar?**	**1** ☐**Jefe/a** **2** ☐**Esposo/a** **3** ☐**Hijo/a** **4** ☐**Hermano/a** **5** ☐**Sobrino/a** **6** ☐**Nieto/a** **7** ☐**Cuñado/a** **8** ☐**Otro miembro de familia_____** **9** ☐**Otro:_____**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 1b		**¿Cuál es su nivel de educación?**	**1** ☐**Analfabeto/a** **2** ☐**Sólo sabe escribir y leer** **3** ☐**Primaria incompleta** **4** ☐**Primaria completa** **5** ☐**Secundaria incompleta** **6** ☐**Secundaria completa** **7** ☐**Estudios Superiores**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 1c		**¿En qué trabaja Usted?**	**1** ☐**Agricultura** **2** ☐**Ganadería** **3** ☐**Peón agrícola** **4** ☐**Chichera** **5** ☐**Pensionista** **6** ☐**Comerciante** **7** ☐**Albañil** **8** ☐**Bodeguero/ Vendedor** **9** ☐**Profesor** **10** ☐**Carpintería** **11** ☐**Empleado Público** **12** ☐**Empleada doméstica** **13** ☐**Costurera** **14** ☐**Sin empleo** **15** ☐**Otro:_____**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 1d		**¿Cuántas personas viven en el mismo hogar?**	_____		
P. 1e		**¿Cuántas personas son menores de 14 años?**			

I. CARACTERISTICAS SOCIO – ECONOMICAS DEL HOGAR

P. 1f		**¿Cuántos hombres y cuántas mujeres?**	**H**_____ **M**_____
P. 1g		**¿Cuántas de las personas del hogar trabajan?**	_____
P. 1h		**¿En qué trabajan?**	**1** _____ **2** _____ **3** _____ **4** _____ **5** _____ **6** _____
P. 1i		**¿Cuál es el ingreso mensual del hogar?**	_____**Nuevos Soles** **96** ☐**No respondido** **98** ☐**No conocido** _____**US$** **97** ☐**No aplicable** **99** ☐**Falta**
P. 1j		**¿Cuántas personas contribuyen al ingreso?**	_____
P. 1k		**¿Cuáles son los gastos mensuales para el hogar?**	(ver tabla abajo)
P. 1l		**¿Cuál es el ahorro mensual del hogar?**	_____**Nuevos Soles** _____**US$**
P. 1m		**¿Hay meses en los cuáles puede ganar más?**	**1** ☐**Si** **96** ☐**No respondido** **98** ☐**No conocido** **2** ☐**No** **97** ☐**No aplicable** **99** ☐**Falta**
P. 1n		**Cuáles son:**	(ver tabla abajo)
P. 1o		**¿Por qué puede ganar más en estos meses?**	**1** _____ **2** _____ **3** _____
P. 1p		**¿Cuál es el ingreso en esos meses?**	_____**N. S.** **96** ☐**No respondido** **98** ☐**No conocido** _____**US$** **97** ☐**No aplicable** **99** ☐**Falta**
P. 1q		**¿En qué tipo de casa vive?**	**1** ☐**Propia** **2** ☐**Alquilada** **3** ☐**Herencia**

Servicio/ Gasto	**Nuevos Soles**	**US$**
Agua		
Luz		
Teléfono		
Alimentación (Comida)		
Movilidad		
Ropa		
Educación		
Otro, que:_____		

E	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**

I. CARACTERISTICAS SOCIO – ECONOMICAS DEL HOGAR					
			4 ☐Por Invasión 5 ☐Otro_____		
P. 1r		**¿De qué material es su casa?** **(señalar el material que predomina)**	1 ☐Ladrillo o material noble 2 ☐Adobe 3 ☐Hormigón 4 ☐Madera 5 ☐Carrizo 6 ☐Tabique 7 ☐Otro, que:_____		
P. 1s		**¿De qué material es el techo de su casa?** **(señalar el material que predomina)**	1 ☐Calamina 2 ☐Eternit 3 ☐Teja 4 ☐Tortilla de barro 5 ☐Otro, que:_____		
P. 1t		**¿Su casa está situada en una zona propicia a inundaciones?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta
		¿Conoce el valor de su casa?	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta
		Si, lo conoce: ¿cuál su valor en Nuevos Soles?	_____ Nuevos Soles	_____US$	
P. 1u		**¿Cuáles de esos bienes posee? (solo los que estén funcionando)**	1 ☐Teléfono fijo o celular 2 ☐Cocina a gas o eléctrica/horno 3 ☐Cocina a carbón o madera 4 ☐Motor para electricidad 5 ☐Televisor 6 ☐Radio o sistema de música/sonido 7 ☐Refrigerador o congelador 8 ☐Maquina a cocer 9 ☐Tractor 10 ☐Motor de alta presión 11 ☐Mochila de fumigar 12 ☐Carreta 13 ☐Arado de reja/Arado de mulo 14 ☐Equipo de bombeo 15 ☐Vehiculo (Carro)		

I. CARACTERISTICAS SOCIO – ECONOMICAS DEL HOGAR			
			16 ☐ **Moto** **17** ☐ **Bicicleta** **18** ☐ **Otros, cuáles:**_____
P. 1v		**¿Cuáles de esos servicios posee?**	**1** ☐ **Electricidad** **2** ☐ **Agua Potable** **3** ☐ **Desagüe** **4** ☐ **Telefónico** **5** ☐ **Ninguno** **6** ☐ **Otro:**_____
P. 1w		**¿Cuáles y cuántos de los siguientes animales posee?**	**1** ☐ **Vacunos:** _____**(Numero)** **2** ☐ **Caballos :** _____**(Numero)** **3** ☐ **Burros:** _____**(Numero)** **4** ☐ **Ovejas:** _____**(Numero)** **5** ☐ **Chanchos:** _____**(Numero)** **6** ☐ **Caprinos:** _____**(Numero)** **7** ☐ **Gallinas:** _____**(Numero)** **8** ☐ **Pavos/Pavas:**_____**(Numero)** **9** ☐ **Patos/Gansos:**_____**(Numero)** **10** ☐ **Ninguno** **11** ☐ **Otros:**_____**(Numero)**_____
P. 1x		**¿Qué hace cuando alguien de su familia está en dificultades económicas?** **(escoja la que utiliza más)**	**1** ☐ **Pide ayuda de familia o amigos** **2** ☐ **Pide ayuda del empleador** **3** ☐ **Pide ayuda de la iglesia, ONG o otra institución** **4** ☐ **Pide crédito** **5** ☐ **Disminuye gastos para comida** **6** ☐ **Disminuye otros gastos** **7** ☐ **Hace trabajo adicional** **8** ☐ **Tarda en pagar cuentas** **9** ☐ **Nada** **10** ☐ **Otro:**_____

