Productivity in Nutrition-Sensitive Landscapes

Evaluating agricultural best practices, mindset and social values systems in Barotse floodplain, Zambia

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**“Can development be taught?...
No. It can only be learnt.”**

(Clapham, 1996)

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Abstract

Nutrition-sensitive landscapes address the relationship between agriculture, nutrition and environment. Increasing farm productivity and diversification of nutritious food crops are key issues in agricultural development, as improved productivity and diversification provide opportunities to reduce poverty, food insecurity and malnutrition. However, improving the quality of life and ensuring food and nutrition security also involves an important human component, as people interact with their environment.

This study is part of the CGIAR Research Programs on Aquatic Agricultural Systems (AAS) and Agriculture for Nutrition and Health (A4NH). The overall objectives of the programs are to understand the conditions for natural resources use and management and to seek pathways to transform the livelihoods of households depending on natural resources (CGIAR, 2013). The programs coordinate and facilitate pilot projects in three landscapes. The Barotse floodplain, Western Zambia, is one of the pilot areas. Communities in this area have highlighted increased productivity and diversification of nutritious food crops as one of the most important development priorities. The aim of this study was to develop a better understanding of the mindset and socio-cultural aspects that influence the relations between nutritious food production and landscape, while studying successes.

The research question 'What are the dominant mindsets and social values systems of rural communities in the Barotse floodplain, Zambia and how are these related to landscape, agricultural practices and diversity of diets?' with four sub questions 'What are contemporary mindsets and values systems in the Barotse floodplain, Zambia?', 'Which best agricultural practices do farmers currently apply?', 'What food groups are currently used in the diet?', 'How are the values systems affecting concepts of 'place', 'landscape', 'adoption and learning strategies' and 'agricultural practices'?' are answered.

This study is based on qualitative and explorative research that was conducted in two communities, Kapanda and Lealui, during the period October 15th, 2014 until February 15th, 2015. Both villages are considered as an ecological land-use system, consisting of different elements, which are governed by natural processes and influenced by agricultural practices and decision-making processes (human interventions), in order to produce food, fibre and agricultural products and services (Conway, 1987; Fresco and Westphal, 1988). To answer the research questions, I assessed landscape elements (They), people's mindset (I), socio-cultural values (We), agricultural best practices and currently used food items (It). Data was collected through participatory mapping, transect walks, semi-structured interviews, infographics, observations made during (informal) meetings, questionnaire 'Personal qualities' and a focus group meeting. During the various research activities, I particularly focused on 'What works well?' and investigated best practices and effective, positive experiences. I highlighted best practices of example farmers within the community, as I assumed that this (appreciative inquiry) approach enhanced farmers' pride, trust and confidence and stimulated farmers to share knowledge and experiences.

The research results show similarities and differences between the two case studies. Both villages are located in the Western Province, near Mongu, dealing with similar climate conditions, seasonal variability's (flooding and droughts) and soil types. Much of the direct surroundings are characterised by the presence of the plain. Fluvial soils are fragmented into relative small fields and show high heterogeneity. In both case studies, soils and consequently, fields, differed in soil fertility and –moisture. Both villages are characterised by low-input farming systems, in which farmers use simple tools, such as hoes and hands, and produce maize, rice, cassava and vegetables, amongst others. Most farmers live in permanent settlements, located in higher sandy areas.

Farmers in Lealui, as compared to farmers in Kapanda, use a slightly different livelihood strategy to overcome issues. This is partly due to a different economic network (better infrastructure, available input and output market). As compared to Lealui, Kapanda deals with limited, poor quality infrastructure. Consequently, the trading opportunities are small and farmers mainly produce for home-consumption. Furthermore, farmers in Kapanda have little access to financial loans and external inputs (seeds, fertilizer, pesticides, tools and knowledge).

Agricultural practices with regard to field preparation, soil fertility, water supply, weed and pest management seem to be quite similar. However, in Kapanda the agricultural practices are mainly rooted in traditional agriculture (*chimetene*). Lealui, on the other hand, shows greater variability in agricultural practices, as farmers have better access to financial loans, external inputs, cultivating permanent, larger fields, rearing cattle and producing cash crops for the market in Mongu. The best practice farmers in Lealui all applied conservation agricultural techniques.

In both Kapanda and Lealui, farmers tend to enjoy learning opportunities with concrete, practical solutions. They are quick and practical problem solvers and are willing to learn from experiences and experiments. In both villages, key leaders play an important role when it comes to adaption of new practices, as they enjoy gathering information, gaining knowledge and analysing how different elements interconnect. These qualities are important when it comes to providing information and creating awareness with regard to new practices.

It is quite remarkable that farmers in Kapanda show risk-averse behaviour, emphasizing harmonious family ties and specific gender and age-related roles. Families are bonded by kinship and traditional practices and it is important to stay loyal to complex rituals that pre-describe relationships. One can even say, that farmers avoid '*being different*'. Being loyal to the community, showing respect for existing rites, tradition and honouring elderly and their habits are highly valued. Witchcraft is an accepted way to cope with all kind of uncertainties and issues. These strong believes in superstitions results in even stronger risk-averse behaviour. In general, farmers aim at *improving existing* techniques better (as compared to *implementing new* techniques). These motives and qualities partly explain why farmers still apply shifting cultivation techniques and why the adoption rate of new practices is generally low.

Farmers in Lealui show a different profile; they are more individualistically orientated, curious and willing to experiment with *new* techniques. Furthermore, values such as 'tradition, discipline, morality and obeying rules and order' flourish. This results in a relatively orderly and dutiful community and farmers enjoy working with experts, detailed instructions and procedures (strictly by the book) to improve their farm productivity. In Lealui (as compared to Kapanda), farmers tend to be less impulsive and are more likely to build a (financial) buffer, which can be used to ensure farm resilience and stability.

Generally, it was found that contrasting place-related life conditions (soil heterogeneity, moments and severity of flooding, droughts, economic infrastructure), created a heterogeneous assemblage of mindsets, values systems, agro-ecological practices and farming styles. It can be argued that the mindsets and values are a '*best solution*', 'rational' or '*best behavioural response*' to cope with place-related life conditions. Furthermore, the study argues that rural development approaches and technologies that support, meet or fit currently, existing mindsets and social development stages (values) are more likely to be adopted. Choosing a teaching approach and developing communication strategies that honour, endorse and appreciate current values systems are key, as social change is partly based on semantic discourse.

Keywords: Adoption of new technologies, agri-ecological land use systems, socio-cultural values and mindset, nutrition-sensitive landscapes, Zambia

Preface

(Bot, 2011)

"An old Arab man, finding himself about to die, wanted to divide his camels among his three sons. The first borne would inherit, according to tradition, half of the amount of camels. The second borne was to get a quarter of the camels while the youngest son would get a sixth of the camels.
However, there appeared to be a slight problem. The old Arab man owned eleven camels, which could not be divided into two, four or six and he and his sons could not solve the problem. The Arab foresaw a big argument.
That's why they asked a wise man to help out. The wise man said: 'Let's put my camel with the other camels.' Consequently, the first son was given six camels, half of the camels. The second son received a quarter of the animals e.g. three camels. The third son was satisfied with his two camels, as this was exactly a sixth of the amount of camels. Furthermore, the wise man took his camel and drove off to the desert, on his way to his next challenge."

I would like to express my gratitude to many different people and organizations, who contributed to the successful completion of this work. First, I would like to thank the people in Kapanda and Lealui, who joined me on this research journey. It was a pleasure to share stories, practices and (funny) habits. And I enjoyed the African hospitality, learning me about daily life. Furthermore, I would like to thank my WorldFish colleagues and, in particular, Andy Ward, WorldFish Zambia, for being so enthusiastic and supportive about the idea to invest research capacities in mindset issues and socio-cultural values systems. Andy, it was great to be adopted in your productivity team and to join you in the world of interconnectivity. Thanks! Furthermore, Lummina Horlings and Jeroen Groot supported me throughout the process, providing feedback and fruitful suggestions. I really appreciated your help and attention, especially in the, sometimes, confronting situations. Mrs Ngula joined and helped me at the right moment, being a true example of African female power.

Miss Angela Wasamunu assisted me as translator and turned out to be of indispensable help. She not only translated the local language and subtitled live events, but she also explained local customs and habits. Giving me the chance to understand the village system from within. Mr Felix Luwawa and Mr David Makuyu, drivers of WorldFish, helped me out with the logistics; driving me up and down in Mongu and Lusaka, dropping and picking me up in the villages. *'Come on girl, let's go home.'*

Furthermore, I would like to thank Paul Zuiker and Auke van Nimwegen for sharing all their valuable knowledge and information about social values systems. I am grateful for Dennis Kerkhoven's creative support, never-lasting attention and willingness to let me travel and work. I really appreciate all your efforts to take care of our house, animals, garden, and so on, while I was puzzling camels. My experiences in Zambia have made me a wiser, richer and more understanding person, Litumezi Zambia.

Minke Stadler

1 Introduction

1.1 General context

Sustainable food security involves many components and is subject to different interpretations (Aiking and de Boer, 2004). Generally, the concept includes both physical and economic access to food that meets people's dietary needs as well as their food preferences (WHO, 2014). It reflects the production, distribution and consumption of plants and animals and the movement of people and power. All these processes are influenced by people, organizations and interests (Lang *et al.,* 2009) and play a key role in issues related to food security. This term covers not only food sufficiency and reliability, but also focuses on food safety, quality and timeliness of food to ensure healthy populations (Juma, 2011). Consequently, food availability (sufficient quantities of food are available on a consistent basis), food access (having sufficient resources to obtain appropriate foods for a nutritious diet) and the appropriate use of food are subject to both socio-cultural as well as technological developments (WHO, 2014).

Good nutrition is essential for human wellbeing, development and health. Unfortunately, world wide 870 million people are still undernourished and suffering from a lack of calories (FAO, WFP and IFAD, 2012). However, the number of people suffering from deficiencies in micronutrients (zinc, vitamin A, jodine, amongst others) is much higher. Estimates are around 2 billion (Tulchinsky, 2010). Recently, the concept of food security has evolved to include nutrition security and variables such as healthy dietary practices (Aliaga and Chaves-Dos-Santos, 2014). So, a lack of *healthy and nutritious* food also becomes an issue.

Thompson *et al.* (1996) coined the term “food and nutrition security” to distinguish the quantity of food (energy) and the quality (dietary diversity). They emphasize the importance of dietary diversity, widely recognized as key for healthy diets, in addition to total energy intake. The term highlights the role of consumers in defining sustainable diets and the importance of diversity for nutrition. Nutrition-sensitive agriculture is a concept that aims to narrow the gap between available food and the food needed for a balanced diet, incorporating nutrition objectives into agriculture (Jaenicke and Virchow, 2013). In that sense, nutrition-sensitive agriculture aims to better connect agriculture, health and nutrition sectors within the agro-food system (Jaenicke and Virchow, 2013).

Developing a sustainable food system aims at ‘meeting the needs of the present without compromising the ability of future generations to meet their own needs’ (Brundtland & World Commission on Environment and Development, 1987). This classical definition of sustainable development emphasizes the interaction between material, biological, cultural and social worlds and links ecology with society. It emphasizes a fair intergenerational allocation as well as the preservation of natural resources and biological systems function across time (Kibert, 1999). Consequently, food systems can be seen as an intersection point of competing issues (Lang *et al.*, 2009), as both a fair intergenerational allocation and the preservation of natural resources rely on trade-offs and decisions made by humans, which can differ in time and space.

Historically seen, agricultural intensification has been successful in providing sufficient and affordable food, by levelling up the productivity per unit area (Bommarco *et al.*, 2013; Bock, 2013). The need to reduce dependency on food imports and exposure to international food price volatility, the need for increased food production and access to commodities seems inevitable, especially when we take the growing population and number of undernourished people into account (Baudron and Giller, 2014; Juma, 2011). Although agricultural intensification is often associated with eutrophication, greenhouse gas emissions, water pollution and social and economic inequity, Baudron and Giller (2014) argue that, in most African countries, the lack of nutrients (e.g. mineral fertilizers) results in low crop yields, soil degradation, non-responsive soils and deforestation. For many smallholder farmers in Africa, this leads to a poverty trap, in which farmers are unable to create a stable and resilient farming system (Tittonell and Giller, 2012). This type of farming is sometimes even ironically described as 'recycling poverty' (Giller *et al.*, 2002). So, under certain conditions, the use of external inputs (early maturity seeds, mineral fertilizers, amongst others) is a necessary prerequisite to re-vitalize farming systems.

Despite beneficial effects of agricultural intensification, much of the current discourse emphasizes downsides of agricultural intensification, such as air, soil and water pollution, loss of biodiversity, loss of landscape elements, health issues, socio-economic dependency, amongst others (Brussaard *et al.*, 1997; Pretty *et al.*, 2011; Geiger *et al.,* 2010; Godfray *et al*., 2010). Consequently, alternative eco-efficient approaches gain more and more attention. Designing eco-efficient agricultural systems that mimic nature are expected to help turning farms into efficient and productive systems, especially in the Southern, poorest regions. As agriculture binds nature and society, cultural and management elements are also essential requirements for successful agro-ecological practices (Wiskerke, 2013). Warner (2007) stated it quite clearly: "*agricultural development must be collaborative, engaging farmers and communities in which the farms operate, and must anticipate developing the kind of local knowledge, local economies and local culture that are appropriate to the local ecology in which the farms exist*".

The majority of African farmers (many of them are women) are "low-input" smallholders, producing the majority of cereals, almost all root, tuber and plantain crops, and the majority of legumes consumed in the region (Altieri *et al.,* 2011). One could argue that many African smallholders are 'ecological by default', since they face limited availability and accessibility of agricultural commodities, technical knowledge and financial institutions (loans). Besides that they have to deal with poor transport and infrastructural conditions (Godfray *et al.,* 2010).
Rural women tend to play a crucial role in agricultural development (Van Klaveren *et al.*, 2009). Traditionally, they carry out much of the field activities and foster local knowledge about on-farm seed conservation, cultivation, and crop-based gastronomy (Altieri *et al.*, 2011). Besides that women tend to be the main responsible for household activities (CGIAR, 2012). The amount of time spent by women in household maintenance activities turns out to be significantly positive for both the intake of both calories and protein (IFPRI, 2014). So, gender roles influence agricultural developments, consumption patterns and the intake of nutritious food. Therefore, focussing on how to improve the productivity of farmers through adoption of appropriate technological innovation is of great importance (Juma, 2011).

1.2 CGIAR Research Program

This study is part of the CGIAR Research Programs on Aquatic Agricultural Systems (AAS) and Agriculture for Nutrition and Health (A4NH). The overall objectives of the programs are to understand the conditions for natural resources use and management and to seek pathways to transform the livelihoods of households depending on natural resources (CGIAR, 2013). The Barotse Hub aims "to help reduce rural poverty and hunger by harnessing the full development potential of aquatic agricultural systems" (Dugan *et al.,* 2013). The AAS-programs seek to address the paradox of widespread poverty amidst high ecological and agricultural potential, on the assumption that the rural poor have the potential to transform their lives using the natural resources in their environment (CGIAR, 2013). The programs coordinate and facilitate pilot projects in three landscapes. The Barotse floodplain, Western Zambia, is one of the pilot areas (see Figure 1). It is expected that working in these different landscapes will demonstrate possible interactions between various agro-ecological systems and their populations.

Figure 1: Western region of Zambia, the Barotse floodplain (CGIAR, 2013).

1.3 Case study area

This study was conducted in Zambia, a landlocked country in Sub-Sahara Africa. Although the economy in Zambia mainly thrives on the (copper-mining and processing) industry (Govereh *et al*., 2009), the agricultural sector is one of the key economical growth areas (CGIAR, 2012). Over 60 percent of the Zambian people live in rural areas with rain-fed agriculture being the main economic activity (Govereh *et al*., 2009). The Barotse floodplain is located within the Western Province and this region can be characterized as rural, poor and under-developed. The province covers an area of 126,386 km^2 and, in 2010, the population consisted of 881,524 people (CSO, 2010). The population density is low, approximately 7/km^2 and 46,8% of the population is between 0-14 years old (CSO, 2010). A tropical savannah climate and seasonal inundation of the floodplain frames rural livelihoods and puts constrains on agricultural practices (Dugan *et al.,* 2013). The climate can be divided in three main seasons: a hot wet season (November to April), a cool dry season (May to June) and a hot dry season (August to October) (CGIAR, 2012). Annually, the mean rainfall ranges from 800 – 1,000 mm (Flint, 2007).

From a national perspective, the Western Province is considered as ecologically marginal and less suitable for crop production (see Figure 2), due to flooding, sandy soils and poor infrastructure. The terrain is mostly high plateau and soils are mainly classified as Fluvisols and Gleysols (Jones *et al*., 2013). In areas with high water velocities, Fluvisols consist of intensively weathered soils with a low fertility status. These soils contain low level of organic matter, are prone to leaching and their capacity to retain nutrients and water is low (Aweto, 2013).

However, in areas with low water velocities, Fluvisols are fine structures soils with high amount of organic matter (Jones *et al.*, 2013). These particular areas are highly suitable for wetland rice production. The Gleysols are found in low-lying areas and are prone to high groundwater levels (Jones *et al.*, 2013). Consequently, soils are saturated with water for long periods of time

Figure 2: Administrative map of Zambia, Western Province highlighted (Nations Online, 2014).

The floodplain is the second largest wetland in Zambia and subject to annual floods and droughts (CGIAR, 2012) (see Figure 3). The floods tend to be highly variable throughout the years and frustrate agricultural investments. On average the floodplain stores 8,600 Mm^3 at low flow and 27,000 Mm^3 during the peak flood (World Bank, 2010). Ironically, outside of the hot wet season, water shortages are quite common (Flint, 2006). Consequently, crops are regularly lost, because of either flooding or droughts, and livestock have to be moved towards less productive pastures (CGIAR, 2012). In large sections of the Barotse floodplain the soils are of poor quality as they mainly consist of sand (Panulo, 2014).

Aquatic agricultural systems contribute over 70% of animal food sources and produce high-value crops such as rice, maize, cassava, millet and sorghum, amongst others (CGIAR, 2012). Most of the population depends on mixed farming, combining crop farming, livestock rearing, fishing and collecting wild fruits (CGIAR, 2012). Small-scale women farmers conduct the majority of farming practices and are responsible for household, care giving tasks and other income generating activities. This is partly due to the absence of young men.

Figure 3: Farmer fields in the Barotse floodplain.

Particularly, young men tend to migrate to other parts of Zambia to seek job opportunities and to escape from the harsh living conditions (poor economic growth, poor infrastructure, poor governance and limited industrial investments) (Flint, 2006). This results in labour shortages in rural economy and legally disrupted households, since women don't own land and are not able to access credit (CGIAR, 2012). In 2006, the Living Conditions Monitoring Surveys reported that 80,4% of those living in the Western Province is classified as poor (CSO, 2010). Human Health Indicators reported that 23,3% of children will not reach the age of five, 11% of the population has no access to health services, 60% of the population has no access to save water, and 20,5% of the children under five are moderately or severely underweight (CGIAR, 2012). The main causes of death are related to diarrheal diseases (23,7%), malaria (20,8%) and other infectious diseases (31,3%) (ZHDR, 2007).

The study area of this research is restricted to the AAS-communities of Kapanda and Lealui, both located in the Barotse floodplain (see Appendix I, Figure 43). The participating communities and farmers were selected in close cooperation with researchers of the Barotse Hub in Mongu and camp extension officers in order to prevent research-fatigue and 'stand-alone activities'. The final selection of the two communities aimed at covering significantly *contrasting places*, rather than obtaining a district representative sample. The city Mongu served as the operating research base and could be qualified as one of the most urbanized areas in the Western Province.

1.4 Challenge in the Barotse floodplain AAS-communities

Increasing productivity and diversification of nutritious food crops are one of the highest priorities for the target communities of the Aquatic Agricultural Systems (AAS) hub in the Barotse floodplain (CGIAR, 2012). Especially, farm productivity has been identified by AAS-communities as a key area where support would lead to improved livelihoods (Madzudzo *et al.,* 2014). Both the Ministry of Agriculture and Livestock (MAL) and Concern Worldwide Zambia (CWZ) showed interest in working with AAS to boost farm productivity. The focus on nutritious crop and livestock production, both traditional and novel, is set in an environment of relatively fertile floodplains and relatively infertile upland areas.

Within the Barotse Hub, research capacity is very limited and agricultural development approaches have been based on introducing previously generated research knowledge (see Figure 4). Partners, such as Ministry of Agriculture and Livestock and NGO's, prefer to implement new techniques by using so-called 'Lead farmers'. The lead farmers are responsible for sharing knowledge (based on farmer field school concept and exchange visits, amongst others) (Madzudzo *et al.*, 2013). However, it would appear that agricultural research knowledge has had very limited impact in improving productivity and strengthening diversification with the Barotse Flood Plain System (Ward, 2014). Productivity is not going up and could even go further down, despite all the efforts of several stakeholders (Ministry of Agriculture and Livestock, Concern Worldwide Zambia, SDACSS, amongst others) (Ward, 2014). Consequently, there is a need for to a better understanding of factors affecting whether or not research knowledge (with regard to agricultural practices and/or diversity of diets) is adopted, and then building on this understanding to introduce new knowledge with ongoing reflection and learning (Madzudzo *et al*., 2014).

Figure 4: Farmer practising conservation agriculture in the Barotse floodplain.

1.5 Purpose of this study

The aim of this study is to develop a better understanding of the mindset and socio-cultural aspects that influence the relations between nutritious food production and landscape, while studying successes. It explores the relation between current agricultural practices, diversity of diets and landscape from a sociological point of view. The research efforts are aimed at evaluating how mindsets and value systems contribute to effective learning events and the adoption of terrestrial agricultural practices or more diverse food groups, in order to successfully introduce and offer future deployments that support healthy livelihoods.

