

Disentangling the complexity of jatropha practices in Southern Mali



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Thesis code: TAD-80430

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Technology and Agrarian Development

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Abstract

In Mali, jatropha is traditionally planted for medicinal purposes or as fences. Hence, the introduction of jatropha as biofuel crop is for the most part linked to external intervention of northern based organizations. Such external development interventions entail relations between local actors and development practitioners who approach the domain, such as jatropha, from very different positions, in terms of technical knowledge and livelihood motivations. These relations are shaped by the interlocking of different practices, knowledge, interests and values. The differences can have substantial impacts on project outcomes and efficacy.

This research aims at elucidating the social-technical setting in which jatropha is introduced. To this end, social interfaces around jatropha are analyzed. Social interfaces are defined as critical point of intersection between social worlds, fields or levels of social organizations where social discontinuities, based upon discrepancies in values, interests, knowledge and power, are most likely to be found.

In the case of the analyzed project ALTERRE, which aims at co-developing a local biofuel supply chain based on jatropha, several actors are connected through jatropha. These are for instant local actors, jatropha producers, extension agents, international NGO, donor agencies, development practitioners. While jatropha acts as a shared point of reference the various actors' practices with, approaches to, and objectives with jatropha may differ in ways which have the potential to influence the outcomes of ALTERRE's participatory action research project. Objective of this research is to describe and analyze similarities and differences in the ways that multiple actors approach jatropha in a shared context. By elaborating on the different social worlds and practices of the involved actors, rationales for different patterns will emerge.

For this end, the first results chapter focuses on farmers' experiences with, practices of, and motivations for jatropha production in order to analyze the positions from which they approach the project in the context of their livelihoods. The second results Chapter effectively parallels the first but focusing on ALTERRE rather than farmers. The first part of this chapter examines the institutional context, which is important in that it frames ALTERRE's relationship with jatropha just as farmers' experiences shape theirs. This analysis informs the second part of the chapter, which looks at how this context is translated into ALTERRE's practices around jatropha promotion in the context of the Malian project.

The third chapter is based in ethnographic description of the occasions where farmers and ALTERRE meet, analyzing overlaps and discontinuities in the ways farmers and ALTERRE approach jatropha from their different positions. The discussion chapter of the thesis provides synthetic analysis of the three results chapters, elaborating their theoretical and practical significance regarding the co-production of knowledge and technology between farmers, scientists and development practitioners.

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1 Introduction

1.1 Problem statement

Jatropha as a biofuel crop has earned much attention over the last two centuries. The worldwide interest in the plant is high; typing the term ‘jatropha’ in Google search earns alone one million search results. Jatropha was hyped up to be the ‘wonder-crop for the future’. Claims vary from ‘jatropha can grow with little inputs where nothing else is growing anymore’ to ‘jatropha is the solution for decreasing oil sources without competing with food crops’. Yet, for the most part this hype turned out to be more based on claims than sustained by facts (Jongschaap et al., 2007).

On the ground, many jatropha projects face difficulties with the wonder-crop jatropha. The ‘Jatropha reality check’, a study conducted by the German Development Organization (GTZ, 2010), showed that small-scale jatropha farmers in Kenya experienced disappointing yields due to the lack of agronomic understanding and unimproved germplasm. Numerous other studies are reporting of disappointing results and unfulfilled hopes (Openshaw; 2000; Ribeiro, 2009 and 2010). The major part of jatropha studies is concerned with seed improvement or socio-economic issues of jatropha projects (Loos, 2000; Messemaker 2008). However, the introduction of jatropha as biofuel crop is for the most part linked to external intervention of northern based organizations. These external interventions entail relations between local producers and development practitioners, which approach jatropha from different context. Studies of socio-economic and agronomic data tend to overlook that different interest and motivations can have a substantial influence on project outcomes.

ALTERRE, a project with roots in France, is intending to introduce jatropha as a biofuel crop to Malian farmers. ALTERRE consist of several organizations based in France (GERES, IRAM and TOTAL) and in Mali (AMEDD) (see Chapter 3 for more details). It started its work 2008 in three intervention zones located in the administrative zone of Sikasso in the south-eastern part of Mali. The project objective is to establish a local biofuel supply chain, where the oil is produced and used locally. The straight jatropha oil can be used in service mills in villages and in diesel generators to generate electricity. Due to the early phase of the project, most activities are concentrated on establishing sufficient jatropha production in the area. In order to create knowledge on best jatropha cultivation practices, ALTERRE aims at using action research to include farmers in the co-production of knowledge. Reason and Bradbury defined action research as:

A participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes. . . . It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities. (Reason & Bradbury, 2001a, p. 1)

There are many possible types and levels of participation ranging from long-term participation in a participatory plant breeding program to one-time participation in a questionnaire or survey (Sumberg et al, 2002). Biggs (1990) contrasted in a simple dualistic form two models of innovation in agriculture, the “central model” and the “multiple source model”. In the first model farmers are passive recipients of information or technology. The model implies a hierarchical system of research and extension, where the communication and information flow is linear and unidirectional.

The “multiple source model” is more dynamic, with multiple, interacting sources of knowledge generation. Here farmers are active participants, innovators and experimenters which lead to multidirectional information and communication flow.

The co-production of knowledge in an action research entails the cooperation and negotiation of the actors over a shared point of reference; in the analyzed case this is jatropha. The actors involved in the process of establishing the biofuel supply chain have different interests and practices in jatropha which only partially overlap. The problem is that frustration and low effectiveness of the project can develop if these interests and perspectives and thus the mutual expectations are not fully understood.

1.2 Research objective and research questions

Understanding the interests of each actor in the project, will help to see which interests overlap and which are divergent. Interests are linked to practices around the shared point of reference. The interaction of actors with various interests forms the implementation of the project. Divergent interests might lead to dysfunction of the project. Displaying overlapping and divergent interest will enable practitioners to understand emergent practices and possible reasons for problems in implementing the project. The objective of this research is to provide a deeper understanding of the diverse set of interests and practices involved in an establishment of a jatropha supply chain and thus contribute to a better understanding of encountered problems in jatropha projects

Interests, motivations and practices are embedded in different social worlds. The first two research questions thus aim at discovering these social worlds in order to understand the emerging interests in jatropha and the prevailing practices. The discovery of these different social worlds, aims at displaying diversity and coherence within a specific social world as well as between various social worlds. Question 1 is tailored towards discovering farmers’ social world:

Which role does jatropha play in farmers’ social world?

Main ingredient to understand farmers’ social world in regards to jatropha is their past experience and prevailing usages of jatropha. The sub questions explore these aspects further.

- How has the use of jatropha changed over time?
- Which interests do farmers have in intensifying jatropha production?
- How are farmers cultivating jatropha?
- What are rationales for their practices?

Parallel to farmers’ social world, research question 2 explores the social world of ALTERRE.

How does ALTERRE promote more intensive jatropha cultivation?

As ALTERRE is part of a diverse network of organizations connected to each other, other key aspects than in farmers’ social world are relevant. One research activity shall be to elucidate ALTERRE’s objectives and motivations, the institutional context and development history of its various actors. This will help to gain a deeper

understanding of the various objectives of each of the actors involved in ALTERRE and see how these form ALTERRE's specific objective and interest in jatropha. The sub-research questions help to explore ALTERRE's social world.

- How did ALTERRE develop?
- What is ALTERRE's institutional context?
- What are ALTERRE's promoted jatropha practices?

Answering these first two research questions is a necessary step towards research question 3:

How is the interaction between farmers and ALTERRE shaping the establishing of jatropha production and the co-production of knowledge on jatropha?

The ethnographic descriptions of interactions in events where both social worlds interact shall display the negotiation processes which shape the relationship of farmers and ALTERRE and thus the co-production within the project. According to Faucault (in Kontinen, 2004), power is always intertwined in the process of communication. Therefore, power relationship within the interaction will be analyzed. The analysis of the ethnographic descriptions of interactions of both social worlds is furthermore tailored to reveal existing expectations of both parties towards each other.

Questions here fore are:

- Who is facilitating the event?
- Who is participating?
- How does participation manifest itself in the events?
- What kind of information was exchanged?
- Whose knowledge and experiences were brought to bear?
- How are farmers' and ALTERRE's concerns, interest and knowledge negotiated?
- With which techniques and tactics is the objective of the event realized?

1.3 Jatropha technological background

Jatropha curcas (from hereby referred to as jatropha) is a small shrub or tree and belongs to the Euphorbiaceae family. It can reach a height up to five meters and has a life expectancy up to 50 years. Jatropha is native to Central America and Mexico and is spread widely in the tropics. It is drought resistant and traditionally used as a medical plant. Its fruits contain three to four seeds, which have an oil content of approximately 30-35% (Heller, 1996).

The contemporary world wide interest in jatropha is due to its high oil content which makes it a suitable feedstock for oil production. Hereby the gained oil is differentiated into two different kinds of oil: straight plant oil (known as biofuel) and esterified oil (known as biodiesel). In the case of the project ALTERRE, the focus is on the production and use of straight plant oil. The next paragraphs will provide an overview of the difference between biofuel and biodiesel.

Esterified oil as diesel substitute (Biodiesel)

The world wide interest in jatropha is mainly due to its potential use as a substitute for diesel fuel. Through the process of transesterification the oil becomes what is known as biodiesel. Through this process, the oil is chemically changed to obtain physical

values very similar to those of diesel oil. Thus biodiesel can be used in any diesel engine without the need of modifying it. During transesterification organically derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst and transform into ethyl or methyl ester. A by-product of this process is glycerin which finds uses mainly in the cosmetic industry e.g. to make soap (Eijck, 2006). The chemical transformation of plant oil to biodiesel requires a laboratory set up and a certain minimum operational size (more than 500 l/day) to be safe and economical (Rucodia, 2007). For that reason transesterification is not profitable for smaller quantities and thus ALTERRE opts for straight jatropha oil.

Straight plant oil as diesel substitute (biofuel)

Principally, unprocessed plant oil can be used in

diesel engines without any chemical modification of the oil. This holds true also for the oil gained from the jatropha plant. However, plant oil has a higher viscosity than diesel fuel. Jatropha oil's viscosity for example is 52 mm²/ s at 30°C, while as standard diesel has a viscosity of 3,5-5 at 40°C (Francis and Becker, 2001;p.3). The higher viscosity of plant oil leads to an incomplete burning, which is harmful for the piston rings and the injection nozzles. Carbon deposits can develop to such an extent to completely clog up the nozzle.

Older engines, such as pre-chamber engines can cope with a high viscosity better than direct direct-injection engines. Pre-chamber engines are mostly found in small village mills all over Mali. The solution for direct injection engines is to preheat the oil with the engine's cooling water and thus lower the viscosity. This is realized by using a two tank system, where the engine starts with diesel and once the cooling water has reached its operating temperature and can preheat the plant oil, the fuel supply is switched to plant oil (3E GmbH, 2005). A lot of experience exists in Europe on modifying diesel engines to plant oil. Change- over- kits are available for most makes of engines. Running diesel engines on plant oil is documented for projects in Mali, where the straight plant oil is already used in diesel engines to run equipment like grain mills, dehullers and electric generators (see www.folkecenter.dk).

1.4 Conceptual Framework

1.4.1 Introduction

The conceptual framework for this thesis needs to integrate the various aspects covered in the research questions. As the research concentrates both, on jatropha as a technology and actors using jatropha, both aspects need to be integrated in the study (Section 1.4.2). The problem statement already suggested that different actors approach jatropha from different angles. An important part of the conceptual framework is tailored towards discovering this aspect (Section 1.4.3). The different actors interact in the project around their shared point of reference jatropha drawing upon their own rationales and knowledge. A conceptual framework is needed, which enables to understand how different actors interact around jatropha and how interests and knowledge is negotiated in this process (Section 1.4.3).

1.4.2 Technography

Technography, as an ethnographic study of human-technology interaction was developed by the Technology and Agrarian Development group of the Wageningen University and sits partially in anthropology and partly in Science and Technology Studies (STS). In this thesis, technography is used as a tool describing similarities and differences of the ways multiple actors approach jatropha in a shared context. Technography particularly draws the attention to situated action and embodied knowledge. The term situated action emphasizes the interrelationship between action and its context of performance (Chen and Rada, 1996). As such, technography aims at researching the shaping, use and impact of technologies in actual social situations. In doing that, it is not only asking *how* a technology can achieve its purpose but also *why*. Technographic scholars believe that it is not useful to study a technology outside its social context. In the case of studying a jatropha project, the social context in which the project is embedded is necessary in order to understand the actual technology use of jatropha. At the heart of technography is the systematic study of the process of making. This implies the observation of what people do and searches for underlying reasons. In the case of the studied project the ‘process of making’ is establishing a local jatropha supply chain for biofuel. Several steps are necessary to put such a local supply chain into place.

- Establishing sufficient jatropha production
- Elaborating a reference on best agricultural practices on jatropha
- Establishing a jatropha processing unit
- Developing a market for jatropha oil

This thesis focuses on the two first steps: ‘establishing jatropha production’ and on ‘establishing references on best agricultural practices’ as due to the early stage of the ALTERRE project, not all steps are implemented yet. Both of these are treated as processes of making because both imply the action of people from different social groups. In the study of these two processes, technography is a useful tool as it highlights the need to study the interaction of both, the people interacting with jatropha and jatropha as a technology on itself. Jatropha cultivation – including propagation, weeding, applying fertilizer, pruning, harvesting and its different usages – is seen as the jatropha technology. Farmers and the project staff are working together on completing the task to establish jatropha production and a set of references on best agricultural practices. Grouped together, they form the so called ‘task group’.

McFeat (1974) introduced the concept of task groups to describe groups which collectively perform a task. The performance of the task group is influenced by the interlocking of different practices, knowledge, interests and values of actors. In order to achieve their ends, task groups need to organize themselves and cooperate. To illustrate a task group, Vellema introduced the example of whale hunters in the 'technography class' (lecture notes, 2010). Whale hunting with small fisher boats (technology) requires coordination between the different actors performing the task (task group). On a whale hunter boat there are steersman, harpooner and paddlers which all take part in the process of hunting. In order to catch a whale all participants in the boat need to perform their specific task in a coordinated way. Another example of a technographic inquiry is that of Edwin Hutchin's (1996) "Learning to navigate". In his detailed ethnographic descriptions he explains how the task (navigating a vessel) is performed by the navigation team (task group). In the process of navigation the navigation group interacts simultaneously with technologies and the group itself. With the ethnographic description of the process Hutchin was able to find out more about the order and culture involved in the navigation team which shape the interaction with the used technology and in the end led to a precise navigation.

Similar to the study of vessel navigation, a technographic study of a development project, such as ALTERRE, is helpful in revealing how a task group (practitioners and farmers) organizes and cooperates itself in order to perform their task. Each actor in the task group has his specific role in reaching the project goal. One part might be responsible for keeping the direction (steersmen) whereas the other part might be more responsible for executing (seaman). In order to achieve the project goals (the harbor) both need to organize and cooperate. In the case of the project studied, all actors involved need to work together in one way or the other in order to achieve their aim of establishing jatropa production and references on jatropa practices. The performance of the task group thus is depending on a successful communication between the actors involved. In the following chapter a concept is described shading light on the diversity of actors and their interests in order to understand what might hinder a successful communication.

1.4.3 Social worlds

The notion 'social worlds' is used to describe the social context of both actors, farmers and project staff. 'Social worlds' draws from the concept 'life-worlds' introduced by Edmund Husserl (1936). The concept was further developed by Habermas (1987) and Schutz and Luckmann (1973) who defined it as "*lived-in and largely taken-for-granted world*". According to Leeuwis et al. (1990) life-worlds are:

Constituted of various forms of social knowledge, intentions and evaluation modes, and types of discourse and social action, through which actors attempt to order their world. Such life-worlds are the products of past experiences and personal and shared understandings, and are continuously reshaped by new encounters with people and things (Leeuwis et al., 1990:26, note3).

However, the term 'life-worlds' is used to portray an individual social context of a person. As this study concentrates on similar patterns emerging from similar social contexts, the term life-world might be confusing therefore the term "social worlds" is used in this context. Nevertheless, Leeuwis' definition of life-worlds will be a basis to build the concept of social worlds upon. Just as in the concept of life-worlds, social worlds are also constituted of various forms of intentions and evaluation modes and

types of discourses through which actors attempt to order their world. Past experiences and shared understanding are ingredients of social worlds. Social worlds shall represent a set of individual life-worlds, which all have similarly shared social contexts. It also includes, such as in the case of project staff, the institutional setting to which they are bound to. By elaborating on social worlds and practices of the involved actors, rationales for different patterns in the task group will emerge.

In this thesis the studied task group entails the intersection of different actors from different social worlds, with different viewpoints about cooperation and the practice in question (jatropha technology). To achieve the set tasks (establishing jatropha production and references on best agricultural practices) co-production of knowledge between the two actors is necessary. For a fruitful cooperation between the actors, reconciliation is essential. ‘Social interfaces’ are encounters, where both actors meet and this reconciliation most likely take place.

1.4.4 Social interface

The concept ‘social interface’ was introduced by Long (1989:254) who defines social interfaces as “*critical points of linkage or confrontation between groups*”. These points or social interfaces enable to research discontinuities based on differences of normative value, knowledge, power and interests. According to Long:

Analyzing interface situations aims to bring out the dynamic and emergent character of the interactions that take place and to show how the goals, perceptions, interests, and relationships of the various actors are reshaped as a result of the interactions, leading to a ‘new’ interface encounter the next time round (Long, 1989: p.254).

In his view, social interfaces are “*battle fields of knowledges*”. The idea is not to document types of negotiations and struggles taking place in these interfaces. Rather, to understand the structural discontinuities in encounters between social worlds. In Long’s view (1989), it should sensitize the researcher to the importance of exploring how discrepancies of social interest, cultural interpretation, knowledge and power are mediated and perpetuated or transformed. The study of interfaces is significant according to Long (1989) as it forges a theoretical middle-ground between “so-called ‘micro’ and ‘macro’ theories of agrarian change by showing how the interactions between the ‘intervening’ parties and ‘local actors’ shape the outcome of a particular intervention”.

In this study, social interfaces will be used in order to comprehend how the interaction between farmers and project staff (both belonging to one task group) is shaping the outcome of the jatropha project. Social interfaces are events where farmers and project staff meet. In contrast to Long, in this study social interfaces will not mainly be used to display discontinuities but to understand the process of negotiation which takes place in these events. By depicting the different social worlds, the analysis of interfaces is situated in a broader framework. The insights gained through the analysis of interfaces will help to provide answers to a wider set of questions concerning the general co-production of knowledge in development projects.

