Comprehending Indigenous Knowledge: An Ethnographic Study of Knowledge Processes within Natural Resource Management

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ABSTRACT

This study explores the phenomenon of indigenous knowledge within Ethiopia against a background of increasing concern for the sustainability of natural resources. A review of the indigenous knowledge, information systems and innovation studies literature finds little in the way of relevant theories and hence the study applies concepts from knowledge management. In particular, it takes the notions of tacit knowledge and knowledge processes and applies them in the context of indigenous knowledge concerning natural resource management. It combines existing knowledge process frameworks with stakeholder analysis to produce a robust conceptual tool to explore systems of indigenous knowledge.

The research uses an ethnographic approach to studying an indigenous community in Debre Berhan, Ethiopia. The four-month fieldwork produced extensive data concerning indigenous knowledge within the community and the interface with scientific knowledge. It also shows the ingenuity and extent of local innovation by the villagers in an effort to solve local problems with local solutions.

Using the conceptual framework, developed in the first part of the study, the data is analysed with reference to knowledge processes and the four main stakeholder groups: the indigenous farmers, the government, research institutions and local non-governmental organisations. This analysis clarifies the existing roles of the stakeholders and leads to a new conceptualisation of indigenous knowledge, and the knowledge transfers between the indigenous and scientific communities, in terms of systems of knowledge processes. The implications of this model are considered within the light of the various external threats to indigenous communities and their knowledge.

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List of Acronyms

ABEL	Achieving Basic Education and Literacy
AEZ	Agro Ecology Zone
AHRDA	Association for Human Resources Development in Africa
APIK	Association for Promotion of Indigenous knowledge (Ethiopian NGO)
ASEPA	Association of Sustainable, Ecological and People-Centre Agriculture
AU/OAU	African Union (formerly known as (OAU) Organisation of African Unity
AWAPE	Association of Women of Ankober for the Protection of the Environment
CBWPD	Community Based Participatory Watershed Development
CDD	Community Driven Development
CEP	Community Empowerment Program
CGIAR	Consultative Group for International Agricultural Research
DoARD	District Office of Agriculture and Rural Development (Ethiopian)
EARO	Ethiopian Agricultural Research Organisation
ECA	Economic Commission for Africa
EDRI	Ethiopian Development Research Institution
EEC	European Economic Community
EPLUA	Environmental Protection and Land Use Authority
EPA	Environmental Protection Authority (Ethiopian)
EPE	Environmental Policy of Ethiopia
FAO	Food and Agricultural Organisation of the UN
FFW	Food For Work (Ethiopian)
GDP	Gross Domestic Product
GTZ	German Technical Assistance
HLI	Higher Learning Institutions
I.Es	Indigenous Experimenters (Ethiopian)
ILEIA	Information Centre for Low-External-Input Agriculture (The Netherlands)
IFAP	International Federation of Agricultural Producers
IK	Indigenous Knowledge
ILRI / ILCA	International Livestock Research Institute (ILRI) *formerly known as (ILCA International Livestock Centre for Africa,*
ISWC	Indigenous Soil and Water Conservation
LLPPA	Local Level Participatory Planning Approach
LUPRD	Land Use Planning and Regulatory Department

MDG	Millennium Development Goal
MERET	Managing Environmental Resources to Enable Transition (Ethiopian)
MoA	Ministry of Agriculture (Ethiopian)
MoARD	Ministry of Agriculture and Rural Development (Ethiopian)
MoH	Ministry of Health (Ethiopian)
NCP	Natural Crop Protection (Ethiopian)
NGO/INGO	Non-Governmental Organisation /International NGO
NMSA	National Metrological Services Agency (Ethiopian)
NPP	Natural Plant Protection (Ethiopian)
NRM	Natural Resources Management
S-NRM	Sustainable Natural Resources Management
OSCA	Organization for Security and Cooperation in Africa
P-AVT	Participatory Audio-Video Technology
PADETS	Participatory Demonstration Extension Training System
PLUP	Participatory Natural resources Use Planning
PRA	Participatory Rural Assessment
PTD	Participatory technology development
RARI	Regional Agricultural Research Institutions
RVADP	Rift Valley Agricultural Development Project
SCRP	Soil Conservation Research Project
SIDA	Swedish International Development Agency
SK	Scientific Knowledge
S-NRM	Sustainable Natural Resources Management
SSA	Sub-Saharan Africa
SST	Sea Surface Temperatures
SWC	Soil and Water Conservation
T&V	Training and Visit
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VAF	Voluntary Associations of Farmers
WG/NFE	Working Group on Non-formal Education
ZoARD	Zonal Agriculture and Rural Development (Ethiopian)