This study will identify, analyse and visualise current successful agricultural practices to produce nutritious food. By highlighting best practices of example farmers within the community, we assume that farmers' pride, trust and confidence will be enhanced, stimulating farmers to share knowledge and skills. Consequently, farmers tend to become more comfortable in doing things in a different way, building their capacity to change cropping plans and monotonous diets into diverse and nutritious ones. These assumptions have been endorsed by Treasure and Gibb (2010), who conducted a review of community empowerment projects in Zambia. Farmers will benefit from this study, as they start sharing knowledge about nutritious production systems and diversity of diets.

Eventually, the research results can be used as inputs for the demonstration and learning plots, which provide knowledge to enable farmers to experiment with growing nutritious food crops and to inform others about what they are doing. These learning plots aim at introducing new nutritious crops and conservation techniques to level up productivity of a broader variety of nutritious food crops. This is especially appreciated by women, with limited time, many of whom who can neither read nor write. Finally, the research results might contribute to the development of a 'theory of change', linking values systems, agricultural practices and participatory learning processes.

Figure 5: Community in Senanga district, in the Barotse floodplain.

2 Theoretical framework

2.1 Social change and adoption of new technologies

Social change and adoption of new knowledge and technologies can be an unpredictable and messy process with unintended or unexpected outcomes, as innovations rarely follow a linear, ordered path (Kasper and Marcoux, 2014). Change '*arises from multiple interactions in and between networks whereby phenomena such as coincidence and self-organization play a major role'* (Giller *et al.,* 2008). Consequently, adoption of new technologies consists of both technical devices and new social and organisational arrangements (Leeuwis and Aarts, 2010). New rules, perceptions, agreements, identities and social relationships '*are no longer considered as external conditions that influence adoption, but rather as integral parts of an innovation*' (Leeuwis and Aarts, 2010). Skills to understand the new technology and to align existing practices, resources and multiple stakeholders are key, when it comes to implementing new developments in a smooth, positive, and additive way. It entails more or less a process of weaving together best practices, information sources and asymmetries of knowledge, motives and power of stakeholders (see Figure 6) (Duurzaam door, 2014; Giller *et al.,* 2008).

Figure 6: Schematic overview of weaving activities (left) and stakeholders (middle) together to favour social innovation (Imeshworks, 2014).

In order to enhance social change and adoption, Horlings (2015) frames social change in relation to a so-called '*place-shaping process'*. This relational place-based approach aims to utilize the full potential of places and communities. Changes in a system are rooted in physical places and are considered to be outcomes of different political, institutional, socio-cultural and economic networks. Consequently, places are considered as dynamic 'meeting places', that link different social, economic and political relations and networks. (Re-)connecting these relations and networks fosters change, mainly by:

- Re-appreciation of respective places;
- Re-grounding of practices, resources and assets;
- Re-positioning towards markets, institutional policies and technologies.

Although the approach does not explicitly distinguish an individual perspective, it integrates empowering elements such as '*building capacities of people', 'reflection processes'* and '*the agency of humans'* (Horlings and Hebinck, 2015). Collaboration and engagement of multiple stakeholders help to understand and direct individual and collective action.

2.2 Participatory action research (PAR)

The CGIAR research programs AAS and A4NH provide good conditions for action research. The programs investigate human situations in which people are attempting to take purposeful aquatic and agricultural actions, which are meaningful for them in order to change their livelihoods. The Soft System Methodology (SSM) is used as a methodological framework (Checkland, 2011). The methodology builds on system thinking and experimental learning (Checkland and Scholes, 1990). As Reed *et al*. (2006) state: "*the approach attempts to understand the scale, scope and nature of problems in the context of the community's organisational structure and the processes and transformations that occur within it*". Some important assumptions are that human beings tend to see the world in a particular way, attributing certain (shared) meanings to the world, mobilizing political and communal power and acting strategically in relation to existing and emerging issues and solutions. Consequently, forming intentions and desired outcomes and deciding what to do next is what characterizes people, sometimes resulting in experience-based knowledge and social change (Checkland and Scholes, 1990).

The term 'Action Research' was first coined by Kurt Lewin (1946), who described this type of research as '*a spiral of steps each of which is composed of a circle of planning, action and fact finding about the result of the action'*. Participatory action research refers to an inquiry process, which seeks to address solutions for real life issues (Reason and Bradbury, 2008). This type of research makes it possible to observe the tension among what people say and what people actually practice and do (Vlasblom, 2015). Partnership among equals with complementary knowledge or expertise, education and action are considered to be its three key elements (Macaulay *et al.*, 1999). Particularly since the 1990s, participatory approaches started to spread (Ponzio *et al.*, 2013). Many of these participatory approaches aim to reach consensus among different stakeholders about desired innovative solutions (Giller *et al.*, 2008). However, they differ in the mode of decision-making ranging from contractual, consultative, collaborative to collegiate (Sutherland, 1999). Mother and Baby trials design, Benchmark sites (BSs) in Uganda, Farmer Field schools and participatory plant breeding methods seemed to be promising and successful examples (Blackie and Gibbon, 2003).

The full potential of participatory approaches, however, has not yet been adequately exploited (Ward *et al*., 2007). Limited availability of time of the farmer, time consuming processes, farmers' lack of specific technical preparation, structural inadequacy of experimental farm land, poor scientific validity of research results (due to flexibility and research simplicity), poor statistical methodology (partly due to multiple disciplines working together) and possible conflicts of interests limit the implementation of participatory action research (Ponzio *et al*., 2013). In order to be successful, Giller *et al.* (2008) emphasize paying attention to conflict of interests, strategic action and the distribution of power amongst stakeholders, as '*conflicts of interests among stakeholders can be solved through the development of shared understandings resulting from joint learning and improved*

communication'. Treasure (2009) also accentuates the importance of power in development projects. Therefore, incorporating farmer psychology and socio-cultural dynamics into development implementation are important (Ward *et al.,* 2007).

There is a general consensus that action researchers enter a problematical situation and become both participant as well as a researcher, bringing together action and reflection (Checkland, 2011). In that sense, action research requires a readiness to use the experience itself as a research object and the researcher works as a so-called *reflective practitioner* (Schön, 1983). Understanding and being aware of the researcher' own values and drives are important. Science is not neutral and researchers ascribe meanings to phenomena to categorize and understand the world (Boogaard, 2009). The term "post-normal science" was coined to express the need for scientists to be involved in the process and embed their research in interaction with stakeholders, as science continuously needs to cope with uncertainties and cannot be completely controlled (Funtowicz and Ravetz, 1993). '*The need for researchers operating in a different mode than currently dominant*', is also mentioned by Giller *et al.* (2008). Conscious reflections afterwards result in lessons to be learned and new knowledge (Checkland and Scholes, 1990). In that sense, defining an intellectual framework and keeping careful records are of upmost importance.

2.3 Appreciative inquiry

Appreciative inquiry (AI) is an emerging research perspective and worldview that builds on action research, communal learning and change (Trajkovski *et al.*, 2012). The concept of appreciative inquiry distinguishes five phases, 'Define, Discover, Dream, Design and Deliver', to foster innovation (see Figure 7) (Watkins *et al.,* 2011). It systematically investigates best practices, effective and positive experiences and particularly focuses on 'what works well?' (as opposed to 'what is the issue or problem?'). The approach emphasizes to harvest exceptionally positive moments, sharing these in order to identify conditions that favoured the positive outcome. The shared best practices can re-vive dreams and community visions and be used as a guideline for innovation, learning and change.

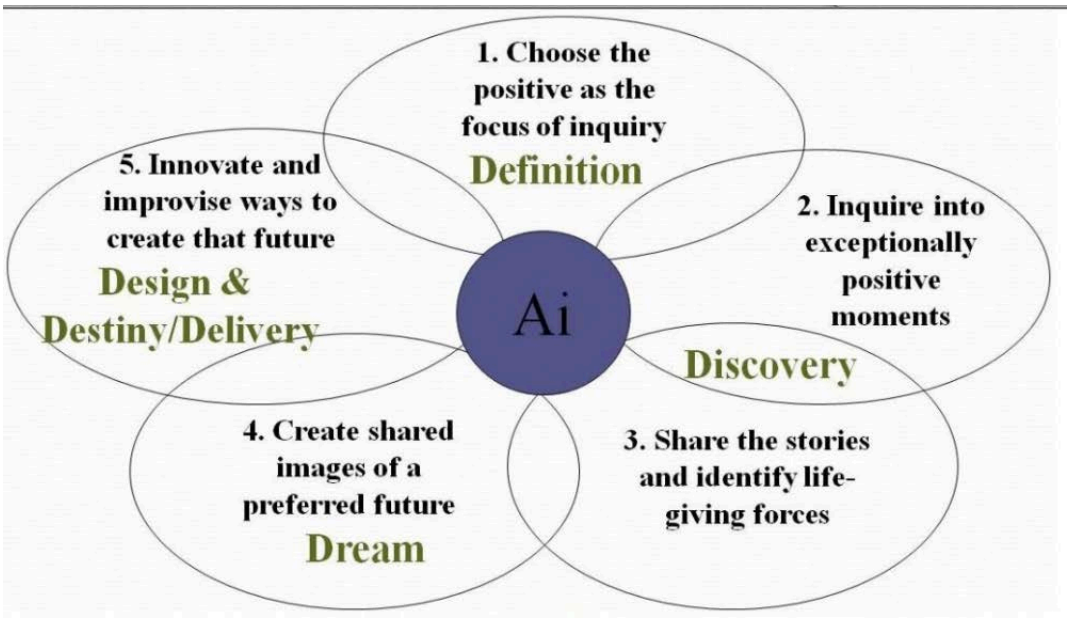

Figure 7: Generic appreciative inquiry process (Watkins et al., 2011).

The appreciative inquiry process enables communities to build on strengths to set the agenda for learning and innovation (Whitney *et al.,* 2010). The basic assumption is that successful experiences (from the past) provide guidance and answers for future initiatives. The AI-approach argues that in a multi-stakeholder world it is not about (isolated) strengths per se, but about combinations and interfaces (Coopperrider, 2012). So, not only individual strengths are being emphasized; (re-) connecting individual and community strengths are considered to be key for learning processes (Whitney *et al.,* 2010). Appreciative Inquiry assumes that changing mindsets and what people think is the focus of change (Marshak and Grant, 2008).

The InDEED-cycle is an extension of the DEED-approach (Giller *et al.,* 2008) that incorporates an inclusive stakeholder oriented perspective. It helps to define options for sustainable intensification and innovation at systems level (Groot, 2014). Four cyclical and iterative phases (Describe, Explain, Explore, Design) are described in which stakeholders work together, select and implement (innovative) actions. The principles of InDEED (Groot, 2014) use more or less the same phases as Appreciative Inquiry and fit well with the concept of action research, as both concepts emphasize alternating processes of action and reflection and purposeful actions. Purposeful actions can be defined as 'deliberate and decided actions of either individuals and/or groups' (Checkland and Scholes, 1990).

Interaction with stakeholders, incorporating their values and investing in positive outcomes can either be used to set targets or to establish baselines (e.g. a defined minimum level). Both targets and/or baselines can be used to determine directions of change in relation to a reference condition (Reed *et al.,* 2006). Establishing baselines values progress, rather than simply assess whether a target has been reached or missed (Reed *et al*., 2006). It that sense, establishing baselines fits with the ideas of appreciative inquiry and trying to develop a community from 'within'.

Each concept, mentioned above, starts with defining a real-world situation with different stakeholders. Neither of them is expressing a particular tool or technique. Techniques range from informal unstructured discussions on daily routine to quantitative structured questionnaires (Checkland and Scholes, 1990). Participatory mapping and transect walks are for example useful tools to conduct a participative and appreciative inquiry (Chambers, 2002).

2.4 Creation lemniscate

The creation lemniscate depicts the human process of social change, in which social actors adopt new initiatives and create value from knowledge and experiences (Coppenhagen, 2002). This system approach emphasizes that the context, resources and social aspects cannot be treated as discrete entities in isolation. In order to develop agricultural initiatives, it is important to take the environmental context and social dynamics of farmers into consideration (Cunguara and Darnhofer, 2011). Or as Fabinyi *et al.* (2014) state: '*it emphasizes that humans are part of nature, not external to and dominant over it.'* The creation lemniscate simply describes four system elements, which, in conjunction, are needed for social change at village level.

Successful adoption of new initiatives requires a balanced use of the power to nourish (They), personal power (I), the power to cooperate (We), and the power to shape (It) (Coppenhagen, 2002). Detailed descriptions of these four system elements can be found in Appendix II. Changes in one element automatically affect other elements, creating an ongoing learning process. For example changes in the landscape (e.g. flooding) (=They), will result in the place-specific knowledge and 'flooding-robust' skills (=I), which will affect the need of farmers to cooperate with regard to canal management (=We), asking for different tools and agricultural practices (e.g. early maturing seeds) (=It).

Figure 8 shows the relation between the four system elements and its subthemes. The orange arrows indicate a participatory bottom-up process of change (Bos and Harting, 2006). Research anchored in this tradition emphasises the need for understanding the local circumstances (Reed *et al.,* 2006). In order to understand the local context, it is necessary to actively involve social actors in the research process to stimulate social action or change (Pretty, 1995). The approach gains not only information about local perceptions of the environment and society. Deeper understanding of land use systems (it) and places (they) also provides information about '*why, what, when and where*' to change. Information with regard to '*with whom and how*' requires an understanding of individual motives and qualities (I) and the social development stage of a community (we). This knowledge offers opportunities to enhance community capacity for learning and understanding (Reed *et al.,* 2006).

Figure 8: Participatory bottom-up process of social change with four system elements at village level (based on Coppenhagen, 2002).

2.4.1 Place (They)

As already mentioned, the place and context of the study area is rather specific. In the Barotse floodplain, the climate, geology, rhythm of dry and wet seasons and land use, amongst others, have a strong impact on the daily livelihoods of farmers. These biophysical forces steer new developments and both foster and put constraints on change. Although 'markets and infrastructure' are equally important as 'landscapes', the former two elements are not extensively investigated in this study. Data with regard to political institutions, different levels of governance and domains of policy (other relevant contextual elements) are not included, due to the extent of these subjects.

Landscape is defined as a complex system where climate, geology and geomorphology, soils, hydrology, vegetation, fauna and land use intersect over time, creating different landscape elements and characteristics (Alvarez, 2014). Human activities modify landscapes considerably in order to obtain fundamental necessities, such as the availability of clean water, production of nutritious food, infrastructure and the suitability for housing, amongst others (Gulickx, 2013). The landscape is therefore particularly interesting, as interactions among biophysical and socio-cultural factors occur and can be observed. This study describes typical landscape characteristics of the communities Kapanda and Lealui, in terms of altitude, moments of flooding, severity of flooding, area of flooding (ha), soil diversity, land use types, soil types and the economic network. 'Participatory mapping' and 'transect walks' were used as tools to obtain a general understanding of the state of natural resources and perception of appreciated places. Chapter 3 describes the methodology in more detail.

2.4.2 Farmer (I)

Several studies showed that behaviour, perceptions, motives and skills of individual farmers influence the adoption rate of new farming activities (Simpson, 2015; Panulo, 2014; Boogaard, 2009; Willock *et al.*, 1999). The term mindset is defined as core assumptions about personal qualities that determines how an individual person will interpret and respond to situations (Yeager and Dweck, 2012). One reason for this interest in the mindset of farmers is the need to understand the decision-making processes of farmers in order to design initiatives that foster social change (Austin *et al.,* 1998). Farmers take decisions based on available information and their own evaluation of the potential benefits and costs of the technology (Kabwe and Donovan, 2005).

However, in many cases psychological factors surpass rational economic reasoning. Consequently, farmers' personal qualities, motives and skills are important as they determine the individual learning capacity and readiness to adopt new practices. Austin *et al.* (1998) suggested that innovative behaviour (e.g. willingness to adopt new ideas) was related to their personality type. Therefore, designing and implementing adoption projects require attention for psychological dimensions, such as perceptions, of smallholder farmers (Nyanga *et al.*, 2011, Ward *et al.*, 2007). Research done by Nyanga *et al.* (2011) showed, for example, that adoption of conservation agriculture is significantly associated with smallholder farmers' perceptions related to floods and droughts.

The questionnaire 'Personal qualities' and in-depth interviews were used as tools to collect data (see Appendix III). The core qualities concept of Ofman (2006) is used to analyse the data and describe the mindset of farmers. Chapter 3 describes the methodology and tools in more detail.

2.4.3 Community (We)

The adoption and integration of new technologies by individual farmers and their spread through communities do not occur uniformly (Simpson, 2015). The process involves basic steps as gaining awareness, being interested or persuaded, evaluating and deciding to use an new solution, implementing it and finally integrating it in daily farm practices (Simpson, 2015). Effective communities generate collective action and adaptive management, in which the precise technological content is not specified beforehand (Pretty *et al.,* 2011). In this case, the community is

defined as ‘a grouping of people living in a collective space that is small enough to implement an action plan involving work on the ground’ (Dugan *et al.,* 2013). Trust and solidarity, the use of reciprocity and exchange to build relationships in order to achieve beneficial, collective outcomes are important prerequisites to the adoption of new technologies (Pretty *et al.,* 2011). Mutual understanding, trust, solidarity and good relations are more likely to emerge when people have corresponding values or thoughts about ‘how life should be’ or share a vision on desired future developments. Therefore, similarities or differences in values systems are relevant to examine.

Through subjective values, people attribute meanings to objects, which then become valuable subjects with a specific appreciation (Boogaard, 2009). Multiple definitions of the word “values” indicate that it has personal, cultural, economic and biological meanings (Hamilton, 2006). This study builds on Graves (1966) work on values. He described values as: ‘*thoughts, motives and instructions that determine how people prioritize and take decisions in their lives’* (Beck and Cowan, 1996). As he distinguishes multiple values systems or social development stages, there are multiple realities that co-exist at the same time. The Spiral Dynamics model describes eight social development stages as deriving from the interaction of “life conditions” and “capacities of the mind” (Cacioppe and Edwards, 2005).

Spiral Dynamics analyses social development under the assumption that a cognitive mindset is dependent on a particular array of life conditions. Consequently, it is postulated that principles and ideas about ‘how life should be’ emerge in response to contextual life conditions (Pesut, 2001). These principles and ideas hold as long as the conditions remain in place and until better fitting principles or ideas come along. In that sense, the principles of Spiral Dynamics correspond to the principles or assumptions of neo-functionalism, coined by the anthropologist Orlove (1980). This approach considers ‘*the social organisation and culture of populations as functional human adaptations to successfully exploit the environment without exceeding its carrying capacity’* (Fabinyi *et al.,* 2014). The model illustrates how individuals and communities tend to think and act, and which values and motives are involved when it comes to social change (Dobbelstein and Krumm, 2012; Beck and Cowan, 1996).

Beck and Cowan (1996) distinguish eight stages of social development (see Figure 9), each with its specific principles that indicate how individuals think, believe, learn, change, choose and adopt new ways of (in this case) farming practices (Pesut, 2001). The values systems are defined as hierarchically ordered models of the world that allow people to take care of perceived issues (Beck and Cowan, 1996). This hierarchy does not imply a need for ‘higher’ or ‘more complex’ stages, as the model aims at optimizing the fit between current social values, practices and context. It emphasises development within social development stage as compared to development to the next development stage. As it is assumed that the emergence of the next social development stage will occur when the previous social development stage has reached a sufficient level of fit with life conditions.

Figure 9: Summary eight social development stages (Beck and Cowan, 1996; Drawing Auke van Nimwegen).

Each stage entails specific thoughts, motives, presuppositions and norms that determine how to decide and what to prioritise (Beck and Cowan, 1996). In general, African societies are dealing with issues within the first three social development stages; showing higher rates of violence and poverty (Beck, 2014). Staying alive, finding safety, and dealing with feudal age conditions matter most (Beck, 2014). Appendix IV provides a brief description and key words per social development stage. This study describes the current values systems of the communities Kapanda and Lealui by using infographics, in-depth interviews and observations.

2.4.4 Farming systems (It)

In the Barotse floodplain, farming systems vary, in response to differences in climate, soils, natural vegetation, culture and diet preferences. In general, the length of the growing season is reduced, due to extended droughts and lower rainfall. Consequently, cultivating cereals, such as maize, millet and sorghum, and drought-resistant crop varieties, such as cassava, is important. The presence of extensive grasslands (savanna vegetation) results in possibilities for livestock farming. In the Barotse floodplain, families cultivate crops, raise livestock, farm or catch fish, gather fruits and other trees crops (CGIAR, 2014). Furthermore, farmers utilize natural resources such as timber, reeds, medicines and wildlife. Crop diversification (from maize production to cassava, cowpeas, groundnuts, rice, fruits and vegetables), integrated fish farming and increased livestock production are expected to increase incomes and contribute to food security (Bentley, 2014).

Farmers tend to pursue adaptive livelihood strategies to overcome constraints and to reach an adequate production level, by applying different ways of farming. These farming systems can be divided in three categories: conventional, conservation or traditional (CGIAR, 2014).

- Conventional agriculture is defined as specialized and capital-intensive farming system that involve large-scale, crop production (often monocultures). It requires a well-developed infrastructure and skilled labour force, as, in many cases, products (commodities) are being traded and/or exported.

- Conservation agriculture mimics ecological processes and tends to increase production levels of products and services (food, fibre, air, water and soil quality), while reducing the use of external inputs (fuel, plastics, amongst others). This farming system aims to preserve soil fertility, increase the water holding capacity and stimulates natural biodiversity, amongst others. Conservation practices in the Barotse floodplain include crop rotation and intercropping, potholing (minimal tillage and seed basins with line spacing), mulching (see Figure 10 and 11).