1.5 Methodology

Data collection and analysis

Data were collected during a three months research period in Mali, from the 15th of February 2010 to the 16th of Mai 2010. The first two weeks were spent in Bamako and the rest of the time in the research area. Through personal contact, it was possible to live in a Malian host-family during the stay in Bamako, which allowed me to become acquainted with Malian culture, values and day to day life, which turned out to be very useful in the further research with farmers in the village.

In the research area, the stay was split between the head office of the project ALTERRE in Koutiala and in the villages to conduct interviews. For data collection a diverse approach was chosen including interviews, participant observations and document analysis. Part of the week was dedicated to data collection in the villages. The other part of the week was dedicated to reviewing the collected data. This enabled me to adjust the questionnaire and interview strategy where necessary. This part of the week was mainly spent in the head-office of ALTERRE which allowed me to gain an insight in the working environment of the NGO and offered the chance to have informal conversation with project members in order to triangulate the gained knowledge from the conducted interviews.

One important part of this research was to understand both farmers' and ALTERRE's social worlds in order to understand the interaction in interface situations. The data to understand ALTERRE's social world is based upon project reports, informal interviews and participate observation of the day to day 'project-life' as well as of project meetings. Informal interviews were conducted with extension officers, the GERES-team on the ground, the person in charge of the agronomic division of the project, members of the Malian partner NGO as well as members of the partner organization in France. Participant observation was used in several project meetings. The missing data on partner organization connected to the project was drawn to a big extent from their homepages.

The data necessary to get an insight into farmers' social world was collected in two steps: The first step was semi-structured interviews and the second in-depth interviews with previously interviewed farmers. Currently 349 farmers, distributed over 11 villages, are part of the project in the Commune of Yorosso. In order to get an overview of farmers' experience with jatropha and motivations to participate in the project a sample of 41 producers from 8 villages was chosen including producer representatives and village chiefs. The sample was selected with the help of the extension officer in order to cover as diverse set of producers as possible including size of jatropha production, household and farm. The interviews were semi-structured and included open ended as well as closed questions. The questionnaires were written in French. Together with the translator they were translated in the local language (Mianka). The questions were mainly concerning farmers' experience with jatropha, their size of production, experienced problems concerning agriculture in the area. After a couple of interviews, the gained data was reviewed and if needed questions added or adjusted. Thereby missing data could be collected in the next round of interviews. A limitation of the collection method was that not all questions could be compared to each other as data from some samples were missing. In a second step, out of the first 41 producers a sample of 6 were chosen for follow up interviews in order to gain more profound knowledge of farmers' social worlds. The sample was

chosen based on the information gained in the first round of interviews. The in-depth interview lasted half a day and incorporated field visits. The questions were open ended and included questions concerning land issues, experience in agriculture and with jatropha as well as common, experienced problems in farming in the research area.

To understand reasons for not participating in the project ALTERRE, a sample of 6 non-jatropha farmers were chosen. The sample was selected using the snow-ball sampling. The questionnaire covered aspects related to knowledge about jatropha, reasons for not participating in the project, general problems encountered in farming and general household data (farm and household size, income source et al.).

Much of the data concerning the project-farmer interface was collected through participant observation. During the research period one meeting between extension officers and producer representatives, three village meetings as well as four nursery workshops were studied. The events were documented with pictures in order to understand how the interaction was organized (e.g. placing of participants).

The research was an iterative process and the quality of gained data was improved in several rounds during this process. The findings were shared with extension officers and other ALTERRE staff which helped to sharpen the interpretation of the data. One key informant during the entire research period was the extension officer.

Limitation

Conducting research abroad always embraces difficulties due to the foreign language and difference in culture. Especially if one wants to study other peoples' social world culture plays an important role. A translator can help to bridge and evaluate on the cultural differences but some information might be lost during the research process and thus is not considered in this thesis. In the process of translating from one language to another, information might get transformed or even lost. This is especially a limitation in research situations, such as the interface analysis where nuances in the use of language can be crucial.

Due to the cultural structure of Mali, almost all informants on the producer side were men and thus there is a gender bias in the data collection. Women were included into the conversation were possible but in most instances it was men who were spokespersons.

Interviews with farmers were conducted without the presence of any ALTERRE staff however it was the extension officer which helped organizing interviews with farmers. Thus, although in the introduction of each interview it was clearly stated that this was a research independent from ALTERRE farmers might have formulated their answer to avoid any negative connotation towards ALTERRE.

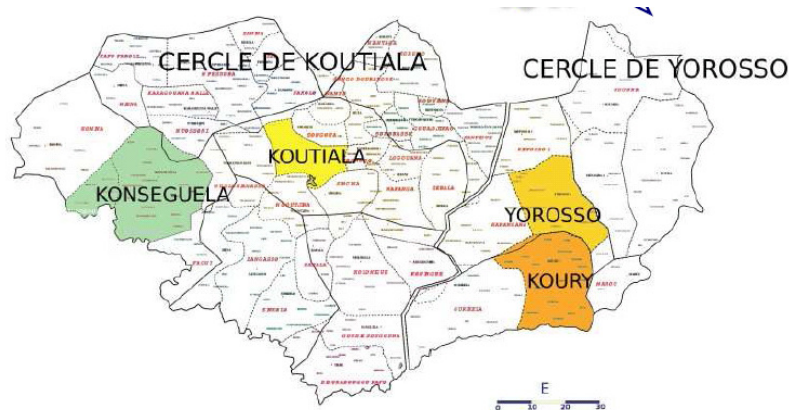
1.6 Research area

Case study selection

The project ALTERRE has three intervention zones: Koury, Yorosso and Konseguela. The capital cities of the first two zones have access to electricity through a mini-grid powered by a diesel generator, the third one, Konseguela, has only access to electricity through small solar panels. The head office of ALTERRE is based in

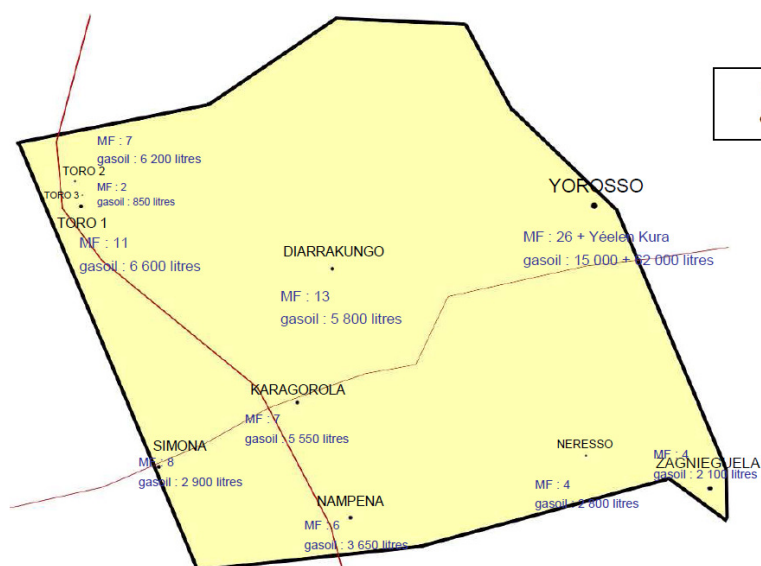
Koutiala. Out of ALTERRE's three interventions zones, the Commune of Yorosso was chosen as an explorative case study. The choice was driven by practical issues such as access and distance from the villages, availability of accommodation and as well as Yorosso was the first zone in which ALTERRE introduced jatropha (2008) and therefore more experience existed with jatropha for biofuel production than in the other zones.

Figure 1: Project area



The Commune of Yorosso is composed of several villages surrounding the main city Yorosso. The project is focusing on 10 villages in the Commune. The villages are located approximately 5 to 20 km away from Yorosso. All villages are situated away from the paved road and only accessible via dirt road. Yorosso is the only city with access to electricity from a diesel generator operating only for some hours in the morning and the late afternoon.

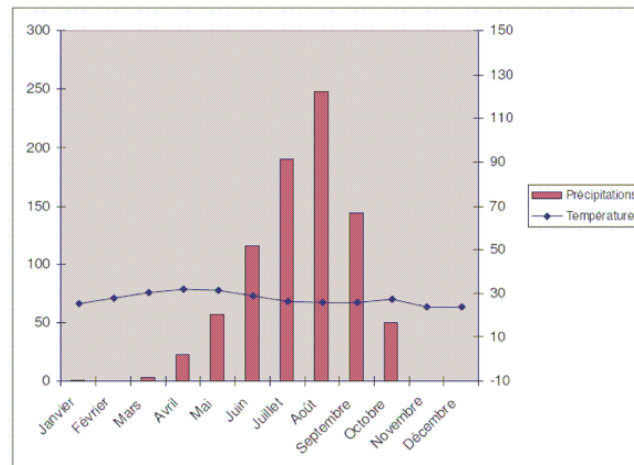
Figure 2: Map of the Commune of Yorosso



Climate

Yorosso is located between Sahelian and Sudanese zone, with rainfalls of about 900-1000 mm (RDef_Total, ALTERRE, 2009). The region is characterized by two seasons; a rainy season which starts in March or April, reaches its maximum in August and lasts about 120 days and the dry season starting in October or November and lasting about 7 months (Gomes, 2005).

Figure 3: Ombrothermic diagram of project zone



Source 1: ALTERRE

The vegetation in the zone is influenced by the big difference in precipitation between the dry and rainy season. Situated between two zones, Yorosso's vegetation consists of localized forest corridors where the rest of the area is dominated by savanna. Common trees in the area are néré (*Parkia biglibaso*) and shea (*Butyrospermum paradoxum parkii*). Farm sizes in the region vary between 10 to 20 hectares. However, the usable agricultural surface (arable land, plus herbs, plus perennial crops, excluding tress) is much lower. On each farm there are normally 5 to 20 actively working persons, each of them in charge of at least one person to feed and with an availability of about 1,5 to 1,8 ha usable agricultural surface. The dominant cash crop in the area is cotton. Next to cotton, maize, sorghum and millet are grown. Secondary crops are groundnuts, black eyed peas, sesame, chili pepper, gardening and mangos. Livestock farming includes cattle, chickens, goats and sheep (ALTERRE, Gomes, 2005).

1.7 Thesis outline

This thesis is divided into five chapters covering three areas: background of the study and conceptual framework (Chapter 1); empirical data chapters covering the different social worlds of farmers as well as of ALTERRE (Chapters 2 & 3) and the analysis of the social interface (Chapter 4); lastly discussion and conclusion chapter which discusses the empirical chapters and draws conclusions from it (Chapter 5).

Chapter 2 focuses on farmers' experiences with, practices of, and motivations for jatropha production in order to analyze the positions and institutional contexts from which they approach the project in the context of their livelihoods. Chapter 3 focuses

on ALTERRE's social world. The first part of this chapter examines the project history as well as different actors connected to the project which is important in that it frames ALTERRE's relationship with jatropha just as farmers' experiences shape theirs. This analysis informs the second part of the chapter, which looks at how this context is translated into ALTERRE's practices around jatropha promotion in the context of the Malian project.

Chapter 4 is based on an ethnographic description of the occasions where farmers and ALTERRE meet, analyzing overlaps and discontinuities in the ways farmers and ALTERRE approach jatropha from their different positions.

The discussion chapter of the thesis will provide synthetic analysis of the three results chapters, elaborating their theoretical and practical significance regarding the co-production of knowledge and technology between farmers, scientists and development practitioners. For closing this chapter, conclusions and recommendations will be drawn from the discussion.

2 Jatropha cultivating technology as practiced by farmers

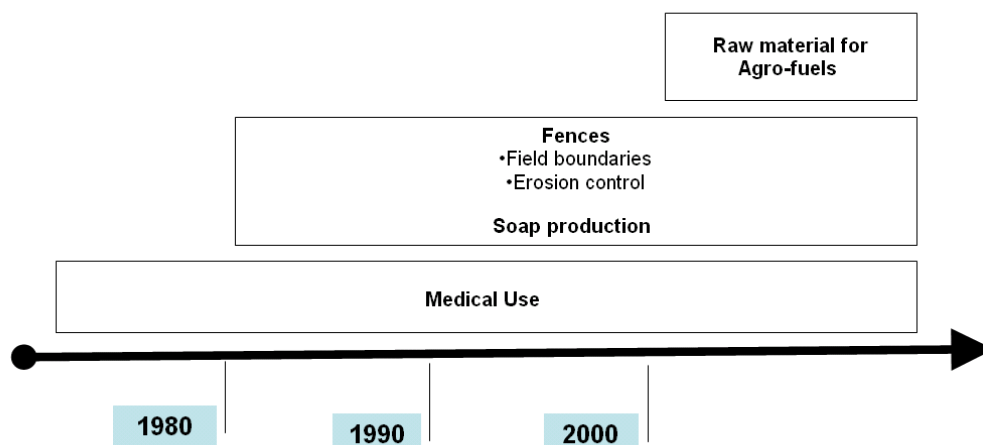
This chapter will focus on farmers' experiences with, practices of, and motivations for jatropha production in order to analyze the positions from which they approach the project in the context of their livelihoods. The following paragraphs will elaborate on changes in farmers' jatropha cultivation and usage over time. Emphasis is placed on the changes in usage and briefly on ways of planting jatropha. To better understand what triggered changes in practices, the frame of references of these practices is further investigated. In this particular case the frame of references is strongly influenced by various external organizations intervening in the area and a brief description of their objectives is provided. To understand the diverse motivations of farmers to intensify jatropha cultivation within the ALTERRE project, a second paragraph will give an insight into different driving factors. The last section of this chapter summarizes how the above explored variables; time, frame of reference, usage and motivations translate into planting techniques used by the farmers.

2.1 Historical context of jatropha in the study region

2.1.1 Overview

Changes in jatropha usage and cultivation in the study region can roughly be divided into three periods: first the period before external intervention in the late 1980's, secondly the first intervention in the late 1980's and lastly the start of the new millennium and the use of jatropha as raw material for biofuels. These three periods are chosen as they were characterized by intervention of different external organization which introduced new ways of using jatropha. The following section explains how jatropha's use as a wild plant changed to its present state of more intensified cultivation.

Figure 4: Jatropha usages over time



2.1.2 Jatropha before external intervention in 1980's

The jatropha plant originated from Central America, and has been spread to Asia and Africa by Portuguese seafarers from the Cape Verde Islands and former Portuguese Guinea (present day Guinea Bissau). Furthermore, around 1940 Madagascar was an exporter of jatropha seeds to Marseille in France, where they used the raw material for soap production (Heller, 1996; Henning).

No information is available on when exactly *jatropha* was introduced to Mali. However, older farmers mentioned in the interviews that they knew *jatropha* from their childhood. Single plants were sporadically found in the villages but were grown wild. The use of *jatropha* for soap and oil production were unknown, hence farmers paid little attention to the plant. One older village chief explained that the seeds were used for lighting in his childhood. For that purpose three or four seeds were pinned up on a stick and then lighted. This usage was the earliest use of the seeds mentioned in the interviews.

First attention to *jatropha* was given due to its medicinal properties. The medicinal properties mentioned vary but the most common one is the use for inflammation of the gum. For this end, branches are broken off the tree. The wounds are then rubbed in with the sap by using the branch like a toothbrush. The sap helps to arrest bleeding of wounds, which is also stated in literature (Heller, 1996). Other farmers mentioned the ability of *jatropha* leaves to cure inflammations of the bladder, for this end a tea made of the leaves is used. One farmer reported that in one village a woman had a serious malaria infection in order to cure it people gave her two *jatropha* seeds to eat. After eating the seeds she had to vomit and according to the farmers the malaria was gone after this treatment. Whether it is possible to cure malaria by vomiting can not be verified in the available literature, however Fagbenro-Beyioku et al. (1998) proved in their experiment that *jatropha* could be used as a prevention of malaria as it is a good malaria control vector.

Henning (2004) mentions that *jatropha* was planted as hedges before external intervention of development organizations in the 1980's in this sector. This statement could not be verified in the interviews. It is true that farmers use hedges in the area but all the interviewed farmers which had hedges before the intervention of the ALTERRE project and were interviewed, stated that they planted the hedges together with the Malian Cotton Industry ("Compagnie Malienne pour le Développement des Textiles", CMDT).

2.1.3 Late 1980's

Different usages were introduced to the farmers in the late 1980's. The German development organization ("Deutsche Gesellschaft für Technische Zusammenarbeit", GTZ) was one of the pioneers of introducing different properties of the plant in Mali. In 1987, GTZ launched the Special Energy Program (SEP) which focused in Mali on the utilization of *jatropha*. The activities continued in different organizational forms until 1997 (Henning, 2004). This project was the first to introduced the use of *jatropha* oil as fuel for diesel engines and its decentralized extraction by expellers to Malian farmers. In this project, basic studies were carried out on the extent and density of existing hedges, on the oil yield of expellers and ram presses available on the market, on the economy of soap production and the use of *jatropha* oil as diesel substitute (Henning, 2004). This knowledge was built up in a rather confined area. This becomes apparent if one considers that the concept of using *jatropha* oil as fuel substitute was unknown for most of the farmers in the case study area of the research presented here, before the intervention of the project ALTERRE.

In mid to late 90's, the CMDT (Malian cotton company) started a program for improved fallow, introducing the growing of legumes. In order to protect these leguminous from browsing animals, fencing of these plots was necessary. Mechanical

fences, such as barbwire, would have been too costly; therefore living fences were promoted (Henning, 1995). The CMDT introduced two plants for living fences; one was jatropha and the other one balsam spurge (*Euphorbia balsamifera*), which both belong to the Euphorbiaceae family. The latter one is more often found in the study area than jatropha. Farmers explained that both plants are easy to propagate, through the use of cuttings, and grow easily. Balsam spurge is not used for anything else than fencing as the milky sap makes it hard to use it as firewood and it produces no seeds. The hedges were not only promoted as protection against animals, as farmers and project staff explained, but to mark fields of cotton production and thus to make it easier for the CMDT to estimate how many hectares of cotton is grown.

During the same time, CMDT introduced jatropha hedges (and balsam spurge), under their Agro-Ecology project (PAE), as an erosion control tool. This project evolved out of the last drought period in the early 80's. The project was based on the idea to secure farmers' livelihood living in this ecologically fragile region. The program took different measures for efficient erosion control and for improving soil fertility. One measure was 'biological' erosion control through the planting of living fences (Ominaverlag, 14.06.2010). In order to have an effective protection against wind and water erosion, the farmers were advised to plant jatropha plants rather close to each other (approximately 10-15 cm).

In the research region the use of jatropha as a measure against erosion is known amongst farmers. Farmers stated in the interviews that the CMDT was distributing seeds to them for this purpose. Apparently the demand of seeds from the farmers' side was much higher than the supply from the CMDT and thus a great number of interested farmers were left without jatropha seeds for hedges. Balsam spurge seeds/cuttings were easier available and thus today more balsam spurge than jatropha hedges can be found in the region. The successful application of jatropha as erosion control spread between the villages and farmers started to get cuttings and seeds from neighboring villages. The large number of hedges found in the area is a direct result of CMDT's promotion activity.