Glossary

Amharic	the Ethiopian official language
Areke	home made alcoholic drink
Ato	Mr
Belg	short rains (usually fall between January and April)
Debo	formal work arrangement between individuals
Dega	highland
Derg	the former Ethiopian Marxist military government (1974-1991)
Kiremt	the main Ethiopian rainy season
Kolla	lowland
Lem	fertile
Medeb	raised fields
Meher	long rains (usually lasting from June to the beginning of September)
Megazo	indigenous share cropping arrangement
Teff	the staple Ethiopian cereal
Wonfel	indigenous work arrangement between neighbours
Woreda	district
Wzo	Mrs (a married Woman)

Chapter 1 - Introduction

1.1 Introduction and research aim

The aim of this PhD thesis is to investigate the phenomenon of indigenous knowledge (IK) within natural resource management (NRM) from an information systems perspective. This includes the role and status of IK as it is practised on an everyday basis. The approach taken is an in-depth ethnographic study of a community in Debre Berhan, Ethiopia.

It is believed that the indigenous community there faces a serious natural resource related dilemma, partly as a result of the breakdown of indigenous farming systems, which is threatening environmental deterioration and widespread poverty in this rural community. As such, this is a case study representative of many indigenous communities in Africa and beyond.

This first chapter provides a brief introduction to the study and to the context, in terms of the research site at Debre Berhan. It also examines the problem situation, leading to a formulation of the research questions that the study attempts to address. The intellectual starting point is reviewed through the literature on IK in Chapter 2. Most of the specific IK literature is descriptive and normative and provides little in the way of a theoretical basis.

IK is very rarely touched on within information systems and it is within the literature of knowledge management where relevant theories and frameworks are found, including the work of Polanyi (1967), Nonaka (1994), Blackler (1995) and Alavi & Leidner (2001). Even here, their work seems to be bounded by the constraints of a single organization or industry, with little mention of community knowledge. Nevertheless, the work of the above authors does seem to be sufficiently portable to be transferred to the field of indigenous knowledge. The literature of innovation studies is also reviewed but, again, indigenous innovation within communities is largely ignored, and the macro focus of the concepts used is less portable to the individual community level.

I decided to focus on the notion of knowledge processes as these seemed relevant to both the knowledge management literature and my informal understanding of indigenous knowledge within the community of Debre Berhan. Accordingly, I took the organizational process framework of Alavi & Leidner (2001) as my initial conceptual tool. However, in order to capture the rather different processes apparent within indigenous knowledge, I combined this with a framework from the World Bank (1998).

In addition, I overlaid this with a stakeholder analysis, in order to capture the roles of the various stakeholders operating within the IK system in Debre Berhan. This led to a modified framework, described in Chapter 3. As indigenous knowledge is largely tacit (Polanyi, 1967), I adopted Blackler's (1995) conception of knowledge as an inter-subjective process, which also fitted the process framework.

The research design (described in Chapter 4) is based on the ethnographic methodology and describes how the data was collected during a four-month field research. I have not attempted to comprehensively review all IK practices related to natural resource management due to time and resource constraints. However, from my field research, I was pleasantly surprised to discover that not only does IK exist and is widely practised but indigenous people actively innovate and create knowledge in order to find local solutions to local problems.

As shown in the findings (Chapters 5 and 6), I collected a wealth of information concerning indigenous knowledge and the way the various stakeholders use it and relate to it. These chapters describe various examples of often innovative IK practices. This chapter is analysed using the knowledge process and stakeholder framework in Chapter 7, which provides an original perspective on indigenous knowledge practices. This leads on, in the same chapter, to a reconceptualisation of IK as a system of knowledge processes. This new model is outlined and its implications are discussed in the light of the external threats to the IK system within Debre Berhan. In Chapter 8, I draw some general conclusions and make recommendations for further research, mostly using the new process systems model.