- Traditional agriculture is based on shifting cultivation, characterised by temporary, arable cultivation (Aweto, 2013). This farming system involves cultivating fields for a few years (1-3 years), laying the fields fallow for a longer period of time (10-20 years), so the eco-system can restore its soil fertility and natural vegetation (Aweto, 2013). In general, the area consists of small, scattered, cultivated fields and a mosaic of fallow or regenerating fields. Slash and burn practices (*chitemene*) are common in this type of farming system (Chidumayo, 1987). Particularly, when fallow periods are reduced and the soil does not have enough time to regenerate, these practices have a negative effect on soil fertility and frequently burning fields will lead to considerable losses of topsoil. Crops include millet, cassava, groundnuts, sorghum, maize and beans and are being planted in the ash-covered area (Aweto, 2013). Furthermore, farmers rely on hunting and fishing practices. This farming type is generally associated with spatial relocation of houses and households. However, these days, most farmers live in permanent houses and fixed villages. In that sense, it shows that traditional agricultural is not a fixed type, but evolves over time. This farming system is ecologically sound, when land is plentiful and population density is low.

Decisions about the daily diet and its composition of different food groups are critically important in improving dietary diversity. The current, local diet predominantly relies on traditional food items such as root crops (e.g. cassava, sweet potato) and cereals (e.g. maize, millet and sorghum), rather than rice. Consequently, most people still obtain most of their energy from starchy staple food with less access to nutrient-rich resources of food (Fanzo *et al.*, 2013). The consumption of food items across different food groups more or less guarantees adequate intake of essential micronutrients (FAO, 2014).

The adoption of agricultural technologies, targeting rain-fed systems, deals with particular constraints (Simpson, 2015). As agricultural activities depend on the growing season, there are often limited opportunities to observe and evaluate the appropriateness and effectiveness of a particular technique (e.g. potholing, mulching, composting, crop rotation, amongst others). It is quite likely that evaluations with regard to the effectiveness of a technique can only be made at a particular moment during the season. Furthermore, weather-related seasonal variability strongly influences the evaluation process whether a proposed new technique is useful. Consequently, adoption of agricultural innovations is time consuming. One way to improve the adoption rate is to spread already existing best agricultural practices. The assumption is that these practices are more likely to be adopted by other farmers, as they can be considered as 'locally proven'.

Figure 10: Conservation agriculture, male farmer using basins and mulching, in Senanga District.

Figure 11: Conservation agriculture, female farmer using basins and mulching, in Senanga District.

3 Research methodology and material

3.1 Main research question and sub-questions

This study aims to answer the following main research question:

What are the dominant mindsets and social values systems of rural communities in the Barotse floodplain, Zambia and how are these related to landscape, agricultural practices and diversity of diets?

To answer the main question, four sub questions were formulated:

1. What are contemporary mindsets and values systems in the Barotse floodplain, Zambia?
2. Which best agricultural practices do farmers currently apply?
3. What food groups are currently used in the diet?
4. How are the values systems affecting concepts of 'place', 'landscape', 'agricultural practices', 'diversity of diets' and 'adoption and learning strategies'?

I hypothesise that the geographical location and position in the landscape result in different values systems, which will result in different agricultural practices and adoption strategies. To test this hypothesis, I will compare two communities, Kapanda and Lealui, each located in a different agro-ecological setting. It is expected that working in different communities will demonstrate possible interactions between agro-ecological systems, values systems and participatory learning processes, allowing us to differentiate factors, which are context-specific.

3.2 General research methodology

This study is based on qualitative and explorative research that was conducted in two communities of Zambia's Western Province during the period October 15th, 2014 until February 15th, 2015. Since this study is part of the AAS- and A4NH-programs, I worked closely with other stakeholders and researchers of the World Fish office in Lusaka, the Barotse Hub in Mongu, professionals from Ministry of Agriculture and Livestock, community facilitators and Barotse Royal Establishment (*Induna's*) as this work further elaborated on and strengthened (existing and new) communal relations. In order to collect useful and viable data, I lived for nearly four weeks in the communities of Kapanda (November 17th, 2014 – November 28th, 2014) and Lealui (December 4th, 2014 – December 15th, 2014). Data was collected through participatory mapping, transect walks, semi-structured interviews, infographics, observations made during (informal) meetings, questionnaire 'Personal qualities' and a focus group meeting.

3.3 Research object, participants and sample size, materials

3.3.1. Research object

The villages Lealui and Kapanda are the two research objects. Both villages are considered as an ecological land-use system, consisting of different elements, which are governed by natural processes and influenced by agricultural practices and decision-making processes (human interventions), in order to produce food, fibre and agricultural products and services (Conway, 1987; Fresco and Westphal, 1988). Essentially, both villages are places where organisms and environment interact (Post *et al.,* 2007). The system boundaries distinguish the system from the environment. These are based on physical boundaries. The defined boundary is however obscure, since external factors, such as migration patterns and cash transfers, influence the different system elements, interactions and outputs.

3.3.2. Participants and sample size

The participants were selected by purposive sampling. The community facilitators in Lealui and Kapanda selected twenty (lead) farmers that were typical, in the sense that they highlighted successes. This so-called extreme (or deviant) case sampling was chosen, as it is a recommended sampling technique when it comes to best practice research (Patton, 2005). However, by selecting a typical group of participants, the sample is not a statistically representative of the population of the Western Province. The sample size of twenty participants is required to be small, since the collected data is detailed and rich (Ritchie and Lewis, 2003). The participating farmers were being mapped in different respondent categories, based on gender (female, male), village (Lealui, Kapanda) and cash transfer (yes, no). Cash transfers (e.g. financial support per household) are part of social safety net programs provided by the Zambian Department of Social Welfare to reduce poverty levels through income support.

3.3.3 Materials needed

To conduct the study I used the following materials: Garmin GPS Summit HC and batteries, digital cameras for communities, poster Kapanda, poster Lealui, transparencies, sticky notes, pictures of food items of ten different food groups, interview guide, questionnaire ‘Personal qualities’, instructions ‘participatory mapping’, guide ‘Reconnaissance visit and transect walk’ (FAO, 2014), format ‘data transect walk’, paper, clipboard, digital camera, internet, telephone and print facilities.

3.4. Data collection and stakeholders

The stages of the Methodological Research Framework (partly based on Dougill *et al.,* 2002) were used to conduct this study. Per stage, I conducted several activities in order to assess the landscape, mindset, socio-cultural values and agricultural best practices and, to identify opportunities to improve the adoption rate. Data were collected through participatory mapping, transect walks, face-to-face semi-structured interviews, infographics (pictures made by the community members), questionnaire ‘Personal qualities’ and personal observations. Furthermore, I organised a focus group meeting and a validation meeting in the community. Table I gives an overview of the research stages, data collection activities and stakeholders involved in both Kapanda and Lealui.

Table I: Research stages, activities to collect data and stakeholders involved in Kapanda and Lealui.

Activities to collect data per research phase	***Stakeholders involved Kapanda, Lukulu District***	***Stakeholders involved Lealui, Mongu District***
(0) Desk study and preparation meetings	WorldFish, MAL camp extension officer, translator	WorldFish, MAL camp extension officer, community facilitator, translator
(1) Landscape assessment - Participatory mapping - Transect walks (3)	MAL camp extension officer, Ministry of Livestock (vet), two community facilitators, three lead farmers, Induna, translator	MAL camp extension officer, one community facilitator, five lead farmers, Induna, translator
(2) Ten semi-structured interviews, questionnaire 'Personal qualities'	Ten (lead) farmers, translator	Eight (lead) farmers, two Induna's, translator
(3) Infographics; taking pictures of valuable places, practices, food items and people	Eight (lead) farmers	Three community members
(4) Focus group meeting to share best practices and pictures (using fish bowl technique).*	Approximately eight (lead) farmers, two community facilitators, Induna and five community members	Eight (lead) farmers, two Induna's, community facilitator, MAL extension officer, four community members
(5) Focus group meeting sharing posters and validating data with regard to landscape, best agricultural practices and food items	Conducted by Mrs. Ngula, Manager Mongu Hub	Twenty six (lead) farmers and community members, two community facilitators, MAL camp extension officer, translator.

* *In Kapanda, farmers only shared their best agricultural practices during the focus group meeting. The scheduled (second) focus group meeting, in which farmers would discuss values related to pictures, was cancelled. Instead, I used the pictures as an example to support data that were collected during the transect walks and interviews.*

The various data collection activities built on each other, providing opportunities to check and validate data (see Table II). The three transect walks were, for example, selected during the participatory mapping meeting. The individual interviews were partly a preparation for the focus group meeting in which participants shared and selected best agricultural practices. So, the focus group meeting elaborated on the data collected during the interviews and infographic activities.

The design contributed to building a trustful relationship with the community members, as I participated in the activities and shared experiences, thoughts and ideas myself. This resulted in an informal and receptive atmosphere, in which participants felt comfortable to actively exchange information, examples and stories. My translator and I noted these stories not only during the activities, but also during our daily debriefing meetings.

Table II: Research design, showing the planned activities per day.

Activity day 1	Activity day 2	Activity day 3-5	Activity day 6-11	Activity day 12
Meeting local key leaders to introduce and discuss purpose and research design	Participatory mapping meeting	Transect walk 1-3	Semi-structured interview and questionnaire 'Personal qualities' 1-10	Focus group meeting
	Infographic activities			
Personal observations and registration				

3.4.1 Data collection place (They)

As a prerequisite, I needed to get familiar with the landscapes of the study area on the base of (local) expert knowledge (meeting with local stakeholders) and observations. I collected satellite-images, air-images (GoogleEarth) and available images from partners (Bioversity International). In order to identify the main land use functions and to obtain a general understanding of the landscape and resources I conducted a participatory mapping meeting and three transect walks in each community (FAO, 2014).

Participatory mapping refers to a variety of participatory research approaches, all of which involve local community members who map places and visualise spatial knowledge into cartographic and descriptive information (see Figure 12 and 13) (Herlihy and Knapp, 2003). Research done by Fagerholm *et al.* (2012) showed that involving community members enhances the assessment of landscape services. The approach has emerged to better understand and generate information about knowledge, practices, and beliefs of local people (Ramirez-Gomez *et al.*, 2013). And, as De Groot *et al.* (2010) have mentioned before, the perceived benefits of these services are time-related and tend to differ among geographical places. During the participatory meeting, I first discussed the overall research approach and purpose. An aerial map of the study area, labelled sticky notes and transparencies were used to identify special places and landscape values and services. Consequently, participants were able to draw landscape features. The detailed instructions are described in Appendix V.

With the help of the community members of Kapanda and Lealui, I produced posters with landscape functions, valuable and special places. During the feedback meeting, these posters were shared and validated with the community members.

Figure 12: Participatory mapping in action in Kapanda.

Figure 13: Participatory mapping in action in Lealui.

During the three transect walks, I assessed the landscape with local informants and farmers. The method described in the guide 'Reconnaissance visit and transect walk' (FAO, 2014) was used to classify the following indicators:

- Determination of class of landscape (local names);
- General description of landscape units (e.g. hills (1), valley (2), plain (3));
- Altitude (m);
- Distance to Mongu (km);
- Hydrological patterns (e.g. no evident water courses (1), sparsely spaced watercourse (2), moderate incised (3), densely spaced watercourses (4));
- Soil erosion by water (e.g. active (1), partly stabilised (2), stable (3));
- Severity of flooding (low (1), moderate (2), severe (3));
- Land use types (e.g. crop production (1), animal production (2), water supply (3), species habitat (4));
- Appreciated, precious places (low (1), moderate (2), acceptable (3), good (4));
- Organization of housing (e.g. grouped (1), dispersed (2), along the road (3)).
- Soil fertility (low (1), moderate (2), acceptable (3), good (4));
- Soil type based on local knowledge (sandy (1), sandy loam (2), loam (3), clay loam (4), clay (5)).

The length of each transect walk varied, but in general ranged from 5-8 km. Appendix VI shows the format used to collect data. Myself and two other participants, who became actively involved in keeping records, recorded the data (see Figure 14 and 15).

Figure 14: Transect walk in action in Kapanda (Moono, 2014).

Figure 15: Transect walk in action in Lealui.

3.4.2 Data collection farmer (I)

Prior to the interviews, I asked two colleagues to complete the questionnaire 'Personal qualities' (Bos and Harting, 2006) (see Appendix III). The main reason was to discuss the usefulness of the questionnaire, as the questions and set up could be biased by a Western perspective. However, both colleagues advised me to use the questionnaire and to validate the outcomes at the end of the interview. During the interview I asked the participants to complete the questionnaire 'Personal qualities' to collect data with regard to their mindset. The questionnaire helped each participant in recognising his or her personal qualities and motives. At the end of the interview I explained and validated each individual result, asking for examples that endorsed the outcome of the questionnaire. It gave the participants the opportunity to consider his or her strengths. The final results were converted in a total group overview. Based on this table and the descriptions of the different mindsets (Appendix III), I gained insights into the mindset of the group participants.

The questionnaire was developed by Bos and Harting (2006) and consists of six statements. Each statement is cut in two. The first half is a given, which the participant were required to complement by choosing from six possible alternatives. Per statement, the participant was asked to divide ten points over these six alternatives. Miss Angela Wasamunu translated the questionnaire into Silozi. During the interview, she supported each individual participant completing the questionnaire. After the questionnaire was completed, I immediately analysed the data and validated the results with each participant.

3.4.3 Data collection community (We)

To collect data about social development stages and values, I firstly recorded personal observations and quotes during formal and informal activities (Cowan and Todorovich, 2000; Hamilton, 2006; Beck and Cowan, 2006). I recorded the observations and quotes in fourteen reflection reports. The observations and quotes were then classified using the Spiral Dynamics categories and descriptions. Secondly, I used infographics to collect data about values (see Appendix VII). Several community members received a camera and were asked to take pictures about valuable things. Pictures were taken based on four questions:

1. What are precious agricultural practices and/or tools?
2. What are precious food items?
3. What are precious places?

During the focus group meeting, I showed a powerpoint-presentation with the pictures made by community members and asked women and men separately to write down meaningful values, expressed by that particular picture. Furthermore, both men and women selected their top three 'best practices and tools' and top 5 'precious places'. Their explanation (why this top 3 and top 5) gave insights in their values system. Approximately 12-16 people participated in the focus group meeting (see Appendix VIII).

3.4.4 Data collection land use system (lt)

In order to collect data about best agricultural practices and diversity of diets, I conducted semi-structured interviews with 10 female and 10 male farmers. During the interview, open questions were asked to gather information with regard to current agricultural best practices (see Appendix IX). The questions focussed on positive, exemplary experiences and practices and were related to:

- Soil fertility practices, such as cover crops, minimum tillage, crop rotation, fertilizers, manure, compost, mulching, kraals, amongst others;
- Weed and pest reducing practices, such as use of pesticides, fungicides and herbicides, predation and parasitism, allelopathy, cover crops, intercropping, mulch, crop rotation, amongst others;
- Practices that successfully cope with droughts/ flooded areas;
- Utilizing nutritious crop varieties and livestock;
- Recycling local seed varieties.

Furthermore, this study uses a simple proxy indicator (see Appendix IX) to assess the diversity and micronutrient adequacy of current diets (FAO, 2014). I combined the simple proxy indicator with pictures of different food items per food group and data of CGIAR-seasonal calendars (see Figure 16) (Pasqualino, 2014). During the semi-structured interviews, participants were asked to pick pictures of food items they ate on the day before. Although the results are probably biased by seasonal availability, it gives an indication of the dietary diversity.

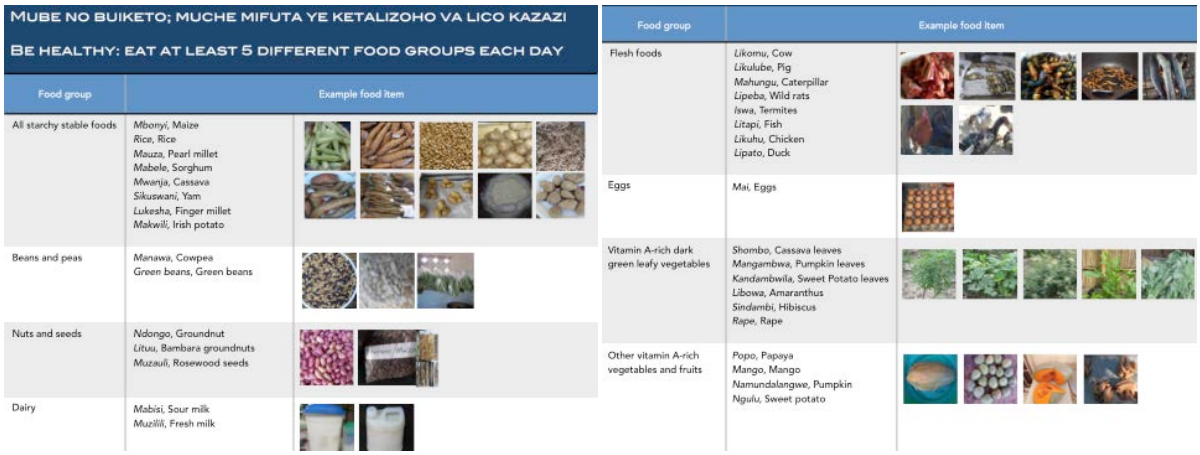

Figure 16: Part of simple proxy indicator with pictures of different food items per food group.

The semi-structured interviews provided a setting, where I could discuss agricultural best practices in more detail and gather more in depth information. Prior to the interview, I explained the purpose of the study and the interview set up. All participants were reminded that their participation was voluntary and that they were free to ask any question or raise any point. Interviews were conducted on a one-to-one basis, and lasted between 60 - 90 minutes in total. The interview guide provided focus and structure. Interviews were recorded on a digital recording device and were transcribed into sorted computer files.

3.5 Method of data analysis

This research study employed the first three steps of the Methodological Research Framework to analyse qualitative data describing observed behaviours, thoughts, and believes (Ritchie and Lewis, 2003). The core of the analysis is about identifying key themes and subthemes from qualitative data (Judge *et al.*, 2014). The first step of the framework analysis methodology is getting familiar with the data. The data was registered in reflection reports, progress reports, transcriptions and pictures. The format of the reflection reports is based on the communication model of Remmerswaal (1998), categorising data into four categories: content, procedure, process and feeling. The content category described the data and information. The procedure category described the way the data was collected (agenda). The process category provided insights in interpersonal dynamics and the feeling category described my own personal feelings. Finally I labelled the observations, using the categories described by the Spiral Dynamic model to classify different values systems.

Carefully examining my reflection reports, progress reports, transcriptions and pictures helped to list key issues and themes that appeared to be important. Interesting segments, key issues and themes were classified using the four pillars (They, I, We, It). Thirdly, Data was organised into posters, tables or descriptions. Finally, the posters, tables and descriptions helped to find explanations for the findings, draw conclusions and suggest further recommendations. I decided cutting the data by case study and theme, as it provided the opportunity to compare geographical locations and themes. The framework seems ideally suited for this case study, as it has a limited time frame and predetermined semi-open questions (Srivastava and Thomson, 2009).

3.6 Research process

During the implementation of the research, there were several occasions in which I informed other partners and stakeholders. These stakeholders were involved as implementation partners or funding partners. Generally, people emphasized and recognised the need for paying attention to cultural diversification and mindset issues. Table III gives an overview of the presentation activities.

Table III: Presentation activities and stakeholders involved in research process.

Presentation	***Stakeholders involved***
(0) Presentation thesis proposal - October, 14th 2014	Wageningen University
(1) Presentation thesis proposal - October, 19th 2014	Mongu Hub (senior) researchers and staff
(2) Presentation thesis proposal - October, 26th 2014	Caritas and Concern Worldwide, Mongu
(3) Lunch presentation Lemniscate, learning and social development stages - January 22th, 2015	Concern Worldwide, World Fish Lusaka staff, senior researchers Lusaka
(4) Presentation best agricultural practices, most valuable places and proxy simple indicator – January 23th, 2015	UK Department for International Development, Zambia Office
(5) Presentation best agricultural practices, most valuable places and proxy simple indicator	Mongu Hub researchers and manager
(5) Presentation preliminary results, January 11th, 2015	World Fish Lusaka staff, senior researchers Lusaka
(6) Colloquium, May 26th, 2015	Wageningen University

4 Results

4.1 Introduction

This chapter will give an overview of the research findings per research object. Maps, boxes with quotations and pictures are used to present the findings more effectively. In accordance with the theoretical classifications of Chapter 2, I will present findings with regard to landscape (They), mindset (I), social development stages and values (We) and agricultural best practices and diversity of diets (It). Furthermore, I will reflect on the research process itself and describe similarities and differences between Kapanda and Lealui.

4.2 Kapanda, Lukulu District

4.2.1 Place: landscape, market and infrastructure (They)

Data collected during the participatory mapping meeting and three transect walks and literature is used to describe the context (e.g. landscape, market and infrastructure) of Kapanda. The village is located in the Mbanga area in Lukulu District and is one, out of ten, communities participating in the AAS-programme. The population density in Lukulu district (5,2/km^2) is among the lowest in Zambia, as only 9,5% of the population of Western province lives here. Kapanda is located approximately 60 km from Mongu, at GPS-coordinates S14^o 42'25.9 - E023^{0}11'55.1. During the dry season the area is accessible by 4x4-car. The trip will take about 4-5 hours, driving through the plain. In the wet season the village can only be reached through the Kaoma road, which takes about 8-9 hours drive from Mongu. Consequently, the economic network (infrastructure, market and trading opportunities) is rather poor, translating to high transportation costs and difficulty of finding transportation into market centres.

Farmers mention relatively high transport costs (e.g. Lukula - 200 Kw, Mongu - 250 Kw), relative low yields (e.g. six bags of 50kg rice) and fixed sales prices (e.g. 50 kg rice – 120 to 150 Kw). Consequently, farmers tend to prefer using crops for home consumption or selling them in the village. '*Storing maize and wait for better prices*' was another strategy to cope with high transport costs. Although farmers said there is a need for a market place, up to now there is no such formal trading place. However, farmers do sell their daily surplus to other community members. The traded goods mainly comprise maize, fish, perishable vegetables, local beer (spirit) processed from wild fruits, firewood and baskets. Social cash transfers are another source of income. In some cases, local beer or cassava roots were used as payment for pieceworkers.