With the introduction of hedges, women started to make soap out of the seeds. When questioning the women how they learned how to make soap out of it, some answered that women visited a workshop provided by CMDT to learn how to make soap out of jatropha seeds and spread the knowledge in the villages. The extension officer explained that women in general use different seeds found in the areas for soap production and that possibly they just tried to use jatropha seeds. This explanation is convincing as jatropha soap making is very similar to the process to make soap out of shea butter. The traditional jatropha soap making process is time consuming for the women and involves several steps. First the jatropha nut has to be cracked to get the three seeds out. This is either done by hand, hitting them with a stick or walking over them. In order to get the kernels out of the shell each seeds is knocked with the help of a stone. The white seeds are then pounded and sieved. The powder is mixed with water and caustic soda and heated under steady stirring to get a homogenous mass. When this mass is cooled down it is molded by hands into balls.

Picture 1: Soap making



Women removing black shells from jatropha seed (left pic.); women with jatropha soap (right pic.)

In Diarrakoungo, a woman reported that the 7 kg of jatropha soap she produced will last about one year for her family (9 person household). The soap is used for washing clothes, bodies and dishes. In some of the inquired villages, a small, informal jatropha seed market for soap production exists. A kilo of seeds is sold for 100 CFA on these markets. Women, who buy these seeds, are most of the times having a jatropha plant themselves but not enough seeds to produce a sufficient amount of soap. It is mainly the women who harvest the seeds, when they use it for soap production. The seeds which are sold on the market, however, are harvested by older men who sell them. One village woman explained that jatropha soap is better than soap made out of shea butter as cloth are easier to get clean and it is easier to fabricate. Although a lot of women stated that they make already soap out of jatropha, it was not possible to find soap neither on the small village markets nor on the bigger market in Koutiala, where women from rural villages come and sell their products. Indicating that the amount of soap produced in the region is small and mainly used for self-consumption.

Box 1: Exploiting the potential of jatropha: The case of Siaka Goita, Neresso

Siaka Goita was born as the youngest of two sons in Neresso. In an early age he went to the Ivory Coast for an apprenticeship in gardening. Later, he was working on several different plantations where he gained experience in growing perennial crops. After five years he returned to his village and started cultivating. As one of the only farmers in the region with an education in gardening, he became a quiet successful farmer.

His village has many problems with soil erosion. The ground is steep and with the heavy rain in the rainy season, the little organic material of the soil is eroded. Siaka Goita's vegetable and fruit tree area got flooded once a year in the rainy season.

When the CMDT started to promote jatropha for erosion control, he decided to plant hedges around his gardening area and some of his fields to prevent his fields from flooding. He planted jatropha plants closely to each other and to facilitate an even better protection against the water he interlaced branches on the bottom part of the hedges.

Picture 2: Jatropha hedge for erosion control supported through branches



The women in his households were making soap out of the seeds but as he had a lot of seeds and the project was not yet in the area, he used the seeds to produce organic fertilizer. To produce the organic fertilizer he takes residues from the field, millet husk and jatropha seeds as well as residues from the jatropha nut and puts everything in a hole in the ground. The mixture is then watered everyday and after a while turned. Since the project is interested in buying his seeds he is not using jatropha seeds anymore for fertilizer, but sells it to the project. With the contribution from the money of first harvest he was able to buy a water pump.

Next to the fences he is planting jatropha in fields to enrich his soil. He explained that if he sees that low input plants, for instance peanuts, are not growing well on his fields anymore, he starts to plant jatropha. He plants rows of jatropha with a distance of 7 meters in between the rows. Each year in the hot season jatropha loses his leaves which provide organic material for the soil. The first year after planting jatropha he plants a food crop with one meter distance to jatropha. In the second year, he enlarges the distance to two meters and in the third year he cuts the jatropha plants down because then they eventually become too big and will shade the other food crop.

When asked how he learned about this special jatropha planting technique he answered that he learned it himself through the try and error principal.

2.1.4 Start of the new millennium

With the introduction of several international policies to increase the use of biofuels for transportation (see for example Directive 2003/30/EC, Germany) the urge for raw material which could be used as fuel increased. Jatropha's high oil content made it an interesting raw material and worldwide interest in this yet unknown plant increased. Most farmers, in the study region did not know that jatropha could be used to produce oil. Yet, the Malian media picked up the worldwide discussion on the use of jatropha as a substitute for diesel. Although TV's are hardly found in the study area, some farmers reported that they know from the use of jatropha from the TV. Others told that they heard from it from friends and family. The project ALTERRE started their activities in 2008. In their promotion campaign the organization made use of the local radio which was widely received in the area. Next to these activities, they made promotion tour visits in the different villages to encourage farmers to start planting jatropha. With the introduction of the jatropha oil use, farmers started to grow jatropha not only in hedges but also in fields.

2.2 Farmers interest to intensify jatropha production

The historical background and thus the experiences farmers gained with jatropha over the years influences farmers' interest and motivation to intensify jatropha production. In order to understand the way farmers cultivate jatropha today, it is necessary to look at the different usages and how they change over time and also to understand what motivates farmers to start planting jatropha within the project. One focus of the interviews' questions was on the motivations of farmers' to join the project ALTERRE.

Seed market

One evident reason why farmers start planting jatropha is the presence of the project and the creation of a jatropha seed market. Prior to the initiation of using jatropha for oil production, farmers had no way to market jatropha seeds, apart from the very small local seed market for soap production. The plants were used for non-monetary benefits such as erosion control. With the possibility to market jatropha products, the interest in the plant raises and farmers hope to earn money through selling the seeds on the market. Almost every village has a small village mill which could potentially run on jatropha oil. A majority of farmers mentioned that the possibility to use jatropha oil as a cheaper diesel substitute in the village mills is interesting for them as they hope that costs for milling their products will decrease with the use of cheaper oil.

Complement to cotton

The study area is characterized by cotton production. 34% of the total exports of Mali are due to the cotton sector. Cotton production increased from 68,000 tons in 1972 to 620,000 tons in 2004 (Benjaminsen et al, 2009). Farmers in the study villages are highly dependant on cotton. Cotton is not only the major source of income for many people; the cultivation also provides access to the micro-credit system of the CMDT to buy chemical fertilizer. In the villages, the only way to buy chemical fertilizer for other crops such as maize is through the CMDT. Only on rare occasions, are farmers able to find chemical fertilizer on the local markets, and then for a much higher price than the one from the CMDT.

Since 1992, the Malian cotton sector is in a crisis. In the planting season 2000-2001 this crisis reached its climax with the boycott of many cotton producers which

resulted in a price fall for cotton seeds. The boycott was a response from the producers to CMDT's price policy. Several factors led to the cotton crisis. A major factor was the high subsidies the US government provided for their domestic cotton production. Political unrest in Mali's neighboring country the Ivory Coast hampered additionally the transport and export of the cotton. In 2005-2006, cotton prices decreased by 25%. After this fall, cotton producers diminished their cotton production and used inputs for food crops. With the decrease in cotton area and the lower use of inputs for cotton, cotton yields decreased considerably. Additionally, the CMDT is obliged to immediately sell their cotton on the world market even if it means risking unfavorable prices in order to pay their loans back (Tefft, 2000; UNDP, 2009; Moore 2004).

Farmers also reported that they have problems with paying back the loan which the CMDT gave them before the start of the cotton season. After harvesting and selling the cotton, farmers are normally able to pay back these loans. In recent years, however, many farmers have problems paying back their loans as either the maize harvest is lower than expected due to external factors (e.g. rain) and/or that the CMDT are not paying them on time for the sold cotton. A number of farmers explained that in order to pay back the loans to the CMDT they have to take out another loan from the Banque National de Development Agricole (BDNA) to unfavorable conditions. In one village, the majority of the interviewed farmers stated that in 2006 they had a poor harvest and had to take loans from the BDNA, they remained in debt since then.

Since farmers are highly dependant on the cotton sector for income, they are also very concerned about the development. As a response they are looking for alternatives to cotton production. Jatropha is, however, seen as a complement crop rather than as an alternative which could replace cotton. This is due to the positive side effects of cotton, mainly having access to chemical fertilizer which is very hard to get in the villages, overweighing the risks they have to take when producing cotton. Furthermore, jatropha production and market is still developing and farmers are not convinced yet if the production is profitable. Many producers stated that in case the jatropha production would work out in the future that they would like to diminish their cotton production. In light of the cotton crisis, the production of a new cash crop such as jatropha is a promising way to diversify production for many farmers. The cotton crisis is thus an important driver in farmers' decision to intensify jatropha production in the region.

Income possibility

As in most rural context in the developing world, income possibilities apart from the agricultural sector are low. The agricultural production in the area is mostly used for self-consumption and only a small amount sold on local markets. The most important income possibilities are sewing cloths, carpeting of houses and fabrication of furniture. Additionally, women earn money through selling of shea butter, soap and vegetables. The most common mentioned problem in farming in the study area is the lack of working material and chemical fertilizer. In order to buy working material the farmers need to have cash. These investments were in the past made with the help of the gained money through cotton production. With problems in the cotton sector, one farmer explained, the situation changed tremendously; now they have to sell working material to be able to pay back their loans. The possibility to gain an additional

income source from jatropha seed selling is therefore a motivation to start jatropha production.

Extensive farming

The project is not advising the farmers to use chemical fertilizer on the jatropha fields. This is an important factor in a region where fertilizer is scarce and expensive. Jatropha is promoted and managed by the farmers extensively, meaning that only little inputs such as water and nutrients are needed and the time invested in maintaining the fields is believed to be little. One farmer, for example, explained that jatropha is relatively easier to farm than food crops. Perennial crops, such as jatropha, commonly include just a onetime investment for the installation of the plantation. However, some studies show that claims that jatropha can be grown under extensive conditions are not true. Ribeiro and Matavek (2009) show in their study “Jatropha! A socio-economic pitfall for Mozambique” that jatropha production in Mozambique requires irrigation, the use of pesticide, and fertile land. Also Jongschaap (2007) warns that claims concerning low input demand of jatropha are not proven yet. Nevertheless, most investigated farmers hold on to the low input perception. Especially the fact that there is no need to use chemical fertilizer influenced farmers’ decision to intensify jatropha production.

Soap production

In the conducted interviews jatropha producers were questioned about what they would do in case the jatropha project would fail. A common response was that they would simply keep the plants and make soap out of the seeds. Some also said they would harvest the seeds and sell them on the market to women who want to make soap. The common price achieved on the local market for one kilo jatropha seeds is about 100 CFA, the project is willing to pay only half of it, 50 CFA. That means the farmer would actually make more money by selling the seeds on the local market. The local jatropha seed market, however, is only marginal and it is unlikely that the demand would be big enough in case a lot of producer would sell their seeds. The soap making aspect is very important in the farmers’ decision to plant jatropha. On one hand farmers are familiar with the soap making process and know that it works. On the other hand shea tree, the other raw material to make soap in the region, has no stable yields. In all villages farmers were reporting that the shea tree yields in the last couple of years went down. One explanation they gave was the small amount of rain, later rainfalls in particular in the last couple of years. Another is that shea trees are wild trees and therefore have big yield variability (Juma, 2006). Other raw materials for soap production are either cotton oil or peanuts. These raw materials, peanut, cotton and shea, are also used for cooking.

Jatropha has thus two advantages in comparison with other raw materials: it is not used for food production and yields are relatively more reliable than yields from shea tree. Farmers regard the quality of jatropha soap as the same or even superior than other soaps produced in the region. So even if jatropha seed selling for oil production would fail, farmers could still use their seeds to make soap. This might be one reason why the farmers take the risk to invest in intensifying jatropha production without having a certainty that their investment will be profitable.

Soil erosion

As mentioned above, only one village specifically mentioned jatropha's ability to fight against soil erosion as an important usage. As a result erosion control does not seem to be the most important reason to start planting jatropha in the frame of the ALTERRE project. In many villages, farmers use stone walls to fight against soil erosion. This technique is widely distributed and farmers which used the stone walls stated that they are satisfied with them and do not see the need to switch to jatropha hedges. However, in villages with high risk of soil erosion, jatropha could be an interesting option. Even more so, considering that the project is providing free planting material, which would make jatropha a cheap erosion control measurement.

Secure land tenure

The pressure on land in the region is increasing in the last centuries. The region is known as the cotton belt in Mali. Cotton is also referred to as the "white gold", which shows its value for local people. Farmers planting cotton are able to benefit from the CMDT's loan and subsidy system and earn a remarkable income. This fact attracted many people from other, poorer regions in Mali to move in this region (Benjaminsen, 2009). As in other regions in Africa, the population growth rate is with 2.6% one of the highest in the world (The World Factbook, 2010). The increasing population is also increasing the pressure on land. The region furthermore experiences more and more separations of big family structures which additional increases the pressure on land. Legal land titles are almost non-existent in the rural areas and the confusion about the different types of land rights, customary versus legal land rights, is substantial. The ambiguity about the land rights results in a fear of losing land. The next three cases illustrate how farmers use jatropha to avoid the loss of their land.

Case 1:

The only woman producer of the ALTERRE project is Alisse Dacko. Her uncle passed away and left his small children and a big area of land behind. Mrs. Dacko is in charge of cultivating and managing this land until the children are old enough to take over this responsibility. The land is far away from Mrs. Dacko's house and she is not able to visit it often. One of her uncles had a jatropha nursery and so she decided to start growing it on this land. If she planted food crops, she would need to build a fence or have a guard to watch the fields in order to avoid browsing damage through animals. Mrs. Dacko wanted to plant different trees but water in that region is scarce and so she decided to plant jatropha. In case Mrs. Dacko would not cultivate this land, she would risk that other people take over this land. When the children, the 'owners' of the land, are old enough to cultivate and manage their land, she will let them decide what they would like to do with the jatropha plants. Until now she has 4 ha but would like to add 2 ha each year. She is not making soap and is planning to sell all the seeds to the project.

Case 2:

A second interesting case is that of Marcel Goita. He is one of the richer farmers in the region. When he was young, he had several income sources next to agriculture; tailoring, import and export of cars as well as electrolinal goods. Goita is an active member of the Christian community and had a lot of strong ties with the local authorities. Although he was not originally from that village and thus he did not inherit land, he has a lot of land under cultivation. His strong ties to local authorities allowed him to get access to good land, which was given to him however without

legal land title for the land. All his children are grown up and live in bigger cities in Mali. Mr. Goita is now cultivating his land alone with the help of some laborers. He stated that he is producing a lot more than he can consume himself and his “*children in the cities are not interested in what is grown here in the village*”. The majority of his harvest he is sells on the market. The field where he planted jatropha is far away from his house. To the question why he chose this particular land he said that in the future he would like to keep this land for his children. In case one day they would like to cultivate it they could decide what they want to do with the jatropha plants. In case they liked to plant another crops Mr. Goita explained that they could simply clear it. In our first interview he said that he wants to plant more jatropha hedges around his fields as every year neighbors are taking small pieces of his land.

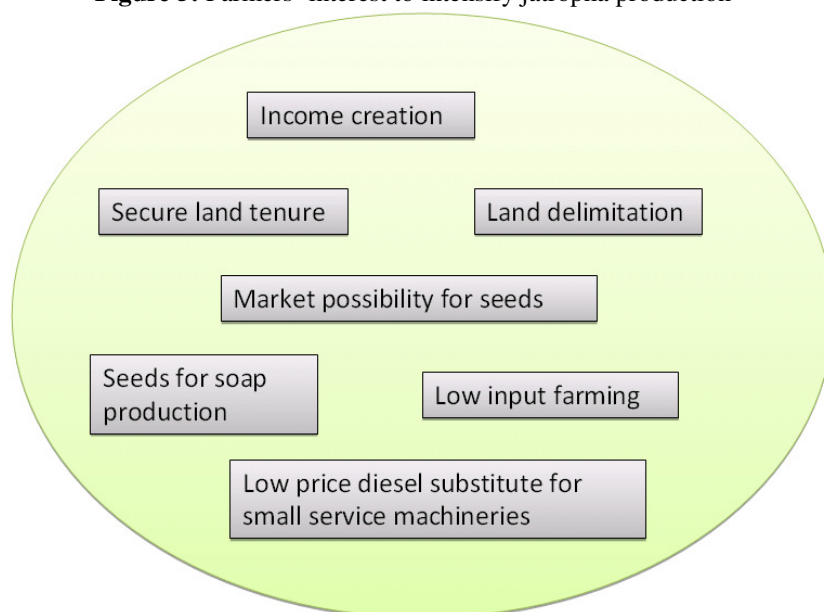
Case 3:

The third case is that of Draman Goita, a farmer in his 40's. He planted 0.75 ha jatropha with the project ALTERRE for his family. The land he chose was rented out to another farmer for many years. Before planting jatropha, he heard on the radio about a new land law¹. This law determines that if a land is cultivated over several years by the same family, than this family will get the owner rights. This new law is contradicting to the customary land law, which gives user rights to the tenant but ownership to the landlord for an undefined period of time. Draman Goita now feared that he might lose his land in the future and hence needed to find a way to ask the land back. According to the local code of conduct, a landlord can only ask a tenant to return his land in case he needs the land to sustain his family; otherwise he would refuse another family access to food. In the case of Draman Goita this is not the case as he has enough land under cultivation to sustain his family. But as his family grows he knows that this situation might change and that in that case he would need this land. With the arrival of the project ALTERRE he found a solution for his dilemma. Jatropha is not a food crop and hence he can ask the tenant to return his land as he now needs his land in order to grow a cash crop. For Draman Goita jatropha has therefore two positive sides; he was able to get his land back into cultivation and he hopes to make money out of selling the seeds.

In all three cases, farmers do not prioritize planting jatropha for seed production but to mark their land in order to prevent losing it. Other farmers mentioned that they planted hedges to prevent fights with their neighbors about their field boundaries. With the prior focus on securing that land stays in their property, it might be possible that the interest in jatropha seed production is low and the effort put into the plantation marginal. Thus, the way farmers manage jatropha may vary as well. Figure 5 summarizes the different interests farmers have in intensifying jatropha production.

¹ Land Tenure Code cited in Nijenhuis 2010

Figure 5: Farmers' interest to intensify jatropha production



2.3 Farmers' jatropha practices

The previous section showed that jatropha is a multipurpose plant. Over the last century, the plant gained more importance through the newly explored usages; from first being only used for medical purposes, over erosion control and field limitation, to soap production to now a day's straight oil production. The changes in usages implied also changes in the planting focus. With the introduction of jatropha for erosion control and field limitation, farmers started to cultivate jatropha. Seed production became only important with the focus on oil production. The establishment of the project ALTERRE, and thus the creation of a seed market with the plant focus on seed production, is not incompatible with the early usage and so jatropha plants are still used for field limitation or as erosion control tool. In the following section the way the different usages translate into planting practices are further explored.

