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# **Adoption of Knowledge Related to Sustainable Forestry from a Gambian Perspective**



Author:

**Björn Gunnarsson**

Supervisor:

**Anna-Karin Bergman**

## **Abstract**

The paper examines the adoption and diffusion of sustainable forestry related technologies in the Gambia. Firewood collection and improved stoves are included in the study for the roles they play in deforestation. Innovation theory is used to explain the diffusion process of new technologies.

Two communities relying on the forest and two stove producer groups are investigated. It is found that the ease of the spread of information about locally adopted technologies is crucial. The important role of government departments is confirmed, if a participatory approach and sufficient follow-up are to be observed in the process. However, a certain level of mistrust towards the government is evident in the study.

Village groups are found to be inefficient. Interviews with informed members and NGO staff indicated a cultural norm of keeping knowledge to oneself without spreading it. An alternative approach of targeting dedicated individuals is recommended instead. The result of the study indicates that the adoption of sustainable forestry might not necessarily come with the adoption of improved stoves.

*Keywords: Adoption, innovation, forestry, improved stoves, The Gambia, Africa*

*“Knowledge is a secret you must pay for”*

*Maj Britt Mukonde, a quote which led to a breakthrough in the field work.*

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## Abbreviations

FD:	Forest Department
CDD:	Community Development Department
GGFP:	Gambian German Forestry Project
VDC:	Village development committee

## 1. Introduction

According to the UN Department of Economic and Social Affairs (United Nations, 2005), there is a need for increased energy services in developing countries, since they have positive impacts on poverty eradication and improve standards of living. The forest is a major source of energy in this region (Karekezi, 2007), which is why the diffusion of energy related technologies reducing deforestation is crucial. According to the UN's Convention on Climate Change, developing countries need the transfer and adoption of environmentally sound technologies (UNFCCC, 2002). However, there may be circumstances that prevent the adoption process, even if scholars argue that the poor economic conditions in developing countries should encourage innovations in new technologies (Lundvall, 2007). One question arising is whether poor people are able to carry the costs of risk-taking associated with new technologies. It might well be that poor households are incapable of taking advantage of opportunities offered by new technologies.

One major use of energy, contributing to deforestation, is traditional cooking. Consequently, variants of improved stoves have been considered to be environmentally sound technologies in many developing countries (Barnes et al, 1994). Therefore, it is relevant to conduct research concerning improved cooking methods and investigate how such methods can be spread. Obviously, there are factors preventing the adoption process. A World Bank report asks, for instance, why so few improved stoves have been disseminated despite considerable benefits. Estimates suggest a payback to society of only a few months for most stove programmes (Barnes et al, 1994). Even if the focus of this thesis is on fuel wood collection, it should be mentioned that agriculture plays the major role in deforestation due to land use competition (Naughton-Treves et al, 2002).

The traditional three stone stove relying on fuel wood, and stoves using charcoal, have both environmental and social impacts. Environmentally, they lead to overexploitation of the forest, i.e. deforestation. Socially, women must spend several hours in the forest collecting fuel wood. Women are also exposed to indoor pollution when cooking. This is an important health issue since about 1.6 million people annually die of illnesses related to indoor pollution (Kantha et al, 2007). Even if social effects of cooking methods are important, the main issue to be addressed in this thesis is their effects on the forest. If the cooking methods are improved, less fuel wood will be collected which will reduce the pressure on the forest. Therefore, innovation processes related to stoves are discussed in the theory (ch. 3) and further analysed in ch. 5.

It is often argued that networks play a crucial role for the adoption of technologies. It is pointed out that if there is heterogeneity in networks, individuals tend to be affected by the choice of others in the social network (Bandiera et al: 2006, Conley et al, 2010). Therefore, my initial interest focused on the ability of networks to spread information and knowledge about innovations in technologies preventing deforestation. However, while conducting the field study in the Gambia, I found that networks did not play an important role for the adoption of new technologies. Therefore, the focus moved to the adoption of technologies, which influences the improvement of the condition of the forest. I found many hindrances of adoption. For instance, that communities and individuals tend to keep their achieved knowledge for themselves without spreading it to other people or communities.

Another major finding is that observation is an important factor for adoption, but if people lack education, the ability to observe is reduced. There is a difference between obtaining information and achieving knowledge about a phenomenon. Education helps the transformation of information to knowledge. It is questionable whether poor people can bear the risk costs associated with the uncertainties of innovations. The adoption of new technologies is not even supported by formal groups and Village Development Committees (VDC). According to findings discussed in the thesis, it is more relevant to target individuals who are active and well respected in the community, and let them spread their knowledge.

## **1.1 Aims of the study**

The primary aim of the study is to examine how knowledge about innovations improving the forest, both directly and indirectly, is adopted in local communities and if it is transferred to other communities as well. I argue that there are sustainable methods improving the condition of the forest. Direct methods can include various planting and harvesting practices, while indirect methods can be the implementation of improved stoves, a change in fuel wood collection behaviour and ecotourism. This is brought up in theory, (ch. 3), empirical findings (ch. 4) and analysis (ch. 5). Another aim is to investigate if these methods affect deforestation.

Two governmental departments, the Forest Department (FD) and the Community Development Department (CDD), target communities while spreading new technologies in these areas. The study also aims at investigating how these departments work with communities to disseminate sustainable technologies related to forestry. For instance, the role VDCs and village groups play in the dissemination of these methods will be looked into.

One question arising is if they behave entrepreneurially by being social responsible for education and the spread of knowledge about sustainable technologies. I will try to find out whether these institutions are used, and if they are effective or if individual key actors are the most important driving forces of these processes. It is also interesting to examine how family structures and caste structures play a role in the spreading of this information and knowledge.

## **1.2 Research questions**

What is needed for innovations in stoves and in sustainable forestry to be locally adopted?

- a) Shall innovative activities in sustainable forestry be decentralized from governmental organisations to rural people?
- b) What is the importance of village organisations, individuals, caste and ethnicity for these adoptions?
- c) How does the adoption of new technologies for cooking and for sustainable forestry affect deforestation?

## **1.3 Structure of thesis**

Certain theories were used as starting points in the research process. But, during the field study, where qualitative methods were used, it was clear that these theories were not suitable for the specific context. It turned out that inductive reasoning should be used to modify the original theories to better grasp reality. It is necessary to explain this development of theories as a background before presenting the theory which was actually used in the analysis of the cases. This is done in the methodological chapter (ch. 2), which also gives a detailed description of the methods used in the research. In ch. 2, themes for interviews are discussed, which are used in the empirical study. In ch. 2.4 criteria for success are defined, which are discussed in depth and schematised in the analysis (ch. 5).

In the theoretical chapter (ch. 3), innovation theory is considered as the grand theory, and with a focus on adoption and diffusion. Roger's (1995) factors explaining adoption of new technologies are emphasized in this study, and are used as a basis for a large part of the analyses in ch. 5. Innovation theories are followed by additional theories concerning processes of sustainable forestry and dissemination of sustainable stove technologies. Wood fuel collection behaviour is included in the discussion about sustainable forestry. These theories are presented in order to be used in ch. 5 for analysing the case studies.

Themes presented in ch. 2 provide a framework for the empirical study (ch. 4). In the empirical study, the institutional context is exemplified by FD and the CDD (ch. 4.3). These institutions are closely connected to the investigated communities since they are initiating trainings, while the FD also has a law enforcing role towards the communities. The communities are often acting according to initiatives from those two departments. After the institutional description, fuel wood collection is exemplified in one case study. The second case is forest management where a forest park is used as an example. The third case concerns improved stoves, where two pottery producer groups are discussed. While no households involved in the first two case studies have adopted any improved stoves, it is also interesting to find out why they continue to use traditional stoves (4.4-4.7).

After the empirical part, the cases are analysed and compared with theory in ch. 5. Theories concerning adoption of technologies improving the forest are related to the cases and discussed following Roger's (1995) factors for adoption of technologies. Finally the paper is concluded both in relation to the research questions and in relation to the field work process (ch. 6).

## **1.4 Background of the Gambia**

The study is carried out in the Gambia, which is a small West African country. This country is interesting since 97% of the population depends on biomass as an energy source when cooking (95,6 % depends on fuel wood, 1% depends on charcoal, while 3.4% depends on gas) (Sallah, 2000). The country has experienced droughts, due to lacking rain during the rainy season, which is between June and September. Due to a dense population, relying on farmland and fuelwood, there is an increase in deforestation (UNESCO, 2010).

The Gambia, surrounded by Senegal, is 400 km long. It is situated along the river Gambia, which is why it is only 40 km wide (Barnes et al, 1994). The population is 1.7 million (CIA, the world factbook, 2010). The main religion is Islam, and the official language is English. The Gambia was an English colony until 1965. In the rural areas most inhabitants rely on agricultural activities. While the country experiences urbanization (57% live in urban areas), 80% of the population still depends on agriculture (CIA, the world factbook, 2010). The literacy is low in the country since only 47.8% males and 32.8% females can read and write (CIA, the world factbook, 2010).

The ethnic groups in the Gambia which are relevant in this paper are: Mandinka (42%), Fula (18%), and Wolof (10%). Mandinkas were among the first settlers. They originate from the ancient Mali Empire, but they settled along the river Gambia as farmers.



Fula are traditionally nomads originating from Sudan and trading with Berbers. Today, most Fulas have settled with farming. The Wolof originated from Mauritania, but have been pushed southward due to wars. They are most common in urban areas, but Wolof is the trade language in the Gambia (Sonko-Godwin, 1994).

Four community groups are investigated in three case studies exemplifying different aspects related to forest improvement. All the communities are situated in Central River Division<sup>1</sup>. The first case is fuel wood collection, which is exemplified by the village Saite Maram; the second case is improved forest management involving ecotourism and sustainable utilization, which is exemplified by Kunkilling Forest Park; the third case is improved stoves, which is exemplified by Ndowen pottery group and Panchang village group<sup>2</sup>.

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<sup>1</sup> See Appendix 11 for maps over locations of the villages.

<sup>2</sup> See Appendix 1, table 1 for the list of targeted groups and departments.

## **2. Methodology**

### **2.1 Theory development**

The study started with the aim of being deductive with innovation theory in focus. However, when conducting the study I realised that the inductive method is more relevant. An inductive study is considered to be beneficial in order to grasp realities in the daily accomplishment (Silverman, 2005). Scholars defending inductivism argue that prior definitions of topics and concepts would hinder a new understanding of the cultural world that is explored. The criticism of this approach is that there is a risk being descriptive, and blind to cumulative bodies of knowledge. In order to avoid this trap, it is recommended to use earlier learned concepts to sensitize you as a researcher; follow up findings from earlier studies, and introduce a third variable in already existing studies by adding a specific factor to focus on (Silverman, 2005).

In this study innovation theory is considered a grand theory, while processes connected to forestry and environmental processes connected to stoves are seen as additional theories. These theories are used for analysing my case studies. Initially, the study focused on the spread of technologies through networks such as travelling businessmen, people from the same ethnic groups or networks established through migration. When approaching the field, no networks – in which information was shared – could be found. When the question from whom the villagers learned about methods for forestry and technologies concerning stoves was posed, the answer often was that they had not talked to anyone about it. Therefore, my theoretical focus was put towards the individual. Mainly, how the individual gets knowledge that influences his or her decisions. The new approach was developed when staying a week in the urban area before going back to the field. During this week, I discussed the issue with informed members of the society such as NGO workers and my interpreter. When going back to the communities a new approach had been developed.

### **2.2 Methods used in the research**

The set-up of this study is a case study consisting of three cases, namely improved stoves, fuel wood collection and forest management. It is conducted as a qualitative study with a few cases described in depth. By doing this, it is possible to get a deep understanding of a few stories (Bryman, 2004). It is necessary to emphasize that a qualitative study has limited possibilities to make general conclusions that can be applicable in other

situations and regions. Since I am interested in how knowledge concerning new technologies is adopted within specific communities and how individuals value and understand this knowledge, a qualitative study is appropriate.

Qualitative research sometimes requires the researcher to live close to the community, which gives a possibility to participate in daily activities. It is possible to get a deeper understanding of the community and to go back and ask for clarifications and most importantly to look with an eye of a local. The participation will facilitate the understanding of the social behaviour in the community. If the researcher participates in the daily life it is possible to make observations, which are not possible to get through interviews. It may be possible to understand cultural aspects beneath the surface (Bryman, 2004). If the researcher stays long enough it is even possible to be considered and accepted as one in the group and therefore get better access to information. However, the researcher will not become one in the group, but is able to analyse events taking place as an outsider.

In order to achieve a reliable qualitative study, it is helpful to use a variety of methods to collect data and compare patterns from the different methods. This is described as triangulation (Silverman, 2005). Triangulation also supports my approach to use theory as the basis for my study. In my case triangulation consists of group interviews, individual interviews, narrative walks, observations and descriptions of the ecological system in the different sites.

To find relevant interviewees, I used snowball sampling, which is a useful method for this study. In this case the researcher relies on acquaintances of a certain informant. That is, one contact can lead to another contact (Scheyvens, 2003). When using this method the choice of the first informant becomes important. In my case, I started snowball sampling by interviewing government officials in the FD. Staff in the FD was considered to be good to target since they have an overview of what is going on and good contacts to communities. The CDD also knows interesting groups and projects, which I was introduced to. Seven groups and two government officials were found through snowball sampling.

The main method is semi-structured interviews (see appendix 1, table 1). There is not a specific answering sheet, but the interview is organised in themes, which are discussed more in detail in ch. 2.4. This method allows the interviewee to answer freely and the interviewer to follow up based on the response of the interviewee. Therefore, there is room for improvisation and coming up with questions depending on the development of the

interview (Bryman, 2004). This method is used because narratives and views from the various interviewed groups and individuals are at the focus of this study.

Semi-structured interviews are used to exert certain control over the interview, but at the same time let the interviewees come up with their own thoughts, which can lead to new and interesting pathways for the study. Seven semi-structured interviews were conducted, divided between NGO workers (1), government officials (4) and female members of a group producing improved stoves (2) (appendix 1, table 1). Governmental officials from CDD and the FD were interviewed, to find out how governmental institutions are working with communities and which insemination methods are used. Moreover, they were interviewed as informants, helping me to interpret answers from the interviews with village groups. The NGO – Peace Corps – was used as informant in order to help me understand experiences from the field. The member from this NGO was also interviewed in order to find out how they work with communities.

Unstructured interviews were conducted with Camara from NACO Gambia, members from Peace Corps and Dieng from FD (appendix 1, table 1). By unstructured interview it is meant that questions are not prepared, but only a theme. The interview is shaped more like a conversation (Bryman, 2004). The unstructured interview is a good way to informally achieve clarifications from unclear issues related to the case studies.

Narrative walks were used for additional information concerning methods used in the forest. The researcher follows the targeted person on his or her everyday activities and lets the person speak freely about practices (Olsson, 2009). In informal situations you may get sensitive information you would not have got during formal interviews since the interviewee is in a comfortable and well known environment. This is an excellent way to let the interviewees tell about their situations and opinions. The first narrative walk took place in the community forest of Saite Maram together with the head of the forest and the second took place in Kunkilling forest park together with the village promoter (appendix 1, table 1 and appendix 2). Various trees and planting methods were shown and discussed.

