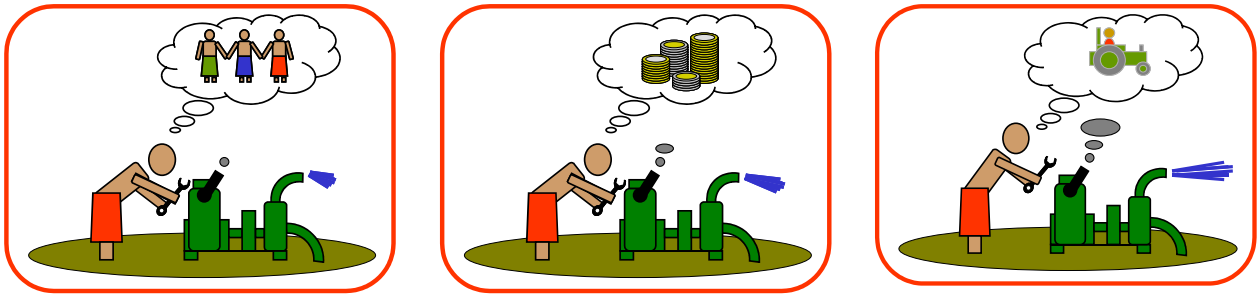
# Negotiating Technology

The role of local technicians in North - South technology transfer in North Bengal, India



Jan Nederstigt

**MSc thesis**

# Negotiating Technology

The role of local technicians in North - South technology transfer in North Bengal, India

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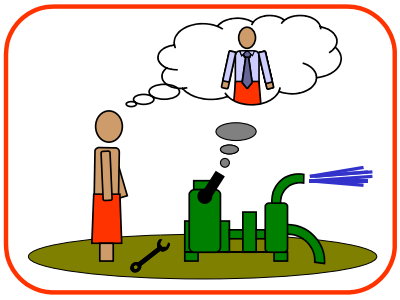
**'Mankind's habitual positivistic error is to assume the existence of a commonly shared reality that functions as the objective standard for every interpretation of the world.'**

from: Lee Spinks, (2003)



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# Preface

Right now, you are holding the product of three months fieldwork and about one year of writing. Not full time of course, but still much longer than planned. Several explanations can be named for this long time span, but there is one specific reason that justified it: I enjoyed writing this thesis very much. The long time span allowed me to read about topics that I was interested in, but that were not directly related to the topics that I cover in this thesis. Besides, it allowed me to reflect on certain issues more thoroughly. The result of this is a thesis in which I have tried to combine different fields of knowledge; what initially appeared to be technical problem is placed in a sociological context which resulted in some interesting new insights.
When reading this thesis one should realise that it has not been written by a sociologist, neither by an engineer. Rather I would like to picture myself as a socio-engineer; it is the combination of the two fields of practice that allows for interesting standpoints and perspectives in this thesis. The pitfall of this fusion of perspectives is that the possibility exists that neither an engineer nor a sociologist will understand what is presented here. Nevertheless, I have tried to keep it readable for a wide public by avoiding the excessive use of jargon and by explaining most relevant terminology.


## Special thanks

Almost needless to state is that doing my research and writing this thesis has only been possible through the support of lots of different people. It is nearly impossible to thank everybody separately here without forgetting to mention anybody. However, some persons were so directly involved that their personalities can almost be recognised in the ideas and perspectives that are presented in this thesis. In this series of words of gratitude, first of all I would like to thank Leontine Visser, professor in rural development sociology, Wageningen University, as she supported me all the way through my fieldwork and thesis writing by reading and commenting on my reports and as she kept feeding me with new theoretical and practical ideas during all the stages of thesis writing.
The fieldwork I have done in the Terai Region in West Bengal, India has been backed up by the Centre for the Development of Human Initiatives (CDHI) in Jalpaiguri, India. Without the support of all the staff members of CDHI, the fieldwork would not have been possible. Especially Dr. Rajeshwar Mishra, the director of CDHI supplied me with everything I possibly needed, ranging from insights in the Bengal society, theoretical considerations and reflections, local transport, food and shelter to even father-like mental support when things ones again did not work out the way I had planned. Thanks a lot for that. Also Dhananjay Ray and Mrinal Shil deserve special thanks as interpreters and research assistants. I really appreciated their input and useful comments during my fieldwork and the patience they had with me in explaining the all-important details about dealing with the mistris. It are also the mistris that I want to thank separately, especially all the members of Sarkarpara Cooperative and Beltali Cooperative, who invested a lot of time in answering my questions and in participating in my research, even though it might have looked nonsensical and foolish to them.
Gert Jan Bom from Practica Foundation also deserves words of gratitude, for introducing me in the research topic and linking me with the relevant persons. I hope this thesis will contribute to future projects of Practica in the Terai Region.
The last one I want to thank is Debasish Saha, my friend and room mate in Jalpaiguri who had nothing to do with mistris or cooperatives, what made him very nice company to hang around with. He also helped me to understand social relations and stratification of the West Bengal society: One time he was fixing the electric water pump in our apartment as it was leaking badly. So I called him a mistri. He replied me by saying 'Don't call me a mistri, it's a bad word!' Thanks Debasish!


Jan Nederstigt
Zeist, February 2005

# Abbreviations and terminology

## Abbreviations

| | |
|---|---|
| CDHI | Centre for the Development of Human Initiatives, Jalpaiguri |
| INR | Indian Rupees (in this thesis referred to as Rupees), the Indian currency. During the time of field work, the exchange rate of Indian Rupees was around 49,00 (€1,00 = INR 49,00). |
| MC | Mistri Cooperative |
| NBTDP | North Bengal Terai Development Project |
| NGO | Non Governmental Organisation |
| PSU | Project Support Unit |

## Terminology

| | |
|---|---|
| Bigha | A land measure in rural areas in India; its definition varies from state to state. In West Bengal 1 bigha is about 0.33 acre (www.riceweb.org). This is equivalent to an area of 120 by 120 feet, or 37 by 37 metres. |

## Notations

| | |
|---|---|
| Websites | Information drawn from for example the website 'http://www.scu.edu.au/schools.html' is referred to in the text as '(www.scu.au)'. The full website address is given in the list of references, stated in the format of 'http://www.scu.edu.au/schools.html (July 2004)' where the date in between brackets indicates the date that the specific information was drawn from the website. |

# Chapter 1 Introduction

Exploring a problem situation

> 'Technology is an important driving force for social and economic change, not just in the richer parts of the world, but also in the world's poor areas. Despite the huge need, the development and promotion of technology for the rural poor is much under-resourced. As a result, opportunities in improving livelihoods and making better use of local resources are missed out' (www.practicafoundation.nl).

> 'By organising rural technicians, they can claim certain services that were hardly, if at all, accessible for them, like government programs, opening bank accounts, etc. When organised in a group, they get more self-esteem, which stimulates the development of the individual. The members in the group can be handed new tools to develop alternative modes of existence. It is important to organise these technicians and stimulate them to use their expertise to generate more income and improve their livelihoods. One way to let them use their technical expertise is by means of new technological input. If this fits with their existing business, they can use the new technologies to expand their job responsibilities'. (interpretation based on informal interview with Dr. Mishra, chairman of CDHI on September 5, 2003).

> 'At the beginning, I thought it was good to be a member of the cooperative and I was getting the main idea clearly. But there are so many loans and dues and nobody is taking the responsibility of collecting those loans and dues from the other members. For that I am sorry. I could not get enough information about this during our meetings. That is why I am not interested to continue my membership of the cooperative.' (fragment from a letter from Maneswar Barman, member of the Chilkirhut mistri cooperative, to the Project Support Unit, translated from Bengali, dated December 19, 2000)

When reading this three fragments, the question might rise what these three fragments have in common. At face value, not much. And exactly that is the interesting thing about these fragments: These fragments each come from one of the three major actors in a development practice in North Bengal, India, in which I got involved. More specifically, these actors are involved in what I will call a 'process of technology transfer', where a new technology is introduced in a rural context with the aim to improve the life of the rural population through this technology. And that is what this thesis is about; a technology transfer process. This in itself is not a new subject. However, in this thesis I want to avoid the technocratic approach to a technology transfer process, in which the technology plays a central role and social processes are centred around and related to the technology. I rather want to focus on the technology transfer process as a negotiation practice, in which the different people involved are considered as different parties in the process. These parties, or 'actors' as they are usually referred to in the literature, all have their own ideas about the process and about the desired outcome. These ideas are not necessarily compatible with the ideas of the other actors.
With this thesis I want to show how this negotiation process, although subject to phenomena like power relations, relations of trust, incompatible perceptions of technology, prevailing self interest, miscommunication, etc., still can have acceptable outcomes for all actors.

## Involvement

When searching for a research topic for my MSc thesis for the master programme 'Management of Agro Ecological Knowledge and Socio-technical Change (MAKS)' on the Wageningen University, the

Netherlands, I coincidently got to know about Practica Foundation, an organisation that aims to facilitate research, development and commercial application of technology in the field of water and energy in developing countries. This scope of Practica Foundation linked nicely with my field of interest. During the master program I worked on linking my technical background (BSc Mechanical Engineering) with the socio-technical change processes and sociology of development practices.
During an exploratory meeting with Gert Jan Bom from Practica Foundation, we talked about the introduction of fuel efficient pumpsets and the modification of old pumpsets in North Bengal, India, that took place in the context of the North Bengal Terai Development Project. For the introduction and dissemination of the fuel saving technologies, the project made use of local artisans in the field of simple irrigation technologies. These local artisans or local technicians are called 'mistris' in Bengali, the local language. The concept of using local technicians for the introduction and dissemination of new technologies was quite new and unusual. The main idea was to use their (technical) skills and social network to fulfil the role as intermediary to reach the targeted people with new technologies. To give these mistris a legal basis for their work in the project and to streamline communication, the mistris were organised in a couple of cooperatives, the so called mistri cooperatives. This took place in 1999. Afterwards, more mistri cooperatives were established in the North Bengal Terai[1] region. And although the North Bengal Terai Development Project ran to an end in 2000 and local means and management were handed over to a for this purpose newly formed NGO, the Centre for the Development of Human Initiatives, the mistri cooperatives continued to exist.
The fact that the mistri cooperatives still exists, intrigued Gert Jan Bom. He had formed the hypothesis that if these mistris continued with their cooperatives, there must be something to gain for them. At the same time, he was interested in if and how the concept of cooperatives of local technicians that take care of the introduction and dissemination of new technologies could be applied for other projects and other technologies.
We agreed that I would go to North Bengal to study the cooperatives to gain insight in the functioning of the cooperatives.

## Problem perception

As a result of the cooperative action of the government of India, the government of West Bengal and the government of The Netherlands, a development project for the rural north of West Bengal was set up in 1984; the North Bengal Terai Development Project (NBTDP). A sub-goal of this project was promoting irrigation in the area through the provision and promotion of irrigation facilities and the development of water management associations (Arcadis Euroconsult; 2002). This included the construction of multi filter shallow tube wells[2] and installing fuel-efficient diesel pumpsets in cooperation with local well- and pump technicians (mistris). To organise the mistris, a number of cooperatives were established by the project, all containing around a total of 15 to 20 members, both well- and pump mistris.

The concepts of mistri cooperatives in the project were:

- Cooperatives are formed in concentration areas of micro-irrigation activities, consisting of local mistris;
- These cooperatives will disseminate the developed techniques through their commercial activities and as such act as change agents (Arcadis Euroconsult; 2002).

[1] See appendix 1 for geographical location of the Terai region.
[2] The concept of multi-filter shallow tube wells is that a group of 3-4 farmers each install a well in their own land (choosing whatever technique they prefer - which will generally be bamboo or PVC - which are both low cost). Against this contribution farmers are supplied a 2.5 HP pumpset, that is lightweight and fuel-efficient. The light weight makes it easy to transport the pumpset to the different wells. The farmer groups further sign an agreement of joint ownership and open a bank account.

The development paradigm

The NBTDP as well as the involvement of local mechanics took place against the background of the development paradigm of 'participation' that started to gain popularity in the 1970s. This came hand in hand with a focus on decentralised, local approaches. Simultaneously, the dominant role of advanced technology was altered to emphasize 'appropriate' technology which, if not always smallest in scale, was more manageable by the majority (Uphoff; 1979). The shift in paradigm that took place from the 1980's onwards can be portrayed as a shift from development of natural resources to development of human resources and a shift from appropriate technologies to innovative technologies. In spite of this shift, the concept of participation stayed equally important. Using the description of participation in development projects from Uphoff (1979) as 'the involvement of a significant number of persons in situations or actions which enhance their well-being, e.g., their income, security or self-esteem' matches the objectives of the NBTDP.

Ideas about mistri cooperatives

One of the targets for the mistri cooperatives was to identify additional technical innovations in water management that could be added to the field of practice of the mistris. The project assumed that expanding the tasks of the mistris would result in more income and income security by overcoming seasonality of the traditional tasks. Two examples of technological innovations that were feasible for adding to the job responsibilities were:

- The stone hammer technique; an innovative technique for drilling wells in a stony soil;
- Fuel saving technology for existing diesel pump sets; existing diesel irrigation pump sets could be modified to reduce diesel consumption with up to 50% with only simple and relatively cheap modifications (see also the text box 'Fuel saving pumpset modifications in India' in chapter 7).

Later on (2003 / 2004), additional job opportunities that were offered to the mistri cooperatives were also indicated in other fields of practice. These additional jobs were for example:

- Village power; an initiative to supply electrical power to small villages. A diesel generator has to be placed on a central location in the village, from where the different households can be supplied with electrical power through simple power lines. Initial costs should be covered by a subscription fee of the members. Afterwards, the members pay a fixed amount per month. Maximum energy use is limited by a simple fuse. The mistri cooperative could be responsible for the operation and maintenance of the generator set and collecting the monthly fees. The generator should be property of the cooperative (see also the text box 'Sarkarpara village power' in chapter 5).
- Low cost water filter; a filter based on a ceramic filter element that can provide safe drinking water for a reasonably low price. Mistri cooperatives could, if interested, be involved in distribution or production of these low cost water filters (see also chapter 8 on mistri involvement of water filter dissemination).

In all cases of additional job opportunities, it concerns technological innovations introduced by an external agent, in this case Practica Foundation. This is not coincidental, because Practica expected the mistri cooperatives to be a strong and solid introduction and dissemination channel. They could form the ultimate intermediary between the (poor) rural population (often the target population of development projects) and the western technology designers.

To retain grip on the mistri cooperative, a local body was needed that helps the cooperatives with organisational and regulatory problems. During the NBTDP, the project took care of this by the locally situated Project Support Unit (PSU). When the project ended in 2000, local means and management responsibilities were handed over to a newly formed NGO, the Centre for the Development of Human Initiatives. CDHI started to take care for the mistri cooperatives. This also included organising meetings and offering training courses in the use of new technologies. For the new technologies, CDHI kept close contact with Practica Foundation. But in spite of the technological input from Practica,

the performance of the mistri cooperatives in using the technologies and disseminating the technologies to the farmers was not satisfactory. Opposite to what one might expect, this did not mean that the cooperatives ceased to exist. On the contrary, even new cooperatives were established. The causes of this phenomenon were not directly clear. At Practica, the hypothesis was that there were certain advantages for the members of the cooperatives, like the revolving funds that are available for the members as a direct result of the contribution that they have to pay. But the future role of the mistri cooperative in technology transfer processes and the reasons for diminishing interest for technological progress were not clear.
It was up to me to investigate what role mistri cooperatives did or possibly could play in the introduction and dissemination of new technologies.

## Problem statement

It is hard to determine the exact nature and cause of problems with the introduction and dissemination of technologies. When approached from a technocratic perspective, Schumacher (1973) gives some leads. Schumacher introduced the term of *appropriate technology*, by which he explained that problems with the introduction and dissemination of technology were dominantly caused by the inappropriateness of the technology itself. As a result of that, he claimed, technology had to be re-designed to fit local condition and circumstances. This included simple design and the use of locally available materials. Although the concept of appropriate technology, if applied well, might contribute to acceptance and sustainability of the technology, it neglects the social processes that surround the introduction and dissemination of the technology.
The same problems with introduction and dissemination of technology that Schumacher tries to approach by looking at technical characteristics, can also be approached from a sociological perspective in which appropriateness of a technology is determined by studying the social processes that surround the technology.
This thesis rather draws on the interpretative flexibility of technology as introduced by Kline and Pinch (1996) than on the ideas of Schumacher. This interpretative flexibility refers to the way in which different groups of people involved with a technology can have very different understanding of that technology, including different understanding of its technical characteristics. This includes that the function and use of the technology is something that is negotiated through interaction between different actors that are involved in the introduction process rather than that the function is determined by designers and engineers. 'Machines work because they have been accepted by relevant social groups. That one type of machine works better than the alternatives may reflect their histories of adoption, negotiation and improvement rather than any intrinsic, unalterable features of the technology involved.' (MacKenzie; 1999).
In this thesis, I will continue from this point to focus on the communicational and organisational processes that surround the introduction and adoption of new technologies. The introduction of new technologies is often a negotiation process between different parties. As in any negotiation process, the parties involved have their own specific interests and their own ideas about desirable outcomes.
I will argue that exactly this negotiation process of the different actors in a technology transfer process determine the *histories of adoption and improvement*, that causes one technology to be adopted and another to be rejected.

With this, I leave my familiar field of technocratic cause - mechanism - outcome - thinking and enter the field of sociological process-thinking. Ideas in this thesis will thus be based on social and organisational theories, unavoidably approached from a sometimes more critical-realist angle.

## Research justification / Why this thesis?

The basis of this thesis is formed by what is called 'exploratory research', in which the focus is on gaining understanding about certain phenomena. And although the research has been conducted in the context of my master programme, which implies an emphasis on learning objectives, it still professes to contribute to enhanced understanding of the research situation.
In the case of technology transfer by local technicians, I try to fill the knowledge gap that exists about the consequences of using local mistris as agents of technological change. The opportunities and limitations of the involvement of mistris are not isolated characteristics that relate to the mistris as individuals, but process characteristics that can tell something about the role of the mistris in the technological change process. I will focus on the potentials and limitations as system characteristics by using case studies, focusing on the interaction between the different people involved in the technological change process.

In this thesis, I will show how different actors participate in a technical project, all with their own perceptions of the technology, their own goals and hidden agendas. I will do this by first introducing the context in which the technical projects take place. Then I will introduce the three major actors in the technological change process. By doing so I will try to elucidate the differences in ideas, values and perception of the technological change process. The three actors have an own perspective on a common process.
With this strategy, I want to enhance understanding of the role of local technicians in technology transfer processes. At the same time, I want to raise awareness about how the different perspectives of the actors of a change process will lead to different interests and objectives. I will show that these different interests, in contrast to what is often thought, will *contribute* to a sustainable outcome of the change process rather than hamper it.

## About this thesis

Throughout this thesis I have tried to keep the content of the chapters clear and readable. The body of the thesis is formed by and based on field data. Where possible, the findings are illustrated with examples from my fieldwork. A theoretical chapter is included to place the field data in a theoretical frame and position it in the contemporary technology and development paradigms:

In **Chapter 2**; I will first give an overview of the set-up of the research, the research questions and how the field situation caused a shift in research focus. In this chapter, I also describe the methods I used in the field to gather the data. Finally, it shows how the research set-up enables for the multi-perspective approach as is used in this thesis. **Chapter 3** introduces the concept of the ' process of technology transfer', which serves as a framework that will form the backbone of the thesis. In the second part of this chapter, different theories of the contemporary development paradigm are introduced and evaluated on their applicability for enhancing understanding of the problems as introduced in chapter 2. Besides, some concepts are introduced to help understand phenomena that occurred in the field.
The *body* of this thesis is the description of experiences and findings of the fieldwork, which includes the description of relevant issues of the research location (context) in **chapter 4**, and description of the three main actors (the mistris and the cooperatives, the Centre for the Development of Human Initiatives and Practica Foundation) against the background of the technology transfer process in the **chapters 5, 6 and 7**. Justification of these chapters is based on the idea that understanding the three actors separately makes it possible to understand their ideas, values, motivations and perception of the other actors and the technological change process. As the focus of the research is

on the role of the mistris and the mistri cooperatives in the technological change process, chapter 5, which describes the mistris and cooperatives, is given more importance in the thesis.

**Chapter 8** contains a case where a practical problem on the introduction of a low-cost water filter is introduced. The chapter shows how the three actors play a role in the introduction of a low-cost water filter and how the three parties approach the process from a different perspective and with other ideas and objectives. The different objectives result in negotiation about the actual introduction of the filter. Through this negotiation, a shared process is created in which the three different objectives of the three actors are represented.

Concluding remarks about the roles of the three actors in the technological change process are collected in **chapter 9**. This chapter also summarises the answers to the research questions and gives, where possible, some recommendations and points of attention for inclusion of local technicians in technological change processes.

# Chapter 2 Approach and methods

Designing research on mistris and cooperatives

If anything about doing field research is truly contextual, it are the approach and methods used during the research. Even the slightest differences in the field situation in for example culture, environment, climate or infrastructure can cause your initial research set-up to be completely useless. That is what I experienced during my fieldwork in North Bengal, India as well.
What I want to point out with this chapter is the highly fluid nature of approach and methods. This is equally true for research objectives and research questions: An increased understanding of the local situation (what usually *is* part of the objective of the research) will most certainly cause you to adjust the objectives of the research and the research questions accordingly.

In this chapter I will sketch the process of design and redesign of the approach and methods. This means that I will include the ideas as from where the research started, the intermediary products and the final ideas that form the basis of this thesis. Of course, these final ideas that function as point of departure will show imperfection, especially when analysed and put in context in this thesis. This is inevitable. Chapter 9 will be the place in this thesis where concluding remarks will be presented and new findings will be critically reflected and related to the objectives and research questions.

## Research objectives and research questions:

Exploratory research is aimed at gaining understanding about certain phenomena. Research objectives should thus point out the blind spots in knowledge and information already available. Initial research objectives and research questions are often based on poor or incomplete information, so adjusting research questions in an early stage of the field work is necessary to include advancing insights in the research.
The main problem with my initial research focus that I came across in the first two weeks of my fieldwork was the choice of perspective; initially, the research was focused on *using* (cooperatives of) local technicians for technology transfer purpose. This, as I realised during the first orientation in the field, points at a too technocratic and linear understanding of the process of technology transfer, in which technological knowledge and artefacts are simply transferred from one actor to another: Mistris are not *primarily* agents of technological change. This means that mistris cannot be isolated from their normal day to day routines to study them in their role as agents of technological change. Involvement in new technologies forms just one small part of their whole set of livelihood strategies, that appeared to play a less significant role than expected. Studying mistris from a technocratic point of view would isolates them from their environment and traditional livelihood and so neglecting the processes and mechanisms that form the basis in their role as agents of technological change. The research objective as I formulated in my research proposal (to evaluate the efficacy of using mistri cooperatives for the introduction of the fuel saving technologies by studying the interactions between different actors in the process of technology transfer) resulted in the following research question:

> initial research question:
> What are the strong and weak points of using mistri cooperatives for the introduction and dissemination of new (fuel saving) technologies?

This research question was based on a number of hypotheses. Validation of these hypotheses in the field, which was the first step of my field research, showed that the actual situation deviated from my initial ideas. The following hypotheses were all proved false:

hypothesis #1
I assumed that a cooperative of mistris to a large extend represented the ideas of its members. In the field situation, I noticed that the members of the mistri cooperatives did not all have an equal share in the cooperative. A small group of members of the cooperative forms the backbone and accordingly, their share in trends and actions of the cooperative is more evidently present than the opinions and ideas of the other members. Cooperatives cannot be considered as uniform entities and so in many cases it is more useful to talk about ideas, values, opinions and objectives of the individual mistris than about common interests of the cooperatives.

hypothesis #2
My perception of the mistri cooperative was that of an organisation of a number of mistris (around 15 (Arcadis Euroconsult; 2002)) who are concerned with the same type of activities in the field of irrigation. In practice, the cooperatives exist of mistris and farmers, as these farmers are often involved in contract work for mistri activities in the off-season. Among the mistris, divisions can be made on bases of full-time (landless) and part-time (farming) mistris and on the different types of specialisation of mistris, like pump and well mistris, which will be elaborated in more detail in chapter 5. Needless to say that the heterogeneous composition of the cooperative makes it difficult to consider it as one entity and to consider the members equally appropriate to promote new technologies.

hypothesis #3
I expected the fuel saving technology for irrigation pumpsets[3] to be a promising technology that was practiced by the mistris and appreciated by the farmers. In the field situation, the fuel saving technology was not a hot issue anymore. Or at least not at the time of my field work, which was in the monsoon season. When sufficient water is available through rain, farmers do not use their irrigation pumpsets. And when these sets are not in use, there is no direct need for modification. For the fieldwork it became useless to build up a case study around the introduction and dissemination of the fuel saving technology. Rather, I included this technology in the case studies on cooperatives, by asking about experiences and perceptions of the fuel saving technology.

hypothesis #4
In the research proposal I indicated (groups of) actors involved in the process of introduction and dissemination of the new technologies. When this process is considered as a linear process with a starting point and a goal, the involvement of the actors can be seen as successive steps in this process. During the first weeks in the field, I noticed that these actors had their own ideas about the process and desirable process outcomes, caused by different (personal) objectives, ideas, values, etc. Processes of technology transfer are not linear and are formed by communication, cooperation and negotiation rather than by calculation and planning.

These advancing insights made me realise that both mistris and mistri cooperatives were not just tools that could be used as a step in the technology transfer process. Rather, mistris are knowledgeable actors with their own ideas and interests. Especially when involved in interactions with others, they also have their own perception of reality and their own ideas about desirable process outcomes.

[3] For a more detailed description of the fuel saving technology for irrigation pumpsets, see also the box 'Fuel saving on pumpsets in India' in chapter 7.

So technology transfer is a negotiation process rather than a linear process, in which involved parties project their own perception of reality. This made me form a new hypothesis about the technology transfer process:

> New hypothesis
> *Technology transfer is a negotiation process. The outcome of the process is a compromise based on the different objectives and values of the actors and shaped by agency, power relations and relations of trust.*

Based on my new hypothesis that within this negotiation process all parties have their own objectives and values, focusing on the role of the three major actors (mistris, Practica Foundation and the Centre for the Development of Human Initiatives) gives an interesting new perspective to do the research. This logically resulted in new research objectives. The new objectives are formulated around the role of the three actors in the negotiation process of technology transfer, focusing on the mistris and the mistri cooperatives. The objectives are:

- Determine the different roles, objectives and motives of the three actors in the negotiation process of technology transfer;
- Examine the added value of the mistri cooperatives within the technology transfer system;
- Examine how the concept of technology transfer and technological innovation fits in the livelihoods of the mistris;
- Examine how the membership of a mistri cooperative fits in the livelihoods of the mistris and how this might facilitate improvement of the livelihoods or social capital;
- Examine the added value of the mistri cooperatives for the Centre for the Development of Human Initiatives and for Practica Foundation as seen in the context of technology transfer.

With these new insights and new objectives as a starting point, I realised that poor outcomes of the negotiation process of technology transfer could be easily dedicated to differing and incompatible objectives of the different actors. But in case of my research in Jalpaiguri and Cooch Behar district on technology transfer, still mistri cooperative structures were in place and still processes were ongoing. This made me realise that although objectives may differ, it does not necessarily mean that they are conflicting and not compatible. The question remained *how* those actors managed to pursue their own objectives within the process of technology transfer, and especially how the least powerful actors, the mistris, managed to pursue their own objectives without obstructing the process.
This lead to a new research question in the initial stage of my fieldwork, focussing on *livelihood improvement* of the mistris. I expected that personal objectives of the mistris were demonstrable by focussing on opportunities for livelihood improvement and security of the mistris as a result of membership of the cooperative and the technology transfer process. During the fieldwork I reshaped the research questions to enable for testing my hypothesis about differing but reconcilable objectives and to focus on livelihood improvement of the mistris:

> *New research questions:*

1. *How does the negotiation process of technology transfer lead to acceptable outcomes despite the different objectives of the actors involved?*

2. *How do mistris integrate new organisational structures and technological development in the continuing process of securing and improving their livelihood?*

## Research methodology:

As stated earlier in this chapter, within the approach of the research, the research methodology is highly contextual. Any preparations for the approach made before actually having seen the field situation are liable to change. At least, they should be critically reviewed before applying them. That is what I did with my initial research methodology as well. I will describe the methods I used in research practice. I will also describe how I adapted the methods to the field situation and how I was confined in some ways by the on-site situation.
The initial plan was to do a comparative case study between two cooperatives. In the following part I will describe how I appropriated the case study to fit my research objectives and the importance of case selection for the case studies. I will also point out the contextual limitations that I experienced in both the case selection and the case study itself. Within the case study I used different tools and techniques for data collection, which I will describe in this chapter.
Due to unforeseen circumstances and new opportunities, I extended my data collection with what is called 'action research'. I will explain the concept of action research and the added value of this methodology for my research.

### The case study

The fieldwork for this thesis professes to be *exploratory*. This means that the methods used are not targeted on getting statistical prove or generalising findings on statistical basis. Instead, exploratory research aims at contributing to the solution of certain conceptual problems and an improved understanding of the research problem.
To reach this improved understanding, a case study appeared to be a good methodology: 'The case study is a type of research during which the researcher tries to gain a profound insight into one or several objects or processes that are restricted in time and space.' ( Verschuren; 1999). A case study enables me to go deep into the situation and so to find underlying thoughts, ideas and processes.
Selecting two cases for a comparative case study would not only enable me to see differences between the two cooperatives, but at the same time it should highlight important issues more significantly. I opted to divide the available time in two equal parts to study two cooperatives (see appendix 2 for planning).

#### Case selection

The selection of the cooperatives is the first step in the process. Selection of cases can be based on a whole range of criteria. Case selection of the mistri cooperatives was based on the available data from the CDHI office on characteristics of the cooperatives (size, composition, organisation, estimated efficiency, age, etc.) and additional information from CDHI members on other more practical characteristics (ability to reach the location, means of communication, expected willingness to cooperate in the research, etc.). This means that practically the case selection is always a compromise of what is most desirable for the research data collection and what is most desirable for the research efficiency.

During the first two weeks of orientation at the CDHI office in Jalpaiguri and in the field, I developed the idea that the functioning of the different cooperatives and the activities of the members could be related to the age of the cooperative. My hypothesis was that the younger the cooperative, the more active its members and the more fruitful its activities. This effect could be enhanced by the limited resources of CDHI compared to the NBTDP: Less money is available for activities with the cooperatives (see also text box 'Good old days') and more support by CDHI is given to the newer cooperatives.

**Good old days**

In times of the North Bengal Terai Development Project, more money was available. Ensuing from this, the cooperatives established during this period, in 1999 (see also appendix 1 for these cooperatives), could count on a lot more financial support those days: Meetings included hot meals, members could declare travel expenses, and even a compensation for invested time was not unusual. Needless to state that attendance of meetings was high in those days.
Nowadays, with CDHI taking care of the meetings with limited resources, the members of the cooperatives are expected to invest their own time and money for attending the meetings. Especially at meetings with members of different cooperatives that take place either in Jalpaiguri district or Cooch Behar district, travelling times can mount up to four hours single trip. Mistris are less interested in attending those meetings because of the time and money required. In some cases, the cooperative pays the trip for one of the members, usually the president, the secretary or the cashier, to attend the meeting.

From informal interviews with Dhananjay Ray , my research assistant from CDHI, who is responsible for coordination of the mistri cooperatives (called 'Joy' further throughout this thesis), it became clear that there were significant differences between the cooperatives, irrespective of age of the cooperative. We could think of dozens of things that could cause a cooperative to be less active, but there did not appear to be a direct causal connection. The only link that did appear, was the link of success of the cooperative and strong leadership. Or at least a leader that was dedicated and active.
Choosing two cooperatives on basis of strong and weak leadership could be an interesting starting point for a comparative case study, but in this case, gaining understanding of sustainability of the cooperatives was not my main objective. I was interested in the role of the cooperatives in technology transfer. And the role of CDHI and Practica in the technology transfer system, the establishment of the cooperatives and the role of CDHI and Practica in sustaining the cooperative. So it was more interesting to choose the cases on basis of their active role in technology transfer or even participation in technology design. For this I did not opt for the good practice / bad practice comparison in which I could have compared two cooperatives on basis of their technology transfer output. Apart from the fact that the technology transfer output is not quantifiable, poor results on this issue can have a range of different causes. And probably it is the result of a combination of direct causes that can be indicated, indirect causes that cannot easily be indicated, and consequences of the specific time-space configuration that cannot be indicated at all.
Coming back to my hypothesis for case selection that the direct involvement of CDHI influences the functioning of the cooperative in a positive way, I decided to focus on two active cooperatives; one that was established in 1999, Beltali Cooperative in Mathabanga block, Cooch Behar district[4] that functioned almost independently from CDHI and that was active in different, technology related businesses. The other cooperative, Sarkarpara Cooperative in Jal Sadar block, Jalpaiguri district[5], was established more recently, in 2001. Members of the cooperative had close contact with staff members of CDHI and were very much into trying new technologies and picking up new initiatives.
The reasons for choosing these two cooperatives will be elaborated in detail in chapter 5, where I will also go into the findings of both cases in detail.