The natural environment of Kapanda is highly diverse (see figure X). The Zambezi river area is characterised by wetlands and floodplains and are governed by low gradients and high evaporation (Winsemius *et al*., 2006). Droughts are generally common during the dry season and the area floods extensively during the wet season. The landscape comprises different land-use types, namely grazing lands, forest, streams, marshes and permanent and temporary ponds, held as common resources (CGIAR, 2014). Most people practice farming within both the relative fertile floodplain as well as the higher sandy uplands. Grassland is used for cattle and wild life.

Figure 17: Map of Kapanda, Lukulu District.

The area south of Kapanda floods due to the high water level in the Luena river (see Figure 17). The floods are valued for bringing manure and fertile soil particles. Consequently, the preferred (fertile) soils are found near the Luena river (see Figure 17). Sand deposits can be found in the higher uplands. These areas are less valued, since these soils tend to be less fertile, salinated and more prone to leaching and erosion. The forest (Liamutinga bush) is valued for the possibility to extract wood, fruits and wildlife. Agricultural fields are found in and near the village, whereas pastures and rice fields are found in the plain, further away from the village.

Cutting trees is a common practice, as the wood is sold and used as charcoal. Figure 18 shows former forest patches near the village, which are now used for cultivating cassava and beans. Traditionally, farmers used slash and burn practices (*chitemene*). Burning leaves and crop residues prior to potholing (e.g. digging pits to harvest water) and sowing is also frequently done. Farmers still strongly believe that these burning practices have positive effects on soil fertility, as the ashes are considered as fertilizer. Participants also classified the clay soils as less preferable, since these were considered as '*too wet, slippery and cracked*' being less suitable for vegetable production.

Figure 18: Former forest patches near Kapanda, now used for cultivating cassava and beans.

Changing flood patterns (extended rains, less severe flooding) influence seasonal and daily farming activities, damaging crop yields and are altering the timing in which activities are carried out (CGIAR, 2014). Extended drought periods shorten the agricultural season and reinforce the need for conservation agriculture practices. Consequently, farmers expressed a need for flood resilient crops, adjust timing of potholing and sowing, use rice varieties with a short growth cycle, use drought resistant crop varieties and improved irrigation systems, use mulch to retain water, use N-fixating beans as natural fertilizer and rotate crops to prevent soil depletion. Furthermore, farmers are concerned, because of reduced fish stocks, especially since fishing activities are seen as the most important and profitable practices.

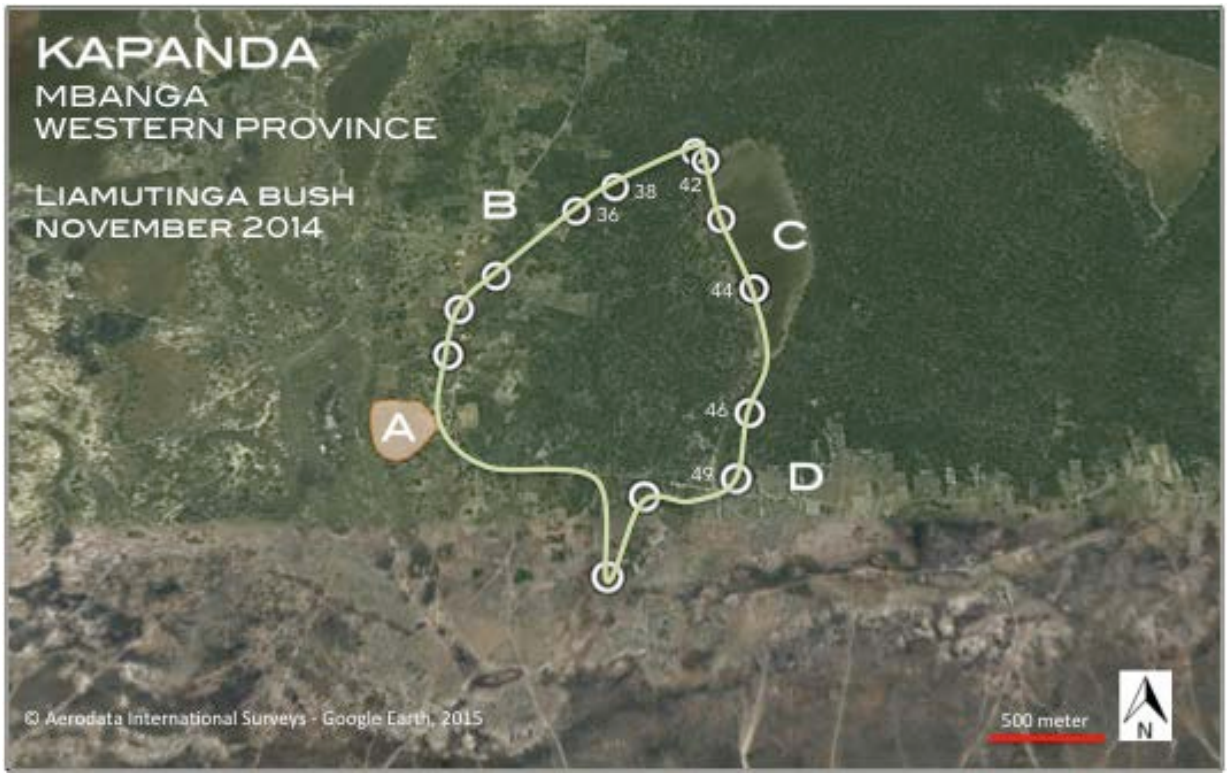

Figure 19: Map of first transect walk Kapanda. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

The Liamutinga bush is located on the east side of the Kapanda community (A) (see Figure 19). The altitude varies from 1030–1034 m. Houses, vegetable gardens and the cattle house are located in the dry, sandy upland area (A). In the Liamutinga bush (B), farmers mainly cultivate cassava, maize, ground-nuts and beans. The permanent pond '*Liamutinga*' provides irrigation water during the dry season. The floodplain and lower areas flood during the wet season and are used for fish farming and rice production (C). In the dry season, these areas are used for cattle grazing and collecting reeds in order to produce baskets and ropes. The forest produces fruits and firewood and provides shelter for wild animals (D). Figure 20 shows landscape pictures made during the first transect walk in Kapanda.

Figure 20: Landscape pictures made during first transect walk in Kapanda, November 19th, 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

The Luena plain is located south of Kapanda (A), S14° 43'19.5 - E023°11'55.5 (see Figure 21). The altitude varies from 1029–1034 m. The landscape comprises of ponds, streams and a plain held as common resources. The plain and lower areas actively floods during the rainy season. These areas are used for fish farming and rice production. In the dry season, farmers use these areas for cattle grazing, maize cultivation, fiber production and reed collection. During this period, the permanent water ponds and streams provide irrigation water and drinking water. The area serves as a habitat for animals, such as impala, bats, birds, rabbits, snakes, tortoise and wild ducks. Figure 22 shows landscape pictures made during the second walk in Kapanda.

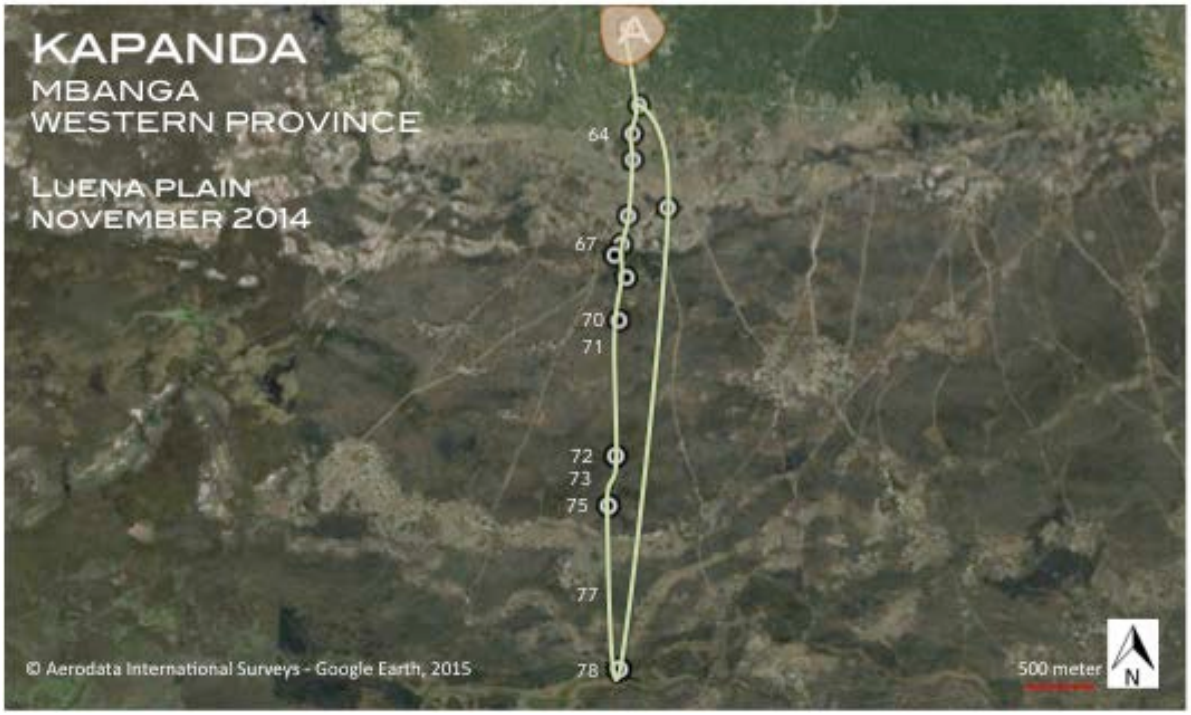

Figure 21: Map of second transect walk Kapanda. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Figure 22: Landscape pictures made during second transect walk in Kapanda, November 20th, 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

The Sikeletu plain is located on the western side of Kapanda (A), S14°42'43.3.5 - E023°11'40.4 (see Figure 23). The altitude varies from 1019-1024 m. The landscape comprises of areas of grassland and trees, held as common resources. The plain floods during the wet season and is used for rice production. Permanent and temporary ponds are used for fish farming. In the dry season, farmers use these areas for cattle grazing, some maize and vegetable cultivation and harvesting fruits, wood and medicinal trees and shrubs. No slash and burn practices were carried out in this area, probably because of the economic value. The surroundings serve as a habitat for wild animals, such as birds, rabbits, snakes, dykers and wild ducks. The area mainly consists of (saline) sandy soils. Fertile clay soils are found in temporary ponds, such as the Sikeletu pond (see Figure 24, waypoint 92).

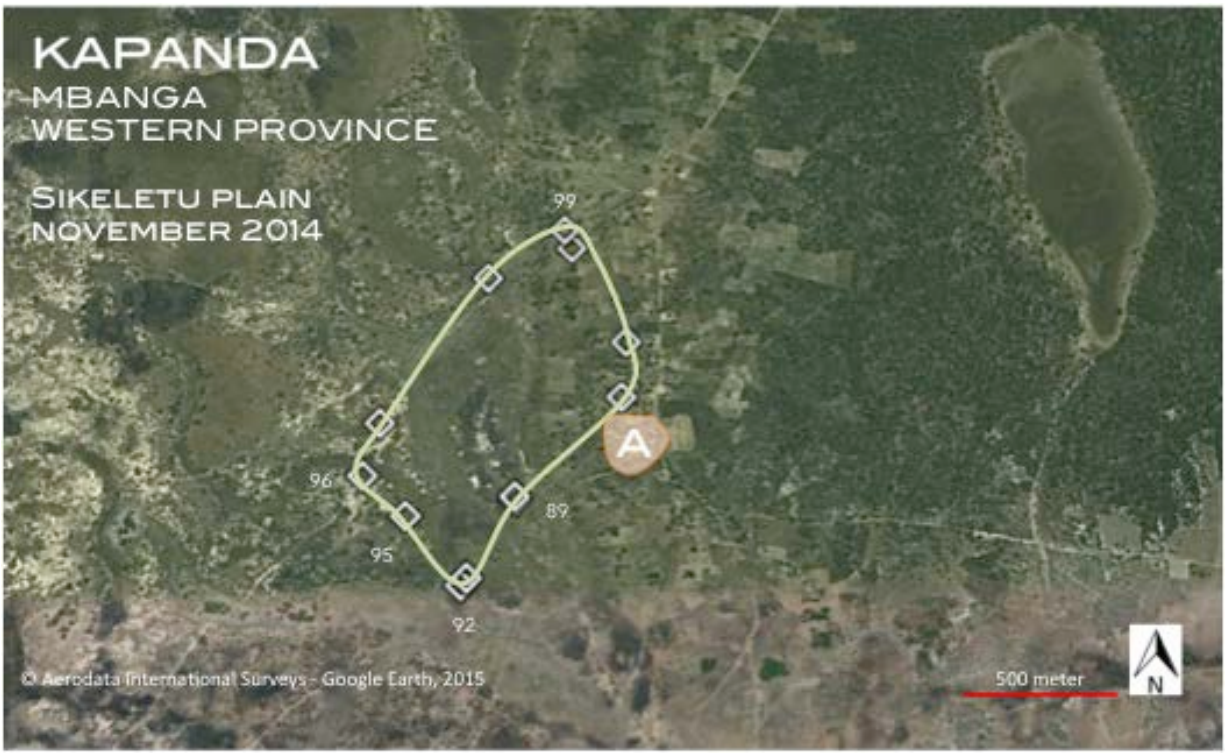

Figure 23: Map of third transect walk Kapanda. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Figure 24: Landscape pictures made during third transect walk in Kapanda, November 21th, 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Soils in the area of Kapanda are heterogeneous, as soil types range from (saline) sandy soils in the upland areas, to clay-loam soils in the plain, to peat soils near the streams (see Figure 25). Farmers have a good sense where to locate fertile soils. The most preferred soils are clay loam soils near the village. However, most of these soils are found near the (far) streams or at the bottom of temporary ponds.

Figure 25: Soil pictures made during three transect walks in Kapanda, November 19th, 20th, 21th 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

4.2.2 Farmer: mindset (I)

In Kapanda, ten participants (five men and five women) completed the questionnaire 'Personal qualities' to collect data with regard to their mindset. Table IV shows the data collected from these participants. The red numbers are (part of) the lowest scores of a particular participant. The green numbers are the highest scores of that particular participant. Appendix III gives a short description of the six different mindsets in terms of qualities, pitfalls and allergies (Bos and Harting, 2006). Based on these descriptions and the results presented in table IV, I have analysed the current mindset of the ten participants.

Table IV: Mindset in Kapanda. The scores range from 0 to 27. The green colour indicates the highest score per participant and the red colour indicates the lowest score per participant.

Participant	Gender	Innovator	Entrepreneur	Pragmatist	Custodian	Helper	Analyst
1	F	**5**	10	10	5	**15**	**15**
2	F	**5**	5	13	**15**	**17**	5
3	F	11	**2**	9	**20**	**11**	**2**
4	F	**4**	**4**	**14**	**19**	13	6
5	F	6	8	**26**	5	**2**	**13**
6	M	**0**	**13**	8	**0**	**27**	12
7	M	**4**	10	**14**	11	**15**	7
8	M	6	**4**	**20**	10	**20**	**0**
9	M	**17**	**4**	10	9	10	10
10	M	**11**	**2**	**22**	8	9	**2**

Firstly, the results in Table IV show that the mindsets of the '*pragmatist', 'helper'* and *'custodian'* are generally most observed. Combining the descriptons of these three mindsets (see Appendix III), it can be said that, people tend to prefer working with concrete reality and have an ample supply of experiences. They retain many useful facts and are considered to be practical and quick problem solvers. They are mainly interested in practical solutions that show instant results. They tend to enjoy undertaking applied research, especially when it results in quick benefits. At the same time, participants pay attention to processes within the group, valuing cooperation and harmonious relations. Generally speaking, participants set team objectives above his personal interests and appreciate firming up and sticking to what has been reached so far. The past and tradition are both highly valued and people (especially women) have a deep concern for quality. Women, as compared to men, tend to be more serious and think before they act.

However, if participants tend to perceive stress they are likely to start complaining. This would particularly be the case in situations when no practical results or instant benefits are seen, when the harmony in the community is threatened due to internal conflicts and arguments or when the community lacks dependable, trustful structures. Under these conditions, it is very much likely that these participants will show negative behaviour, its so-called pitfalls (Ofman, 2006). In this case, the positive qualities could turn into distortions, such as '*no willingness to deal with sudden changes'*. Furthermore, they can become '*chaotic, losing interest, impatient, critical and conservative, stifling new developments and losing sight of the broad view'*. In particular women tend to become indecisive or passive.

Secondly, Table IV shows that the qualities of the '*innovator'* and *'entrepreneur'* are less represented in the group of participants. It can be argued, that the qualities and motives of the '*innovator*' and '*entrepreneu*r' are less present. Consequently, it is quite well possible that there is an active avoiding mechanism (*allergy*) or taboo in the group of participants, when it comes to *'future-orientation', 'change and new plans', 'taking initiative'* and *'being more successful than others'*. Particularly when these qualities are being personified in someone else, the average participant appears to be *allergic* to an excess of these latter qualities and motives (Ofman, 2006). It then becomes very much likely that these qualities are perceived as *'extravagant pie in the sky'* or '*nonsense'*. This will in particular be the case when these qualities are being addressed and emphasized by outsiders (e.g. NGO) and activities lack quick benefits or concrete short-term solutions. The more outsiders confront community members with their own allergy, the greater their chance of falling into their pitfall (Ofman, 2006). Meaning that adoption of new initiatives is more likely to fail.

When we have a closer look at the data per participant, it is remarkable that 8 out of 10 participants gave high scores to question 6a (innovator), whereas other items related to the style 'innovator' received very few points. Another remark can be made with the two community facilitators. Both community facilitators have a relative higher score on the qualities and motives of the '*analyst'*. This means that they (as compared to most other participants) enjoy thinking logically and analytically and they can enable others to consider situations in a broader perspective. However, their positive impact and influence on the community also depends on power relations, the willingness to listen and accept these ideas.

4.2.3 Community: social development stage and values (We)

Reflection reports with personal observations, infographics, data gathered during the focus group meeting and the classification of spiral dynamics are used to describe the current development stages in Kapanda. The tribal (purple) and power-driven (red) stages tend to be dominant, showing nascent authority based (blue) development stages.

Villagers that are bonded by kinship and traditional practices characterize the tribal values system. In general, people think it is important to stay loyal to complex rituals that pre-describe relationships and pedagogic, transitional periods. For example greeting is subject to complex clapping rites. The initiation rites, such as the *Mukanda* ceremony (circumcision) for boys and the *Mwasikenge* ceremony for girls (see Figure 27), are also exemplary rituals. The ceremonies are particularly appreciated by Lunda's, Luvale's and Kaonde's (minorities living in the area/Kapanda), amongst others.

The ceremonies are characterized by seclusion of the initiates and involve circumcision of the initiates, tests of courage and lessons on their future role as men and husbands, and finally the presentation of the initiated to the community (National Museum Lusaka, 2014). The *Makishi* (e.g. masked characters) play an important role and are believed to represent the spirit of the deceased that return to the world of the living to guide, assist, protect and even educate community members (see video 'private video host family in Mongu'). These social and ceremonial happenings secure the group safety and the relationship with ancestors. Among other characteristics, these happenings are considered to be key for tribal, animistic values systems.

Figure 26: Images Mukanda (boys) and Mwasikenge (girls) ceremony from private video host family in Mongu.

People perceive life as a cycle; '*seasonal timing'* is during the interviews often mentioned. The first rain is mentioned as an important indicator for the agricultural calendar. This determines the moment of potholing and sowing, the harvest moment and the risks losing crops due to floods. The daily practices focus on securing daily needs (continuous attention for fetching water, cleaning and physical shelter, cooking, eating and social interaction). The attention is limited to the own community.

A small group of elites shares power and responsibilities (Induna, secretary of the village, community facilitators, camp extension officer). Each individual person is expected to be loyal to the community and needs to show respect to elderly and ancestors and their habits, emphasizing harmonious *family ties* with *specific gender and age-related roles*. Witchcraft is an accepted way to cope with all kind of uncertainties and issues (see recipe for becoming '*warm and sweet*', economic witchcraft and medical witchcraft), see Box 1.

Box 1: Examples of witchcraft

Recipe 'warm and sweet'

In a small cup you just add half a teaspoon of pounded leaves/roots to either tea or porridge.

Economic witchcraft

Boys selling fish (1,5 kg for 5 kwacha) near the tent, afraid that I would use magic. They believed that exchanging money with me, putting my money in their wallet, would make their money disappear. They traded with the translator.

Figure 27: Boys selling fish in Kapanda.

Medicinal witchcraft

We daily see a young man walking through the village. He does not communicate and walks at high pace. According to the villagers, he is bewitched: "They gave him the heart of a dog. That's why he walks around like a dog."

The power-driven values systems are also dominant and characterized in a small group of educated, 'better off' people who share power and a large group of people who are considered at the bottom of the community's socio-economic ladder. People making charcoal, collecting firewood, reeds, grass, and providing piecework are exemplary for the latter group. These activities are generally performed as coping strategies when households are experiencing a period of insecurity due to the hunger season (October- January), divorce, illness, amongst other (CGIAR, 2014). In Kapanda, payment for piecework is given in cash, foodstuffs and spirits.

In times when sufficient food is available, people tend to be friendly and thoughtful with regard to maintaining a certain level of wealth. However in periods of insecurity, abuse of power, exploitation and intimidation can become commonly accepted and less attention is paid to its (negative) consequences. The mindset is generally focused on instant (immediate) satisfaction of desires and needs with regard to status, sex and money, without thinking about consequences (Beck and Cowan, 2006). Negative excesses (alcoholism, corruption, familiar violence, neglect of children, amongst others) occur, particularly in times of weak community leadership. The used sefa-sefa fishing technique (e.g. very fine mesh netting) is an exemplary aquatic practice of short-term (depleting) fishing technique (although motives are understood).

Box 2: Examples of power-driven values system in Kapanda.

Personal notes: "*The young girl makes drawings about two fishing techniques. She explains that the pond is divided in two parts. When one part is empty, they start fishing in the second part of the pond (see Figure 28).*

1) Using baskets to catch big inch fish – "we disturb the water with our hands. The water becomes dark and the mud disturbs the fish and causes confusion. We catch the fish with our hands. Sometimes fish escape the baskets. Each day we start with this technique. When the water gets too dark we start using the second technique."