I. CARACTERISTICAS GEOGRAFICAS DE LAS TIERRAS AGRÌCOLAS					
P. 2a		**¿El hogar cuenta con tierras agrícolas?**	**1** ☐**Propias** **2** ☐**Alquiladas** **3** ☐**Herencia** **4** ☐**No tiene** **5** ☐**Otro:**_____	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2b		**¿Cuántas hectáreas posee?**	_____**ha**		
P. 2c		**¿Conoce el valor de las tierras que posee?**	**1** ☐**Si** **2** ☐**No**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2d		**Si lo conoce: ¿cuál es su valor en Nuevos Soles/ por hectárea?**	_____ **Nuevos Soles/Ha** _____**US$/ha**		
P. 2e		**¿Tiene título de propiedad de sus tierras?**	**1** ☐**Si** **2** ☐**No**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2f		**Su chacra está en un terreno predominantemente** (**Marque lo predominante**)**:**	**1** ☐**Plano** (**0-5 grados de pendiente**) **2** ☐**Ondulado**(5-15 **grad. de pendiente**) **3** ☐**Empinado** (**15 a 25 grad. de pend.**) **4** ☐**Muy empinado** (**>25 grad. de pend.**)	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2g		**¿Qué río provee agua para regadío?**	_____		
P. 2h		**¿Qué canales utiliza para regar el fundo?**	**1** _____ **2** _____ **3** _____		
P. 2i		**¿Existen pozos para extraer agua subterránea?**	**1** ☐**Si** **2** ☐**No**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2j		**¿Si sí, cuántos y de qué capacidad?** **N.B. Indicar el nombre del pozo (si tiene) o localización y la capacidad.**	**1** _____ _____ **m^3/ha** **2** _____ _____ **m^3/ha** **3** _____ _____ **m^3/ha**		
P. 2k		**¿Cuál es la disponibilidad de agua promedio en la chacra?**	_____**m^3/ha**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2l		**¿Cuál es el mes de menor disponibilidad de agua y a cuánto alcanza el flujo disponible en este mes?**	**Mes:**_____ _____**m^3/ha**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2m		**¿Tuvo suficiente disponibilidad de agua para garantizar una producción normal en la campaña**	**1** ☐**Si** **2** ☐**No**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**

I. CARACTERISTICAS GEOGRAFICAS DE LAS TIERRAS AGRÌCOLAS

		de este año?			
P. 2n		**¿Piensa que habrá suficiente disponibilidad de agua para garantizar una producción normal en la campaña que viene?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 2o		**¿Sus tierras están situadas en una zona propicia a inundaciones?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 2p		**¿Sus tierras están situadas en una zona propicia a sequías?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 2q		**¿Existen zonas del terreno más expuestas a inundaciones o sequías?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
			Explique: _____		

P. 2r — **Por favor detalle el sistema de riego de la chacra**

Gravedad		Bombeo		Pozo		De secano		Otro:_____	
Cultivo	Área (Ha)	Cultivo	Área (Ha)	Cultivo	Área (Ha)	Cultivo	Área (Ha)	Cultivo	Área (Ha)

P. 2s — **¿Cuántas hectáreas del área de su chacra utiliza para?**

Cultivo/Hectárea	Ha
Cultivos	
Pastos y Ganado	
Bosque - Reforestación	
Otros:_____	

P. 2t — **¿Cuáles son los principales cultivos, cuántas toneladas cosecha por hectárea y a qué precio lo vende?** **(periodo de referencia: última campaña)**

Cultivo	Toneladas /ha	Precio (N.S.)	Precio (US$)
1			
2			
3			
4			

P. 2u		**¿Está satisfecho con el precio de venta de su cultivo?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 2v		**¿Su cultivo forma parte de una cadena productiva?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**

I. CARACTERISTICAS GEOGRAFICAS DE LAS TIERRAS AGRÌCOLAS

Precisar el cultivo:_____
_____

P. 2w **¿Quién es el comprador directo/inmediato?** _____

P. 2x **¿Cuál es su objetivo al realizar sus actividades productivas?**

Actividades/ Objetivos	Venta al mercado	Auto-consumo	Conser-vación	True-que	Otro: _____
Cultivos					
Pastos y Ganado					
Bosques					
Otras actividades: _____					

P. 2y **¿Qué cultiva y en que campaña lo hace? (los principales)**

Cultivos	Campaña Grande	Campaña Chica	Permanente

P. 2z **¿De qué depende el número de campañas agrícolas? Explica por favor**

1 _____
2 _____

P. 2aa **¿Cuál es el ingreso en la campaña grande?** _____**Nuevos Soles** _____**US$**

P. 2bb **¿Cuál es el ingreso en la campaña chica?** _____**Nuevos Soles** _____**US$**

P. 2cc **¿Cuáles son los gastos por la campaña para la chacra?**

Gasto en Nuevos Soles o US$ (precisar)	Campaña Grande	Campaña Chica	Cultivo Permanente
Preparación del suelo			
Agua			
Semilla			
Siembra			
Fertilizantes y aplicación			
Herbicidas y aplicación			
Pesticidas y aplicación			
Fungicidas y aplicación			
Servicio de Peón agrícola			
Servicio de arado			
Otro, que:			
Costos Totales			

I. CARACTERISTICAS GEOGRAFICAS DE LAS TIERRAS AGRÌCOLAS					
P. 2dd		**¿Recibe alguna ayuda del estado por parte de adquisición de los insumos?**	**1** ☐**Si** **2** ☐**No**	**96** ☐**No respondido** **97** ☐**No aplicable**	**98** ☐**No conocido** **99** ☐**Falta**
P. 2ee		**Si sí, para cuales:**	**1** ☐**Semillas** **2** ☐**Abono** **3** ☐**Fertilizantes** **4** ☐**Pesticida** **5** ☐**Herbicida** **6** ☐**Maquinaria** **7** ☐**Herramientas** **8** ☐**Concentrados** **9** ☐**Plantones** **10** ☐**Otros, cuales:** _____		
P. 2ff		**¿Que otra ayuda del Estado recibe?**	_____		

III. RIESGOS Y VULNERABILIDADES				
P. 3a ¿En los últimos 10 años por favor indicar los años que eran buenos, regulares o malos económicamente?	**Bueno +**	**Regular**	**Malo -**	**¿Porque?**
2007				
2006				
2005				
2004				
2003				
2002				
2001				
2000				
1999				
1998				
1997				

P. 3b		**¿Ha tenido pérdidas a la producción de cultivos anteriormente?** **Qué cultivos: _____** **_____**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 3c		**Indica el orden de importancia con respecto al impacto negativo económico de los siguientes eventos en su chacra** **1= lo más afectado** **4= lo menos afectado**	**1 ☐Inundación** **2 ☐Sequía** **3 ☐Plaga o enfermedad afectando al cultivo** **4 ☐Otro, que:_____**		
P. 3d		**¿Ha habido inundaciones o sequías en la chacra en los últimos 10 años; en que año y que era el efecto de la pérdida?**			