During studying the second case, the Beltali Cooperative in Mathabanga, I experienced that case studies have their limitations. The limitation that I came across was the lack of control on the situation: With a case study one should study the existing situation. Introducing changes can distort

[4] See appendix 1 for geographical location of Beltali Cooperative
[5] See appendix 1 for geographical location of Sarkarpara cooperative

the actual situation that you are trying to understand. This means that intervention in normal routine and business should be as less as possible. For this reason, the researcher is very much dependent on the cooperation and initiatives of the people you want to study. In the case of the Beltali Cooperative, I had the disadvantage of difficult communication, long travel distance and a poor cooperation of the president of the cooperative. This, combined with the fact that in October, the month of Puja's[6], people are more concerned with preparation of the festivities than with normal work, considerably slowed down the progress of the case study. To avoid idling too long, I decided to pick up another initiative of CDHI and Practica, in which I got involved during my presence on a technical basis; the Ceramic Silver water filter, a low cost technology for point-of-use water filtration for domestic use. This ceramic low cost water filter that is produced by local potters, had been tested and was ready for introduction on small scale to get feedback from users. And as CDHI considered the mistri cooperatives to be a good intermediary for introduction and dissemination, I decided to hook up with this development by going to boost the process of technology transfer for the water filter. This research methodology is called 'action research'.

## Action research

'Action research can be described as a family of research methodologies which pursue action (or change) and research (or understanding) at the same time. In most of its forms it does this by using a cyclic or spiral process which alternates between action and critical reflection and in the later cycles, continuously refining methods, data and interpretation in the light of the understanding developed in the earlier cycles. It is thus an emergent process which takes shape as understanding increases; it is an iterative process which converges towards a better understanding of what happens. In most of its forms it is also participative (among other reasons, change is usually easier to achieve when those affected by the change are involved) and qualitative' (www.scu.edu.au).
The introduction of the low cost water filter fits in the definition of action research, only the time span was limited: To take full advantage of the iterative process, a longer period of study is required. Nevertheless, the action research proved to be very useful to gain additional insight in the process of technology transfer and the roles of the different actors in this process.
A full description of the process of action research and the findings is given in chapter 8.

## Tools and techniques

For both the case studies and the action research, I used different tools and techniques for data collection. Most of these are quite straight-forward and do not need any explanation about the technical use. But applied in the context of this research, all tools and techniques have their own advantages and limitations and so they are mentioned and elucidated to show the relevance for this research. Different types of data acquired by the different techniques are mentioned and the relevance of the data for answering my research questions is stated.

### Interviews and group interviews

The most straightforward technique of data collection for social studies is conducting interviews. Depending on the format of the interviews, the data collected can be either more quantitative or qualitative. To reach my research objective of gaining a better understanding of a social phenomenon, I chose to conduct in-dept interviews with a relatively small number of people rather than collecting less detailed information from a larger sample. The initial plan was to make the interviews as informal

[6] Festivals and holidays dedicated to Hindu gods. Many festivals are held in October, which for that reason is often indicated as the Puja month. See also Chapter 4 for a more extensive description of the influence of the puja's on the daily lives of the Bengali.

and open as possible, to enable the respondents to talk about issues that they considered to be important. However, during the first couple of interviews, I noticed that conducting an informal interview was pretty difficult as it also entailed creating the informal setting. It was Joy, my research assistant who pointed this out to me, and who showed me that especially the Bengali people are more comfortable and more willing to answer questions after taking some thirty minutes of social talk, including taking some tjai[7] and biscuits. Especially after returning to the same people several times, the interviews got more informal and people were talking more openly about the different issues. This is something that I did not take into consideration when designing and planning my research and so it caused my planning to change in a way that I was able to visit the same person a couple of times rather than visiting more people a single time.

I planned to complement the data from interviews with data from group interviews: I tried to have the different members of a cooperative together, not only to hear the different ideas from all the members, but also to see the processes that took place in the group. Having the group together as a whole should give me information of the different roles of the individuals in the group. Only again the responses of individual members where not only representing their role in the cooperative, but also depended on the relationship that I already had built with individuals. For more information about group processes, see also the heading 'workshops'.

An often used method for recording interviews is using a tape recorder. This is what I used during the first interviews, but I was facing difficulties with the quality of the recordings. The idea was to have my interpreter write out and translate the interview in full afterwards, but due to high noise levels, it was hardly possible to retrieve the interview data from the tape. Besides, I noticed that the presence of a tape recorder had a negative influence on the creation of an open and informal setting. Because of this, I decided not to use the tape recorder during informal semi-structured interviews.

Participant observation

Participant observation is mainly a form of observation where a researcher sets up and takes part in the observational study. The researcher does take an active role during his data collection by participating in the activities the object of research is conducting. 'Sociologists who use participant observation aim to discover the nature of social reality by understanding the actor's perception, understanding and interpretation of the social world. For this reason, participant observation is sometimes called a naturalistic method. The methodology is primarily interpretive.' (www.sociology.org.uk). Advantages of observing people while participating in activities are for example that the presence researcher is accepted better and that the researcher can interpret these activities more easily from the perspective of the other. Participant observations also have some serious drawbacks; for example, there may be problems of access to a group. Besides, participant observation is primarily interpretative, which entails that the data collected during observation does not make sense without its social context.

During fieldwork, I planned to do participant observations to learn more about the role of mistri in technology transfer by looking at their ability to transfer new technologies to other mistris and farmers. However, I faced some practical problems with this form of data collection as most activities with the technologies take place in the dry season, while my research was during the monsoon season. As a direct consequence of this, participant observation did not form a substantial part of the data collection for my research. Rather I did participant observation for collecting background information on how mistris organised their work. Besides, I will use some examples of participant observation in this thesis to illustrate how mistris work with different technologies and how these mistris are involved in a range of different activities.

[7] Indian tea traditionally prepared with milk and lots of sugar.

Interpreter

To be able to conduct interviews during my case studies, the use of an interpreter is inevitable. Local people only speak Bengali and three months is too short to gain a sufficient understanding of the Bengali language to conduct interviews. Almost needless to state that the use of an interpreter has some serious disadvantages compared to direct interviews: One difficulty is the problem with formulating the questions, as you depend for this on the understanding of the question by the interpreter both concerning language and content of the question. However, the major problem is that of the answers of the respondent. It is almost impossible for an interpreter to translate all answers literally, especially with semi structured and open interviews. Incomplete answers makes probing on the same subject a lot more difficult too. Some of the problems can be overcome by introducing the interpreter in the research subject thoroughly and so enable him to probe on unclear or incomplete answers of respondents. A disadvantage of this is that it is more difficult to lead the interview.

During my research, I mainly used two different interpreters:

Especially during the first phase of orientation and introduction I worked closely together with Joy from CDHI. The advantage was that Joy knew the mistris already and so he had easy access to the different cooperatives and mistris. A disadvantage was that Joy worked for CDHI and that the mistris knew him in that setting. Previously established roles and patterns of communications hampered the informal and open setting of interviews.

To overcome these problems I hired an interpreter who had worked before with foreign researchers; Mrinal Shil. Especially after I established the initial contacts, using a new and neutral interpreter made the mistris talk more openly about technology and the role of CDHI. But still there were some problems to see Mrinal and me completely separate from CDHI and their activities, causing us to be caught in awkward positions every now and then.

Both interpreters can also be considered as research assistants, as they were introduced in the research topic and so gave their own input in the interviews. This also helped to create a more informal and easy-going setting during interviews and to prevent the undesirable situation of ask-and-answer setting of formal interviewing.

It has to be mentioned that quotes in this thesis, that are represented as quotes from respondents, in fact are quotes of the translation of the interpreter of the respondents answer.

Video registration

After poor results with recording interviews with my tape recorder, I decided to record group interviews and other events on video. The video tape enabled me to analyse conversations and interviews afterwards, because the additional visual material made the conversations much easier to follow for my interpreter. Besides, the video tapes enabled me to analyse non-verbal modes of communication and body language during group sessions afterwards.

Another advantage of video registration was that I could attend meetings and gatherings without my interpreter. After registering meetings on video, I could analyse these meetings with my interpreter.

A disadvantages of using a video camera during meetings is that it appeared to distracts people from the meeting. Besides, when operating the camera, I also missed some details of for example interaction between mistris that could have been observed more easily without the camera.

Workshops and training

Organising workshops and giving training are both techniques for data collection that are less familiar in sociological / anthropological research as this is basically based on studying and understanding *existing* situations rather than introducing change. However, in the context of the research methodology of action research, organising workshops and giving training is more appropriate.

I used the concept and setting of a workshop primarily to observe interactions between the individual members of the cooperative. For that, my role (or the role of my interpreter, who had to do the practical work) in the workshops should be that of a facilitator rather than that of a trainer. The

primary objective of the workshops was to have the mistris think and talk about some predefined topics.
Organising workshops like this, that are solely focused on the process of interaction and not on concrete outcomes, is only possible when the participants are not focused on direct output either. West Bengal society, where people like to sit down and chat, appeared to suitable for this set-up.
Giving training in a social research context entails on the one hand the introduction of new knowledge and on the other hand the observation of the social processes that are initiated by this new knowledge. Especially with the research on the process of technology transfer and the related negotiation processes, knowledge exchange is one of the processes that precedes the actual exchange of technology. Two examples where knowledge exchange in the form of training was involved are an information session that I have held in Sarkarpara about the possibilities of the project of 'village power' (see also the text box 'Sarkarpara village power' in chapter 5) and the information session about involvement of mistris in water filters dissemination (see chapter 8).

Document analysis

Especially to go into the history of establishment and management of the mistri cooperative, I used existing documentation of communication between CDHI and mistri cooperatives or individual mistris from the period 1999 till 2001. This included minutes of meetings of both the cooperatives and meetings of cooperatives with CDHI. In these letters and minutes I was looking for conflicts about practical problems that might indicate conceptual differences between CDHI and the mistris about the goals of the cooperatives. A practical problem with these document analyses was that all documentation is in Bengali: When analysing documents, one normally skims through the content by focussing on keywords or key events. Translating documents is time consuming and it is often very difficult to translate all the nuances that give information 'between the lines' correctly. So I was limited in the number of documents that I could include in the analysis as well as information that I could retrieve from it. To partly overcome these problems, I gave the documents that were the most interesting a second look, by analysing the translation again with my interpreter.
Data that I retrieved from the documents is sometimes stated directly in this thesis, but most of it I used to complete the whole picture of interaction between mistris and CDHI[8].

Data collected with these tools and techniques should lead to increased understanding of the research problem. The data in itself will not lead to increased understanding and is useless without interpretation to relate it to the context of the research questions.
For this, in chapter 3, I will introduce a framework that helps to find interrelations between the objects of study, the observed phenomena and the organisational problem of technology transfer. Here I will also introduce theories that can be helpful in explaining the data that I collected using the different tools and techniques. At the same time, field data can help to reflect critically upon theories and test the applicability of theories in real-life situation. This I will do while describing the different actors in the field situation.

[8] However some of the letters of mistris were addressed to the Project Support Unit (PSU) functioning under the North Bengal Terai Development Project, I included these as well in creating the total image of communication between mistris and CDHI. The main reason for this is that the vision on, and management of the cooperatives did not change that much when the PSU evolved into CDHI.

# Chapter 3 Framing reality

Framework and concepts for studying mistris, cooperatives and technology transfer

In this chapter I will introduce the framework that I used throughout the research. The framework represents a theoretical perspective from which I have approached the research problem and helps to structure the ideas and findings in this thesis.
For constructing this framework I will draw heavily on the ideas of Norman Long (2001; 2002) on the 'actor oriented approach' that values the knowledgeable actor and the 'existence of 'multiple social realities' (i.e. the co-existence of different understandings and interpretations of experience)' (Long; 2002) of the actors involved.

The framework that is introduced in this chapter is based on a what I call the 'process of technology transfer'. This framework can be seen as a starting point; a simplification of reality that serves to gain understanding and to get grip on the real situation. At the same time, the framework can be used as a basis for this thesis, representing the major actors and their relations.

In this chapter I will show from what theoretical basis I started the research, which includes my hypotheses and prejudices. It will also show that using a sociological framework to describe what can be perceived as a technical problem might cause epistemological problems between the multiple social realities and the ontological realism of positivist science (i.e. of a 'real world' that is simply ‘out there’ to be discovered) (Long; 2002)

## Framework

### Process of technology transfer

The main objective of this thesis is to explain the different phenomena that I came across during field research on the mistris as agent of technological change and the organisational structure of mistri cooperatives in North Bengal. To enhance understanding of the phenomena in the field, I will use a framework as an abstraction of the real situation, based on Long's (2001, 2002) ideas on the actor oriented approach. For this I will introduce the concept of the 'process of technology transfer', which describes the processes that take place during the introduction and dissemination of a specific technology in a new context. The layout of graphical representation of the process is based on the idea that the transfer of technology is a specific mode of exchange of information, knowledge and goods between individuals or groups of people.
The advantage of delineating such a process is that relevant actors can be indicated as well as the flow of information, knowledge and technological artefacts. By mapping these flows, the role of the different actors in the process can be displayed. Also linkages, connections, communication lines and flow of information and knowledge between the different actors can be mapped. This gives a good overview of the process as a whole. It also helps to place phenomena that are observed during field research in the context of the total picture. This is needed as social processes as well as the function of a technology are highly contextual and can only be understood if other actors and context are taken into consideration.

The different components in the process are positioned according to flows of information and hardware and are not necessarily centred around and related to a technology or technological artefact. This process thus is not technology centred. Instead, I have chosen for a social focus rather

than a technocratic focus. However, the graphical image of the process can also serve as a starting point to follow the flows of hardware. A research focus on specific parts of the process is possible too.

The layout of the process of technology transfer is not static. On the contrary; it has been composed during an early stage to shape the research and to sketch initial ideas about the field situation. The first step I took in the field was to verify initial ideas and make adjustments to the graphical image of the process that I was about to study. This resulted in revising the process according to the new insights of the field situation. Full understanding of the field situation normally occurs (if at all) during final stages of fieldwork. Advancing insights in this stage result in a updated version of the graphical image of the process of technology transfer. This updated version forms a good starting point for thesis writing, as it includes the latest ideas on the different actors and linkages, connections, communication lines and flows of the technology, money, information and knowledge between the different actors. The graphical image of the process as I constructed during the final stage of my fieldwork and reconstructed during thesis writing is displayed in figure 3.1. The initial and updated ideas about the layout of the process are included as graphics in appendix 3.

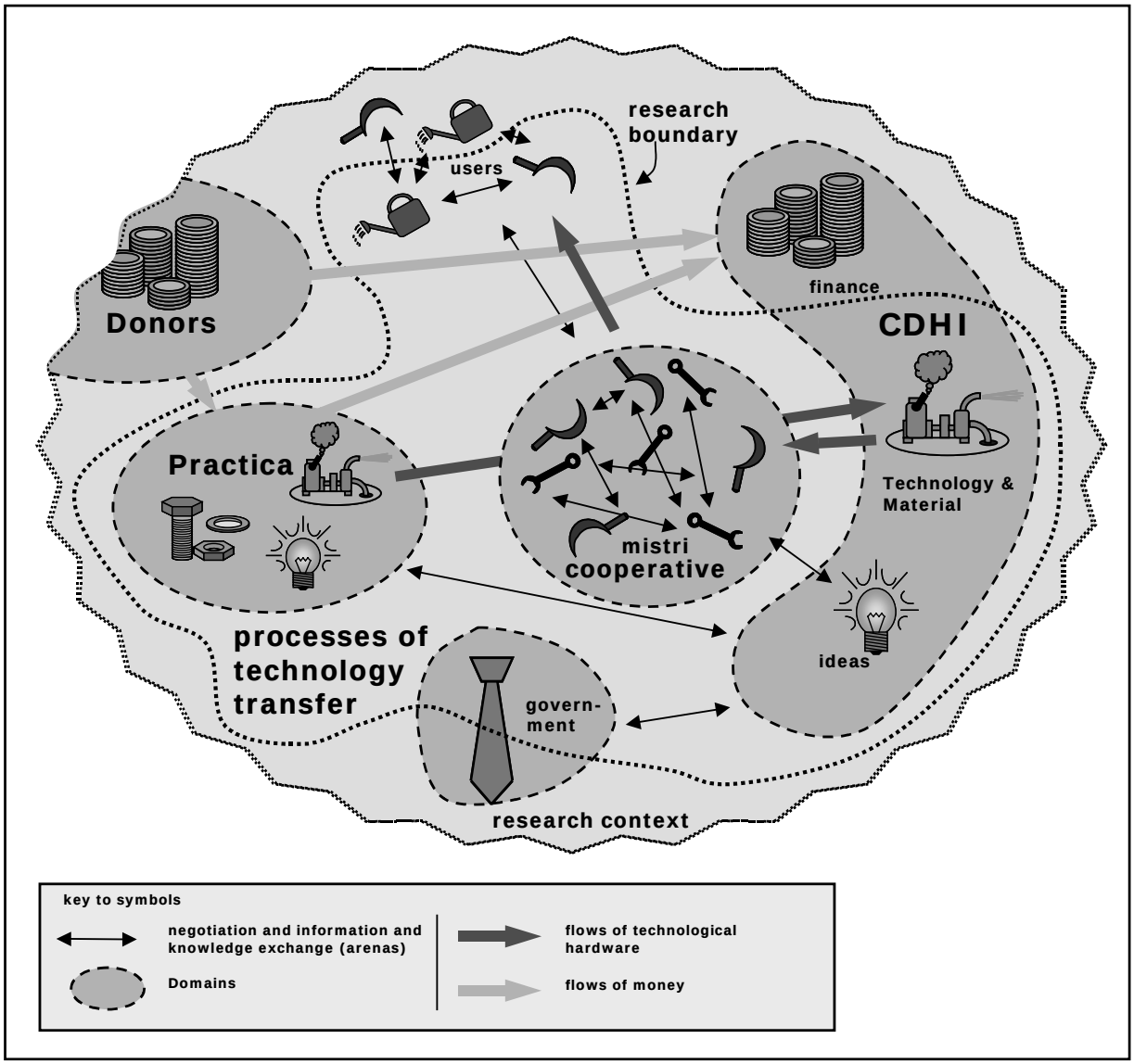


Figure 3.1; graphical image of the process of technology transfer

## Technology transfer; actor perspectives

The schematic representation of the process of technology transfer as shown in figure 3.1, allows for different approaches. As outlined in chapter 2, the approach was initially on the cooperative and their role in the process, but shifted in an early stage to a less technocratic and more sociological perspective, focussing on interactions between the different actors. This includes focussing on the dynamics of information and knowledge exchange. The graphical representation of the process helps to define important social actors as object of study, lines of communication between the relevant actors and flows of information, technical hardware and money.

From the way the process of technology transfer is pictured, it appears that also the term 'network of technology transfer' would apply. The concept of network is often linked to the actor oriented approach, as it is a tool to map the linkages between social actors. The difference with the concept of a process is that it shows the temporary nature of the network that exist *as a result of* the process that takes place; when there is no technology transfer, the network will probably look different. However, on this temporary basis, the process can be defined as a network that is made up of sets of direct and indirect relationships and exchanges (interpersonal, inter-organisational and socio-technical). It transcends domains and links together a variety of arenas (Long; 2001).

Long (2001) defines domains as representing 'the loci of rules, norms and values that become central to this process of social ordering and to the establishment of certain pragmatic rules of governance. The idea of domain is also important for understanding how social and symbolic boundaries are defined and upheld, though precisely which normative or strategic principles will prevail situationally or over the longer term remains an open question. Domains should not be conceptualised as 'cultural givens' but as being produced and transformed through actors' shared experiences and struggles.'

Within the process of technology transfer, different (groups of) social actors can be indicated. Long (2001) defines the social actors as 'all those social entities that can be said to have agency in that they possess the knowledgeability and capability to assess problematic situations and organise 'appropriate' responses. Social actors appear in a variety of forms: individual persons, informal groups or interpersonal networks, organisations, collective groupings, and what are sometimes called 'macro' actors (e.g., a particular national government, church or international organisation).' Long (2001) further stresses that care should be taken not to assume that organisations act in unison with one voice. Rather, collectives like cooperatives are better 'depicted in terms of 'coalitions of actors', 'interlocking actor projects', and 'the interplay of discourses'.'

The process of technology transfer covers different arenas; 'spaces in which contests over issues, claims, resources, values, meanings and representations take place; that is, they are sites of struggle within and across domains' (Long; 2001).

## Technology transfer in focus

The process that was the initial focus of the field research could be simply defined as 'making new technologies available for the rural poor'. By stating the process this way, it might appear that this is a linear process in which technology flows from one actor to another, following straight lines. When studying processes superficially, this might appear to be the case; new technologies or technological artefacts from Practica then can be seen as mainly pre-defined entities that are developed for a specific target group, reaching those end users by some intermediary steps. But when looking at the process of technology transfer more closely, then these intermediary steps appear to play an important role in this process: It are those steps that are the arenas in which negotiation takes place and in which appropriation and internalisation of technology is getting shaped. So for studying technology transfer, studying the intermediary steps as arenas of negotiation is of great importance.

This is also where it comes to practical application of the graphical model of the process of technology transfer:

By focussing on one of the social actors specifically, the relevance of this social actors within the process becomes more tangible. Here, the graphical representation of the process is constructed around the central concept of the mistri and the mistri cooperative. The graphical image also shows that, when focussing on any of the social actors in the process, the end users play a less significant role in the interaction and negotiation processes that occur between the three actors that together shape the process of technology transfer, namely Practica, CDHI and the mistri (cooperative). This appears to be contradictive to the contemporary development paradigm where emphasis is on participatory technology design and participation of the targeted people. The absence of a direct focus on the arena in which end users and other actors contest the characteristics of a new technology in the graph has two specific reasons: First of all, the graph is based on my observation during fieldwork. And as I focussed mainly on two technologies of a whole range of possible technologies, this figure is based on two off-the-shelve solutions in which end users did not play a significant role in the development trajectory[9]. The second reason builds on the fact that some of the technologies, although introduced to improve the livelihoods of the rural poor, are not directly used by these people. The stone hammer technique is an example of a technology that ultimately aims at improving the livelihoods of poor farmers, but is not used by the farmers themselves. The stone hammer tool enables low cost well drilling even in stony soil, so that cheap wells for drinking water and small scale irrigation are available for the poor farmers. However, it are the mistris who use this technology. Distinction thus has to be made between the *users* and the *beneficiaries*. In this context, mistris are often the users of the technology. Besides, mistri cooperatives consist of both fulltime mistris and mistri-farmers, so no sharp distinction can be made between mistri-users and end users. This I represented in the graph by including 'farmers' in the mistri cooperative.

Within the process, I expected the three main actors to have the same goal; that is introduction and dissemination of new technologies. Nevertheless, the emphasis of this thesis is on understanding the role of the mistris and the cooperative in the process. I will relate the role of the other two major actors to the mistris and the cooperative.

Other actors that appear in the process are the donors and the (local) government. They are not explicitly included in the research (research boundary) for the reason that during my field work they formed (part of the) enabling and constraining conditions for the process and did not have an active role in the technology transfer system. Still they are drawn as actors because their role can change over time and they can be included in a negotiation process. Their role in the process will be touched upon in the following chapters, but is not a subject of direct study.

## Framing the framework

To understand the relevance of the framework that I have pictured here, it should be placed in the context of the different theoretical approaches for understanding human behaviour and human action: Choosing to work with an actor oriented approach for illustrating what happens in the process of technology transfer includes rejecting the structuralist and structural functionalist approaches for explaining human action. Firth (1951) for example, as a structural functionalist states that: 'As a member of a society, each separate individual is striving to attain his ends, interacting with other members. All of them are largely governed in their behaviour by the sets of established basic relationships of the social structure. This embodies sets of expectations as to what people will do in virtue of their social roles, and ideals as to what they ought to do. So the conduct of the individual has a complex scheme of motivations. His own interests, recognition of interests of other members of the society, and recognition of the structural values by which he has been guided so far in his career, all

[9] In the range of different technologies, the well wash techniques are an example of participatory technology development. Well washing as a method to increase water discharge from an old well was introduced by Practica and appropriated to the local situation through intensive cooperation with mistris and farmers as end users of this technology.

affect his patterns of behaving.' So with this statement, Firth claims that individuals will behave in virtue of their social role and in virtue of established basic relationships of the social structure. The social roles and basic relationships of social structure are pre-defined entities that are needed to help society to operate. There has always been a tension between the two trends of structure versus human agency for explaining human behaviour. The Wageningen perspective emphasizes 'the continuing value of 'actor-oriented' approaches to the study of development, arguing that an actor-oriented perspective entails recognising the 'multiple realities' and diverse social practices of various actors, and requires working out methodologically how to get to grips with these different and often incompatible worlds' (Grillo; 1997).

But to what extend is this theoretical debate of structures versus agency useful in explaining what happens in the above sketched process of technology transfer?

The process of technology transfer leans heavily on the conceptual ideas of the actor oriented approach as outlined by Long (2001). This approach allows for explaining the negotiation processes (arenas) that exists between the different social actors. However, when using the actor oriented approach, one might advocate to consider the cooperative as a social actor as well. But as the actions of the cooperative should rather be depicted in terms of 'a coalition of actors' and an 'interplay of discourses', and because the agency of the cooperative is not self-evident, I will not consider the cooperative as an actor. On the other hand, considering the mistri cooperatives as only a collection of individuals does not allow for exploring the added value of this organisational structure and the incorporation of the cooperative in the life worlds of the mistris.

Giddens (1998) tries to circumvent the dichotomy between structures and agency with his 'structuration theory' in which he claims that structures exist, but only as far as the individuals produce and reproduce these structures. Social actors behave according to structures that they construct and maintain themselves. Giddens' structuration theory can especially be of help where of behaviour of the individuals cannot be explained by simply looking at agency of the individual. That is for example, when appropriate responses of the mistris to problematic situations are (partly) determined by the ruling norms and values of the cooperative of which they are a member.

## Structuration theory (Giddens)

In *The Constitution of Society* (1984), Giddens' major statement of structuration theory, he outlines a theoretical and methodological alternative to the persistent dualisms of social theory, centred around the tension between the individual and society. Giddens therefore rejects not only both methodological individualism and methodological collectivism, but also any dialectical reconciliation or mediation of the two perspectives, claiming the development of a new and alternative position (http://home.mira.net).

The basis of Giddens' structuration theory is formed by his perception of the relationship between social structure and human action, which can be summarised as:

**Social structure** *shapes and determines* **Human action**, by enabling and constraining.
**Human action** *shapes and determines* **Social structure**, by producing and reproducing.

So for Giddens, human action (or human agency) and social structure are not two separate concepts or constructs, but are two ways that social action can be studied and understood sociologically. There is a duality of structures in society – on one side there are situated actors who undertake social action and interaction, and enter into knowledgeable activities in various situations. At the same time, social systems and structures form the rules, resources, and social relationships that actors produce and reproduce through social interaction (http://uregina.ca). Structuration means studying the ways in which social systems are produced and reproduced in social interaction. Giddens defines structuration

as 'the structuring of social relations across time and space, in virtue of the duality of structure' (Giddens; 1984).
When applying the concepts of structuration to the process of technology transfer as research framework, especially the cooperative can be considered as a *social structure* that refers to the 'reproduced relations, or regular social practices which can exist across time and place. Critically, the structural properties of social systems are both medium and outcome of the process of structuration. The study of structuration is the study of how these rules and principles are enacted, reproduced, and transformed' (Stillman; 2004).
In addition, the utilisation of different resources (for example, technological artefacts), further contributes to the development of particular structural principles. The structure which emerges through using the resources, can be enabling and constraining for actors (Stillman; 2004). In this thesis I will focus on how the mistris use the different resources and how the structure of the cooperative is produced and reproduced through these resources. Enabling or constraining effect of the structures will be related to possible improvements of the livelihoods of the mistris.
The cooperative is a special form of structure, reproduced by the mistris, in which the 'mediation' of different frames of meaning, different sets of principles, or different *perspectives*, results in the politics of organisations. This is the starting point of analysis for understanding how organisations or institutions (and the people within them) work – or don't work (Giddens; 1976).

### The framework; hardware and software

Up to this point, I have introduced two pillars that theoretically support the thesis: The 'process of technology transfer as a graphical simplification of reality, showing social actors, domains, arenas of negotiation and flows of information and artefacts, forms the *hardware* to approach the research situation. It is used to delineate the problem and to frame the problem in its context. The ideas on the actor oriented approach of Long as well as the structuration theory of Giddens can be of great use for describing and explaining what is happening within the process of technology transfer; the *software*. Especially Giddens' structuration theory can be used for understanding the value of the mistri cooperatives, while the arena's as 'spaces in which contest over issues, claims, resources, values, meanings and representations take place' (Long; 2001) and the domains as 'the loci of rules, norms and values' (Long; 2001) are of help for understanding the negotiation processes that takes place within the process of technology transfer.

To identify the relations between the actors, I will make use of different concepts. These concepts will help to understand the human action, negotiation as form of human interaction and social structures.

## Concepts

From the framework of the process of technology transfer that forms the backbone of this thesis, a number of concepts can be extracted that are helpful for structuring relations and interaction. Here, concepts are conceptual representations of different phenomena that occur in the process of the described technology transfer. The relation of the concepts to the research problem forms the basis to include contemporary theoretical ideas.
The concept stated here have a dual role: ideas and theory are used to make assumptions about the situation in the field and to predict and understand phenomena. In the following chapters, the theory is also used as a comparison to the situation in the field. Differences and inconsistencies between the

practice of field research and theory are located and explained where possible. The following concepts are used throughout the thesis:

## Social capital

One of the concepts that I will use to help explaining the internal characteristics of the mistri cooperatives is the concept of 'social capital'. Based on my hypothesis that mistris experience positive effects or 'added value' of their membership of a cooperative, the concept of social capital is especially useful for gaining understanding in how the membership of a mistri cooperative fits in the livelihoods of the mistris and how this might facilitate improvement of the livelihoods, which is one of the research objectives.

However, for the concept of social capital to be useful to explain phenomena that I observed during fieldwork, first it has to be clear what is referred to by using this concept. Putnam (2000) uses the concept of social capital to describe the negative effects of the process of individualisation and how social capital helps creating cohesion in American contemporary society. He gives the following delineation of the concept of social capital: 'By analogy with notions of physical capital and human capital - tools and training that enhance individual productivity - the core idea of social capital theory is that social networks have value. Just as a screwdriver (physical capital) or a college education (human capital) can increase productivity (both individual and collective), so too social contacts affect the productivity of individuals and groups.' (Putnam; 2000). Especially this tension between affecting productivity of individuals *and* groups makes the concept interesting for studying mistri cooperatives, as it enables for looking at personal improvements in livelihoods. So 'Social capital has both an individual and a collective aspect - a private face and a public face. First, individuals form connections that benefit our own interest. ... However, social capital also can have 'externalities' that affect the wider community.' (Putnam; 2000). The externalities of social capital, affecting the wider community also represents the idea of the Centre for the Development of Human Initiatives that establishing self-help groups like mistri cooperatives will have impact on the community as a whole. I will come back to this in chapter 6 in which I will describe the role of CDHI in promoting and sustaining the cooperatives.