Propagation

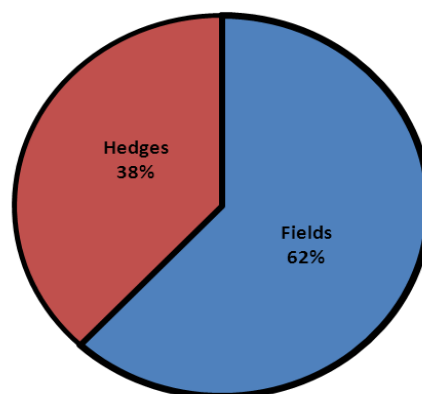
Before the intervention of the project ALTERRE in the region, farmers mainly used cuttings for propagating jatropha. This is due to two reasons: first, the CMDT did not have enough seeds for every interested farmer and so they took cuttings from older trees. Second, propagation with cuttings has two advantages: it is less time consuming than seedling production in nurseries and farmers are able to select their plants. With the planting focus on hedges for either erosion control or field limitation, it is less important if the plant produces enough seeds but more important that the plant grows fast and especially in the case for erosion control, develops to a strong plant. Plants from cuttings grow relatively faster than from seedlings. By cutting branches from older trees, farmers could easily select strong plants for their hedges as cuttings are identical clones from the mother plant. Disadvantage of the use of cuttings is that the plant only develops lateral roots and no tap root. Without the tap root it cannot access nutrients and water in deeper soil layers and has thus only limited drought tolerance. For a better seed production, it is therefore recommended to use seedlings for propagation (FACT, 2010).

The project ALTERRE introduced the propagation through seedlings to the farmers. There are two ways of propagation through seedlings; either direct seeding or the pre-propagation in nurseries. Advantage of direct seeding is that it is less time consuming and the optimal root development. However, as the toxic content is still low in the young plants they are easier attacked by animals and insects (FACT, 2010). Farmers in the region experience massive losses of direct seeded plants through damage by termites and bad germination rate because of bad planting material. Propagation of jatropha in nursery has the advantage that the plants are stronger when they are transplanted to the field and resist better termite attacks. Furthermore, weak plants in the nursery can be taken away and only the strong plants are transplanted. Propagation of jatropha in nurseries is a new technology for farmers in the area and thus they need guidance from the project.

Planting forms: Hedges versus field

Jatropha was before the project ALTERRE only planted as hedges or as single plant. With the focus on seed production, farmers started to plant jatropha also in fields. The majority of the interviewed farmers decided to plant jatropha in fields. As the following figure shows 62% of all the producers in Yorosso (328 producers) plant jatropha in fields.

Figure 6: Plantation type for Yorosso



Source: Project ALTERRE

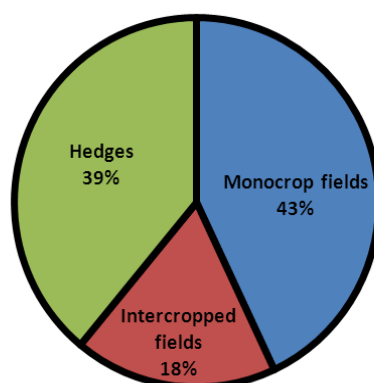
The decision to plant jatropha in fields are influence by the farmers perception that they can earn more money from a field of jatropha than from hedges because on a field more jatropha seeds can be produced. Farmers, who decided to only plant jatropha in hedges, stated that they had not enough land available. Planting in hedges has the further positive side effect that farmers can limit their land and that the hedge benefits from possible fertilizer application and weeding of the crop in the field.

Different hedge forms, depending on the usage, can be found in the region; hedges for erosion control, field limitation and/or seed production. Hedges for erosion control can mainly be found in the village with the farmer elaborated in Box 1 (“Exploiting the potential of jatropha”). In hedges for erosion control, plants are closely cultivated to each other and supported on the bottom part with branches to ensure an optimal protection against water erosion. The farmer, described in Box 1, was showing this technique to the villagers and some of them adopted it. Disadvantage of close planting of jatropha is the possible yield loss as the plant has not enough space to develop a lot

of fruits. Farmers planting jatropha for field limitation leave more distance between the plants (20-30 cm). One farmer decided to leave almost a meter between the plants, as he did not have enough land to cultivate jatropha for seed production but still wanted to ensure that the plant had a good seed yield. With the bigger distance between the plants, the plant can develop more seeds as if the plants had been planted densely.

Farmers planting jatropha in fields have the possibility to intercrop with another food crop. Most farmers planted jatropha in the field with a distance of three meters in between the plants, which is the recommended planting distance found in the available jatropha literature (e.g. Henning; FACT, 2010). This planting distance has the advantage that jatropha can be intercropped for the first three years, when the plants are still young. This distance furthermore ensures that, next to providing a sufficient number of plants per hectare, the plants still develop well. According to ALTERRE, 18% of the farmers in Yorosso are planting jatropha intercropped with another plant, and 43% as monoculture crop.

Figure 7: Ways of planting jatropha in percentage



Source: Project ALTERRE

Choice of land

Jatropha is a perennial plant; therefore farmers take a long-term decision when deciding where to plant jatropha. As the project advises the farmer to plant jatropha on less fertile land, most farmers chose less fertile land. Farmers categorize less fertile land as land where “*pearl millet or black-eyed peas (niebe) grow not well anymore*”. One third of the interviewed farmers are however also taking into consideration land conflicts with neighboring farmers. One interviewed farmer, for instance, explained that he chose the specific land for jatropha production as he had yearlong fights with his neighbor about the boundaries of his land. Planting a tree on a field, traditionally symbolizes property rights of the land. Jatropha, being a perennial crop, has a similar effect as planting a tree. In order to avoid that the neighboring farmer could still take parts of his land, he planted additionally a hedge around his field. The farmer reasoned that with planting jatropha he now would not only be able to earn money but also set an end to the quarrels with his neighbor.

Weeding

Before ALTERRE’s intervention, jatropha was planted in hedges and farmers usually did not weed their plants. ALTERRE’s extension officer advised farmers to do weeding at least twice a year. Yet, the intensity of weeding varies between farmers

from weeding the entire plot, to only around the plants and to no weeding at all. The conducted interviews suggest that more than half of the farmers did not weed in the planting season 2009. Rationales for these variations are explored in the next section.

Pruning

For pruning the situation is similar as for weeding, only a minority of farmers pruned jatropha before the intervention of ALTERRE. These farmers reasoned that jatropha develops into a stronger plant after pruning and they also constituted higher seed yields. In order to achieve better seed yields some farmers taking part in the project ALTERRE prune their plants in frame of the guided research. As no exact references on best dates for pruning exist, the ALTERRE's extension officer asks farmers to prune their plants on different times in the year.

Fertilizer application

Jatropha hedges were not fertilized before the intervention of the project, but they most likely profited from fertilizer application to the field which they surrounded. The intensity of fertilizer application of the project farmers varies and depends on the availability of organic fertilizer, availability of transport possibilities for the fertilizer and farmers' choice to invest time, work and fertilizer on jatropha. Due to the general lack of organic fertilizer, and fertilizer in general, a majority of farmers use only little or no organic fertilizer on their plants

2.4 Farmers' rationales for their jatropha practices

Different rationales help to explain farmers' variations in the way the farm jatropha. Out of the interviews with jatropha producers and non-jatropha producers the rationales can be grouped into four groups:

- Risk aversion
- Experiences with perennial crops
- Overlaps with working peaks
- Securing land tenure.

Risk aversion

Farmers are dealing with many uncertainties in jatropha seed production. Firstly, jatropha has no considerable yields in the first three to four years. Thus, farmers can start having income only from the fourth year onwards. Secondly, due to the early stage of the project, the jatropha seed market is still developing, and so some farmers are skeptical in believing that it will be possible to market the seeds in the future. All interviewed farmers are cultivating cotton. Most of them are disappointed about the CMDT as in their opinion the company does only little to help farmers. About half of the interviewed non-jatropha farmers and one forth of jatropha farmers mentioned that they fear that they will encounter a similar situation as with cotton. Jatropha farmers, fearing this are hesitant to put much effort into jatropha cultivation and rather wait until they see the success of neighboring farmers. Thirdly, the amount of labor, time and inputs farmers are willing to invest in jatropha cultivation depends on farmers' general disposition to take risk. This disposition depends on two factors: on farmers' willingness to take risk and farmers ability to take risk. A farmer which is already relatively poor is more risk averse than a better situated farmer. The interviews also showed that 20% of the farmers are not willing to take the risk, to invest a lot of resources in cultivating jatropha while being uncertain about how the entire sector will develop.

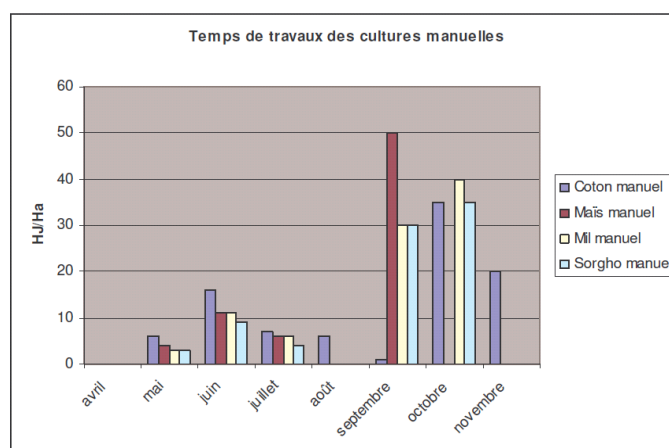
Experience with perennial crops

For the most part farmers grow annual crops in the region. The perennial crops found in the region are single trees, which are not pruned or fertilized. For the majority of farmers, jatropha is the first perennial crop they grow. Some of the older farmers have been working in the Ivory Coast on cacao, coffee or avocado plantations. These farmers can use this experience in jatropha farming. The farmer elaborated in Box 1, for instance, used his knowledge on pruning and was one the only farmer who pruned jatropha before the intervention of ALTERRE. His positive experiences with pruning other perennial crop encouraged him to also prune jatropha. In a trial and error principle he found out that if jatropha is severely pruned after three years, the jatropha plant develops more seeds and more branches in the next year. In general, farmers with experiences were putting much emphasis on maintaining their plants. Farmers without knowledge on perennial crops need to rely on the advice given by the project staff or other farmers in order to know special practices inhabited in perennial crop farming (such as pruning or propagating seedlings in nurseries).

Overlap with working peaks

Preparation for planting other important crops in the area such as maize, cotton, millet and sorghum start in the month of May. ALTERRE recommends transplanting the jatropha seedlings in the period between end of May and end of July, which overlaps with the preparation period for other crops (Gomes, 2005).

Figure 8: Distribution of working periods for manual crops over the year



Source 2: Gomes, 2005

In an interview with a non-jatropha farmer, a farmer stated that since two years he is planting jatropha seedlings in a small nursery. Each year when he would need to transplant the seedlings to the field, he was so busy with preparing his fields that he did not transplant. The transplantation and the first weeding of jatropha also fall into work peaks of farmers. The amount of time farmers are able to dedicate to jatropha cultivation depends on the availability of labor during work peaks.

Securing land tenure

Section 2.2 showed that farmers have diverse interests in intensifying jatropha production. One identified interest is to secure land tenure. In all three cases as illustrated in Section 2.2, farmers were using jatropha as a way to secure land tenure. The first case of Alisse Dacko, illustrated that she was growing jatropha on land

which was far away from her house and which she was in charge of until her small cousins are old enough to take care of it themselves. Her decision to cultivate jatropha on this land was not so much driven by the interest in jatropha for seed production but rather by putting a perennial plant on the land which keeps the land occupied so that other farmers can not take it from her. As her jatropha fields are far away from her home, she will spend more time on her own fields. This example suggests that if farmers' primary interest is not in jatropha production, the amount of labor they are willing to put into jatropha could be marginal. Due to time constraints it was not possible to investigate this aspect further.

2.5 Conclusion

The purpose of this chapter was to analyze jatropha's role in farmers' social world. The analysis showed that farmers' social world is heterogeneous and thus jatropha plays multiple roles. Different interests in the crop co-exist. These interests have a great deal of influence on how the technology (e.g. cultivation) is used. For erosion control for example, plants need to be densely planted in order to build a good barrier against erosion. Farmers which cultivate jatropha as field boundary are interested on a fast development of the plants and do not care so much about planting distance. The understanding of farmers' particular interest in the crop needs to be recognized and seriously evaluated whether it can be made use of or whether specific project activities are necessary to further develop farmer's knowledge so that it can provide a positive input towards the objectives of the project. Generally speaking this observation would translate into the statement that for any project intending to introduce new usage of a crop in an area where farmers have already experiences, a defined effort has to be made to consider, evaluate and integrate a great variety of already existing practices into the activities of the project.

The usage and interests in a crop is influenced by past experiences. New usages of the jatropha plant introduced by external intervention to farmers' social world changed it from a wild plant, used only for medicinal purposes, into a multipurpose plant, with usages ranging from the use of jatropha as a means to reduce erosion, as a way to securing land tenure or even as a novel source of income. Even though farmers have grown jatropha for many years, the cultivation of the same plant for new uses entails new farming practices. This requires from any project interested in introducing new uses to first and foremost develop the interest and motivation of the farmers for it and provide the knowledge about novel practices required. Projects intervening in such a situation need to be aware that producers might tend to stick to their already established practices unless enough information on the new techniques and convincing arguments for the new use are provided. In cases where established practices may have a negative influence on yields this results in a negative impact on the overall outcome of the project.

Past experiences with cash crops have taught farmers to be careful with putting too many resources into the production of cash crops. The analysis of farmers' rationales for their planting practices revealed that farmers tend to be risk averse. Intervening projects need to be aware of the reluctance of farmers to accept changes.

3 Jatropa technology as promoted by ALTERRE

3.1 Introduction

Objective of this chapter is to analyze how ALTERRE promotes more intensive jatropa production. In order to understand how ALTERRE promotes jatropa it is crucial to understand what ALTERRE is. For that reason, the first sections explore ALTERRE's objective, the different organizations connected to the project. The different organizations form ALTERRE so it is important to understand their objects and interests in the project. An understanding of the institutional context will help to understand ALTERRE's practices.

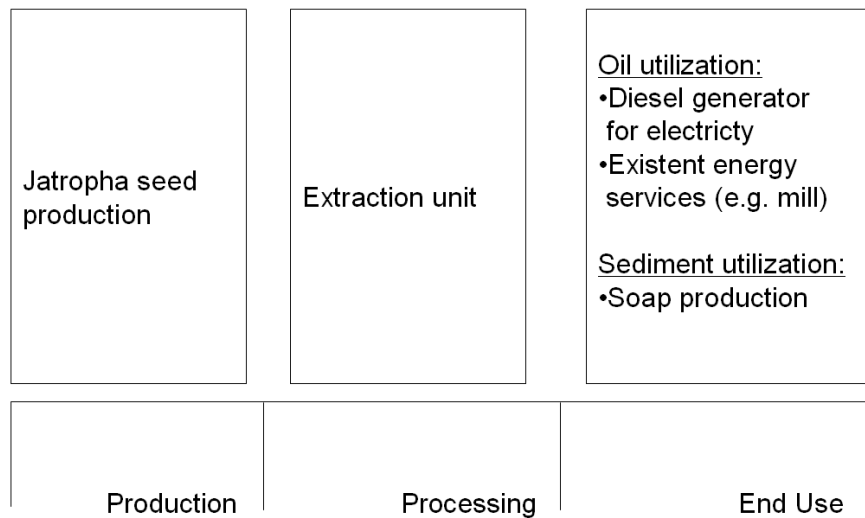
Section 3.2 introduces the project ALTERRE in more detail. Its overall objective as well as the underlying idea on how such a local biofuel supply chain could look like is explored. Section 3.3 provides an historical overview of the project and also introduces the different partners connected to ALTERRE. This will help to understand the institutional context explored in Section 3.4. These three sections will provide the basis to understand the emerging positions of different actors (Section 3.5) and ALTERRE's interest in jatropa production (section 3.6). Section 3.7 will then look at how ALTERRE promotes jatropa to the farmers.

3.2 The project ALTERRE

ALTERRE (“Agrocarburants Locaux, Territoires ruraux et Energie “, “Local Agrofuels, Rural Territory and Energy”), composed of several partner organizations, is a project aimed at establishing a local biofuel supply chain based on jatropa in order to generate a new source of income for local communities and to improve their access to energy. The overall objective of the project is to set up a replicable scheme to create access to sustainable energy for rural communities in West Africa. A study conducted in the frame of the project showed, that a number of agronomic, technical and socio-economic assumptions need to be validated. For this purpose, ALTERRE sees itself not only as a developing project but also as a research project. In their project documents, the conducted research is referred to as action research. In ALTERRE's view, action research entails collective learning with the help of technical exchange groups. This entails that knowledge which is gained by farmers and project staff in the process of establishing jatropa production should be exchange so that everyone can learn from each other. The exact steps of the action research were not accessible in any written form.

According to the project design all steps (see figure 11) of the biofuel supply chain are tailored to be local. In contrast to other biofuel projects, which produce jatropa biodiesel for export purposes (for instance in Mozambique, Ribeiro, 2009), the end product will also be used locally. In that way, ALTERRE seeks to make the local population as the main beneficiary of the project.

Figure 9: Jatropha production chain



In 2008, ALTERRE introduced jatropha for biofuel production to farmers in the Commune of Yorosso with the planting focus on seed production. Up till now the main center of attention of the project is given to establishing the production part of the value chain. The proposed idea for the value chain in the Commune of Yorosso is the following: farmers sell jatropha seeds to an extraction unit, where seeds from the surrounding project villages are collected. Here the oil is pressed and the sediments, which are a byproduct of the pressing process, sold for a marginal price to women for soap production. The oil is sold partly to the electricity company SSD Yeelen Kura, which will use it in their diesel generator and partly back to the villages to small energy services.