In order to investigate the role of the local marketplace in the dissemination of new technologies, structured interviews were used. Seven market goers were interviewed (appendix 1, table 1). The aim of these interviews was to find out the relationships between interviewees and the FD, and if interviewees obtain information from the market. A structured interview sheet was used due to time constraints for a deeper interview with longer stories. However, there were few visitors to the FD, which is why women selling gardening products

were also interviewed in order to see how they consider the market in terms of obtaining information about new technologies.

Village groups were interviewed through group meetings. Group meetings can bring about discussions and the interviewees may come up with new ideas when they listen to another person's view. Four group meetings were conducted (a detailed overview of number of participants can be seen in appendix 1, table 1).

During the interviews in Saite Maram and Panchang, time line mapping and social mapping were conducted. These are methods that can give a background of the group and how the group achieved what they have today. It can also give a picture of who provides the information and how the technology has been adopted (learned from Camara, NACO Gambia). However, the problem encountered when using these methods is that the interviewees are not used to draw such maps. Thus, it was difficult for them to understand what they were supposed to do, which made these mappings useless in this specific study.

### **2.3 Cultural adaptation at the field**

During my field study, I stayed in a village nearby the investigated villages. I lived with local people and participated in daily activities, such as eating together with the host family. This was also a good way to talk about relevant issues for my study informally. In such situation there is no pressure and people may talk more spontaneously and freely. The informal talks are used as observations in my study. Since I am a European and white person, it was not possible for me to become one of them. I would always be considered as an outsider. However, I lived with the locals and did what they did, during which I showed respect and understanding of their way of living. For instance, in the Gambia it is common that everyone eat from the same bowl. I participated around the bowl. By doing this it was possible to be accepted and respected in the community.

I was offered a room in a forest camp together with FD staff, where I could have informal talks, for instance during meals. I stayed in this camp for ten days, which gave me an opportunity to have many informal talks with the staff. The camp was closely situated to Kunkilling Forest Park. Often, villagers came to the camp and I had a chance to get to know them before approaching Kunkilling Forest Committee. Furthermore, I travelled around like the locals with minivans and donkey carts instead of a nice pick-up to avoid showing distance to the villagers.

For communication issues, I used an interpreter, who originates from the region, but had gone to school in the urban areas of the Gambia. The interpreter was not only an

interpreter between English and the local languages (Wolof and Mandinka), but a cultural interpreter who explained various behaviours and responses. It was possible to have discussions with my interpreter about the interviews and therefore be able to put the answers into contexts. When interviews were conducted in English the interpreter was present to be able to follow the development of the study.

## **2.4 Variables examined through the interviews**

The interviews are used to judge the success of the communities and groups interviewed. Success is judged in terms of adoption of new technologies, the extent to which the adopted technologies are still practiced and the ability to observe and adopt new technologies (absorptive capability). Skilled training and formal education are used to explain the level of success<sup>3</sup>. Information concerning these factors has been obtained from interviews with the communities, the groups and through the FD and the CDD. During the interviews, I was careful not to pose questions in a way that could arouse suspicion among the interviewees. Some questions concern how they learned about the technology and whom they talk to, and how the technology is practiced. From this it is possible to get a general picture, which is further developed in ch.4 and ch. 5.

The interviews are organised in themes and the same interview sheets are used with similar groups or institutions. This is done in order to get a continuation of the interviews and be able to schematise the answers. The themes are started with general questions to get the interviewees to talk freely. If there are no relevant answers, there are more specific questions. When interviewing government representatives the first theme concerns governance policies and national programmes. Thereafter, the theme concerns the implementation of programmes, where a specific case shall be used as an example. The discussion concerns how those programmes are implemented, which stakeholders are relevant and which groups/individuals which are most important to target. The follow up is also involved as a theme. The first theme is chosen in order to understand how processes in my cases are linked to national level policies. It is also relevant to understand how the governmental institutions collaborate with local communities and how they follow up implemented projects.

Concerning the groups, the interviewees are always told to give a background of the group such as when and why it was established. The same is asked about a specific

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<sup>3</sup> See table 1 (ch. 5) for a detailed overview of the criteria and level of success of the specific cases.

project. Thereafter, questions concerning changes in the everyday life are posed after implementation of the specific technology. The last themes concern networks and to whom the people talk about the technology and ideas in general<sup>4</sup>. The first theme in the interviews with village groups is chosen in order to get a broad background of the village and groups, to understand why they ended up adopting a technology or why not. The last theme is discussed in order to find out who the interviewees talk to and socialize with in order to see how technologies can be spread and then to see if technologies actually are spread through these contacts.

## 2.5 Methodological limitations

With regard to benefits from improved stoves and biodiversity in the forest, quantitative data are appropriate. However, these data are not available for the Gambia and experience from other countries are usually not transferable. Therefore, I solely had to rely on qualitative data collected from interviews.

During the study I experienced unexpected obstacles. Partly, it is because of the methodology used in the specific cultural context in the Gambia. As an outsider, especially as a European, it can be difficult to be trusted and accepted in the communities. It is not possible to enter a community without a proper gateway. The gateway must be a trusted individual or an organisation, which has a good relationship to the community. Furthermore, it is recommended to stay a longer time in the community in order to create a trustworthy relationship (Bryman, 2004). The contacts in this study were initiated by governmental departments, which I initially thought was a good gateway. However, I found out that in the Gambia governmental institutions are often not trusted. There could be a suspicion that I work and report for the government. Saite Maram, for instance, does not have a good relationship to the FD, which may be why it was difficult to obtain information from them. Kunkilling, on the other hand, had a better relation to the FD, and from what I experienced, it was easier to obtain information.

Another difficulty was the initial link with communities. The meeting with Ndowen Pottery Group should have been arranged through the CDD beforehand. However, the villagers had not been informed about my arrival. This can influence the outcome of the interview since they are interrupted in their daily activities and not prepared to answer questions and they may not have trust in me. The snowball interview is usually a good tool,

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<sup>4</sup> See appendix 3- 10 for detailed plans for the interviews.

but if the bureaucracy is not well-functioning, it may not be beneficial since the linkages between governmental organisations and communities may not be satisfactory.

Another reason why it was difficult to obtain information is related to the aim of this study. In the Gambia it is not common to share information between one another unless you pay for it, either money-wise or helping in the daily activities. Since I did not come to the communities with new tools or pay them more than the equivalent of some kola nuts or the local tea, the willingness to share information might have been limited. If I had had more time and worked in the community, it might have been easier to receive relevant information. However, since I have previous experience from the Gambia, I have achieved a certain level of understanding of the country, culturally and socially.

In many interviews I used a tape recorder, from which my interpreter transcribed. Using a tape recorder can be problematic since the interviewee may feel uncomfortable and afraid that the interview will be misused. This can create a situation where relevant information will not be shared. In some cases the interviewee would not allow me to use the recorder, which is why I had to rely on my own notes. After some interviews, which had not been as informative as expected, I decided to conduct interviews without recorder to see if the answers were more informative.

The amount of time spent in the Gambia was also a constraint. Five weeks are not enough to get a broad understanding. If I had been there for a longer time it would have been possible to create relationships and a better understanding of the communities.

Despite these difficulties it was possible to obtain rich knowledge by comparing all interviews to one another and through discussions with informed members of the society. Observations, literature reviews and previous experience from the Gambia contributed to the understanding.



## **3. Theory**

### **3.1 Introduction to choice of theories**

Innovation theory is used as a background and a starting point for this study as well as grand theory to inspire the study. As processes connected to forestry, and environmental processes related to stoves, are at the centre of concern in my empirical study, they will also be examined theoretically. These theories are included in the thesis as additional theories.

I argue that innovations should be seen as an integrated part of technology dissemination (see ch. 3.2). Thereby, issues on dissemination of sustainable technologies become an integrated part of my grand theory. Sustainable technologies refer to technologies improving the environment, and conditions for people, like gaining an income (Weaver, et al, 2000). The improved stove is one example of sustainable technology. Environmental processes are not only related to the forest, but also to carbon emission and health, but the case studies mainly concern environmental impacts on the forest. In this paper there is a distinction between utilizing the forest and saving the forest. Sustainable forestry methods are ways of utilizing the forest, while improved stoves and ecotourism are indirectly saving the forest without utilization, and at the same time gaining an income. Ecotourism can save the forest since villagers will be able to gain an income by preserving the forest. Tourists are willing to pay an entrance fee to experience the animal life, which can only be kept if the forest is maintained.

Innovation theories and additional theories, discussed in this chapter, will be used in ch. 5 for analysing the empirical results obtained in the field study (ch. 4).

### **3.2 Innovation theory**

The idea of innovation can be traced back to the work by Schumpeter, one of the founders of evolutionary economics at the early 20<sup>th</sup> century, originally as an idea on the evolutionary nature of the capitalist system. Schumpeter viewed the evolution of capitalism as an open process of innovation that induces qualitative changes in the society. It is accelerated by technological changes, which keeps firms competitive with increasing productivity (Fagerberg, 2003). Schumpeter defined innovations as: “ “new combinations” of existing resources, equipment and so on” (Fagerberg, 2003: 131). In innovations knowledge comes

from different sources. Knowledge will become an innovation when the entrepreneur puts it into the market. Schumpeter argued that innovation is a social activity carried out in an economic sphere with a commercial purpose, while invention may not have any commercial purposes. Schumpeter's idea of innovation is an entrepreneurial function of the capitalist system (Fagerberg, 2003).

Schumpeter argued that adoption of new methods or scientific ideas is difficult since we tend to turn back to the accustomed track we have always followed, despite the traditional method proving to be unpractical and that the innovation is simple to apply. The resistance to change or to adopt innovation is deeply embedded at the social level, which is difficult to overcome (Fagerberg, 2003). Agarwal (1983) has a similar argument concerning improved stoves. He argues that traditional habits concerning consumption and cooking methods can be so strongly rooted that it is difficult to inculcate improved stoves. For instance, in the Gambia improved stoves are not efficient for steaming rice, so many have hesitated using the stoves. In such case, managerial competence is not enough. Innovation necessitates certain skills from an entrepreneur to implement the change (Fagerberg, 2003). Foxon argued that the term path dependency is also related to the spread of innovations. It refers to the direction of the innovation depending on pre-existing factors like initial markets, institutional factors, and – what is relevant in this study – expectations from consumers (Foxon, 2002).

Schumpeter mainly considered big innovations in a national context, while Lundvall as a contrast also considers small innovations in local contexts. Lundvall argues that the cumulated impact from small scale innovations can be equally good to cause a larger impact (Fagerberg, 2003). Fagerberg includes imitation and efforts related to the commercial exploitation of technologies, which are important for economic growth. The term low-growth trap becomes relevant, by which it is meant that poor countries with a low capability are trapped in poverty (Fagerberg, 2003). In the context of the rich world the technology will be managed and organised gradually through trial and error, using common sense (Fagerberg, 2003). However, this may not suit poor countries since they are too poor to afford trying out innovations since trial and error is too risky when there hardly are enough means for survival. Lundvall (2007) argues that in developing countries, where the main aim is to get the basic needs to survive, an innovative behaviour might be necessary and not a luxury. They must learn new opportunities. However, this is often not the case since it is risky dealing with innovations, which means that if you are too poor there are no resources to risk trying out innovations, since they may fail.

In this paper the spread of new sustainable technologies, is at the centre of concern. The adoption process is first slow, and accelerates while it spreads among the adoption population, as consumers learn from neighbours. When the relevant population has adopted the innovation, the innovation rate slows down according to an S-curve of the spread of innovation (Hall, 2003). Diffusion of innovations has two general characteristics: it is a slow process and the innovations have a wide range of acceptance among consumers.

Roger (1995) discusses four central factors slowing down or accelerating the adoption of new technologies. These factors are important in this thesis as they give a basis for analysing adoption of sustainable technologies:

- 1) *“whether the decision is made collectively, by individuals, or by a central authority.*
- 2) *the communication channels used to acquire information about an innovation, whether mass media or interpersonal.*
- 3) *the nature of the social system in which the potential adopters are embedded, its norms, and the degree of interconnectedness.*
- 4) *the extent of change agents’ (advertisers, development agencies, etc.) promotion efforts.”*

(Hall, 2003: 5)

The above four factors constitute the so called National Innovation System. As discussed in ch. 5, many of those aspects are lacking in the cases investigated in this thesis. The communication channels and interpersonal relations are not well used to spread ideas and knowledge. However, local radio is a commonly used communication channel. Hall (2003) describes the crucial role of mass media in the initial stage of the diffusion, while later on interpersonal communication becomes the most important factor.

Schumpeter focused on the entrepreneur in relation to the economic environment. Lundvall, on the other hand, who recognizes the importance of relationships between firms, customers and suppliers is of special interest with regard to factor 2) in Roger’s scheme. According to Lundvall, an economic system is characterised by these three actors (Fagerberg, 2003). The level of innovation depends on how much firms are interacting with one another both concerning knowledge and infrastructure. However, the knowledge is often localized and therefore not transferred from one place to another (Lundvall, 2007). Thus, communication can be hindered by geographical barriers. In my study, the pottery group in Ndowen actively spreads information about the improved stoves to neighbouring villages. Due to immobility it is difficult to spread the knowledge. However, they use radio as a tool for spreading information about their stoves.

User-producer relationship is another useful communication channel for information about innovation. Lundvall (2007) divides these two categories of actors into

pioneers, the early users and the late followers and interaction between the three roles affects the adoption of new technologies. As discussed in ch. 5, Ndowen Pottery Group experiences problems reaching customers. They aim to contact neighbours, but due to immobility and lack of interest from neighbours, they experience problems reaching out with their products.

Lundvall uses the notion National Innovation Systems and argues that there are two main factors that influence the adoption of innovations. Firstly, the history of the nation. If, for instance, industries are closely connected to each other, it is easier for innovations to develop. Secondly, factors such as a common culture, language and institutions are central factors in the relationships between firms and the environment (Fagerberg, 2003). This brings us to factor 3) in Roger's scheme (the nature of the social system). The adoption rate varies depending on the traditionality or modernity of the social system. In a traditional society, the degree of ability to change might be limited. Another relevant aspect is the level of collectivity in the community (Agarwal 1983). If the community is individualistic there might not be much communication and networking, which hinders spread of innovations. Class, social grouping and gender can play a crucial role in the adoption of innovations. Even though the innovation is feasible under specific conditions, all members of the society may not have access to the innovation due to social issues. In many cultures, women may not have access to the same resources as men (Agarwal, 1983).

Ethnicity is not directly discussed by Roger (1995), but can be seen as a part of the social system. In a study conducted in Tanzania concerning agricultural technologies, it is argued that the probability of adoption increases if there is a strong ethnic affiliation compared to a high ethnic diversity. However, if there is a strong tribal-base the group will be more isolated, which leads to less participatory decision making (Isham, 2000). Traditionally, there is a strong caste system in the Gambia. Caste is a part of the social system since it is a job division linked to hierarchies, where the slave caste must obey and work for the noble caste. Traditionally, the noble caste is farming. The slave caste is divided into various occupations such as pottery, blacksmith, musician/storytellers (Tamari, 1991). The caste system has still an influential role in occupations and marriage. According to Tamari (1991), it is not possible for people from one caste to be involved in the work and duties of someone from another caste. Therefore, adoption of certain technologies, for instance within pottery, may not be feasible regarding individuals not belonging to the specific caste.