Putnam stresses two types of social capital: 'Of all the dimensions along which forms of social capital vary, perhaps the most important is the distinction between *bridging* (or inclusive) and *bonding* (or exclusive). ... Bonding social capital is good for undergirding specific reciprocity and mobilizing solidarity. ... Bridging networks, by contrast, are better for linkage to external assets and for information diffusion.' (Putnam; 2000). Generally, in social processes either one of these can be distinguished. However, in the research on mistri cooperatives, these two processes of bridging and bonding seem to occur simultaneously. That is, bonding *inside* the cooperative among the members, and bridging *between* mistris (cooperatives), NGO and foreign technology consultants, creating a global network of technology transfer[10].

Putnam (2000) summarises that trust and citizen participation operate through a variety of mechanisms to produce socially desirable outcomes and the mechanisms at work will vary by the circumstance (context) and outcome in question. But in general social capital has many features that help people translate aspirations into realities. First, social capital allows individuals to resolve collective problems more easily. Second, social capital sets the conditions that allow communities to advance smoothly. A third way in which social capital improves the lot of individuals is by widening awareness of the many ways in which well-being of an individual is related to the well-being of others and so shows that fates of individuals are intertwined.

[10] Bridging also in less extend takes place at local level by linking the cooperatives through establishment of a mistri federation, but this process is less relevant in the context of this thesis. It will be mentioned in chapter 5 on the mistris and the cooperatives.

## Trust

However undoubtedly related to social capital, trust is a concept worth mentioning separately. Part of the hypothesis about the technology transfer is that this takes place based on relations of trust. Lyon (2000) states that 'trust operates when there is confidence in other agents, despite other uncertainties, risks and the possibility for them to act opportunistically. Trust can come from both generalized norms of morality and more personalized sources embedded in social networks.' Trust is often associated with long-term relationships and based on the probability that the other will behave as expected. But trust can also be based on the norms and values of a society that also assure that the other will behave as expected. In this sense, norms define what actions are considered acceptable or unacceptable and include customs of cooperation, reciprocity, avoiding deception, keeping verbal contracts and deciding on acceptable sanctions. (Lyon; 2000).

In the process of technology transfer, trust occurs through different mechanisms, that means, there are different reasons to believe the other to act as expected and not to act opportunistically. These mechanisms are subject of study and will be included and elucidated in the description of the different actors in the following chapters.

## Technological change

Technological intervention and technological change are two related concepts in this thesis. Intervention is the basis on which the technological change process takes place. Especially emphasis should be on change as a *process*: From a more technocratic perspective, change is often seen as the *outcome* of a process. When looking at technological change as a special form of change, MacKenzie (1999) warns for technological determinism: 'As a simple cause-effect theory of historical change, technological determinism is at best an oversimplification. Changing technology will always be only one factor among many others: political, economic, cultural, and so on. If technology's physical and biological effects are complex and contested matters, it would clearly be foolish to expect its social effects to be any simpler. A 'hard', simple cause-and-effect technological determinism is not a good candidate as a theory of social change.'

Putting the concept of technological change to the background of the process of technology transfer, it becomes clear that technological change will take place during interaction (negotiation) between the social actors; the so called arenas. For technological change to take place, the *values* of the social actors governing the ideas and perceptions about technology should be compatible, or at least have some degree of plasticity.

Relating this to the ideas of Giddens about structures, it are the values governing the old structures that must have some degree of flexibility. So it probably is the combination of overlapping values of the actors on the one hand, and on the other hand the willingness to change other values, that enable them to produce new structures and reproduce other existing structures.

The technological change process involves issues concerning generation, dissemination, utilisation and transformation of knowledge, in which different modes of knowledge (so called 'expert' and 'lay' modes of knowledge) as well as different sets of values might clash or accommodate (Long; 2001).

## Values

Although a lot of different definitions of values can be found, I prefer to use the definition of values as 'The particular (frequently subjective) positive point of view of an individual or the common point of view of a group on an issue, way of life, or concerning the worth of things or experiences. Values may range from those that are subjectively meaningful to a given individual to those that are shared cultural norms. They influence the selection of the means and ends of actions, and they serve as criteria by which objects or actions are evaluated.' (fwie.fw.vt.edu)

Using the concept of values in social research gives meaningful clues to explain behaviour and choices of individuals. Values can also be used for explaining behaviour of individuals in a group, although these may be other values: 'Values can be conceptualised on the individual and group level. At the individual level, values are internalised social representations or moral beliefs that people appeal to as the ultimate rational for their actions. ... At the group level, values are scripts or cultural ideals held in common by members of a group; the group's 'social mind'.' (Oyserman; 2002).
Values do play an important role to understand harmony within the cooperatives, as this is based on a shared value system of the mistris: 'Values do not exist as isolated entities - they link as systems, with some degree of integration, for every individual. At the same time, the value systems of different individuals must present some common elements in order that community life can go on. And for values to be capable of influencing choice there must be standards, i.e., elements of relativity, involved.' (Firth; 1951).
In the context of the process of technology transfer, in which different (groups of) actors interact, positive as well as negative results of the interaction can be explained by differences or inconsistencies in the different value systems of the social actors: 'Values, to which individuals feel they owe an allegiance as members of a particular group or society, are seen as the glue that makes social life possible *within* groups. Yet, they also set the stage for frictions and lack of consensual harmony in inter-group interactions.' (Oyserman; 2002).
Also context or locality is important in understanding values, as values are not simply individual traits. The construction of sets of values as 'social agreements about what is right, good, to be cherished' (Oyserman; 2002) depend on a lot of different factors, of which social background, religion, culture, education and climate are just a few. The system of values that is created gives identity to the individual. Social structures are held together by corresponding systems of values and believes that individuals have internalised. The role of the Hindu religion in the livelihoods of the mistris, as I will describe in chapter 4, is an example of how religion can be internalised in the system of values of individuals.

## Negotiation and Power

Among the research objectives, emphasis is on the different roles, objectives and motives of the three actors in the negotiation process of technology transfer. Here, the hypothesis is that technology transfer comes about through negotiation and not through pre-fixed roles that actors are expected to have in the process of technology transfer. To specify negotiation: 'Negotiation is the process whereby interested parties resolve disputes, agree upon courses of action, bargain for individual or collective advantage, and / or attempt to craft outcomes which serve their mutual interests. It is usually regarded as a form of alternative dispute resolution.' (en.wikipedia.org). Rather than the win-loose situation that often comes about through negotiation in conflict situations, the negotiation process of technology transfer does not come about through conflict and so it is based on the idea to create a win-win situation. This is also referred to as 'mutual gains bargaining'.
The concept of power is often linked to the concept of negotiation. However, it is often too easily assumed that the outcome of negotiation processes is determined by the 'power' actors have to impose their ideas on the other, less powerful actors. This perception of power entails that power is seen as something someone imposes over someone else. For understanding the outcomes of the negotiation process of technology transfer, though, it is more fruitful to use the ideas of Foucault about power, showing that power, like knowledge, is not simply something that is possessed and exercised: Power relations are rather shaped through negotiation than the other way around: McHoul (1995) explains Foucault's ideas by stating that 'power is both reflexive and impersonal. It acts in a relatively autonomous way and produces subjects just as much as, or even more than, subjects reproduce it.' This is supported by the statement of Foucault (1980) that 'power is employed and

exercised through a net-like organisation. And not only do individuals circulate between its threads; they are always in the position of simultaneously undergoing and exercising this power.'
For studying the process of technology transfer, negotiation will not be considered as an act of power, but rather as a process in which power relations are shaped and again reshaped. The consequence for the process as such is that it should not be considered as a linear process; negotiation and the changing power relations that stem from it make the outcome of the process highly unpredictable.

## Organisation:

The starting point of the fieldwork was to consider the cooperative as a specific organisational form. So, before going into detail in the theory about the organisation of a cooperative, the theoretical ideas on internal set-up of (other) organisational forms should also give insights in the role of the mistris in the cooperative and the interactions between the mistris in the cooperative. Theoretical ideas on the cooperative as a specific form of organisation will be presented in chapter 5, using the ideas of Galle (1994).
Silverman (1970) gives a definition of an organisation as: 'a social system organized for the attainment of a particular type of goal'. When this goal is defined as the common goal of technology transfer, then studying the cooperative as an organisation cannot be seen apart from CDHI or Practica. However, when the goal is defined differently (for example supporting livelihood improvement for the individual members), this will have consequences for how the social system is organised and how this social system operates in society.
According to Silverman (1970), there are two ways of approaching organisational issues. This division primarily comes down to the distinction between the functional structuralist approach (system model) versus the actor oriented approach (alternative model):

System model

The systems approach stresses the way in which the action of the parts is structured by the system's need for stability and goal-consensus and emphasises the processes of integration and adaptation.
An organisation defined as a system can either be studied as a *partially open system*[11] or as an *open system*[12]:

Alternative model

The alternative approach argues that organisations are merely the ever-changing product of the self-interested actions of their members and concentrates on conflict and the role of power. It suggest that it would be more fruitful to analyse organisations in terms of the different ends of their members and of their capacity to impose these ends on others. It considers the members of an organisation as independent individuals with own ideas and goals who see the organisation only as a means to reach these goals.

The most significant difference between both models is the role of individuals in the system: The system model is based on the idea that the individual members form the system whereas the alternative model presumes the existence of a system in which individuals try to attain their own ends. This alternative model that focuses on the role of the individual in an organisation does not allow for cooperative action and social cohesion.

[11] While recognising the influence of the environment, it is sometimes best to give prior attention to organisational variable in order to limit the scope of the study. In this case, the partially open system includes that external factors are used only as 'controls' to explain complexity in the data afterwards, while hypotheses derive from internal factors.
[12] Also society consists of a collection of systems and sub-systems of greater or lesser complexity. The functioning of each depends upon the interrelationship with the others. Studying organisations as open systems focuses on interaction between different social systems.

Within the framework of Giddens' structuration theory, studying organisations using the system model does allow for studying the production and reproduction of structures and how these structures enable or constrain the individuals, whereas in the alternative model structures are prefixed entities. This system model also seems to apply on the mistri cooperatives, where no pre-existing structure is in place; the mistris produce and reproduce the structure of the cooperative and meanwhile experience the enabling and constraining consequences of such a structure. It are those 'enabling consequences' of the cooperative that allow for personal gain. When trying to explain phenomena that occur in the cooperative with the alternative model that is based on personal gain, the continued existence of the cooperative in times of lack of any demonstrable personal gain, the model runs short.

Nuijten (2003) uses the ideas of Law (1994) to open up the idea of the uniform organisation that Silverman uses: Studying organisation using the system model or the alternative model both includes assumptions about the roles of individuals in the organisation. Law (1994) argues that there are many organisational narratives that can be found in every organisation. Participants in an organisation may present very different and contradictory narratives about what the organisation is about and / or should be about. Using Laws approach for capturing the dynamic of the organising process, all narratives are true and incomplete at the same time. In this approach, the forms of discourse available to and used by social actors in assessing their organisational situation are a central object of study. Nuijten even takes this position a step further by stating that 'different views or images of the organising process not only show different sides of the organisation; they also reflect areas of tension and conflict.' So instead of looking at the organisation as unity, the dynamics of organising practices can be better understood by looking at contrasting views and discourses of the members.

## Livelihoods and livelihood improvement

The concept of livelihoods appears in the research objectives: *examine how the membership of a mistri cooperative fits in the livelihoods of the mistris and how this might facilitate improvement of the livelihoods*.

Livelihood is quite a broad concept. As a general definition, it can be summarised as the way one acquires the means that are needed to sustain himself and dependant family members.

When talking about livelihood improvement through changes in work, one can think of two realistic options. The first options is what I call livelihood intensification, which means that the mistri will get more work in his field of profession. And as more work generally means more income, this will lead to improvement of the livelihood of the mistri. Livelihood improvement through intensification is relatively easy to measure by observation of activities and by conducting interviews.

For mistris in the cooperatives, mistri work is almost never the only source of income. Often agricultural work is involved, and there might be more or less emphasis on the mistri work or other activities by different mistris. Having multiple sources of income is quite common in low-income or developing countries, mainly among the poorer, rural population. In literature, this phenomenon is referred to as 'livelihood diversification'. Diversification occurs for many reasons. Ellis (1998) mentions declining returns to farming compared to other activities as one. Livelihood diversification as household survival strategy includes components like risk reduction, overcoming income instability caused by seasonality, improving food security, taking advantage of opportunities provided by nearby or distant labour markets, generating cash to meet family objectives, etc. Ellis (1998) introduces his article on livelihood diversification and sustainable rural livelihoods as follows: 'Farming on its own rarely provides a sufficient means of survival in rural areas of low income countries. For this reason most rural households are found to depend on a diverse portfolio of activities and income sources, among which crop and livestock production feature alongside many other contributions of family well-being. Livelihood diversification is widespread and is found in all locations, as well as across farm sizes

and across ranges of income and wealth'. Positive effects of diversification on the livelihood of mistris is more difficult to measure as it might include lots of different activities.
Intensification as well as diversification of livelihoods mainly generate extra revenue and lead to material improvements of the livelihood. Besides material improvement of the livelihood as described above, there are also other ways of livelihood improvement, which include livelihood improvement through creating social networks, achieving status, acquiring access to loans, etc. Although equally important, this social side of livelihood improvement is underdeveloped in literature about livelihoods. This might be because it is more difficult to measure and thus not useful to include in evaluation research on livelihood improvements. Besides, the mechanisms of this social livelihood improvements overlap with the terrain of social capital and so it is more logical to cover these issues by studying social capital, as I will do throughout this thesis as well.

## The practical study on technology transfer

The process of technology transfer, the theoretical ideas and the theoretical concepts mentioned in this chapter will function as framework for the description of the field situation that is presented in the next chapters. However the basis for these chapters is formed by the observations, ideas and thoughts gathered during the fieldwork period, the actor oriented approach that I have introduced in this chapter has some consequences for the way the field data is presented: As the actor oriented approach values the knowledgeable actor and the 'existence of 'multiple social realities' (i.e. the co-existence of different understandings and interpretations of experience)' (Long; 2002), it is a logical step to present these 'multiple social realities', and so the social actors, separately. However, presenting a whole 'social reality' in itself is impossible. Representation of this social reality will take place through description of structures, events, ideas, values, etc. that are part of this social reality. Besides, it is never an objective description of these realities, but always influenced by the subject who describes this reality, relating it to his own social reality.

The analyses of the applicability of the theoretical ideas on the field situation as presented in the next chapters, and the evaluation of possible inconsistencies between theory and practice will be done in a separate chapter of concluding remarks.

# Chapter 4 This time, this place

The role of context

Context, the correlation in which things take place. Everything is contextual, but what does that mean? For this thesis, it means that the things that I have done took place on a certain moment in time, in a certain place. According to Scharfstein (1998, stated in Dilley; 1999), 'context is that which environs the object of interest and helps by its relevance to explain it'.
Admitting that everything is contextual implies admitting that the things I write down cannot be understood without a sound understanding of the context in which I did my research. And probably that is the most difficult part of research: Understanding the things you see is only possible when you understand the things you do not see. 'The idea is that anthropologists who interpret social and cultural phenomena do so with reference, therefore, to something called 'context'. This apparently simple notion that it is contextualisation that gives form to our interpretations raises important questions about what a context is, how it is defined and selected, and by whom' (Dilley; 1999).

What Dilley calls the *definition and selection of context* somehow is essential for understanding the role of the different facts that I will mention in this chapter: It implies that reading this chapter gives an indication of *my* vision on the context. Phenomena in contemporary North Bengal society are written down in this chapter only because I assessed these phenomena as being important for understanding behaviour of people, communication lines, flows of information, motives for actions, etc.
Describing context from my perspective has some advantages: It will guide the reader into my ideas, norms, values and believes and so helps to gain understanding about the research set-up and research focus. At the same time, reading these factors that I considered relevant for understanding the context will enable for a more critical standpoint in reading this thesis. After all, by describing relevant contextual factors, I have pinpointed the contextual factors that I considered to be less relevant by leaving these out.

For the study on technology transfer, other contextual factors play a role than when studying for example the role of women in small scale enterprises. This seems logical, but too often people get stuck in describing generalities rather than focusing on subject-specific factors. However, the themes that I will mention are by far exhaustive, but at least it should help to create a better understanding of what I consider to be the context.

## Technical state of affairs

One of the different contextual factors that seem to influence the process of technology transfer is the contemporary state of technical affairs in North Bengal and the Terai region specifically: For people to be able to be part of processes in which different technologies and technological artefacts are introduced, accepted, internalised and transferred, the technologies and technical artefacts must somehow fit with those technologies people are already acquainted with. The technical state of affairs in North Bengal seemed to be in line with other regions in India. This did not mean that the agricultural technologies available in the market are also available for the rural poor, but at least they are aware of the existence of the technologies. Awareness in itself will enhance acceptance as soon as the technologies are available.

When drawing from my own experiences and comparing the technical state of affairs in North Bengal with that in Ghana[13], technology and technical artefacts seem to be much more integrated in Indian society than it is in West-African society. An indicator for this is that India produces a lot of different technical products for the domestic market, varying from pumpsets for irrigation to motorbikes, while Ghana almost completely depends on foreign import of all kind of technical artefacts. Own production as in place in India, indicates a history in technological development while Ghana depends on external technology development and Ghanaians are only end users.
This history in technology also has repercussions on the delivery and maintenance chain that is in place: This delivery and maintenance chain that is in place in India, and of which mistris are a part, appears to be well established and integrated in society. This results in well-trained mechanics (experience-based) and a very good availability of spare parts. In Ghana, conversely, the delivery sector depends on uncertain foreign delivery, which results in poor and uncertain availability of products and parts. The art of maintenance and repairs is relatively new and depends heavily on the (new) knowledge of the foreign technologies. In practice, this can be observed by looking at the skills of mechanics: Both Indian and Ghanaian mechanics are mainly experience-based trained, but the experience-base of which Indian mechanics draw from seems to be more solid and complete, resulting in better trained mechanics.

## Religion and technology

Hindu religion does play an important role in the West Bengal society. However, for understanding the practice of the mistris and the process of technology transfer, the question of how religion shapes society is subordinate to the question how Hindu religion affects the mistri practices and how it determines the view on technology. Especially during my research, I came across two phenomena that had quite an impact on my research in a practical way as well as a conceptual way. Both are about the celebration of days dedicated to the different gods, called 'Puja's'.

Bishwakarma Puja (also referred to as Vishwakarma puja)
Hinduism is polytheistic. Practically, this means that there is a different god for all important aspects in life, and technology gradually has become one of these: 'Hindus widely regard Bishwakarma as the god of architecture and engineering, and September 17 every year is celebrated as Bishwakarma Puja - a resolution time for workers and craftsmen to increase productivity and gain divine inspiration for creating novel products.' (hinduism.about.com). 'Bishwakarma revealed the sciences of industry to man and is thus the patron god of all the workers and engineers providing them with courage and inspiration. All over the country factories, workshops and manufacturing units are in festive mood. Shop spaces are cleared to make way for the deity. (www.bangalinet.com) 'Bishwakarma is the son of Lord Brahma. Lord Bishwakarma has four hands, wears a crown, loads of gold jewellery, and holds a water-pot, a book, a noose and craftsman's tools in his hands.' (www.amantran.com). See also figure 4.1; Bishwakarma.

[13] Drawing from experiences with technology in Ghana from 2000, when I did an internship of 6 months at the Ghana Textile Printing Company Ltd. in Tema, Ghana.

Figure 4.1; An image of Bishwakarma, the god of architecture and engineering.

To illustrate how much modern technology is integrated in Indian society, I will describe the Bishwakarma Puja as I witnessed in Jalpaiguri on September 17, 2003:

As with other important puja's, one can distinguish the regularities accompanying the celebrations, like production and selling of statues of the god, the use of incense sticks and the use of fireworks. And as with other puja's, also the Bishwakarma puja has a specific focus; the technology. In Jalpaiguri, This puja is celebrated by owners and employees of workshops and factories and self employed fitters as well as owners and drivers of cars, taxi's, busses and motorbikes, owners of any electrical or mechanical equipment like pump sets, cement mixers, and computers. On this puja, people make offerings to Bishwakarma and pray for prosperity for their business and equipment.

Practically, this meant that I woke up early morning on the 17$^{th}$ by fireworks and drums from the metal workshop opposite my apartment, where celebration already started. When I got outside, I noticed that my roommate had decorated his motorbike and the motorbike and cars from the CDHI office were nicely cleaned. I felt awkward I didn't clean my bicycle.

When I got to work on my computer in the CDHI office, I was surprised when the others from the office came to me, together with a drum players and a priest. That is, they were not coming to me, but to my computer and consecrated all the parts with incense sticks and petals and placed five red dots on all the parts of my computer. The fax, the printer and the electric water filter in the office underwent the same procedure.

I started wondering about the purpose of these actions. Of course, religious celebration fulfil different purposes, but as this is a specific celebration dedicated to technology, I also tried to approach it from a Western technological perspective. It took me some time to find any specific purposes. That means, no improvement of the machine can be expected based on consecrating a technical object with incense sticks, flower leaves and red paint. But when focusing on other procedures that come with this celebration, there is technical relevance: People spend a lot of time on preparations for the celebration. This includes cleaning of the technical objects, doing repairs and maintenance. And so indeed, a better performance of the machine can be expected after the Bishwakarma puja.

Even more interesting for my research is the sociological mechanism of creating *technical awareness*. The celebration of this puja shows that technical artefacts are integrated part of West Bengal society,

incorporated in daily life, and that people *value* these technical artefacts. This in contrast to Western societies where technology is an obvious, taken-for-granted matter rather than something you should dedicate celebrations to.
Incorporating technology in religion has some other effects as well: It detaches technological artefacts from the purely scientific field of knowledge that created these objects and so it influences the knowledge base of people working with and on technology. The influence of Bishwakarma for example gives mistris alternatives for explaining technical phenomena and so their knowledge base might not correspond with the knowledge base of the other actors of the process of technology transfer. The different knowledge bases of the social actors will influence if not determine the outcome of the negotiation practice in which the value of the technology is determined.

Durga Puja, Kali Puja and Diwali Puja

Although not related to technology like Bishwakarma, celebration of other puja's has impact as well on the daily routine of the mistris, especially in the context of my research. Here I mention Durga puja, Kali puja and Diwali puja. These puja's are held in a period of about thirty days, which is the traditional puja month in North Bengal. Exact dates vary each year depending on the new moon. This month is also the long school break, after which the new school year starts. 'The Durga puja, held annually in September-October, is one of the greatest festivals of north-eastern India. A special image of the goddess is made that is worshiped for nine days, then immersed in water, all accomplished with large processions and much public and private festivity.' (www.goddess.ws). 'Performed on the night of Kartik Amavasya, which falls in October/November, Kali puja is an intense invocation to the fearsome goddess. The main purpose of the puja is to seek the help of the goddess in destroying evil – both in the outside world and within us.' Kali puja is followed by Diwali puja. 'Diwali is the festival of lights, marked mainly by four days of celebration. Diwali is a pan-Indian festival. It is celebrated on a grand scale in almost all the regions of India and is looked upon mainly as the beginning of New Year.' (www.theholidayspot.com).
These puja's are worth mentioning as context for my research. First of all as it are the most important events through which Bengali express their religion and culture. But also as part of my fieldwork coincided with these puja's, it influenced my data collection more practically. And as I had not realised this in advance, I did not include the puja's in my planning. This resulted in some delay in my research. But more important, the fact that work and daily routines during the puja month were this heavily influenced by the activities that were related to the puja celebrations, gives additional information about the importance of the festivities. The fact that for the local population of North Bengal and also the mistris religion and religious festivities are this important will probably influence their behaviour in the short period before and after the celebrations too. Individuals might have a bigger need for cash money to finance activities, while long term investments in these months are of less importance. Besides, mistris might for example be less interested in additional job opportunities because they simply do not have time for it.
There are probably dozens more phenomena that can be related to the celebrations around these puja's, but these are less relevant in the context of this research. More important for a researcher is to realise that events like this are all somehow influencing field data, often without being visible directly.

## Shaping context

Besides seeing context as only something that is discernibly or indiscernibly influencing data gathered during field research, it is also something that reacts on changes and events and so something dynamic. Coming back to Scharfstein's definition of context (1998, stated in Dilley; 1999) that 'context is that which environs the object of interest and helps by its relevance to explain it', the question occurs to what extend context is shaped by phenomena that occur as a results of the research being

conducted. During interviews and observations, the presence of a researcher is such an unusual phenomenon, that it might be more prominent than other 'contextual' factors. What I want to show with this, is that one should be aware of the influence of a researcher in the process of research, and the influence of trivial things in this process. This is what I will call 'shaping context'. This process entails shaping conditions under which interviews and observations can take place in a relaxed and natural way. This includes the processes of gaining trust and promoting transparency. This means that it is very important that the people under study can judge the researcher for what he is. Uncertainty about the background and intentions of the researcher are likely to disturb the process of data collection. The people that are object of study will base their behaviour and responses on their perception of the research situation. For example, when villagers think the researcher is sent by the government, they will act as if he is a government official. Likewise, they will act differently when they are convinced that the researcher is a student without any powers to influence their lives, either positively or negatively. In both cases, the perception of the research situation will influence the actions and responses of the objects of study. But more important, by being aware of these perceptions one can anticipate on it. Let me explain this with two examples; the first example is about modes of transport that can be used when visiting a research location, the other example is about participating in rituals.

Example 1; local transport

For the field visits, I could use the car and driver of CDHI. This was quite useful, because the mistri cooperatives were sometimes located in remote areas that were not easy to find without a good guide. But the car was not always available, and besides, it is an expensive mode of travelling. So when I got accustomed to the situation on the road, I was also allowed to use the project motorbike. This really came in handy, because it allowed me to travel together with my interpreter to more remote places that were not easily accessible by car. Besides, the motorbike is the usual mode of transport for the middle class in Northern West Bengal, as a car is considered to be more for the upper class. Also, me driving the bike myself did not seem to fit in the existing ideas about white researchers. The mistris seemed to appreciate this and it took away some prejudices, which created a more open atmosphere during interviews. But there were even better ways: During two days of planned participant observation, both car and motorbike were not available, and public transport to the remote area was not a realistic option. So I decided to go by bicycle, which was about one and a half hour. I guess that the combination of my old bicycle and the fact that I came to work in a bicycle repair workshop of one of the mistris caused the villagers to laugh for hours. At first, they did not believe that I travelled the distance by bicycle, but they liked the idea anyway. I could have pictured in advance that there would be a difference between travelling by car or by bicycle, but the real impact of this simple consideration is something that you can never take into account at forehand.

Example 2; Tjai, biscuits and biri

In every society habits and rituals play an important role. Understanding the habits and rituals, and anticipating on or participating in it can make a big difference during fieldwork. In West Bengal, the habit of drinking tjai with some biscuits comes together with a lot of gossiping. Especially the men like to sit, talk and enjoy, while smoking a biri, the local cigarette. During a participant observation without my interpreter, I joined the mistris in sitting together, drinking tjai and smoking my biri. Especially that I was smoking a biri seemed to break the ice. In the small shops, biri's as well as filter cigarettes are available. Biri's are cheap while filter cigarettes are more expensive and thus only for the richer people, who consider the biri as really bad and unhealthy. When spending time together with the mistris like this, they started accepting me among them. A funny observation during this 'session' was that some of the mistris appeared to speak a little English. They had not shown that before, probably because I had my interpreter with me, and because the situation was too formal.

## Context and research

In the foregoing paragraphs, context is portrayed as influencing the research and at the same time being influenced by the research. Or more precise, it shows how I perceived the context to influence the research and how I interpret the influence of my own presence on the context or research. What it does not show is the perceptions the actors of the process of technology transfer have of the context. That is, these actors might perceive the context as enabling or constraining in relation to their specific objectives and desired outcomes of the negotiation process. These actor-specific perceptions of the context are given attention in the following chapters on these specific actors.

# Chapter 5 Mistris and cooperative action

The role of the mistris and cooperatives in technology transfer

With the theoretic and contextual ideas in place, it is about time to introduce the first and most important players in the process of technology transfer and the subjects of the extensive case studies, the *mistri* and the *cooperative*. In this context, it is useful to mention the role of the mistris and the cooperatives in the North Bengal Terai Development Project again as stated in the introduction, as this was the initial point of departure of the collaboration between the different actors:

> For the introduction and dissemination of technologies, the project made use of local artisans in the field of simple irrigation technologies. The main idea was to use their (technical) skills and social network to fulfil the role as intermediary to reach the targeted people with new technologies. To give these mistris a legal basis for their work in the project and to streamline communication, the mistris were organised in a couple of cooperatives, the so called mistri cooperatives.

Although the role of the mistri cooperative as local organisational form is central in the process of technology transfer, it is the *role of the mistri* in this process that is supposed to be the knowledge gap that this thesis aims to fill. However, as change agents, the mistri and the cooperative cannot be separated completely; it is the cooperative that sets the enabling and legal conditions for the mistris to act as agent of technological change.

The first part of this chapter gives a characterisation of the mistris and covers the role of the mistris as change agents in the process of technology transfer. The second part focuses on the role of the cooperative in the process, as well as the role of the cooperative as a social structure produced and reproduced by the mistris and the role of the cooperative in livelihood improvement of the mistris.

## The mistris

To see the mistri only as a key player in a process of technology transfer would imply isolating the concept of mistri from the person, resulting in a far too technocratic description of the field situation.

In line of the actor oriented approach, in this chapter I aim to introduce the mistri as a person, an individual, who is different from his neighbour mistri but also has some important things in common. Common characteristics result in a general description of the mistris that is needed to understand their role in technology transfer and to characterise the mistri cooperatives, while differences between the mistris are crucial for understanding individual behaviour and courses of action.

Here, I will introduce the mistris as social actors, their livelihood, their day-to-day business and their role in the process of technology transfer. It does not profess to give a truly anthropological description of the life of the mistris, but focuses on characteristics that are relevant to understand their role as agent of technological change.

### Mistri; profession or lifestyle?

The term 'mistri' has been mentioned before, but has not been elaborated this far. Up to this point, it has been sufficient to use the term 'mistri' as a synonym for 'local technician', 'artisan' or 'fitter', but I noticed that this word does imply more than only a specification of profession. The indication of a profession often gives additional information about other personal characteristics like socio-cultural, educational or economical background. In the case of the mistris, the profession is normally associated with rural people. The term 'mistri' was often translated as 'fitter', but this does not cover

the whole spectrum of activities of the mistri; the term 'mistri' is used in a broader sense, also for people repairing motorcycles, bicycles, grain mills, etc in a rural context. For my research I tried to reserve the term for those who are involved in the technological and mechanical side of irrigation practices on village level. This included the repair and maintenance of hand pumps and diesel pumpsets (see also figure 5.1; pumpset maintenance), the boring of tube wells and digging and building of shallow tube wells. Only throughout the research, I noticed that this was a too narrow conception of the mistris:

Figure 5.1; testing of a pumpset after maintenance

Especially in the context of diversification of activities, a man can be a mistri one day, and a farmer another day. The most straightforward conceptualisation of the term mistri, would be to reserve it for those who are actually practicing technical activities, related to the technological and mechanical side of irrigation. As the mistri is one of the central concepts of the research, it is needed to further specify this term in relation to the professional and personal characteristics of this persons.
And although the research focus is also on the organisational form that brings the mistris together, the mistri cooperatives, this cooperative is not necessarily the unit of analyses. To analyse the functioning of the cooperative, the individual members with their individual ideas and competences play an important role as 'participants in an organisation may present very different and contradictory narratives about what the organisation is about and / or should be about' (Law; 1994).
To get insight in who those member mistris are, I focused on the individual members of different cooperatives by means of observation and interviews. I was especially interested in their daily business and routines. Besides, I was interested in how they got involved in the profession of mistri, their own ideas about being a mistri, their educational background and technical knowledge, their family situation, their financial situation and their social status within the village or community. For gaining a better understanding about the lives of the mistris, it is useful to present the findings of interviews and observations. These findings can be grouped around the three themes: livelihood, knowledge and skills, and position in society.

## Livelihoods of the mistris

The livelihood of the mistris, contrary to my assumptions, does normally not consist of fitter jobs solely. For about half of the mistris involved in the mistri cooperatives and in the research, the main source of income is farm activities and agricultural business. They do the fitter jobs next to their normal farming business to get some extra revenue, while other family members take care of the farming. This group of mistris can also be indicated as farmer-members of the cooperative.