Evento	Año	Efecto de la Pérdida		
		Baja	Moderada	Grave

III. RIESGOS Y VULNERABILIDADES

P. 3e **¿Existen obras construidas en la chacra para evitar las inundaciones o sequías?**

Evento	Tipo de Obra	Año de Construcción	Estado de la obra		
			Buena	Regular	Mala
Para evitar inundaciones					
Para evitar sequías					

P. 3f **Por favor indica las pérdidas anteriores ocurridas en su chacra**

Año	**Cultivo**	**Causa de Pérdida**	**% de producción Pérdida (aprox.)**	**Valor de la Pérdida en Nuevos Soles o US$**

P. 3g **¿Cuáles de estos eventos cree que van a ocurrir en su chacra en el futuro?**

Evento/Probabilidad	**A: Muy Probable**	**B: Probable**	**C: Improbable**
1 Inundación			
2 Sequía			
3 Plaga o enfermedad al cultivo			
4 Otro, que:_____			

IV. ESTRATEGIAS DE AUTOPROTECCIÓN Y DE ADAPTACIÓN (COPING STRATEGIES)			
P. 4a		**¿De qué manera prevee un año seco?** **N.B. Para cada respuesta dejarle al encuestado precisar y elaborar la información que recibe o que deduce primero y después poner las categorías.**	_____ _____ _____ _____ _____ **1 ☐Clima – Pronóstico climático:**_____ **2 ☐Aves, cuáles:**_____ **3 ☐Animales, cuáles:**_____ **4 ☐Plantas, cuáles:**_____ **5 ☐Información del Gobierno, ONG, etc.**_____ **6 ☐Otro, que:**_____
P. 4b		**¿De qué manera prevee un año lluvioso?** **N.B. Para cada respuesta dejarle al encuestado precisar y elaborar la información que recibe o que deduce primero y después poner las categorías.**	_____ _____ _____ _____ **1 ☐Clima – Pronóstico climático:**_____ **2 ☐Aves, cuáles:**_____ **3 ☐Animales, cuáles:**_____ **4 ☐Plantas, cuáles:**_____ **5 ☐Información del Gobierno, ONG, etc.**_____ **6 ☐Otro, que:** _____
P. 4c		**¿De qué manera prevee un evento El Niño?** **N.B. Para cada respuesta dejarle al encuestado precisar y elaborar la información que recibe o que deduce primero y después poner las categorías.**	_____ _____ _____ **1 ☐Clima – Pronóstico climático:**_____ **2 ☐Aves, cuáles:**_____ **3 ☐Animales, cuáles:**_____ **4 ☐Plantas, cuáles:**_____ **5 ☐Información del Gobierno, ONG, etc.**_____ **6 ☐Otro, que:** _____

IV. ESTRATEGIAS DE AUTOPROTECCIÓN Y DE ADAPTACIÓN (COPING STRATEGIES)

P. 4d Por favor indica su capacidad de manejar los eventos mencionados debajo y porque	Bueno	Regular	Malo	¿Por qué?
1 Inundación				
2 Sequía				
3 Plagas y enfermedades				
4 Otro:_____				

P. 4e		¿Cómo se prepara para un año seco?	En la casa 1 ☐Acopia agua 2 ☐Acopia alimentos 3 ☐Ahorra 4 ☐No hago nada 5 ☐Otro, que:_____ En la charca 1 ☐No cultivo nada 2 ☐Diversifico los cultivos, cuáles:_____ 3 ☐Cambio por cultivos más resistentes, cuáles_____ 4 ☐Busco otro trabajo, en qué y a donde:_____ 5 ☐ Migro a otra zona temporalmente, a dónde y que cultiva: _____ 6 ☐Acumulo cultivos en la campaña anterior u otros bienes 7 ☐Utilizo fertilizantes 8 ☐No cambio nada 9 ☐Otro, que:_____	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4f		¿Cómo se prepara para un año lluvioso?	En la casa 1 ☐Acopia agua 2 ☐Acopia alimentos 3 ☐Ahorra 4 ☐No hago nada 5 ☐Otro, que:_____ En la chacra 1 ☐No cultivo nada 2 ☐Diversifico los cultivos, cuáles:_____	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta

IV. ESTRATEGIAS DE AUTOPROTECCIÓN Y DE ADAPTACIÓN (COPING STRATEGIES)					
			3 ☐Cambio por cultivos más resistentes, cuáles_____ 4 ☐Busco otro trabajo, en qué y donde:_____ 5 ☐ Migro a otra zona temporalmente, a dónde y que cultiva: _____ 6 ☐Acumulo cultivos en la campaña anterior u otros bienes 7 ☐Utilizo fertilizantes 8 ☐No cambio nada 9 ☐Otro, que:_____		
P. 4g		**¿En los últimos 20 años, piensa que el clima está cambiando?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta
P. 4h		**¿Cómo afecta el cambio climático a su cultivo?**	1 _____ 2 _____ 3 _____		
P. 4i		**¿Piensa que se puede hacer algo para adaptarse a los cambios del clima y evitar pérdidas agrícolas en el futuro?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta
P. 4j		**¿Qué medidas tomaría Usted para adaptarse al cambio climático? ¿Qué propone?**	1 _____ 2 _____ 3 _____		
P. 4k		**¿Recibe alguna información sobre el cambio climático? Por favor dé ejemplos**	1 _____ 2 _____ 3 _____		
P. 4l		**¿De quiénes recibe la información?**	1 _____ 2 _____ 3 _____		
P. 4m		**¿Cómo maneja pérdidas asociadas a sequías después o durante la sequía? ¿Qué hace? (escoja la que utiliza más)**	1 ☐Pide ayuda de familia o amigos 2 ☐Pide ayuda del empleador 3 ☐Pide ayuda del Gobierno 4 ☐Pide ayuda de la iglesia, ONG o otra institución 5 ☐Pide crédito 6 ☐Disminuye gastos para comida 7 ☐Disminuye otros gastos 8 ☐Hace trabajo adicional 9 ☐Tarda en pagar cuentas	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta	