Whether decisions are made collectively, by individuals or by a central authority (Roger's factor 1) concerns the question if innovative activities shall be decentralized from governmental institutions to rural people. Thus, this factor involves local learning processes,

where technologies are adapted to local conditions and local norms. For instance, improved stoves must sometimes suit cultures, where extended families and neighbours participate in dinners. Thus adoption of an innovation cannot be implemented from the outside. This is especially true in the context of developing countries where extension workers play a crucial role since they often in-seminate new ideas. The attitude from the extension workers and the level of training and information are crucial for the success of in-semination of innovations in poor rural communities (Agarwal, 1983). The technology must be developed and adapted in the community to become innovative (Agarwal,1983).

There is a crucial difference between information and knowledge about the world and how to change it (Lundvall, 2007). You receive information, but this may not necessarily mean that you know how to use it. This is an aspect, which seems to lack among Roger's factors influencing the diffusion rate of new technologies. To become innovative, an actor must be equipped with absorptive capabilities to observe and adopt new technologies. According to Cohen et al (1989), the absorptive capability is associated with firms' ability to identify, assimilate and exploit knowledge from the environment. Besides Rogers scheme, this factor is emphasized in the analysis (ch.5). However, while Cohen et al consider absorptive capability as developed through R&D, in this thesis basic formal education and training play a key role in the development of this ability. A low level of education hinders the learning and observation skills, and leads to ineffective or non-ideal communication.

### **3.3 Sustainable forest technology dissemination**

In this and the next section, additional theories concerning processes related to forestry, and environmental processes related to improved stoves, are discussed. There are various processes revealed in the case studies, by which forests can be sustained, for instance, replanting, thinning trees in new ways, and mixing fast and slow growing trees. However, a notion of sustainable forestry must include social processes, where people can increase their wealth (Khalikane, 1997). Thus, in this paper sustainable forestry is not only regarded as protection and restoration of intrinsic values in the ecosystem. The community should also be able to earn a living from the forest while improving it. In this study increased wealth is seen in view of using forest resources for cooking and in off-farm activities such as production of furniture and ecotourism.

A definition of sustainable forestry, which catches the essential points of this paper, can be listed as:

*“(...) an ability to, either currently or at some future time, provide habitat for the full array of organisms historically found on the site and, of course, the continuing capacity to provide the same quantity and quality of products for human consumption”*

*(Franklin, J, 1993: 127)*

The following points show the importance of productive capacity and diversity in the forest:

- 1. preventing the degradation of the productive capacity of our lands and waters – no net loss of productivity; and*
- 2. preventing the loss of genetic diversity, including species – no loss of genetical potential”*

*(Franklin, J, 1993: 127)*

This quote outlines the necessity of considering the ecosystem as well as human services both for today and for future generations. It is relevant to consider a broad array of species and consider a broader concept of management units, such as landscape scale areas, where ecological boundaries are taken into consideration (Sample et al, 1993). FAO and UNEP have seven criteria for sustainable forestry (Castañeda, F, 2001)<sup>5</sup>. In ch. 5 some of these criteria are discussed: biodiversity, resources in forest, and socioeconomic functions.

Forests are socioeconomically important, since they are a source for food production, energy, building materials, medicine, while they are a habitat for wildlife (Khalikane, 1997). The forest in itself plays crucial roles for soil protection against erosion, purification of air and water, reduction of wind velocity, regulation of stream flow and even influencing global and local climate change. Moreover, habitat is important to preserve biodiversity (Khalikane, 1997). Forests influence climate change due to the important role of trees in carbon sequestration where carbon is stored in trees (Miller, 2007). These are reasons for improving and restoring the forest. Soil protection is necessary in order to avoid soil degradation. Trees play a crucial role to alleviate soil degradation and soil erosion (Khalikane 1997). Khalikane (1997) argues that ecotourism is an important sector in Africa; especially in forests where a broad variety of flora and fauna is found. It can be used as an incentive to sustain the forest and it is a valuable contribution to the economy.

There are various contributing factors to deforestation such as fuel wood collection and commercial logging. Therefore, it is relevant to come up with alternative sources for income and energy (Khalikane, 1997). Khalikane discusses the management aspects of forests and argues that ownership is a central aspect as it gives incentives to protect the forest. If forest resources are protected the well-being of local communities are better assured. Furthermore, Khalikane (1997) argues that it is vital to take traditional systems into account, including traditional knowledge, skills and cultural habits. If traditional systems are

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<sup>5</sup> See appendix 1 table 4.

considered, local communities are allowed to play a central role in the decision making. It is rarely seen that forests, which are only guarded and taken care by governmental departments, can be sustained in the long run. If only government employed guards are used, the destruction of resources will continue (Khalikane, 1997).

An example of sustainable forestry can be found in a forest restoration project in Mali. The delta experienced droughts in the 1970s and 1980s, where forest and wildlife disappeared. The communities are actively working for restoration, mainly because they benefit economically from the trees they plant. The forest has even contributed to local fisheries. Another interesting fact is that since there are more birds, the droppings help with vegetation growth. The communities dig water channels from the river to provide water to the forest. The community fines people misusing the forest. This money is used to buy seeds for transplantation of trees (Diarra, 2010).

As mentioned above, fuel wood collection is partly responsible for deforestation, which is why a change in fuel wood consumption in some cases has a central role towards sustainable forestry. Fuel wood collection is related to a balance in the ecosystem. In a global perspective 15% of the primary energy consumption depends on biomass, while in developing countries it is about 38% (Bhattacharya, 2001) In Africa about 50% to 90% of the total energy use depends on biomass (forest residue, agricultural waste, wood and wood waste, animal waste, aquatic plants and municipal waste) and 76% of the Sub-Saharan population rely on biomass (Kartha et al. 2007). Biomass is burned to such a degree that it causes adverse environmental impacts through deforestation and indoor pollution. The smoke from biomass consists of various poisonous constituents such as respiratory particulate and carbon monoxide (Karekezi, et al, 1995). However, it must be emphasized that fuel wood is not solely responsible for deforestation. Expansion of farmland is an important factor causing deforestation and a reduced amount of fuel wood. For instance, in Kenya, the expansion of farmland has led to women carrying fuel wood much longer distances. At the same time landowners saw a possibility to plant trees so they could sell fuel wood (Crowley et al, 2000). Naughton-Treves et al (2002) argues that 88% of the net loss of forests in tropical Africa is caused from degraded and abandoned land due to agricultural activities. Fallowed or abandoned land can slow deforestation since it can provide resources such as fuel wood. Therefore, pressure can be alleviated from high canopy forests (Naughton-Treves et al, 2002).

Maconachie (2009) discusses the linkage between deforestation and fuel wood, where the wood fuel gap theory is involved:

*“increasing deforestation problems are interpreted as a problem of a growing gap between population driven demand and diminishing resources, usually radiating out from centres of habitation in increasingly wider circles” (Maconachie, 2009: 1029).*

The population driven demand is caused by an increased urban population and therefore an increased demand for fuel wood in urban areas. The urban demand for fuel wood (or charcoal) is considered to be a major cause for deforestation (Maconachie, 2009). This demand has led to a new market for people in the urban periphery in which they can sell their wood (Maconachie, 2009). Saite Maram is an example where villagers earn money from selling their wood to remote urban regions. However, agriculture is disregarded in the wood fuel gap theory. Maconachie (2009) argues that in Sub-Saharan Africa off-farm activities are a greater threat to forests than wood fuel collection. Another reason that fuel wood plays a less important role than earlier expected is that rural households use various organic residues, and not only fuel wood (Kartha et al, 2007). Despite the above arguments, fuel wood collection plays a role in deforestation. If fuel wood is collected, there will be fewer residues in the forest which are decomposed into humus, which is important for the well being of trees. If wet fuel wood is collected, living trees will die (Miller, 2007). In the Gambia fuel wood is the most common biomass source (Karekezi, 2002).

Looking at the social aspects of fuel wood collection, one finds that women walk 5-10 km spending 3-4 hours every day collecting fuel wood, a time which can be used doing other activities (Kartha et al, 2007).

### **3.4 Sustainable stove technology dissemination**

Under the scope of this study sustainable technologies include both technologies directly used in the forest, and technologies used in cooking and in off-farm activities. By off-farm activities it is referred to improved-stove production, sustaining forest and ecotourism. In this section focus will be put on stove technologies. In ch. 3.1 sustainable technologies are defined as improving the environment and socioeconomic conditions for people. In this section it is discussed why improved stoves can be seen as a sustainable technology improving the forest, through reduced fuel wood collection, and through improvements of socioeconomic conditions for rural people. Greenhouse gases are also discussed.

In Sub-Saharan Africa the traditional three-stone stove is still the most common. The social aspect of traditional stoves relates primarily to health issues due to indoor pollution. It is estimated that 1.6 million people die annually from indoor pollution. Usually, it is women and children that are exposed to smoke (Kartha et al, 2007). There is a study of 500



children in the Gambia showing that children carried on the backs of their mothers while cooking with three-stone stoves run a 6 times higher risk to get respiratory illnesses (Barnes et al 1994). Indoor pollution can be 50 times as high as the recommended exposure (Karekezi, Murimi, 1995). The traditional three-stone stove has a dispersion of the flames and heat, if there is wind and there is no control of the fire. The traditional stove has severe impacts on the environment as well. Carbon dioxide is the most common greenhouse gas produced from biomass combustion. Incomplete combustions such as carbon monoxide, methane and higher hydrocarbons can also be found. The emission from traditional stoves may consist of 10% incomplete combustion. The incomplete combustion has a devastating impact on the climate by unnecessarily releasing greenhouse gases. It is argued that the incomplete combustion from traditional stoves was a quarter of all incomplete combustion in Asia (Kartha et al, 2007). If an improved stove is used the emission of incomplete combustion will be insignificant, while carbon dioxide and water vapour will dominate (Barnes et al, 1994).

Globally, there are about 220 million improved stoves, while about 204 million are in China and India (Kartha et al, 2007). There are many types of improved stoves depending on where they are constructed. The basic concept of an improved stove is that the oxygen is reduced in the stove to slow down the burning of biomass. Therefore, many improved stoves are constructed in such a way that only 2 to 3 sticks can be put into a hole on the side. The smoke should be reduced if the space is reduced between the pot and the stove. Some versions are constructed in such a way that the pot is surrounded by the stove. In this case, the stove must have measurements based on the pot. However, the most common versions are constructed in such a way that the pot is put on top of the stove. Since the stove is oxygen proof and the fire is kept inside, the stove becomes hotter and the fire lasts longer, and the food can be cooked faster. A problem with many improved stoves produced from clay is that they are fragile and can easily break. Many improved stoves fail because producers are not using the correct clay mixtures (Walubengo, 1995). It is important to use a good quality soil and burn the stoves properly.

Some improved stoves have disadvantages. For instance, the cooking surface is inflexible, which means the pot hole in the stove can limit the pots that can be used. If a pot that does not fit the hole is used, there is a risk that both smoke and heat escape from the stove (Agarwal, B, 1983). This implies that stoves should be tested and constructed in the local context. Agarwal, B. (1983) gives examples such as some stoves need larger wood pieces, which are unavailable in the area. The surface of some stoves has been too high up for women to stir. Mbow from the CDD (interview: 20100224) argues that the improved stoves

introduced in the Gambia were not suitable for steaming rice, which is a common way of preparing food.

Various programmes, both governmental and non-governmental, have tried improved stoves, but with various success. Those that succeed have usually involved the local community with the design and dissemination. Those less successful have usually disregarded local conditions and habits (Westhof et al, 1995). There are environmental, health and socioeconomic benefits of improved stoves. The environmental benefits are that the exploitation of the forest may be reduced due to less fuel wood needed and less carbon dioxide and incomplete combustions emitted. The Commission of the European Communities has published a report on stove efficiency, where the three-stone stove is the most inefficient. The three-stone stove is compared to an improved stove called Maendeleo in Kenya, which is similar to the Gambian version. The Maendeleo stove has a fuel saving efficiency of 40 – 60% compared to the three-stone stove (Westhof et al, 1995). Since less fuel wood is burned, less carbon is emitted into the atmosphere. However, the actual efficiency depends on the quality of the improved stove.

Socially speaking, improved stoves influence the health in such a way that indoor pollution is reduced and less time is spent in the kitchen which is why those cooking are exposed to less smoke (Mabogunje, 2004). Socioeconomically benefits are gained in two ways. Firstly, the amount of fuel wood you need to buy is reduced. A test of improved stoves in Kenya shows that up to 50% less fuel wood is used with the Maendeleo stove (Chavangi, N, 1995). Secondly, since less time is spent collecting fuel wood, there will be more time for income generating activities (Karthi et al, 2007).

Conditions leading to successful implementation of improved stoves are that people experience health problems from traditional stoves, lack of fuel wood, stoves are designed according to consumer preferences, stoves designed with assistance from local artisans, the stove is easy to light and can suit different sized wood, as well as good monitoring and evaluation criteria. Failures can be caused by outside experts advocating for improved stoves, designs made in a laboratory ignoring local preferences (Barnes et al, 1994). As mentioned above, biomass used for cooking can be various residues from forest and farmland. This is common in Africa, especially if fuel wood is not available or too expensive. Therefore, if improved stoves should be adoptable in many rural communities, they must allow residues other than fuel wood.

The improved stoves exemplified in this study are produced from clay and work with fuel wood since that is the most common biomass source in the Gambia. There are no

exact numbers of how much fuel wood is saved, but Ndowen Pottery Group claims they only have to collect a donkey cart full of fuel wood every second month compared to every month with a three-stone stove, hence it saves 50% of firewood.

### **3.5 Analytical framework for the cases**

Ther part of the analytical framework that concerns the grand theory (adoptions of new technologies) is mainly based on Roger's (1995) four factors influencing adoption processes of new technologies. Also absorptive capability is included in the framework, and has a separate section in the analysis (ch.5.2). It is argued that education, training and ties between villages are the most important absorptive capabilities for villagers to adopt specific innovations. Roger's factor 2), communication channels for information and adoption of innovations, is discussed in ch. 5.3 and concerns the relationship between village groups and potential adopters, where social learning is emphasised. Factor 2) also concerns the user-producer relationship. This relationship is essential if an innovation is to be spread, which is exemplified with Ndowen pottery group. Connections between governmental departments and communities are analysed in relation to Roger's factor 1) concerning decision making (collectively, by individuals or by a central authority). Issues on local learning are included in factor 1). Technology must be developed in the community if adoption shall be feasible, which is evident in the discussion concerning Panchang Village Group (ch 5.5). Roger's factor 3 on the nature of the social system includes issues on norms for information and knowledge sharing, as well as the role of caste and ethnicity. The role of these aspects of the social system is evident in relation to Ndowen Pottery Group and Saite Maram.

The additional theories are used as framework for the analysis of sustainable forest practices (ch. 5.6). Communities must be involved in the forest management for adopting sustainable forest practices. Utilization and biodiversity must be considered in the management, while also future generations must be considered which is further developed in the analysis of sustainable forest practices (ch. 5.6). The wood fuel gap theory discussed in this chapter is relevant in relation to Saite Maram since this village is supplying urban regions with fuel wood since it is an important energy source and a crucial income source for Saite Maram. In ch. 5.6 it is argued that fuel wood collection is partly responsible for deforestation. The improved stove is a technology, which can reduce fuel wood collection and CO<sub>2</sub> emissions, while it is also income generating. This discussion is central in relation to Panchang Village Group and Ndowen Pottery Group.