2) Using mosquito net [illegal sefa-sefa method]– "we catch smaller fish, when we can't see the fish anymore. We add a plastic bag to the mosquito net. This plastic bag is used to fetch water. The fish stay in the net. The good thing is that we yield a lot of fish, all species. We can sell this fish to other people."

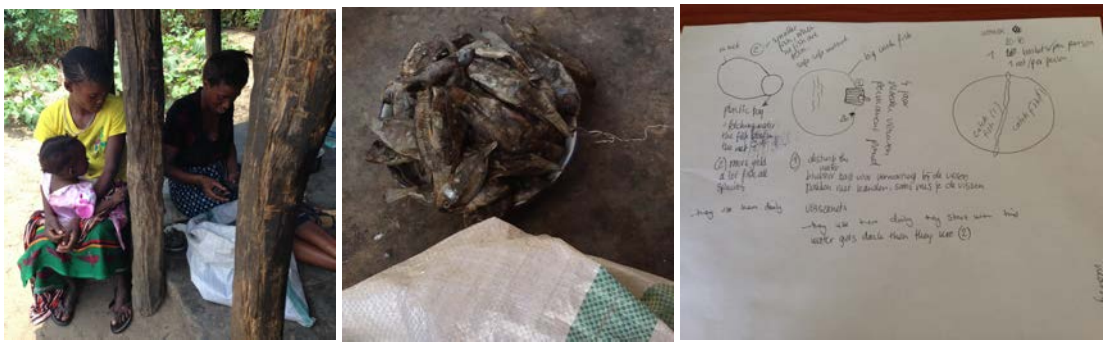

Figure 28: Young girl selling door-to-door fish, explaining their fishing practices.

Employee distribution centre of medical health Mongu: *"They say: we can die of hunger, or we can because of Malaria. Malaria is treatable. So we use the nets for fishing and make some money. Our ancestors have died of hunger too, so why don't they take care of the fish?"*

Personal notes: "*Illegal practices of making beer (see Figure 29). The Kapanda community is not checked by the governmental agencies, as there is no police station. Consequently, making beer practices flourish. If the authorities would come, these people would be arrested. This 'beer' has an alcohol percentage of about 80%. Bottles of beer is substitute for money to pay pieceworkers."*

Figure 29: Process and tools needed to produce local beer.

Personal notes: *"During the evening a lot of noise (around 23.00 hrs). I thought they started slaughtering a pig. For 20 minutes I can hear a 'pig' screaming. I ask Angela what is going on (she on telephone with friends). She explains: "a drunk uncle is beating his two-year old niece, without notice of the mother." When the mother arrives the beating stops. The mother and uncle are in a severe dispute. "You nearly broke my daughters ribs. Can you replace my daughter? You overdrink, you normally exceed your drinking!" Angela: "The uncle took advantage, because the mother is pregnant, without a dad around."*

In Kapanda, the Mbanga Rural Health Center (RHC), the Mbanga Basic School, the church and the presence of the Ministry of Agriculture and Livestock are examples of valued authority-oriented institutes (see Box 3). These institutes represent the 'blue' value meme. Villagers are generally satisfied with the quality of the medical support. Figure 30 shows valuable places in Kapanda. Participants valued the medical center, the school, the church and the cattle service house, amongst others. These pictures of valuable places can be seen as an indicator, that participants value authority-based and task-oriented institutes.

Figure 30: Valuable places in Kapanda.

However, young children dropping out of school at an early age, the limited trust in 'modern' medical support and the excessive use of alcohol make the development of a mindset that favours '*discipline, morality, equity and justice*' quite difficult. These factors, however, seem to be of vital importance to start adopting new initiatives, such as conservation agriculture, as they require planning, structure and discipline.

Box 3: Examples of task-oriented and authority-based development stage in Kapanda.

Personal notes: "*Each meeting starts and ends with a prayer, which is devotedly applied. During the transect walks 'God' is often recalled. When I ask: "How come these hills are here?" "God created those and wanted them there." Another farmer answered: "Fifteen km's further down there are hills and many streams. This part is just the interconnection between that area and the plain."*

The Induna is a traditional key leader and a representative of the Barotse Royal Establishment, who are known to have 'close contacts with God'. The Induna are considered to be wise men, which represent 'discipline, morality, equity and justice' (=blue system). In case of disputes or incidents, they are responsible for traditional court meetings (*Ubuntu*), which can be understood as a formal court system. Furthermore, they lead dispute resolution, the assigning of farmland, resource allocation, and community organization (CGIAR, 2014). The Induna has a final say, judges and decides about right and wrong. Final decisions and punishments are legal. When the convicted person is not able to meet (pay) the punishment, he is expelled from the village. In Kapanda, there seems to be a deadlock with regard to the role of the Induna. Current authority structures are limited or subject of discussion. The current Induna is labeled as 'not strong' and part of the community does not accept him (see Box 4). Therefore, the current 'blue' system can be considered as 'under construction' or 'nascent'.

Box 4: Examples of task-oriented and authority-based development stage in Kapanda (2).

Participant 1: "*The community does not want this Induna, since he does not attend meetings, he is not a good listener, he gossips, he is not wise or disciplined. He does not have a vision or dream for the community. A good leader shows these qualities and he is not courageous to seek and tell the truth*."

Participant 2: "*The induna is not accepted by the community. The late Induna appointed him, just before he died, since he had been working as a counsellor and he was expected to be a wise man. It was at gunpoint; he did not have an alternative by then. He doesn't understand how things work. He likes to claim; he puts himself in positions he can't manage properly. He wants to show that he is doing all these things. He is not good in implementing; he is only talking and he failed to mobilise people to attend the meeting."*

4.2.4 Farming systems: best agricultural practices (It)

Data collected during the three transect walks, ten interviews and one focus group meeting is used to describe the best agricultural practices in Kapanda. The farming systems in Kapanda can be classified as a small-scale, low input, mixed farming systems and are partly rooted in traditional agriculture. On average, the farm size is < 5ha and farmers cultivate several (scattered) fields at the same time. Farms are relatively small, as farmers depend on human energy (limited labour force) and simple tools (hoe, digging sticks, amongst others). Field preparation (clearing) prior to sowing is done by means of slash and burn, use of hoes and digging sticks, and only minimal use of the plough.

Farmers combine cultivating crops, keeping livestock (ducks chickens, cattle, amongst others), fishing and collecting wild fruits. This diversified livelihood strategy spreads risks can be considered risk-averse and secures food and income throughout the season. As most of the agricultural activities heavily rely on the first rains, the production level is subject to high levels of uncertainty. Farmers harvest a wide variety of produce, such as wild fruits, firewood, vegetables and crops. Maize, cassava, sweet potatoes, groundnuts and vegetables are the main crops. Both men and women do not use any pesticides, mainly due to limited availability of money. Weeding was primarily done by hand. Farmers frequently combine wet-rice systems, perennial crop cultivation and gardening, trying to secure year-round food availability. Besides that most farmers are involved in fisheries, only a few are involved in cattle rearing.

Interviewees mentioned three broad categories of reasons to be proud. Firstly, knowledge gained through skills training was highly valued to secure a higher and more stable level of production. The Ministry of Agriculture and Livestock was mentioned as the main teacher. It introduced practices related to conservation agriculture (potholing, line spacing, using two seeds per basin, amongst others). Secondly, people were proud of their own abilities to cultivate the fields without relying on external inputs (e.g. '*using my hands, I am my own manpower', 'I am proud not to depend on external tools'* and *'recycling seeds for the next year'*). The third category identified by farmers interviewed concerned the fact that they could send their children to school and secure year round food availability for the family.

When asked what knowledge would be valuable enough to pass on to their children, female farmers mentioned that they would encourage their children to start gardening and grow vegetables (for sale), use ropes and cultivate maize in lines (as this increases yield) and start at the right time with field preparation. Male farmers were more likely to encourage their children to grow cash crops and to know his fields (e.g. different soil types in their fields), to farm large scale and to finish school. Generally, both men and women classified a farmer with large fields (>3 ha), high production levels (enabling to sell produce to the market) and access to external equipment and inputs (plough, tractor, seeds, fertilizer, pieceworkers) as a successful one.

During the focus group meeting I asked male and female farmers in separated gender groups to discuss and register their best agricultural practices (see Figure 31). Female farmers mentioned they were proud to grow maize at this time (see Box 5). In the wet fields, maize was usually planted from August to September. Other drier fields were planted from October up to December. The planting season varies depending on soil types, water availability and moment and severity of flooding. Furthermore, interviewees were proud to cultivate cassava, rice, sorghum, millet, groundnuts, Bambara nuts, beans, sweet potatoes, tomatoes, rape and onion (see Box 5). The mentioned crops were merely starchy, energy providing (maize, rice, cassava, millet, sorghum) and protective crops (Pasqualino, 2014). Crop diversification was mentioned as an important technique to reduce risks and to secure food availability throughout the season.

Figure 31: Male farmers sharing and discussing their agricultural practices in Kapanda, using the fish bowl dialogue technique.

Box 5: Best agricultural practices mentioned by male and female farmers in Kapanda.

Female farmers mentioned the following activities and listed them as best agricultural practices:

1. Before we plant we collect straw and shrubs and burn them in the fields (1);
2. We apply cow dung, which is collected in the plain (2);
3. We intercrop maize, beans, groundnuts and pumpkins (3);
4. Where we harvest cassava, we plant maize because the cassava leaves are fertilizers/manure;
5. We cut big trees in the fields and once they are dry, we burn them because the ashes act as manure.

Male farmers listed the following activities as best agricultural practices:

1. Soil fertility
- By shifting kraals on a field to apply cow dung and chicken droppings
- Putting shrubs in the field and burning them
- Crop rotation (1)
- Cutting down big trees and burning them (3)
2. How to plant
- We start by preparing and cleaning the fields (September-October)
- We use ropes when planting and ploughs
3. Crops grown (2)
- Maize, sorghum, millet, groundnuts, cassava, Bambara nuts, rice
4. Weeding
- We use hoes for weeding (1)
- We use hands to remove weeds (2)
- The male farmers mentioned the use of herbicide and oxens. However, this was not actively applied, due to limited availability of cash.
5. Warehouses of maize seed
- Thatched warehouse
- Putting ash or pesticide (*Shuma*) in the bag with seeds.
- Store seeds in the corn cops, so pests don't eat up the maize.
- Store maize in roofs of the kitchen, so the smoke can help the maize from being eaten up by pests.

The mentioned best practices are a combination of traditional (shifting cultivation) and conservation agriculture. Both types of agriculture were considered to be a rather low input 'female' approach. As Mrs Ngula mentioned: "*Using a hoe, collecting manure in the field and the use of rather small fields (e.g. two lima), makes conservation agriculture a rather 'female' approach. Men are more likely to use a plough and kraals to cultivate their large-scale fields.*" Labelling conservation agriculture as a 'female, low input' type of agriculture might be a reason for its low adoption rate.

Figure 32: Agricultural practices in Kapanda.

The results of the simple proxy indicator showed that the daily diet contained a variety of food items (see Table XIII and XIV, Appendix X). Based on these data, one could argue that the diet quality (with a specific focus on micronutrient adequacy) at that time of the year was good, as participants said they would at least five out of ten food groups. However, it is possible that at other times in the year the diet is not so nutritious.

4.3 Lealui, Mongu District

4.3.1 Place: landscape, market and infrastructure (They)

Data collected during the participatory mapping meeting and three transect walks and literature is used to describe the context (e.g. landscape, market and infrastructure) of Lealui. The village, located on the western side of Mongu in the Siwito area, is one out of ten communities participating in the AAS-programme. The population density in the district (17,7/km^2) is among the highest in the Western Province, as 20,1% of the population lives here (CSO, 2010). Lealui is located approximately 25 km from Mongu, at GPS-coordinates S15^{o}13'36.1 - E023^{0}00'15.7. The area is accessible by car year round. The trip will take about 20-30 minutes, driving on a dirt road.

The Mongu-Kalabo road and bridges that are currently under construction are an eye-catching element in the landscape. This road will further improve the accessibility of Lealui, resulting in increased business due to larger numbers of customers from Mongu and eventually Angola. It is expected that these potential demand and income opportunities will stimulate the need for levelling up agricultural productivity (tonnes/ha) and motivate people to start farming (#farms/km^2). Consequently, the economic network (infrastructure, market and trading opportunities) is rather good.

Farmers tend to cultivate crops for both home consumption and trade. Crops are sold within the community, or taken to markets in Mongu. The traded goods mainly comprise rice, fish, perishable vegetables, maize, amongst others. Furthermore, the Kuomboka ceremony in April generates extra income possibilities, as many tourists visit the village. This cultural ceremony takes place at the end of the raining season and celebrates the move of the *Litunga* (Barotse King) from Lealui to Limulunga.

Lealui mainly comprises of canals, permanent and temporary ponds, and grazing lands, which are held by the Barotse Royal Establishment (BRE). Agricultural fields are found within the boundaries of the village, the floodplain and upland areas, mainly nearby water sources, such as ponds, the Kings canal, the 12th canal, Zambezi river and Lwanginga river (see Figure 33). In the dry season, farmers use the floodplain mainly for cattle grazing and vegetable production. During the wet season the area is used for fish farming and rice production. The area serves as a species habitat for wild animals, such as crocodiles, hippos, water lizards, snakes, birds and tortoise. Less preferable soils are found on the east side of town (see Figure 33). These soils are less valued due to its (salinated) sandy composition. Soils on the western side of Lealui mainly consist of preferable clay loam. Yearly floodings are considered to provide fertile clay particles.

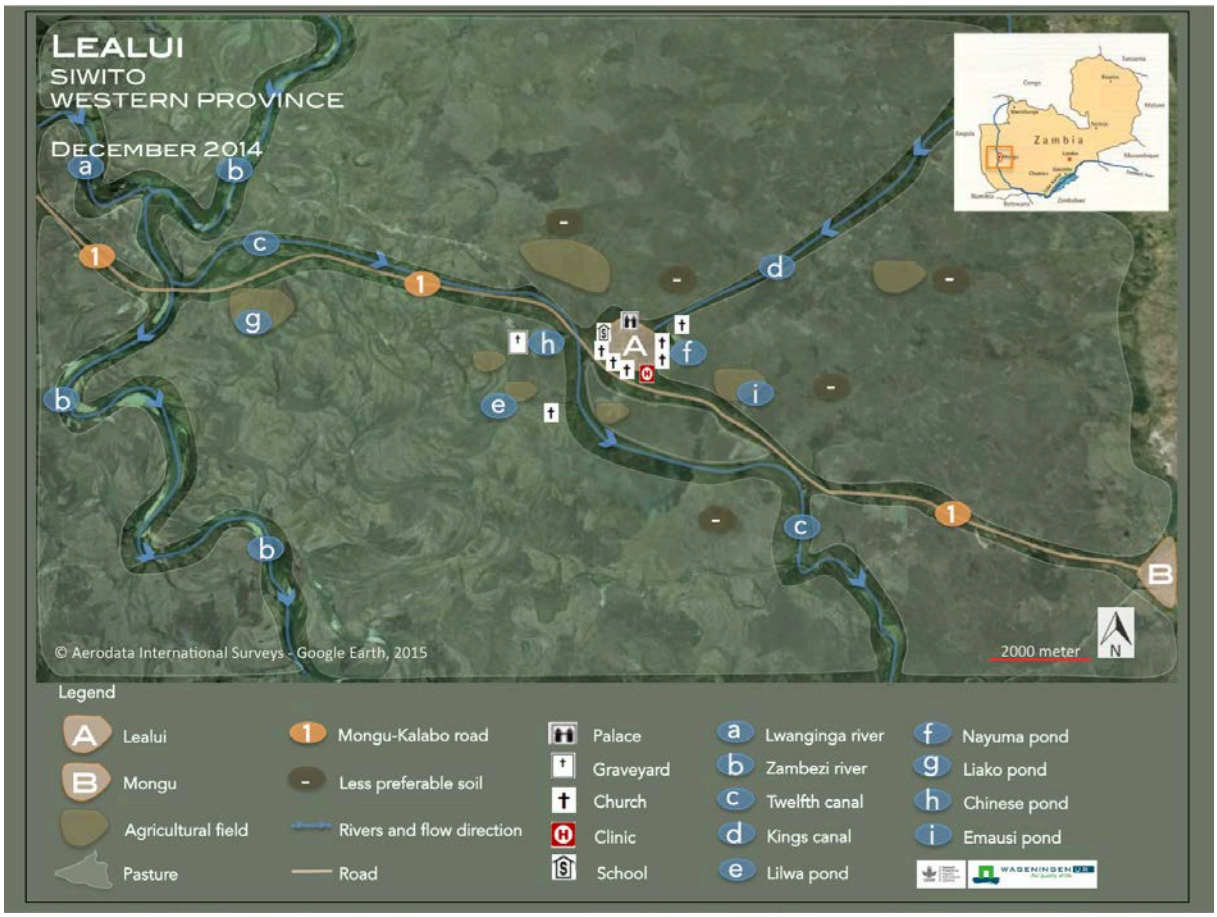

Figure 33: Map of Lealui, Mongu District.

Close to the road constructions, several artificial ponds can be found, as the road constructors are using the sandy soil for building and levelling up the Mongu-Kaloma road. *Ngonyande* (waypoint 127, see Figure 34 and Figure 35) is one of these. The pits that are left can be used as water reservoirs, fishing ponds or intensive fish farms in the near future. The soils on the western side of Lealui (waypoint 121 and 123, see Figure 34 and Figure 35) are classified as clay loam soils and valued for its fertility.

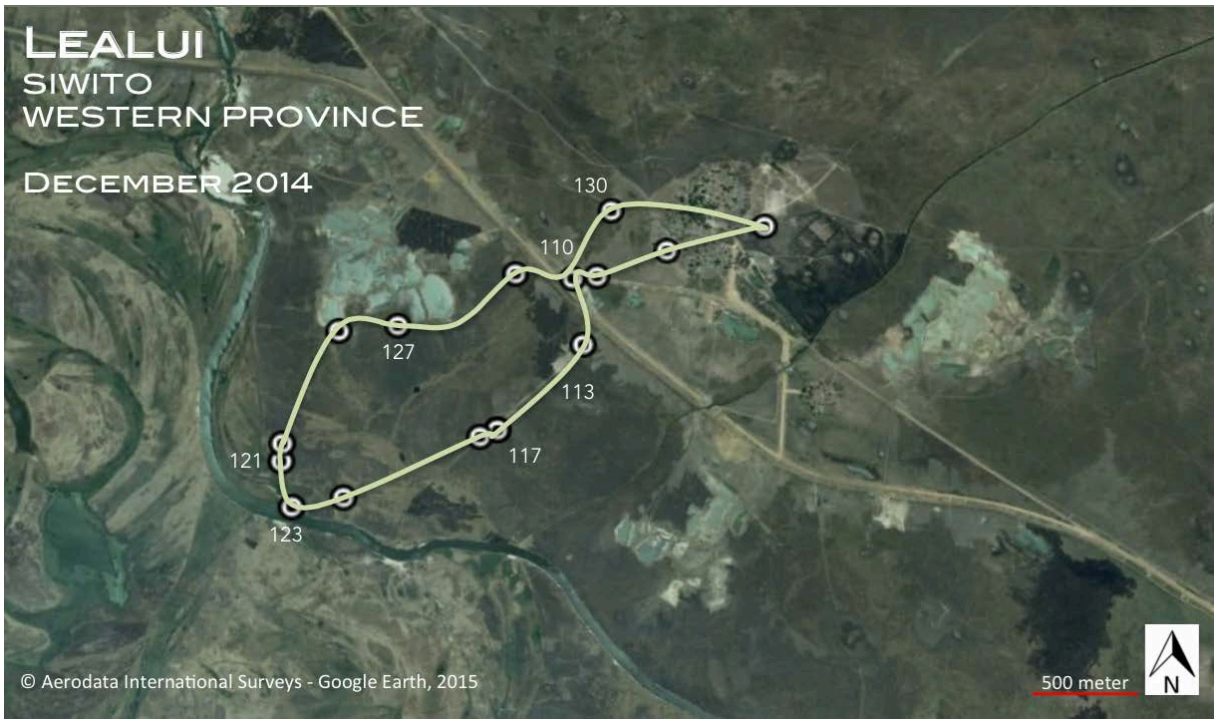

Figure 34: Map of first transect walk Lealui. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Figure 35: Landscape pictures made during first transect walk in Lealui, December 5th, 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Figure 36 gives an overview of the second transect walk in Lealui. The area severely floods during the wet season and is mainly used for fishing activities as the water level can rise by 2-3 meter. During the rainy season, fishing activities are the most important and profitable livelihood strategy. Canals (see Figure 37, waypoint 141) are a common source of water used for transport, drinking, cooking and bathing. The area is appreciated for its diversity, as it serves as a species habitat for wild animals, such as crocodiles, hippos, water lizards, snakes, birds and tortoise. Furthermore, the area locates several mixed farming systems, most of them rearing cattle and cultivating cash crops, such as wheat, spinach, tomato, onion, roselle, rape, sweet potato, cabbage and pumpkin (see Figure 37, waypoint 142 and 150).

Figure 36: Map of second transect walk Lealui. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Figure 37: Landscape pictures made during second transect walk in Lealui, December 6th, 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

The third transect walk showed agricultural fields close to the village. The four farmers (see Figure 38 and Figure 39, waypoint 152, 155, 162 and 164) mainly produce cash crops, such as eggplant, amaranthus, spinach, okra, green pepper, pumpkin, tomato, onion, rape, cabbage, white squash, sweet potatoes, maize, millet. One farmer recently started an orchard, planting banana and orange trees. This farmer wants to start an intensive fish farm, using the artificial ponds created by the road constructors. The moderate to severe flooding results in active soil erosion and the sandy soils are less valued.