IV. ESTRATEGIAS DE AUTOPROTECCIÓN Y DE ADAPTACIÓN (COPING STRATEGIES)				
			10 ☐Nada 11 ☐Otro, que:_____	
P. 4n		**¿Cómo maneja pérdidas asociadas a inundaciones después o durante la inundación? ¿Qué hace?** (escoja la que utiliza más)	1 ☐Pide ayuda de familia o amigos 2 ☐Pide ayuda del empleador 3 ☐Pide ayuda del Gobierno 4 ☐Pide ayuda de la iglesia, ONG o otra institución 5 ☐Pide crédito 6 ☐Disminuye gastos para comida 7 ☐Disminuye otros gastos 8 ☐Hace trabajo adicional 9 ☐Tarda en pagar cuentas 10 ☐Nada 11 ☐Otro, que:_____	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4o		**¿La estrategia de protección logra cubrir la pérdida total?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4p		**¿Cambiaría su estrategia de manejar sequías la próxima vez que piensa que va a ver sequía?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4q		**¿Si sí, que cambiaría por favor elabore en detalle?**	1 _____ 2 _____	
P. 4r		**¿Cambiaría su estrategia de manejar inundaciones la próxima vez que piensa que va a ver inundación?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4s		**¿Si sí, que cambiaría por favor elabore en detalle?**	1 _____ 2 _____	
P. 4t		**¿Recibió asistencia del Municipio durante los desastres en el pasado?**	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4u		**¿Si sí, que tipo de asistencia recibió?**	1 ☐Asistencia humanitaria 2 ☐Alimentos 3 ☐Ropa 4 ☐Asistencia médica 5 ☐Transferencia de efectivo (Fondos sociales) 6 ☐Otro, que: _____	96 ☐No respondido 97 ☐No aplicable 98 ☐No conocido 99 ☐Falta
P. 4v		**¿Recibió asistencia de entidades**	1 ☐Si	96 ☐No respondido 98 ☐No conocido

IV. ESTRATEGIAS DE AUTOPROTECCIÓN Y DE ADAPTACIÓN (COPING STRATEGIES)					
		financieras (Caja Municipal, Banco) durante un desastre en el pasado?	**2 ☐No**	**97 ☐No aplicable**	**99 ☐Falta**
P. 4w		**¿Si sí, que tipo de asistencia recibió?**	**1 ☐Crédito** **2 ☐Otro, que:_____**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 4x		**¿Recibe asistencia técnica?** **Por ejemplo: Extensión agrícola, etc.**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 4y		**Si sí, ¿de que institución recibe asistencia técnica y para qué?**	**Institución** / **Tipo de Asistencia Técnica**		
P. 4z		**¿Pertenece a alguna organización o cooperativa en su distrito?**	**1 ☐ Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 4aa		**Si sí, ¿a cuál o cuáles organizaciones pertenece?**	**1** _____ **2** _____ **3** _____		
P. 4bb		**¿Qué tipo de redes sociales tiene?**	**1 ☐Familiares** **2 ☐Vecinos** **3 ☐Amigos** **4 ☐Comunidad Campesina** **5 ☐Asociación de auxilio mutuo** **6 ☐Otro, que:_____**		
P. 4cc		**¿Cómo funcionan esas redes en tiempos de desastres?**	**1 ☐Bueno** **2 ☐Regular** **3 ☐Malo**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 4dd		**¿Cuales cree qué son los tres problemas principales del Sector Agrario?**	**1** _____ **2** _____ **3** _____		
P. 4ee		**Si lo eligen alcalde de su distrito, ¿qué medidas promovería para mejorar el sector agrario?**	**1** _____ **2** _____ **3** _____		

V. CREDITO					
P. 5a		**¿Tiene un crédito?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 5b		**Si sí, ¿cuál es el monto total del crédito que recibió este año?**	**_____ Nuevos Soles _____US$**		
P. 5c		**¿Cuál es la tasa de interés del crédito?**	**_____ %**		
P. 5d		**¿Ha recibido un crédito en el pasado? (el último)**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 5e		**Si sí, ¿cuál era el monto total del crédito que recibió en los años pasados (por año) y qué era la tasa de interés del crédito?**	**_____ Nuevos Soles _____US$** **_____ %**		
P. 5f		**¿Tuviste algún problema en pagar el crédito?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**
P. 5g		**Si sí, ¿qué tipo de problema?**	**1 _____**		
P. 5h		**¿Para qué recibió el crédito?**	**1 ☐Comprar semillas para agricultura** **2 ☐Cultivos** **3 ☐Crianzas** **4 ☐Comercialización** **5 ☐Conservación del Bosque** **6 ☐Infraestructura** **7 ☐Conservación del suelo** **8 ☐Mejorar cantidad de agua** **9 ☐Maquinaria y herramientas** **10 ☐Infraestructura de producción** **11 ☐Construcción de casa** **12 ☐Gastos de matrimonio** **13 ☐Gastos de Muerte/Enfermedad** **14 ☐Gastos diarios (Compra de comida, etc.)** **15 ☐Para pagar otro crédito** **16 ☐Otro, por favor especifica: _____** **17 ☐Recibió el crédito para lo mencionado arriba pero lo utilizó para otra cosa, especifica:_____**		
P. 5i		**¿Quién le dio/otorgó el crédito?**	**1 ☐Gobierno Regional o Local** **2 ☐Banco Agrario - Agrobanco** **3 ☐Caja Municipal de _____**		

V. CREDITO					
			4 ☐EDYFICAR 5 ☐Prestamista local informal (Alquilador de dinero) 6 ☐Unión crediticia 7 ☐Cooperativa 8 ☐Asociación de agricultores 9 ☐Asociación de obreros 10 ☐ONGs 11 ☐Iglesias 12 ☐Escuelas 13 ☐Empleadores grandes 14 ☐Bodeguero 15 ☐Dueño de la casa 16 ☐Pariente/Familiar 17 ☐Amigos/Vecinos 18 ☐Otro, especifica: _____		
P. 5j		¿Por qué razón prestó de esta fuente? Explica por favor	1 _____ 2 _____		
P. 5k		¿Si prestó de un prestamista local informal indica la razón?	1 ☐No califica para crédito formal 2 ☐Costumbre de prestar al prestamista informal local 3 ☐No sabe 4 ☐Amigos/Familiares 5 ☐Otra razón, especifica: _____		
P. 5l		¿Es suficiente el monto del crédito?	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta
P. 5n		¿Está preocupado por deudas ahora?	1 ☐Si 2 ☐No	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta
P. 5o		¿Porqué está preocupado por deudas?	_____		
P. 5p		¿Con qué institución quisiera un crédito?	_____		
P. 5q		¿Para qué necesitaría el crédito?	_____		
P. 5r		¿En cuánto tiempo piensa que podría pagar el crédito?	_____		
P. 5s		¿Cuánto debería ser el monto del crédito?	_____ Nuevos Soles_____US$		
P. 5t		¿Cuánto debería ser la tasa de interés del crédito?	_____%	96 ☐No respondido 97 ☐No aplicable	98 ☐No conocido 99 ☐Falta