## 4. The empirical findings

### 4.1 Introduction to the field study

The data for this study derives from three case studies. The first case study concerns fuel wood collection exemplified by Saite Maram. The reason for choosing this case is to examine how the villagers in Saite Maram, when trading with fuel wood, adopt methods that are in line with the principles of sustainable forestry discussed in ch. 3. The second case concerns forest management exemplified by Kunkilling forest park. This case has been chosen in order to provide insights into how combined management of forests, involving government and local villagers, may become an innovation leading to sustainable forestry, also including reduced use of fuel wood. Finally, Panchang village group and Ndowen Pottery group are included as examples of innovations in stoves from the point of view of the producers. This kind of innovation is crucial in this thesis, as the traditional three stone stove has been considered an important cause of deforestation, even if agriculture most probably is the main factor.

Together these cases can provide insights into how innovations, which directly and indirectly improve the forest, are adopted in local communities. The case studies are complementary since, for instance, the study of improved stoves also refers to experiences from Saite Maram and Kunkilling to show barriers to the dissemination of improved stoves among consumers. There is also an institutional context of the cases, described in ch. 4.2. The FD and CDD play an important role as project initiators, following up projects, while the FD also has a law enforcing role and collects taxes.

The data for this chapter is primarily collected through interviews. The interviews are guided by themes as described in section 2.4. In the case study section a background is given of the groups and villages. Thereafter, the specific activity (fuel wood collection, forest management and improved stoves) is described and related to the degree of adoption. Adoption is described theoretically in ch. 3 and discussed in relation to the cases in ch. 5.

In this study, the villagers are poor and rely on subsistence farming. Some have off-farm activities, but all depend on agriculture. The villagers, except from those in Saite Maram<sup>6</sup> depend on rice, which is found on swampland close to the river Gambia. During rain season groundnuts, hirse and millet are harvested. Sometimes, women are involved in

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<sup>6</sup> Saite Maram is far from the river, which is why they cannot grow rice.

gardening, but this is only done in a small scale since it is a dry region and water is carried from wells.

## **4.2 The institutional context<sup>7</sup>**

The institutional level plays a crucial role in this thesis. It consists of the FD and the CDD, both are working close with villages and initiating projects related to forestry and social development. Both departments are established to help villages to develop, while the FD also has a law enforcing role towards communities and must protect the forest. There are collaborations between the various departments such as multidisciplinary facilitation teams, where representatives from various departments investigate the needs of the communities in a participatory manner. It is necessary to collaborate since some departments have access to the field while some have not. With regard to fuel wood, which is the most important energy source in the Gambia, one would expect the energy department collaborating with the two mentioned departments. The CDD is always out in field, while e.g. the energy department does not have many field workers, but much research. Initially the energy department was involved in improved stoves, but they transferred the task to the FD.

Both Cham (interview: 20100218 ) and Mbow (interview: 20100308) argue that it is beneficiary to target associations of certain skills such as e.g. pottery, since these associations already have a pre-knowledge of the skill producing pottery.

### **4.2.1 Community Development Department**

CDD Extension workers play a crucial role in social mobilization since they are out in the field in order to stay close to the communities (Suwareh, L, interview20100219). Therefore, other departments are collaborating with them when implementing projects.

CDD uses a participatory approach and a bottom up approach, which means that the department investigates in the villagers needs<sup>8</sup>.

The department is not following national programmes since they work for the needs of the villagers but not the national policies. The aim is to follow the specific needs of villagers instead of national policies. Food security and deforestation are central issues for the

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<sup>7</sup> The information is derived from observations and interviews with Aliou Mbow, Lang Suwareh, Ousainou Cham, Pa Dieng, Jeff Gilleo and Kanimang Camara. See Appendix 1 table 1 for details.

<sup>8</sup> Some of the methods are found in Appendix 1, table 3.

CDD. Since deforestation is seen as a central point, the department collaborate with FD in some projects. The improved stoves were introduced by the FD together with the German organisation GTZ. The FD assigned the task to the CDD for training groups in the production of improved stoves (Mbow, interview: 20100224).

The VDC is a central tool for the departments since it is considered to be an important legal entity. The departments will only collaborate with villages if there is a VDC to target. The VDCs are supposed to participate in trainings, which are arranged by the departments, and thereafter train other villagers. Mostly, the CDD uses sensitization and trainings instead of supplying equipments.

#### **4.2.2 The Forest Department**

The forests are divided as state forest, community forest, and forest which is shared by the FD and communities. The communities must help in the shared forest. Usually communities get seeds for the shared forest, but also for the community forest as well. By working in the shared forest, villagers will learn how to take care of the community forest. The state forest is managed by the FD, but it is possible to get licences to pick fuel wood. The community forest is entirely managed by the community, where the FD is not participating except in certain cases for giving advice. The villagers must pay a license in order to utilize the state owned forest (Cham, interview: 20100218). It is worthy to stress the role of the FD in the spreading of technologies for promoting sustainable forestry. The FD defines sustainable forestry as follows:

“Continued production of goods and services for mankind, which involves recreation, goods timber, and fuel wood.” (Dieng, interview: 20100310).

This definition implies that the forest is not only considered for its intrinsic value, but also for utilization. However, it is emphasized that future generations must be able to use the forest to the same degree as the current generation.

The FD engages in educating villagers in forest management. Thinning is advocated, which means that certain trees are cut so other trees can grow freely. The FD recommends cutting down old or sick trees and a thinning rate of 25%, so there will be more sunlight and more space for healthy trees to grow thick. The FD gives seeds to communities for enrichment planting. During the dry season the FD does assessments together with villagers to find areas in need of enrichment planting. During the rain season seeds are planted. Villagers are guided and followed up by the FD. Normally, 1000 seeds are planted in a plantation. After a year it is assessed, and failed trees are replanted. Another planting

method is that 1 hectare land is divided into three sections. Each section is planted with one year interval, for a division of utilization (Dieng, interview: 20100313).

The FD advises villagers to not use controlled fires on farmland. Nevertheless, it is common to burn in order to get rid of grasshoppers and crop residues. The FD teaches villagers how to avoid wild fires while using controlled fires. Villagers are told to practice early fires, which means that controlled fires should only be used after rain season when the ground is wet. When trees are cut down it must be done slanting due to wind and heavy rain. If it is cut straight the stem will easily rot. Furthermore, the tree must be cut 20 centimetres above the ground. This means it will sprout better.

Besides training in sustainable forestry, the FD is providing seeds for villagers. Usually they give mahogany, *gmelina arborea* tree, eucalyptus and acacia *cypros* seedlings to communities. This is a mixture of fast and slow growing trees. The reason why mahogany seeds are given is that it is an indigenous tree, which can be used as timber for furniture and canoes as well as medicine. The leaves are used for traditional dance costumes. The problem is to convince villagers to use a tree, which first can be used in 10 years (medicine, leaves) or 70 years (timber). The argument is that what is used today was planted yesterday, and what is used tomorrow is planted today (Dieng, interview: 20100313). The FD has a long term perspective in their tree planting, while the communities usually have a shorter term perspective, which may cause a conflict of interest. There have been examples of failures when planting *Gmelina arborea* trees, as villagers were not interested in *gmelina arborea* trees due to a lack of understanding of their usefulness. Therefore, they left them to dry out. This shows that there is a difference between interests of the FD and the inhabitants of the communities. If villagers request something, it will usually not be a failure. But, if villagers are told to do something it will often fail.

The law enforcing role of FD ensures that the communities follow the forest regulations and if not, the FD can give fines to the communities. The dichotomous roles as law enforcing and educational can create a lack of trust from the villagers. On the one hand the FD punishes communities if they are not following regulations, and on the other they advise villagers how to improve the living condition using the forest. Dieng (interview: 20100310) argues that this law enforcing role has a learning effect in the villages. If you are fined, you change the approach of your activity. Often, villagers only regard themselves without considering future generations. They may over-exploit the forest. Therefore, it is necessary to both use law enforcing methods and sensitization. If there are no fines it may be difficult to change people's behaviour. But, if there is no sensitization and education there

will be no understanding and learning of the importance of legislation and thus it is difficult to change behaviour.

Sometimes, the departments may experience mistrust and suspicion when approaching communities since they represent the government. This may be a hindrance for the implementation of projects (Camara, interview: 201003219).

The FD seems to be aware of the problem with VDCs. Therefore, they often collaborate directly with various specialized committees. The department understood the benefits of individuals, so they have started training village promoters, who are individuals that can read and write. As these individuals are respected in the community and have a broad network, they can train other communities.

### **4.3 Case study 1: Saite Maram, Fuel wood collection<sup>9</sup>**

#### **4.3.1 Description of Saite Maram**

Saite Maram<sup>10</sup> is the only Wolof village in the neighbourhood, and most villagers do not speak other languages. Therefore, the community is relatively isolated. The villagers rely on crops such as millet, maize, groundnuts and sesame. Their main income is from fuel wood collection, which is an activity carried out by men. Since 1994 there has been a primary school in the village, which means that only recently children have access to school, thus, the level of education is relatively low. Still, many villagers cannot afford sending their children to school.

The village has a VDC, which is set up in order to create a legal channel towards institutions such as governmental departments and NGOs. The VDC started in 2006 in order to improve the condition of the village. There are no formal elections of the members of the VDC, but the villagers discuss who shall be a member. The committee sends representatives to trainings and information meetings organised by NGOs and departments. When the VDC transfers information from trainings, each family compound must send one representative.

#### **4.3.2 Fuel wood and the forest**

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<sup>9</sup>The information in this chapter is collected from group meetings (the VDC and the school committee), a narrative walk with the head of the community forest and information from the FD. See Appendix 1, Table 1.

<sup>10</sup>The size of the village and ethnic distribution can be seen in Appendix 1, table 2.



The forest surrounding Saite Maram is divided into 3 parts: the community forest, the state owned forest and the shared forest. The seeds are planted during the rainy season, (between June and September). During this period the villagers are busy planting trees in the shared forest, which is why they do not have time to plant trees in the community forest. The village holds a license to collect fuel wood from the state owned forest all year.

According to the FD, the villagers earn well on fuel wood collection. The son of the head of the village has connections in Farafenni, a bigger town 100 km west, where he sells fuel wood. This shows that there is a demand for their fuel wood in urban regions. The FD has targeted Saite Maram since 1996 concerning fuel wood collection.

The villagers have inherited an interesting practice from their forefathers. They cut down trees from the top in order to not destroy the nearby trees. Furthermore, they have learned from their grandfathers that they shall not cut down more trees than what they need for their own consumption. Besides this, I got the understanding from the interviews, that they have not much knowledge about biodiversity and the need for sustaining the forest.

#### **4.3.3 Saite Maram and the Forest Department**

The VDC could not tell much about what they have learned from the FD except from how to use controlled fires to protect the village and farmland from wild fires. The FD has mainly targeted the village concerning limitations on fuel wood collection. Yet, the members of the VDC emphasized the importance of fuel wood collection for survival and for giving their children a better living. Since there is plenty of fuel wood in the forest for the time being, the villagers have not understood the need for sustaining the forest. For instance, recently, a villager had been fined for illegal logging.

The villagers are provided with mahogany and gmelina arborea tree seeds which are planted in the shared forest. However, they cannot understand why they get these seeds. They prefer seeds they can use for utilization such as mango, cashew and oranges, which are not suitable for the area due to a dry climate, while mahogany in the long run can be used as cash crops (Dieng, interview: 20100310). The head of the community forest committee cannot recall that they have ever brought up the issue with the FD, nor with other issues they want to implement themselves, as they feel they are not in a position to bring up their own suggestions.

## **4.4 Case study 2: Kunkilling Forest Park, Forest management<sup>11</sup>**

### **4.4.1 Description of Kunkilling**

Kunkilling forest park is situated at the south bank of the river Gambia, where the FD initiated an ecotourism project in 1998. Four villages, all neighbouring Kunkilling, were targeted with this project<sup>12</sup>. Mostly, the villagers rely on rice fields and dry farmland for crops such as groundnuts, millet, and hirse. Some are fishermen and herders. The villagers have a relatively high level of education, since the villagers in Korrop for generations have sent their children to primary school. The four villages have chosen a committee to be responsible for managing the forest park in a sustainable manner. By sustainable manner they mean that a new tree must be planted every time a tree is cut down. A promoter from each of the four villages is selected to teach other village groups about sustaining forest and producing furniture from mahogany trees. Nevertheless, according to the committee, the promotion of sustainable forestry has not been successful. They have not experienced any villages adopting the idea.

### **4.4.2 The forest park**

The forest did not have bush fires for about 18 years. The villagers realized that this can explain why there are a lot of animals in the forest. The villagers realized there will be a richer biodiversity if the forest is sustained. They had first learned about the benefits of sustaining and improving the forest after visiting another forest park. The forest committee members emphasized the importance of sustaining the forest to give the same opportunities to their children. Therefore, children participate in the tree planting so the knowledge is transferred to the next generation. The FD gives mahogany, cashew tree and neem tree seeds. When they plant trees, seeds are randomly thrown in the forest. Usually, they do not practice thinning. But, if they do, they try to dig the trees up with the root and transplant it on an empty spot.

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<sup>11</sup> information in this chapter is collected from 1 group meeting with Kunkilling forest park committee and 1 narrative walk in Kunkilling forest park with the village promoter and from the FD. See Appendix 1, table 1.

<sup>12</sup> Keserr Kunda, Bukary Kunda, Korrop, Boraba. The size of the villages and ethnic distribution can be seen in Appendix 1, table 2.



**Picture 1:** Kunkilling Forest Park at the river Gambia.

The park has an environmental value with its rich bird-life, of which many birds cannot be found anywhere else. Furthermore, there are many monkeys (baboons). The forest is situated at the riverbank where there are many rhun palm trees. Before they knew about utilization of Rhun palm trees, Senegalese people picked all the leaves. Fallen leaves can be used for making fences and ropes.

The villagers have derived various benefits after adopting sustainable forestry. Since there are more trees, there is more dry wood that can be used for cooking, which means that the fuel wood behaviour has not changed.

Before the project was initiated, cattle herders cut down trees in the forest to get feedings for their animals. Today, there is an understanding that you cannot do that since it will hurt your neighbours and future generations. They have also learned how to use the forest for medical purposes. Some trees can be used for treating stomach problems while others can be used for toothache. They are careful to pick fuel wood from some of the fallen trees because there may be beehives from which they can use the honey.

#### **4.4.3 The Kunkilling villages and Forest Department**

The FD understood that it was not possible to improve the forest without the involvement of neighbouring villages, which is why these four villages are targeted. A reason to involve the villagers was that this can promote the prevention of forest fires and create awareness for improving the forest. Initially, only the FD was responsible for the forest, but no improvements took place. To initiate the project, the FD and German Gambian Forest Project brought the forest committee to Mauritania so they could observe the results of using forest in an unsustainable manner.

The villagers involved in Kunkilling have a better relationship with the FD than the villagers in Saite Maram because they have understood the benefit from the help of the

FD. The villagers benefit from the ecotourism project since visitors pay 100 dalasis (€3) for a visit and the communities get 60% of the income (40% is paid as tax to the government). Half of the income is put in the bank while the other half is used for development in the villages.