In its reports, ALTERRE states its objective as the following:

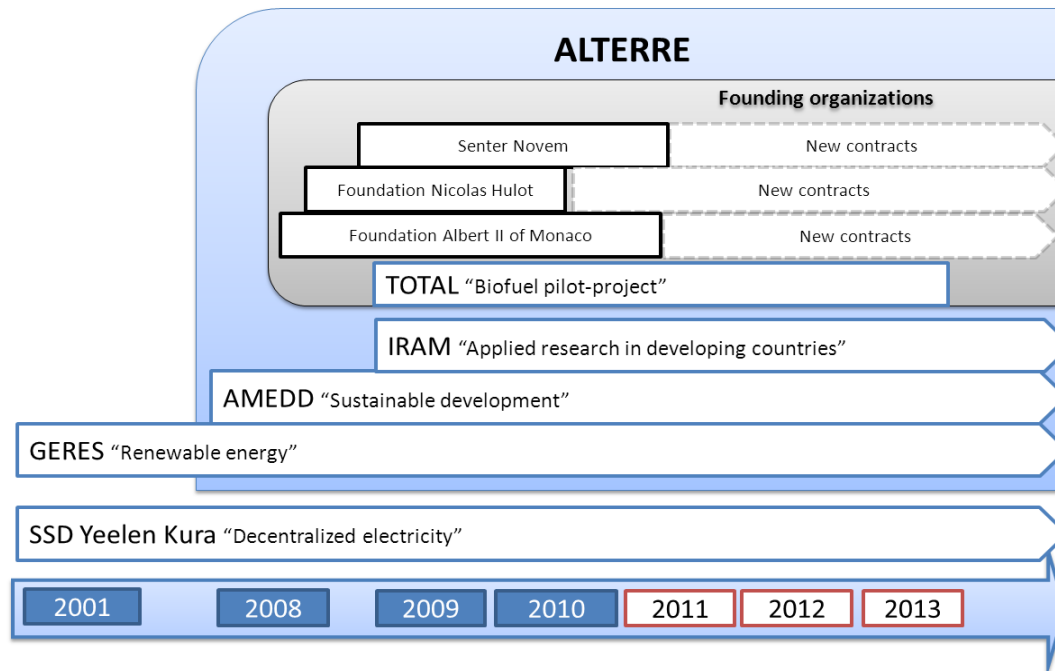
Overall objective of the project ALTERRE is to contribute to the fight against poverty and the amelioration of living conditions of the rural population. On a commercial balance and energy political scale, ALTERRE is participating in the reduction of energy costs and the increase of Malian energy independence from foreign fossil fuel. In order to reach its goals, ALTERRE's specific objective is to develop a local agro-fuel supply chain on the basis of jatropha and to create technical, economical and organizational references on characteristics of such a supply chain and the steps necessary to put it into place (Project ALTERRE: Rapport de Demarrage, 2010 ; CASCADE Africa, 2010)

In contrast to the organization which introduced jatropha for erosion control and living fences, ALTERRE is market-oriented. The sufficient production of seeds in order to satisfy the demand on the market is the main objective on the production side of the project. The agricultural practices are thus tailored towards seed production. Consequently, ALTERRE promotes jatropha practices focused on seed production such as propagation of plants in nursery and maintaining the plants (weeding, pruning, fertilizer application). Section 3.7 will further elaborate on different cultivation practices.

3.3 ALTERRE's historical context

Several organizations are connected to the project ALTERRE. These organizations joined and terminate their contract with the project at different times. Each of the organizations has their own institutional context and objectives which influence ALTERRE's practices. Figure 10 provides an overview of the different organizations connected to the project, their relationship, their overall objective and their duration time in ALTERRE.

Figure 10: Project history



GERES

The French non-profit NGO GERES (Groupe Energies Renouvelables, Environnement et Solidarités), which was created after the 1976 oil crisis, was the founder of ALTERRE. The promotion of renewable energy utilization was a response of the organization to the augmentation of petrol prices. GERES's mission, as stated on their homepage, is:

To implement solutions based on promoting energy efficiency and renewable energy, to preserve the environment and natural resources while promoting sustainable development at local level, respecting the needs and wishes of communities and their territories (Geres, 2010).

The organization is working in the field of environmental conservation, climate change mitigation and adaption, reducing energy poverty and improving livelihoods of the poor. Biomass is seen as the prime energy resource in poor countries and thus its use highlighted in projects in these countries (GERES, 2009).

SSD Yeelen Kura

SSD Yeelen Kura is a private decentralized electricity company with the French EDF (Electricité de France) and the Netherlands's multi-services NUON as stakeholders. Yeelen Kura means 'new light' in the local language Bambara. They became the principle decentralized electricity operator in the region in 2006. SSD Yeelen Kura's objective is:

To deliver services for lighting, broadcasting, power and battery re-chargement from energy production equipments, on a financially rentable base to ensure the sustainability of the system (SSD Yeelen Kura, 2010).

SSD Yeelen Kura's initial activity was to rent out individual photovoltaic kits. In 2006, with the financing help of AMADER (Agence Malienne de l'Energie Domestique et de l'Électrification Rurale) SSD Yeelen Kura installed six additionally diesel generators for the electricity network in Yorosso city. The diesel generators provide electricity for three hours in the morning and two hours after sunset.

GERES started its work in Mali in December 2000 and provided ad hoc support to the development of SSD Yeelen Kura activities. Starting in 2007, with the all year long presence of GERES, they were looking into intensify their partnership. Focus was given to the productive valorization and distribution of electricity. In 2007 until 2008, a GERES volunteer conducted a study about the development of new energy services in the cotton belt in Mali. Amongst others, the study showed that part of the diesel used in SSD Yeelen Kura's diesel generator could be substituted by biofuel. This study – along with the possibility of having a potential consumer and GERES' long term partnership with SSD Yeelen Kura – led to the creation of ALTERRE (GERES, 2010).

AMEDD

For the implementation of a local biofuel supply chain, profound knowledge about the agricultural, social and economic context of the region was necessary. In late 2007 GERES decided to partner up with the Malian NGO AMEDD (Association Malienne d'Eveil au Développement Durable). AMEDD has been involved in sustainable development in the region since 1998. Its major aim is to ameliorate existing living conditions. AMEDD assists in the building of local competences, in dialogues between actors and in financing social projects. The organization is well known in the villages for their diverse projects. Through the collaboration with AMEDD, ALTERRE could use their familiarity with and knowledge about the local context as a good entry point for the project.

TOTAL

In 2009, TOTAL became a major funding partner and member of the pilot committee of ALTERRE. TOTAL is one of the six major oil companies in the world. It was founded 1924 in France. TOTAL believes, as stated on his homepage, that

As an energy producer, [...] it is our responsibility to facilitate access to energy, particularly for communities neighboring our sites. We want to promote access to affordable, reliable and sustainable energy sources for low-income populations (TOTAL, accessed 14.9.2010).

The company has been evaluating several options for this end. Currently they are working around three key themes:

- Short biofuel supply chains (biofuels produced and consumed locally)
- Access to photovoltaic solar power in rural areas
- Local valorization of gases produced at some of their sites.

Their main goal in the development in these three themes is to identify business models that will enable them to offer low-income populations a reliable and affordable energy source that they can use sustainably and independently (TOTAL, 2010). In this context, TOTAL developed a frame of reference for developing access to energy for the poor population. In this frame of reference, the use of biofuels are not yet part, due to lack of sufficient experience and missing evaluation measures in the economic, social and environmental field. For TOTAL, it is of interest to be able to compare results of a biofuel project which is based on local supply and demand strategy with other electrification schemas (RDef ALTERRE, p. 127, 2009).

IRAM

The establishment of such a detailed frame of reference on a local biofuel supply chain needs analysis and reporting of results. In order to help GERES in this field, IRAM (Institut de Recherches et d'Applications des Méthodes de développement) joined the project as a partner in 2009. IRAM, located in France, is an organization specialized in applied research in developing countries. In ALTERRE it supports GERES in its work and strengthens particularly the monitoring and evaluation part of the project. By doing this, IRAM is currently developing a monitoring and evaluation tool which includes specific necessary measurement. The creation of technical, economical and organizational references, in order to possibly multiply such a system in the future is an important part of the project. The research characteristic of the project and its influence on ALTERRE's jatropha practices will be discussed later on in this chapter.

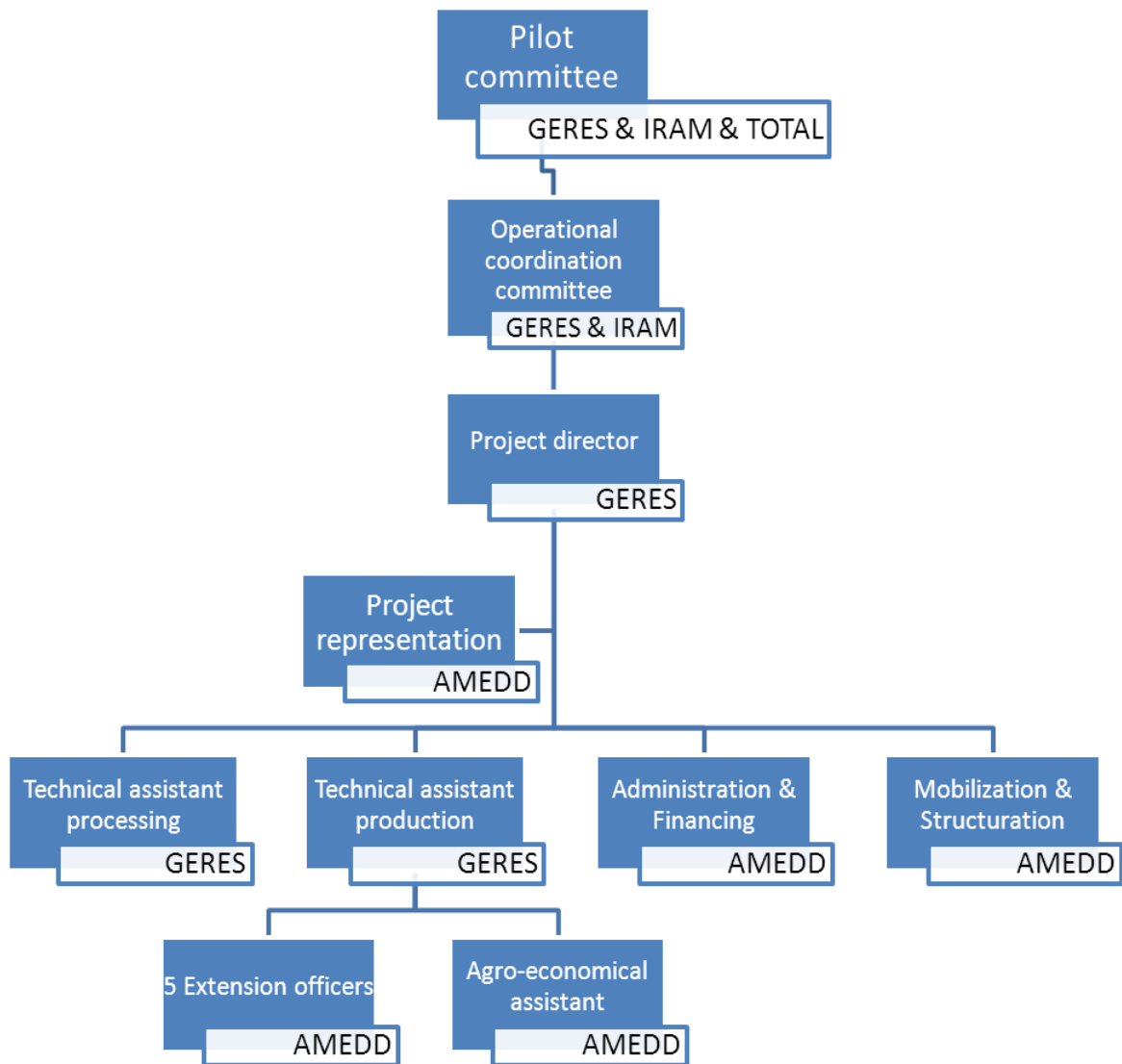
Funding organizations

Since the creation of ALTERRE, the Nicolas Hulot Foundation and the Prince Albert II of Monaco foundation provided financial support. The prince Albert II of Monaco foundation encourages the implementation of innovative and ethical solutions in three main areas: climate change, biodiversity and water. Its envisaged objective for ALTERRE is to increase income of villages in rural areas, improve living conditions and to involve the rural population in their development (www.fpa2.com, 2010). The Nicolas Hulot Foundation works on for main topics: climate and energy economics, sustainable food supply, biodiversity and sustainable management of coastal and marine areas (www.fondation-nicolas-hulot.org, 2010). The engagement period ended in August 2010 for Nicolas Hulot Foundation and will end in April 2011 for Prince Albert II of Monaco Foundation. One year after the creation of ALTERRE, Senter Novem, a Dutch government organization, became ALTERRE's third funder. Their engagement period will end in June 2011.

3.4 Institutional context

Due to the fact that various organizations are part of ALTERRE, different organizations have different positions in the project. Figure 11 depicts the institutional organization of ALTERRE as described in written form in its reports. This thesis argues that organizations in a higher, hierarchical position also have more power in decision making and in the strategic layout of the project. This is significant because, it influences the work with farmers on the ground.

Figure 11: Organizational chart



Since 2009, with the entrance of TOTAL as partner in ALTERRE, the management of the project is divided between two organs: the pilot committee and the operational coordination committee (CoCoop). The pilot committee is based in France and is composed of the director of IRAM and GERES and a representative of TOTAL. The committee maps out the strategic orientation of the project. It is in charge of approving the yearly activity plan and monitoring its realization. Furthermore, it approves the obtained results and is responsible for the diffusion of results to external partners. The pilot committee is validating decisions taken by the CoCoop in one of their half-yearly meetings.

The CoCoop is composed of three persons: a technical referent from IRAM and from GERES and the project chef of ALTERRE (GERES). The technical referent from IRAM is based in France; the other two are based in Mali. In monthly meetings via Skype or telephone, the committee decides on technical and budgetary issues. On the basis of the bigger strategic orientation of the project, the CoCoop decides on the annual strategic plan. This plan has to be validated by the pilot committee.

The position of the project director of ALTERRE is occupied by GERES. The director is in charge of the implementation of decisions taken by the two committees. Additional, she is the one monitoring the activities in the field and coordinates financial and administrative activities. For the representation of the project to the public she is supported by AMEDD's program director. He is also present and gives advises at the monthly project team meetings.

As IRAM is the main contact person for TOTAL, they are responsible for finances and administration of ALTERRE. A sub-regional GERES coordinator supports the project director in administrative decisions. Administrations and finances of the day to day business in the project are managed by a secretary (AMEDD).

The current project team is composed of 12 workers (including the director and AMEDD's program director). As the project aims at developing an entire biofuel supply chain, the work is divided into three parts of the supply chain: production, processing and end-use. The processing division is in charge of the technical side of the project. This includes the evaluation of existing diesel engines in the region and their potential to run on jatropha fuel as well as all the questions concerning the oil production. There is only one person permanently working in the technical division however he is reinforced by regularly present interns from Malian, European and Canadian universities which work on specific technical topics such as finding a way to test jatropha oil quality locally. The production division is composed of seven people: the technical assistant production (a volunteer from France), an agro-economical assistant and five extension officers. The division is in charge of supporting farmers in jatropha cultivation and to search, together with the farmers the best way of cultivating jatropha. The technical assistant is coordinating the work of the five extension officers as well as of the agro-economical assistant. Main task of the agro-economical assistant is to conduct surveys with farmers in order to monitor the project outcomes. The five extension officers are distributed over the three working zone, with one for the research area Yorosso (SE_ ALTERRE, 2009).

The extension officers are working closely together with the farmers and represent the project in the region. As such they are the main contact persons for farmers in the

project and the connecting link between farmers and other ALTERRE' staff. They are also responsible for organizing the planting season, accompanying farmers in their cultivation and providing necessary data for the agro-economical department which is in charge of monitoring and evaluation of the project. In the zone Yorosso, one extension officer is in charge of 394 producers. Due to time constraints, it is not possible for the extension officer to spend a lot of time advising every single farmer. However the extension officer stays in a frequent exchange with producers through village meetings, field visits and workshops. This enables him to monitor the planting process, encourage farmers to maintain their plants and in general show presents of the project itself.

To better facilitate field visits and workshops, the producers in each village elected a producer representative. The representative is the intermediary for information and questions between the extension officers and the producers. Furthermore he is in charge of collecting the seeds harvested by each producer and to sell them to the project. In cases where farmers' participation in meetings are low, the representative is in charge of transmitting information from meetings to producers who did not participate. The representative works on a voluntary basis and only receives compensation money if he works a full day or if he uses his own vehicle.

3.5 Positions of extension officers and farmers

This chapter focuses on ALTERRE's jatropha practices with special attention on the production side of the project. Therefore, farmers and extension officers were identified as important actors on the production side. Farmers because they are the one producing the raw material and extension officers as they are the connecting link between ALTERRE and the farmers. Studying project reports and participating in project activities revealed that the research character of the project influences the position of farmers and extension officers in the project.

Position of farmers

According to ALTERRE's project reports, beneficiaries of the project are amongst entrepreneurs working in the energy service sector and women (in the jatropha soap production), and the jatropha farmers themselves. On the production side of the entire value chain they are the main beneficiary as producing and selling jatropha oil should become another income possibility in the future. Farmers do have experience with cash crop production in the region, mainly with cotton. For many years the Malian cotton industry had an intensive extension program. Part of the program is the diffusion of production techniques and intensification of the crop and to ensure high cotton quality (Malian Agricultural Ministry, 2004).

Box 2: CMDT's extension system

The French colonial power established the *Compagnie Française pour le Développement des Fibres Textiles* (CFDT) in the year 1949. CMDT got nationalised in 1974 with the Malian government holding 60 per cent of its share while the rest remained with the CFDT. As an extension agency the CMDT has a dual objective to first promote cotton production and second to implement an integrated rural development programme. Like many other government agencies, the CMDT has a traditional authority system with a hierarchical and centralised structure. The extension approach aims at the distribution of a standard technological package designed to increase the production of high quality cotton. Farmers, in such a top-down strategy are thus receivers of information rather than active members in the search for better production methods. The CMDT engages in many aspects of rural life such as provision of credits and physical infrastructure (roads etc.), literacy, book keeping, accounting courses and organisational support to rural population.

Cotton's crucial role in local incomes, results in a high farmers' engagement in cotton production and in a big interest in CMDT's assistance to increase cotton production. Extension officers live in the village, which increased the trust between farmers and them as the extension officers share conditions with the local population. Face-to-face relationships are strong; a survey with 312 farmers showed, that they have in average 18 annual, personal contacts with the CMDT.

In 1974, as a response to farmers' demand for more influence on extension activities, the CMDT created village associations. Big parts of CMDT's task were transferred to these village associations. After building up local capacity, the number of extension officers in the region decreased.

Source: Degnbol, 2001

ALTERRE's extension program is not comparable with that one of the Malian cotton industry (see Box 2: CMDT's extension system) as within the project ALTERRE, farmers have a double entendre; they are beneficiary and at the same time investigator. Their role as investigator is described in a project report as:

The jatropha producers, organized on the village and communal scale, are part of a collective learning process, with the help of technical exchange groups they will be able to learn from their jatropha cultivations. (RD Alterre, p.24)

Due to the lack of knowledge on jatropha and the pilot character of the project, farmers are part of the search for best jatropha planting practices. The project idea is to organize knowledge exchange platforms, such as village meetings, where farmers together with the extension officer can share their experience with different planting and management techniques. ALTERRE wants to put information together in the future in order to create references on best jatropha planting practices. Farmers' position as part of an experiment entails a certain risk of failing of their cultivation. The project recognizes this risk and provides subsidies for jatropha plants. ALTERRE guarantees two subsidies; one for the installment of the plantation and one for the maintenance of the plants.