For the other half, the main source of income are the mistri jobs. That does not mean that this is the only source of income. This is almost impossible, because mistri jobs are seasonal just like farming: The mistris that I focus on in this thesis are involved in irrigation activities. Irrigation only takes place in the dry season and so in practice, mistri jobs in the rainy season are scarce. Farmers do not bother about irrigation in the rainy season and start planning only at the end of the rainy season. Besides, soil conditions in the rainy season hamper the construction of irrigation facilities like wells and canals. This means that these mistris need additional jobs as well. The landless mistris often work as labourer in agriculture or other businesses, while those who own a small plot use the rainy season to cultivate paddy rice or jute. Especially for the landless mistris additional job opportunities that link with their knowledge and skills can be helpful to improve off-season income. Bablu Ray (president of Beltali Cooperative) for example, is involved in training activities. He is the teacher of a pump class, to train youngsters in the repair and maintenance of pumpsets. The course takes 3 months, 4 afternoons per week. The course is organised by the a local club and is paid by a governmental organisation. Bablu Ray is considered to be one of the best pump mistris and was already involved in pump modification issues during the North Bengal Terai Development Project.

A third, relatively small group of mistris in the cooperatives operates as part time mistri next to other non-agricultural business, like having a small shop or workshop. For instance Mohim Chandra Ray (member of the Sarkarpara mistri cooperative) owns a bicycle repair shop on the market of Laxmi Nager. Next to that, he owns a generator and a pumpset that he rents out (see also figure 5.2; Mohim and his generator). Another example that I came across, is that of Maloy Kanti Das, cashier of Beltali Cooperative. He is a farmer who started a fertiliser business and a business in spare parts of pumpsets. He told he joined the cooperative to increase his business. Through the cooperative, he now has contact with 300 farmers for selling fertiliser, pumps and spraying machines.

Figure 5.2; Mohim Chandra Ray showing his generator set

For the mistris in all three groups applies that mistri work is never the only source of income. Fitter jobs of the part-time mistris as well as the farm and agricultural activities can be seen as livelihood diversification activities. The difference between mistris in the three groups is mainly the role of mistri work in the total picture of livelihood activities: It is the difference between doing mistri work in addition to other activities, or doing other activities in addition to mistri work. At face value, this looks much the same, but in the context of the process of technology transfer, those mistris that generate their main income through mistri activities are likely to invest more time in this business, because it should give them more income security.

## Knowledge, skills and ambitions

To see the mistris as agents of technological change, that means the mistris are considered to have a certain level of understanding of the technology *and* that they have certain skills that enable them to handle the technology. This does not only include *technological* knowledge and skills; especially trivial skills such as literacy can be of essential concern in these kind of processes. The education of the mistris did not appear to give any problems. All of the mistris I talked with had basic education of primary school and a fair level of literacy. None of them had any advanced technical training other than training from CDHI. This also came forward from the questionnaires that the members of Sarkarpara Cooperative filled out during the group workshop. The mistris in my research communicated in Bengali, the local language in West Bengal. Initially, none of them did have enough understanding of the English language to communicate with me, although when visiting the field without my interpreter, Ranjit Ray (the cashier of Sarkarpara Cooperative) and Mohim Chandra Ray (member of Sarkarpara Cooperative) appeared to know some English words, enough for very basic communication.

During my field research I tried to get more insight in the technical knowledge and skills of the mistris by focussing on their understanding of the technologies they used, and by focussing on their ability to innovate on existing technologies. Assessing their knowledge and innovating capacity, I realised afterwards, took place against my own understanding of the technologies; that is, my own (western) technological paradigm and my own social reality. This has some consequences for the value of their specific knowledge, as it is valued with reference to my own value system. Where possible, I have tried to comment on this by relating the value of technical knowledge to the local context and value system.

### Understanding technology

Knowing how to work with a technological artefact is something different from understanding how the technology works: Why bother about how the 8-bit DA-converter inside your CD player translates light pulses into music, if you only need to know how to put in the disc and push the play-button to play your favourite music? But even for repairs, advanced understanding is not always a necessity. Regularly checking the car's oil level and filling up if necessary does not necessarily involve knowledge about internal friction and heat conducting capacity of the oil. Consequently, mistris do not need to have advanced understanding of a diesel pumpset to perform maintenance and repairs.

But to function as agents of technological change in the process of technology transfer, the mistris are expected to be technical agents: With their technical knowledge, they should be able to convince users of the advantages of the technologies. The assumption that someone who repairs pumpsets as a profession has sufficient technical knowledge about the pumpset, appears to be a logic one. But earlier experiences with mechanics in Ghana learned me that this assumption was worth testing.

During interviews and participant observations I have focussed on the understanding of technology by observing how mistris work with technology and by asking the mistris to explain the different technologies. With simple and straight-forward technologies like a bamboo water filter, this is not a problem. Especially when focussing on more complex technologies, there appeared to be some problems with understanding: When asking for the fuel saving pump modifications, none of the mistris that I interviewed could explain me exactly how the technology works. Or as Sureash Ray stated: 'I know how to fit it, but I don't know the theory.' The only mistri I met, who had advanced understanding of diesel pumpsets was Bublu Ray, president of Beltali Cooperative. In the context of the North Bengal Terai Development Project, he did over 300 pump modifications.

Lack of understanding of the technology in itself does not necessarily has to be a problem, as long as the mistris are able to do maintenance and repairs. But when it comes to convincing farmers of the new technologies, it might be more difficult. Problems already start when convincing the mistris themselves of advantages of new technologies. Mistris that are not convinced of the advantages

themselves, will undoubtedly have difficulties convincing farmers and other users with technical arguments and so they cannot be the agents of technological change that they are expected to be. Technical training of the mistris might appear to be useful in this process. However, giving technical training is based on the idea that teaching the mistris the western technical knowledge and value system will help them to convince farmers of using the technologies. Using the ideas of Long (2002) on multiple social realities and different systems of values, it can be doubted that this will help convincing the farmers as they are more likely to share the technical value system of the mistris than the western technical value system.
The use of technical arguments is certainly not the only mechanism through which end users can be convinced of something. Other mechanisms that are also included in the original set-up of the mistri cooperatives is convincing end users by *relation of trust*. Here, the basic assumption is that the relationship of mistris with the end users (farmers) is one of expert - layman. In the paragraph 'Mistris in society' in this chapter, I will go into detail about the relationship of mistris with farmers and others in society.

Technology improvement: innovative capacity and technological agency

During my research, a special interest in the field of knowledge and skills was the capacity of the mistris to innovate. One of the ideas of establishing mistri cooperatives was to involve the mistris in the process of technology design and technology improvement. Apparently, this is based on the assumption that mistris strive for improvement of existing technologies, or that they can be triggered to do so. Technology improvement is on the one hand based on the ability to think of the technology and technical artefacts as something dynamic that can be changed, modified and improved, which I call *innovative capacity*. On the other hand, technological change is something that does not come about automatically. It requires investment in time and money and it requires convincing others of the use of the new or improved technology. This is what I call technological *agency*.
The issue of technology improvement is something that I always mentioned during interviews. There appeared to be considerable differences in the ambitions of the different mistris. As Sureash Ray from Lalbazarpara cooperative stated: 'There is no need to improve the bamboo filter, it is perfect. Everybody is happy with it, so why change?'. And this attitude toward technology improvement was not uncommon. And although it sounds completely logical not to change something that is good, it does not strike with my own western technical paradigm, in which I am taught that everything can be improved. This does not mean that everything *has* to be improved, but often I did not find any awareness among those mistris that there was the possibility of improvement. However, there are also mistris who are actively working on technology improvement:
During an informal interview with three mistris[14], while waiting for the other mistris to show up for a meeting with representatives of different mistri cooperatives on August 23, 2003, I touched upon the issue of technology innovation. We started discussing the topic of technology improvement after the question 'Do you have any ideas for improving the technologies the cooperative is working with?' This question triggered a vivid discussion from which some very interesting ideas emerged. Besides the concrete ideas, also the way these mistris communicated with each other about technology was very interesting. The mode of communication tells a lot about the understanding and conceptualisation of things. Also most of the communication between the mistris and me took place without intervention of the interpreter. We appeared to have a shared understanding of some kind about technical issues that allowed us to communicate about technology by means of drawings, symbols, and gestures. It was also interesting to see how the mistris invested time and money to experiment with different applications of technical artefact and how they managed to build prototypes with locally available materials and limited financial means.

[14] Present during interview: Kalimohan Iswar, secretary of Balarampur cooperative; Ranjit Ray, secretary of Sahebganj cooperative; Nitai Das, secretary of Pundibari cooperative; Dhananjay Ray, CDHI.

To illustrate the ideas of the mistris about technology design, I will describe two specific cases of technological innovation that the mistris explained to me. Describing the process of innovation design tells something about the technological paradigm that lays the foundation for ideas about technology, application of technology and technological change. The following examples thus show not only the ideas about technological innovation, but also the perception of technology and perception of technological innovation of the mistri.

*Innovation 1; irrigation without a pumpset*

Nitai Das, the secretary of Pundibari Cooperative in Tufanganj block, Cooch Behar came up with an idea: irrigation without a pumpset. My first perception of his explanation was that of a siphon; a construction that is used to transport fluids from one place to another under the conditions that the fluid level drops during transport. But as I suggested this, he convinced me that this was meant to transport water from a lower level well to a higher level, like a paddy field. He drew the schematic construction for me which I adapted in fig 5.3. He already did some practical test with this system and he was very positive about the results. Now he had my attention. Of course, I was very sceptical about this, as was my research assistant Joy, who, as a mechanical engineer too, translated for me and took part in the discussion. Joy tried to convince Nitai that this was not possible because it was against the laws of nature. And of course, there are limits to the overlap of technical paradigm of a mistri, based on indigenous and experimental knowledge, and the technical paradigm of a mechanical engineer who is trained according to western technical ideas. But I did not expect the two fields of knowledge already to differ with such a small issue as the flow of water. Or more concrete, that water can only flow from high to low, and not the other way around I expected to be common knowledge irrespective training or paradigm.

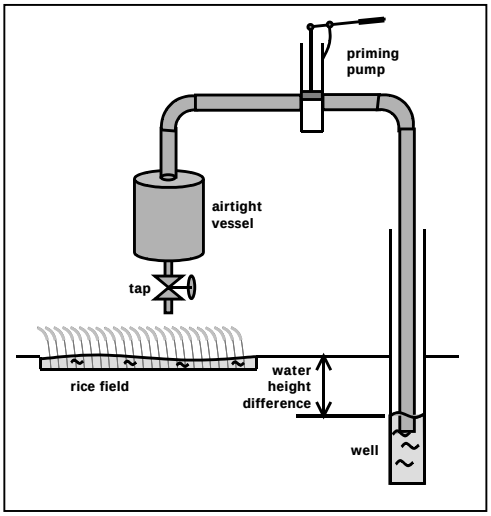

Figure 5.3; Nitai's irrigation innovation

After some more discussion, the mistri offered to give a demonstration of his innovation for Joy and me. Only he was facing one problem with financing this endeavour. He needed some money to invest in materials to build his prototype. From the point of view of CDHI, Joy did not want to invest in something of which he was sure that it would not work, so they decided that the cooperative should invest in this project. I was not satisfied with this, because that almost certainly meant that no funds would be available for the mistri to experiment. I considered privately financing this project, for the sake of research, but that in itself would interfere with other research objectives. After all, I was not only interested in the technical knowledge and skills of the mistris, but also in their technical *agency*. In other words, to see to what extend they could manage technological innovations by themselves. The financial part in this is just as important as the idea and design. I assumed that if he was really convinced of his idea, he would invest some money to make it work. Especially because a machine like this could save him a lot of money in the future. A bit of a anticlimax after all those enthusiastic ideas, but the mistri did not manage to get this thing going. The mistri had enough innovating capacities, but when it came down to technological agency, the project got stuck.

*Innovation 2; high discharge pump*

Ranjit Ray, secretary of Sahebganj cooperative in Dhinhata block, Cooch Behar came up with an innovative idea of a new pump design. For this he connected four pump cylinders to a common suction pipe, which could be connected to a well or open water. These pumps should be operated by

connecting the four pistons to one crankshaft. The crankshaft could be operated by a pedal mechanism.
During the interview, Ranjit told that he already made a prototype of the pump and that we were welcome to see the pump. So I went to visit him on Saturday October 11, 2003. I went to his house and he took me with him to the local workshop were the pump was constructed. Figure 5.4 shows Ranjit together with his innovative pump.

Figure 5.4; Ranjit Ray presenting the prototype of his innovative pump

Further plans were to replace the pedal mechanism with a leaf spring that could be winded. According to Ranjit, this leaf spring should, when fully winded, enable the pump to operate for eight hours continuously. I had serious doubt about the technical functionality of this construction. Besides, my first impression when seeing the prototype was that it was badly constructed with a low level of precision that is needed to make the pump work smoothly. Also the materials that were used were second hand and of low quality. For example, the four pump cylinders were all of different diameter and length. Also the hand-bended crankshaft appeared to be inappropriate for the job to me.
Ranjit told me that the pump had cost about 1300 Rupees this far and that he estimated the total sum to be around 3000 Rupees. This is an enormous amount of money, considered that a mistri earns approximately 50 to 100 Rupees a day, and that he could have bought a brand new bicycle for around 1700 Rupees. These high costs immediately struck me as unrealistic. If I should have made an estimation of the costs for this pump, I would have estimated this around 500 Rupees for the whole device.
What does these facts tell about the mistri and his innovative capacity and technological agency? First of all, that Ranjit Ray is one of those mistris that are able to innovate on existing technologies like existing pump configurations. This means that he understands the basics of pump mechanics and that he can use this to elaborate on existing technologies. He is able to translate his ideas into action by sketching his ideas on paper and explaining these ideas to the technicians in the local metal workshop so they can construct it for him. Ranjit appears to have sufficient *innovative capacity* to get his ideas going. Besides, the fact that he is able to collect enough money to have his idea realised, and that he is able to bring it into the attention of CDHI officials and me also shows that he has *technological agency*.
When I try to assess the technology with my technical value system on its technical and functional characteristics, I conclude that the technology does not add anything to the existing range of products. Besides, I think it is far too expensive and that the prototype will not give satisfying result

with tests. However, when I picture the gathering in the workshop when Ranjit presented his pump, the workshop mechanic as well as the spectators appeared to value the technology as promising. Apparently they used another set of values to judge the technology.

What can be concluded from these two examples of technological innovation, is that the whole trajectory from idea to realisation is quite a complex process, in which different barriers must be taken. Especially for relatively poor individuals like mistris, these barriers are often related to poor financial means and the consequential disability to experiment. In the context of the process of technology transfer as described in chapter 3 and of which these mistris are part, a more active role in developing new technologies and improving existing technologies can be stimulated by taking away these financial barriers. This gives the mistris room to experiment and to learn to innovate. But more important, it is not only the lack of technological agency that hampers the innovative capacity to result in technically viable innovations. It appears that also the technical knowledge of the two mistris from the examples is limited, or rather; that it does not match with my own technical understanding and western technical paradigm and value system. This might result in possibly poor-functioning technical artefacts just as well as contextually appropriated and socially accepted innovations. Either way, the difference in value systems and paradigms has a negative consequence in the process of technology transfer; the other actors assess the technologies as non-promising, and thus do not invest in these innovative processes. For mistris it is very difficult to get the innovative processes going.

## Mistris in society

To see the mistris as agents of technological change, it is necessary to place them in the social context in which this change takes place. The original idea of giving mistris a role in the process of technology transfer must be based on assumptions of the role of mistris in society. This is elucidated in Bom (2002-2): 'Efforts at promotion also underwent serious rethinking. It became obvious that the *mistris* were the most effective channel because they had the confidence of the clients and could persuade them to overcome some persistent misconceptions about pumpsets. They could earn money by modifying existing pumpsets and servicing new ones. Moreover, they could introduce other new technologies such as the bamboo filter and the stone hammer. ... The mistri route proved to be the most effective way of promoting efficiency improvements and treadle pumps. ... A comparison of the mistri cooperatives and the training efforts[15] showed that promoting fuel efficiency improvements was not just a matter of disseminating knowledge, but also of developing confidence in the new techniques and setting up a service sector that could sustain it.'

Involvement of the mistris is apparently based on the assumption that mistris had the confidence of the clients. During fieldwork, I have observed interaction of mistris with each other and with other members of the community, mainly farmers. I noticed that, notwithstanding the class society, there was no significant difference in status of mistris and farmers. Probably, this can be explained by the fact that most of the mistris are farmers themselves, or are involved in agricultural activities. So it is not the profession of mistri in itself that generates a confidence among farmers. Another explanation for building confidence can be that normally farmers stick to one mistri, so mistris have their own clientele. This enables the mistris to build relations of trust with the farmers, as long as the mistri will deliver good work. This explanation appeared to be more suitable, but it does not take into account the fact that the technical knowledge of the mistris is probably not superior to that of the farmers. The mistri might deliver good mistri work, but I still do not expect a farmer to base strategic choices that involve huge financial investment only on personal trust and earlier experiences. This is also what mistris indicated during interviews. Mistri Sureash Ray for example explained that farmers did not believe the theory about pump modification, but that he was able to convince them with tests. Mistri

[15] efforts of training end users and local mechanics in the use of fuel efficient pumpsets by government mechanics

Goutam Sarkar told me that the farmers were hesitating first, but when they saw the technologies work, they changed and even came up with new ideas. 'It takes one month to convince the farmers of new technologies. First I try to convince them theoretically, then practically. I even have money-back actions if farmers are not satisfied afterwards. It also occurs that farmers stop using the technologies like fuel saving modifications after six months, because they simply do not want to take the risk of spoiling their pumpset.' Both mistris indicate that they have problems convincing the farmers and that there is not automatically this relation of trust. Farmers often use the principle of seeing is believing.
I tried to touch upon the issue of trust between mistris and farmers during interviews, and this often lead to issues that related back to the cooperative as organisational structure and its influence on village level. The second part of this chapter handles about the cooperative as organisational form, which also includes issues as this role of the cooperative on village level and the relations of trust and status that it generates for the members among the other villagers.

## The mistri cooperative

The cooperative is a special form of structure, produced by the mistris, in which the 'mediation of different frames of meaning, different sets of principles, or different *perspectives*, results in the politics of organisations. This is the starting point of analysis for understanding how organisations or institutions (and the people within them) work – or don't work' (Giddens; 1976).
Throughout the field research, the focus has shifted away from the heavy emphasis on the cooperative as organisation and organisational structure. Instead, focus went in the direction of the role of the mistris as social actors in the process of technology transfer. However, the mistri cooperative still is a central structure, as it enables the mistris to *get involved* in technology transfer and it enables the other actors to actively *involve* the mistris in the process. And although other forms of organisation could be used as well, the set-up of the mistri cooperatives seems to fit this purpose.
In this chapter about the organisation of the mistri cooperatives, I will introduce the concept of the cooperative and some more theoretical ideas about cooperatives and organisations. I will describe how the mistri cooperatives work and how this organisational form influences the objectives of technology transfer.
Besides, which is even more interesting from the sociological - organisational point of view, I will take a closer look at the survival of the cooperatives even without any directly identifiable benefits. Or to state it differently, I will examine the reasons the mistris reproduce the structure of the cooperative even if it is not directly necessary from the perspective of technology transfer. To relate this back to the research objectives stated in chapter 2:

> *Examine how the membership of a mistri cooperative fits in the livelihoods of the mistris and how this might facilitate improvement of the livelihoods or social capital.*

So there will be focus on organisation of the cooperative as well as personal interests and relations that are formed by as well as form the cooperative. Data collection is done through observation, interviewing and organising workshops with the cooperatives as a whole.

### The cooperative as special form of self-help group

Although the cooperative is a commonly known and used form of organisation, it is quite difficult to give an exact definition of it. Galle (1994) for example, describes the cooperative both as enterprise as well as a form of concerted action. He states that by practising and managing the *enterprise* by its members, the cooperative should provide in the needs of its members. Members participate in the cooperative to satisfy a specific and individual financial need. The cooperative exists exclusively for

members and the primary task of the cooperative is to fulfil the economic needs of its members. Galle (1994) also describes some basic principles which he bases on ideas of other cooperative-thinkers. These principles include:

- one men, one vote;
- free entry and resign from the cooperative;
- politically and religiously neutral;
- stimulating education of the members;
- solidarity between the members.

But although these ideas about cooperatives seems to be broadly applicable, they are clearly based on cooperatives as can be found in Western Europe, where for example farmer cooperative fulfil the role of collective market or collective purchase of raw materials and consumer goods. As will be demonstrated by the field data later on, the members of the mistri cooperatives of Northern West Bengal participate not only for satisfying individual *financial* needs.

Other activities of the cooperative, as will be elucidated in the following paragraphs, are more concerned with capacity building and membership of a community. For this, one should rather speak of a club, group or association. Especially when comparing the mistri cooperatives with other local organisational forms like women groups, there are some striking similarities concerning the form of organisation.

In the participation debate, Shepherd (1998) stresses the possible positive effects of these local organisational forms like women groups and mistri cooperatives as an answer to the overmuch emphasis on the 'community': The community level is often advocated as the ideal level for participation, especially because all people are supposed to be reached. Shepherd (1998) put the stress on community down to a hangover from colonialism, which relied on hand-picked community leaders to keep discipline and make sure that colonial laws were implemented. But in practice, nowadays community participation again comes down on individuals that are able and willing to invest time in these processes. These individuals are often not representing the real poor of the community, who simply cannot invest the time, or who are not allowed to participate according to rules and laws of the community, unknown to outsiders. To avoid such targeting failures, it can be more fruitful to work with smaller peer groups that are set up around a specific theme or subject.

Participation in rural development is not primarily about inclusion or involvement of the rural poor in development projects, but about the development of sets of organisations in which the rural poor can articulate their interests, defend what they have, and stake out new fields of promise. Linking groups with others in networks or associations will induce a mutual learning process. The emphasis on organisations entails a concern with membership, rules, boundaries and the relationship between groups or organisations. According to Shepherd (1998), rural development agencies' best role is to facilitate these organisational developments, and to link them with material.

Groups which are effective in development - for themselves, or as contributors to the wider interest - can sometimes remain based on informal relationships, trust and spontaneity. But although altruistic motives for participation in these kind of activities should not be neglected, it is human nature to look for advantages and benefits out of participation in group activities (Shepherd; 1998).

Shepherd (1998) distinguishes the following factors that are conducive to success of such groups:

1) Group membership is voluntary, and groups are homogeneous - have a common interest, and belong to the same socio-economic category;
2) Small groups allow open and intensive discussion and a higher quality of participation;
3) Leaders are elected, and leadership rotates. Decisions should be taken by collective deliberation;
4) Regular meetings, savings and credit funds activities help build unity and cohesion;
5) All decisions (what to do, how to do it, etc.) are taken by the group; external agents should only provide advice when asked;

6) Among poor people activities are initially directed at improving livelihoods.

Shepherd's ideas can be used to reflect on the mistri cooperatives. His success factors give some clues for comparison with the actual situation of the cooperatives and can be used to point out possible causes for lack of success. His ideas can also be used to place the mistri cooperative in a societal context and study the role of the cooperatives as contributors to the wider interest.
What links up with these observations on cooperatives and (self-help) groups, is the confusion about the official local name of the mistri cooperatives: Terai Krishi Projukti Samprasaran Sangstha, or TKPSS. Literally, this means Terai Agricultural Technology Promotion Society (or Association or Club). I touched upon this issue during a discussion with a pensioned Chief engineer in Cooch Behar that Joy and I visited for promotion of a low cost water filter[16] on September11, 2003. The role of the mistri cooperatives was discussed in relation to the introduction of the water filter. Joy explained that the mistri cooperatives are registered under the Society Act in Kolkata (Calcutta). According to the engineer, it was not allowed to use the name of cooperative unless they are registered under the Cooperative Act. The discussion came down to the translation of the Bengali name to English. Officially, the cooperatives are registered under the name TKPPS, in which the Sangstha should be translated as Society, Club or Association. This does not give legal problems. The more interesting question is when the name *mistri cooperative* came in. This is not completely clear, but what is clear, is that this name was used during the initial phases of establishing the groups during the international North Bengal Terai Development Project. For this reason, I assume that the name mistri cooperative did fit into the contemporary development paradigm and that the name linked better with the initial objective of technology transfer and innovation.
Although the name mistri cooperative is legally incorrect and mistri self-help group would have fitted the objective and organisational structure better, I continued using this name 'mistri cooperative' in this thesis to avoid making the reading material unnecessarily complex. Besides, the name is so much embedded in the daily business of Practica, CDHI and the mistris themselves, that it only relates to the specific configuration of mistri groups in the Terai Region of Northern West Bengal and so confusion is not likely.

## Ideas on internal organisation

The ideas on cooperatives can be put in a broader context by using different organisation theories. While the ideas on organisations as given in chapter 3 are used to place the organisation in the societal context and the ideas of Galle (1994) about cooperatives are used to study formal structures, other theories give insight in processes that take place *within* the cooperative. This topic can be the subject of another extensive study, but that will be outside the scope of this research. For this thesis, I will stuck to the ideas on internal organisation presented by Nuijten (2003) that 'different views or images of the organising process not only show different sides of the organisation; they also reflect areas of tension and conflict.' This allows me to consider the cooperative as a collection of individual social actors rather than a fixed unit.
Notwithstanding the areas of tension that exist in the cooperative, the organisational structure of the cooperative is produced and reproduced (or sustained) in the daily life of the mistris. So it is equally useful to state some theoretical ideas about cohesion within organisations. Lammers (1993) describes some driving forces for organisations, of which the sense of norms and solidarity is one that can create *social, instrumental* and *idealistic cohesion*. In case of the mistris, solidarity stems from both shared professional activities and a shared position and status in society. That is, mistris are expected to have certain cohesion by sharing ideas about their work. And so they also have shared norms and

[16] see also chapter 8 for detailed information on the water filter

values, they understand each other and they value each others work. Besides, in the highly stratified[17] Indian society, the mistris share the same status: To understand the cohesion of the cooperatives, it is essential to realise that organisations do not operate in a social vacuum. In the execution of activities, organisations depend on the opportunities and limitations of their surroundings. In the social structure of society, stratification plays a significant role. The stratification of a classical (bureaucratic) organisation reflects the stratification of society, while a cooperation is characterised by the absence of hierarchical stratification (Lammers; 1993).
Considering internal cohesion as the driving force in the cooperatives, allows to approach the cooperative with Silverman's (1970) System Model in which the action of the parts is structured by the system's need for stability and goal-consensus with emphasis on the processes of integration and adaptation. Considering the cooperatives as open systems includes society of which the organisation is part and in which most of the processes of technology transfer take place.

## Organisation of the mistri cooperatives

To get insight in the organisational form of the mistri cooperatives, it would be useful to look at the initial ideas and concept that laid the basis for the cooperatives.
The initial concept for the mistri cooperatives, as restated in the Arcadis Euroconsult coordination report 39 (Arcadis Euroconsult; 2002) was that:

- cooperatives are formed in concentration areas of micro irrigation activities, consisting of local mistris;
- these cooperatives will disseminate the developed techniques through their commercial activities and such act as change agents.

These concept do say something about the *objectives* of the cooperatives, but not about the actual organisation. The coordination report contains some ideas about the role of the Project Support Unit in the set-up and maintenance of the cooperatives: the role of the PSU[18] mainly consisted of:

- continuous support and monitoring of the new cooperatives;
- helping with registration;
- organising demonstrations on all new technologies for newly formed mistri cooperatives;
- review of new technologies;
- attending the monthly meetings of the cooperative, if necessary;
- organising workshops for all the cooperatives on technological innovation, leadership, bookkeeping, etc.

This gives some clues about roles, tasks and responsibilities, but still not about organisation. I tried to find documents that described the organisation of the cooperatives, but I did not find the detailed description that I was looking for. So I will base my description of the organisational setting of the cooperatives on information from CDHI staff and information from the field:
A mistri cooperative always consists of a president, a secretary, a cashier and ordinary members. The three candidates for the special functions are elected by the members of the cooperative and are generally occupied by the better educated mistris. Their roles are not that much specified on paper: the president has as primary task to chair the meetings and to be the first one that should be approached for anything concerning the cooperative. The secretary takes care of administrative issues of the cooperative while the cashier does the financial matters. These financial matters include collecting of contribution of the members. The height of the contribution is determined by the

[17] The stratification of a society is the sectioning in different layers (groups or categories) that are unequal in status, power and esteem, and that have a certain social distance to one another. In India, traditionally the cast system is in place, but this is less obvious in West Bengal. Stratification is based on both cast and class or social status, so the new term 'clast system' is often used.
[18] PSU: now CDHI; Although the role in set-up and maintenance of mistri cooperatives has not changed that much, the organisation did change. PSU functioned as a part of a project, while CDHI functions as an NGO. This did influence the amount of money and time available for tasks related to mistri cooperatives.

members of the cooperative. Normal amounts for contribution are around 10 to 25 Rupees a month. The contribution is used for different purposes like for purchasing equipment, but often it also serves as a revolving loan system. To get the money from the cooperative available for any purpose, a resolution is needed. This means that all the members present during that specific meeting should give their signatures for spending the money.
Although the roles of the president, secretary and cashier on paper are not that much more important than the roles of the members, in practice the president, secretary and cashier are the more active mistris. They play a crucial role in organisational issues in the cooperative.
Understanding the functioning of the cooperatives by focusing on the organisation as formal structure is impossible, as there are considerable differences between the formal and practical organisation of the cooperative. Besides, there are also practical and organisational dissimilarities between the different cooperatives, which also result in different roles in, and attitude to technology transfer processes. I will elucidate the practical organisation as well as dissimilarities in roles in technology transfer in the next paragraph about the mistri cooperatives in practice.

## Mistri cooperatives in practice

Against the background of the organisation of the cooperative and the organisational theory, I will start describing the field situation of two cooperatives. Here I will focus on the differences in actual organisation of the cooperatives, and how this relates to organisational theory.

As stated in chapter 2, two cooperatives were selected for case study. Here I will introduce the two cooperatives in more detail. I will go into the organisation of the cooperative, but I will also pay attention to the individual members, the dynamics in the cooperative, the relation of the cooperative and its members to CDHI and the direct surroundings. Besides, I will go into the views of the mistris on the cooperative, their perception of the technology and the benefits that they experience of being a member.
As a result of the different circumstantial factors that I mentioned in chapter 2, the case study on Sarkarpara Cooperative has been done more extensively than the case study on Beltali Cooperative. Nevertheless, comparing the two cooperatives gives some interesting insights in similarities and differences. It also helps to explain occurring phenomena and to gain better understanding of the life and work situation of the mistris.

### Sarkarpara Cooperative

Sarkarpara was the first cooperative that I selected for a case study. The Sarkarpara Cooperative is one of the 10 cooperatives that were established after the first positive results from the five initial cooperatives. Or as stated in the *brief report on mistri cooperatives*, an internal document at the PSU from end 2000: *'In the period of monitoring and in the training it is noticed that new mistris as well as farmers from other places got the interest and wanted to know the rules and regulations for the cooperatives, so that they could also form a new cooperative... To comply to this fact, PSU is now planning to form more cooperatives in Jalpaiguri district and Siliguri subdivision'.*
In 2001, three cooperatives were established in Jal Sadar district, of which Sarkarpara Cooperative was one. Sarkarpara Cooperative is officially located in Sarkarpara village in the Jal Sadar district, Jalpaiguri block, very close to the border with Bangladesh. The cooperative consists of members from three villages: Sarkarpara is the biggest of the three villages and lies on a paved road. From Sarkarpara, it is another 10 minutes more by bicycle taking a small dirt road to Sashanpara and

another 5 minutes along the same road from Sashanpara to Laxmi Nager. The three villages are surrounded by agricultural land. Main crops in the monsoon season are rice and jute, while in the dry season people grow tobacco and vegetables. Also some tea gardens can be found around the villages, mainly supplying for a tea factory nearby. Sashanpara and Laxmi Nager both have some small shops around the village square and a small school building as the centre of the village, whereas the centre of Sarkarpara is formed by shops organised as a market place. As members of the Sarkarpara Cooperative come from the three different villages, sometimes tension exists about the location of activities. For an example on this, see also the text box 'Sarkarpara village power' in this chapter.
Although the measurable technology output[19] of Sarkarpara Cooperative was not really considerable, the cooperative was actively working on new ideas to generate income for the members by using new technologies. An example of this was the planned technology mela[20] (see also the text box 'Sarkarpara technology mela'). And exactly the active attitude of the mistris toward technological change and how the mistris generated extra income through the cooperative was of great interest for my research. The active attitude of the members of the cooperative was also an indicator for the different ways the mistris use the cooperative for improving their livelihood.