Figure 38: Landscape pictures made during third transect walk in Lealui, December 7th, 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

Figure 39: Map of third transect walk Lealui. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

During the three transect walks several soil samples were taken. Figure 40 shows an overview of different soil types. One could state that there is a high diversity of soil types, ranging from (saline) sandy soils to clay loam. The soil type located at waypoint 130 (see Figure 40) is located near the village. The local name of this place is *Litako* and the fertile clay loam soil is a good example of how 'unspoiled, natural soils' can look like. The location is surrounded by indigenous trees and not actively used for agricultural practices. This place is valued as it is owned by the *Litunga.*

Figure 40: Soil pictures made during three transect walks in Lealui, December 5th, 6th, 7th 2014. The numbers in the pictures indicate waypoints referring to GPS-coordinates listed in the reflection reports.

On the western part of Lealui, soils are richer with organic matter and valued for their fertility (see Figure 40, waypoint 142, 147, 164). This is a result of the labour-intense shifting kraals practice. Most farmers use manure instead of commercial fertilizers and intercrop maize with cowpeas to fertilize the fields. Generally, the sandy soils on the eastern side of Lealui are less valued, since they are considered as less fertile (see Waypoint 152, 154, 162, Figure 40).

4.3.2 Farmer: mindset (I)

In Lealui, nine participants (five men and four women) completed the questionnaire 'Personal qualities' and this data is use to analyse the mindset. One participant did not complete the questionnaire, due to difficulties in understanding the questions and set up. Table V shows the data collected from these participants. The red numbers are the lowest scores of a particular participant. The green numbers are the highest scores of that particular participant. Appendix III gives a short description of the six different mindsets in terms of qualities, pitfalls and allergies (Bos and Harting, 2006). Based on these descriptions and the results presented in table V, I have analysed the current mindset of the nine participants.

Table V: Mindset in Lealui. The scores range from 3 to 23. The green colour indicates the highest score per participant and the red colour indicates the lowest score per participant.

Participan	Gender	Innovator	Entrepreneur	Pragmatist	Custodian	Helper	Analyst
1	F	16	11	10	10	10	3
2	F	15	5	13	3	12	12
3	F	12	3	20	14	4	3
4	F	6	10	12	19	7	6
5	M	15	5	5	16	9	10
6	M	13	10	9	10	8	10
7	M	6	9	23	8	10	4
8	M	19	6	6	3	6	20
9	M	5	12	13	4	6	20

Table V shows that the mindsets of the *innovator, pragmatist* and *custodian* are generally most observed. Combining the descriptions of these three mindsets (see Appendix III), the participants of the sample can be described as curious, creative and enjoy using their imagination. They tend to enjoy envisioning what should happen in future, keep the long-term objectives in mind and they can see things in a broader perspective. These qualities are important necessities when it comes to adoption of new initiatives. Based on these results it is expected that new initiatives will be relatively easily adopted, due to participants' curiosity. However, supervising an accurate implementation can be easily overlooked. As (lead) farmers enjoy working independently and individually, this might also prevent farmers from learning from each other.

Furthermore, participants prefer working with concrete reality and have an ample supply of experiences. They retain many useful facts and are considered to be practical problem solvers. They are particularly interested in practical solutions that show instant results. Undertaking applied research, such as the learning plots intents to, is appreciated, especially when it results in quick benefits. People (especially women) have a deep concern for quality. Women, as compared to men, tend to be serious and think before they act. However, when times become stressful (e.g. no practical results are seen, droughts, little trade opportunities amongst others), these participants will show negative behaviour, its so-called pitfalls. Under stressful conditions, these people tend to become too individualistically oriented, somewhat chaotic and impatient or easily annoyed by indecisive and passive behaviour shown by other.

Secondly, table V shows that the qualities of the helper and entrepreneur are less represented in the group of participants. It is quite well possible that there is an active avoiding mechanism (*allergy*) in the group of participants, when it comes to slow, time-consuming, impractical people-oriented learning approaches. Problems occur when the average participant appears to be *allergic* to an excess of these latter qualities and motives, particularly if personified in someone else. In particular, when these qualities are being addressed and emphasized by outsiders (e.g. NGO), and activities lack quick benefits or concrete short-term solutions. The more outsiders confront the community members with their own allergy, the greater their chance of falling into their pitfall.

The Indunas (participant 8 and 9 in Table V) have a relative higher score on the qualities and motives of the analyst. This means that they (as compared to most other participants) enjoy thinking logically and analytically and gathering information as much as possible, link different information sources to finally take a decision about what should be done. The main joy is, however, in gathering information, gaining knowledge and analysing how the different elements interconnect with each other. These qualities could have a positive impact on the development of the community, as the Indunas are respected community leaders.

4.3.3 Community: social development stage and values (We)

Reflection reports with personal observations, infographics, data gathered during the focus group meeting and the classification of spiral dynamics are used to describe the current development stages in Lealui. Lealui is under the authority of the Barotse Royal Establishment (BRE) and the village houses the summer palace of the *Litunga,* the King and central authority of the BRE, the Lozi administrative centre and the Royal fleet used in the *Kuomboka Kufuluhela* ceremony. The king is supported by a prime minister and local *Induna's* for the running and developmental affairs (CGIAR, 2012). The *Litunga* select and appoint the *Induna's*. One participant said:

> *'In short we are traditionalists, but the Litunga also listens to people's recommendations when appointing new leaders. […] The Induna's observe each other. It is important to interact with fellow Induna's freely, to give advises, to have an open attitude towards the local people, to interact with local people, to be reliable when it comes to new ideas. When one is giving a post in BRE and fails to perform his tasks, the Litunga will dismiss you. You will be told to go and rest. It's more of a dictatorship.'*

Men occupy all high-level community leadership positions and women are mainly represented in leadership structures as vice-chairs, vice-secretaries, and vice-treasures (CGIAR, 2014). The BRE controls over the access to and utilization of most of the land, water and natural resources, influences the availability of services, controls the construction and maintenance of road and canals, controls the settlement of people, and is responsible for (land) dispute resolution, amongst others (CGIAR, 2014). The *Kuta* (the traditional court) is considered as a symbol of (masculine) power and much appreciated for its legislative function (see Figure X). One of the participants said:

> *'the traditional Kuta calls people and advises them that they cannot improve their livelihood apart from engaging themselves in livelihood. We encourage exchange visits, so there is an exchange between the BRE and people.*'

Farmers expressed they valued functional village elements as the toilet (sanitation: '*that is where we answer the call of nature from.'*), school (education: '*our children become intelligent […] This includes the parents, they also learn from the school.*'), clinic (health: '*people get treated and medicine and it has stop us visiting witch doctors.*'), road (transport and employment for youth), canals (transport, fishing and irrigation) and church (worship/congregation) (see Figure 41). The presence of a dirt road between Lealui and Mongu (and eventually the Kalabo-Mongu road), several shops and a café can be characterized as symbols for the '*blue*' development stage. As these functional services are part of a legal system with formal rules and procedures, rights and obligtions. Furthermore, it is noticeable that Lealui houses seven churches. The Christian values are therefore well represented in the community. This is also a strong indication for the '*blue*' development stage.

Figure 41: Valuable places in Lealui.

The presence of the king and its administrative centre results in a structured and ordered organisation of the village. Consequently, the authority based development stage is well developed; meaning that discipline, work ethics, a sense of time and rules are being valued and respected among the villagers. For example the village bell is as a good representation of this so-called 'blue' development stage (Beck and Cowan, 1996). Each evening at 21.00 hrs one of the community members rings a bell, to announce that the villagers should stay inside their house, stop walking around or making music/noise. Another example is the Savings and Internal Lending Committee (SILC-groups), who locally operate as a relationship bank. It requires clear (financial) guidelines and personal savings, as these formally organised groups provide financial services to local farmers and small businesses.

It is said that most people in Lealui (approximately 80%) migrated from their village to Lealui to start trading mealy meal, street food, charcoal and fire wood from Limunga, pottery from Lukulu groceries, sour milk, fish and vegetables. Approximately 25% of the households in Lealui mention 'trading' as the most important enterprise (Sampling frame listing aquatic agricultural systems-Barotse, 2013). Individually oriented trading activities fits with 'red' elements, trying to become the best and increase wealth and status standards. Consequently, cultivating cash crops (such as wheat, rice, maize and vegetables) and selling fish is a common habit. Farmers tend to act optimistically, take risks and are interested in new practical improvements (e.g. seed varieties, fertilizers, pest management, amongst others). However, according to one participant: '*working together and learning from each other is not commonly practiced and would improve productivity in Lealui*.'

High monetary costs and the limited availability of necessary (labelled or certified) inputs, such as (hybrid) seeds and fertilizers favour the drive to maintain a certain market-independent position. Most farmers mainly use conservation agricultural techniques (shifting kraals, potholing, line spacing, amongst others) and most of the irrigation is done using containers, as they aim to ensure their self-reliance. Permanent and large financial investments are rarely done. Central to the development of an autonomous resource base, is the ownership of land (Van der Ploeg, 2014). Land requirements on a permanent basis are still really hard, as the BRE is still controlling and owning the majority of the land resources. Consequently, farmers tend to face restrictions with regard to permanent investments and structures. In the long run, this might be a constraint for further development of the entrepreneurial social development stage.

4.3.4 Farming systems: best agricultural practices (It)

Data collected during the three transect walks, ten interviews and one focus group meeting is used to describe the best agricultural practices in Lealui. Farmers' best practices are mainly based on principles related to conservation agriculture. The farming systems in Lealui can be classified as a small-scale, low input, mixed farming systems. On average, the farm size is < 5ha and most of the fields are permanently cultivated.

Farmers combine cultivating crops, keeping livestock (cattle, ducks and chickens, amongst others), fishing and collecting wild fruits. This diversified livelihood strategy can be considered as risk-averse and aims to secure food and income. As most of the agricultural activities heavily rely on the first rains, the production level is subject to high levels of uncertainty. Farmers harvest a wide variety of

produce, such as wild fruits, firewood, vegetables and crops. Maize, cassava, sweet potatoes, groundnuts and vegetables are the main crops. Farmers frequently combined wet-rice systems, perennial crop cultivation and gardening, trying to secure year-round food availability. Besides that most farmers are involved in fisheries.

Cultivating and selling rain-fed maize, vegetables and livestock was mentioned as the most important enterprise for households (Sampling frame listing aquatic agricultural systems-Barotse, 2013). Maize was cited as the primary cash crop of Lealui (CGIAR, 2014). Selling fish is considered to be '*quick money*'. Farmers apply conservation agriculture techniques, such as terracing, potholing, crop rotation, mulching, manure and kraals (see Figure 42). In the dry season, farmers use the area mainly for cattle grazing and production of vegetables, such as tomatoes, rape, onions, roselle, sweet potatoes, cabbage, okra and pumpkins. One farmer started producing wheat, an uncommon crop planted in the area, which turned out to be a profitable activity.

Farmers tend to use hoes and ploughs to prepare their fields prior to sowing. Planting starts in August-September in an effort to generate a harvest before the rains and floods. Approximately, 80% of the farmers own cattle, which are kept in wooden kraals (Sampling frame listing aquatic agricultural systems-Barotse, 2013). Using kraals, cattle manure, mulch and the yearly deposition of alluvium help to improve the amount of soil organic matter and soil fertility. Farmers shift kraals every three or four days, to make sure fields are sufficiently being fertilized. The process is labour-intense as the farmer needs to construct a new kraal whenever shifting (Panulo, 2014).

Although the majority of farmers use containers to irrigate their fields, some of them invested in treadle pumps. Mulching, using kraals, collecting manure in the plain, using treadle pumps and containers to irrigate fields and potholing were mentioned as best agricultural practices (see Figure 42). Both men and women did not use any pesticides, mainly due to limited availability of money. However, some farmers mentioned using a mixture of chilli and water (*periperi*) to reduce the amount of pests. One female farmer mentioned collected bat droplets (inside her house) to fertilize her fields. Both men and women did not use any herbicides and weeding was primarily done by hand.

Figure 42: Agricultural practices in Lealui; keeping cattle, using kraals, ploughing, potholing, using canals and containers to irrigate fields, intercropping and terracing.

The lead farmer, whose farm is located in *Natuma* (see Figure 34, waypoint 121), applies conservation agriculture techniques. These low input practices include mulching, applying manure by using kraals, ploughing through the use of a hoe, or if accessible, draft animals, potholing and applying line spacing, using treadle pumps and water from the permanent pond and 12th canal to irrigate the fields. This farmer still lives '*the simple life'*. He and his family (wife and sons) live and work in the plain from June to January. From February to May, they live and work in higher upland areas. This successful farmer relies on his sons as (free) labour source, owns 70 cows that provide milk, meat, draft power and manure and cultivates rape, maize, Chinese cabbage, pepper, okra and eggplant.

The farmers mentioned two broad 'most proud of' categories. Firstly, farmers were proud when they produced high yields (e.g. harvest of 7 bags of 50 kg rice or 3 crates of tomatoes). Mr. Yaba Kabesanu (extension officer from The Ministry of Agriculture and Livestock) was mentioned as the main teacher. The second category identified by farmers interviewed concerned the fact that they could support their family and send their children to school. One participant expressed it as follows: '*I don't lack anything at home; I can buy cloths for my kids, soap and they are clean at all times I can eat different types of relish and I can buy fish or meat out of farming.*'

When asked what knowledge would be valuable enough to pass on to their children, farmers mentioned that they would encourage their children to start farming (even when fully employed), as this secures food availability and provides sales opportunities, planting in lines using ropes, using two seeds per basin to prevent wasting seed, applying cow dung before the rains start and using their own hands (and not just depend on equipment), using grasses to mulch as '*They don't want to rely on (expensive) fertilizers*'.

Generally, both men and women classified a farmer with farming equipments, cattle, financial support and capital and who is able to sell the produce to the market as a successful one. One participant mentioned that successful farmers were hardworking persons with a competitive spirit. Keeping cattle is strongly associated with farm success, as they provide manure, milk and meat and transport large quantities of crops. During the focus group meeting we asked male and female farmers in separated gender groups what their best agricultural practices were. Box 6 shows what female and male farmers listed as best practices.

Box 6: Best agricultural practices mentioned by male and female farmers in Lealui.

Female farmers mentioned the following activities and listed them as best agricultural practices:

1. Soil fertility – '*If the soil is fertile, then everything you do in it grows well and the yields are good'*.
2. Conservation farming – '*Potholing is good, because it also brings good yield as we grow in lines. Unlike planting anyhow, like pupils at school who are just lingering around.'*
3. Cattle – '*This is the Barotse bank where we get the milk, beef and money*.'
4. Crop diversification in Sepo's paradise – '*If you grow different types of crops, it means that in a crop where you don't have good yields then in another there will be good yields*.' [e.g. crop diversification is used to secure food security as it spreads the risks of losing crops, as crops yield in different seasons and differ in pest, weed, drought, flood resistance].
5. Canoe – *This is our vehicle, when it floods. No wonder you hear many people calling their boats "Grace of floods". No matter how much you hate a canoe owner, once it floods, you will go to them*.'

Male farmers listed the following activities as best agricultural practices:

1. Soil fertility – *'If the soil is fertile then everything you do in it grows well and the yields are good.'*
2. Maize fields – '*We have seen that the main crop grown in the Barotse is maize.'* [e.g. learning by copying behaviour]
3. Cattle – '*This is more like a channel of inheritance. Cattle bring money or wealth to us in our area. Even kings own cattle.'*
4. Canoe – '*During the floods we use the canoe. As a saying goes: "those without canoes are just good at saying they will arrive early, but fail because they will still wait for those with canoes to transport them. Whilst those with canoes will say and arrive early."*
5. Fish – '*Fishing is the livelihood activity that brings a lot of income. Out of this income people are buying clothes, paying school fees for children and many more things.'*

In order to improve the diet diversity people mentioned crop rotation and preservation techniques are important requirements. The results of the simple proxy indicator showed that the daily diet contained mostly starchy, energy providing food items (maize, rice, potatoes) and green, leafy vegetables with protective value (see Appendix X). Nearly all participants mentioned '*dairy*' as an important daily protein resource. Based on these data, I could argue that the diet quality (with a specific focus on micronutrient adequacy) was good at that time of the year was good, as participants said they would at least five out of ten food groups. However, it is possible that at other times in the year the diet is not so nutritious.

4.4 *Overview of the study's major findings*

Tables VI, VII, VIII and IX show similarities and differences between the two case studies. They provide an overview of the study's major findings, which can be used to link and analyse relations between the four different elements (They, I, We, It) and to address real-life complexities faced by farmers.

Table VI: Overview of different and similar 'They'-elements in Kapanda and Lealui.

Elements (they)	Kapanda	Lealui
Landscape	Plain, bush, forest, fixed settlement	Plain on hill, fixed settlement
Infrastructure	Poor quality, sandy roads, remote area, one shop	High quality, (inter-)national road, accessible area, shops and permanent market, churches
Market	Home consumption and informal, local market	Market (Mongu and Lealui), shops
Land use system	Shifting cultivation	Permanent cropping
Fields	Scattered, small fields	Permanent, concentrated fields
Soils	Fragmented and heterogeneity	Fragmented and heterogeneity
Water	Temporary and permanent ponds	Rivers, canals and (artificial) ponds
Flooding	Flooding of lower parts (plain), dry areas upland	Severe flooding in whole area

Table VII: Overview of different and similar 'We'-elements in Kapanda and Lealui.

Elements (We)	Kapanda	Lealui
Principles	- Respects rites, rituals, taboos, honours family ties, superstitions - Traditions are important, family is security net, traditional gender and age-related roles - Act swiftly and score quickly, immediate satisfaction of needs and wishes	- Conserves peace and quit, discipline, traditions, morality, rules, create order and obedience - Individualistic, trade-oriented - Social and economic structures, dutiful, status, growth
Quality	- Emotional bonding, care for family, strong bond, shaping power, nostalgia, true to tradition, loyalty, symbolism, action oriented, breaks free from constraints	- Action-oriented, faith, just, strict, a deal is a deal - Expert, strictly by the book, disciplined, formal, orderly, organizational ability, reliable
Negative outcomes	- Alcoholism, witchcraft, gossip, banishment if not loyal, strong resistance to any form of change	- Judgmental, preferential (our kind of people versus those kinds of people), rigid, bureaucratic

Table VIII: Overview of different and similar 'I'-elements in Kapanda and Lealui.

Elements (I)	Kapanda	Lealui
Qualities	- Concrete reality, learn for experiences, quick problem solvers, practical instant solutions and benefits - Harmonious relations, risk averse, conflict avoidance - Innovation is making existing techniques better (as compared to implementing new techniques)	- Curious, creative and enjoy using their imagination, have long-term objectives and broader perspective - Practical problem solvers, experimenting and enjoying applied research
Pitfalls	- Chaos, losing interest, start critically blame and complain - No willingness to change	- Solo, impatient, rigid
Allergy (=taboo)	- Future-orientation, taking initiative, being different or more successful	- Slow, time-consuming, impractical learning approaches
Key leaders	Community facilitators: - Relative higher score on 'logical and analytical thinking', 'consider situations in a broader perspective'	Induna's: - Relative higher score on 'logical and analytical thinking', enjoy gathering information and gaining knowledge and analysing how the different elements interconnect
Stressful situations are	- Lack of leadership or trustful rules and procedures	- Lack of decision making and being dependent

Table IX: Overview of different and similar 'It'-elements in Kapanda and Lealui.

Elements (It)	Kapanda	Lealui
Cropping system	Shifting cultivation, chitemete, slash and burn, cutting and burning trees	Permanent cultivation in river banks and plain
Crops	Cassava, maize, sweet potato, rice, fruits, sorghum, nuts	Cash crops, rice, vegetables, maize
Animals	Few cattle, ducks, few chickens, impala	80% of farmers own cattle, ducks, chickens, hippo's, crocodiles
Field preparation	Potholing, occasionally plough, using ropes, 2 seeds per pit, before the first rains	Potholing, occasionally plough, using ropes, 2 seeds per pit, before the first rain
Water management	Rain, containers	Rain, containers, treadle pumps
Weed management	Hand weeding and hoes	Hand weeding and hoes
Pesticides	Nil	Chilli tinctures, occasionally pesticides

Both villages are located in the Western Province, near Mongu, dealing with similar climate conditions, seasonal variability's (flooding and droughts) and soil types. Much of the direct surroundings are characterised by the presence of the plain. Fluvial soils are fragmented into relative small fields and show high heterogeneity. In both case studies, soils and consequently, fields, differed in soil fertility and –moisture. Both villages are characterised by low-input farming systems, in which farmers use simple tools, such as hoes and hands, and produce maize, rice, cassava and vegetables, amongst others. Most farmers live in permanent settlements, located in higher sandy areas.

Farmers in Lealui, as compared to farmers in Kapanda, use a slightly different livelihood strategy to overcome issues. This is partly due to a different economic network (better infrastructure, available market opportunities). As compared to Lealui, Kapanda deals with limited, poor quality infrastructure. Consequently, the trading opportunities are small and farmers mainly produce for home-consumption. Furthermore, farmers in Kapanda have little access to financial loans and external inputs (seeds, fertilizer, pesticides, tools and knowledge).

Agricultural practices with regard to field preparation, soil fertility, water supply, weed and pest management seem to be quite similar. However, in Kapanda the agricultural practices are mainly rooted in traditional agriculture (*chimetene*). Lealui, on the other hand, shows greater variability in agricultural practices, as farmers have better access to financial loans, external inputs, cultivating permanent, larger fields, rearing cattle and producing cash crops for the market in Mongu. The best practice farmers in Lealui all mentioned to apply conservation agricultural techniques.

Tables VII and VIII show that both case studies reflect similarities and differences with regard to the mindset and socio cultural values. In both Kapanda and Lealui farmers tend to enjoy learning opportunities with concrete, practical solutions. They are quick and practical problem solvers and are willing to learn from experiences and experiments. In both villages, key leaders play an important role when it comes to adaption of new practices, as they enjoy gathering information, gaining knowledge and analysing how different elements interconnect. These qualities are important when it comes to providing information and creating awareness with regard to new practices.