#### **4.5 Case 3: Panchang village group and Ndownen Pottery Group, Improved stoves<sup>13</sup>**

##### **4.5.1 The groups**

Ndownen Pottery Group<sup>14</sup> consists of women from the pottery caste, who traditionally belong to the slave caste. The group has existed for several years. Ndownen is a Wolof dominated village. Equal to Saite Maram, it is situated in a Mandinka dominated area. Their main product is water jars but they are divided into units, where some produce pottery, some make batik, while others produce soap. In 2008 the CDD targeted the group and provided training on improved stoves. It should be noted that the entire village was invited, but only those who were associated with the pottery caste participated in the training.

Panchang stove producer group<sup>15</sup> is a Wolof group that was established in 2007 when the CDD trained women in producing improved stoves. Representatives were trained, who returned and trained the rest of the group. They also went to neighbouring villages for teaching, but few found interest in it.

##### **4.5.2 Improved stoves**

The stove, produced by Ndownen Pottery Group, is made of clay, are collected from a riverbank 10 km from Ndownen. They hire a donkey cart and pay for each bag of clay they transport. The stoves are moveable and constructed for fuel wood, which is put into a hole on the side fit for three wood pieces. There are three different sizes so it can suit various pots. The pots are put on top of the stove so some smoke can escape from the sides<sup>16</sup>.

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<sup>13</sup>The information from this chapter is from 1 group meeting with Ndownen pottery group, 2 semi structured interviews with 2 female members from Panchang village group, and from the CDD. See Appendix 1 table 1 for details.

<sup>14</sup>The size of the village and ethnic distribution can be seen in Appendix 1, table 2.

<sup>15</sup>The size of the village and ethnic distribution can be seen in Appendix 1, table 2.

<sup>16</sup>The stoves can be seen in Picture 3.



**Picture 3:** Improved stoves produced by Ndowen Pottery Group.

Panchang Village group turned not to be successful in stove production. They were taught by the CDD to produce the stoves attached to the ground outside. The stoves were produced from clay which was collected from a lake outside the village, which means they did not have any problems in obtaining the material. Grass found in the forest was used to rub into the stove to conserve it. However, the quality of the stoves was not up to expectation, as the stoves were put outside of the users place. All produced stoves were destroyed after the second rain season. They have never produced it since. The CDD office in the area did not know about the failure, indicating that there has been a lack of follow up and communication. No descriptions of the specific stove can be found, but it is similar to the Ndowen stove and the Kenyan stove described in ch. 3 (designed by GTZ). The difference is that the Panchang stove was fixed to the ground.

Despite the failure, the members in Panchang Village Group could see benefits with improved stoves. For instance, less fuel is wood used and food is cooked faster so children can go to school earlier. Furthermore, they experienced health benefits since there is no direct smoke and there is less heat.

#### **4.5.3 Adoption of improved stoves**

Neither Saite Maram nor Kunkilling are producing improved stoves as they do not consider themselves having problems with fuel wood, suggesting that they are not motivated to adopt improved stoves. Saite Maram is an interesting case as the primary school had been targeted by the Swedish NGO Future in Our Hands to install an improved stove in 2007. Nevertheless, no one in the village has got any improved stoves. The members of the

VDC have heard about improved stoves, but the information they have obtained is limited. Although Future in Our Hand had given a stove to the school, they did not transfer the knowledge to the community. The villagers did not understand that a smaller version of the stove can be constructed. However, according to Panchang Village Group, representatives from Saite Maram VDC had participated in the training. Nevertheless, the knowledge had not been adopted. It is interesting to note that the communities dealing with Kunkilling forest park had not adopted improved stoves either. As they do not have a problem finding fuel wood, they have not experienced a need to adopt improved stoves.

Ndownen Pottery Group experiences problems selling their stoves either owing to the low rate of adoption or people are not interested in learning about it, or they find it costly to get one. They find it difficult to sensitize people about the long term benefits from improved stoves. Ndownen Pottery Group is able to target the weekly market, although there are not many buyers, so they mainly rely on water jars. The incentive given from the CDD to produce improved stoves is that they get a free place at the market.

Ndownen Pottery Group was requested by CDD to train other groups. Nevertheless, they have not experienced any groups adopting their idea and starting a production. They promote their stoves by taking them to a village and cook a lunch for the villagers. The targeted villagers are able to see the benefits. As most people are not aware of the improved stove, it is necessary to actively target the communities. Still, they experience difficulties to sell the stoves. Immobility is a problem since it is difficult to transport stoves long distances with donkey carts. The stoves can be destroyed during the transport, and it is costly to hire donkey carts and buy food and fuel wood.

The members of the group understand the benefits from improved stoves, such as that there is less risk for fires and there is more time for other activities since the cooking is faster and you do not have to guard the stove because of the risk of spreading the fire. Through discussions in the village they reached a common understanding that if they started the production they would get a better and a more sustainable living and their children would be able to go to school.

Due to immobility, they cannot do the teaching frequently, but if they come across someone who shows interest, they share their knowledge. When approaching a village they always go to the head of the village to arrange a meeting. Sometimes they target the community radio and even the national radio to inform about their products. Ndownen Pottery group have some awareness concerning the problems of collecting fuel wood. They know that if they use a traditional three-stone stove they have to collect a donkey

cart full of fuel wood every month, while if they use their improved stove it is enough to collect a donkey cart load of fuel wood every second month. Before Panchang Village Group was approached by the CDD they had a vague idea about the importance of saving fuel wood, but they did not know how to do it, and the benefits. They got this knowledge from the CDD. Initially, there was a suspicion towards improved stoves, but sensitization gave the understanding of the benefits, such as health benefits.

#### **4.6 Sum up of case studies**

To sum up, the villagers have experienced varied results in adopting information concerning new technologies and methods. Saite Maram has been targeted by the FD, but the population has not changed the utilization of the forest to a large extent. Villagers in Saite Maram have not succeeded adopting new technologies because they are benefiting from the traditional fuel wood collection. Furthermore, Saite Maram is an isolated community and most villagers have not gone to school, so they have difficulties to obtain new knowledge from information. The villages surrounding Kunkilling Forest Park have also been targeted by the FD and have changed the way they work with the forest, thus sustaining it. This is partly because they understand the benefit of changing behaviour in the forest, as Korrop has a large number of villagers that have gone to school. This may be why they have the ability to observe changes in the forest.

Ndownen Pottery Group is still producing improved stoves, but is experiencing difficulties to approach customers, due to both immobility and a lack of interest from consumers. Still, initially, they got the understanding from the CDD that they could earn money from stove production. Furthermore, they had the existing skill of pottery. Panchang did not succeed well since the production stopped and they were not taught how to change the design of the stove. This may be due to a lack of education, and inability to absorb knowledge from the information they get as well as a stove design without fitting local conditions, and a failure of follow up from the CDD. Kunkilling has not changed behaviour related to fuel wood collection and improved stoves even though they are working with forest improvements. Inhabitants in Ndownen have changed their fuel wood collection behaviour after starting production of improved stoves.

## 5. Analysis and discussion

### 5.1 Introduction

In ch. 4, it turned out that the villagers in Kunkilling Forest Park and in Ndowen Pottery Group were successful in adopting sustainable technologies, while this is not the case for the villagers in Saite Maram and in Panchang Village Group. Despite the success in the forest, Kunkilling did not change habits concerning fuel wood collection and cooking methods. They are still using the traditional way of cooking, as they are not facing fuel wood shortages. In this chapter the cases are arranged according to success with regard to criteria for adoption of new technologies and absorptive capability as defined in ch. 2.4. In table 1, the criteria for success is shown and related to the cases and probable causes. Below in this chapter the role of trainings and education for adoption and continuation of the technology is discussed.

*Table 1: The level of success in the investigated cases.*

Case	Level of success		
	Adoption and continuation	Absorptive capability	Determinants
Saite Maram	Low	Low	No education
Kunkilling forest park	High	High	High level of basic formal education
Ndowen Stove producers	High	Middle	Skilled training
Panchang Village Group	Low	Low	Unsuccessfull skilled training

In this chapter, I attempt to explain this difference in success using theory from ch. 3. According to the analytical framework for the cases (ch.3.5), the explanation of adoption of sustainable technologies emphasises the factors suggested by Rogers (1995). At the same time Roger seems to neglect the importance of absorptive capability, which, however, is included in the analysis of this thesis. In ch. 3.3, 3.4 and 3.5 additional theories concerning processes related to dissemination of sustainable forest technologies and sustainable stove technologies are discussed. These theories are related to the case studies and analysed in ch. 5.6 concerning adoption of sustainable forest technologies.

### 5.2 Absorptive Capability

Probably, absorptive capability is the most important factor for the villagers in my case study for adoption regarding sustainable technologies. As argued in the theoretical



section a high level of absorptive capability is important for adoption of new technologies (Fagerberg, 2003).

Since Saite Maram only has had a primary school since 1994 the level of education is low. Another indicator of lack of education is that no one speaks English in the village. The low level of education creates a low level of absorptive capability, which is one reason why the villagers may get information but may not be able to transfer the information into useful knowledge that can be used in practice.

However, no one has attended primary school in Ndowen, which disproves the theory of absorptive capability. The group members could adopt improved stoves more willingly than Saite Maram, because the members did not benefit from business as usual, while villagers in Saite Maram earn from selling fuel wood. They were in a poor condition and understood that they could benefit from starting to produce stoves. They already had some pre-knowledge which made it easier for them to adopt the idea. In other words they did not have much to lose in trying the innovation. Through training they got the understanding that they would benefit from learning about the innovation so they could adopt the idea easily. This suits Lundvall's theory that the adoption of an innovation is essential to be able to survive (Lundvall, 2007). However, the behaviour is not very innovative since they did not come up with the idea themselves, but adopted the idea after training from the CDD.

Conversely, Kunkilling has absorptive capability since the level of education is higher. The importance of education for absorptive capability was confirmed from interviews with visitors at a local market place. Of seven respondents, only three answered that they had adopted new ideas at the market place, which improved their livelihood<sup>17</sup>. The reason may be that some lack the ability to transfer information into useful knowledge (absorptive capability). Among the respondents that had adopted ideas, one was an English speaking businessman, who successfully conducted business at market places. The other two respondents were local craftsmen producing forest products. They had learned their skills from NGOs. Those respondents, who had not adopted knowledge were uneducated women who sold vegetables from their own garden.

If villages are connected there is also a higher chance that a village without educated people can benefit from absorptive capability. If there is one village with educated people, their capability can also be used by the other villages. Moreover, local learning is influenced by the level of absorptive capability. One example can be given from Saite Maram.

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<sup>17</sup> Answering sheet is found in Appendix 2.

This example shows that the village may achieve information but is not able to transfer it into useful knowledge. They experience soil degradation on their farmland, but they do not connect it to the controlled fires they use to get rid of plant residues.

### **5.3 Communication channels for information about innovations**

Communication channels, as discussed by Roger (1995), are crucial in the user-producer relationship (see ch. 3.2). Producers need channels such as mass media or interpersonal relationships to spread their technology.

According to Lundvall (2007) the user-producer relationship is essential for the diffusion and adoption of new technologies. It is expected that these relations can be created at local market places, but during the interviews no one could confirm this except for Kunkilling Forest Park Committee. This even counts to Ndownen pottery group, which had a free place at the market. They have never done observations or learned about new technologies. No one is interested in sharing ideas since everyone is only concerned with money. The exception is members of Kunkilling Forest Committee, who emphasize the importance of local market places for learning.

Lundvall's discussion on supplier-user relationship is also interesting in relation to Ndownen. According to Lundvall, this relationship is an important factor in the adoption process and spread of innovations (Fagerberg, 2003). Ndownen pottery group shows how relevant Roger's (1995) factor 2) is for adoption. This group has problems with interpersonal relationships due to a lack of interest from neighbours. While the group informs communities other than those given by the CDD, they experience difficulties transferring their knowledge due to immobility. This means that it is difficult to achieve successful adoption by only talking about the technology. It is necessary to demonstrate and show how it works so the targeted people will see the benefits with their own eyes. Since they must transport the stoves they cannot spread the information other than to neighbours. They are also using radio for spreading information. According to the Peace Corps, radio is an effective tool for community groups to spread information, as radio is found in most villages. But it is questionable for the diffusion of innovations due to a general lack of capability to transform information into useful knowledge (Peace Corps, interview: 20100317). The radio can reach out to remote communities in the area, but Ndownen pottery group did not experience much response after being in the radio.

Dieng (interview: 20100310) discussed how to approach the communities about information concerning deforestation. It is not helpful to use arguments such as that Sahara is

getting closer, and that there is a risk of desertification. It is better to use arguments which relate to the everyday life. This can be that the grandparents only had to go outside the compound to pick fuel wood, while their parents had to walk a longer distance. They, themselves, have to use donkey carts, from this, one can infer that their children may need to use cars.

As argued in ch. 3, if local learning is lacking, adoption will not take place (Hall, 2003). This argument can be used to explain the failure of Saite Maram. Mostly, the VDC members are the ones taking part in education and sensitization meetings. As described in ch. 4.1 most information is not transferred to the rest of the village as seen in the case of the improved stove education they had participated in. One possible reason is that the VDC may not consist of members that are interested in transferring knowledge, but they are only members of the committee because of political or religious reasons (the son of the imam or the son of the head of the village) (Camara, interview: 20100319).

The above discussion shows that targeting VDCs may be ineffective to bring benefit to the entire community. According to Gilleo (interview: 20100304), the Peace Corps has changed approach and now go to the farmland to look for individuals that are actually working there. When other people see the success they may adopt the idea. Camara (interview: 20100319) argues it is important to work with village promoters, who are individuals with dedication and an ability to teach. In Kunkilling the FD is working with village promoters. Gilleo and Camara shared same criteria for village promoters: ability to read, broad network, well respected in the community, reliable and semi-local (also a root outside the village).

In ch. 3.2 various criteria for success and failures are brought up, which can be factors related to monitoring and evaluation, local participation, and considerations of the local condition and culture. Panchang did not succeed in the production of improved stoves. Even though the members of Panchang Village Group had heard about the improved stoves before, they had never investigated and adopted the idea. They first started to use the technology when CDD approached them with training. As the stove did not suit the local conditions causing destruction from rain, the adoption failed. Agarwal (1983) discusses how stoves must be constructed and tested in the local context. Both stove producer groups (Female member of Panchang stove producer group, interview: 20100227; Ndowen pottery group, interview: 20100310) and Mbow (interview: 20100224) mentioned the fact that it is difficult to use improved stoves for steaming rice, which is a preferred dish. Therefore,

women hesitate to use them. The stoves may have been tested in the Gambia, but these factors indicate that local habits have been disregarded.

## **5.4 The nature of the social system**

As discussed in ch. 3.3, interpersonal relations and communication channels as well as social systems are crucial for adoptions of new technologies (Roger, 1995). In the Gambian context information and knowledge is not easily spread among people or communities. After talking to members of the Peace Corps (interview: 20100317) and from observations from informal discussions with informants it is possible to say that it is not common in the Gambia to share your knowledge with other people due to fear of competition. One comment is that knowledge is a secret that you must pay for. This means that you either must give gifts or you must work for the person having the knowledge. Gilleo (interview: 20100304) sees jealousy as a hindrance for the spread of technologies. If you see someone doing something that improve the situation you will either go home and talk bad about the person or try to do better.