### Sarkarpara and technology transfer

As processes of technology transfer formed the body of my research, I tried to get a grip on the processes that were going on in the cooperative and on the role of the individual members in these processes. Initially, I expected the processes to be present by means of selling or installing technologies that were introduced by Practica and CDHI, but it was not this tangible. There were various reasons that could be indicated for this, of which most of them were related to the monsoon season, which is the off-season for irrigation and thus for irrigation related activities as mistri work. Other reasons I heard from the mistris were related to the input from CDHI; the mistris claimed CDHI needed to be more active with the technology transfer. The role of CDHI will be elaborated in more detail in chapter 6.
As observation of the activities of the mistris with technologies could not be done directly, I tried to extract it from activities that were taking place during my presence in Sarkarpara. One of these activities was the organisation of a technology mela, which is described in the text box 'Sarkarpara technology mela'.

| Sarkarpara technology mela |
| --- |
| During one of my first interviews with members of Sarkarpara Cooperative, with Motilal Ray (president of Sarkarpara Cooperative) on August 12, 2003, he told me about plans to organise a mela. The mela would be held in Sarkarpara and would be organised by the cooperative without any help from CDHI. The cooperative was willing to invest time and money to promote the new technologies. The idea was to introduce the different technologies to the villagers and to share some tjai and biscuits. For this mela, the cooperative was planning to invite officials from the local government. I was also invited. Both the government officials as I would have a dual role: The government officials could see the technologies and that could result in commissions for more work. I could join the mela because it would be interesting for my research. But at the same time, the presence of both the officials and me would add lustre to the mela and would result in extra status |

[19] As far as it is measurable: the output of numbers of modified pumpsets, sold bamboo filters, number of installed shallow tube wells etc.
[20] Mela's or fairs are a common way in North Bengal to organise gatherings on a specific topic. People come together and talk about anything that attracts the attention. During the NBTDP pump mela's were organised to make farmers, mistris and pump manufacturers acquainted with the new technologies. Mistri cooperatives took over the initiative for the mela's to enhance their reputation and to increase their market share in the different businesses.

and prestige for the mistris and the cooperative. That is, if they are able to organise a mela that is attended by government officials, a local NGO and even a foreigner, the villagers would probably think that this cooperative really has to be important.
The mela was planned to take place on short terms, so I waited for information about the date. But as I already expected, the mela was delayed. The main reason was a lack of funds. CDHI offered to subsidise a part of the mela, but still finding money to cover the other part of the budget was causing problems. I was really interested in seeing this mela, because it would generate a lot of information about the technology transfer and about interaction with the other actors, so I was thinking about donating the remaining part of the money. But the fact that these mistris were planning this mela, but did not manage to realise it, gave me even more interesting information. This is again about the difference between ideas and actual agency to execute these ideas. So I decided not to become involved in this, only to ask about it every now and then. And although the time span was long enough to get the funds and organise the mela, the mistris did not manage to do so.

Another activity was related more directly to the input of CDHI and Practica and the communication processes that resulted from this project. And although I tried not to get involved in this project and just use it as a research possibility, I did not managed to stay out of it completely. My experiences with the specific project of village power are recorded in the text box 'Sarkarpara village power.

Sarkarpara village power

During my research on the Sarkarpara Cooperative, CDHI and Practica were working on a project called 'Village Power'. Village Power is an initiative to supply small villages with electrical power. The idea was based on an observation that the high costs for rural households using kerosene for lighting purpose could be reduced by using electrical lighting. Calculations showed that using electrical fluorescent lighting powered by a centrally placed diesel generator set was cheaper than the traditional kerosene lamps. Besides, the lack of electrical power gives the inhabitants of these villages the idea of backwardness and most of the small and remote villages do often have to wait very long before they are finally connected to the central power grid. The Village Power system consists of a fuel-efficient generator, a cable network to link the different households and a house connection with fuse to limit power consumption per household
People in a village interested in electrical power would have to do an initial investment of 700 to 800 Rupees each to buy the generator equipment and wiring. Ones in place, this system will supply electrical power for about three hours a day for about 42 Rupees a month (calculations Practica). Households would be able to save on cost for lighting by switching to electrical power.
Members of the Sarkarpara Cooperative heard about this project and got interested. They could organise village power in such a way that the cooperative could be the owner of generator and so make some additional money, expected to be around 450 Rupees a month (calculations Practica). The first quarrel in the cooperative started with the question in which village this village power should be installed. Of course, the mistris all preferred their own village. This quarrel was not easily solved, so some of the mistris started thinking about starting the village power as a private business without involvement of the cooperative. However, after a while it was agreed to start the project in Sarkarpara village.
Although I did not want to get involved in this project, the people in the village associated me with CDHI and expected me to answer some questions about village power. Even up to a point that I planned a workshop with the mistris, but that this was misunderstood: When I showed up that day the mistris and the villagers expected it to be a gathering about village power. It was useless to do

the workshop that day, because not all the mistris did show up. And as I did not want to let down the people that showed up, I decided to do an information session about the village power together with Mrinal, my interpreter. I expected that it would at least give me some information about how the mistris and villagers communicated about technical issues. And it did. Especially the initial investment that people needed to make for getting linked up with the system appeared to problematic. The mistris were convinced that involvement of CDHI in the set-up and management of the village power system was needed to get the confidence of the villagers. They argued that the villagers were not willing to pay such a big amount of money to them, because they were not 'better' than the other villagers. I did not understand why the people rather trusted an NGO that they did not knew that well than other members of their community who they had known for years. One of the mistris told me the story about a respectable man from the village who had collected money for electrical power in the past. He collected 200 Rupees from each of them, and after that nothing happened. According to one of the people, they did not want to ask their money back, because they simply dislike to have problems.

These two examples give some insight in the attitude, ideas and values of the mistris toward the technologies, but as they are based on group observations and group interviews, they lack the specific information from individual mistris of Sarkarpara Cooperative working with technology in their daily routines and the role the cooperative plays in this daily routines. To get this first-hand information on the individual ideas and values, I did some more direct observations of mistris by means of participant observation.

## Observing mistri values

Participant observation is a great technique of getting first hand information about activities, not only by observing, but also by participating in the activities. Often, the concept appears to be less useful in practice because of different reasons: I experienced that some activities for example, are not that suitable for participation just because already enough labour is available (which is often the case in developing countries). Other reasons I found are that the object of study is not eager to have someone participate in the activities because he is not convinced that others are skilled enough to do the work.

The two observations that I will describe here are from participant observation of members of Sarkarpara Cooperative. And although description of the different activities can be included in the paragraph on the livelihood of the mistris as well, I opted for seeing it as part of the cooperative related activities and include it in this part about Sarkarpara Cooperative. However, because of the livelihood diversification of the mistris, these two fields are blurring and information is intechangeable. The first observation is with Mohim Chandra Ray who is a bicycle repairman and part-time mistri. The other observation is during well boring of Nikhil Sarkar.

### Mohim Chandra Ray's bicycle repair shop

I was interested in spending some time with Mohim in his bicycle repair shop in Laxmi Nager (see figure 5.5; Mohim's shop) to see how a part-time mistris like Mohim was running his business. Besides, mistri work in this time of the year was still not much and working together with Mohim on bicycle technology would also give me some insights in how he valued and handled other kind of technical objects. I was planning to spend all day with him, so on September 2, 2003, I arrived around 9.00h in the morning at his shop. I was somehow lucky, because I had a flat tyre during my bicycle trip to Laxmi Nager so that meant that we had some work that morning. Beside my flat tyre, there were some other bikes for minor repairs. Although Mohim is not a person that draws a lot of

attention in the cooperative, he is one of the better educated members. Mohim is pretty good with repairs and he really knows what he is doing. First, I spend some time hanging around in the shop, communicating with other people hanging around and watching Mohim's little nephew fixing tyres. Then I tried to get involved in the repairs. Mohim allowed me to do some small jobs, but not without keeping an eye on my work. Although the mistris generally value the technical knowledge of the foreign people quite high, Mohim did not seem to value my technical experience in Indian bicycle maintenance equally high.
The communication with customers that I observed also seemed to go smoothly. Of course, this did not have to do anything with *transfer* of technology, but still it indicates that there is a good relationship between mistri and customers. This is probably also caused by the long term relationship that these villagers already have.

Figure 5.5; Mohim Chandra Ray's bicycle repair shop

Figure 5.6; Gopal Adhikara and Sanjay Mishtri working for Nikhil Sarkar as labour mistris in hand sludge well boring

Nikhil Sarkar's well boring

Nikhil Sarkar is considered to be the master in boring of shallow tube wells. At least, that is what some other mistris of the cooperative told me. When I heard about his activities of well boring close to Sarkarpara, I asked him if I could join. First he was not really enthusiastic about the idea, but after some pressure of the other members of the cooperative he showed me the location so I could find the place the next day. The location for making the well was on the premises of a family. Only the better-of can afford to have a private well. I planned the participant observation on September 3, 2003 and so I arrived at 11.00h on the spot. By then the boring already started. Nikhil was in charge while two others helped him with the boring (see also figure 5.6; well boring). That Nikhil is in charge of the work also appears from the way he communicates with his customer. Nikhil appeared the one who is doing most of the work. Later that day, they change tasks. When I try to get involved in the boring practice, Nikhil first is reluctant to let me work. After a while, he allows me to do some small jobs, but I did not seem to meet his standards and so they preferred to do it by themselves. So I spent the rest of the day sitting and watching them together with the owner of the house.
Two days later I came back to the same place with Shashi Kant Giri, an Indian student who worked at CDHI, to do some more observations and to do interviews. Through these interviews I got to know some background information: Well boring normally takes about 3 days to do the 100 feet depth that is needed. Nikhil charges 15 Rupees per feet depth. Nikhil works together with Gopal Adhikara and Sanjay Mishtri, 2 helpers. These helpers are not a member of a mistri cooperative, but are thinking about membership of Sarkarpara Cooperative. Nikhil explains that he does not hire members of the cooperative because none of them has the expertise required for well boring.
Because Nikhil did not seem to be involved in the cooperative that much, I asked him about the advantages of his membership. He tells that there are only few concrete advantages; Joy convinced

Nikhil to join the cooperative and told him that it would have a lot of advantages like more work from government contracts. One advantage is the shared pumpset (see also the cooperative benefits part in this chapter). He is only continuing his membership because he hopes for improvement in the future.

After the observations with both Mohim and Nikhil, I got the feeling that the technical part as well as the communicational part of transfer of familiar technologies is not a problem as the mistri and customer have a shared understanding of the problem. That is, they share a technical value system. This might be different when it is about new and unfamiliar technologies: Either they might value the new technologies differently as the value system of mistris is influenced by CDHI and Practica, or their shared value system makes them value the technology equally unpromising or dangerous. The problem with the introduction of a new technology will be elaborated in detail in chapter 8.

### Sarkarpara workshop

To learn more about the role of the mistris and the cooperative in the process of technology transfer, I organised a workshop for the members of the cooperative. The advantage for me was that during this workshop I would have all the members of the cooperative together and I would have the opportunity to see communication and interaction between the members. Besides, I could use the setting of a workshop to talk about imaginary problems and to have the mistris work on certain topics. After being postponed twice due to organisational problems, the workshop was planned on September 15, 2003, from 13.00h till 17.00h in the school building of Laxmi Nager.

The workshop consisted of two parts; an evaluative part, expected to generate information about the ideas of the mistris on the functioning of the cooperative, and a creative part in which the mistris had to come up with new ideas and ways of promoting new technologies by making a poster advertisement. Mrinal would lead the workshop while my role was to videotape everything and to back up Mrinal with more ideas.

When I arrived with Mrinal in Lami Nager around 13.00h, only 6 mistris were present. These were the mistris that played a more prominent role in the cooperative. Because of their more prominent role, I already knew these mistris better than the other 8 mistris. After about an hour, 5 other mistris showed up. 11 out of 14 was not bad at all, so we got started. It was interesting that Nikhil Sarkar was among the absent mistris. He is considered to be the well boring master and already during participant observation during his work, I noticed that he was not outstanding for his cooperative mindset.

Before starting with the workshop, I had the mistris fill out a questionnaire (see appendix 6) to learn about their individual backgrounds.

During the first part of the workshop, I planned to have the mistris think of strong and weak points of the cooperative. The idea was to create a discussion in which the mistris came up with their own perception of the advantages of membership. What happened was that two groups were formed; one with active and one with passive mistris. The first group had a serious discussion, while the second group, sitting in the back, lost interest and people started walking in and out. Video analyses of the group discussion on the strong and weak points showed some interesting things. As strong points the mistris mentioned that:

- 'We learned a lot of things through the cooperative and we can learn more when we stay member and maintain the cooperative';
- '14 people have more energy and power than 1. We can do anything very easily with the cooperative';
- 'Through the cooperative we can help the poor with the new technologies'.

Discussion on the weak points showed some controversies:

- First discussion point is if there are *any* weak points at all. Some say there are not, while others say there are too many;
- There are problems with the attendance of the meetings and so it is very difficult to get the resolutions through, because all the members are needed for that;
- There are some problems with the ego of some people, as the use their power to take down ideas of other members of the cooperative.

The second part of the workshop was about new ideas and ways of promoting these ideas. I expected this to yield information about opportunities to get more work and income from the cooperative. Brainstorming and discussion about promotion of these ideas should give information about the role of the mistris in the process of technology transfer and about their ability to develop own initiative. When talking about the new ideas, also the less active mistris got involved. This appeared to be more interesting for them than talking about strengths and weaknesses of the cooperative. Ideas that the cooperative came forward with after discussion were:

- Making a River Lift Irrigation system for selling water to farmer;
- Getting involved in road making, making of dams and making street lights and to contact the government for this;
- Helping farmers to set up duck or hen farming by providing loans to the farmers;
- Building and management of a colds tore to preserve fruits and flowers;
- Building of a meeting place and storage place for equipment of the mistris;
- The cooperative can cultivate fish.

There are some interesting ideas present among the members of the cooperative. To see what kind of concrete ideas can be generated about the realisation of these ideas, I divided the participants in two group and distributed flip-chart sheets for a poster presentation. I put all the active mistris in one group (group 1) and the passive mistris in the other (group 2), to see if there are differences between the creativity of both groups. During this session, the quiet group asked Motilal Ray, one of the active mistris, to join them, because they claimed not to have any experience in this kind of work.
The initial idea for this poster design session was to pick one of the possible new ideas and present this idea on a poster to the villagers so that they get to know about this technique in a advertisement style. I made a sheet with guidelines for poster making and an example poster about an imaginary plastic hand pump . Both sheets are included in appendix 4.
The mistris were not used to this way of writing down ideas and so Mrinal had to give more explanation. From the video registration it appeared that he told the mistris to tell about the cooperative on the poster. Not what I planned, but it explains the results of the poster writing. I included translations of the two posters in appendix 4. Both groups worked on it for about one hour and mention the following things while they work:

- Group 2 suggest to write the poster in the form of a rhyme because it will be better to hear;
- Group 1 has a discussion about where the villagers should go to for information. The agree that the villagers should come to the members of the cooperative or that they should go to the CDHI office;
- Group 1 agrees on writing down the name of the cooperative on the poster because they think it is important that the villagers know it is from their cooperative;
- Group 1 is thinking about making a slogan in the form of a song.

When the posters are finished, one person of each group presents it to the others. All the mistris are really interested and concentrated and enjoy the presentations. Additional information came forward from group 2, who state that the cooperative has a system with rules and regulations. Mistris should obey these rules, otherwise the cooperative cannot function. The mistris and the cooperative should

fulfil a model role in the village and so be an example of how people can influence their own lives. Besides, the mistris should take more information from outside, like now with the workshop. A lot of people are coming to the village and the mistris should take advantage out of that.
Also, Ranjit Ray, one of the more active mistris in group 1 compares the two posters and concludes that 'they have defeated us'.

## Beltali Cooperative

The second cooperative that I selected for case study was Beltali Cooperative in Mathabanga block, Cooch Behar (see also appendix 1 for a map of the Terai region and location of Beltali Cooperative), a mistri cooperative that functioned almost independently from CDHI. There were several reasons to choose for Beltali Cooperative as cooperative for the second case study. As stated in chapter 2, it is mainly based on the hypothesis that direct involvement of CDHI influences the way a cooperative functions in a positive way. Contrary to Sarkarpara Cooperative, members of Beltali were not that much interested in direct involvement of CDHI. Besides, I was interested in issues of leadership and wanted to know the influence of a strong leader on the cooperative. The president of Beltali Cooperative, Bablu Roy, was involved in the North Bengal Terai Development Project from the beginning and played a major role in the modification of 5 hp diesel pumpsets (see also boxed text about fuel saving pumpset modifications in chapter 7). Recent developments (or gossips) in the cooperative were that Bablu was drinking too much and he was accused by others for spending money of the cooperative for his drinking habit. And although I did not find any evidence for this during the case study, it was an interesting starting point though to focus on this cooperative that used to function quite well independently form CDHI and that now was facing problems with the leadership. Besides, Beltali Cooperative was relatively easy to reach with public transport, which made it practically possible to visit meetings and individual members without being completely dependent on transport from CDHI.
Data collection at Beltali Cooperative did not go as smooth as with Sarkarpara Cooperative. For time planning, I allocated equal shares to the two case studies to make sure to spend about the same time at the two locations (see appendix 2 for time planning of the field work). Only I did not take the different festivities and puja's into account. The problem that I was facing especially with the celebration of Durga puja, the most important puja in West Bengal, was not only about the week of holidays that the mistris took for this. Especially the preparations for the puja threw a spanner in the work: At least one week before the puja started, the mistris did not care about work anymore and were only working on preparations for the puja. As a result, mistris were not only unwilling to make appointments for interviews, but also participant observations were impossible because no work was done. This forced me to change my research design in such a way that the case study on Beltali Cooperative was les extensive as I would have liked it to be and that I started to look for other research methods to gather more information about the role of mistris as change agents. The action research on the introduction of a low cost water filter that was a result of that, is described in chapter 8. Meanwhile, I was still pushing the members of Beltali Cooperative to invest some time in my research. This resulted in two meetings with Bablu Ray (on September 18 and October 11, 2003), a participant observation with Bablu Ray during one of his training courses on pump repair (on September 19, 2003) and a group interview with Bablu Ray, Jyotin Das and Maloy Kanti Das (on September 23, 2003). I was not able to organise a workshop in the same way as I did in Sarkarpara. The information that follows is based on these meetings.

Beltali Cooperative consists of 14 members, of which Bablu Ray is the president, Jyotin Das the secretary and Maloy Kanti Das the cashier. Only six of the members are professional mistris, of which Bablu Ray is one. The others are part-time mistris except for Jyotin and Maloy, who are educated and

did not consider themselves as mistris. They take care of the communication in the cooperative. They also sell pumps and spare parts and go out to take in work for the other mistris, of which they get a margin. As Jyotin and Maloy are no mistris, I was interested in why they joined the cooperative. Maloy explained me that he has a fertiliser business and a business in spare parts for pumps. 'I wanted to increase my business through the cooperative. Now I have contacts with 300 farmers for selling fertiliser, pumps and parts and spraying machines. People more easily believe me because they associate my business with CDHI. Within the cooperative, I do the communication like fixing the dates for the meetings and informing the members about that.' Jyotin explained that he joined the cooperative because 'the idea is good. I am a farmer and the cooperative will give benefit for farmers. I can help other farmers with this. Through the cooperative, I learned how to modify my pumpset for fuel saving. I also read the books from the NBTDP[21] and use these ideas on my land.' When asking about the role of CDHI, all three of them agree that CDHI is not giving any support anymore, but that they will also continue with the cooperative without the help of CDHI. Also, the cooperative is not generating extra work anymore. In the beginning, they got a contract for installing 200 bamboo filters, but right now, the work is going to the contractors again. As a possible cause, the mistris mention that the people used to know the NBTDP, but do not know about CDHI.

### Bablu Ray's pump class

Bablu Ray is definitely the master in pump repairs and pump modifications. He is one of the few full-time mistris who uses his technical skills to diversify on his livelihood in the same field of practice. Now he is contracted by the local government to give a technical training in the maintenance and repair of diesel pumpsets to young farmers, so they can work as mistris in the future. The training takes 3 months and the trainees follow practical courses 4 afternoons a week. I joined one of these courses to see how Bablu managed the course and to see how he worked with the pumpsets. Giving training appears to be a good and sustainable way of generating extra income.

During this training, Bablu gave the impression to be a technical professional. However, he is less convincing in his appearance and does not really have charisma. That means that his power to convince others of his ideas must be based on his superior technical knowledge and skills rather than on his communicative skills. Other mechanisms to convince both customers and trainees might be his status that comes together with association with first the NBTDP and later CDHI. This might also explain the arrogance or haughtiness that he seems to have. However, it gives him the advantage of being heard during the training sessions and makes him a good trainer.

The training consists of both theoretical and practical courses, of which I attended the practical one. Trainees had to dismantle a pumpset and name the different parts (see figure 5.7; Bublu's pump class).

[21] During the NBTDP some brochures were distributed about new crops and innovative farming practices.

Figure 5.7; Bablu Ray's pump class students dismantling a diesel pumpset

From the interviews with mistris as well as from the observations of the pump class it is difficult to deduce as much information as was possible at Sarkarpara Cooperative. Besides, it is impossible to draw conclusions about the cooperative as a whole, because I have only met some of the members of the cooperative and because I was not able to organise a workshop. However, from the information that I did get, I can conclude that the structure of the cooperative is still in place and working. And although the members claim not to have that much benefit of the cooperative through CDHI, they are still sustaining the structure.

In the context of technology transfer as a process as outlined in chapter 3, in which technology and technological knowledge flows from one actor to another, the cooperative does not play an active role. But when looking at sustainability, still members of the cooperative are transferring technologies that they acquired during earlier cooperation. Their role in the process is still in place, only it is inactive; members of the cooperative have shaped the technology as well as the organisational structure of the cooperative in such a way that they can still gain from it. However, the mistris still are connected and their role can easily change to a more active role if there is a need for it by one of the two other actors (Pracica and CDHI).

Other advantages from membership of the cooperative that the mistris mentioned are included in the next paragraph that covers the benefits that are referred to by mistris from Sarkarpara Cooperative and Beltali Cooperative as well as mistris from other cooperatives that were not included in the comparative case studies.

## Benefits; does membership pays off?

Although most of the data about the two cooperatives that I studied is case-specific, there are topics in which both cooperatives showed huge resemblances. I focused especially on the benefits of membership of the cooperative. By combining input from both case studies and additional input from mistris from other cooperatives, I will sketch a more general picture of the possible benefits that the members of cooperatives can have.
During fieldwork I tried to get insight in these benefits that the members of the cooperative had. I tried to split the concept into 'actual' or measurable benefits and 'perceived' benefits, that could not be measured easily. This can be related to the second research question,

> *How do mistris integrate new organisational structures and technological development in the continuing process of securing and improving their livelihood?*

that is based on the hypothesis that benefits can be located mainly in the sphere of improvements of livelihood, either financial, social, or by any other means. However, the divide between actual and

perceived benefits is not that easy to make, because it would imply measuring livelihood improvement, which in itself again is very difficult to ascribe solely to membership of the cooperative. So I opted to focus on perceived benefits of membership of the cooperative, which can be examined qualitatively by observation and interviews. The topics mentioned here that came forward from these interviews and observations, differ from my expectation as I supposed more work and more income to be the main benefits. However, the topics of extra work and income as a result of membership of the cooperative were only mentioned when I directly asked for it and could hardly be quantified at all by the mistris. The following benefits can be extracted from the interviews that I did with the mistris:

Loaning system

Members of the mistri cooperatives can have access to small loans through revolving funds: Opening a bank account is one of the procedures of starting a cooperative. Contribution of members of the cooperative is collected by the cashier and deposited periodically on this bank account. Through resolution of the members of the cooperative, the money can be lend out to members of the cooperative at an attractive interest rate.

The members of Sarkarpara cooperative preferred not to bring the money to the bank, according to Ranjit Ray (interview on September 30, 2003), because 'the bank is six kilometres from Sarkarpara and it takes too long to get the money from the bank. Especially when a member is ill, he needs the money quickly'. Ranjit tells that 'there are some problems with the loaning system. Some people do not refund the money because of family problems. Others do not refund for other reasons, like Mohim Chandra Ray who took a loan for his bicycle shop. He took 400 Rupees, but he is not refunding it. Now he is paying interest. He said he can refund it when needed, but now he prefers to pay interest.'

It is interesting that different members of Sarkarpara Cooperatives mention the loaning system as one of the big advantages of membership. It gives them access to money that they did not have before and so it enables them to do some small investments or to overcome financial setbacks. Also several members of other cooperatives mention the loaning system as big advantage. The positive impact of small loaning schemes or micro credit systems is also recognised by the UN as a promising tool for development that can contribute to reaching the millennium goals to halve poverty in the world before 2015. (Vossen; 2005).

So benefits of the cooperative are not solely based on extra income generating activities, but also on creating and sustaining other structures like this loaning system that help improve livelihood security.

Shared pumpset

An advantage that many of the mistris refer to is the shared pumpset that a cooperative can get from a government program. When I conducted my field work, five of the fifteen cooperatives got this new 2.5hp pumpset from the government program. This program is an initiative of the local government to support small-scale irrigation in the region. To qualify for a pumpset, farmers must organise themselves and make a shallow tube well in their fields. Establishing a cooperative is one way in which farmers can organise themselves. The members of a mistri cooperative can, if they fulfil the requirements, apply for a pumpset too. The light weight pumpset can be transported from one field to another by two persons or by a small barrow (see also fig. 5.8; transportation of pumpset). The members of the cooperative make rules for using the pumpset themselves. Bablu Ray for example explained that members of Beltali Cooperative can use the pumpset for 5 Rupees per hour, excluding fuel costs and maintenance. Also renting this pumpset out to others generates some extra income for the cooperative.

Sarkarpara Cooperative received the pumpset when I was around for my research. There were no arrangements for using the pumpset in place, but the shared ownership stimulated a lot of discussion and optimistic thinking about future possibilities with this pumpset. It fuels communication and cooperation within the cooperative. One of the ideas that originated was of selling water for irrigation to farmers, using this pumpset. After having the pumpset, the mistris of Sarkarpara Cooperative

started thinking about purchasing a power tiller to use it in the same way as the pumpset and to rent it out to other farmers who are interested.

Figure 5.8; easy transportation of the shared pumpset of Sarkarpara Cooperative

More work

Improving the livelihoods of the mistris by generating extra work was one of the objectives for establishing the cooperatives. Most mistris do not mention this as one of the advantages of membership of the cooperative directly, as most of them are quite critical: Generation of extra work would be done by the introduction of new techniques as well as by creating the legal basis for getting involved in government contracts. Here, the work from the new technologies like making and selling bamboo well filters and using stone hammer well boring techniques seemed to be more sustainable than the extra work from the government contracts. Mistris find it difficult to sustain the contacts with the government. Mistris from Sarkarpara Cooperative for example, faced problems when they accepted a contract for boring wells close to Siliguri. When working in that region for a contractor, they were chased off by local mistris who accused them of taking away their work. The Sarkarpara mistris did not want to go back there and since then they were not that eager in taking work from contractors.

In general, when mentioning 'more work' as advantage of the cooperative, mistris also mention that they expected the help from CDHI for this and that they do not get as much extra work as they first expected. Still mistris have a potential interest in any new work generating activity. Initially, the role of the mistris in the process of technology transfer was partly based on the idea that it should generate more work and so directly or indirectly more income. However, as positive effect are difficult to measure quantitatively and as mistris do not mention this as the major benefit, it can be doubted that this is the core strength of the cooperatives. It is for sure that generating extra work is not a precondition for continued existence of the cooperatives.

Status and the image of modernity

I asked Goutam Sarkar (interview on August 22, 2003) for the differences between mistris who are a member of a mistri cooperative and mistris who are not. He told me that 'We [members] have a much better position because we get work from the contractors and from the government. Also we are very much accepted by the farmers, because of our contacts with the government and with the project.' Not only from the interview with Goutam I got the impression that the true benefits of membership go far beyond the visible benefits like the extra work and the pumpset. Also other mistris associated their livelihood improvements with the 'better position in society' that came with the membership of the cooperative and the new contacts that resulted from it. It gave them the status to be more modern.

This 'image of modernity' of the mistris is created through different mechanisms. The association with modern and innovative technologies is an obvious one[22]. However, obtaining the image of a 'modern man' by being associated with foreigners that visit the village is a less obvious mechanism that appears to be even more important than association with the technology itself. Especially in the stratified West Bengal society, it is not common to have these inter-class connections the mistris have with government officials, CDHI staff and foreign consultants and researchers. Indications for the importance and impact of these contacts stem from observations of interaction between mistris and villagers, reactions of villagers on the presence of a research team and CDHI staff and the emphasis on the presence of CDHI staff, government officials and me during mistri cooperative events as technology mela's and workshops (see also text box 'Sarkarpara technology mela earlier in this chapter).

### The cooperative as enabling structure

In this chapter I have made an effort to elucidate the role of the mistris and the mistri cooperatives in the process of technology transfer by focussing on the mistris as social actors and on the cooperative as an organisation that functions as an enabling structure. I have tried to use field data to show that the cooperative should not be seen as social actor, but rather as a domain, representing the loci of rules, norms and values that are central to the process of social ordering. At the same time, 'domains should not be conceptualised as 'cultural givens' but as being produced and transformed through actors' shared experiences and struggles' (Long; 2001). That is, the cooperative can thus be seen as a structure that is produced and reproduced by the mistris and that creates an enabling context for the actions of its members.

Seeing the cooperative as a domain or structure rather that a social actor is a subjective choice based on how the mistris see the cooperative; mistris refer to the cooperative in constructions like 'I can do this and that through the cooperative' rather than 'the cooperative can do this or that'. That in this view contrasts with the other actors in the process of technology transfer who do refer to the cooperative as a unit (an actor) having agency.

The purpose of rather seeing the cooperative as a domain or structure is supported by the ideas of Nuijten (2003) and Law (1994) that within the cooperative very different and contradictory narratives exist about what the organisation is about and / or should be about. The different narratives that prevent seeing the cooperative as social actor acting in unison with one voice is endorsed by the observations and interviews of the different mistris that have been presented in this chapter.

Chapter 6 and 7 present the ideas of respectively CDHI and Practica. In these chapters, also the ideas of these other two actors on the cooperative are presented. The differences in perceptions of the role of the cooperative in the total picture of the process of technology transfer will be dealt with in chapter 8.

[22] See also Wicklein (2004) for 'the image of modernity' as one of the design criteria for appropriate technology: 'The citizens of many developing countries just as citizens of many industrialized countries want to perceive themselves as modern and progressive, at least within their context. There is an innate desire within most of humankind to feel important and be perceived as worthwhile.'

# Chapter 6 CDHI; linking initiatives

The social project perspective on technology transfer

On the local or 'grassroots' level of the process of technology transfer, the NGO Centre for the Development of Human Initiatives (CDHI) is the link between Practica Foundation and the mistri cooperatives. In the process of technology transfer, one might expect the role of CDHI to be purely that of an intermediary between Practica and the mistri cooperatives. However, that would be an unrealistic representation of the process, as it is far from linear: CDHI has its own input in the process, as well as own ideas and objectives about both technology and organisation of mistri cooperatives. Of course, it is not only the mission statement of CDHI that determines the attitude towards the mistri cooperatives and Practica. Strategic choices and action in relation to the other actors are equally the result of competences and preferences of the individual members of CDHI who are engaged in the negotiation process of technology transfer.
In this chapter, I will outline the courses of action of CDHI, the role in the process of technology transfer in relation to the other actors and the motives that lay the foundations for the actions. Besides, I will touch upon the system of values that governs the motives and courses of action.

## Centre for the Development of Human Initiatives; capacity statements and programs

CDHI evolved around involvement of some of its core members in the implementation of North Bengal Terai Development Project (NBTDP) and quest for sustainability of the impact created by the project. It was realised that an institutional intervention was necessary to facilitate institutionalisation and consolidation of the project outcomes. This was discussed at various levels and finally CDHI was registered under the Societies Registration Act of the Government of West Bengal during the year 1999-2000.The core objective of CDHI is to facilitate a process of human initiatives in the realms of natural resources management; enterprise development and development of human resources.