The first subsidy for the installation of the plantation is meant to facilitate nurseries and to encourage producers to transplant the seedlings on time. Contrary to other jatropha projects who give jatropha plants to producers, ALTERRE opt for the promotion of locally installed nurseries. For the nursery 10 CFA is paid for each seedling. One part of the subsidy is given to the farmers when they start with the nursery. The other part is given after transplanting the seedlings to the field. The survival rate of the transplanted plants depends on the transplantation time. For a high survival rate best time for transplantation is in June. To encourage farmers to transplant on time, the project opt for a subsidy system which depends on the planting time: farmers who transplant jatropha seedling between June and July will receive 10 CFA/ plant, for transplanted seedlings after July and before end of August farmers will receive 5 CFA/plant, and transplanted plants after August will not receive any subsidy.

The second subsidy for good maintenance of the plants, are meant to reward and to encourage farmers to maintain their plants well in order to ensure good plant development and to improve their results. The exact execution of this subsidy was still discussed amongst the project members at the time of this research. The subsidy furthermore intends to motivate farmers to engage in jatropha production and to help to establish reference on best jatropha practices.

Position of ALTERRE's extension officer

Being the connecting element between ALTERRE and the farmers, the five extension officers have a crucial role in the project. All of them are in their twenties and have an education in agriculture. Some of the older extension officers gained experiences in working in other development projects before working with ALTERRE. For the others, ALTERRE was their first job. Their role within the project is defined as:

- Organization and monitoring of the campaign's course
- Animation and consultation of villagers and mobilization of actors
- Organization/ Animation of exchange meetings between the producers
- Technical support and individual recommendation
- Participation of monitoring and evaluation of the research under peasant conditions
- Collection and analysis of data (specifically counting of plants) (Slide from meeting with representatives, 2010)

The extension officer has thus multiply roles; as facilitator, enumerator and technical advisor. First, as a facilitator he organizes exchange platforms such as village meetings where farmers can share their experiences and challenges with jatropha. As a facilitator he also accompanies the farmers in jatropha planting and motivates farmers to maintain their plants (e.g. weeding, pruning, fertilizer). The second role as an enumerator plays an important role for the monitoring and evaluation part of the project. In this role he assists the agro-economical assistant in collecting socio-economic data. Furthermore, he is the one who helps keeping track of the size of the project by reporting the number of plants in the area. Thirdly, he gives advice to the farmers about certain planting techniques and transmits information gained through ALTERRE's experiments in universities. As the main contact person for farmers, ALTERRE's jatropha practices in the field are depending to a considerable amount on the performance of the extension officer.

In the Commune of Yorosso the responsible extension officer is in charge of 394 producers. Next to the time spend on organizing the planting season and collecting data, there is only little time left to have individual producer visits. However, when visiting the project villages, he tries to get an overview about the state of the different planting sides and stays in contact with the producers.

3.6 ALTERRE's interest in jatropha

Various organizations with different objectives are connected to ALTERRE. Their specific interest in ALTERRE is different from each other. The pilot committee (GERES, TOTAL and IRAM) has most influence in the execution of the project as they are responsible for mapping out the strategic direction of the project (see Section 3.4). With their decision about the strategic direction, their interests in jatropha are also prevailing in the entire project.

GERES idea to launch ALTERRE was influenced by its partnership with Yeelen Kura and the idea to find a substitute for the diesel used in Yeelen Kura's diesel generators. As the organization's mission is to promote renewable energy while promoting sustainable development at the local level, the decision was to introduce a local biofuel supply chain. Their interest in jatropha is thus provision of energy while providing income to the local population.

TOTAL plays a double role in the project; they are funder and a member of the pilot committee. Hence, they have a considerable influence on the project strategic direction. Their interest in identifying replicable business models on how to establish an affordable energy source for low-income population is visible in ALTERRE's effort to create knowledge on best agricultural practices and also to document this knowledge.

IRAM, as an organization working in applied research in developing countries, is a partner in the project that offers support in the monitoring and evaluation conducted in the project. Their interest is thus, that the project creates a frame of references which can possibly be applied to other projects in West Africa.

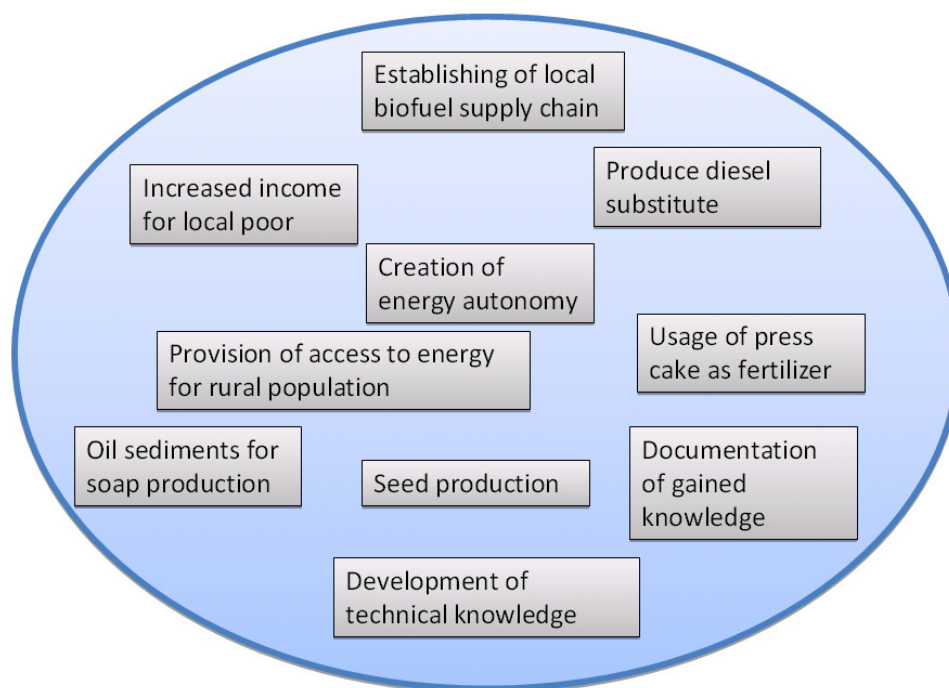
ALTERRE's logical framework, consisting of four general objectives, reflects the interests of the three organizations:

- Fight against poverty
- Amelioration of energy access
- Local development
- Energy autonomy (RD ALTERRE, 2009, P.21).

Contrary to farmers, which use jatropha as a multifunctional plant, ALTERRE introduces it for one specific goal; biofuel production. The promoted ALTERRE practices are thus targeting towards seed production (see Section 3.7 for more specific techniques). The production surface for example was calculated on the estimated demand for oil in the region. In order to be able to promote the use of oil to possible buyers, ALTERRE needs to make sure that enough oil is produced. The extension officer which is the one in contact with farmers needs to ensure that production on the ground is tailored towards seed production.

Figure 12 summarizes ALTERRE's interest in jatropha. In the graph two additional interests can be found; oil sediments for soap production and usage of press cake as fertilizer. These two are side products of the oil pressing process and should be used by the local population in the future.

Figure 12: ALTERRE's interest in jatropha



3.7 Promoted Jatropha practices

Propagation

Jatropha can be propagated in two ways: germination either through direct seeding or pre-propagation in nursery or through vegetative propagation with the use of cuttings. Although, the use of cuttings is known in the study region before, ALTERRE opt to promote jatropha through germination in nursery. Disadvantage of cutting propagation is that the cuttings do only develop lateral roots and cannot access nutrients and water in deeper soil layers and thus have limited drought tolerance (FACT, 2010). In the beginning of the project, ALTERRE promoted direct seeding but had a high mortality rate of the plants. In the jatropha handbook published by the FACT foundation (2010) high mortality rates with direct seeding are explained as the result of the low toxin content of the young plants. Without this toxin plants are vulnerable to damages through animals. For the planting season 2010, ALTERRE is now promoting collective nurseries. Advantage of propagation in nurseries, is the germination and development under controlled condition. Slow or abnormally growing plants can be removed and only strong seedlings selected to transplant to the field (FACT, 2010, p.26). The advantage of collective nurseries for the extension officer is that he can monitor the development of the plants better.

Transplanting date

According to the available literature on jatropha (e.g. FACT, 2010), the best time for transplanting the seedlings is the onset of the rainy season. In this period the soil has taken up already first soil moisture. The rainy season in the research takes place between May and September. To profit from the rain, ALTERRE promotes transplanting between end of May and end of July.

Weeding

ALTERRE promotes weeding whenever the jatropha plants are too much covered by weeds, but at least twice a year. Although jatropha can survive when it is overgrown by weeds, plants will not produce as many flowers. With the project focus on seed production, weeding is thus recommended.

Plowing

Plowing after the rainy season is recommended as it has a positive influence on the plants' resistance in the dry season. It allows better water infiltration in the soil in the end of the rainy season and thus makes this water more accessible for the plants. ALTERRE recognizes that in order to plow a considerable amount of resources are necessary. To demonstrate the positive effects of plowing, certain farmers were asked to plow in 2010 (ALTERRE_Mission report, 2010).

Pruning of jatropha

Although ALTERRE is still experimenting with best time for pruning jatropha, they recommend pruning. Together with the farmers, they are trying out different times for pruning. Up to now ALTERRE generally promotes pruning in the first year after planting jatropha, with the start of the month August. For the years 2 and 3, they would like to test different times for pruning: during the dry season, in the end of the dry season or in the beginning of the rainy season. For a high seed yield pruning is important (see RDEF ALTERRE, 2010; FACT, 2010). Jatropha flowers are found on the end of branches, and cutting the end supports ramification. In turn this leads to more branches and as such to more potential fruits for production.

Fertilizer application

ALTERRE promotes the application of organic fertilizer application when the plants are first transplanted to the fields and in the first several years that follow. To grow into a full size plant and to produce seeds, jatropha needs sufficient amounts of nutrients, especially when planted under poor soil conditions (FACT, p.28, 2010).

3.8 Conclusion

The motivation and interest in promoting more intensive jatropha production in Mali is shaped by its main owners located in France. These three external partner organizations form the pilot committee have the final say as to how policy issues and distribution of resources is decided. Even though ALTERRE states that the beneficiaries are the local farmers, farmers' interests are not represented in the decisive committees and thus have no influence on the way the project and its resources are implemented. This remote control of the project has implications on the ground. Even so the project aims at improving the live of farmers the decision making body is far from this reality and the feedback from the field has to go a long way to reach the top. The strategic layout of the project's hierarchical order gives a strong emphasis to those at a higher positions and thus the decision making process is very likely to be rather a top-down approach than a program shaped by the interests of the beneficiaries.

ALTERRE was established out of the founders' idea to substitute diesel fuel used for energy production with a locally produced biofuel and not by an articulated interest of local beneficiaries. The project aims are thus also formulated by project partners in such a way that they fit the partners' specific overall objectives. Therefore, the flexibility to adjust to the local situation of such a project is only possible to a degree that it meets the different organizations objectives.

The project combines development and research on a biofuel supply chain; as such farmers are part of the collective learning process. According to the projects' vision, by organizing exchange meetings between farmers, farmers should learn from each others jatropha practices. Nevertheless, the project has a hierarchical structure and thus is only flexible to a certain extent (as long as they are in line with seed production) to consider farmers' own practices in the exchange groups.

The extension officer is the connecting link between project and project beneficiaries. He can receive feedback on the project from farmers. However, as he is on the bottom part of the organizational hierarchy his ability to bring this feedback into the project design is limited. Thus, with such an institutional configuration farmers interests are difficult to integrate in the project design which can have the effect that these interests are overlooked.

4 Project- Farmer interaction

4.1 Introduction to project-farmer interfaces

So far the two previous chapters were looking at farmers' and ALTERRE's social worlds separately from each other. For both interest in, motivations for and their historical context of intensifying jatropha production were explored. The exploration indicated that farmers and ALTERRE's social worlds differ from each other in the way they use jatropha (farmers use it as multifunctional crop, ALTERRE as mono-functional crop). Due to the fact that ALTERRE sees jatropha producers not only as receiver of information, but as partners in the research process for best agricultural practices, ALTERRE and farmers social worlds interact in many ways.

In ALTERRE's view point, farmers are part of a pilot project and they are the ones testing different practices under "uncontrolled" or "real world" conditions and either confirming or adapting them. It is thus not envisaged to implement a linear technological transfer from extension officers to producers, but rather to implement a participatory technology development where farmers actively participate and farmers and ALTERRE work together on finding best ways of cultivating jatropha. ALTERRE's aim is that in the end of the project participating farmers and extension officers are on the same knowledge level. Farmers in the research area are used to the extension system of the CMDT. In this system, farmers are taught in a linear way how to improve their production by teaching and informing them about different techniques. Thus, these farmers have no experience in participatory technology development. With such experiences farmers are not expecting to be involved in the process, but rather anticipate that ALTERRE will provide them with the needed knowledge.

In interactions, ALTERRE and farmers bring their different expectation upon each other with them. This part of this thesis focuses on such meeting points, the social interfaces. Both actors bring and manifest their social worlds and values in practical encounters. In these encounters, actors' strategies to accommodate synergize with or struggle against each other will be unveiled. Detailed description of events where ALTERRE and farmers meet will help to understand these strategies better. The description will be based on the discussed content as well as the actual form of the events. For one part the form will be the composition of participants, unwinding of meeting and ways of communication. The other part will be the analysis of the content. In this part questions concerning who brings forward certain topics and how the comments are taken into consideration will be discussed. The analysis of the encounters will provide explanations for the different strategies of farmers and ALTERRE, by contextualizing it in the different social worlds, interests and expectations from each other. Key questions will help in the operationalization of the information in an attempt to analyze the social interfaces. The analysis of these detailed descriptions will provide insights which can contribute to more effective socio-technical co-production between actors in the ALTERRE project.

Key questions are:

- Who is facilitating the event?
- Who is participating?

- How does participation manifest itself in the events?
- What kind of information was exchanged?
- Whose knowledge and experiences were brought to bear?
- What were those knowledge and experiences?
- How are farmers' and ALTERRE's concerns, interest and knowledge negotiated?
- With which techniques and tactics is the objective of the event realized?

Additionally, perceptions of different positions will be taken into consideration. Chapter four mapped out special positions of farmers and extension officers, which are a result of the research character of ALTERRE. In ALTERRE's view farmers have a double role; they are beneficiary and investigator at the same time which not all farmers are aware of. Important questions for the analysis of social interfaces to tackle the special position of farmers are:

- Are farmers' positions discernable in the content of the meetings?
- Are farmers aware of their role?
- Are farmers taking on both roles or is one role stronger than the other?

The extension officer has multiply roles; he is facilitator, enumerator and technical advisor at the same time. Important questions for the analysis of social interfaces here are:

- Is the extension officer's position discernable in the content of the meeting?
- Does one role outweigh the other?
- Does that have an influence on the position of farmers?

During this research, which was in the time of preparing for the new planting season, several meetings between ALTERRE and farmers took place. The following description of the events are taken from observations of three village meetings, one meeting between producer representatives and ALTERRE's employees and four nursery workshops. There are other events where ALTERRE and farmers meet, but due to the scope of this study only these three events could be observed.

4.2 Project-farmer interfaces

4.2.1 Meetings with producer representatives

4.2.1.1 Description

Objective

Prior to the village meetings, the extension officer and the technical assistant on the production side (here short "agronomist") organized a meeting with the representatives of each village. The representatives were elected in each village to represent the producers. The objective of the meeting was:

- Discussing the feasibility of plants which needed to be transplanted, necessary surface and number of new producers in order to achieve the set cultivation objective,
- Clarifying different roles of representatives and extension officers,
- Preparation and organization of the village meetings.

A detailed description of the outcome of the plantings season 2009 and the way to proceed in 2010 was not planned to be part of the meeting and was reserved for the village meetings (ALTERRE_ "Rapport mission production", 2010).

Agenda

The agenda points for the meeting with the representatives were:

- Presentation of project development
- Role of representatives and extension officers
- Planting techniques
- Organization of village meetings
- Meal

Date, Place and Participants

The meeting was held in the Commune of Yorosso the 25.03.2010 and took place in the city Yorosso in the partner NGO AMEDD's meeting room. All five extension officers, the agronomist and from the eleven project villages ten representatives were present. With two representatives for the city Yorosso, two representatives were absent. Except for me and my translator, all participants were men. The extension officer in charge of the Commune of Yorosso was facilitating the meeting in the local language and with the help of a PowerPoint presentation in French. One extension officer translated the meeting to the agronomist as he could not speak the local language. The agronomist and an extension officer took notes.

The room was arranged in such a way that the representatives were seated in several rows of chairs. Members of ALTERRE were seated on a desk in the left corner in front of the rows of chairs. While going through the slides, the extension officer was either standing in front of the audience or was seated next to the table. Due to the delay of the agronomist, who had the laptop and beamer necessary for the presentation, the meeting started one hour later.

Picture 3: Meeting with producer representatives



Presentation of project development

After welcoming the representatives, the extension officer presented the project development. For this end, he showed slides with tables with numbers of producers and plants for each of the three intervention zones. Next he showed a graph displaying the rate of survived plants for each village in the Commune of Yorosso. In half of the villages the success rate was less than 50 per cent. The extension officer asked if anyone could give their opinion concerning the reasons for the low rate. After some

minutes without any comments from the audience, the extension officer asked each representative directly. The discussion identified following factors:

- Termite attacks
- Way of planting the plants (hedges or fields)
- Quality of land
- Delay in planting.

Furthermore, some representatives suggested that this might also be due to the fact that each producer did his own nursery. The challenges of individual nurseries are, in their opinion, that farmers are not following the instruction and change planting methods. They, therefore, suggested having one nursery per village with the representative in charge of it. The extension officer responded that the project and producers already decided to have collective nurseries in each village. One person will be in charge of the nurseries, which will be commonly agreed upon. Low survival rates of the newly planted seedlings are highly depending on the diameter of the stem, explained the agronomist. To visualize the size of a diameter, he showed a graph displaying the diameter of the stem plotted against the survival rate of the seedling. The extension officer translated the graph by using a big text marker to show how big the stem approximately must be. As the agronomist could not speak the local language, the extension officers had to translate and retranslate the agronomist suggestion during the discussion. This created many smaller pauses which had the effect that some representatives were closing their eyes or were losing their concentration.