As discussed in ch. 3.2 it is uncommon to share knowledge between castes, since skills are strictly kept within the caste (Tamari, 1991). Ndowen Pottery Group is an example where the pottery knowledge stays within the caste, partly because no one outside the caste is interested in the pottery skill. Most respondents said that they share knowledge within the family or with neighbours, but Gilleo disagreed (interview: 20100304). If you have a conflict concerning land ownership with your neighbour you will not share information. In the Gambia, polygamy is common, which causes extended families. Often, this causes conflicts between children of various wives.

In the Gambian context it is not possible to find National Innovation Systems, like linkages between universities, firms and government. However, in this thesis local connections between villages are found advantageous for dissemination of knowledge (see ch. 3.2). Saite Maram is a counter example. This may be due to the isolated Wolof community in a region dominated by Mandinka, suggesting that communication to neighbourhoods is low, which is also considered to be an important aspect in the spread of innovations. However, Ndowen is also a Wolof village in a Mandinka dominated area. Despite such isolation Ndowen pottery group does better than Saite Maram, With regard to Panchang village group, none of the interviewees told that they had learned new methods or got ideas from people outside their own community. They only talk about such issues with relatives or neighbours.

According to my findings, the four villages around Kunkilling do not seem to have a broader network compared to other communities. However, compared to Saite Maram they are not isolated since they share the same language as neighbouring communities. Furthermore, with four communities joining together they share experiences and learn from each other since they have shared goals and aims. Through this they may understand the benefits of learning from each other. The success can be attributed to the level of education in Korrop, so they managed to adopt the knowledge while others did not. Basic formal education, experience in Mauritania and experience from the positive results of forest management are crucial factors. Most importantly, the community members can benefit and earn money from changes towards new and sustainably improved technologies.

## **5.5 Government – local community interaction**

In ch. 3.2 the role of extension workers is discussed. This can be related to Roger's (1995) factor 1 (see ch. 3.2) in which decision depends on whether it is taken collectively, individually or by central authorities. Agarwal (1983) argues that extension workers have an important role in the adoption process of new technologies since they are responsible for insemination of the idea, the training and level of information. This may be a problem in the Gambia since there is often mistrust towards the government. Cham (interview: 20100301) told that villagers in Saite Maram were not happy about being in contact with the department. The FD is an interesting case since they have two roles in relation to communities. Firstly, the department has a law enforcing role, which means that villagers have to pay tax to them and fines if illegal logging is discovered. At the same time they are educating communities how to improve their living. Camara (interview: 20100319) argues that this may be a hindrance and a way of losing trust. One day they fine the community and the next day they give ideas for improvement. However, according to Dieng (interview: 20100310), the law enforcing role is necessary if villagers shall understand the necessity of following regulations. Furthermore, if someone is fined, this individual will know it is wrong and probably change approach (Dieng, interview: 20100310). The villagers in Saite Maram had never brought up their own ideas or wishes to the FD because they thought the department is an authority possessing the true knowledge (Head of Community Forest, Saite Maram, interview: 20100313).

Khalikane (1997), discusses the inefficiency of guards in forests since they will not stop exploitation of the forest. The FD came to the same understanding, which is why the local community is involved. This proved to be a success in Kunkilling Forest Park. This can

be related to Roger's (1995) factor 1) on adoption of new technologies (ch. 3.2), where it is argued that it is crucial whether the decisions are made by individuals, collectively or by a central authority. The FD understood that decisions must be made collectively instead of by a central authority in order to be effective.

The CDD aims to work close with communities and listen to their needs. They use various methods to elucidate local needs. However, the experience from Panchang shows that there can be problems with communication and the follow up. This links to the approach from the institutional level. Even though the aim is a bottom up approach it does not work as expected in all cases. Since the production stopped, the bottom up approach in this case may not have been successful. The understanding from the group may not have been properly analysed. In order to relate this to Roger's (1995) factor 1), the decisions have been made from a central authority without collective involvement.

## **5.6 Adoption of sustainable forest technologies**

In ch. 3.3, processes related to two aspects of sustainable forestry are discussed: sustainable forest technology dissemination (including fuel wood collection behaviour) and improved stove technology dissemination. In this section Saite Maram and Kunkilling forest park are related to these processes. Saite Maram is considered less successful, while Kunkilling a relatively successful case<sup>18</sup>. In Saite Maram, sustainable forestry is not observed apart from the practice of controlled fires. This can be linked to the wood fuel gap theory (Maconachie, 2009). The urban populations and their demand for fuel wood are increasing, creating deforestation around urban regions (Cham, interview: 20100301). The villagers in Saite Maram experience that people come from urban regions far away in order to buy fuel wood. Despite this, there is plenty of fuel wood in the forest surrounding Saite Maram. As long as it is possible to satisfy the urban demand for fuel wood, people in Saite Maram have no incentive to adopt sustainable forest practices.

The villagers around Kunkilling improve the forest and utilize it for their livelihood. This goes in line with the literature, which emphasizes the need of sustaining the ecosystem, in order to give future generations the same possibility to utilize the forest (Franklin, J, 1993). Initially, my presumption of sustainable forestry was that it would not be possible to collect firewood, but the project in Kunkilling suggests a different case. Firstly, they have plenty of other areas they can collect from and secondly, since there are more trees,

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<sup>18</sup> See table 1.

there will also be more dry wood, which can be used as fuel wood. Therefore, it can be argued that this is not a sustainable behaviour. Since dead wood is collected, it will not decay and turn into humus, which is important for trees and the soil (Miller, 2007).

The four villages connected to Kunkilling Forest Park have been able to adopt a new way of working, which can improve their livelihood and sustain the forest. What is interesting in this case, is that the knowledge occurred through experience and observation of improvements in the forests due to lack of forest fires, and observations of other similar projects. In Korrop children are sent to school, resulting in a certain level of education among the villagers in Kunkilling, which implies that the villagers involved in Kunkilling Forest Park have a higher level of absorptive capability than Saite Maram. Kunkilling Forest Park correspond with literature on sustainable forestry since the committee members are aware of the need for biodiversity both as an intrinsic value, but also that they and their children must be able to utilize the forest to the same degree. The villagers have learned that they can use the forest for building materials and medicine, while maintaining the wildlife habitat (*see ch. 3.3*).

## **6. Conclusion**

### **6.1 Conclusions with regard to the research questions**

The thesis focuses on adoptions of sustainable technologies that improve and restore forests in a Gambian context. Therefore, three case studies are conducted. The first is a study of a village (Saite Maram), which deals with fuel wood collection; the second case is forestry in which a forest park involving four villages is investigated (Kunkilling Forest Park); the third case is improved stoves, where two stove producer groups are investigated (Ndowen Pottery Group, Panchang Village Group). I am looking at technologies affecting the forest directly and technologies affecting the forest indirectly, which in this study are improved stoves.

In order to answer the main research question, the most important factor driving local adoptions of innovations related to forestry is that the adopters must realise they can earn a living from utilizing the forest sustainably. Absorptive capability through formal basic education is crucial to be able to observe new technologies and methods and to learn from information coming from outside the village. Therefore, local learning is central. Concerning technologies affecting forests indirectly (improved stoves), it is equally important with absorptive capability for adoption. The user-producer relationship is crucial if improved stoves are to be spread. If there is immobility or no contact between users and producers, or if the users are not interested or informed, the spread of improved stoves is hindered.

The villagers in Saite Maram have not adopted new technologies in forestry since they do not have a high level of absorptive capability due to low educational level and that the village is an isolated Wolof community. Kunkilling forest park succeeded because the villagers have a higher degree of absorptive capability and more efficient local learning due to a higher level of education, as well as the fact that several communities are joining together. They were able to observe a higher level of biodiversity in the forest and its benefits. The members of Panchang village group have a low level of absorptive capability and local learning since there is a low level of education among the members implying that they are unable to transfer observations into knowledge. Another reason for the failure in Panchang is insufficient follow up from the CDD. Members of Ndowen pottery group may not have a high level of absorptive capability, but they had the pottery skills from before and they did not lose anything trying the new technology. However, they experienced problems in spreading the stoves, as potential users did not show interest.



It is vital to regard the local context to make sure stoves fit the local use, which renders it necessary to decentralize responsibilities for innovations from governmental institutions to the rural people. However, there must also be a follow up from FD and CDD, meaning that there are limitations on the possibilities to decentralize.

Initially, I focus on formal village groups and associations, but in the Gambia they are not always working well. After listening to NGOs such as Peace Corps and NACO Gambia, I found individual dedicated individuals with a broad network and who are respected in the community are more relevant and efficient to involve than formal village groups. Gilleo (interview: 20100304) argue that it is better to go out to the field and see who is actively working. It is concluded that to a large extent it is not beneficial to decentralize to formal village groups, but to dedicated individuals. Due to limitations on decentralization, NGOs play a crucial role. For instance, they identify dedicated individuals by requiring them to contribute a part of the funding or equipment. The dedicated individual can link up with people who are equally dedicated, which may lead to a more successful adoption. It is possible to use the term socially responsible entrepreneur, by which it is meant that it is an entrepreneur who is not only interested in his/her own development, but also in spreading the knowledge to other people who can adopt the practice.

With regard to the importance of formal village organisations compared to individuals, the village groups investigated in this study were not efficient channels for local learning. Knowledge from trainings, initiated by FD and CDD, is to a large degree staying within the group without being spread. The exception is Kunkilling Forest Park, which had the understanding of the benefits of sustainable technologies and thus the knowledge is spread through dedicated village promoters. Formal village groups may be a hindrance for adoption since they often consist of members, who are not interested in the wellbeing of the village but have their own interests. In Saite Maram the VDC has taken part in improved stove trainings, but the village did not benefit. This is why village promoters or socially responsible entrepreneurs may be more relevant to target. These individuals have a broad network, are dedicated, and respected in the community.

As discussed in ch. 3.2, ethnicity can play a crucial role in the local learning since the ethnicity of a village can create isolation if the ethnic group is the only one in the area. Saite Maram is isolated since they cannot communicate with neighbours due to language barriers. Ndownen is also a Wolof community in a Mandinka dominated area, but is not isolated since there are other Wolof villages in the neighbourhood. Panchang is a Wolof

village in a Wolof dominated area, while all the villages around Kunkilling are Mandinka and Fula, so they can communicate.

Caste is vital in the Gambian context. Each caste is involved in specific labour, so it may be relevant to know which caste to target for specific purposes. In the case of improved stoves, pottery groups are crucial since they already have the knowledge. Ndowen Pottery Group is an example of a group which belongs to the pottery caste. They already had a pre-knowledge and could easily adopt the new stove. The members of Panchang Village Group do not belong to the pottery caste and do not have the knowledge of clay.

With regard to the influence of improved stoves on forestry, it is often considered that fuel wood collection is causing deforestation. However, new research indicates that extension of farmland is more important and fuel wood collection has limited influence (Naughton-Treves et al, 2002). Nevertheless, in the Gambian context it is evident that fuel wood collection plays a role since fuel wood is the most common biomass used and the country is densely populated. The example in Ndowen shows that the fuel wood collection habit is changed when improved stoves are used. However, it is not possible to determine the impact on the environment since the adoption of new stoves is low. Kunkilling shows that the adoption of sustainable forestry does not ensure a change in fuel wood collection behaviour.

With regard to sustainable forestry, the adoption of sustainable technologies helps decreasing deforestation. Adoptions depend on an understanding of economic benefits of increased biodiversity in the forest. In Saite Maram the forest is not used in a sustainable manner due to a lack of understanding and to incomes from unsustainable fuel wood collection. Kunkilling has adopted sustainable technologies in forestry as they have observed the importance of biodiversity and they understand that they can utilize the forest more efficiently and earn an income from it. Kunkilling is considered a successful case in this study, but since there is no adoption of improved stoves, more can be done to adopt a sustainable behaviour in the forest.

## **6.1 Conclusion with regard to the field work process**

Since there is not much research conducted related to the spread and adoption of sustainable technologies in the Gambia, it is not possible to be fully prepared for what to find. This is why an exploratory approach has been chosen for this study. It is possible to open up new doors during the field study. Initially, theories on West Africa indicated the relevance of networks. But, when approaching the field, it turned out that networks were not relevant in the Gambian context, which is why the focus turned to adoption of sustainable technologies.

Initially, I did not have direct contacts to the communities, which is why governmental institutions were contacted and used for snowball sampling. It was considered to be an appropriate gate into the local communities due to a broad overview and knowledge about communities. The government officials were helpful and willing to give information and help accessing communities. However, during the field study problems were encountered when approaching the villages. The interviewed groups and individuals were often not willing to share information. As mentioned in the thesis, there may be suspicions towards government authorities, and the interviewees may believe that I report the answers to the government. This indicates that other people such as NGO staff or local people could have been more beneficial for snowball sampling. Another hindrance for understanding the groups and communities is that I did not understand the languages and needed an interpreter. Important points may be missed in the translation. However, since the interpreter followed the entire process, and I discussed the project both before and after interviews, the interpreter was well aware of what was relevant and important in the interviews. Furthermore, the interpreter introduced the purpose of the study in a way that was proper in the specific cultural context. This could for example be that the meetings started with prayers. Before interviews, the approach and local habits was discussed so both I, as a researcher, and the interpreter were prepared to approach the communities appropriately. It proved beneficial being with a local interpreter. But, he was often not known in the targeted villages, which may have reduced the level of trust from the interviewees. However, the interpreter had grown up in rural Gambia, so he knew how to approach people with a respectful manner.

When talking to people it was important to show that I respected their way of living and thinking. I did not wish to come to the communities to show what is right and wrong; I listened to them. However, I could give advice in a spirit of sharing ideas, so the interviewed people also benefit from my visit.

The narrative walk was a good complimentary method in this study since it gave an open and interesting dialogue. In Saite Maram it was possible to have a discussion, where both I and head of the Community Forest Committee learned from one another and share ideas. Since the head also learned something, he was willing to give information. I, as a researcher, was able to show interest and curiosity in their working methods.

In some cases women were interviewed. Being a white male interviewer and a Gambian male interpreter can have created a situation where the women felt insecure and therefore not willing to tell openly about their situation. Relevant information might have been left out. This is why a gender discussion is not brought up in this thesis. If I as a male

researcher bring up sensitive gender related questions, the women may not tell anything and close even more. A situation where women would refuse to participate could occur. This situation is obvious since the women might be suspicious towards the local male interpreter, who is from the same culture and region.

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<sup>19</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>20</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>21</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>22</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>23</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>24</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>25</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>26</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>27</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>28</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>29</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>30</sup> See appendix 1 table 1 for a detailed description of the interviews.

<sup>31</sup> See appendix 1 table 1 for a detailed description of the interviews.