### Institution building

CDHI believes in the institutional development as one of the conditions for sustainability. Keeping this in mind it has facilitated in evolving institutions relevant for sustaining the program impact. CDHI in the present case has facilitated the:

- Formation of women groups;
- Formation of women federation-fully autonomous and functional;
- Formation of Mistri cooperatives;
- Formation of farmers groups(not yet formalised)-process.

In the above CDHI has facilitated capacity building for the institutional stakeholders and spread over effect. CDHI has proved its relevance widely and gone beyond the North Bengal Terai Development Project.

### Formation of Mistri Groups

The project[23] had the stronger components of technology development that involved association of a large number of village mechanics in the operation and maintenance of various irrigation installations. Now, the mistris have been organised into a society[24] and have an independent association. CDHI offered the followings in the organisation of mistri cooperatives:

- Facilitation of envisioning process;

[23] The North Bengal Terai Development Project.
[24] Note the interchangeability of the concepts of 'society' and 'cooperative' that CDHI uses on its website.

- Formulation of by-laws and memorandum;
- Their registration as society under the relevant Act of the Government;
- Capacity building including training in business development;
- Monitoring and evaluation

All said and done, the core competency of CDHI lies in its quest for innovation and willingness to learn and develop through iterative experimentation.' (www.cdhi.org). The overall approach to development issues that CDHI is using can be characterised as a project approach, which includes a limited scope, limited time and limited resources. The ultimate aim of the projects is to reach sustainability in the long run and withdrawal from the projects. Participation of the beneficiaries in those projects plays an important role in the approach of CDHI for reaching sustainability of the projects.

## Vision on mistri cooperatives and women groups

Looking at mistri cooperatives in the context of institutional development, the philosophy or vision of CDHI is crucial in the process of set-up and maintenance of the cooperatives. The set-up of the cooperatives is basically the same as the set-up of the women self-help groups (women groups), which can be explained by the fat that for CDHI the philosophy of the mistri cooperatives is somehow similar to that of the women groups. Dr. Mishra, chairman of CDHI, explained it as follows during an informal interview on September 5, 2003.

> 'The philosophy of the women groups is basically one of helping the women to get out of the anonymity and giving them a voice. By organising the women, they can claim certain services that were hardly, if at all, accessible to women, like government programs, the opening of bank accounts, etc. When the women are organised in a group, they get more self-esteem, which stimulates the development of the individual. The women in the group can be handed new tools to develop alternative modes of existence. Revolving funds in the group give the members access to direct and attractive loans that are needed to start up a small business or home industry.'(Mishra; interview September 5, 2003).

Although there are similarities between the women groups and mistri cooperatives, there are also considerable differences. Some differences in organisation of the two groups relate to the traditional distinctions within positions of men and women in society, while other relate to the traditional differentiation of men and women jobs: While women need to be handed tools to develop new modes of existence, mistris gain more by further developing the old modes of existence. Or as Mishra describes it:

> 'The difference between women and mistris is that the mistris already have different tools at their disposal, which is basically related to their expertise. Technological knowledge and skills are the integrated tools of the mistris, which shape for an important part the thinking and acting of the mistris. It is important to stimulate the mistris to use their expertise to generate more income and improve their livelihoods. One way to let the mistris use their technical expertise is by means of new technological input. If this fits with their existing business, the mistris can use the new technologies to expand their job responsibilities. One step further is that mistris themselves start looking for additional tasks and technologies to expand their job responsibilities, stimulated by the cooperative. The cooperative also enhances the self-esteem of the mistris. Within the cooperative, differences can be observed between the members and so the members can learn from each other.' (Mishra; interview September 5, 2003).

According to Mishra, the unity in the cooperative is very important. The cooperative is the basis and new technologies are only used as tools to generate more income for the members and are not a precondition for the existence of the cooperative:

'One explanation for the fact that cooperatives are popular in India, is the Indian collective society: Individuals want to belong to something they can identify themselves with. Cooperatives thus function also as clubs where people with the same profession can come together and can derive identify from. There are cases where this secondary function has become more important than the primary function of technological development and generating extra income.' (Mishra; interview September 5, 2003).

## CDHI and the process of technology transfer

Something that does not become completely clear from CDHI's program and vision on the mistri cooperatives, is the attitude toward the process of technology transfer. This attitude is hard to capture, because it entails more than CDHI's written programs: The attitude of Mishra (Mishra; interview September 5, 2003) toward technology and technology transfer is one that is purely perfunctory; it serves the goal of rural development and livelihood improvement of those involved. This can be partly explained by the professional and educational background of Mishra who is a social scientist by training. Other professional and educational backgrounds of members of CDHI account for other perspectives on technology. Subrata Majumadar for example has been working on the design part of the fuel saving technology during the North Bengal Terai Development Project. For him, technology is more than only a tool for development: For him. the fuel saving technology above all entails technical matters which create technical problems during introduction and dissemination. For both perspectives applies that prior knowledge and experiences as well as personal interests determine the perception of an object and courses of action.

Joy (a mechanical engineer by training too) is closely working with the mistri cooperatives for training and supervision. Observations of the interaction between Joy and the cooperatives shows a focus from Joy (representing CDHI) on development of the institutional part of the cooperatives rather than on the technology side. Technology and technological input are still of secondary importance compared to input in the organisational processes and institution building. Because of this, CDHI does not appear to take an active role in technology development: Technology and ideas mainly are introduced by Practica and passed through by CDHI. That is, CDHI not *only* passes it through, but also somehow internalises the technologies by accepting these as possible tools for livelihood improvement for mistris.

Summarising on the role of CDHI in the process of technology transfer, it is the all-important link with the 'beneficiaries' of technology transfer. CDHI has access to these beneficiaries through their network in different communities and villages as well as through contacts with other local organisations and local government. By establishing and supporting the mistri cooperatives, the networks can be sustained. Support mainly takes place through helping the cooperatives with organisational and legal matters. By maintaining the structure of the cooperative, CDHI can help the members by handing them new tools through which they can improve their livelihood. Tools can be new technologies (technological artefact) as well as new a (technological) knowledge.

Maintaining he structure of the cooperative together with the new tools for livelihood improvement can be capture under the concept of 'capacity building' as process that helps the mistris advance.

## Mechanisms of capacity building

Capacity building is the main objective of CDHI for the mistri cooperative. The mistris perceive this capacity building as an advantage of their membership of the cooperative. The role of CDHI in the process of technology transfer will become more clear when focusing on the mechanisms by which the process of capacity building of the mistris and cooperatives is shaped, and the role CDHI and technology play in these mechanisms.

Registration under the society act

Giving the mistris a legal basis for operation is one of the first steps in capacity building and so it functions as an important mechanism. In the case of the mistri cooperatives, this included registration under the society act. With this registration, mistris can claim certain services that were not accessible for individuals, like participating in government programs, applying for government tenders, the opening of a bank account, etc. By recognition as (member of) a society, mistris will get more self-esteem, which stimulates the development of the individual mistri. Besides the positive effects of membership on the individual, it also affects the attitude of society towards the members. Membership of a mistri cooperative appeared to improve the status of the individual mistri, which proved to be an important precondition for other positive effects as well:

Status through networks

According to Joy (informal interview on August 7, 2003), the fact that membership of the cooperative generates extra work for the mistris, is partly due to the status that comes with the membership of the cooperative. The cooperatives derives its status partly from the registration under the Society Act, but probably more important, also from the contacts with the people from CDHI. Especially the field visits of the CDHI officials, bringing cars and even foreigners, give the other villagers the impression that these mistris really are important. After all, In the eyes of the villagers, these mistris *have to be* good, otherwise they were never selected for the cooperative.

So it is not only the membership of the cooperative in itself that generates the extra work and extra income, but also the fact that the cooperative is established, supported and maintained by a respected third party, in this case CDHI (in other words, the fact that the mistris are included in the process of technology transfer through the cooperative). In this case, the simple fact that CDHI supports the mistris through the cooperative, links the mistris to the network of technology transfer. This connection with the network is the mechanism through which capacity is built.

Technology as tool for livelihood diversification

An aimed effect of membership of a mistri cooperatives is generating extra work and income. This extra work does not only include expansion of the fixed activities, but also using input of new technologies for appointing additional income generating activities for the members. In the literature, this phenomenon is referred to as 'livelihood diversification'. New activities should complement the current activities and generate extra income for the members. Livelihood diversification can have some meaningful positive effects on the livelihoods of the mistris. Ellis (1998) states some positive effects all leading to a reduction of the vulnerability of the individuals and households, including:

Overcoming seasonality: The mismatch between highly uneven farm income streams and continues consumption requirements causes livelihood insecurity. When diversification involves seasonal activities that are not synchronised with the farm's seasonal cycles, income flows can be smoothened.

Risk reduction: Diversification can reduce the risk of income failure. The key to risk reduction is to seek additional income sources that are not prone to the same risk factors as the other source of income.

Asset improvement: Poverty is strongly associated with a lack of assets, or the inability to put assets to productive use. Assets include human capital (education), physical capital (equipment), financial capital (savings), social capital (networks) and natural capital (natural resources). Cash resources obtained from diversification may be used to invest in any of these classes of assets.

These three effects of livelihood diversification all result in a more sustainable and secure livelihood, which ultimately allows for investment in education, investment in social networks and access to money in the form of savings or revolving funds. Livelihood diversification thus functions as a mechanism for processes through which capacity is built.

The ideas of CDHI on diversification of the livelihood of the mistris link up with the contemporary wider scope for intervention in support of livelihood diversification. This should include improving the *institutional context of private decision making* by, for example reducing risks, increasing mobility and minimising barriers to entry. It is also about helping the poor to identify opportunities, and facilitating them to improve their assets and income-generating capabilities. (Ellis; 1998)

Livelihood improvement of the mistris is also one of the objective of Practica within the process of technology transfer. However, the underlying ideas of Practica are not directly related to capacity building. Rather, ideas relate to the opportunities for technological progress and more equal distribution of technological means. Chapter 7 will elaborate on the objectives of Practica and the role of Practica in the process of technology transfer and how both relate to goals of direct or indirect livelihood improvement of the mistris.

# Chapter 7 Practica; making technology work

The technological perspective on technology transfer

The third important actor in the process of technology transfer, and at the same time the third perspective on the process is the Dutch organisation Practica Foundation. Practica Foundation is a technical consultancy organisation, focusing on technical problems and opportunities for technology improvement in developing countries.
The role of Practica Foundation as a social actor within the process of technology transfer is less visible than the role of the other two actors, as Practica is (normally) not present when interaction with the other actors takes place. The role of Practica in the process is mainly that of supplying the technology as hardware or the ideas and design for the technology, as well as assisting with introduction and dissemination. However, direct communication with other actors does take place during field trips of members of Practica Foundation, when they interact with both CDHI and mistris.
One could argue, in the line of thought of the actor oriented approach which 'in particular, does not celebrate the idea that there is a difference in kind between people on the one hand, and objects on the other' (Law; 1992), that it is not the Practica consultant who is the actor in the process of technology transfer, but it is the technology itself that can be seen as actively influencing the process; as a social *actor*. This would imply that in the process of technology transfer as outlined in chapter 3, the role of Practica is interchangeable with the role of the technology. However, I prefer not to use this rather deterministic notion of technology, in which the technology determines what happens in the process, as this would imply a passive attitude toward technological change by the other actors. Or, as MacKenzie (1999) explains: 'It focuses on how to *adapt* to the technology and not how to *shape* it.' Rather, Practica can be seen as the one who determines the technology as input for the negotiation process, and so playing an active role in the process of technology transfer.
In this chapter, I will describe the ideas and background of Practica Foundation. Furthermore, I will describe the involvement of Practica in the project in the North Bengal Terai region and how this all determines the role of Practica in the process of technology transfer.

## Practica Foundation

On the website, Practica explains its role as technical consultant in developing projects and development contexts as follows: 'Technology is an important driving force for social and economic change, not just in the richer parts of the world, but also in the world's poor areas. Despite the huge need, the development and promotion of technology for the rural poor is much under-resourced. As a result opportunities in improving livelihoods and making better use of local resources are missed out. It is against this background that the Practica Foundation was established in 2001.'
'The Practica Foundation aims to facilitate research, development and commercial application of technology in the field of water and energy in developing countries. The choice for water and energy-related technology comes from an assessment that these are often prime movers in rural livelihoods and the conviction that there is still considerable scope to reduce cost and improve the quality of technologies in use. For Practica the commercial promotion is as important, if not more important, as the development of technology. Towards this end Practica works with a network of partner organisations that produce, promote and sell improved rural products.
Practica receives requests from developing countries and looks at their implementing ability, financial aspects, and their relevance in terms of market potential, social and environmental desirability. Practica then helps develop the initiatives further; with technical assistance, linking proposals with financial resources and marketing opportunities and making sure that there is clear agreement on the

rights to the technology. It functions as a clearinghouse for funding the dissemination and commercial application of promising technologies.' (www.practicafoundation.nl)

### Improving technology

It is in line with these ideas that Practica developed a set of technologies that for introduction in the Terai region as a part of the North Bengal Terai Development project. Examples of these technologies are fuel saving pump modification, improved well filters, well washing techniques and stone hammer well drilling. Especially the fuel saving pump modification technology got a lot of attention during the project, because it would reduce irrigation costs considerably with only minimal investments, and so enable marginal farmers to improve farming efficiency. Interesting about this technology for my research was that it is only a small modification of an accepted and approved technology. This would do away with common problems of social acceptance and technological appropriateness that normally surrounds the introduction of new technologies[25]. With a technology like this, it would be easier not to focus on the technology itself and the local appropriateness, but solely on the communication and negotiation processes that are needed to disseminate the technology; the process of technology transfer. So the initial research focus was on the social processes that surrounded the introduction and dissemination of this fuel saving technology. Due to practical limitations, the research focus shifted away from this particular technology[26]. However, describing this specific technology development still gives some additional insights in the relationship between Practica and the mistris participating in the pump modifications. So as an example of the field of practice of Practica, this technology, with technical and organisational details, is elaboratedin the text box 'fuel saving pumpset modification in India'.

**Fuel saving pumpset modification in India**

In the agricultural sector of India, animate energy (human and draught power) accounts for more than one-third of the total energy consumed. Inanimate energy inputs are mainly used for irrigation, for example diesel and electrical pumpsets, of which there are an estimated 10 million electric and 6 million diesel pumpsets in India. However, tube well configurations are not optimal in terms of fuel consumption and water saving. Substantial improvements in well technology, pumpset design and conveyance systems are possible at modest cost. This is indicative of the technological vacuum in which private tube well development has taken place.

The typical configuration in areas with shallow water tables in India is that of a centrifugal pump operated with a 2.5 - 10 horsepower engine. In some areas diesel pumpsets have been common from the beginning. In other areas, the failing reliability of rural power supply has encouraged farmers to replace electric pumps with diesel pumpsets. A striking feature is that within this broad category each area has its own typical irrigation tube well configuration (size of engine, capacity of centrifugal pump and type of well), related to the depth of the water table, prevailing land ownership, soil condition and local tradition.

As part of the North Bengal Terai Development Project (NBTDP), studies have been carried out to improve fuel efficiency of low-lift tube well irrigation. It was shown that combined improvements in well, pump and conveyance technology in North Bengal could translate into a 70% saving in fuel required for a given volume of water.

After some experiments, it was thought that overcooling of the engine, one of the causes of low fuel efficiency, was best corrected by replacing the method of passing pump water through the engine jacket by thermosyphon drum-cooling. This reduced fuel consumption of the standard pumpset by

[25] See also Ahmad (2001), Wareham (1997) and Wicklein (1998) for examples of problematic introduction of new technologies.
[26] See also chapter 2; research objectives; hypothesis #3 for details.

13%. Removing the check valve from the suction pipe reduced the hydraulic friction losses, saving another 18% on the fuel consumption. In order to mitigate the effects of the engine being oversized, the engine speed was decreased from 1500 to 1100 rpm. This resulted in a further reduction of the fuel consumption by 20%. Total fuel consumption could in this way be reduced from 1 l/h to 0.5 l/h, while the discharge of the pumpsets remained unchanged. The cost of these modifications on shallow tubewell pumpsets is RS 350. During the irrigation season, this cost can be recovered through fuel savings in 70 running hours, with the diesel fuel costing RS 10 / l.

Figure 7.1; standard 5hp pumpset (left) and the new model 2.5hp pumpset (right)

In the long term, a better solution for the North Bengal Terai region would be to introduce smaller engines instead of modified 5 hp engines. In the shallow water tables of the North Bengal Terai, 2.5 hp pumpsets are more appropriate. Lower power engines have the additional advantage of lower weight (90 kg instead of 220 kg) and therefore easier transport in the field (see also figure 7.1 of the two models). Further modifications followed: Abandonment of thermosyphon cooling in favour of a flow restrictor; improved priming pump; and better orientation of pump discharge orifice from upwards to sideways (in collaboration with a manufacturer).

The Government of West Bengal has adopted the specifications and placed orders for the improved pumpsets. Triggered by the demand from this important institutional investor two of India's main pump manufacturers have started to produce improved pumpsets. (www.practicafoundation.nl)

## Modern men

Practica Foundation as an organisation stands for the technical approach for solving problems. Technology is claimed to be promising to solve problems in developing countries and to help improving rural livelihoods. Practica claims that not only the introduction of new technology, but also the optimisation of existing technologies can offer great advantages for the marginal people. For the new technological initiatives, Practica often uses existing technologies that are adapted and tested to fit certain local conditions.

This standpoint seems to link up with the ideas of Schumacher in the 1970's about the use of appropriate technologies (Schumacher; 1973), which comes down to the idea that appropriate (or intermediate) technology is intended to build upon the existing skills, knowledge and cultural norms of women and men in developing countries, while increasing the efficiency and productivity of their enterprises or domestic activities. Only the ideas of Practica differ from the original idea of Schumacher, as he states: 'In many cases, the task of intermediate technology would be to find a technology, which obtains a fair level of labour productivity without having to resort to the purchase of expensive and sophisticated equipment' (Schumacher; 1973). According to Practica, it are not necessarily inexpensive and simple technologies that can help the poor. Modern and sophisticated technologies are appropriate in many cases as well. Strangely enough, it are often not the simple technologies that link up with the demand from rural dwellers. When looking at demand from marginal farmers, the preference for modern technologies is striking and at the same time quite logical. Through different forms of communication and media, even the most marginal farmers learn

about the *modern world*. This does not only create awareness about the new technological possibilities, but it also creates awareness about their own situation as not having these modern technologies. The drive to link up with this modern technological world and so to become a modern man can be very strong. Classical appropriate and low-tech technologies do not have this image of modernity and are therefore not considered to be an improvement on their situation.
The *image of modernity* and the urge to link up with the modern world that I found with the mistris has already been touched upon in chapter 5.

## Pratica and mistri cooperatives

Although Practica was established in 2001, involvement of members Practica with mistris in India goes back to the later years of the North Bengal Terai Development Project. Especially in the 3rd phase of the NBTDP (1995 - 1999), emphasis shifted from infrastructure of irrigation systems to smaller technological innovations and localised training. For this purpose, also the Project Support Unit (PSU) was established (NBTDP; 1995). When the NBTDP ran to an end and the PSU evolved into the Centre for the Development of Human Initiatives, this shift in mode of organisation had consequences for the mistri cooperatives (as the cooperatives were backed up by a different organisation) as well as for Practica. To explain the relation of Practica to the other actors and the evolving role of Practica in the process of technology transfer in North Bengal, I will relate this to the two different eras.
Although Practica Foundation was not established yet in the 3rd phase of the NBTDP (PSU era), individual members were involved in the different practices and so the foundations for the ideas of Practica were formed.

### The PSU era

During the 3rd phase of the North Bengal Terai Development Project, efforts for promotion of technologies underwent serious rethinking after having problems with the introduction and dissemination of fuel saving modifications for diesel pumpsets: After trying other channels of introduction, like demonstration of the pumpsets by government mechanics, 'it became obvious that the mistris were the most effective channel because they had the confidence of the clients and could persuade them to overcome some persistent misconceptions about pumpsets. Mistris could earn money by modifying existing pumpsets and servicing new ones. Moreover, they could introduce other new technologies.' (Bom e.a.; 2002-2).
This initial phase of involvement of mistris was characterized by direct control by the project. Mistris were trained and stimulated to fulfil this new role as agents of technological change and connections with suppliers of technology were established. 'After a training programme, a number of these village-level mechanics agreed, that, apart from selling the new technology, they would also gain if they provided their service as a group. This would allow them to gain recognition, learn from each other, undertake common promotion, and become collectively engaged in government contracts.' (Bom e.a.; 2002-2). Of course, the organisation of the mistris in groups was not only advantageous for the mistris themselves. For the project, it was much easier to support and communicate with a group than with individuals. Besides, registration of the cooperative provided the project and donors a sustainable structure.
Summarising the findings, Bom e.a. (2002-2) state some *lessons learned* on dissemination of fuel saving technology for pumpsets in which they promote the involvement of the mistris: 'Contrary to common belief it appears that demand is not generated so much as an objective need but more as a response to what is being offered. The lesson from promoting fuel efficient pumpsets in northern West Bengal was that consumer training was not sufficient and, probably, not even useful. ... The first lesson learned was the importance of convincing and engaging the delivery sector in the promotion of the new technology. Pumpset promotion started to move only when the self-organised

mistri groups were in the business. At that point, promotion perpetuated itself because better service and a better product meant improved incomes.'
This statement is more than only a representation of the effectiveness of the cooperatives, once in place. It also shows the shift in focus of the NBTDP and Practica from the consumer side to the delivery sector. This shift is not only a practical issue that leads to a better acceptance of new technologies, but also a shift from farmer- appropriate technology to commercially attractive technology. After all, if a new technology is not profitable for the delivery sector, they will not invest in promotion and dissemination of the technology.
As those mistri cooperatives appeared to be effective, new technologies that were developed aimed at use or retail by the mistris. This shift in approach also explains the way I have pictured the process of technology in chapter 3: End users appear to play a subordinate role in the process of technology transfer.

The CDHI era

After the initial stage in which the mistri cooperatives worked with support of the NBTDP, the cooperatives started working on a more autonomous basis. Support of the cooperatives went from the Project Support Unit that worked directly for the project, to the Centre for the Development of Human Initiatives. During the NBTDP, technical input used to come from Dutch technology consultants. The same consultants stayed involved, but now offered their services under the name of Practica Foundation. In this new phase, the ideas of Practica on the mistri cooperatives (represented by Bom; 2002-1) focus on increasing the knowledge base of the members of the cooperatives. He states:

- Out of all the pump mistris in the MC's, only a few seem to have enough authority with their clients to convince them on a large scale to go for modification. There appears to be a direct relation between the authority (quality) of the mistri and the number of pumps that he gets modified;
- It should be endeavoured to draw in more 'good' mistris into the MC's because those that remain outside advise their clients against it;
- Quite a number of pump mistris seem to be rather weak in their profession; training could be beneficial here.

This differs from what was concluded in earlier writings about the cooperatives (see Bom e.a.; 2002-2). Among other activities, also the dissemination of pump modification dropped. As a cause of poor results in disseminating the fuel saving pump modifications, Bom (2002-1) states: 'It is clearly a matter to what extend the mistri can convince the owner that instead of damage, the engine will actually require less maintenance. The convincing power of the mistri depends on his authority, or status as a mistri. As mentioned before, there are generally not many pump mistris in the MC's and of those pump mistris in the MC's, not many are good ones with authority'.
Poor technical knowledge is indicated as one of the causes for the poor result in dissemination of the technology and training and education of the mistris is mentioned as the key to improvement. Also lack of authority of the mistris is indicated as cause for poor results in technology transfer.

Of course, also other causes can be indicated for the dissatisfying results on technology transfer of the mistri cooperatives. But it is more interesting to note that notwithstanding these results, the cooperatives did not cease to exist. The members appreciated other than only technical benefits.
I observed that technologies did no longer have the same priority as they used to have during the PSU era. In this sense, the set-up of the cooperatives had turned around: First the cooperatives were used by the project to implement and sustain the technology, as in the new situation technologies were put to use to increase job opportunities for the mistris and so to sustain the cooperatives. Consequently, the role of Practica in the process had to change as well.

So to summarise the view of Practica on the mistri cooperatives, it shifted from purely *means* of introduction and dissemination of technology for the rural poor to an *objective* of rural development and an institution that could contribute to local development and that thus should be sustained.
From the documentation used in this chapter, Practica appears to advocate a technocratic approach for organising the mistris: The cooperative are established and continue to exist as an assembly of technical knowledge, technical skills, technical authority and a pro-modern attitude.

## The role of Practica in the process of technology transfer

The information about the background of Practica Foundation, the practices and view on technology give quite a good picture of the role of Practica in technological innovation and development practices in developing countries. More concrete, it should also give insight in the role of Practica in the North Bengal Terai Development Project, the role in the establishment of mistri cooperatives and, more important, in the actual role in the process of technology transfer through mistri cooperatives: Practica takes care of the technological input. The goal of the technical innovations is twofold: When the innovations are used by, or disseminated through the mistri cooperatives, they serve the goal of improving the situation of the marginal farmers and rural poor by for example improving means of production, improving facilities for irrigation or improving drinking water quality. At the same time, the technologies supply the mistris with additional job opportunities and so with additional sources of income. This livelihood *intensification* generates more income and is basically different from the process of livelihood *diversification* as I described in chapter 5.
To serve both goals, Practica works on assessment of needs of their target group, which is not only improvement of livelihood, but also linking up with the modern world and modern technologies. From these needs, Practica works on technology design and *localising* the design to fit local conditions and circumstances. For introducing the specific technology, Practica helps setting out introduction and dissemination paths in collaboration with local agencies like CDHI and Practica can take care of monitoring and follow-up, if there is appears to be a need for this by the local agencies.

# Chapter 8 One mission, one goal?

The case of the ceramic silver water filter

As the previous chapters focussed on the three social actors of the process of technology transfer separately, this chapter focuses on the interaction between the actors; it describes the arenas in which exchange of information and knowledge as well as negotiation takes place. More precise, it describes my involvement in the transfer process of a new technology, the ceramic water filter. This new technology was introduced to CDHI by Practica Foundation, already about one year before my involvement. Since the introduction, experiments had taken place to set up local production and test the filter in the field. Also activities had taken place to make government officials acquainted with the product in order to create markets for the filter. My involvement with the filter started as personal interest in the technology. I visited the two pottery workshops where the filters were produced, I did some quality control tests on flow-rate with filters that were available and I designed a cheaper model based on a locally available plastic bucket. At the point of time where I came in, the filter was not brought in technical perfection yet, but it was usable and so extra input was needed for the marketing and distribution of the filter among potential users.
One of the objectives of Practica and CDHI with the cooperatives is indicating additional job opportunities for the mistris as livelihood diversification to increase their income and income security. The distribution and possibly also the production and assembly of the filters could be one of these opportunities. However, the feasibility of involving mistris in the transfer of this health product was something that still had to be examined.

Because of some setbacks causing delay with the case study on Beltali Cooperative (more extensively described in chapter 5), I decided to extend my fieldwork with doing action research. By studying a practical example of introduction and dissemination of a technology, I hoped to gain more understanding about the role of Practica, CDHI and the mistris in this process. The ceramic water filter was a good option for extending my research, as some first steps of involving mistris in the dissemination of this filter had already been taken by CDHI. My role was to fuel the process so it would gain momentum.
In the action research, the emphasis was again on the mistris and the cooperative, to see the ideas of the mistris on the technology of the water filter and to learn about their approach to get benefits from this technology. Besides, I looked at possible benefits for CDHI and Practica that would come forward from involvement of mistris and mistri cooperatives.
And as I expected mutual benefits to be the result of negotiation, this set-up of the action research should help answering my first research question:

> *How does the negotiation process of technology transfer lead to acceptable outcomes, despite the different objectives of the actors involved?*

This research question is based on the hypotheses that:

1. Technology transfer is a process and not an event;
2. Technology transfer takes place by negotiation;
3. The actors involved in the process have different objectives;
4. The process of technology transfer leads to acceptable outcomes for all actors.

Taking these hypotheses, the action research on the water filter had to fuel the process and should enable for observation of the negotiation processes. At the same time, it had to focus on the different objectives of the actors. Because of the relatively short time span, it was hard to focus directly on acceptable outcomes, so the action research was more process oriented than outcome oriented.

Instead of focusing on acceptable outcomes directly, I have tried to asses to what extend the negotiation process was aimed at reaching a mutually acceptable outcome.

I will describe the action research by first introducing the technology. As mentioned in chapter 4, I do not consider the technical artefact to be an *actor* in the process. That means that I do not consider the filter to *shape* the negotiation process. Rather, it are the characteristics of the low cost water filter that are negotiated and so the filter is *shaped by* the process. This is also what Kline and Pinch (1995) describe, using the term Social Construction Of Technology (SCOT), developed earlier by Pinch and Bijker (1984) in the 1980s: 'Different social groups associate different meanings with the artefact leading to *interpretative flexibility* appearing over the artefact' (Kline; 1995). Interpretative flexibility also entails that different groups have their own perception of the artefact. I will touch upon the issue of interpretative flexibility when describing the role of the different actors in the process of disseminating the low cost water filter.
After introducing the ceramic silver water filter, I will describe the roles of the different actors. Finally, I will describe the interactions that took place and the data that I extracted from this. Interaction also includes a workshop with mistris that I organised to find out about the mistri interpretation of the low cost water filter and their ideas about dissemination of the water filter.

## The ceramic silver water filter

The functioning of a ceramic silver (CS) water filter is based on the porous characteristics of ceramic material. When adding a certain amount of combustible organic material to the clay the filter pot is made of, the organic material will burn out during firing of the clay filter, leaving a more porous structure. This allows water to seep through at a higher rate. When a very fine powder of organic material is used (like sawdust or ground rice husks), the internal pore size of the fired filter is too small to allow bacterial contaminations to flow through. When the filter element is treated with a bactostatic colloidal silver solution after firing, the filter will destroy bacterial contamination as a backup for the filtration. The clay with organic material can be used to make different shapes of filters, of which disc filters, candle filters and pot filters are the three basic shapes. The pot filter as shown in figure 8.1 is preferred by different organisations that are working on development and promotion of these filters[27].

Figure 8.1; ceramic pot filter

These filter pots can be produced by local potters on the potters wheel, but for production on a larger scale and better quality control, shaping the pot by using a mechanical press with moulds is preferred. By using the moulds, it is easier to control the production variables. The clay pot is dried and fired to get the final filter pot.

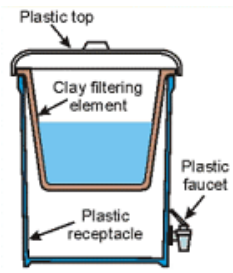


Figure 8.2; filter configuration

The filter pot is placed in a receptacle with a faucet and covered with a lit. The receptacle can be from any material, but often either plastic or ceramics are preferred by users of the filter. Figure 8.2 shows a typical filter configuration with the ceramic pot filter as it is also used by CDHI in the Terai region. The typical water discharge of the filter pot is between 1.5 to 2 litres per hour, which is enough to provide for the drinking water needs of a family of 4 to 6 people. Higher flow rates can be obtained by adding more organic material to the clay mixture, but with higher flow rates, the effectiveness of the filter is

[27] leading organisation in research and promotion of the CS pot water filter is the Nicaraguan based organisation Potters for Peace (www.potpaz.org).

less. Tests on bacteria levels of the filtered water show that a flow rate of 2 litres per hour is the upper limit to guarantee safe drinking water.
Originally, the CDHI CS water filter was supplied with a receptacle that was made of ceramics with a steel faucet, but by using a standard plastic bucket and a plastic faucet available in local markets, I managed to cut the costs of the total filter. An advertisement for this ceramic silver water filter with plastic receptacle (bucket) is included in appendix 5.