VI. PERCEPCION, DEMANDA Y ENTENDIMIENTO DE SEGUROS						
P. 6a		**¿Cómo maneja económicamente las siguientes catástrofes?**	**Catástrofe/Manejo**	**Bien**	**Regular**	**Mal**	**Fuera de Control – No se puede hacer nada**
			Sequías				
			Olas de Calor				
			Olas de Frío				
			Inundación				
			Plaga o enfermedad del cultivo				
			Otro:_____				
P. 6b		**¿Entiende como funciona un seguro?** **Explica: _____** **_____** **_____**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**		**98 ☐No conocido** **99 ☐Falta**	
P. 6c		**¿Cuál es su percepción sobre el uso de seguros?**	**1 ☐Buena** **2 ☐Mala** **3 ☐No tiene opinión**	**96 ☐No respondido** **97 ☐No aplicable**		**98 ☐No conocido** **99 ☐Falta**	
P. 6d		**¿Tuvo un seguro en el pasado?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**		**98 ☐No conocido** **99 ☐Falta**	
P. 6e		**¿Qué tipo de seguro tuvo?**	**1 ☐Enfermedad** **2 ☐Accidente** **3 ☐Vida (muerte)** **4 ☐Casa** **5 ☐Incendio** **6 ☐Agrícola** **7 ☐No sabe** **8 ☐Otro: _____** **_____**	**96 ☐No respondido** **97 ☐No aplicable**		**98 ☐No conocido** **99 ☐Falta**	
P. 6f		**¿Como fue su experiencia con seguros?**	**1 ☐Buena** **2 ☐Regular** **3 ☐Mala**	**96 ☐No respondido** **97 ☐No aplicable**		**98 ☐No conocido** **99 ☐Falta**	
P. 6g		**¿Compraría seguro para proteger su chacra y cultivos contra fenómenos catastróficos (Inundación, sequías, plagas, olas de calor y de frío)?**	**1 ☐Si** **2 ☐No**	**96 ☐No respondido** **97 ☐No aplicable**		**98 ☐No conocido** **99 ☐Falta**	

P. 6h		**¿Si sí cuanto pagaría para un seguro agrícola en Nuevos Soles por hectárea? ***	**_____ Nuevos Soles/ha _____US$/ha**		
P. 6i		**¿Qué le parece un fondo de aseguramiento contra desastres entre comuneros? ****	**1 ☐Bueno** **2 ☐Malo** **3 ☐No tiene opinión**	**96 ☐No respondido** **97 ☐No aplicable**	**98 ☐No conocido** **99 ☐Falta**

* El costo del seguro depende del cultivo a asegurar y de los riesgos a proteger. Te pongo como ejemplo lo siguiente: Si en una región se siembran 1000 Ha. de arroz y por sequía se dañan 50 la pérdida bruta es 5%. Si el daño de las 50 es al 20% quiere decir que del 5% se perdió en números absolutos el 1%. Una vez que tienes la pérdida neta del 1% viene el incremento de gastos. Si una aseguradora tiene un gasto del 30% el costo del seguro sería 1%/0.70, es decir agregas gasto del 30% para llegar a una prima comercial de 1.43% sobre la suma asegurada (valor asegurado).

Por ejemplo, si se aseguran 1000 soles por hectárea, el costo del seguro serían (1000*1.43%) = 14.30 soles. Lo anterior fue solo un ejemplo, habría que ver cual es el cultivo, cuales riesgos, como son las pérdidas normalmente, etc. Generalmente los costos de los seguros pueden ir desde un 3% hasta un 15%, depende de la región, de los riesgos y del cultivo.

** **Fondos de aseguramiento:** son asociaciones civiles con fines no lucrativos integradas por los propios productores quienes a través de ese instrumento deciden asociarse para otorgarse a si mismos el servicio del seguro agropecuario. Ejemplo: Cada comunero cotiza digamos 20 Soles/ha/mes en un fondo común y este fondo puede ser administrado por la Caja Municipal y ganar intereses.

11.2 Documentation of workshops

11.2.1 Documentation of international workshop

The presentations and complete documentation can be downloaded from the GTZ website in Peru (http://www.riesgoycambioclimatico.org/tallerPiura/index.html)

11.2.2 Documentation of focus-group workshop

MEMORIA DEL TALLER
ESTRATEGIAS DE ADAPTACIÓN AL CAMBIO CLIMÁTICO, SERVICIOS FINANCIEROS Y SEGUROS EN EL SECTOR AGROPECUARIO

DIRIGIDO A MIEMBROS DE JUNTAS DE REGANTES Y DE ASOCIACIONES DE PRODUCTORES AGRICOLAS

Piura, 03 de Marzo de 2008
Lugar: Auditorium Biblioteca Central Universidad Nacional de Piura

Philine Oft

1. Presentación[13]

El día 03 de marzo de 2007, se realizó el taller ***Estrategias de Adaptación al Cambio Climático, Servicios Financieros y de Seguros***, promovido por PDRS / GTZ Sede Piura, con la participación de miembros de Juntas de Regantes de la Región Piura y miembros de asociaciones de productores de la región.

El objetivo de este taller fue ***analizar las estrategias de autoprotección que utilizan los agricultores frente a fenómenos y cambios climáticos, así como conocer los servicios financieros y de seguros con los que cuentan los participantes, así como determinar que otros servicios financieros y de seguros requieren.***

La facilitación del taller estuvo a cargo de la srta. Philine Oft; estudiante de doctorado de la UNU – EHS, además se contó con el apoyo en facilitación y logística de María Isabel Gonzáles; practicantes PDRS / GTZ sede Piura, Karina Gutiérrez Valdiviezo; practicante SENAMHI y de David Moreno Córdova, estudiante Facultad de Economía UNP.

2. Presentación del Taller

Philine Oft, fue la encargada de dar la bienvenida a los participantes y hacer la presentación general del taller, así mismo realizó una exposición introductoria, sobre Cambio Climático, servicios financieros y seguros agropecuarios con el fin de enmarcar a los asistentes en la temática a desarrollar a lo largo del taller.

El taller se desarrollo a través de ejercicios, donde los participantes pudieron compartir sus experiencias e inquietudes.

3. Desarrollo del Taller

A lo largo del desarrollo del taller se utilizaron distintas metodologías, como exposiciones, ejercicios participativos y plenarias.

[13] Esta memoria fue realizada con apoyo de María Isabel Gonzáles

El taller estuvo conformado por 4 ejercicios participativos donde cada participante impartió sus experiencias e inquietudes, además de un intercambio de ideas entre asistentes.

3.1. Ejercicio Nº1

REGLAS POPULARES; a los participantes se les pregunto que *reglas populares o creencias populares tienen para determinar que el año venidero es un año seco, un año lluvioso o bueno y un año extremo (FEN),* pregunta que fue pocos pudieron contestar pues en su mayoría decían tener reglas pero que en la actualidad ya no se cumplen a consecuencia de que el clima esta cambiando.