It is quite remarkable that farmers in Kapanda show risk-averse behaviour, emphasizing harmonious family ties and specific gender and age-related roles. Families are bonded by kinship and traditional practices and it is important to stay loyal to complex rituals that pre-describe relationships. One can even say, that farmers avoid '*being different*'. Being loyal to the community, showing respect for existing rites, tradition and honouring elderly and their habits are highly valued. Witchcraft is an accepted way to cope with all kind of uncertainties and issues. These strong believes in superstitions results in even stronger risk-averse and avoiding behaviour. In general, farmers aim at *improving existing* techniques better (as compared to *implementing new* techniques). These motives and qualities partly explain why farmers still apply shifting cultivation techniques and why the adoption rate of new practices is generally low.

Farmers in Lealui show a different profile; they are more individualistically orientated, curious and willing to experiment with *new* techniques. Furthermore, values such as 'tradition, discipline, morality and obeying rules and order' flourish. This results in a relatively orderly and dutiful community and farmers enjoy working with experts, detailed instructions and procedures (strictly by the book) to improve their farm productivity. In Lealui (as compared to Kapanda), farmers tend to be less impulsive and are more likely to build a (financial) buffer, which can be used to ensure farm resilience and stability.

5 Discussion, conclusion and recommendations

5.1 Discussion

This subsection will present an overview of the most important limitations of the study. The first limitation of the study is the use of certain sampling techniques. The two villages were selected, as they were located in *significant contrasting places*. The participants were selected through purposive sampling, as these techniques are useful in best practice studies, like this one. However, it is unsure whether the research sample is a typical representation of agro-ecological systems in the Barotse floodplain, Zambia. As a consequence, the research findings cannot be generalized. Furthermore, a sample size of 20 participants is considered to be small, especially compared with quantitative research. However, since the collected data is detailed and rich, sample sizes are required to be small (Ritchie and Lewis, 2003). Future studies could invest more time and attention in identifying those criteria that are needed for an appropriate and representative population sample.

Secondly, the study itself is framed, as it focussed on farmers' perception of *current best practices* in relation to elements with regard to place, farmer and community. Consequently, no data was collected with regard to agricultural issues or local problems. Although these were sometimes mentioned, I did not go in much detail, as the main interest was to collect *'positive'* information and valuable practices (appreciative inquiry approach). Although I could question (and think differently) about some of the mentioned best practices, I appreciated and accepted the perception of the farmers. This research attitude and approach resulted in new insights and a better understanding *how* farmers think, as opposed to *what* they think. I gained, for example, a better understanding of slash and burn practices. In Kapanda, farmers conducted these practices in sandy soils with low moisture content. Strømgaard (1992) indeed showed that, in these soil types, the level of soil organic matter increased after burning. Furthermore, as long as farmers respect the length of the fallow period (>10-15 years), these practices do have a positive effect on soil fertility, since the fire limits weed biomass and increases nutrient availability (nitrogen, available phosphorus, potassium and calcium) (Ando *et al.*, 2014).

Thirdly, data with regard to political institutions, different levels of governance and domains of policy was not included, due to the extent of the topic. Future studies could invest in identifying complementary data with regard to these politically fuelled opportunities and barriers.

Fourthly, the research findings are (partly) based on self-reported, qualitative data sources subject to uncertainties. For example, productivity data turned out to be highly variable and could not be predicted with great precision. It is not clear whether these productivity levels were actually achieved. Secondly, participants were asked to complete the translated questionnaire 'Personal qualities'. To validate the appropriateness of the questionnaire, I consulted two colleagues who completed the questions and who were both positive about its applicability. There might be a bias in the questionnaire; meaning that the '*innovator*' is even less represented in the community, than table X already suggests. Question 6a: "*I am impatient with those who block progress, if only because I myself am a several steps ahead of them"* can also be understood as an item related to '*pragmatist*'.

As this style can also show impatient behaviour. In order to validate and check personal results, I raised follow-up questions and used summarizing techniques. I asked, for example, whether the participant could verify the results with practical real-life examples. These additional questions sometimes provided extra insights in decision-making processes and inter-relational dynamics.

It is quite likely that verbal and non-verbal language differences have influenced and biased the collected data. The different composition of Silozi and English language sometimes resulted in barriers. However, by involving a skilled professional as interpreter, who permanently assisted me during both data collection periods, I tried to limit the impact. Daily debriefing meetings gave me the opportunity to reflect and (if needed) to adjust questions or to give directions.

Finally, data collected with the simple proxy indicator is (especially in Kapanda) quite likely influenced by intentions to exaggerate their social position in the community, as 'having enough food' or 'not being hungry' are important indicators for success and social status. The seasonality (and sometimes limited availability) of food items might also have biased the collected dietary data. However, using the simple proxy indicator did create awareness about nutrient deficiencies and diversity of diets and the posters (eat 5 different food types each day) were much appreciated.

5.2 Conclusion

The aim of this study was to develop a better understanding of the mindset (I) and socio-cultural values (We) that influence the relations between nutritious food production (It) and landscape (They), while studying successes. This study offers new insights into the mindsets of individual farmers and social development stages, by analysing best practices and elements that farmers classify as valuable.

Generally, it was found that contrasting place-related life conditions (soil heterogeneity, moments and severity of flooding, droughts, economic infrastructure), created a heterogeneous assemblage of mindsets, values systems, agro-ecological practices and farming styles. It can be argued that the mindsets and values are a '*best solution*', '*rational*' or '*best behavioural response*' to cope with and that emerged from place-related life conditions. Furthermore, the study argues that rural development approaches and technologies that support, meet or fit currently, existing mindsets and social development stages (values) are more likely to be adopted. Choosing a teaching approach and developing communication strategies that honour, endorse and appreciate current values systems are key, as social change is partly based on semantic discourse.

It seems evident that getting a better understanding of mindsets and value systems contributes to the development of more effective learning events, as new techniques can be introduced in such a way that it fits the needs, motives and qualities of farmers and the social development stage of the community. Implementing new practices using participation processes, in which different stakeholders work together, can be of great help. Although participation processes differ in the extent to which power is shared, the approach is not *always* of great value. As the approach is based on the assumption that transparency, being different and individual contributions are being valued. For example, in highly centralized communities or in communities in which only one actor is about to

bring in knowledge and perspectives, participation processes are of less value and might even confuse participants. This emphasises the need to pay attention to the question *how to locally implement* new technologies.

It is sometimes mentioned that, in order to improve the adoption rate of new technologies, the mindset of individuals should change. However, people and groups will generally only change if they perceive a particular friction that occurs when patterns of thought or behaviour no longer fit with the life conditions (ValueMatch, 2013). Change is often generated by a disruption of the current situation. Based on the research findings, I can conclude that the formal and informal key leaders and (lead) farmers live in a quite stable and balanced way. The livelihood strategies are in that sense well adapted to the circumstances and there seems no real drive for a turbulent change or breakthrough. Under these conditions, improvements and incremental changes *within the current framework of thinking* are more likely to succeed. However, it is plausible to argue that *changing place-related life conditions* (e.g. building roads, improving irrigation systems, improving access to information, inputs, subsidies, amongst others) will trigger the need for changing human coping strategies.

The introduced lemniscate model and its four system elements can provide useful insights for a 'theory of change'. As results showed that introduction of rural development projects and new technologies require a balanced prioritization of '*why, what, when, where*, *with whom* and *how'* to start. Information about '*why, what, when and where to start'* requires an understanding of the place-related conditions (e.g. landscape, infrastructure, input and output market) and land use systems (e.g. best practices). The aspect of *with whom and how* requires an understanding of individual motives and qualities and the social development stage of a community. Selecting the appropriate momentum, place and people seems to be a key issue when it comes to crafting an 'innovation' strategy suitable for a given community.

5.3 Recommendations

Rural development and adoption of new technologies depend on mindsets, socio-cultural values and priorities of the communities, and are strongly related to place (Horlings, 2015). What works and is valued and appreciated is connected to specific places. What works and is valued and appreciated is temporary; it holds as long as the conditions remain in place or until new, replacing innovations are introduced. This, however, does not mean that social change and successful introductions of new technologies are impossible.

In Kapanda, for example, new techniques can be introduced during learning events, that:

- Use rituals, symbols, drawings and visualizations;
- Use group rewards (make no exceptions to secure group safety);
- Let farmers copy and imitate behaviour, step by step;
- Appreciate each experiment or learning attempt and give suggestions for next time;
- Create 'special places' for important and recurring activities;
- Use story telling, myths and metaphors to explain complex issues.

In Lealui, for example, new techniques can be introduced during learning events, that:

- Give clear instructions;
- Use step-by-step and practical rules and to-do-lists;
- Provide data and facts;
- Support memorizing data;
- Use experts and authorities

Because of the great heterogeneity in the biophysical, agro-ecological and socio-cultural conditions in Lealui and Kapanda, further research can give priority to characterizing landscape and agro-ecological farming systems. This information will allow stakeholders to compare and interpret landscape characteristics and land use systems from different locations.

At farm level, the following topics can be examined (amongst others):

- The composition of the farm households and labour availability (both on-farm and off-farm labour);
- The farming styles; including farm income and productivity, cropping systems, animal systems, input requirements and sales opportunities;
- Gender roles, and especially the role of women in producing crops;
- Motives, mindset and socio-cultural values systems with regard to diversity of diets and use of food items.
- Current farm practices with regard to erosion (contour cropping and terracing), weed- and pest management, and post-harvest techniques, ensuring longer lifespan of produces.

At village level, the following topics can be examined (amongst others):

- The availability of farm inputs such as early maturing, flood/drought resistant varieties, fertilizers, pesticides, herbicides, improved irrigation technologies (treadle pumps) and labour;
- The accessibility to land use, financial services and credit facilities for both men and women (cash transfer, SILCY-groups, amongst others);
- The possibility of re-positioning successful products towards markets, by branding unique and valuable local aspects, such as physical qualities, heritage and/or skill sets of products;
- The presence of Mango-processing opportunities, including the infrastructure;
- The use of leguminous (fodder) trees and hedges as green manure and to prevent soil erosion;
- The soil heterogeneity by classifying soils, determining their fertility status and compiling a potential nutritional productivity map.
- Geo-referencing learning plots, soils analysis en possible nutritional crop calendars.
- The potential of introducing regional crops and animals, such as cultivating fruit trees (to improve soil organic matter, buffer water flows, buffer micro-climate, provide habitat, reduce soil erosion, store carbon and harvest fruits), cultivating edible mushrooms (and opening up new markets for female farmers) or rearing goats (to reduce weeds, provide manure, meat and milk).

More in general, the following activities might be considered to facilitate further regional development:

- Develop communication strategies targeted at current social development stages; use for example traditional leaders and healers (animistic tribal), radio, and posters to support awareness and stimulate interest and influence decision-making processes. Integrate positive messages that value and appreciate what farmers already do, link these messages with potentially new practices (e.g. faster, easier, more, better, amongst others).
- Sell small (and therefore cheap – maximum 7-10 Kwacha) trial seed and fertilizers packages to farmers.
- Develop hands on learning plots, which require little investments and effort and let farmers quickly experiment with the techniques to decide their relative success. Organize post-harvest and cooking activities, using the crops cultivated in the learning plots.
- Invest in infrastructure; including roads, schools, (irrigation) water, clinics, sanitation, telecommunications, and energy.

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Appendix I Map case study area

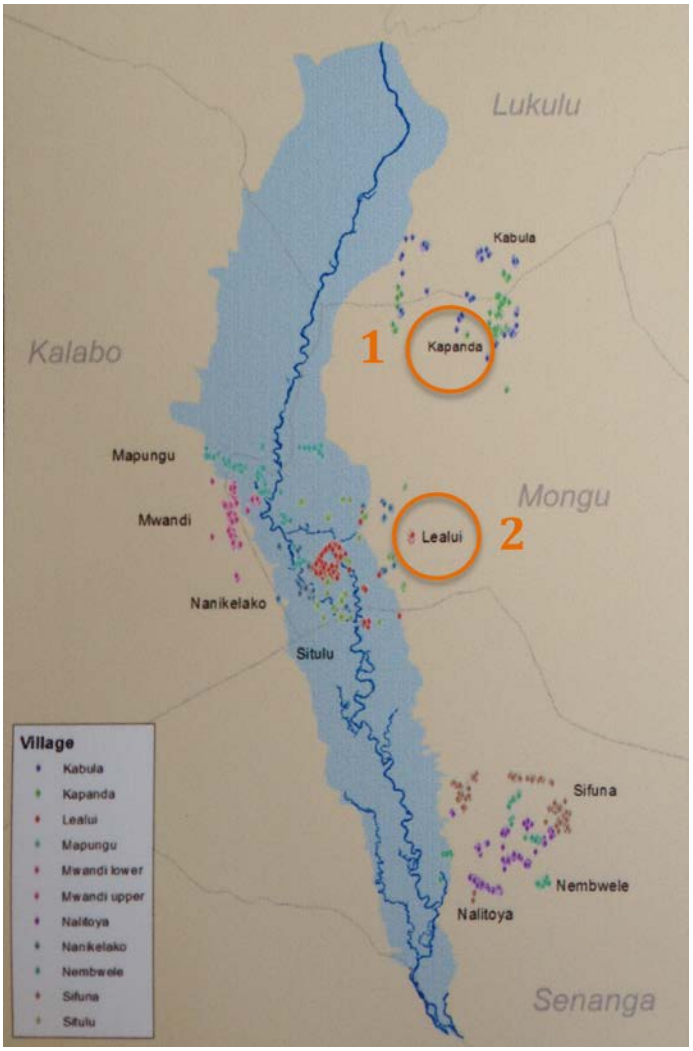


Figure 43: Map Western province in Zambia, its ten AAS-communities and two case study areas: Kapanda (1) and Lealui (2).

Appendix II Creation lemniscate

(Source: Coppenhagen, 2002)

Successful adoption of new initiatives makes use of four creation powers*:* the power to nourish personal power, the power to cooperate, and the power to shape. These four *powers* briefly as follows:

1. Power to nourish (They)

Power to nourish refers to the way the adoption technique is anchored in its context. This power indicates the extent of the importance of the new development, the needs and wishes that are met and the results it achieves. In exchange for this, the context nourishes the initiative with assets (supplies, money, time, and so on), energy (attention and support), and with good ideas that can inspire the community members. Landscape, markets and income opportunities and politics represent the context.

2. Personal Power (I)

Personal power points to the *individual* that is the source of all innovation. Innovation and change always begin with an idea that people develop in their imagination. Imagination is the ability to rise above the current reality and to look forward to a possible or desirable future. Commitment indicates to what degree one associates oneself with an idea and accepts responsibility for its realisation. Individuals make use of their qualities, motivates and skills to realise step by step their ideas.

3. Power to cooperate (We)

The power of cooperation indicates our ability to create *collectively.* When we communicate with each other, we make our ideas clearer to others and assimilate ideas from other people. As a social being, we are capable of generating a stimulating working environment and social value systems. Thus, from a group of individuals, a community emerges in which we – in mutual dependence – create something that rises far above the individual qualities of those involved.

4. Power to form (It)

Power to form refers to all the agricultural best practices, tools, methods and procedures that are available to realise (materialise) ideas, visions and ideals. These tools, method and procedures can be clustered in three different farming systems: traditional, conservation agriculture and conventional agriculture. Secondly, the power to form refers to the diversity of the diet and the different food groups that are used on a daily basis.

Adoption of new techniques only arises when the four pillars or powers are all present and flourish within the initiative or project. In those situations learning processes run smoothly. All people involved are committed and take responsibility. They do this because there is a clear need for improvement and people are comfortable with experiments and expressing their passion and creativity.

Appendix III Questionnaire 'Personal qualities'

(Source: Bos and Harting, 2006)

1. Purpose

This questionnaire helps each participant in recognising his or her personal qualities in relationship to the functioning of the community as a whole. It gives the participant the opportunity to consider his or her strengths. The results are used to consider the mindset and motives of the participants and to gain insights into the functioning of the group of participants/community.

2. Procedure

1 Explain the purpose and answer the questions on pages 2 and 3. Miss Angela Wasamunu has translated the questions in Silozi, the local language. The participant divides ten points per question.

2 The facilitator puts the scores in the chart on page 4 and adds them up horizontally. Make sure the total is 60 points.

3 The facilitator takes the scores from the chart and transfers them to the circle on page 4 by colouring 1 segment per 5 points from the individual score, starting from the centre moving outwards.

4 The facilitator explains the graph and the personal qualities. The facilitator asks for a response and some examples that are exemplary or support the presented results.

3. Questionnaire 'Personal qualities'

This questionnaire is made up of six statements. Each statement is cut in two. The first half is a given, which you are required to complement by your choice from six possible alternatives. Per statement, you must divide ten points over these six alternatives. If there is only one that you find applicable, allocate all ten points to that alternative. In many cases you will find that two or more 'answers' should be given points. Do this as desired, as long as you spend no more and no less than ten points per statement. Again, don't think too long but use your intuition!

1 I love my work, because I:

a like to analyse situations and look for interrelationships;
b am interested in finding practical solutions that really work;
c create the conditions that lead to good results;
d feel good if I can give my all;
e like to find areas that provoke my imagination;
f like to create order, also in the work of others.

2 Typical for my way of working is that I:

a make an effort to ensure that all my colleagues can make their contributions;
b often have a clear view on things, connect things and that I knock the bottom out of inconsistent reasoning;
c make an effort to continually bring up new proposals that are tested by practical experience;
d always keep an eye on what has to be achieved and formulate the aims and objectives based on my vision of the future;
e always aim for perfection in performing any group activity;
f without too much hesitation determine what has to be done when the time has come to take decisions.

3 Once I'm involved in a project:

a I am successful in steering people in a certain direction;
b it's my vigilance that protects us from making again the same mistakes that occurred in previous projects;
c I am always prepared to support a good idea and to encourage others to make a contribution;
d I'm always looking for new ideas and developments without paying too much attention to their immediate feasibility;
e my ability to see the wider context of things and point out consequences contributes to reaching the right decisions;
f I can be trusted to put my heart and soul into creating a practical and feasible result.

4 My most important contribution to the team is that I:

a often inspire others to look for new challenges
b get along well with a large variety of people
c find it easy to distance myself from daily details and think objectively about the general situation
d work efficiently and am able to make others work the same way
e am prepared to be unpopular for a while if that is required to bring the desired results
f usually know what is feasible and realistic to expect, based on my experience.

5 Shortcomings I may have in working in a team are that I tend:

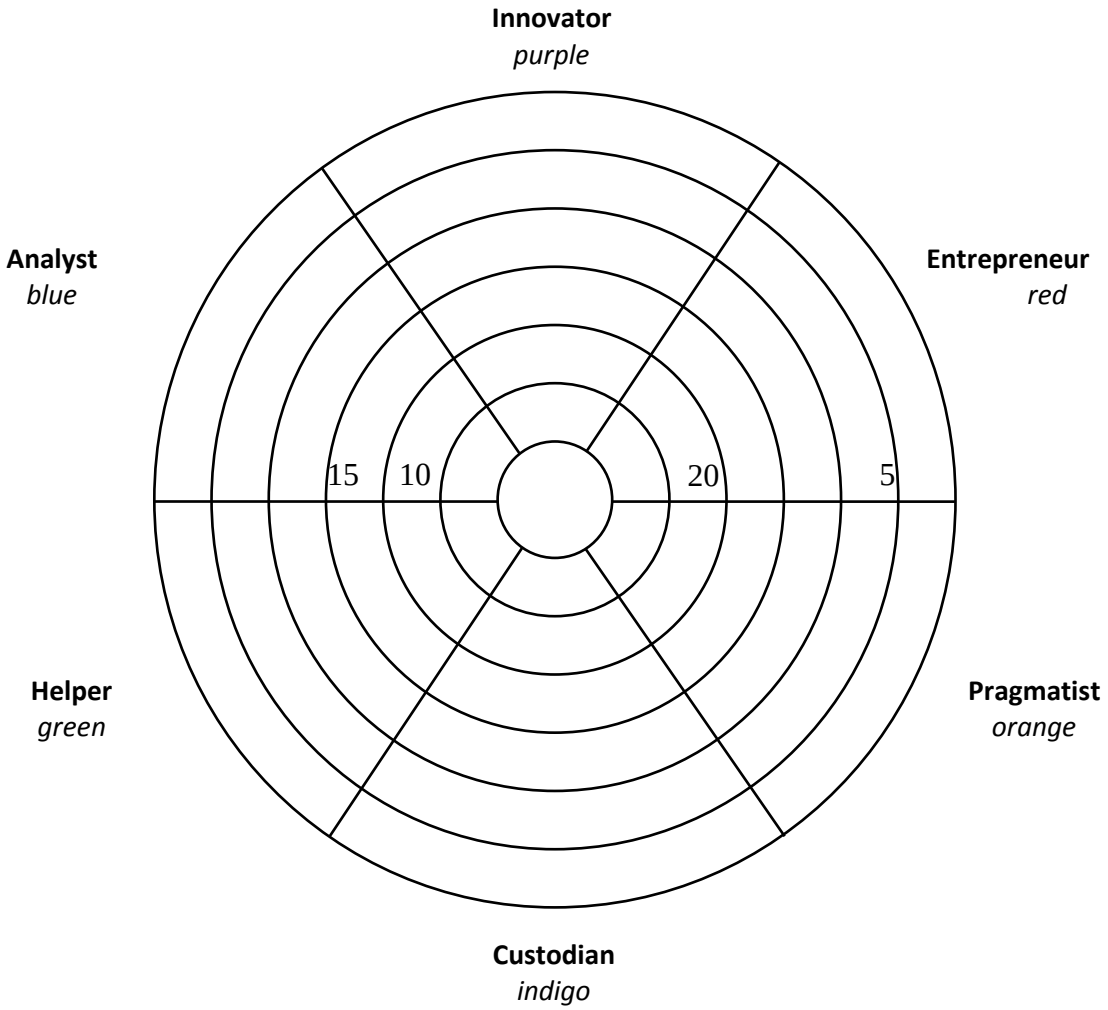
a to feel only really at ease if meetings are lively and stay practical; I give up if they become woolly or too theoretical
b to put pressure on others if I believe in an idea
c to find it difficult to quickly and enthusiastically go along with the opinions and brainwaves of others, such because of my critical attitude
d to find it difficult to take the lead from the beginning and take initiatives; perhaps because I'm very sensitive to the climate within the group
e to loose myself in ideas and ambitions that occur to me and become impatient if others cannot keep up with me
f to sometimes unnecessarily worry about details and the chances of failure, because of experiences in the past

6 Problems I have in working in a group are that:

a I am impatient with those who block progress, if only because I myself am a several steps ahead of them
b I sometimes cause irritation by being concerned to do things well and considered, based on my belief in achieving high quality
c I sometimes need others to make me feel involved with practical matters; I prefer to keep an eye on the larger picture
d I sometimes don't understand why many of my ideas and proposals are not taken up by others
e I get irritated by the thorough approach of others when I see the need for swift action
f I sometimes spend too much time and attention to the conditions that need to be met in order to execute an idea.