## History of the low cost water filter in the Terai region

The ceramic silver water filter is not a new technology, as it is applied in countries in Latin America, as well as in Africa and South East Asia. Application of the ceramic silver water filter on a bigger scale in the Terai region depended on efforts and investments in production, introduction and dissemination. The Terai region was considered to be a potential grow market for these filters, so Practica started filter production on small scale with two local potters. Simultaneously, CDHI did field tests by distributing some of the filters among families and started to raise awareness about this low cost water filter among government officials. This lead to positive reactions, but not to concrete orders for more filters. Besides, there were some serious problems with quality control of the filters produced by the local potters. Own measurements on filters that were available at the CDHI office showed me that there were not only significant differences in flow rate of the filters, but that also the quality of the filters pots was still poor. When visiting the two local potters, it appeared to me that they were not able to sufficiently control the process. My interpretation was that the potters did not sufficiently *understand* the process of filter production to manage the required quality control. To continue filter production, investments in training and in equipment were needed to help the potters improve.
In the mean time, promotion of the ceramic silver water filters continued. Promotion of the filters had mainly two simultaneous paths; promotion at local government level to have the filter included in government programmes and promotion at user level to raise awareness among potential users and to acquire a position on the market among the common water filters. It was a bit of a gamble to start promoting the filters while filter production was still facing problems. The other option was first to optimise the filter production, but that would include investments with no guarantee of demand. Promotion at local government level was not a risk, because there were some filters available for demonstration and testing, and with the local bureaucracy, actual demand was not expected to come that soon.
For getting insight in the local demand among potential users, another strategy was needed. In the line of thought of creating additional job opportunities for the mistris or mistri cooperatives, it would be worth figuring out what role mistri cooperatives could play in the introduction and dissemination of this low-cost ceramic silver water filter on end-user level.

## Designing action research

To answer my research question as stated earlier in this chapter, I had to focus on the negotiation process that I expected to take place between the different actors. The idea of a negotiation process is based on the assumption that the different actors involved had different objectives with the water filter. It might appear that the actors all strive to implement or sell the water filter, but the underlying thought may be different and so the ideas about how to reach the goal may differ as well.
The actors that play a role in the introduction and dissemination of the water filter on user-lever in the Terai region are the same as I described in chapter 3 in the process of technology transfer. Before describing what actually happened during my action research, I will first introduce the three actors and their ideas about and involvement in the filter business. These three actors are:

Practica Foundation; introducing the technology

In the process of technology transfer, Practica takes care of the input of the technology. The role of Practica is less noticeable than the role of the other two actors, but at the same time the input of Practica is strongly influencing the negotiation process as the technology supplied by Practica determines the starting point. That is, the technology is still to be shaped, both technically (by technical improvements) and socially (by interpretation of functions), but it still is the same technology that is the object of negotiation. The technology comes with a whole set of ideas and believes about appropriate use and effectiveness of it, which can be seen as the objectives that Practica has with that specific technology.

CDHI; implementing the technology

The role of CDHI is much more visible than that of Practica, as they fulfil a role as intermediary between Practica and the mistris in the negotiation process of introduction of the water filter. However, their role is also less well defined as their objectives in the process of technology transfer are easily confused with the objectives of the two other actors. As CDHI is an NGO working in the field of rural development, their objectives can be expected to be based on benefits for the mistris and other rural poor people. Nevertheless, besides these objectives, CDHI is also an organisation that, as any other organisation, wants to sustain. That means that other objectives play a role too, related to future projects and generation of income and funds.

Mistri cooperatives; livelihood improvement

With the technology of the ceramic silver water filters, the mistris are not the direct beneficiaries, but also an intermediary, taking a piece of the pie. By getting involved in selling, and possibly production and assembly of the water filters, they can generate additional income. For the mistris, I expected the technology itself to be of less concern: I did not expect the mistris to care for health issues or development issues when selling the filter. As long as it would generate money, I expected it to be good enough. However, what I noticed with Sarkarpara Cooperative during the workshop, and what might apply to other mistris too, is that they do care about development issues. The members of Sarkarpara Cooperative (who were not included in this action research on the CS water filter) appointed a task for themselves in the development of their villages and communities: 'Through the cooperative we can easily help the poor[28].' Probably, this attitude toward facilitating improvement in the community stems from direct involvement and education from CDHI as well as belief in the power and influence of their cooperative in the community.

During the action research on the water filter, I did not focus on the specific reasons that caused the positive attitude toward the filter and of which possible community development could be one.

For focusing on the negotiation process, at least some action should take place. Action could take different shapes, as long as there are enough possibilities for interaction between the actors. As my interests were with interaction of mistris with other actors, in which the mistris should take the role of change agents, I wanted to organise a training and workshop with mistri-representatives from different cooperatives. I wanted this training to be given by CDHI and so it could be used to introduce the mistris in (the perspective of CDHI on) the CS water filter technology. The workshop should enable for interaction between the mistris and between mistris and CDHI. After the training and workshop, the representatives could transfer the ideas to their cooperative and to the other members.

[28] Strength of the Sarkarpara Cooperative written down by the members during the workshop on 15th of September 2003.

## The water filter workshop

The main objective of the workshop as part of the action research was exchanging ideas between CDHI and representatives from different cooperatives about the opportunities that a filter business could create for members of their cooperative. Besides, I wanted to collect thoughts from the mistris about shaping this business and transfer of this technology. As the possibility of starting up a business was something that I came across at different cooperatives, I expected these mistris to have at least some concrete ideas about it.

The workshop that I organised was part of a mistri meeting organised by CDHI to give information on the water filter. First, Joy gave an introduction of the ceramic silver water filter and he explained the possibility for the mistri cooperatives to get involved in the distribution of the water filter. My input in the meeting as part of my action research was a workshop including a brainstorm session and a discussion based on ideas of the mistris. I started the brainstorm session by using a card technique: Card techniques are normally used to organise and rank information. It is a useful technique for workshop settings because of the ease with which many ideas can be quickly collated and organised. It is generally used in small groups. Each idea, issue or piece of information is written on a card. Like items are then grouped together and a name or description given to each cluster. The strength of this technique in the setting of a mistri cooperative meeting was that ideas could easily be shared by first writing them down. In the workshop setting, working with a group, not all mistris are equally stimulated to give their ideas. By using the card technique, each mistri had an equal chance of writing down his ideas. The ideas could serve as input for further discussion about the different topics.

As I wanted to deal with three topics, I used three different sheets with one question that I wanted to deal with on each sheet. These question were:

1. Before starting a filter business with the cooperative, what matters or subjects do you want to know?
2. Before starting a filter business with the cooperative, what work should be done?
3. Do you expect a business of selling filters to be beneficial?

With these questions, I expected to gain understanding about the ideas that the mistris had of the water filter itself: If they were able to come up with question that indicated missing knowledge, it would imply that they were able to understand the general information as given in the presentation. I also wanted to study their ability to think practically, so I related the questions to the possibility of starting a filter business with the cooperative. I had my doubts about if the mistris were able to oversee the implications of starting the business and take up an active role in promotion and distribution of the filters.

The brainstorm session started quite promising. Not all of the participants were as enthusiastic, but in general they were able to reach a certain level of abstraction. Besides, also the mistris that were less assertive in the beginning did put down their ideas on the cards. After everybody had stuck their cards on the posters, the following information could be distilled:

What to know before starting the business: Most of the cards handle about technical matters, which indicates that the mistris see the filter as primarily a technical object. These technical matters include concerns about quality of the filter. Only one mistri indicated a knowledge gap concerning the marketing of the filter. He wrote down he needed more information about how to generate demand for the filter in his village.

What work should be done before starting the business: Main concerns of the mistris relate to getting training, getting initial capital and a shop and making advertisement for the filter. One mistri mentions that they need a licence for selling the filters. These are mainly practical issues that can be solved easily. None of the mistris thinks of market research to see if there is actual demand for these kind of products in their village.

Expectations about benefits: Most of the mistris are quite positive about the ceramic silver water filter and expect a business to be beneficial. They claim that the filter is cheaper than the existing alternatives, but again they do not mention the existing market for water filters at village level. In the workshop setting it is difficult to see the true enthusiasm for this possible business: mistris motivate each other and possibly they do not feel completely free to have a negative attitude toward this new technology while Joy from CDHI is present.

The group discussion that followed the card / poster session was used by the mistris to react on the cards of the others. Mainly explanation was asked about what exactly was meant on the cards. Besides, the mistris used the topics on the cards to ask extra information from Joy. After the group discussion, the attitude toward starting a filter business still appeared to be mainly positive.

The last part of the workshop consisted of some homework. I wrote down four tasks that the mistris should do with their cooperative. The feedback from these assignments should represent the ideas of the mistris after a second thought and, more important, the ideas after consulting the other members of the cooperative. The four tasks were:

1. Find out how much demand for the water filter exists in the villages that your cooperative is covering for both types of water filters[29]. Then discuss in the cooperative if this will be enough for good business.
2. Discuss in the cooperative how you are going to sell the water filter, that is: who, where and how.
3. Discuss in the cooperative how you will promote the water filter to make sure the people get to know about it.
4. Discuss in the cooperative how you will divide the earned money among the members of the cooperative.

Write down the outcomes of the discussions on the cards that are distributed and present your cards in the next meeting.

I expected that bringing these ideas about the water filter to the cooperative in such a concrete way should fuel the interests of the members. Especially to study the *active* role of mistris and mistri cooperatives in the process of technology transfer, I did not want to push them and come up with solutions for problems that the mistris were not aware of yet. So for accurate data on their active role, I allowed the information from the workshop to settle down before I went collecting feedback from the cooperatives or for feedback from the individual members. Because of time restrictions, I was not able to attend a second gathering to evaluate the reaction of the mistris and cooperatives and to initiate more group discussion. Alternatively, I talked to several individual mistris about the potentials for filter business, which I assessed on applicability.

## Negotiating technology transfer

Up to this point, most of this chapter has been about the part of exchange of knowledge between the different actors, which is part of the actual process of transfer of technology. And although the actual process of technology transfer is more tangible (flows of hardware and artefacts are easier to follow than flows of information), it is primarily in the process of exchange of knowledge that the negotiation

[29] Presentation of the filter entailed both a model with plastic receptacle and with a better looking, but more expensive ceramic receptacle.

process takes places in which the actors agree upon desirable outcomes. The negotiation process can have many forms. It should not be visualised as three parties sitting together and discussing matters till a desirable consensus (or win-win situation) is reached about the benefits for each party. Rather, through the process of information and knowledge exchange, the parties (social actors) discuss and negotiate the *meaning of the technological artefact*, as 'different social groups associate different meanings with the artefact leading to *interpretative flexibility* appearing over the artefact' (Kline; 1995). In case of the CS water filter the interpretative flexibility is rather important as the three actors appears to assign different meanings to the filter:
For Practica, the CS water filter is a promising low-cost technology of which production can be implemented as a sustainable small-scale local enterprise. It is a cheaper alternative to the expensive filters that are available in the market with better filtering characteristics.
For CDHI, the CS water filter is a tool to meet the objectives of sanitation programs to supply safe drinking water to rural households. The CS water filter is appropriate for this, as it is inexpensive, easy to use and can be produced locally. Besides, the CS water filter is a tool that can be put to use to meet the objective of creating a better income for the mistris. It is an additional job opportunity that can be implemented through the mistri cooperative.
For the mistris, the CS water filter is an object that, if there is demand in the local market, can be sold to fellow villagers and so creates additional income for those involved in the business. The filter also is a technology with which the mistris can contribute to the development of their community. Besides, the CS water filter is an artefact that links them with CDHI and foreign designers.

These different interpretations of the same CS water filter logically result in different objectives for implementation of the filter for the different actors: Large scale implementation of the water filter for Practica means a successful project and recognition of the technology. For CDHI the objectives are also related to success of their projects on sanitation and mistri cooperatives. Besides, it will give CDHI recognition by local governments and consolidate their position as a trustworthy local NGO. Getting involved in filter business will meet the objectives of the mistris of improving and securing their livelihood by getting more income and probably more income security as well as recognition of the cooperative on village level.

Stated like this, it appears that the interpretation of the CS water filter as well as the objectives for introduction and dissemination of the filter are different and not reconcilable. That is where the negotiation comes in. With the example of the water filter, I noticed that negotiation takes place primarily on basis of the shared ideas and shared characteristics. That is, there is an overlap in the objectives of the three actors with the technology. In the case of the water filter, mainly large scale introduction and an improved health situation for the villagers are characteristics of the project that all three actors agree upon. Negotiation should be seen in line of reaching an agreement on these shared ideas rather than convincing the other actor of (sets of) ideas.
When one of the actors would try to convince the other of their own (set of) ideas, this would imply that there is no room for interpretative flexibility. A mechanism through which sets of ideas are passed on is by education or training. With technology transfer it often entails a technical training in which the 'ignorant' locals are trained in the western technological paradigm. Here, training of the mistris will lead to improved communication between Practica and the mistris, but that most probably does not lead to better performance in technology transfer as the customers of the mistris do not share this paradigm.
What happened with the filter is that there is plenty room for own interpretation of the technology by the three actors. As the objectives of the actors for the technology are reconcilable, the direct interpretation of the technology is of less concern. Here, negotiation mainly takes place around the objectives and goals and not around product characteristics. These shared objectives and goals in the

end determine whether a negotiation process does or does not work whereas the individual interpretation of the technology helps to appropriate and accept the technology on local level.

### The score

One of the questions that I have not touched upon throughout this thesis is the question of the *efficacy* of involving mistris in technology transfer. In evaluative research, the questions about whether things happening in the field are also the things we wanted to happen and we expected to happen is of major concern. Also my initial research questions were about the efficacy of the mistri cooperatives. When looking at efficacy of involving mistris in the process of technology transfer, this would include more than only looking at the specific interaction of mistris and customers. Expected strengths of involvement of the mistris and cooperatives also relate to creating the support base for the technology on grassroots level.

In case of the CS water filter, as is also the case with the other technologies, the added value of involvement of mistris is not easily measured, partly due to the expected benefits being long term rather than instantly visible, but mainly due to problems with measuring quantifying technology transfer. So probably, looking at *efficacy* is not the best way to assess whether involvement of the mistris has an added value in the process of technology transfer. Rather, looking at the mistris and their activities directly should yield more information about positive results of their involvement in technology transfer. I attempted to get this data by observing and interviewing mistris who were working with the filter and relate this to the objectives of technology transfer.

As could be expected in advance, reactions on the filter were very much divergent. Prior to, as well as after the filter workshop, some filters were distributed. By distributing filters to mistris in the field, I expected also others to come in contact with the filter and so to get some insight in the reactions of potential buyers. Garupada Ray, member of Ghugadanga Cooperative, is one of the mistris who already owned a water filter, mainly for getting user response. When visiting Garupada on October 10, 2003, Garupada and his family told me to be very much satisfied with the filter. But when it came to promotion and distribution of the filter, Garupada was less enthusiastic. First of all, he claimed that at the cost of 200 Rupees, the filter is too expensive. People are not willing to pay more than 100 Rupees. Also, even though there is almost no work for the Ghugadanga mistris these days, he did not see an active role for the cooperative in selling the filters. It appeared just to be too much of a circus to him.

There were also much more positive reactions from other mistris, who phoned to the CDHI office to tell about possibilities for local sales, even already having some concrete orders for the filter. Unconfirmed reports from the field even mentioned mistris who started experimenting with own production of these filters.

These reactions from the field indicate huge differences between the various mistris and cooperatives, which is in line with the earlier experiences with mistris and cooperatives that I described in chapter 5. It shows that introduction of the CS water filter, as well as introduction of other technologies, can be boosted by involvement of mistris, as long as these mistris are willing to play the active role that they are expected to play. However, it also shows that mistris have their own ideas on the technologies. If their ideas clash with the ideas of the other actors, involvement of the mistris makes the process of technology transfer unnecessarily complex. The 'score' of involvement of mistris mainly depend on the outcome of the negotiation process, which is an unpredictable compromise.

Using only this example of introduction of the water filter, it is impossible to conclude on the added value of involving mistris in technology transfer processes. Many (contextual) factors play a role in assessing the positive and negative effects of involvement. Generally, involvement of mistris will result in both opportunities and limitations within the process of technology transfer. Disclosure of these

opportunities and limitations will result in a better understanding of the processes that take place than when focusing on efficacy. The opportunities and limitations will be outlined in the next chapter. Besides, in the next chapter I will present some more general findings that are based on observations from the field, combined with the theoretical ideas as presented in chapter 3.

# Chapter 9 Concluding remarks

Summarising results on mistris and technology transfer

In this thesis I have pictured the complexity of a specific configuration of North - South technology transfer in the Terai region in North Bengal, India, in which Practica Foundation is involved as technology consultant, the Centre for the Development of Human Initiatives as local NGO and in which local technicians (mistris) are involved as change agents. Involvement of the mistris as one of the three major actors in technology transfer, takes place through for this purpose established mistri cooperatives. To gain understanding about the set-up of this *process of technology transfer* and the specific role of the mistris, I have used the theoretical ideas and concepts of Long (2001; 2002) and Giddens (1976; 1982; 1984; 1990; 1998). In this concluding chapter, I will reflect on the theoretical as well as the practical issues that have been presented throughout this thesis.
Ultimately, this concluding chapter should answer the questions on which I have based my research, as stated in chapter 2. These research questions are:

1. *How does the negotiation process of technology transfer lead to acceptable outcomes despite the different objectives of the actors involved?*

2. *How do mistris integrate new organisational structures and technological development in the continuing process of securing and improving their livelihood?*

In the presentation of my field experiences and field data in this thesis, I have tried to delineate the complexity of both the negotiation process of technology transfer as well as the diversity of processes of livelihood improvement of the mistris. Summarising the answers on the research questions would not justify the richness of information given in this thesis.
Nevertheless, the approach that I have used for describing the negotiation process of technology transfer, the outcomes desired by the actors, the different modes of personal objectives and personal gain and the relations between these actors, allows for at least some concluding remarks: As I have focussed on the different actors *separately*, this might have resulted in a fragmentation of the whole picture of the process. I will use this concluding chapter to focus on the total picture of the process of technology transfer.
The two research questions allow for separating concluding remarks on the two research topics. First, findings on the negotiation process of technology transfer are collected. Secondly, concluding remarks on the mistris and the integration of organisational structures and technological development in the process of livelihood improvement of the mistris are gathered.
Relating to both research questions, as well as to the broader relevance of the research on mistris, I will summarise the consequences of this specific set-up of technology transfer and the consequences of involving mistris and mistri cooperatives in the process. Finally, concluding remarks about the relevance of studying social processes for understand technology transfer are gathered.

## The complex process of technology transfer

The answer to the first research question directly relates to the hypothesis as stated in chapter 2:

> *Technology transfer is a negotiation process. The outcome of the process is a compromise based on the different objectives and values of the actors and shaped by agency, power relations and relations of trust.*

When relating the findings of the fieldwork to this hypothesis, it can be concluded that this hypothesis still stands. Also the theoretical ideas as explored in chapter 3 do support this hypothesis. Against the background of this hypothesis, the first research question can be elucidated by looking at the interactions between the different actors involved as a negotiation process. However, true understanding of the negotiation process only occurs when focussing on the acceptable outcomes for, and the objectives of the actors involved.

In this thesis, I have outlined how the process of technology transfer can lead to shared action through negotiation. As there are also plenty examples about failures in technology transfer showing that the shared action did not come into being[30], I have tried to take a closer look at the processes that take place. In technical projects, the technology transfer is often conceptualised as a linear process and there is no specific focus on social processes that take place during technology transfer. However, a better understanding of these social processes learns that the process is far from linear. Rather, interaction between the social actors has the form of negotiation, leading to an unpredictable outcome. Focus on the specific social actors should give insight in their life worlds, value systems, knowledge systems, etc. This information results in a better understanding of strategic choices and courses of action. The combination of information on these strategic choices and courses of action of all the social actors should give additional insight in the negotiation process. Understanding human behaviour and motives for actions is a sociological practice, which is normally not included in technical projects. Especially in technical development projects where the other actors or beneficiaries are poor rural dwellers, obtaining a sound understanding of the social situation as well as the ideas, norms and values of the other is a difficult and time-consuming practice.

In most cases, the outcome of the negotiation process is not the most desirable outcome for all of the actors; it is a compromise. The common course of action or 'shared process' of the different actors finally depends on the effort that they think this compromise is worth putting into.

In chapter 2 I have stated that:

> ... I realised that poor outcomes of the negotiation process of technology transfer could be easily dedicated to differing and incompatible objectives of the different actors. But in case of my research in Jalpaiguri and Cooch Behar district on technology transfer, still mistri cooperative structures were in place and still processes were ongoing. This made me realise that although objectives may differ, it does not necessarily mean that they are conflicting and not compatible. The question remained *how* those actors managed to pursue their own objectives within the process of technology transfer, and especially how the least powerful actors, the mistris, managed to pursue their own objectives without obstructing the process.

The clue here, which in fact answers the first research question, is that the objectives of the different actors may differ, but they are not incompatible. In chapter 8, I showed that in the process of the introduction of the CS water filter the three actors all had their own ideas and objectives, still resulting in a shared process. Information from the chapters 5, 6 and 7 on the individual actors is needed to see the objectives of the actors in relation to their vision on technology transfer, socio-economic situation, livelihoods, daily routines, etc.

Apart form negotiation about the objectives and goals of the process of technology transfer, also knowledge interaction influences the outcome of the process: The differing knowledge systems of the social actors result in different perceptions of the technology. This relates to the interpretative flexibility of the product (Kline; 1995); different actors assign different meanings to an artefact as a result of their specific knowledge system. A different interpretation of the technology caused by different knowledge systems necessitates the negotiation about a shared process.

[30] See for example Ahmad (2001)

The observation of different objectives resulting in a shared process in itself is nothing new: Solving conflicts by mediation to a win-win situation is a textbook example of a process in which actors strive for the same output with different objectives. So why this focus on difference of objectives of the actors of the process of technology transfer, as this is not directly something innovative? The main reason for this is that there often is insufficient emphasis on these differences, while in the specific configuration of technology transfer that I described in this thesis these differences appears to play a crucial role. It can be an important tool in understanding practical outcomes of technology transfer. By focussing on the difference of objectives of the actors, this multiple-objective approach can be used as tool for project evaluation as well as a tool for project design, which includes using sociological concepts related to *agency*, *power* and *trust* rather than using technical concepts as *appropriateness, efficacy* and *user satisfaction*. Rather to state that a project has failed, we can learn from it and improve by focussing on the negotiation that takes place.

## Livelihood improvement of the mistris

The second research question focuses on the mistris as one of the actors (*How do mistris integrate new organisational structures and technological development in the continuing process of securing and improving their livelihood?*)
An answer to this second research question can be partly constructed from the rich information in chapter 5 and chapter 8. Concluding from those two chapters, it appears that integration of the organisational structures and technological developments in the process of livelihood improvement of the mistris occurs through a number of mechanisms, of which work, social capital formation and improved access to other capital assets are the three most important.

Improving the livelihood through **work** can be based on both intensification of existing activities as well as diversification of activities. The initial idea of involving the mistris in the process of technology transfer and establishing mistri cooperatives included offering additional job opportunities in the field of practice of the mistris. However, during fieldwork, this livelihood intensification was not evident. Rather, the mistris were more interested in livelihood diversification through the cooperative. Possibilities for additional jobs mistris came up with entailed for example different kind of businesses that could be financed by and managed through the cooperative.

How improved **social capital** influences the livelihoods of the mistris is less tangible than the effects of generating extra work. The core idea of social capital theory is that social networks have value. Studying the social networks that resulted from the involvement of mistris in the process of technology transfer should yield information about how these networks influence the livelihood of the mistris. Using Putnam's (2000) distinction between *bridging* and *bonding* as two types of social capital helps to understand the mechanisms through which social capital leads to livelihood improvement: 'Bonding social capital is good for undergirding specific reciprocity and mobilizing solidarity. ...Bridging networks, by contrast, are better for linkage to external assets and for information diffusion.' (Putnam; 2000). Bonding takes place *inside* the cooperative among the members while the positive effects of bridging are related to the linkages that are formed between the mistris (or mistri cooperatives), CDHI and foreign technology consultants from Practica. Both forms of social capital have many features that help the mistris translate aspirations into realities and so to improve their livelihood; it allows the individual mistris to resolve collective problems more easily, it sets the conditions that allow to advance smoothly and it creates awareness about how well-being of an individual is related to the well-being of others showing that fates of individuals are intertwined (Putnam; 2000).

Lack of access to **capital assets** is one of the reasons that rural dwellers face difficulties to get out of their hopeless situation. Especially access to affordable loans can make a huge difference. With a loan, one is able to start up a small business or overcome shocks. Small credits give poor people the opportunity to build up a fulfilling existence. Also the UN have recognised micro credit as a promising tool for development: To reach the millennium goals to halve poverty in the world before 2015, the UN plead for increasing the number of micro credit organisations. The UN have proclaimed 2005 the international year of micro credit (Vossen; 2005).
As the cooperative provides such credits by a revolving fund system, the cooperative is an important tool for securing and improving the livelihood. Besides, through the cooperative mistris have access to goods that are hard to obtain without any help. The shared pumpset that is distributed to the cooperatives through government programs allows them to irrigate their land and so it can contribute substantially to their income from farming business. Simultaneously, the shared ownership of the pump helps to keep the cooperative together and fuels communication as well as initiatives for income generating activities.

## Opportunities for mistri cooperatives

This research originated from the need to evaluate the efficacy of using mistris and their (technical) skills and social network to fulfil the role as intermediary to reach the targeted people with the introduction and dissemination of new technologies. As the research focus shifted from the technical focus on efficacy to a more sociological approach focussing on reconciliation of objectives of the actors and livelihood improvement of the mistris, also the question of the direct benefits of the involvement of the mistris for the other actors was pushed to the background. I have focused on the consequences of the negotiation process that stemmed from the involvement of the mistris rather than on the direct need for involvement or positive effect of the involvement for the dissemination of technology (efficacy). During field work I noticed that this efficacy is extremely difficult to measure as possible improvements in efficacy stem form both technical processes like creating technical acceptance as well as social processes like creating relations of trust and incorporating the technology in the daily lives.
For a study on efficacy, it would be preferable to come with figures, like stating that involvement of mistris will cause the dissemination of a technology to be X% more effective, but that is simply impossible. Involvement of mistris does create opportunities though, but it also has some limitations:

### Opportunities of involvement of mistris in technology transfer

In this thesis I have shown that for studying opportunities of involvement of mistris in the process of technology transfer a distinction should be made between direct advantages for (the livelihood of) the mistris and advantages or positive effects on the technology transfer itself. Advantages for the livelihoods of the mistris are covered in the previous paragraph, while this paragraph handles about the opportunities involvement of mistris offers for technology transfer.
One of the advantages of the involvement of mistris is mentioned in several project documents[31]; the local network of the mistris and their relation of trust with the farmers as target population creates a solid basis for introduction of technology in the villages. Although I have not been able to find specific evidence that proves the relationship between this network and the influence of it on the technology transfer, I have indeed observed good relations between mistris and farmers. On of the explanations for this is the absence of social barriers between mistris and farmers. This is also stressed by the fact that all mistri cooperatives have mistri members as well as farmer members. This good relationship

[31] See for example Arcadis Euroconsult (2002-1 and 2002-2) and Bom (2002-1 and 2002-2).

enables for easy access to farmers. However, because of the initial absence of differences in status between mistris and farmers, mistris are not necessarily able to convince the farmers of the new technologies. Differences in status are created after a while through the membership of the cooperative by the intensive contacts of CDHI staff and foreign consultants. This appeared to affect the technology transfer in a positive way.
A second advantage is related to the sustainability of the cooperative as a structure. Many development practices face problems with sustainability and as soon as the donor withdraws from the project, it collapses. As mistris are handed new tools to improve the situation of the farmers by for example supplying cheaper wells, they can continue this development practice of introduction of technology as an income generating activity. As long as the activity generates income, it can be expected that the mistris continue this activity. A pitfall in this process is the tenability of the technology itself: Advancing technology development can make other technologies redundant and so it is risky for the mistris to rely fully on the new technologies. An example is the fuel saving pump modification that resulted in a new pump design. The new pumpsets that are sold already have a lower fuel consumption and so modification is no longer necessary. But even with technologies that were still useful, I noticed that the mistris needed a 'boost' every now and then to keep them active with the technologies. So without the backup of a local organisation providing training and help, like CDHI, it can be questioned if the technology transfer through mistris is truly sustainable.

### Limitations of involvement of mistris in technology transfer

The major limitation of involving mistris in the process of technology transfer relates to the introduction of an extra intermediary in the process. The process as well as the communication lines become more complex: Both the flow of information (arenas of negotiation and information and knowledge exchange) as well as the flow of technological hardware become more complex (see also figure 3.1; graphical image of the process of technology transfer). That in itself does not necessarily have to cause problems. Problems do appear because of differences in technological paradigms: As the mistris are involved in the process because of their technical knowledge and skills, they are expected to have a shared understanding of the technology. However, the knowledge base of the mistris is based on practical experience rather than formal (western) education. This leads to a different understanding of the technology. The influence of Bishwakarma, the Hindu god of engineering on their understanding of technology is just one example of how mistris use alternatives for explaining technical phenomena and how their knowledge base might not correspond with the knowledge base of the other actors. These differences in knowledge bases can cause poor results in technology transfer. In Bom e.a. (2002-2), an example of misconceptions about pumpsets is given[32]. These misconceptions that are apparently based on different technological paradigm or knowledge base hampered the introduction of fuel saving technology for pumpsets. Negotiation between the different knowledge systems is part of the interaction that takes place during the process of technology transfer. However, the negotiation does not necessarily leads to a shared interpretation of the technology.
Another limitation that I came across during fieldwork relates to the expectations that mistris have about the benefits that should be generated by their involvement in the process of technology transfer: Mistris mention the 'promise' of CDHI that involvement would generate more work for them. However, more work for mistris through new activities is not always demonstrable directly. As involving mistris is not free of obligations for the other actors and as fulfilling the obligations is not

[32] The misconceptions that for example a heavy pump is a strong pump and that If a pumpset becomes very hot, it will burst are observed among farmers who use diesel pumpsets. Although Bom e.a.(2002-2) do not explicitly indicate so, I noticed that the ideas of 'uneducated' mistris were not any different.

always possible, this might lead to disappointment or conflicts. Care should be taken not to arouse false expectations.

### The organisational structure of the cooperative

By looking at the pros and cons of involving mistris in the process of technology transfer, it appears that the cooperative as organisational structure in which the mistris are organised, plays a less significant role. This is true for the technology transfer itself, where the individual mistris largely determine the course of action. However, it is the cooperative that sets the enabling context for involvement of the individual mistris.

Initially, the cooperatives were established to give the mistris who were already involved in the project a legal basis for their activities. During my field work, the cooperatives appeared to be more than just a legal basis for operation. Chapter 5 shows that mistris maintain the cooperative as a 'club' in which they share ideas, even without direct demonstrable benefits. Seen from the perspective of technology transfer, this has a huge advantage: As the structure is maintained during times of less activity, the mistris can easily be included again when new technologies are available. For the mistris, it has the same advantages, as they stay connected to the network of technology transfer that is formed by cooperation between Practica and CDHI. From the perspective of livelihood improvement of the mistris, the cooperative is a structure that creates additional opportunities for the mistris through different mechanisms of which livelihood intensification, increased social capital and access to credit are some examples.

So the mistri cooperatives function both as a tool in the process of technology transfer as well as a valuable instrument for rural development. In this concluding chapter, the question can be posed to what extend this instrument might be applicable in another context; that is, in other localities or with other technologies. As this research on the mistris and mistri cooperatives is very much related to the context in which it takes place, it is impossible to give any accurate conclusions about broader applicability of the concept of cooperatives of local artisans. However, based on the field data it is possible to state that similar structures like the mistri cooperatives will only be sustainable through times of less or no direct (financial) benefits in a collective society, where 'Individuals want to belong to something they can identify themselves with' and where cooperatives can function 'as clubs where people with the same profession can come together and can derive identify from.' (Dr. Mishra; interview September 5, 2003).

## The relevance of socio-engineering

With this thesis, I did not only want to picture the contemporary situation in technology transfer in the Terai region: I have also tried to integrate the traditionally technocratic notion of North - South technology dissemination with the field of sociology. This can be recognised in the role of technology throughout my thesis; I did not use a technocratic focus in which the technology transfer is seen as a linear causal relationship. Rather I considered the process of technology transfer to be a negotiation process, in which also the characteristics of the technology were to be negotiated. The actors determine the role of technology and not the other way around. This rather unusual angle of approaching technology transfer enabled me to look at the perspectives and objectives of the different actors with respect to the technology.