## Appendixes

### Appendix 1: Tables

**Table 1: Interviews according to method**

Types of Method	Number of interviews	Interviews
Semi structured interviews	7	<ol style="list-style-type: none"> <li>1. Female member of Pachang Village Group (27/2 2010), 1 interviewee</li> <li>2. Female member of Panchang Village Group (27/2 2010), 1 interviewee</li> <li>3. Aliou Mbow from Community Development Department, Kuntaur, snowball sampling (24/2 2010, 8/3, 2010), 1 interviewee</li> <li>4. Lang Suwareh, Community Development Department, Brikama (19/2 2010), 1 interviewee</li> <li>5. Ousainou Cham, Forest Department, Brikama snowball sampling (18/2, 1/3 2010, 21/3 2010), 1 interviewee</li> <li>6. Pa Dieng, Forest revenue collector, Yorebelli Kunda forest camp, Kunkilling, the Forest Department(7/3, 13/3 2010), 1 interviewee</li> <li>7. Jeff Gilleo, Peace Corps, snowball sampling (4/3 2010), 1 interviewee</li> </ol>
Structured interviews	7	1-7. Wassu Lumu (market), visitors (22/2 2010, 8/3 2010, 1 interviewee in each interview.
Unstructured interviews	4	<ol style="list-style-type: none"> <li>1. Kanimang Camara, NACO Gambia snowball sampling (19/3 2010), 1 interviewee</li> <li>2. Pa Dieng, Forest revenue collector, Yorebelli Kunda forest camp, Kunkilling, the forest department. (5/3 2010-14/3 2010), 1 interviewee</li> <li>3. Peace Corps, 4 participants, (17/3 2010)</li> </ol>
Narrative walks	2	<ol style="list-style-type: none"> <li>1. Village promoter for Kunkilling Forest Park Committee (14/3 2010)</li> <li>2. Head of Community Forest, Saite Maram (13/3 2010)</li> </ol>
Group meetings	4	<ol style="list-style-type: none"> <li>1. Kunkilling Forest Park Committee (12/3 2010), 8 interviewees</li> <li>2. Ndownen pottery group, Ndownen (10/3 2010), 15 interviewees.</li> <li>3. Village Development Committee, Saite Maram (23/1 2010), 4 interviewees.</li> <li>4. School Committee, Saite Maram (23/1 2010), 10 interviewees.</li> </ol>



**Table 2: Population Size of villages and distribution of ethnic groups.**

	<b>Saite Maram</b>	<b>Keserr Kunda</b>	<b>Korrop</b>	<b>Boraba</b>	<b>Bukary Kunda</b>	<b>Ndownen</b>	<b>Panchang</b>
Mandinka	2	23	-----	339	25	132	15
Wolof	195	-----	-----	4	-----	12	410
Fula	41	75	102	44	-----	-----	254
Other	9	3	-----	3	-----	-----	33
<b>Total</b>	<b>247</b>	<b>101</b>	<b>102</b>	<b>390</b>	<b>25</b>	<b>144</b>	<b>712</b>

Source: 2003 Census, S05, Gambia bureau of Statistics

**Table 3: Description of Methods used by CDD when targeting communities.**

<b>Name of Methods</b>	<b>Description</b>
Participatory decision method	Group meetings are held with participating groups so they can take part in the decision process.
Problem identification analysis	There is a deep investigation of the community to identify what problem are found in the community
Focus groups	Individuals from the relevant community is chosen to take part in the identification of problems
Trans-active walk	Walk through the village or farmland, so the persons in question can show their daily activities
Village mapping	Extension staff draw a map on the ground with villagers in order to find central places in the village.

Source: Aliou Mbow, CDD, Kuntaur, Central River Division.

**Table 4: Criteria for sustainable forestry according to FAO.**

<b>Criteria for sustainable forestry</b>
Level of forest resources
Biodiversity
Health and vitality in forest
Resources in forest and productive functions
Forest resources and its protective functions
Socioeconomic functions
Institutional, policy and legal framework.

(Castañeda, F, 2001)

## Appendix 2: Questions and Answers from Wassu Market

Question	Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
1) Sex	male	Male	woman	Male	Woman	Male	Male
2) Age	49	35	60	50	35	60	50
3) Ethnicity	Fula	Fula	Mandinka	Mandinka	Fula	Fula	Fula
4) Which village are you from?	Maccurlessy	Dokeh,	Wassu	Farafenni	Pilang Mandinka	Ndokeh allah	Palang
5) What is your occupation/daily activity?	Farming, bamboo stick production for furniture.	Farming and Bamboo production.	Sells at Lumu, working at home, rice fields, village garden.	1) Business	Household, gardening	Bamboo beds	Producing mortars from wood
6) What is the main reason for you to visit the lumu?	Selling beds	sell bamboo products	Sell at the Lumu in order to improve the condition of the family.	Sell better. Lot of people come	Sell potato	Bamboo production	rice, food
7) How often do you visit the lumu?		Every week	Every week	weekly	Every week	Sometimes he does not visit.	Every week
8) What have you sold?	Bamboo bed	Bamboo beds	Cabbage, tomato, onion from own garden.	Onion, potato, garlic, jumbo	Potato	Bamboo beds	Mortar, local hoes from wood, cow tools.
9) What have you bought?	nothing	Food for cooking	jumbo, onion, household products.	Buy charcoal and firewood in order to sell in Farafenni	Nothing	household products	Clothes, food
10) Have you exchanged ideas at the lumu?	no	no	It is possible but cannot recall. Has not seen anything that improve her condition	When see something new and good he tries to convince the youth.	No	When he comes he sometimes see new interesting products	The only improvement from the lumu is food. A different mortar and copied the idea after testing it.
11) Can you give a concrete example of a new method or technology you have learned at the lumu and adopted?	no	no	No	Charcoal is more economic than firewood. understanding behind people's behaviour, how they cheat and lie. The lumu can create awareness within villages. People achieve awareness and knowledge about healthiness and the importance of cleanliness	No lessons	A new cupboard	He has also adopted the idea of making small wooden black boards.

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				because there are certain roles you must follow in order to sell at the lumu. In Farafenni, they learned that it is not good to have the lumu in the center because it will create criminality and prostitution.			
<b>12) Why are you consulting the forest department?</b>	Renew the license for cutting bamboo sticks.	concerning forestry.	----- --	-----	-----	Collect a form for license for bamboo utilization	He does not want to break the roles from Forest Department since he tries to avoid destroying the forest.
<b>13) Have you been in touch with the forestry department before?</b>	Rohey got an assistant who sometimes come to the village in order to give advices.	Meeting with Forest Department before starting with bamboo production in order to learn about laws	----- --	-----	-----	In touch many times	2 years
<b>14) Would you have consulted authorities despite they were not at the Lumu?</b>	Time to time he discuss how to go about with his work. He is happy with advice from the Forest Department.	Yes	----- ----	-----	-----	Would be in touch with forest department	Yes, pay fees. He would still be going to Kuntaur.
<b>15) How did you get information about the forest department for the first time?</b>	They are working with the forest department, which employ them to take care of the forest.	The Forest Department approached them in the village.	----- ----	-----	-----	They approached him.	They are always in touch and give ideas.
<b>16) Why is it important to still keep in touch with the</b>	Only to pay licence	For information.	----- -	-----	-----	Sometimes he gets information from the	They teach how to transplant trees, avoid

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<b>forest department?</b>						Forest Department. Since he started with bamboo he has been in touch with Forest Department.	bush fires. adopt the idea.
<b>17) Are you satisfied with the information you got?</b>	yes	They are happy about what the Forest Department tell them because it usually can benefit them tomorrow.	----- ----	-----	-----	He has got knowledge from the Germans how to plant trees. For example how to clear area rain season in order to avoid bush fires.	Satisfied
<b>18) Have you talked with other people about this thing? In that case who?</b>	Sometimes he discuss with people for getting new ideas. Usually he discusses with relatives.	Yes, from same occupation	----- ----	-----	-----	When the trees are matured they cut down and sell. The money goes to the village. They keep the trees under and cut down the mature trees.	
<b>20) Have the forest department told you something you find necessary?</b>		Yes, how to maintain forest	-----	-----	-----	Yes	Taught how to avoid bush fires.
<b>21) Are you happy about the way the forest department approach you?</b>	Happy	Happy, since taught something that benefit them.	----- ----	-----	-----	whom he assist and gets assistance from.	Yes
<b>22) What could they have done otherwise?</b>	---	Could initiate more and give more accessibility to improvements.	-----	-----	-----		Don't know
<b>23) In your daily life and</b>	Relatives	Coordinator in Action Aid gave	Relatives	-----	-----	kaafoo, people	

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<p><b>work, can you mention 3 people and 3 institutions (departments, NGOs) you are in regular contact to?</b></p>		<p>processing machines, seeds fertilizers and capacity building and horticulture education.</p>				<p>around, but work is not easy and many are not patient to wait. He always starts to inform some people, usually friends. The only reason people go out is if they see it benefit immediately . The people from which he gives and get advice are not common. However, he has a friend in NDOkeh</p>	
<p><b>24) Who are the most important for you to consult when you are trying to improve the condition for you and your family?</b></p>	<p>He is a member of a kaafoo where they assist each other both financially and if they need to sort out a problem.</p>	<p>the wife kaafoo</p>	<p>Kaafoo, husband</p>	<p>-----</p>	<p>-----</p>		<p>It is important to tell strangers about achieved information.</p>
<p><b>26) When you last had an improvement, who were the most important people and institutions you were in touch with?</b></p>	<p>CDDP that help villages to have wells and milling machines.</p>	<p>The last improvement came from Action aid through the kaafoo.</p>	<p>Cannot remember</p>	<p>-----</p>	<p>-----</p>	<p>He once had sensitization from agriculture concerning Poultry.</p>	
<p><b>27) Did you transfer the knowledge you got from this improvement to other people? Who?</b></p>	<p>If they see someone not maintaining the forest, they must inform each other about it.</p>	<p>People are taught through the kaafoo.</p>	<p>Cannot remember</p>	<p>-----</p>	<p>-----</p>	<p>When he visited Fulado he had some friends who adopted the poultry method.</p>	<p>Would go to the bush and show method. Often people</p>

## Appendix 3: Questionnaire to stove producers

- 1) Can you tell me the background of the stove project?
  - a) When was it established?
  - b) Why was it established?
  - c) What is the difference in the village after the implementation of the improved stoves compared to before it was implemented?
  
- 2) Can you tell me about the improved stove project?
  - a) When was the project initiated?
  - b) Who initiated the project?
  - c) How did the initiators approach the village?
  - d) What is the difference in the village now compared to before the project?
  - e) What is better?
  - f) What is worse?
  - g) What are the advantages with improved stoves?
  - h) What are the disadvantages with improved stoves?
  - i) What are the social differences?
  - j) Have you experienced any environmental (reforestation) and health differences?
  - k) What is the most important change?
  
- 3) What was the problems with the old method
  - a) Did you know about the saving of firewood before the project was initiated?
  - b) Which methods are the most important you are using?
  - c) Which technologies are the most important you are using?
  - d) What are the main things you learned during the project?
  - e) How do you work with improved stoves?
  - f) What have you learned about sustainable cooking methods?
  - g) What have you learned about fuelwood collection?
  - h) What role do you think the normal stoves play in deforestation?
  - i) What role do you think the improved stoves play in restoration of the forest?

- 4) Can you tell about how you spread your knowledge to other communities?
  - a) Who are your costumers?
  - b) How do you approach your costumers?
  - c) How come some communities have adopted the adopted stoves and some have not, such as Saite Maram?
  - d) How could you approach them better?
  - e) What can you do to approach them and have them to use the stoves?
  - f) Who have you informed about improved stoves?
  - g) Who do you receive the most valuable information from?
  - h) Which people, groups and NGOs are involved in the education and production of improved stoves?
  - i) Which of these do you consider being the most important for you (rank them)?
  - j) How do you consider which people are the most important to contact, when you want to receive new information?
  - k) How do you consider which people are the most important to contact when you want to spread your knowledge about forestry and improved stoves?
  
- 5) Can you tell me about what the lumu means for you?
  - a) Do you go to the Lumu every week?
  - b) Does the Lumu mean anything for your understanding of new technologies?
  - c) Have you learned important things about the improved stoves while being at the lumu?
  - d) Have you told other people about improved stoves at the lumu?
  - e) Have you yourself learned about other sustainable technologies at the Lumu, that you now have adopted or thinking about to adopt?

Conduct a time line mapping

Conduct a social mapping

Conduct a village mapping

## Appendix 4: Questionnaire to the committee of Kunkilling Forest Park

- 6) Can you tell me the background of the committee?
  - a) When was it established?
  - b) Why was it established?
  - c) What is the difference in the village after the establishment of the committee compared to before it was established?
  - d) How do you choose the members of this committee?
  
- 7) Can you tell me about the forest park?
  - a) When was the project initiated?
  - b) Who initiated the project?
  - c) How did the initiators approach the village?
  - d) How did you get the understanding of that you need to sustain the forest?
  - e) What is the difference in the village now compared to before the project?
  - f) What is better?
  - g) What is worse?
  - h) What are the advantages with sustaining the forest?
  - i) What are the disadvantages with sustaining the forest and not utilize it?
  - j) What are the social differences?
  - k) Have you experienced any environmental differences?
  - l) What is the most important change?
  - m) Can you tell what tourism means to sustain the forest
  - n) Is there a conflict between tourism and fuelwood collection
  - o) Do you use the forest to something else than tourism, such as fruits and nuts?
  - p) Do you allow animals to graze in the forest?
  - q) Why?
  
- 8) Can you explain to me how your understanding of the forest changed after the forest project was initiated and how the use of the forest changed?
  - a) Why did you change
  - b) From where did you get information that made you change
  - c) Did you know about the importance of sustaining the forest before the project was initiated?
  - d) Which methods are the most important you are using?
  - e) Which technologies are the most important you are using?
  - f) Which methods are different today from before the project?
  - g) Which methods did you abandon after the forest project was initiated?
  - h) What are the main things you learned during the project?
  - i) How do you work with the forest?
  - j) What have you learned about forestry?
  - k) What have you learned about fuelwood collection?



- 9) Can you tell about how you spread your knowledge to other communities?
  - a) From who and how do you receive the most valuable information?
  - b) Who have you informed about your methods in forestry?
  - c) Which people, groups and NGOs are involved in the forestry?
  - d) Which of these do you consider being the most important for you (rank them)?
  - e) How do you consider which people are the most important to contact, when you want to receive new information?
  - f) How do you consider which people are the most important to contact when you want to spread your knowledge about forestry and improved stoves?

Social mapping, and timeline mapping (to understand the procedure of events).

## **Appendix 5: Questions to the Village development Committee, Saite Maram.**

- 10) Can you tell me the background of the committee?
- When was it established?
  - Why was it established?
  - What is the difference in the village after the establishment of the committee compared to before it was established?
  - How do you choose the members of this committee?
- 11) Can you tell me about the forest and fuel wood collection?
- When was the project initiated?
  - Who initiated the project?
  - How did the initiators approach the village?
  - What is the difference in the village now compared to before the project?
  - What is better?
  - What is worse?
  - What are the advantages with improved stoves?
  - What are the disadvantages with improved stoves?
  - What are the social differences?
  - Have you experienced any environmental differences?
  - What is the most important change?
- 12) What was the problems with the old method
- Did you know about forestry and the saving of firewood before the project was initiated?
  - Which methods are the most important you are using?
  - Which technologies are the most important you are using?
  - What are the main things you learned during the project?
  - How do you work with the forest?
  - What have you learned about forestry?
  - What have you learned about fuelwood collection?
  - What role do you think the normal stoves play in deforestation?
  - What role do you think the improved stoves play in restoration of the forest?
- 13) Can you tell about how you spread your knowledge to other communities?
- Who do you receive the most valuable information from?
  - Who have you informed about improved stoves and about forestry?
  - Which people, groups and NGOs are involved in the forestry?
  - Which of these do you consider being the most important for you (rank them)?
  - How do you consider which people are the most important to contact, when you want to receive new information?
  - How do you consider which people are the most important to contact when you want to spread your knowledge about forestry and improved stoves?