Table X: Mindset chart per participant.

Personal style	Points		Points		Points		Points		Points		Points		Total	
Innovator	1 e		2 d		3 d		4 a		5 e		6 a			
Analyst	1 a		2 b		3 e		4 c		5 c		6 c			
Entrepreneur	1 d		2 f		3 a		4 e		5 b		6 e			
Helper	1 c		2 a		3 c		4 b		5 d		6 f			
Pragmatist	1 b		2 c		3 f		4 f		5 a		6 d			
Custodian	1 f		2 e		3 b		4 d		5 f		6 b			



4. Qualities and their pitfalls

The six basic mindsets occur in three pairs, each pair a set of opposites. The six mindsets are illustrated in Figure X.

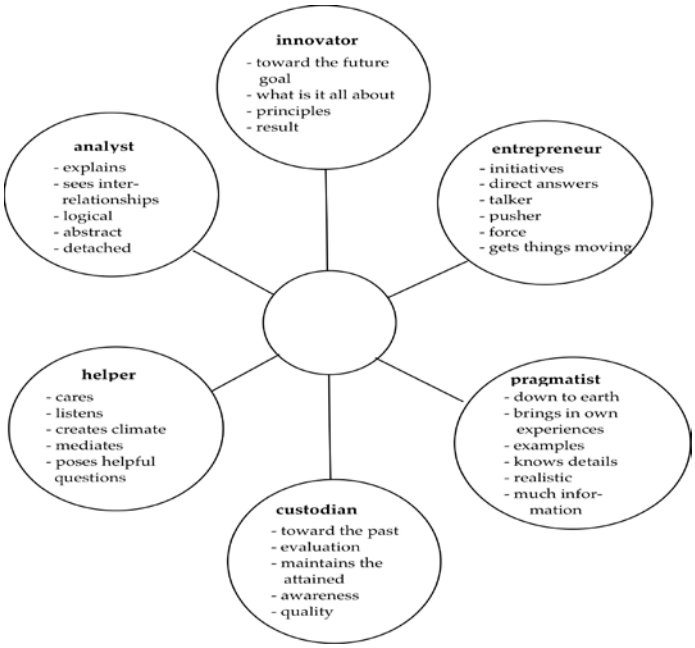


Figure 44: The six mindsets (Bos and Harting, 2006)

The innovator: future-oriented

The innovator uses her powers of imagination. He is creative, future-oriented and links objectives and results to a vision and dreams. The innovator wants to or can see the broad view and keeps in mind long-term objectives. He will continually explain to the group what the actual issues involved are. For him, all kinds of phenomena are significant. The innovator can make snap decisions and be tenacious and informal. This makes him a source of inspiration for the group. He encourages and empowers others to look for new challenges. However, his ideas are not always easily accepted and/or realistic, since, he is not much concerned with details of carrying them out and sometimes supervising teamwork can be overlooked. One of the main pitfalls is that he continues working, while losing an understanding of what is happening in the environment. This might even result in narrow-mindedness. The innovator might be allergic to conservatism and nitpicking.

The custodian: past-oriented

In contrast to the innovator, the custodian has little interest in the ultimate goal. His virtue is in firming up and sticking to what has been reached so far. In that sense, he values the past and prevents making the same mistakes. Structuring information, summarizing and evaluating are considered as qualities. The custodian has a deep concern for quality and he tends to be serious and prefers to think before he acts. He favours to work out decisions in such a way that precisely the right measures are adopted. He cannot and will not deal with sudden changes. A lack of dependable structures makes him uncertain, which might result in a constraining effect on the group. He is notably lacking in own ideas and he can become too critical, conservative and even a nit-picker. When under stress, he can stifle new developments. The custodian tends to be allergic to vague solutions, chaos and untidiness.

The analyst: abstract thinker

The analyst can explain whatever arises, because he can think logically and analytically. He is someone who would rather think than do, and, in general, action is not a strong point. The analyst enjoys analyzing situations and to connect different elements. In this way he enables others to consider a certain situation in a broader perspective. The analyst is therefore pre-eminently suited to sketching out the broad outlines of policy. He can bring systematic order into a complex of activities and problems. When the analyst carries her qualities too far, he becomes rigid, cold, detached, intellectual, and academic. Under stress the analyst can one-sidedly cling to a theory, sometimes resulting in social isolation. The analyst tends to be allergic to chaos, hastiness and incompleteness.

The pragmatist: practical problem solver

The pragmatist prefers working with concrete reality and he has an ample supply of experiences. He has retained many useful facts and is therefore often a source of information and a practical problem solver. He is interested in practical solutions that show quick results. He is lively and constructive in his thinking and his dealings. As a professional specialist he is very reliable, because he only deals in hard, cold facts. He likes undertaking applied research, try new practical things and has an eye for detail. The pragmatist can get bogged down in details and loses sight of the broad view. Under stress, his contribution to the group can be somewhat chaotic and he has little understanding for people who are hesitating to apply his proposed solutions. The pragmatist tends to be allergic to slowness and abstractness.

The entrepreneur: pushing people

The entrepreneur takes the initiative and is the first to step forward. He likes addressing the group and he is driven by any challenges. The entrepreneur calls upon people for action and achievement. He can encourage and stimulate others and keep it up to the mark thereafter. He is a team leader, enthusiastic, dynamic, warm and plunging ahead. However, in the event of stagnation he is easily irritated or pushy, even uncertain. Under stress, the entrepreneur will take big risks and wants to dominate others. The entrepreneur tends to be allergic to passiveness, slowness and laziness.

The helper: caring people

The helper directs his attention to processes within the group. He is attentive by nature, can listen well, and observe clearly what goes on in a team. In general, the helper focuses on group cooperation and harmonious relations. With his feel for group climate and his diplomatic approach, he will try to promote harmony in the team. The helper generally sets team objectives above his personal interests. He will not readily take the initiative himself but, at the inducement of others, will pose clarifying questions and be generally patient and caring. However, his supportive and accepting attitude can make him indecisive and passive, sometimes even stubborn and nosy. The helper tends to be allergic to dominance, relational carelessness and arrogance.

Appendix IV Description 5 stages of social development

(Source: ValueMatch, 2013)

Table XI: Colour codes and key words per social development stage (Valuematch, 2013).

Family culture	Characteristics 'purple' value system
Creed	'Tradition and customs ensure our continued existence'
Focused on:	'Safeguarding and ensuring the survival of the group'
Aspiration:	'To guarantee the survival of the 'company family'
Values:	Seniors, founders
Motto:	Loyalty and social cohesion determine our strength'
Characteristic:	Tightly knit, self-enclosed teams
Conviction:	'Safety is to be found in the midst of my peers'
Reward based on:	Loyalty and experience
Leadership:	Pater/mater familias, group elder
Decision-making based on:	Safety and keeping the group together
Quality:	Feeling for symbolism, able to strike the right chord, creating safety and sense of bond Distortion: mother hen (fussy, protective)
Strength:	Strong bond, shaping power, nostalgia, true to tradition, loyalty, symbolism
Distortion:	Gossip and slander, ex-communication or banishment if not loyal, strong resistance to any form of change

Power-driven	Characteristics 'red' value system
Creed	'It's either bend or break'
Focused on:	'Achieving notable successes in the short term'
Aspiration:	Act swiftly and score quickly
Values:	Personal strength, charisma, courage and dauntlessness
Motto:	'It's not about knowing what's right, but about getting your way'
Characteristic:	(Strong) leadership surrounded by 'vassals'
Conviction:	It's a matter of ruling or of being ruled over'
Reward based on:	Scoring, favour / respect
Learning:	Conditioning through direct reward of good behaviour or achievements, learning by doing
Leadership:	Authoritarian leader
Decision-making based on:	Position of power
Quality:	Decisiveness, inventiveness, boldness, 'where there is a will there is a way'
Strength:	Courage, decisiveness, assertiveness, action-oriented, passion, alertness, power to mobilize
Distortion:	Heeding the whim of the day, either racing or idling, anarchism, chaos, recklessness, manipulation, jumping to conclusions, 'it's either bend or break'

Task-oriented	Characteristics 'blue' value system
Creed	'Think before you act'
Focused on:	'Executing tasks and following the rules as precisely as possible'
Aspiration:	To carry out tasks (or to see that they are carried out) as well as possible
Values:	Self-sacrifice for the greater good
Motto:	'Cobbler stick to your trade'
Characteristic:	Group members are the 'cogs' in a larger hierarchical system
Conviction:	'I perform my work dutifully'
Reward based on:	Years of employment and position
Learning:	Absorbs facts as 'absolute' truths, learns through avoiding punishment
Leadership:	Competent authority
Decision-making based on:	Laws, rules and hierarchy
Quality:	Just, strict, a deal is a deal
Strength:	Expert, strictly by the book, disciplined, formal, orderly, risk-averse, organizational ability, reliable
Distortion:	Judgmental, preferential (our kind of people versus those kinds of people), rigid, bureaucratic, tunnel vision

Result-driven	Characteristics 'orange' value system
Creed	'The result is all that counts' and 'the customer is king'
Focused on:	'Satisfied customers are at the basis of status, success and recognition'
Aspiration:	Utilize opportunities to maximize performance and profit
Values:	Intelligence, success and reputation
Motto:	Competition and performance rewards are the condition for success'
Characteristic:	Units with result responsibility, with talent of personnel as the prime resource
Conviction:	I grab every opportunity and I excel in order to win'
Reward based on:	Added (financial) value
Learning:	Through analysis and experiment (trial and error), competitive learning
Leadership:	Manager/entrepreneur
Decision-making based on:	Debate and best arguments
Quality:	Strategic insight, thinking in terms of what's possible
Strength:	Strategic insight, utilizing opportunities, argumentative capacity, result-driven, entrepreneurial, competitive, customer-centered
Distortion:	Blame culture, fixation on figures, rat-race, permanently busy

People-oriented	Characteristics 'green' value system
Creed	'You can't force grass to grow'
Focused on:	Getting people to really engage in dialogue'
Aspiration:	To create harmony
Values:	Feelings and ideals
Motto:	Everyone is equal and equivalent'
Characteristic:	Community with (virtually) no hierarchy
Conviction:	'The path is the destination'
Reward based on:	Commitment and willingness to reveal yourself
Learning:	Centered on an observational learning *process*, mutual sharing of experience
Leadership:	Smooth out all differences, indecisiveness, downplaying everything
Decision-making based on:	Consensus
Quality:	Involved and empathetic, listening and connecting, idealistic, communicative
Strength:	People-centered, egalitarian, caring, consensus-driven, sensitiveness, empathy, connecting, idealistic, accepting everyone inclusively
Distortion:	Endless discussion without decision, wallowing in emotions, vagueness, narcissism

Appendix V Instructions participatory mapping

Purpose:
Sharing stories about the landscape, to get a better understanding of its different functions.

Materials needed:
Poster with map Kapanda, sticky notes, transparencies and pen
Meaning colour sticky notes:

- Blue: rivers, permanent ponds, temporary ponds
- Green: forests, trees, pasture, cropland (crops + more/less preferable soils (+ or -).
- Yellow: routes
- Pink: houses
- Pink: places for ceremonies and rituals

Transparencies - Erosion (losing value) + direction (arrow)
Transparencies - Ownership of different areas
Transparencies - Responsibility of different areas

Instructions:
Put the poster on the table. And explain the purpose of the exercise. Ask participants to look at the map and understand its meaning (direction North and what do we see).
Use the sticky notes to address current functions in the landscape. Use a different colour for each function. Make a design on top of the poster while using post-its.

Put post-its:

1. Where is the water in the dry season? Show rivers, permanent ponds, and temporary ponds.
2. Where is the water in the wet season? Show rivers, permanent ponds, and temporary ponds.
3. Where are the agricultural fields, with which crops? Where are forests, trees, and pasture?
4. Where are the more of less preferable soils (+/ -)?
5. Where are the (walking) routes?
6. Where are the houses?
7. Where are places for ceremonies and rituals?

Mark on the transparency:

1. Erosion and direction
2. Ownership of areas
3. Responsibility of areas

- What practices do you currently apply to successfully buffer the nutritious soil (coping strategy for soil erosion), water resources, species and crop diversity, and valuable places?
- Select three locations for Transect Walks.

Appendix VI Data transect walks

Kapanda, Lukulu district Date:

Landscape	*Category*	*Data transect walk*
Local name		
General description	1: Hills 2: Valley 3: Plain	
Altitude	(m)	
Distance to Mongu	(km)	
Hydrological patterns	1: No evident water courses 2: Sparsely spaced watercourse 3: Moderate incised 4: Densely spaced watercourse	
Soil erosion by water	1: Active 2: Partly stabilised 3: Stable	
Area of flooding	(ha)	
Severity of flooding	1: Low 2: Moderate 3: Severe	
Land use types	1: Crop production 2: Animal production 3: Water supply 4: Species habitat	
Appreciated places	1: Little bit valued 2: Quite valued 3: Much valued 4: Very much valued	
Organisation of housing	1: Grouped 2: Dispersed 3: Along the road	
Soil fertility	1: Infertile 2: Little fertile 3: Quite fertile 4: Very fertile	
Soil type		

Appendix VII Infographics

Community members will receive a camera and are asked to take pictures. These pictures are used during a learning meeting in which both men and women discuss meaningful issues. The fish bowl method is used during the learning meetings to support the discussion. Pictures are taken based on three questions (see Table XII).

Table XII: Questions in both English and Silozi

English question	*Silozi question*
What are precious agricultural practices and/or tools?	Mikwa ya butokwa ye muitusisa mwanjimo?
What are precious food items?	Lico ze butokwa?
What are precious places?	Libaka ze butokwa?

Instructions:

Step 1: Discuss approach with camp extension officer

Step 2: Instruct how to use camera and appoint ownership (on daily basis)

- 3 females and 3 male picture takers;
- one question per day per gender group

Step 3: Harvest pictures on daily basis and design presentation

Step 4: Learning meeting (fish bowl) to discuss meaningful issues and values

Step 5: Design posters and offer to community

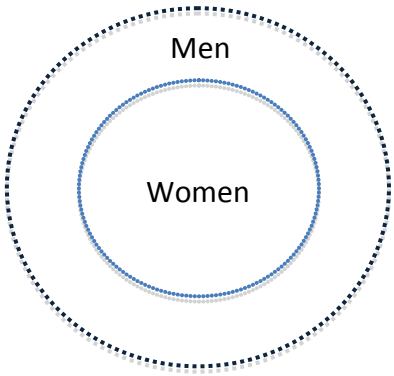
Appendix VIII Instructions focus group meeting

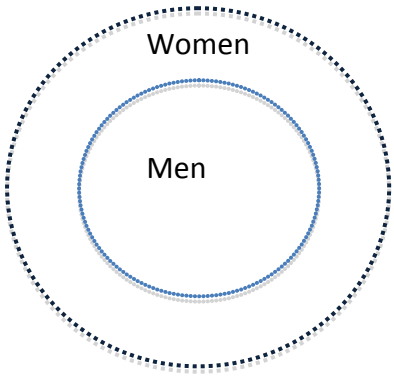
Purpose:
Discuss and collect best practices and tools that are currently working well, giving the conditions in Kapanda/Lealui.

Preparation:
Individual interviews are preparation for me and participants. They know already some examples.

Materials needed:
Fish bowl technique, two rounds (female and male), flipcharts, pens, participatory mapping chart, chairs, video Barotse fishing techniques

Instructions:
- Welcome and prayer
- Purpose, what are we designing – best practices to include in posters
- Show participatory map, mention transect walks and interviews. Ask lead farmers and community facilitators to explain our activities
- Show video as an example of current practices
- Now we can discuss and select those best practices we want to pass on to other farmers and children. Your examples are used to design posters that will be returned in February 2015. We will start with writing flipcharts in four groups (two male and two female groups). Each group can write down exemplary techniques with regard to aquatic and agricultural practices. What information should be shown in the posters? Think about soil fertility, weed and pest management, traditional medicines, timing and field preparation.





Appendix IX Semi-structured interview guide

Community:	0 Lealui	0 Kapanda	
Location:	0 Plain	0 Lowland	0 Upland
Cash transfer:	0 Yes	0 No	
Gender:	0 Female	0 Male	
Name farmer:			
Date:			

I-side

1. What are you dreaming of for the future?
2. What skills, behaviour and norms are important to be a successful farmer?
3. What is the difference between a good farmer and a bad farmer?
4. What are you most proud of, working as a farmer?
5. What are the three most important things you want to pass to your children?

It-side

6. Which agricultural practices are already working well? Which practices in particular work really well here in the plains?
7. What are currently ways to improve the production level of nutritious crops and animals?
8. Which soil fertility practices are already working well? (crop rotation, cover crops/mulching, minimum tillage, fertilizers?)
9. Which weed and pest reducing practices are already working well? (cover crops, intercropping, mulch, crop rotation?)
10. How do you successfully cope with droughts/flooded areas?
11. What tools do you use?
12. Who taught you this and how? Can you show this?
13. What crops (annual, perennial) are you cultivating? Why these?
14. What animals and breeds are you raising? Why these?

15. What food groups do you currently apply in your daily diet? Pick pictures.

MUBE NO BUIKETO; MUCHE MIFUTA YE KETALIZOHO VA LICO KAZAZI

BE HEALTHY: EAT AT LEAST 5 DIFFERENT FOOD GROUPS EACH DAY

Food group	Example food item
All starchy stable foods	*Mbonyi*, Maize *Rice*, Rice *Mauza*, Pearl millet *Mabele*, Sorghum *Mwanja*, Cassava *Sikuswani*, Yam *Lukesha*, Finger millet *Makwili*, Irish potato
Beans and peas	*Manawa*, Cowpea *Green beans*, Green beans
Nuts and seeds	*Ndongo*, Groundnut *Lituu*, Bambara groundnuts *Muzauli*, Rosewood seeds
Dairy	*Mabisi*, Sour milk *Muzilili*, Fresh milk

Food group	Example food item
Flesh foods	*Likomu*, Cow *Likulube*, Pig *Mahungu*, Caterpillar *Lipeba*, Wild rats *Iswa*, Termites *Litapi*, Fish *Likuhu*, Chicken *Lipato*, Duck
Eggs	*Mai*, Eggs
Vitamin A-rich dark green leafy vegetables	*Shombo*, Cassava leaves *Mangambwa*, Pumpkin leaves *Kandambwila*, Sweet Potato leaves *Libowa*, Amaranthus *Sindambi*, Hibiscus *Rape*, Rape
Other vitamin A-rich vegetables and fruits	*Popo*, Papaya *Mango*, Mango *Namundalangwe*, Pumpkin *Ngulu*, Sweet potato

Food group	Examples food item
Other vegetables	*Kabichi*, Cabbage *Matamakisi*, Tomato *Nyanyisi*, Onion *Delele*, Okra *Malaka*, White squash *Malembeka* , Eggplant *Impwa*, African eggplant Chinese cabbage *Carrot*, Carrot
Other fruits	*Mahapu*, Water melon *Makonde*, Banana *Olonji*, Orange *Mambole*, Wild fruit *Simbita*, Pineapple

December 2014

Appendix X Data collected with simple proxy indicator

Table XIII: Food items per food group that are currently used in the diet in Kapanda.

Kapanda – Answers of ten participants												
Food items per food group		*What food groups are currently used in the diet?*										*Total*
1	Starchy stable foods	X	X	X	X	X	X	X	X	X	X	***10***
2	Beans and peas			X	X	X		X		X	X	***6***
3	Nuts and seeds	X	X	X	X	X	X	X	X	X	X	***10***
4	Dairy	X	X	X	X	X		X	X	X	X	***9***
5	Flesh foods	X	X	X	X	X	X		X	X	X	***9***
6	Eggs	X		X			X		X	X	X	***6***
7	Vitamin A-rich dark green leafy vegetables	X	X	X	X	X	X	X	X	X	X	***10***
8	Other vitamin A-rich vegetables and fruits	X	X	X	X	X		X	X	X	X	***9***
9	Other vegetables	X	X	X	X	X	X	X	X		X	***9***
10	Other fruit	X	X	X	X	X	X	X	X	X		***9***
Total number of food groups per participant		***9***	***8***	***10***	***9***	***9***	***7***	***8***	***9***	***9***	***9***	

Table XIV: Food items per food group that are currently used in the diet in Lealui.

Lealui – Answers of eight participants										
Food items per food group		*What food groups are currently used in the diet?*								*Total*
1	Starchy stable foods	X	X	X	X	X	X	X	X	***8***
2	Beans and peas	X								***1***
3	Nuts and seeds									***0***
4	Dairy	X	X		X	X	X		X	***5***
5	Flesh foods				X	X	X	X		***4***
6	Eggs	X								***1***
7	Vitamin A-rich dark green leafy vegetables	X	X	X	X	X	X		X	***7***
8	Other vitamin A-rich vegetables and fruits	X	X	X		X	X		X	***6***
9	Other vegetables	X	X			X	X	X	X	***6***
10	Other fruit		X					X		***2***
Total number of food groups per participant		***7***	***6***	***3***	***4***	***6***	***6***	***4***	***5***	