From our Western paradigm, we appear to be more eager to solve even social problems with technical solution. Slowly the interdisciplinary approaches to technical problems are gaining terrain, but involvement of social scientist is still not common practice. With this thesis, I want to show that a

sociological analysis of the situation will give additional insights that are crucial to solving problems in a sustainable way. Besides, this thesis shows that the actors in a change process not necessarily have to have a shared understanding of the process to reach a mutually acceptable or even mutually desirable process outcome.

Within the contemporary development paradigm of stimulating grassroots initiatives, intensive cooperation with local counterparts and involvement and participation of the beneficiaries, it is not even realistic to presume a common problem perception and shared objectives of the actors. So more attention should be paid to differentiation of the objectives of all the parties involved. As I showed with this thesis, a sound understanding of the actors and their ideas, values and motives for action results in a better understanding of the development practice. Negative as well as positive results of the practice can be understood by looking at the different objectives of the actors. That is, if the different objectives of the actors are reconcilable in the same process, the actors are more likely to dedicate themselves to their tasks and to the process.

# Summary

Negotiating technology transfer

This thesis describes the practice of North - South technology transfer in the Terai Region in North Bengal, India and the role that local technicians (mistris) play in this practice. This practice is conceptualised by delineating the different people as *social actors* and the relations that exists between these social actors. Throughout this thesis, this is called the *process of technology transfer*. The process of technology transfer covers different arenas as spaces in which contests over issues take place in the form of negotiation and information and knowledge exchange within and across domains, where domains represent groups of social actors that share the rules, norms and values that are central to the process of social ordering.

The three most important social actors in the process of technology transfer are Practica Foundation, the Centre for the Development of Human Initiatives (CDHI) and the mistris. Involvement of local technicians in dissemination of technology in developing countries still is a relatively new form of participation; the focus of this thesis is on the role of the mistris in this process of technology transfer and the role that the for this purpose locally established mistri cooperatives play.

Technology transfer processes are not linear. Rather, it is a negotiation process of which the outcome is a compromise based on the different objectives and values of the actors and that is shaped by agency, power relations and relations of trust. That includes that the outcome of the introduction and dissemination of a new technology cannot be predicted by only focussing on technical characteristics of the technology. As the different social actors in the process all appear to have their own objectives and perceptions, the outcome is shaped through interaction (negotiation) between the actors who are all striving to meet their specific objectives. Better understanding about why a process of technology transfer follow certain lines of action can only be gained by looking at the different objectives of the social actors. As these objectives are a combination of discernible and indiscernible motives, ideas, values perceptions and contextual factors, understanding the different objectives requires a sound understanding of the social actors and their life worlds.

Studying the specific process of technology transfer in the Terai Region included studying the three actors separately: Involvement of the mistris in this process was based on their expected role as intermediaries who had the confidence of the farmers as targeted end users. Mistris were expected to transfer the technologies as commercial activity and so to take an active role in the process. However, when studying the mistris more closely it appeared that many of them were not the technical professionals they were considered to be at forehand; mistris combine different activities like agricultural jobs and mistri jobs to construct their livelihoods. Technical knowledge and skills (technical knowledge system) do not necessarily match with the knowledge systems of the other actors.

Objectives of the mistris mainly relate to improvement of their livelihoods, which occurs through different mechanisms. The cooperative plays a role in this as a structure that sets the enabling conditions for the mistris to get involved in the process of technology transfer. Mistris maintain the cooperative (reproduce the structure) because they value the collective structure rather than because of directly demonstrable benefits.

CDHI's role in the process of technology transfer as a local NGO is that of creating opportunities for the rural population of the Terai Region. The objectives of involving mistris are twofold: organising mistris in groups and linking them with new technologies gives them new tools to expand their job opportunities and so to help them out of poverty. At the same time, the membership of a group helps them to claim certain services that are not accessible for individuals and helps them to build capacity.

For Practica, technology is an important driving force for social and economic change, not just in the richer parts of the world, but also in the world's poor areas. Practica claims that despite the huge need, the development and promotion of technology for the rural poor is much under-resourced.

Objectives of technology transfer relate to creating opportunities for improving livelihoods and for making better use of local resources.

Possibilities for reconciliation of the different objectives came forward by studying the process of technology transfer for a ceramic water filter as specific technology: Different interpretations of the same water filter resulted in different objectives for implementation of this filter for the different actors: Large scale implementation of the water filter for Practica means a successful project and recognition of the technology. For CDHI the objectives are also related to success of their projects on sanitation and mistri cooperatives. Besides, it would give CDHI recognition by local governments and consolidate their position as a trustworthy local NGO. Getting involved in filter business will meet the objectives of the mistris of improving and securing their livelihood by getting more income and probably more income security, as well as recognition of the cooperative as important structure on village level.
The different objectives are reconciled through negotiation. Negotiation takes place on basis of shared objectives, shared ideas and shared perceptions of characteristics of the water filter.

For assessing the involvement of mistris in the process of technology transfer on *efficacy*, many (contextual) factors play a role. Generally, involvement of mistris will result in both opportunities and limitations within the process of technology transfer. Disclosure of these opportunities and limitations will result in a better understanding of the processes that take place.
For understanding the opportunities that stem from the involvement of mistris in the process of technology transfer, a distinction should be made between direct advantages for (the livelihood of) the mistris and advantages or positive effects on the technology transfer as a process.
Livelihood improvement for the mistris through integration of the organisational structures and technological developments in their lives occurs through a number of mechanisms, of which generating work, formation of social capital and improved access to other capital assets are the three most important.
For the process of technology transfer, positive effects of involvement of mistris relate to creating a sustainable structure and network on grassroots level through which dissemination can take place.
Limitations of involvement of mistris in the process relate to the fact that both the flow of information (arenas of negotiation and information and knowledge exchange) as well as the flow of technological hardware become more complex. Problems do appear because of differences in technological paradigms: As the mistris are involved in the process because of their technical knowledge and skills, they are expected to have a shared understanding of the technology. However, the knowledge base of the mistris is based on practical experience rather than formal (western) education. This leads to a different understanding of the technology. These differences in knowledge base and knowledge systems can cause poor results in technology transfer

The focus in this thesis on the *process* of technology transfer rather than on the *outcome* of the process elucidates how problems with technology can stem from the different social realities of the actors involved. The scope of this thesis also shows that using a more sociological approach to problems with technology transfer results in additional insights that help to explain poor technical results and that can help to prevent poor results in the future.

# Nederlandse samenvatting

Het onderhandelen van overdracht van technologie

Deze scriptie handelt over de Noord - Zuid overdracht van technologie zoals deze plaats had in the Terai Regio in Noord Bengalen, India en de rol die lokale technici (mistris) hebben in deze overdracht. De overdracht is weergegeven door het afschilderen van betrokkenen als *sociale actoren* en de onderlinge relaties tussen de betrokkenen. Dit wordt in deze scriptie omschreven als het *proces van overdracht van technologie*. Dit proces omvat verschillende arena's als terreinen waarin informatie, kennis en ideeën worden uitgewisseld en meningsverschillen worden beslecht tussen de verschillende domeinen. Deze domeinen vertegenwoordigen groepen van sociale actoren met gelijke ideeën, normen en waarden.

De drie belangrijkste actoren in het proces van overdracht van technologie zijn Practica Foundation, het Centre for the Development of Human Initiatives (CDHI) en de mistris. Het betrekken van lokale technici in het introduceren en verspreiden van nieuwe technologieën in ontwikkelingslanden is nog een relatief nieuwe vorm van participatie; deze scriptie richt zich op de rol van de mistris in het proces van het verspreiden van nieuwe technologieën en de rol die de voor dit doeleinde lokaal opgerichte coöperaties voor mistris hierin spelen.

Overdracht van technologie is geen lineair proces. Het proces laat zich beter beschrijven als een onderhandelingsproces waarvan de uitkomst wordt gevormd door een compromis. Het compromis komt voort uit de verschillende doelstellingen en waarden van de sociale actoren en wordt gevormd door machtsverhoudingen evenals vertrouwensrelaties. Hierdoor kan het resultaat van de overdracht van een technologie niet worden voorspeld op basis van enkel technische eigenschappen. Doordat de verschillende actoren die betrokken zijn in de overdracht elk een eigen visie op het proces hebben en verschillende doelen blijken na te streven wordt het resultaat van de overdracht van technologie gevormd door interactie en onderhandeling tussen de verschillende actoren. De verschillende ideeën en het nastreven van eigen doelen spelen hierin een belangrijke rol. Een beter begrip van het verloop van de overdracht kan worden verkregen door te kijken naar de verschillende ideeën, doelen en belangen. Verschillende motieven, ideeën, normen waarden en omgevingsfactoren liggen ten grondslag aan de verschillende doelen die de actoren hebben met de overdracht van technologie. Om de verschillende doelen te begrijpen is het noodzakelijk om de (sociale) achtergronden van de actoren te begrijpen.

Om het specifieke proces van overdracht van technologie zoals dat plaats had in de Terai Regio te bestuderen, is een losse studie naar de drie belangrijkste actoren uitgevoerd. Het betrekken van mistris in het proces was gebaseerd op hun rol als intermediair, waarbij de mistris gebruik konden maken van de vertrouwensrelatie die zij met de boeren zouden hebben. Het overdragen van de technologie zou dan uitgevoerd kunnen worden als een commerciële activiteit . Echter, bij nader onderzoek bleek dat een groot aantal van de mistris niet over het technische professionalisme beschikten waarvan aanvankelijk was uitgegaan; de mistris combineren verschillende activiteiten zoals agrarische productie, om te kunnen voorzien in hun levensonderhoud. De technische kennis en competenties van de mistris (kennissysteem) sloot niet per definitie aan bij de kennis en competenties van de andere actoren.

Doelen die de mistris nastreven zijn hoofdzakelijk gerelateerd aan het verbeteren van hun bestaan, wat op meerdere manieren kan worden vorm gegeven. De coöperatie speelt hierin een belangrijke rol als structuur (organisatie) waardoor randvoorwaarde worden gecreëerd die het mogelijk maken de mistris deel te laten nemen aan de overdracht van technologie. De mistris handhaven de coöperatie omdat deze waarde hechten aan de organisatorische vorm (structuur) en niet direct omdat zij directe en aanwijsbare voordelen behalen uit de coöperatie.

De rol die CDHI heeft als non-gouvernementele organisatie in de overdracht van technologie bestaat hoofdzakelijk uit het creëren van kansen en mogelijkheden voor de bevolking van de Terai Regio. Het

betrekken van de mistris hierin dient twee doelen: Door de mistris te organiseren in groepsverband en deze nieuwe technieken aan te reiken, krijgen de mistris nieuwe kansen voor het verbeteren van hun bestaan. Daarnaast hebben de mistris, wanneer deze georganiseerd zijn in een coöperatie, de mogelijkheid om aanspraak te maken op bepaalde diensten die niet toegankelijk zijn voor de individuele mistri.
Voor Practica, technologie is de motor achter sociale en economische veranderingsprocessen, zowel in de industriële landen alsook in ontwikkelingslanden. Volgens Practica is de ontwikkeling en promotie van technologieën voor de bevolking van het platte land in arme gebieden, ondanks de grote behoefte hieraan, nog onderbelicht. Practica streeft met de overdracht van technologie naar het ontwikkelen van mogelijkheden voor het verbeteren van bestaansmiddelen en het optimaal benutten van lokale middelen.

Mogelijkheden voor het verenigen van de verschillende doelstellingen kwamen aan het licht tijdens de overdracht van een specifieke technologie van een keramisch waterfilter: De verschillende interpretaties van de waterfilter door de verschillende actoren resulteerde in afwijkende doelstellingen voor de implementatie van het filter. Voor Practica betekent implementatie van het filter op grote schaal dat het project succesvol verloopt. Tegelijkertijd is dit een erkenning van de technologie. Voor CDHI zijn de doelstelling voor het implementeren van het waterfilter ook gerelateerd aan het succes van een project, zowel op het vlak van bevorderen van de volksgezondheid als op het vlak van het creëren van extra werk en inkomen voor de mistris. Wanneer de mistris betrokken worden in een project zoals de introductie en disseminatie van een keramisch water filter, betekent dit dat de mistris nieuwe methodes aangereikt krijgen om een inkomen te verwerven. Daarnaast resulteert betrokkenheid van de mistris en de coöperaties in dit soort projecten in erkenning van de coöperatie op dorpsniveau en geeft het de mistris extra aanzien en status.
Deze uiteenlopende doelen zijn verenigbaar door middel van onderhandelingen. De onderhandelingen zijn mogelijk op basis van ideeën en doelen die de drie partijen delen.

Voor het beoordelen van de effectiviteit van het betrekken van mistris in overdracht van technologie moet rekening worden gehouden met een groot aantal (contextuele) factoren. Het betrekken van mistris in het proces biedt mogelijkheden, maar heeft tegelijkertijd ook serieuze beperkingen. Het proces van het overdragen van technologie is te verduidelijken door deze mogelijkheden en beperkingen nader te belichten.
Wanneer gekeken wordt naar de mogelijkheden die voortkomen uit het betrekken van mistris in overdracht van technologie, moet onderscheid worden gemaakt tussen positieve ontwikkelingen voor de mistris en positieve ontwikkelingen voor het proces van overdracht van technologie zelf.
Het verbeteren van de bestaansmiddelen van de mistris door integratie van de organisatie structuur van de coöperatie en technologische vooruitgang, vindt plaats volgens een aantal mechanismen waarvan het genereren van werk, het creëren van een sociaal netwerk en een verbeterde toegang tot materiële en niet-materiële goederen de drie belangrijkste zijn.
Nieuwe mogelijkheden voor het proces van overdracht van technologie zijn vooral gerelateerd aan het opzetten van duurzame structuren zoals de coöperatie op lokaal niveau. Door middel van deze duurzame structuren kan disseminatie van technologie plaatsvinden.
Nadelen van het betrekken van mistris in het proces hebben vooral te maken met het feit dat het uitwisselen van informatie (wat plaats heeft in de arena's) alsmede het uitwisselen van goederen ingewikkelder wordt. Problemen zijn te verklaren vanuit het idee dat de technologische paradigma's van de verschillende partijen niet overeenkomen: Wanneer de mistris worden betrokken in het proces, wordt er ook vanuit gegaan dat deze de technologie op eenzelfde manier begrijpen en benaderen als de andere partijen. Echter, de technische kennis en ervaring van de mistris is gebaseerd op praktische ervaring en niet op een formele (Westerse) opleiding. Dit heeft een andere begripsvorming van de

technologie tot gevolg. De verschillen in begrip van de technologie in een specifieke sociale context kunnen leiden tot miscommunicatie en zo tot slechte resultaten in de overdracht van de technologie.

Door in deze scriptie de nadruk te leggen op het *proces* en niet zo zeer op de verwachte *uitkomst* van de overdracht van technologie, wordt duidelijk dat problemen met de technologie voort kunnen komen uit verschillende sociale realiteiten van de betrokkenen. Tegelijkertijd toont deze scriptie aan dat een sociologische benadering van technische problemen resulteert in nieuwe inzichten die aangewend kunnen worden om tegenvallende resultaten van de overdracht van technologie te verklaren en mogelijk in de toekomst te voorkomen.

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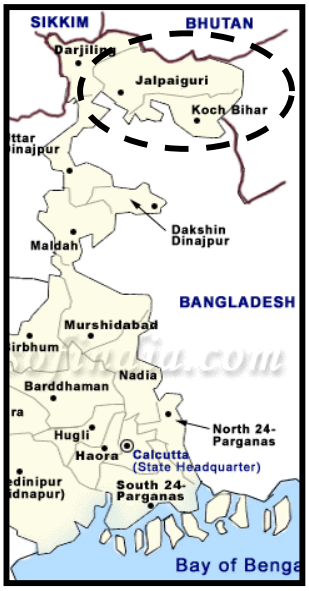
# Appendixes

## Appendix 1

Terai Region and location of mistri cooperatives



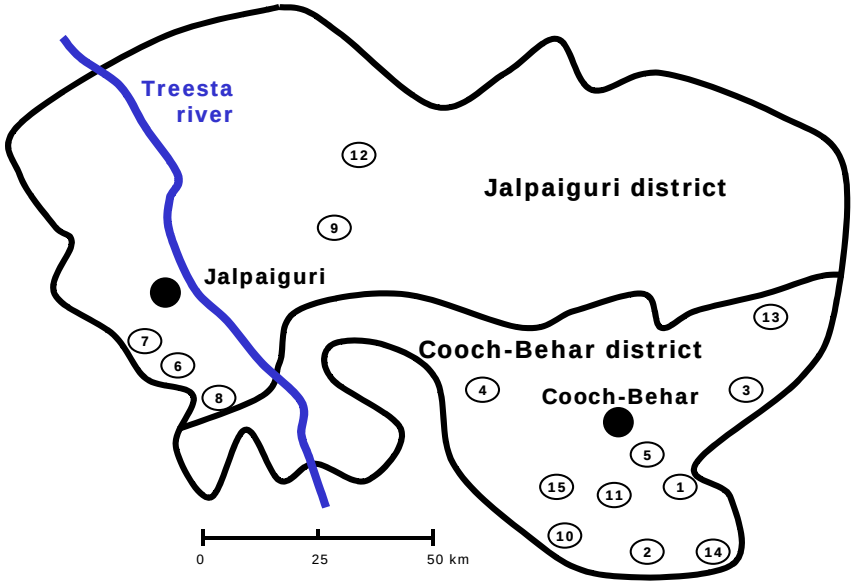




Figure: location of mistri cooperatives in Jalpaiguri and Cooch-Behar districts

| nr. | name of coop | block | district | established in |
|---|---|---|---|---|
| 1 | Sahebganj | Dhinhata | Cooch Behar | 1999 |
| 2 | Gitaldah | Dhinhata | Cooch Behar | 1999 |
| 3 | Balarampur | Tufanganj | Cooch Behar | 1999 |
| 4 | Beltali | Mathabanga | Cooch Behar | 1999 |
| 5 | Chilkirhut | Cooch Behar-I | Cooch Behar | 1999 |
| 6 | Ghugudanga | Jal Sadar | Jalpaiguri | 2001 |
| 7 | Lalbazarpara | Jal Sadar | Jalpaiguri | 2001 |
| 8 | Sarkarpara | Jal Sadar | Jalpaiguri | 2001 |
| 9 | Mallickpara | Dhupguri | Jalpaiguri | 2000 |
| 10 | Rajarhut | Sitai | Cooch Behar | 2000 |
| 11 | Jhuripara | Dhinhata | Cooch Behar | 2001 |
| 12 | Satvandi | Dhupguri | Jalpaiguri | 2001 |
| 13 | Pundibari | Tufanganj | Cooch Behar | 2001 |
| 14 | Bamanhut | Dinhata II | Cooch Behar | 2001 |
| 15 | Paglahut | Cooch Behar-I | Cooch Behar | 2001 |

# Appendix 2

Time planning

### Work plan for the research on the Mistri-cooperatives

Date: 19-8-03
By: Jan Nederstigt

### Time schedule per week:

| activity 2003 week starting on | 4/8/ | 11/8 | 18/8 | 25/8 | 1/9 | 8/9 | 15/9 | 22/9 | 29/9 | 6/10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| Exploration at CDHI and on site | | | | | | | | | | |
| Selection of 2 cooperatives for case study | | | | | | | | | | |
| Interview and orientation coop #1 (Sarkarpara) | | | | | | | | | | |
| Part. observation and in-dept interviewing #1 | | | | | | | | | | |
| Group meeting / brainstorm with coop. #1 | | | | | | | | | | |
| Processing information coop #1 | | | | | | | | | | |
| Interview and orientation coop #2 (Beltali) | | | | | | | | | | |
| Part. observation and in-dept interviewing #2 | | | | | | | | | | |
| Group meeting / brainstorm with coop. #2 | | | | | | | | | | |
| Processing information coop #2 | | | | | | | | | | |
| Co-operating in other MC related activities | | | | | | | | | | |
| Attending CDHI related activities | | | | | | | | | | |
| | | | | | | | | | | |

**Fixed dates:**

| | |
|---|---|
| Sat. 23/8/03 | Cooch Behar MC meeting |
| Tue. 26/8/03 | Jalpaiguri MC technology demonstration |

**Different activities:**

The idea is to do case studies on two mistri-cooperatives. One in Jalpaiguri district, Sarkarpara Cooperative, and one in Cooch Behar district, Beltali Cooperative. For both case studies, three weeks time have been planned. In these three weeks, different activities will take place:

Week 1

This will be mainly making contact with the mistris. Getting to know them by informal interviews; Who are they, what is their background, why did they join the cooperative, what is the gain that that get out of it, how much are they involved in the different activities, etc. The idea is to meet **all** mistris personally.

Week 2

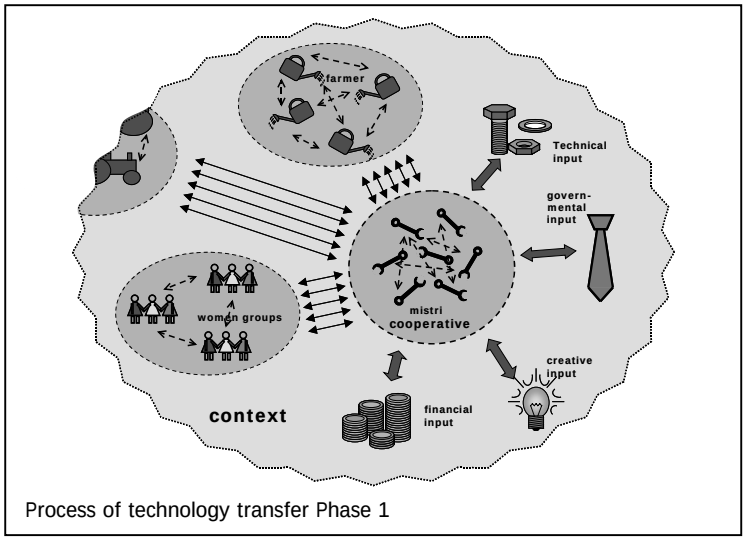
From the first contact, in week 2 it should be possible to interact with (some of) the mistris more deeply. The main idea is to do participant observations, and have more, semi-structured interviews. In this week I hope to see how the mistris do their normal activities and how they relate different technological matters to this. I estimate that I will be in the field for four days, using a interpreter from outside CDHI.

Week 3

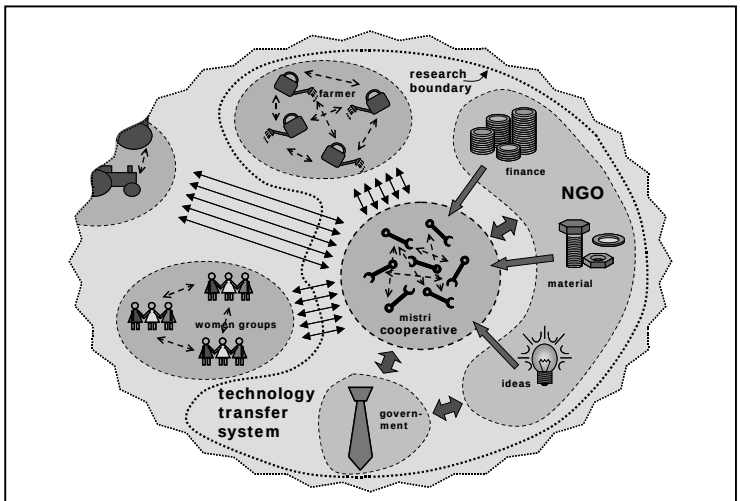
With the things I learned in week 1 and week 2, I will set up a group meeting with the mistris that will be organized as a workshop or brainstorm session. With this I want to see how they interact with each other and how they handle different (artificial) problems. I will video tape this workshop for analyses later on in week 3 and comparison with the video from the other MC.

## Appendix 3

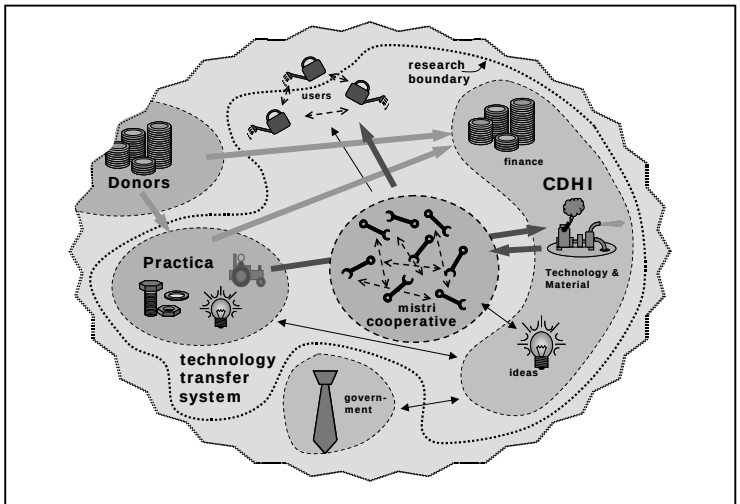
Evolution of the Process of technology transfer




Process of technology transfer Phase 1




Process of technology transfer Phase 2




Process of technology transfer Phase 3

# Appendix 4

Posters of Sarkarpara workshop

**Subjects of wall poster:**

- What are the new ideas?
- Who can apply the ideas?
- How they will work with the new ideas?
- From whom or where people can get the new ideas?

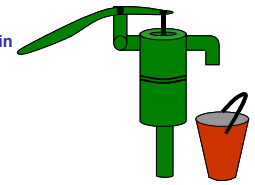
**If possible describe with sketches.**

Assignment for wall poster

**Low cost pump**

NEW TECHNOLOGY

- Now affordable for everyone
- With the new low cost pump for only RS200 every family can have its own pump. To be fitted on dug well or tube well
- New pumps are made of plastic and are high quality
- Now available through the Sarkarpara Mistri cooperative in Sarkarpara market place



RS 200 only!

example of wall poster

(1) If you want water, tube well in the field, go to Sarkarpara cooperative

(2) Education, health

Development of education, health and other side. Everybody wants. For solving any problem we go to Sarkarpara cooperative

(3) Please hear everybody, we are friend of poor. We can't live on without cooperative

(4) Thinking and making plan together do the work of village. For learning about the cooperative going to CDHI

* Sarkarpara cooperative

15 / 9 / 2003

Poster Group 1

**Subjects of poster writing**

(1) If you (farmer, labour) want to get shallow, tube well, village power, you must go to cooperative

(2) Everybody (farmer, labour, general people) can use it

(3) If everybody maintains the rules of the cooperative, it will help to develop the village easily

(4) All the active honest disciplined members think the aforesaid points

Sarkarpara cooperative 15-9-2003

Poster Group 2

## Appendix 5

Advert Low Cost CS Water Filter

# CDHI Low Cost Water Filter

**The low cost water filter:**
CDHI developed a low cost water filter for home use that will filter enough water for the daily consumption of the whole family.

Unfiltered water contains a lot unhealthy elements like germs, which cause different diseases like diarrhea and typhus. By filtering the water you can easily prevent your children and yourself of getting ill as a result of drinking contaminated water.

**How does it work:**
The filter consists of a **container** where the filtered water is stored (which is available in clay or in plastic), a **tap** to tap the filtered water from the container and the most important part, the clay **filter candle**. This filter candle allows the water to pass through while it filters out any contaminations.
A **lit** covers the filter to prevent anything from falling in the water.

Special treatment of the filter makes it kill almost all germs present in the water, preventing you to get ill.

The filter is produced of good quality materials and will last for a long time.

**Two types:**
The filter is available in two types:
The filter unit with plastic container and plastic tap (see picture) and the filter unit with clay container and stainless steel tap.
The retail price of the filter with **plastic** container will be **RS 190**,-, while the price of the filter with **clay** container will be **RS 210**,-

**So for less than RS 200,- you can give your family a healthy future!**

If you have any questions, please contact the CDHI office in Jalpaiguri.

## Appendix 6

Questionnaire for Sarkarpara mistris during Sarkarpara workshop

Please answer the following questions:
( Fill in you answer on the lines)

1. What is your name ?

2. What is your age?

3. In which village are you living?

4. What education did you follow?

5. Do you have any land? Please give number of bigha.

6. Since when have you been a mistri?

7. From who did learn mistri works?( mistri skills)

8. When did you join the co-operatine?

9. Do you have work besides mistri jobs?( farmer, business) please state.

10. Which of the following things do you do as a mistri?

- Shallow tube well boring (yes/no)
- Making tube wells (yes/no)
- Making dug well (yes/no)
- Doing pump-set repairing (yes/no)
- Doing pump modification (yes/no)
- Making low cost bamboo filter (yes/no)

11. Please write down all the other mistri jobs that you are doing:

Thank you very much;

# Appendix 7

List of interviews and field visits

**07-08-03**
Joy
Image of the mistri / the big mistri.

**12-08-03**
Mutilal Ray, president Sarkarpara Cooperative
Semi-structured interview about membership of the cooperative.

**12-08-03**
Sureash Ray, member of Ghagudanga Cooperative
Semi-structured interview about membership of the cooperative.

**13-08-03**
Joy
*Technology mela; Stone hammer, ownership, use, etc.*

**15-08-03**
Block Development Officer (Swapan Kundu)
Workshop on sanitation program.

**15-08-03**
Prof Rajeshwar Mishra, chairman CDHI
*Technology, CDHI, etc.*

**22-08-03**
Joy
*The concepts of Above Poverty Line (APL) and Below Poverty Line (BPL).*

**22-08-03**
Gautam Sarkar, Ghugudanga cooperative, also mistri who did south-south knowledge exchange in Nicaragua.
Semi-structured interview about membership of the cooperative.

**23-08-03**
Mistris present during the Cooch Behar mistri meeting; secretary Balarampur coop, secretary Sahebganj coop, secretary Pundibari coop.
Informal interview about membership of the coop, about new technologies and new ideas.

**29-08-03**
Sarkarpara coop members: Mutilal Ray; Ranjit Chandra Ray; Harijan Ray; Sudhir Ray; Mohim Chandra Ray; Nilkhil Ray
Informal interview about the cooperative and the membership.

**01-09-03**
Mohim Chandra Ray; Binoy Chandra Ray; Mutilal Ray
House visit, talked about generator, village power.

**03-09-03**
Mohim Chandra Ray; Ranjit Ray
Observing participation in bicycle shop Sarkarpara.

**04-09-03**
Nikhil Sarkar
Observing participation in well boring.

**05-09-03**
Women group meeting Cooch Behar District
Informal interview with gramin bank director.

**05-09-03**
Prof. Rajeshwar Mishra; chairman CDHI
Women groups and the philosophy; The role of technology for the mistris.

**06-09-03**
Nikhil Sarkar
Observation well boring and informal interview about the cooperative; his role in the coop and his vision on the coop.

**12-09-03**
Inhabitants of Sarkarpara + some mistris of Sarkarpara Cooperative
Improvised meeting on village power; for this day the mistri workshop was planned, but due to miscommunication people expected explanation about the village power project.

**13-09-03**
Subdivisional agricultural officer (in subdivisional agricultural office)
The use of cooperatives and the distribution of pump sets.

**13-09-03**
Executive engineer (retired) in Cooch Behar
The name of the mistri cooperatives (TKPPS) and the legal restrictions.

**15-09-03**
Members Sarkarpara Cooperative
Mistri workshop in school building Laxmi Nager village.

**18-09-03**
Bablu Ray (Beltali coop)
Informal / semi-structured interview about the cooperative.

**19-09-03**
Bablu Ray
*Visit to the pump-class that is given by Bablu Roy*.

**23-09-03**
Bablu Roy (president); Jyotin Das (secretary); Maloy Kanti Das (cashier); Biren Das (member, joined later)
*Semi-structured interview about the cooperative, it's functioning, the members, the activities, etc.*

**27-09-03**
Mistri federation:
*Mistri federation meeting used to give workshop on possibilities for the introduction of the low cost water filter; to see if members could reflect critically on the concept of the introduction of a new technology and to see if they have a realistic view on the possibilities of this new technology.*

**10-10-03**
Gurupada Ray; Goutam Sarkar
*Informal interview about the water filter. Gurupada Ray owns a water filter.*

**11-10-03**
*Visit to secretary Sahebganj coop for presentation of home made new technology*
*Visit pump dealer Cooch Behar*
*Visit executive engineer Zila Parished Cooch Behar*
*Visit Bablu Roy for low cost water filter*
Search for cone shape filter candle (UNICEF model)