Social mapping, and timeline mapping (to understand the procedure of events).

## Appendix 6: Questionnaire for Community Devevelopment.

Which are the most important policy issues for you?

How do you work when targeting communities?

Are there any national programmes relevant for you?

Which are the relevant governance policies for your fields?

- 1) Tell me about the programmes for bio fuel stoves.
  - a) Why do you work with bio fuel?
  - b) Why do you experiment with bio fuel instead of other stoves?
  - c) What are the benefits with bio fuel stoves compared to other stoves?
  - d) What is the biggest constrain to produce it?
  
- 2) Can you tell me about how the programmes of stoves are implemented in the communities?
  - a) What is the strategy to inseminate the stoves into the communities?
  - b) Do you have a well tested strategy or do you experiment with different strategies?
  - c) Which strategy is the most common used?
  - d) How do you target the communities?
  
- 3) Which groups are the most important to target in order to inseminate the stoves as wide as possible?
  - a) Which factors influence group x with an impact on the implementation of the programme
  - b) How do you consider networks during the insemination?
  - c) are there particular networks of importance for social learning about stoves
  - d) Do you mainly target specific individuals?
  - e) What characteristics do you look at concerning the targeted individuals?
  - f) What arguments do you use when targeting the communities?
  - g) Do you mainly use social, health, economic or environmental arguments?
  - h) Have you observed which arguments the communities listen to the most?
  - i) Do you mainly work with insemination of information and micro loans or do you give the actual invention the communities?
  - j) When it is implemented in one community, do you consider other communities?
  - k) How do you make sure it is spread to other communities?
  - l) Do you teach about how the forest can be used, as an incentive to change to bio fuel?
  
- 4) Can you tell me about how the department work with other relevant departments such as forestry and agriculture and energy?
  - a) Do you have any coordination with them?
  - b) How do you consider the forest in projects?
  - c) How do you consider the agriculture in the projects?
  - d) Do you look at what projects the other departments are dealing with?
  - e) How do you use this information?
  - f) Which NGOs are you in touch with and how do you collaborate with them?
  
- 5) Lastly, are there any interesting projects that I can visit and study?

## **Appendix 7: Modified questions to Community Development in Kuntaur.**

- 1) Concerning the improved stoves in Panchang, can you tell how you approached the women.
  - a) What was the idea behind this specific stove?
  - b) Why did you choose to teach this specific stove and not another one?
  - c) Which sensitization methods did you use in this specific case?
  - d) Did you approach them or did they approach you?
  - e) Did you have to convince them or did they adopt the idea immediately?
  - f) Did you teach many groups or just this group?
  - g) If you taught more than 1 group, how many did adopt the idea and actually started the production?
  - h) Why this group and not other groups?
  
- 2) Can you tell me about the follow up of the project?
  - a) Did you see any problems with the project?
  - b) What have you learned from this project, and what do you do different after this project compared to before?
  - c) How did you follow up the project?
  - d) The group failed with the production after first or second rain season, what did you do about that, and how did you follow it up?
  - e) What have you changed since this failure?
  - f) What did the producers say about the stoves, and did they have ideas for what can be done better?
  - g) Can you give an example of a similar project that succeeded, what did you do different in that project compared to the stove project?

## Appendix 8: Questions to Forest Department

- 1) Which are the most important policy issues for you?
- 2) How do you work when targeting communities?
- 3) Are there any national programmes relevant for you?
- 4) Which are the relevant governance policies for your fields?
- 5) Can you tell me about what models concerning forestry that are used?
- 6) Which specific forestry methods do you teach the villages concerning collection and taking care of the forest, such as which trees to plant, plant and cut circles, (galring), agro forestry, which wood to pick, replantation etc?
- 7) Is there any sustainability thinking behind?
- 8) How is sustainability taken into account?
- 9) Can you tell me about the dialogue to the villages you collaborate with?
- 10) How do you make sure you listen to the villages?
- 11) What have you changed in your model during your work with villages after listening to them?

Thoughts about my hypotheses.

- 1) My initial hypotheses was that inhabitants in villages learn about new sustainable technologies through networks, such as travelling business men, migrants and certain ethnic groups passing by or other kind of networks. I have a feeling that I am wrong, that they do not learn through networks. Every time I ask I am told they don't learn from other people, is it true or are they just saying it. Even when talking about the Lumu.
- 2) Do you have a theory about how they learn, does it have to do with education?
- 3) When approaching Saite Maram I had a strong feeling that they have not learned anything. This is at least the feeling I got from the interview. Have you yourself thought about this and why it is like that?
- 4) Saite Maram sent representatives to an improved stove training, but they never adopted the idea and started to produce or use the sinkri koto. Why do you think it is like that, is it because of a bad VDC or lack of basic education, or do you have another explanation?
- 5) My hypotheses about saite Maram is that it is a small quite lonely wolof village without a larger network outside. What have Forestry Department learned from Saite Maram?
- 6) Do you know a village with better conditions for learning?

Which groups are the most important to target in order implement a sustainable forest use?

- 1) Which factors influence group x with an impact on the implementation of the programme?
- 2) How do you consider networks during the insemination?
- 3) Are there particular networks of importance for social learning about forestry and fuel wood collection?
- 4) Do you mainly target specific individuals?
- 5) What characteristics do you look at concerning the targeted individuals?

- 6) Do you mainly work with dissemination of information and micro loans or do you give the actual invention to the communities?

Can you tell me about how the department works with other relevant departments such as community development, especially concerning improved stoves?

- a) Do you have any coordination with them?
- b) How do you consider agriculture in projects?
- c) How do you consider the agriculture in the projects?
- d) Do you look at what projects the other departments are dealing with?
- e) How do you use this information?
- f) Which NGOs are you in touch with?

## Appendix 9: Revised Questions to Forest Department

- 1) Can you tell me in detail about which forest methods you work with and you teach to communities.
  - a) How do you work with seedlings?
  - b) How do you work with thinnings/culling?
  - c) What is the benefits with controlled fires?
  - d) What is the best methods for fires?
  - e) Are there better methods to achieve the same but not use fires?
  - f) How do you transplant trees?
  - g) Can you tell about regeneration methods?
  - h) Can you tell about the best fuel wood collection methods, if at all there are any sustainable collection methods?
  - i) What are the best methods to avoid soil degradation?
  - j) How doe sthe forest department work with deforestation?
  - k) Are you teaching interplanting?
  - l) Are you teaching about cash crops in the forest?
  - m) Do you ever work with agro forestry?
  - n) How is sustainability considered in all these methods?
  
- 2) How do you work with the communities concerning the above mentioned methods?
  - a) How do you teach communities about each method?
  - b) How do you approach them when starting sensitization about the above methods?
  - c) Can you give a case that you can tell about where you were able to implement one of these methods, how did you do?
  - d) How was the success?
  - e) How did you follow up?
  - f) Is it still working as planned?
  - g) How does communities follow the advices and training?
  - h) Can you give an example where they actually did follow?
  - i) Can you give an example where the villages did not follow the sensitization of one of the above methods?
  - j) How did you follow that up?
  - k) What did you learn from that?
  - l) What do you do different today?
  - m) What is the best method to approach communities?
  - n) Can you tell about the dialogue you have with the communities?
  - o) Which methods do you use in order to understand what the communities need and involve the communities in the decision making?
  - p) Do you consider which groups or people, which are most relevant to approach in order to gain as much success as possible?
  - q) Can you give an example of a success?
  - r) Can you give an example where you realized you approached the wrong people or groups?
  - s) How do you make sure you target the right people?
  - t) Why does some communities adopt your methods, and why does some not adopt?

u) How do you consider environmental issues in relation to human needs?

Can you tell me about how the department work with other relevant departments such as community development, especially concerning improved stoves?

- a) Do you have any coordination with them?
- b) How do you consider agriculture in projects?
- c) How do you consider the agriculture in the projects?
- d) Do you look at what projects the other departments are dealing with?
- e) How do you use this information?
- f) Which NGOs are you in touch with?

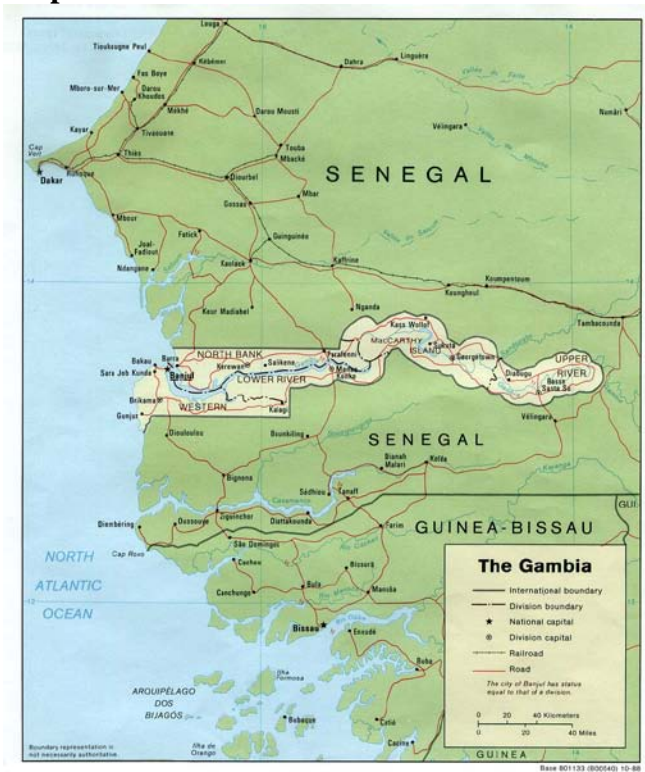


## Appendix 10: Questions to Peace Corps.

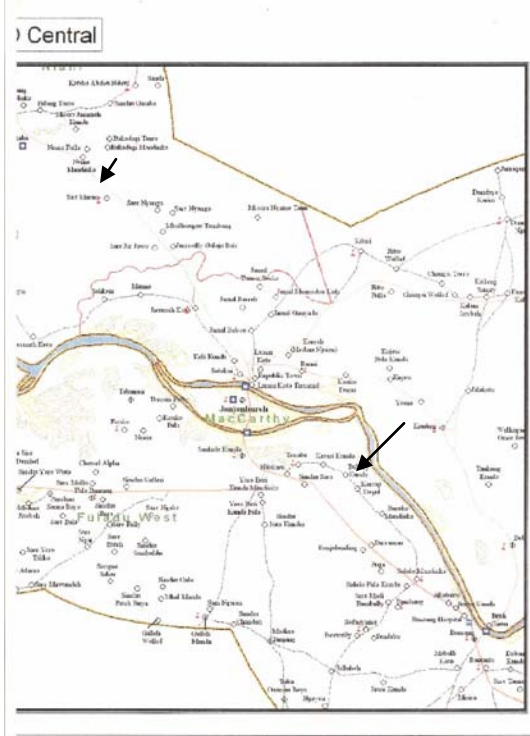
- 1) Can you tell about how you as Peace Corps approach communities when implementing new technologies?
- 2) Which methods do you use when finding out what communities need?
- 3) How do you usually follow up projects?
- 4) Does peace corps change approach after listening to the communities and reviewing implementations?
- 5) Can you tell me about how you involve sustainability thinking in the implementation of projects?
- 6) How do you make sure the idea is spread as wide as possible?
- 7) Do you consider various networks when targeting communities?
- 8) Which groups or people do you find most important to target?
- 9) Before implementating a project how do you think who to target?
- 10) My initial hypotheses was that inhabitants in villages learn about new sustainable technologies through networks, such as travelling business men, migrants and certain ethnic groups passing by or other kind of networks. I have a feeling that I am wrong, that they do not learn through networks. Every time I ask I am told they don't learn from other people, is it true or are they just saying it. Even when talking about the Lumu.
- 11) Do you have a theory about how they learn, does it have to do with education?
- 12) I was looking for clusters concerning fuelwood and improved stove producers, but talking to people it does not seem like there is much collaboration, what are your observations?
- 13) What learning processes do you think are the most important in order to adopt new technologies?
- 14) How important are CBOs and Village Development Committees in the implementation of new technologies?

## Appendix 11: Maps over the Gambia and district:

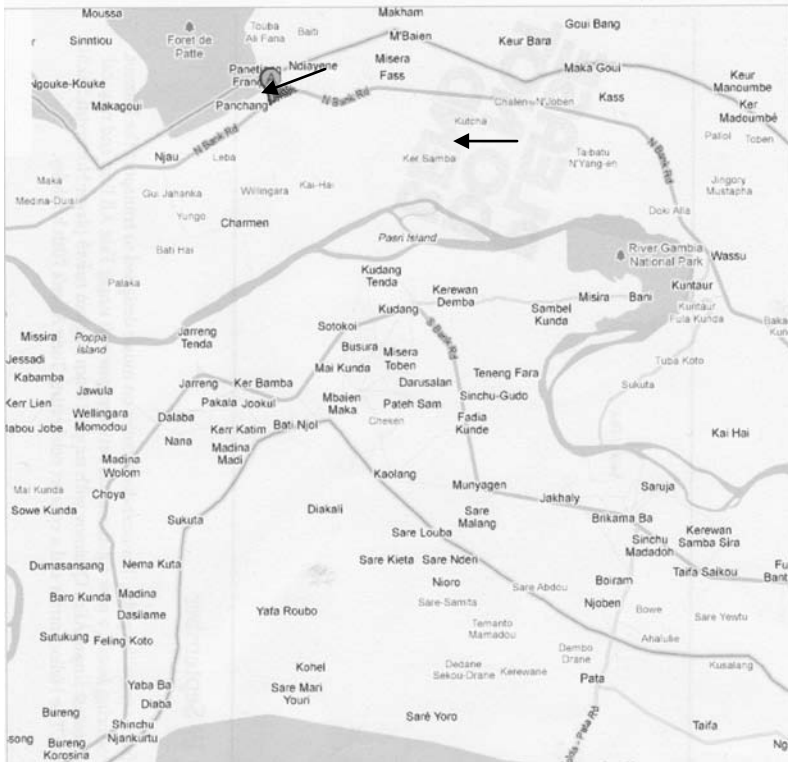
Map 1: The Gambia



Map 2: Central River Division:  
Saite Maram, Kunkilling Forest Park



**Map 3: Central River Division:  
Panchang, Ndowen**



Google Maps 2010:

[http://maps.google.se/maps?f=q&source=s\\_q&hl=sv&geocode=&q=Panchang,+Gambia&sl=61.606396,21.225586&sspn=13.361856,56.162109&ie=UTF8&hq=&hnear=Panchang,+Upper+Salum,+Central+River+Division,+Gambia&ll=13.699362,-15.03891&spn=0.212141,0.438766&z=11&pw=2](http://maps.google.se/maps?f=q&source=s_q&hl=sv&geocode=&q=Panchang,+Gambia&sl=61.606396,21.225586&sspn=13.361856,56.162109&ie=UTF8&hq=&hnear=Panchang,+Upper+Salum,+Central+River+Division,+Gambia&ll=13.699362,-15.03891&spn=0.212141,0.438766&z=11&pw=2)  
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