El representante de CEPICAFE dijo que en Santo Domingo (sierra de Piura), existen algunas reglas populares que aún se cumplen como Gusano "Serruchillo" que sale en agosto y corta las ramas en la parte alta (aún se cumple la regla) lo cual indica que el año venidero será lluvioso.

La mayoría de los participantes manifestaron que antiguamente se regían por el BRISTOL pero actualmente *ya no cumple*, estas y otras reglas ya no cumplen.

Otro punto importante de resaltar en este ejercicio fue que ninguno de los participantes dio alguna regla o indicador popular para predecir que el año venidero sea Extremo, pues manifestaban que era la voluntad de Dios quién determinaba eso.

REGLAS – INDICADORES POPULARES			
	AÑO SECO	**AÑO LLUVIOSO**	**AÑO EXTREMO (FEN)**
Información Climatológica. Bristol pero ya no se cumple	Algarrobo no florea	Aumentan Riachuelos	Temperatura del mar entre 14º y 15º FEN , noticias
	Luna Nueva	En marzo para fecha de San José llueve	
	Suben aves de la costa a la Sierra (parte alta)	Abundancia de Golondrinas	
		Abundan grillos y hormigas	
		Gusano "Serruchillo" que sale en agosto y corta las ramas en la parte alta (aún se cumple la regla)	

3.2. Ejercicio Nº2

Estrategias de Protección para Cultivos antes Amenazas Climáticas; para el desarrollo de este ejercicio se hizo referencia por productos, fue así que cada uno de los asistentes fue detallando la amenaza, el daño, la causa del daño a los diferentes productos agrícolas, complementando esta información también indicaron la estrategia de protección que utilizan y que tan efectiva es esta, señalando este ultimo dato en porcentajes (%).

De esta manera se hablo de productos como el café, limón, mango, maíz, caña de azúcar, arroz, algodón, banano.

A continuación se muestran las matrices por productos con cada una de las respuestas dadas por los participantes.

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
CAFÉ	Escasez de agua	Grano de café muy seco. Broca (perforación del fruto)	Falta de Páramos. Tala indiscriminada. Por ganar Frontera agrícola Necesidad de leña No conocimiento de los efectos Broca incrementa en sequía	Mini reservorios. Riego mejorado(tecnificarlo) Control biológico Trampas a base de aguardientes Cebos envenenados	Se controla la BROCA al 75%
	Neblina (Mucha humedad)	Hongo, se pudre el grano Cae la hoja Arañero Insecto (Plaga)	Nubes con agua Llovizna	Se debe "ralear" la sombra (disminuirla) 800 – 1100 : 75% sombra 1100 – 1400 : 50% sombra 1400 – más : 25% sombra Según la altitud Fumigación con caldo mineral + CAL + Azúfre Compuestos Naturales	Se controla en 75%
	Insolación Mucho Sol	Se quema el grano por dentro está verde	Falta Sombra	Podar la planta en Enero – Febrero	Protegen en 50%
	Degradación del Medio Ambiente (Minas)	Reducción de la calidad del café	Falta de conocimiento pobreza – cortan árboles y se queman los desechos	A largo plazo educación ambiental	Cementerio de desechos

Además de lo anterior señalado, los agricultores comentaron:

- Antes de 1983 el café no tenía plagas, es decir antes del mega Niño del año indicado.
- Para combatir la broca preparan la trampa: en base a cáscara de café (café seco en cáscara) y aguardiente. Lo echan en una botella agujerada y esta trampa permite una reducción en 75% de la plaga.
- El hongo proviene del exceso de lluvia, y hace que se pudra el café y se caen las hojas, se combate con caldo en base a sulfocalcio (es preventivo para hongos).
- También causa la sequía: la insolación en el café cambia de color se pone rojo pero está verde

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
LIMÓN	Exceso de Agua	Enfermedades Hongos Queman las flores Impide brotamiento ANTONOSIS ACAROS Plagas Parasito	INUNDACION Se encuentra "Manchado" "Quemado","Huevo de Pava". Parte externa del fruto	Cada 7 días productos a base de cobre. Limpiar drenes principales y secundarios. En 20 litros poner 4 Kg. De azufre 1 hora hirviendo. 4 Kg. CAL hasta que enfríe. Cada 4 litros por cada cilindro de agua de 50 galones. Preventivo para hongos cada 8 días	100% Efectividad 100% Efectividad
	Falta de Agua Sequía	Minador de la Hoja Arruga la hoja, quita la sabia o la hoja	Falta de Agua o Sequía	Control biológico Curativos (productos químicos)	100% efectividad
	Temperaturas Altas más de 24º	Baja la producción	Brotamiento reducido	Podar en noviembre y diciembre las ramas secas Se sacrifica algo de limón. Raleo en la copa	100% Efectividad

Otros comentarios adicionales fueron:

- Muchas personas tienen la creencia que cuando el limón no crece se debe a que hay relámpagos, sin embargo es porque la planta tiene un hongo.
- Cuando hay sequía aparece el minador de la hoja, ataca a las membranas de las hojas, no las deja efectuar la fotosíntesis, haciendo que las hojas se arruguen ya que les quita la sabia.
- Necesitan de Tº de 24ºC como máximo y de 15ºC como mínimo, para que las plantas floreen bien (abril y mayo).
- Cambios bruscos de temperatura no afectan mucho al cultivo.
- Podan los brotes de las plantas en noviembre y diciembre para que en enero floree la planta y en abril – mayo cosechen. También en abril – mayo se vuelve a podar. Esto lo hacen para afrontar las temperaturas por encima de lo deseado.

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
MANGO	Sequía	Menor Producción	Menor Floración	Menor número de riegos. Riego tecnificado	50% Efectividad
	Plagas Acaros (arañas) Thrips (mariposa)	No desarrolla por el acaro Huevos perforan el fruto y se pierde el mango (thrips)	Contagio externo y encuentra situación medio ambiental propicia Temperaturas altas	Abonos naturales , no utilizan productos químicos (APROMALPI)	70% Efectividad
	Cambio de temperaturas	No florea	Temperaturas no adecuadas	Nitrato de potasio para temperaturas no adecuadas. Medida sanitaria – anillos (evita hormigas y otros insectos) se protege el tallo de enfermedades. Foleares (calcio, potasio, zinc, boro)	100% Efectividad
	Enfermedad	Muerte regresiva del mango. Vejez prematura	La semilla no fue seleccionada	Selección buena de la semilla Eliminación total de la planta	100% Efectividad

Adicionalmente sobre este producto se señalo:

- La muerte regresiva del mango (vejez prematura) debido a que no hay control en el crecimiento del mango, haciendo que cuando tenga 5 años empiecen a salir las plagas y se muere.
- 2006, la producción del mango baja a 40% debido al cambio climático.