Role of representatives and extension officers

After discussing reasons for low success rates in the villages, the extension officer asked each of the representatives personally what they think their role is. The mentioned points were assisting the extension officer if he needs their help; counting plants and telling people about information of meetings. Some of the representative included giving advices to farmers. After the small feedback round, the agronomist explained in French what the role of the representative is in ALTERRE's view. The extension officer translated that representatives' roles are not to give advices to farmers but to mobilize them. Furthermore, they are responsible to control if the counted number of plants is correct and transmit the numbers to the project. The counting of plants is important for the project in order to keep track of the development of the project as well as to know how many plants are still needed in order to achieve the calculated amount of oil. After this remark, representatives started to discuss with each other and gave their opinion to the project staff. One representative stated that they encounter problems with controlling the exact numbers is that farmers found out that, representatives receive compensation money from ALTERRE for their work. Normally, the producers should count their plants themselves and then report the number of plants to the representative. He then recounts them in the field and transmits the correct number to the project. In order to compensate the lost working time of the representatives, the project grants 1000 CFA per working day. This equals a low daily wage in the rural areas. After the producers found out that the representative receives money for their work, they refused to count their plants as they do not get money. According to the agronomist, the money the representative received last year did however not exceed 6000 CFA. The project team wrote down this remark and moved then on by showing a slide with a table which compared the role of the extension officer with the one of the representatives. The table was in French and had no headings which indicated which part of the table

represented the role of the representatives. The extension officer translated the slide in the local language and went through each point. The highlighted role of the representative, as displayed in the slide was:

- Being a contact person for producers who would like to communicate with the project,
- Being a contact person for extension officer.

Discussion about planting techniques

After a 15 minutes break the meeting continued by discussing different planting techniques. To this end, the extension officer showed different slides with pictures of the last planting season. The techniques discussed were:

- Intercropping
- Fertilization
- Maintenance
- Nurseries

These were points, which the extension officer planned to discuss together with the producer in the village meetings. The agronomist explained later, that the aim was to show the representatives what will be discussed in the village meetings. In that way they could assist the extension officer in the meeting.

Organization of village meetings

Last agenda point was the organization of the village meetings. For this each representative could chose a date and time and confirm the date by giving his signature. The extension officer asked them to communicate the date and time to the producers.

Meal

The meeting ended with a free meal and sodas. The meal was shared among all participants. The project staff mixed with groups of representatives. After the meeting the representatives received compensation money (1000 CFA) for the travel cost and as compensation to their lost working time.

4.2.1.2 Analysis

Next to organizing village meetings between farmers and extension offices, this meeting aimed at clarifying the representatives' role. Throughout the discussion it became clear that representatives and ALTERRE have different perceptions about the representative's task. The project decided to let the producers elect one representative to have a contact person in the villages which can help organize and transmit information. Most representatives were elected as they were capable of a bit of reading and writing, or because they had special political positions in the villages. ALTERRE does not intend to transfer the task of giving technical advices to the representative, because they fear that this might lead to distant farmers from extension officer and the quality of transmitted advices are hard to monitor. In the meeting, the project staff told the representative that their task is to make sure the counted number of plants is correct, motivating farmers to participant and to be a contact person for farmers and the project. The representatives seemed to see their role differently. As elected representative and by receiving a small amount of money for their work effort, they see themselves in a position to advice farmers. The role of representatives were previous to the meeting fixed by the project, thus the discussion let only little room to take representatives opinion on their role. Contradictory to the aim to clarify,

representatives' roles and to make sure that they are not advising farmers, ALTERRE gave the representatives a formation on planting techniques prior to giving it to the farmers in the village meetings. Although the roles were clearly stated, ALTERRE's formation created a situation where farmers have a knowledge advantage over farmers and thus would be in a position to advice farmers. In this case ALTERRE's discourse and their actions did not match. This can have a negative effect on project efficacy as the ALTERRE needs again to clarify representatives' position.

It was interesting to observe that throughout the meeting, the representatives were more or less passive listener to what the extension officer told them until the moment the discussion about their role came up. Representatives seem to perceive their status has higher than those of farmers. On other occasions, when going to the villages to conduct interviews with farmers, it was first the village chief we had to visit but directly afterwards the representative. Most of the time he welcomed us with a booklet and pen in his hand or showing us different list which displayed how many farmers plant how many plants. In this way he differentiated himself from other farmers. The project gives him thus a special status in the village. This could partly explain why they were so eager to defend their position.

Although the present project staff listened and took note, they held on to their agenda and left little room for possible ways to transfer more responsibility to representatives. The analysis of ALTERRE's social world in Chapter 4 revealed that ALTERRE's institutional setting is complex and hereby associated decision process involves several partners and needs validation from different bodies. In a discussion with project staff from IRAM, ALTERRE's agronomist and extension officers it was decided upon to clarifying the representatives' positions. The extension officer's task was to communicate this to the representative in the meeting, discussing changes was not a destined possibility. Within ALTERRE's context, single project members, such as the extension officer, have only little room for maneuver to change already decided position and thus cannot take decisions such as taking representatives opinions into consideration. As a result, it is ALTERRE which has the final decision power in discussion such as the role of representatives. Thus practically, the representative respectively the farmers are consulted but ALTERRE decides what it will do with the information.

The position of the participants in the room resembled a school situation, with the teacher in the front and the scholars in rows in front of him. This positioning tends to split the participants into two groups: one which is giving information and the other which is receiving information.

There were several instances with language barriers. Although some farmers speak a little bit of French, for most of them the power point presentation in French was not very helpful, also due to the lack of reading skills. Another language problem, although in sense of being scientific, was when the agronomist used the graph plotting the different diameter of seedlings against the survival rate of the plants in order to show how big the diameter should be for transplanted seedling. With only marginal mathematical skills, this graph was rather confusing for the representatives. The extension officer used a simple text marker to display the diameter. For the project members (apart from maybe the extension officers) the use of a statistical graph seems to be appropriate to explain certain aspect, in contrast with people from the village

which will most likely not understand the graph. The fact, that ALTERRE plotted the diameter against the survival rate, shows their scientific approach. In practice, this approach can lead to misunderstandings between farmers and ALTERRE. The extension officer has hereby an important role, as he is the one who buffers these different understandings by translating it in such a way that representatives can understand it in a practical way.

4.2.2 Village meeting

4.2.2.1 Description

Prior to the start of the planting season 2010, the project organized village meetings in each of the eleven project villages. During this research, I took part in three village meetings. All of the meetings had more or less the same sequence. Here only a description about one of these meetings is given. This particular village seems most interesting to learn more about actors' interaction as due to the amount of participants various topics were discussed.

Objective

The overall objective of the village meeting was to provide an exchange platform to exchange experience with jatropha amongst farmers and between farmers and ALTERRE. The village meeting aimed at recapitulating the last planting season and to plan the new planting season. The experience the project and farmers gained in the last planting season were meant to be discussed and integrated in the planning of the new season. In order to provide an overview of the general development of the project, the project aimed at informing the producers about the state of the project in each of the three zones and the development of the project within their zone in the different villages.

Agenda

Agenda points of all the village meetings were:

- Presentation of project development
- Discussion of last planting season
- Subsidy system
- Role of representative in comparison with role of extension officer
- Discussion of new planting season
- Formation of nursery groups
- Tribute to best producer
- Free meal

Date, Place and participants

The meeting took place in Nampenna on the 16.04.2010. Nampenna is one of the biggest project villages in the Commune of Yorosso with 54 producers. The meeting was scheduled for 9 o'clock at an open area which is used for village meetings. When arriving at the meeting point with the extension officer's motorcycle, only a few participants were present. One producer said that they were expecting the extension officer to arrive with a four wheel and as they have not seen any they thought he did not arrive yet. After organizing tea and women to prepare food for the participants, the meeting started around 11 o'clock. The extension officer was facilitating the meeting and an ALTERRE intern took notes. Almost all producers were present as

well as the village chief and his advisors. The translator and I were the only women participating in the meeting. The participants were seated in a big circle, due to the big number of participants some producers were sitting in the second row of the circle.

Picture 4: Village meeting Nampenna



After the welcoming words of the extension officer and the village chief, the extension officer explained the agenda of the day. Just as in the meeting with the representative, the extension officer was reading out the different number of plants in each of the project villages. After showing a slide with mortality rates for each of the project villages, the extension officer asked the producers for their opinion for the high mortality rate of the plants. The discussion revealed that farmers thought that following factors were responsible for high mortality rates:

- Low maintenance
- Way of planting
- Quality of land
- Date of transplantation
- Termites
- Drought

When producer mentioned that low maintenance was one reason for the high mortality rate, the extension officer noted that farming *jatropha* is a lot easier than farming food crops such as millet. For *jatropha*, farmers don't need any chemical fertilizer, and for food crops weeding is needed two or three times were as for *jatropha* only one or two times. Organic fertilizer is however important for *jatropha*. The extension officer said that even if farmers have not enough organic fertilizer they should try to collect some organic material such as leaves to put it around the plants or in the holes when planting *jatropha*. With the help of pictures which were passed around, different planting techniques were discussed. For each technique two, pictures were presented. For weeding, for instance, one picture showed a weeded field and one picture showed a field where weeds were already overgrowing *jatropha* so that it was hard to make out *jatropha*. The extension officer asked before passing around each picture, what the farmers thought about the pictures. One picture was about pruning *jatropha* plants. One farmer mentioned, that he never pruned his plants but that cows were damaging the young *jatropha* plants on his field so that branches broke off. After a year he now could see that this particular *jatropha* plant developed more branches than the others on his field. The extension officer took this example to explain why pruning is important for plant development.

At one point in the meeting, one producer asked if the project would also take seeds from farmers who were not registered with ALTERRE. The extension officer responded that the project was calculated prior to the start of the project how many plants they would need in order to produce enough oil for Yeleen Kura and the small machineries in the villages. Out of this calculation, ALTERRE decided how many hectares of jatropha they would need. If one farmer now wanted to grow jatropha without ALTERRE then they could not stop him from doing so but also could not ensure him that they will buy his seeds. To the meeting, one farmer brought a small bottle with jatropha oil and a sample of press cake. This was given to him from the project at a demonstration day earlier in the year. On this demonstration day, ALTERRE demonstrated in the village Yorosso how oil is extracted from jatropha seed. From each project village, the representative and two other producers could join the day. Most of the farmers saw jatropha oil and press cake for the first time in the village meeting. One producer said, after seeing the oil with his own eyes he could really believe that oil making from jatropha seed is really possible. One produce who was also present at the demonstration day, said that all of them should put a lot of effort in producing jatropha seeds as diesel, which is bought from outside is expensive in the villages and servers other peoples' interest. Jatropha oil, which is produced locally, however will be cheaper and local seed producer will benefit from the production.

Picture 5:Jatropha oil



After this discussion, the extension officer went to the middle of the circle and said that he is worried, as ALTERRE asked the financier of the project for money for machineries. But the machineries will only be profitable if the producers can produce enough seeds to press oil. After seeing the high mortality rate of the plant he is now wondering if the producers will produce enough. If that is not the case, then the extension officer personally would feel like a liar as he said the producers are able to produce enough seeds.

One farmer was worried about the poison in the seed. He was wondering that if one seed is already poisonous what would happen if women would accidentally use the oil for cooking. To make sure that women don't confuse it with cooking oil, he was

asking the extension officer to make sure to indicate clearly on the bottle that the oil is poisonous. The extension officer remarked that on the oil bottle was already a sign that indicates that the oil is poisonous. Another farmer asked hereupon if it would not be dangerous to fuel mills with jatropha oil. In case the miller would accidentally drop a bit of the oil in the flour or in case he did not wash his hands after handling the oil, would that not cause people to get seriously ill? Another producer answered that jatropha will be used in the same manner as diesel and not as motor oil; therefore it cannot drop in the flour. Other producer responded that they still would prefer if the project would look for non-poisonous jatropha varieties. Hereupon the extension officer answered that scientists are already working on finding a non-poisonous variety but that he does not know when this will be available. One producer asked the extension officer if he would have the right to sell his seeds to another project. The extension officer explained that the project is planning on establishing a farmers' association in each village which is responsible for jatropha production. As soon as this association is in place, the project plans that every producer signs a contract which would oblige him to sell his oil to the project.

Another producer declared that he thinks the price farmers get for their seeds are too low. The representative stood up to speak and told a little story from a CMDT project to secure food safety, in order to justify the low price. In this project, the CMDT said that they would buy a part of farmers' harvest for a low price. During the rainy season, when farmers are running out of food they would be able to buy food from the CMDT for a low price. However, the farmers decided not to sell their food for a low price to the CMDT and sold it to a higher price on the market. In the rainy season, when farmers did not have enough food they asked the CMDT to give sell them food to a low price. Hereupon the CMDT responded that they couldn't do that as farmers did not sell them their food. In the next years, the farmers then sold their food to a lower price to the CMDT. The representative highlighted the fact the ALTERRE calculated a kilo seed price of 50 CFA and that they should keep this story in mind if they think it would be too little.

After this discussion the village women arrived with food which was shared between all the participants. After the food, the best producer of the year was honored. This producer was chosen by the extension officer and the representatives. Criteria for best performance were participation in meetings and visits, maintenance of the plants and general performance of the plants. The handing over of the radio was done in a small ceremony; the unpacked radio was handed over from the extension officer to the representative. He unpacked the radio gave a small speech, congratulating the farmer. He then handed it over to the village chief and after he gave a small speech, he handed it over to the producer.

After the short ceremony, nursery groups were formed. For this end farmers grouped themselves and elected one person responsible for the nursery. The formation of groups was depending on factors such as distance to each other. Each producer of a group had to sign a list. In that way the extension officer had an overview about which producer belonged to which group. Furthermore, the extension officer expected that by signing with their name, the producers would feel more obliged to stick with their group. This process was quite time consuming as the formation of some groups took some time. The meeting ended after five hours. The extension officer thanked for the

producers presence and participations. The closing word had the village chief, who thanked the extension officer for his effort.

4.2.2.2 Analysis

In order to transmit the same information in each village, the extension officer and the agronomist planned the meeting in advanced and decided upon a fixed agenda and more or less on the content. The ability to take possible suggestion for changes in this agenda from the participants into consideration was limited. Depending on the agenda point, the farmers were either listening or actively taking part by providing their opinion, concerns or observations. For instant in the first part of the meeting, when presenting the development of the project, the farmers were listener. In the discussion about the last planting season and the low survival rate of the transplanted plant, the extension officer had to motivate the farmers to provide reasons. As the discussion revealed, reasons for the low success rate are the low effort farmers put in cultivating jatropha. Since this puts a poor image on the farmers, they might have been reluctant to admit this. The extension officer did not ask questions about reasons behind farmers' low effort, but reminded them that jatropha is even easier to farm as food crops. In another instant, the extension officer took farmers' practical observation (positive effect of broken off branches on plant development) serious and took it as an example to show how important pruning is. For all the discussed techniques farmers gave their opinions, but it was the extension officer who summed them up and said in the end which technique is desirable. In that sense, although the extension officer acknowledged farmers observations, it was the extension officer who decided according to from the project pre-designed set of techniques, which once farmers should use.

Throughout the meeting farmers expressed several concerns about jatropha. The fact that jatropha oil is poisonous was a big issue. Some farmers saw the oil for the first time in the meeting. This was when they recognized, that the oil looks very similar to other cooking oil. Farmers realized that the chance to confuse it with cooking oil is great and some farmers expressed their concern. The extension officer listened to these concerns and the intern took notes, but he played the concern down by saying that on the bottle is already a small sign stating this. The reason for playing down this concern is that he knew that ALTERRE's vision is to sell the oil to small service stations as diesel substitute in the villages and not to private persons, as they don't have any use for the oil. So contrary to some farmers believe, the oil will not be in their homes, and therefore women can't confound it with cooking oil. The same holds true with the fear that the drops of oil could poison maize flour. Jatropha oil will be used the same way as diesel and thus the possibility that the oil spills in the flour is as low as for diesel. This suggests that some farmers do not understand ALTERRE's vision to use the oil as diesel substitute.

The fact that a lot of farmers saw the actual jatropha oil for the first time, after already cultivating jatropha for two years, shows the knowledge gap between ALTERRE and producers. Without knowing how the end product will look like or even that it is possible in the first place to produce oil from the seeds, farmers might be reluctant to put much effort in cultivating jatropha. The in-depth-interview with farmers confirmed this suggestion, as the farmers which attended the demonstration day put more effort into cultivating their plants. ALTERRE's knowledge that it is possible to press jatropha seeds and use it in diesel engines, provide them a knowledge advantage

which results that farmers and ALTERRE are not on the same knowledge level on crucial points as the project intends to. In such a situation farmers' role as investigator is in danger. Without real understanding of the end product, farmers will not understand what is important in the production of the raw material.

To motivate farmers to perform better, the extension officer highlighted the fact, that it was his and ALTERRE's faith in their performance which made it possible to receive funding from external organizations. Low performance on their side would fall back on him. In that sense he reminded the producers on their commitment towards the project.

The representative's initiative to explain ALTERRE's reason for paying a low seed price in the eyes of the farmers shows the representative's commitment to the project. When he was telling the story about the CMDT project, the participants were quiet and attentively listening. The extension officer gave the representative room to elaborate on this issue. The representative's broader understanding of the project, due to his position as a representative and thus is ability to take part in a lot of ALTERRE activities, and the fact that he himself is also a jatropha producer; had the positive effect that farmers were listen. With his position as producer himself, the explanation he made seemed trustworthy in the eye of the farmers. He was suggesting to the farmer to see the wider benefits of jatropha in stead of only the seed sell. His example also recommended that the farmers should trust advises and decision of the project; such as the village from the CMDT story trusted the CMDT in the end. This example suggests, on one side that providing more information to the producers about the entire value chain could help to increase their understanding and thus could have a positive influence on their performance. On the other side, that ALTERRE could use the representative's position stronger to motivate farmers.

The ceremonial tribute to the best producer of the last planting season was one highlight in the meeting. The ceremony included the local code of conduct by including the village chief in the tribute. In the three observed village meetings, the best producer was very proud. ALTERRE communicates its activities often through the local radio, so the radio as a gift is beneficial for the farmer and the project. The free meal was a motivating factor for farmers. The fact that it was shared together with the project staff created a positive group dynamic and gave room to exchange jokes and story which loosed up the atmosphere.

4.2.3 Nursery workshop

4.2.3.1 Description

In the planting season 2010, ALTERRE introduced collective nurseries in the villages. In the previous planting seasons, producers got their seedlings from (semi-) professional nurseries or propagated their own seedlings. As the survival rate of seedlings were low in previous planting seasons, the project and the farmers decided together in a earlier meeting to do collective nurseries. These kinds of nurseries have the advantage that monitoring the quality of the seedlings through the extension officer is easier. During this research, four workshops could be analyzed through participant observation. The following description summarizes these four.

Objective

The extension officer together with the agronomist organized the workshops with the aim to transfer knowledge on seed propagation in nurseries. Furthermore, seeds and fertilizer were distributed.

Agenda

- Theoretical formation
- Practical formation
- Seed and fertilizer distributions

Date, Place and participants

The workshop took place in each of the villages in the last week of April 2010. As location the extension officer chose either a free place in the village (school court) or in a field of a producer. Participants of the workshop were the elected responsible persons for the nursery, interested farmers and the extension officer with an ALTERRE intern. The representatives informed the producer about the meeting. My translator and I were the only women present at the meeting.

Theoretical formation

The workshop started with a short theoretical formation, given by the extension officer. He distributed fact sheets in the local language and in French. The fact sheet explained each step for preparing a nursery (preparing of seed bed with fertilizer, planting distance, weeding, watering and transplantation). Depending on the number of producers and the number of plants calculated for replacing dead plants from the last season, about 3-5 nurseries groups were formed in each village. The extension officer explained that the best time for starting a nursery would be the beginning of May. In that way the seedlings can be transplanted in June with the start of the rainy season. During the theoretical formation, the participants were seated in a circle. The extension officer explained each of the steps described on the fact sheet and answered farmers' questions.

Practical formation

After the theoretical formation, the extension officer demonstrated on a small scale how to prepare a nursery. To this end, he invited the producer to help him. Two participants were helping measuring the distance between the plants, some were helping mixing the sand and the fertilizer and the others watering. The necessary steps for a nursery are:

- Measure the correct size and preparation of the seed bed with a mixture between sand, Sabunyuman and other organic fertilizer;
- Marking of the planting distance between the seeds;
- Planting of three seeds per hole;
- Right watering of the seedlings;
- Weeding of the plants;
- Transplanting of small seedlings in case more than one seed grow out of one hole;
- Correct way of transplanting of the seeds.

Picture 6: Nursery workshop



Watering of the small *jatropha* seedlings in the first weeks is crucial for their development, explained the extension officer. For that reason he highlighted the importance to install the nursery next to a water source. With a watering can the plants should be carefully watered. Producers remarked that most of them do not have a watering can and asked the extension officer if he could provide one for them. The extension officer told them that he was not able to provide them with a free one, but that he could offer to buy one now and take the money from their subsidy. However, one farmer remarked that the money they will receive from ALTERRE for installing the nursery is just enough to cover the incurred expenses. In his case he needs to buy organic fertilizer as he does not have enough. The extension officer responded that the subsidy for the nurseries should not be seen as a payment for installing the nursery but rather as a sign of encouragement from the project side. The producers furthermore remarked that the seeds provided by the project are of poor quality. As no *jatropha* planting material is offered on the market, the project has to work with seeds available from old *jatropha* plants and thus recommended the producers to plant two or three seeds per planting hole.

In one workshop, a producer asked what “*pépinière*” (French word for nursery) actually meant. The extension officer used this word already in the village meeting. As there is no direct translation into the local language, the extension officer used a definition to elaborate. In the end of the session, one farmer asked what would happen, if the seedlings in his nursery would develop not well and people would refuse to take their seedlings from him because of bad quality. Would the project handle this case? And if yes how would they handle this case? Thereupon the extension officer explained that as all the producers agreed to be in his group, they would simply be obliged to take their amount of seedlings from him. Furthermore, they all signed a list stating to which nursery they belong, so it would be easy to proof that they belong to a certain group.

Distribution of seeds and fertilizer

Prior to the workshop the extension officer distributed an organic fertilizer called Sabunyuman in 50 kg sacks to each village. Fabricated in Mali on the basis of natural phosphate and organic material, it is a fertilizer with a high percentage of humus and a high amount of micro flora and thus suits well to fertilize the young *jatropha* seedlings in the nursery. The fertilizer was distributed freely to the farmers; however the distribution of the 50 kg sacks was logistically difficult. Each village needed between 15-20 sacks, but with the bad road conditions of some of the villages it was not

possible to enter in all villages with a track. Some of the sacks had thus to be transported to the village via the project car or donkey cart. After the formation, the extension officer calculated the amount of fertilizer and seeds for each person in charge of the nursery. The amount depended on the number of plants the nursery group. The calculation was done with a help of a calculator and the amount weighted with a scale. Prior to the workshop, the agronomist calculated the amount of fertilizer (Sabunyuman) needed for each plant. The extension officer calculated the exact amount of fertilizer each nursery needs by taking into account the number of seedlings. The calculation was done with the help of the calculator, which took some time. The meeting ended with the closing words of the extension officer.

4.2.3.2 Analysis

The meeting was planned and facilitated by the extension officer. Invited participants were producers in charge of the nursery; however in each village a couple of interested farmers were present. This shows that farmers in the project regions seemed to be interested in practical formations. In the practical formation, all participants were somehow included. Although the extension officer was teaching the producers techniques, the workshop was interactive and not reminding of a school situation. The information exchange was very simple and practical. Some producers who had experience with nurseries could bring in their knowledge. Farmers' interest in practical formation originates from the general lack of educational opportunities in the research area. Before the cotton crisis, according to farmers, the CMDT was giving formations about planting techniques. Thus, farmers also know what to expect from such workshops and are interested in participating.

The lack of working material in the region was visible in the meeting. As the extension officer highlighted the fact that the plants should be carefully watered with a watering can, farmers remarked that they did not have any. Watering cans are not found on the small markets in the villages or in the nearby bigger city Yorosso. The head office of ALTERRE is in Koutiala where watering cans are easily found. Farmers' suggestion if it would be possible that the project provide them with a free watering can, could hint that farmers want to take advantage of getting access to free working material. ALTERRE however, did not calculate watering cans in their budget and thus did not anticipate to spent money on that. The extension officer solved the problem by agreeing on a compromise: he will buy and transport them to the farmers and discount the price from the subsidy they receive for the nursery. In this way the extension officer found a solution suitable for both parties.

In frame of the discussion about the watering cans, one farmer remarked that the subsidies are low and will just barely cover their cost. In his case he needs to buy some organic fertilizer as he will not have enough for the nurseries. The extension officer's explanation that the subsidy should not be seen as a payment but rather as an encouragement, seemed not to be understood by the farmers. Here, the risk that the farmer decides to not use organic fertilizer in order to save money is big. Also the extension officer's remark that farmers are obliged to take their seedlings from their nursery group, even if they are not well developed, can risk that the responsible person will not put enough effort in the nursery. The extension officer furthermore said that if one nursery group would produce more seedlings as needed in the group, these seedlings would be used for groups with not enough seedlings. All this suggest that the project will take care of the nursery in case something goes wrong. The

person in charge of the nursery takes thus only little responsibility as he is ensured the project will back him up. Unfortunately my research period was over just shortly after the workshops, so it was not possible to see if this verified.

4.3 Conclusion

As an action research project, the events aim at creating space for a collective learning process. The course of these events followed however a pre-set agenda which was decided upon by the CoCoop and the technical assistant from the production side together with the extension officers. This agenda is necessary for several reasons. Firstly because it informs the entire project which is not taking part what is discussed and if this goes in line with the overall strategic plan. Secondly, it ensures that all the villages receive the same information. Thus, the necessity to plan the course of events before hand has the drawback that it provides little space for participants to steer the event to meet their interests and need.

The analysis of the village meeting finds that the overall vision, thus the entire value chain, is not entirely understood by farmers. A knowledge gap exists between ALTERRE and farmers on topics, such as exact utilization of the oil. In a collective learning process, the basic understanding of the underlying steps of such a supply chain can help to prevent misunderstandings between the involved parties.

In all three cases of the interface analysis, the extension officer was the connecting link between ALTERRE's strategic vision of the project and farmers. In this position, he is translator and communicator between the two social worlds. The room for maneuver for extension officers in such a project is limited, as he needs to primarily follow the set courses of events agreed upon with project owners. However, without this room for maneuver farmers suggestions and concerns cannot be fully met.

The description of the village meeting showed that producer representatives can be very useful to negotiate between project initiators and beneficiaries. As producer himself, a representative understands the social world of beneficiaries and thus is in a better position to explain the position of the project initiators.

The practical formation given in the nursery workshop was positively received by farmers. Due to their past experiences with other extension programs they seem to know about the benefits of such a formation (for example access to free fertilizer and knowledge). The extension officer included the farmers in the different steps of the formation and during this process knowledge was automatically exchanged. Practical formation thus seems to be a useful to in stimulating the co-production of knowledge in such projects.

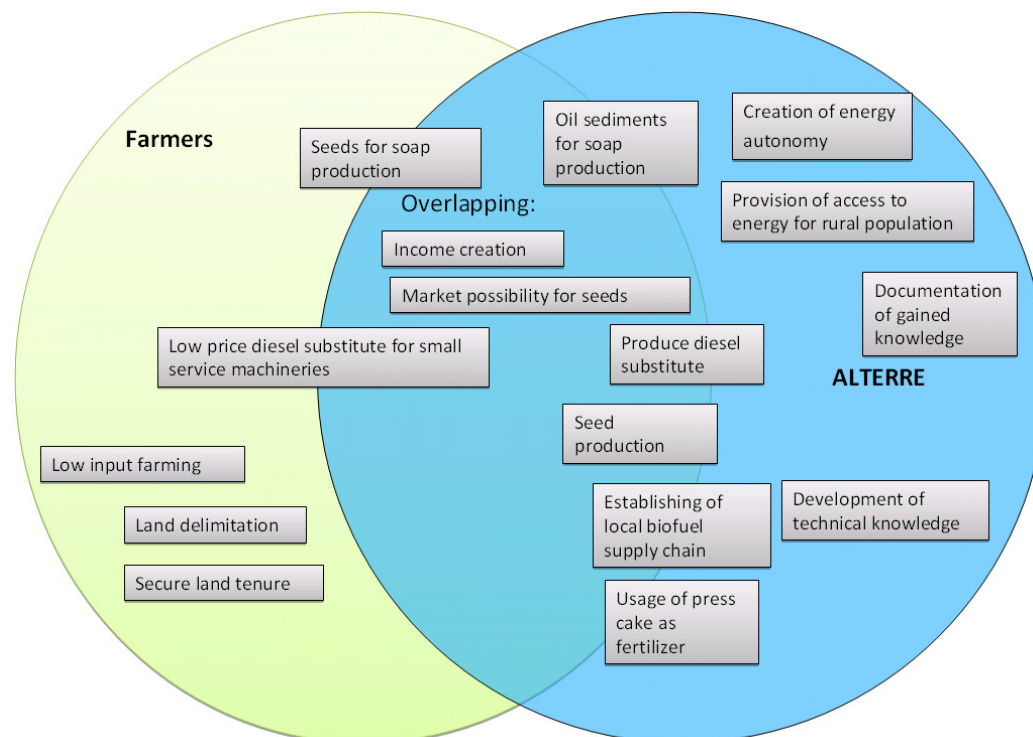
The conclusion drawn from this observation and translated to a more general basis would be, that any project with a strong external influence on decisions, has to be aware that locally produced knowhow can be easily lost and beneficiaries interests cannot be fully met through poor feedback possibilities from the bottom of the hierarchy

5 Discussion and Conclusion

This thesis set out to contribute to a better understanding of problems encountered in a project of jatropha cultivation and to provide a deeper understanding of the diverse set of interests and practices involved in an establishment of a jatropha supply chain. The technographic approach helped to focus the attention to the interaction between technology and its user as well as the users which interact around the technology. The studied case showed that different forms of technologies, in this case jatropha cultivation, co-exist in a small region such as the Commune of Yorosso. The variation in the technology also implies a variation in its users. The exploration of rationales behind these variations and its effect on the interaction of actors within a project was a major driver in this thesis.

McFeat's task group concept was used to describe the project itself and how this group collectively perform the task. In the conceptual framework the task was defined as the establishing of a local biofuel supply chain. Due to the early stage of the project, only part of the entire task, the establishment of jatropha production could be analysed. The task group consists of farmers and ALTERRE. On the basis of Longs' "life-worlds", the concept social world was used to explore the different contexts which shape how actors approach a technology. The analysis revealed that although all the actors involved have the same overall aim, establishing a jatropha cultivation, different interests prevail, some of them divergent others overlapping. Part of the research objective was to display these interests in order to contribute to a better understanding of encountered problems. Figure 13 depicts farmers' and ALTERRE's interest described in Section 2.2 and 3.6.

Figure 13: Overlapping and divergent interests



In the figure the two circles display the social worlds of the actors with their various interests. In an ideal project those interests relevant to the project would overlap and thus making the individual interest a driving force of the project. In reality, however, this is not the case in most projects. Depending on the degree to which divergent interests conflict with each other, the project's efficacy might be affected.

Speaking in McFeat's terms, the group's task is income generation through the marketing of jatropha seed which is the common goal for all actors. This is in contrast to what was originally assumed in the conceptual framework, where the emphasis was more on establishment of a jatropha supply chain.

Exploring farmers' social world (left circle) helped to understand farmers various interests in jatropha. The analysis showed that their past experience with jatropha was based on various usages introduced by external organizations. The introduction of these usages always involved new ways of planting jatropha. Up to day, various usages of the plant co-exist in the area and with that also various planting forms (different forms of hedges, single plants, fields etc). ALTERRE (right circle) as a project promoting seed production for income generation, intervenes thus in an area with diverse ways of cultivating the crop. An evaluation and recognition of farmers' particular interest in the crop can help such a project to understand whether it can make use of the existing practices or how far they contradict with the previewed use.

The three divergent issues in farmers' interest circle (low input farming, land delimitation and secure land tenure) do not necessarily threaten to disturb the successful execution of the task. However, these three lying outside the overlapping area provide rationales why farmers might choose not to perform the task as previewed by ALTERRE. In cases where established practices of cultivation have a negative influence on seed yields a negative impact on the overall outcome of the project can result. Thus, any project intending to introduce new usages of a crop in an area where farmers have already experiences, a defined effort has to be made to consider, evaluate and integrate a great variety of already existing practices into the activities of the project.

The exploration of farmers' social world furthermore showed that the way farmers interact with external intervention projects is influenced by their past experience with external organizations. Section 2.2 showed that farmers had bad experience with another cash crop (cotton) and its promoting organization (CMDT). Through the dependency on external organizations (and world market in the case of cotton) farmers had no control of the benefit of their efforts. Out of fear to be faced with a similar situation, some farmers are reluctant to offer their full available potential to the project or to let alone to start with jatropha cultivation. Projects intervening in such a situation should be aware of this reluctance and define measures to mitigate the same.

Two divergent interests shown in the right circle of ALTERRE are the development of technical knowledge and the documentation of this knowledge gained. These are not necessarily hindering the execution of the common task. However, ALTERRE wants to create technical knowledge in co-production with farmers. As these interests are outside the overlapping area, ALTERRE is required to make an extra effort in order to motivate farmers to participate in this co-production. Thus, the analysis of

interests lying outside the overlapping area and their impact on project success helps to identify interference points which have the potential to hinder the successful execution of a project.

The analysis of the social world of the project focused on its institutional setting. As a project with various donors and partners in Europe and Africa, the project needs to work according to a clear structure in order to satisfy the interests of the connected partners. Although this structure assures straight forward objectives, it risks losing the flexibility to adapt project strategies to the needs of beneficiaries. The strategic layout of the project's hierarchical order gives a strong emphasis to those at a higher positions and thus the decision making process is very likely to be rather a top-down approach than a program shaped by the interests of the beneficiaries. In the interface analysis the consequences of this hierarchical structure is best visible on the role of the extension officer. He finds himself in a "broker position", and as such he is placed in the changeling position "of having to marry, and/or mediate between, different interests" (Leeuwis, 2006). On one hand he needs to work according to the criteria of those funding the activity and on the other hand, he has to work and maintain credibility with the beneficiaries which have different interests. Hilhorst (2000) describes this situation as "juggling with discourses". In the interface events, the extension officer has to work according to a pre-fixed agenda agreed upon primarily in the CoCoop meeting. Thus, the information flow in the meetings is rather unidirectional from the extension officer to the farmers as described in Biggs' central model:

In this model farmers are passive recipients of information or technology. The model implies a hierarchical system of research and extension, where the communication and information flow is linear and unidirectional (Bigg, 1990).

Thus, the extension officers' room for manoeuvre in such a project is limited and farmers' suggestions and concerns cannot be fully considered. With such an institutional configuration (depicting Bigg's central model) farmers' interests are difficult to integrate in the project's activities which can have the effect that this inadequate participation results in interests easily overlooked.

An unsatisfactory participation due to the institutional configuration of ALTERRE is a phenomena described by Quaghebeur et al. for a similar project in Vietnam.

This project aimed, in its social science component, at stimulating and studying processes of reflexive social learning and of participation and negotiation on local water management issues and on project activities. [It was shown] how specific project-related strategies and attempts towards facilitating participation fail and how other initiatives seem to succeed or at least to elicit valuable processes of negotiation and learning (Quaghebeur et al., 2004; p.1).

Thus it is crucial for the project's success to take participation of farmers more seriously or as Bellon puts it

Farmers' participation is more than talking to six farmers or putting ten experiments in their field. Participation is rather a systematic dialogue between farmers and scientist to solve problems (Bellon, 2000).

If action research shall be the objective, as mentioned in ALTERRE's documents, then it will be indispensable to work out a more stringent element of participation. The importance of participation in action research is highlighted in Reason's and Bradbury's (2001) definition of the same: "a participatory, democratic process... [which] seeks to bring together action and reflection, theory and practice, in participation with others [...]" .

Conclusion

The observations and research results mentioned above suggest that the ALTERRE project has an excellent potential improving Malian farmers' income situation. However, their interests located outside the "overlap" constitute potential areas of conflict. In order to convert their potentially negative forces into driving forces it will be necessary that the project's central model is transferred into a multiple source model where farmers are active innovators which lead to a multidirectional information and communication flow. To realise this shift the research results suggest the following areas of change:

- As the project intends to introduce new usages of a crop in an area where farmers have already experiences, a defined effort is suggested to consider, evaluate and integrate the already existing practices into the activities of the project.
- The project needs to increase its knowledge on the reasons of farmers' reluctance to start new ways of cultivation and implement concrete measures to mitigate the risks.
- The project should clearly define those interests lying outside the overlapping area and analyse their potential impact on project success and develop ways to bring them closer into the overlap area.
- The area with the largest room for improvement is seen in the opportunity to develop farmers' participation into a systematic dialogue between farmers and scientist to solve problems. This would require that the project's organisational structure is transformed from a vertical to a more horizontal model, giving more weight to opinion of the beneficiaries.

As ALTERRE is in the beginning of its project cycle and understands itself as learning organization, these suggestions might help to ameliorate the project's positive impact even more.

During my stay in Mali, I myself had to learn from African farmers' experience that:

"A boat gets nowhere, if everyone rows in his own way. "

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