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
MAÍZ	Sequía	Se seca la planta	Falta de agua	Sembrar en abril. Cambiar periodos de siembra	100% Efectividad (utilizar para chala)
	Inundación		Exceso de lluvia	Adecuar la siembra a épocas estacionarias	
	Temperaturas Altas Variación de Temperaturas	Menor producción	Cambios abruptos de temperatura	Calor: algodón, Frío: maíz, zapallo Diversificar cultivo Cultivar en chala para ganado	

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
CAÑA DE AZUCAR	Vientos fuertes	Se cae la planta	Cuando no se aporca se cae la planta	Cercos de piñón. Aporcar la planta	100% Efectividad
	Plagas: 1. Cañero (no se controla) 2. Cogollero 3. Afis 4. Chinche	1. Internamente lo corta no hace producir. 2. Cortar la caña, no florea 3. Produce melasa a la hoja, no hace crecer la planta. 4. Come la hoja y el grano	Plagas comunes	1. Se pone DICTEC granulado (preventivo) – cañero. 2. LORBAN – curativo, cogollero 3. Afis produce melasa se aplica "rescate", perfection. 4. Chinche - dreizer	100% Efectividad
	Inundación	Baja la sacarosa de la producción	Exceso de agua	Drenes Despanque de caña	75% de Efectividad
	Sequía	No crece , aumenta la sacarosa de la producción	Falta de agua	Riego tecnificado por goteo	
	Frío	Baja la producción	Frío	No sembrar muy alto hasta 1600 mts. 1200 – 800 mts.	(1200 – 1600 mts.) 80% Efectividad (800 – 1200 mts.) 100%
	Elevada Temperatura	Produce glucosa No produce sacarosa	Altitud del suelo (suelos bajos)	Sembrar entre 800 mts y 1200 mts	100% Efectividad
	Plagas como : 1. Cañero 2. Cogollero	1. Mal sabor a la caña "agrio", "acidez" 2. Le destruye la yema terminal , trunca su desarrollo	Mal manejo por parte de los productores	1. Se elimina con el despanque, control biológico. 2. Control biológico, insecticida vegetal "hiervas", "jacinto"	80% Efectividad

Otros comentarios adicionales sobre caña de azúcar fueron:

- Este cultivo cada 8 años se tiene que cambiar.
- Para panela granulada se siembra a 600 – 1200 msnm.
- A temperaturas muy calientes se produce glucosa, no sacarosa (panela granulada no se da), la panela granulada utiliza la sacarosa.
- Las temperaturas elevadas (mayor a 24ºC), siempre y cuando no haya agua, no afecta al cultivo.

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
ARROZ	Plaga	Mosquillo Lombriz que ataca la raíz y seca la planta no desarrolla y tiene poco rendimiento	Después de la siembra Falta de análisis de suelo (diagnóstico)	Productos químicos cada 8 a 15 días se aplica	100% Efectividad
		Insecto "cigarra" que chupa el grano Lombriz que corta la raíz	Suelos contaminados	Antrancol	70% Efectividad
	Helada (menos de 20º)	No deja llenar el grano se "embano"	Heladas durante el FEN	Calcio Azúfre	En 2000 se hizo la protección con calcio y azúfre 50% efectividad
	Sequía	No se desarrolla – se muere	Falta de agua	Drenes que se mantienen con agua (se bombea) Faltan pozos – cambiar a otro cultivo Zonificación de cultivos como arroz, algodón, maíz, fríjol Cambiar de cultivos como espárragos, ají páprika, alcachofa	No Aplica No Efectividad

Otros comentarios hechos sobre el arroz fueron:

- Existe una lombriz que ataca la raíz y si no lo combaten la planta no crece.
- En época de producción aparece la cigarra que corta la espiga se chupa.

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
ALGODÓN	Exceso de lluvia	Tropicaliza , no produce se desarrolla muy rápido	Mucha humedad	Capado (a una cuarta) Se corta el cogollo (la yema Terminal) o desyeme Se corta solo un poco de la yema terminal	100% Efectividad
				Control mecánico, recoger bellotas afectadas. Se aplica un fito regulador (producto químico)	80% Efectividad
				Desagüe, drenajes pequeños	50% Efectividad
	Plaga – Hongo Chupadera Plaga arreviatado Gusano rosado	Gusanito blanco que come la corteza del algodón , las plantas se marchitan , se cae y se muere	Residuos que se quedan en el suelo. Mal manejo del suelo	Desinfectar la semilla (prevención). LORBAN (insecticida) con guano al tronco en la tierra. Aporcar control biológico “mariquita”	100% Efectividad
	Sequía	Caida de la bellota	Sequedad de la planta	Calcio, Bor (folear)	50% Efectividad
	Heladas	Se va en crecimiento, se cae el fruto	Baja temperatura < 20º (Tº ideal 25º a 30º)	Desconocimiento Se necesita información	No Aplica

Otros datos adicionales sobre las amenazas del arroz son:

- La mucha humedad tropicaliza el algodón, la producción no da, solo se da forraje.
- El picudo (plaga) corta el botón y las bellotas del algodón.
- Si se desinfecta la semilla del algodón (no atacan las plagas), cuando se siembra se introducen gorgojos de tierra que chupan la semilla.
- La aplicación del LORBAN y guano aplicado en la raíz, hace que el algodón vuelva a enraizar y producir esta medida también evita que ataquen plagas al cultivo.
- La helada hace que la planta solo crezca (solo sirve para el forraje), el calor no le afecta puede llegar hasta 35ºC.
- La temperatura óptima para el algodón es entre 20 – 25ºC.
- El agua para el algodón le dan cada 30 días con riego cada 15 días

Cultivo	Amenaza	Daño	Causa del Daño	Respuesta – Estrategia de Protección	Efectividad de la Estrategia
BANANO	Mal de Panamá. Planta que pica la planta desde el tronco	Pinta la planta (manchas) desde el tronco y malogra el fruto	Contagio (desde Ecuador)	Cortar toda la planta Erradicar la planta Ceniza con abono	100% Efectividad
	Exceso de Lluvias	Lo humedece mucho y con el viento se cae	La raíz es muy corta, no se sostiene	Horquetas Rollos de plástico grueso y amarra las plantas Limpieza de drenes	100% Efectividad
	Sequía	Se seca la planta	Falta de agua	Solo se dejan los hijos con mayor vigor Enfundar el racimo cuando sale la cucula Drenes se mantienen siempre con agua, se riega con motobomba. Limpiar drenes	100% Efectividad
	Vientos Fuertes	Se cae la planta	Exceso de lluvia	Hacer cortinas naturales, que pueden ser de maíz o eucalipto	80% Efectividad

Además de Banano se dijo:

- La plaga Mal de Panamá, pinta la planta desde la raíz hasta el fruto; tienen que cortar del todo la planta (para volver a sembrar) y quemar. Esta plaga puede contaminar la planta a través de los agricultores ya sea por los zapatos, ropa (desde Ecuador).
- En tiempo de sequía solo se cortan las hojas y al aplicar el Deshije la planta se mantiene con la sabia del tallo principal.
- Deshije: Se deja la madre y dos hijos (los de mayor vigor).
- En sequía no se puede abonar la planta, la mata más rápido.
- Al banano no le afecta la temperatura, es un cultivo tropical.

3.3. Ejercicio Nº3

Medidas de Adaptación de Largo Plazo, Mitigación del Cambio Climático a Largo Plazo, Información sobre Cambio Climático; luego de la pausa realizada por el almuerzo, se continuó con los ejercicios participativos del taller, ya se habían visto las amenazas y daños de los cultivos, así como las estrategias para controlar los daños y la efectividad de las mismas, para continuar cumpliendo los objetivos del taller se necesitaba saber que medidas de adaptación de largo plazo tenían los agricultores para sus productos, así como si contaban con alguna medida de mitigación del cambio climático de largo plazo o si reciben algún tipo de información en sus asociaciones o Juntas de Regantes sobre Cambio Climático.
Obteniendo como resultado las respuestas mostradas en la siguiente matriz.

CULTIVO	MEDIDAS DE ADAPTACIÓN (LARGO PLAZO)	MITIGACIÓN DEL CAMBIO CLIMÁTICO (LARGO PLAZO)	¿RECIBE INFORMACIÓN DE CAMBIO CLIMÁTICO Y DE QUIÉN?
CAFÉ	Reforestación Rescatar los páramos Concienciar a la población Educación ambiental	Selección de resididos sólidos, reciclar Cementerios de desechos	CEPICAFÉ recibe por parte de GTZ Por parte del gobierno
LIMÓN	Riego tecnificado tipo INIA	Educación ambiental	MINAG página WEB , da información sobre clima y precios
ARROZ	Pozos tubulares Cultivos alternativos Riego tecnificado	Evitar la quema. Evitar la tala indiscriminada	
ALGODÓN	Cambiar periodos de siembra – adecuarnos	Reforestar Sistemas - agroforestales	
BANANO		Bosque seco Reforestar	
MANGO		Consumo controlado del agua, riego tecnificado	
MAÍZ			
CAÑA DE AZUCAR			

3.4. Ejercicio Nº4

Tipos de Créditos y Seguros, Como lo especifica el objetivo del taller, poder analizar los tipos de servicios financieros y de seguros con que cuentan los participantes, los que manifestaron existir pocas entidades financieras que puedan otorgar créditos agrícolas y las que los ofrecen tienen intereses muy altos lo que de cierta forma limita su acceso a créditos.

En cuanto a seguros dijeron no tener ningún tipo de seguro agropecuario y mucho menos contra cambios climáticos extremos, lo cual consideran muy importante ya que les seria de gran utilidad.

Las entidades financieras como CMAC Sullana, Agrobanco, COFIDE, CEPICAFE, CAJA RURAL SAN MARTIN, son las instituciones que a nivel local ofrecen créditos agrícolas y cuyas tasas de interés fluctúan entre el 1% mensual la tasa de interés mas baja (CEPICAFE) y 4% mensual la tasa de interés mas alta (CAJA RURAL SAN MARTIN).

Se manifestó que en 1997 Seguros Pacifico a través del Banco de Crédito fue la única institución que ofreció este tipo de servicios ya que la mayoría de las instituciones considera muy riesgosa a la agricultura.

¿QUÉ TIPO DE CRÉDITOS EXISTE?			**SEGUROS**
MONTO DEL CREDITO	**TASA DE INTERÉS DEL CREDITO**	**PLAZO DEL CREDITO**	**¿EXISTE ALGÚN TIPO DE SEGURO?**
1.25 has. De limón s/. 5000 CMAC SULLANA	3.8% mensual	1 año	1997 Seguros Pacífico (Banco de Crédito)
1 há s/. 4200 de limón AGROBANCO	18% anual	1 año	No existen en la actualidad
COFIDE UVA $25,000 ha.	12% anual	1 año	
CEPICAFÉ promedio de s/.600 ha. Para Café y caña	1% mensual	1 año	
Algodón $ 900 has. CAJA RURAL SAN MARTÍN (CMAC – PIURA) por intermedio del CIPCA	4 % mensual	6 meses	

3.5. Ejercicio Nº5

Servicio Financiero y de Seguro que necesita Desarrollar, Luego de ver los servicios financieros para el sector agrícola con que cuenta la región, los participantes manifestaron con qué servicios financieros y de seguros les gustaría contar , respuestas que se presentan en la matriz siguiente y donde se recalca los bajos intereses para créditos agrícolas con que quieren contar los agricultores, además de subvenciones agropecuarias para los productos del TLC con el objetivo de estar en las mismas condiciones que EEUU, además demandan asistencia técnica para productores.

Recalcaron la agricultura de Ica y Chavimochic que esta muy tecnificada y avanzada frente a la agricultura regional y se sugirió tomar a estas como ejemplo.

¿QUÉ TIPO DE SERVICIO FINANCIERO Y DE SEGURO SE NECESITA DESARROLLAR?		
¿PORQUÉ RAZÓN NECESITAN DESARROLLAR ESE TIPO DE SERVICIO FINANCIERO O SEGURO?	**¿PARA QUÉ PRODUCTO O PRODUCTOS AGRICOLAS LO NECESITARÍAN?**	**¿QUÉ CONDICIONES DEBE TENER EL PRODUCTO ?**
	Seguros agropecuarios (Modelo México)	Banco que pide un porcentaje razonable al año , 45% es muy alto
	Subvención agropecuaria a los productos del TLC	Banco Agrario bajar de 18% a 14% de interés
	Asistencia Técnica a los productores del TLC	Crédito agropecuario muy riesgoso
		Ica, Chavimochic (Trujillo): Muy tecnificado Practicas adelantadas Clientes comerciales 3 %– 4% anual (con banco de EEUU)

4. Comentarios

Ley de agua:

- Consumo humano y de animales.
- Para productos permanentes (mango y limón).
- Para productos de corto periodo vegetativo.

- Conflictos internos y externos por el agua.
- Etanol: combustible contra tierras agrícolas.
- Tener ventajas comparativas y competitivas para los productos.

5. Recomendaciones

- Buenas Practicas Agropecuarias para los diferentes productos
- Uso alternativo de los productos como el maíz, por ejemplo el uso del maíz para aves.
- Importante la práctica de descolmatar canales y limpiarlos.
- Practicar las MINGAS contribuye para mejorar.
- Guardar alimentos para épocas de escasez.
- Importante practicar la organización, capacitación y planificación
- Ampliar mercados.
- Respetar convenios.
- Tener más cuidado con el exceso de demanda dadas por las condiciones del clima.
- Cuando exista exceso de lluvias practicar la cosecha de agua.
- Crear un fondo auto gravamen.