1.2 Intentions of research

I intend to do three things with my thesis:

i) To meet the academic requirements and also to make a contribution to those who were the focus of this research.

ii) To offer my results to all concerned stakeholders, especially: to the Ministry of Agriculture (MoA), the Association for the Promotion of Indigenous knowledge (APIK), other agricultural and environmental research and education institutions and their development partners.

iii) To contribute to knowledge about the relevance of information systems approaches, like knowledge management, to issues of economic development.

1.3 Explaining and defining indigenous knowledge

As shown in the literature review of Chapter 2, and argued by writers such as Warren (1991), indigenous knowledge is broadly speaking the knowledge used by local people to make a living in a particular environment. Various terms used in the field of sustainable development to designate this concept include indigenous technical knowledge, traditional environmental knowledge, rural knowledge, local knowledge and farmer's or pastoralist's knowledge.

As Johnson (1992) suggests, IK therefore can be defined as: "A body of knowledge built up by a group of people through generations of living in close contact with nature". Generally speaking, such knowledge evolves in the local environment, so that it is specifically adapted to the requirements of local people and conditions. It is also creative and experimental, constantly incorporating external influences and internal innovations to meet new conditions. It is a mistake to think of IK as 'old-fashioned', 'backward', 'static' or 'unchanging'.

As Johannes (2002) states, like any other knowledge system, IK's information base is constantly renewed and revised. Unfortunately, the dynamics of globalisation, industrialization and urbanization threaten the loss of much of this knowledge. This

trend is exacerbated by the fact that, like oral history, this knowledge is tacit and not documented.

The importance of IK in NRM (World Bank, 1999) is the potential that it offers for self-sufficiency and self-determination, for at least two reasons:

i)   people in the developing nations are familiar with indigenous practices and technologies. They can understand, handle, and maintain them better than Western practices and technologies.

ii)   IK draws on local resources and the majority of people are less dependent on outside supplies, which can be costly, scarce and available only irregularly.

Furthermore, one cannot overlook indigenous knowledge's ability to provide effective alternatives to Western know-how. Moreover, IK offers local people and their development workers further options in designing new projects or addressing specific problems and wider disasters. Instead of relying on imported Western technologies, people in the developing nations can choose from readily available indigenous knowledge or, where appropriate, combine indigenous and Western technology.

1.4   The Country: Ethiopia – *brief introduction*

Ethiopia, located in northeast Africa has, according to the Ethiopian Ministry of Foreign Affairs, a population of 72 million people and a total area of 437,600 square miles. A major part of the Horn of Africa, Ethiopia is bounded by Sudan in the north and southwest; Eritrea in the north; Kenya in the south; Somalia in the east; and Djibouti in the northeast.

The climate is temperate on the plateau and hot in the lowlands. At Addis Ababa, which ranges from 2,200 to 2,600 meters (7,000 ft.-8,500 ft.), maximum temperature is 26° C (80° F) and minimum 4° C (40° F). The weather is usually sunny and dry with the short (belg) rains occurring February-April and the big (meher) rains beginning in mid-June and ending in mid-September.

The people and their history

Ethiopia's population is highly diverse. Most of its people speak a Semitic or Cushitic language. The Oromo, Amhara, and Tigreans make up more than three-fourths of the population, but there are more than 77 different ethnic groups with their own distinct languages within Ethiopia. Some of these have as few as 10,000 members. In general, most of the Christians live in the highlands, while Muslims and adherents of traditional African religions tend to inhabit lowland regions. English is the most widely spoken foreign language and is taught in all secondary schools. Amharic is the official language and was the language of primary school instruction but in recent years it has been replaced in many areas by local languages such as Oromigna and Tigrigna.

Ethiopia is credited with being the origin of mankind. Bones discovered in eastern Ethiopia date back 3.2 million years. Ethiopia is the oldest independent country in Africa and one of the oldest in the world (Munro-Hay, 1991; Pankhurst, 2001).

Since 1855, under the Emperors Theodoros II, Johannes IV and Menelik II, the kingdom was consolidated and began to emerge from its medieval isolation. When Menelik II died, Ras Tafari Makonnen (commonly known as Haile Selassie), was crowned emperor in 1930. Haile Selassie's reign was interrupted in February 1974, and a provisional administrative council of soldiers, known as the Derg ('committee'), seized power and installed a government, which was socialist in name and military in style (Economist, 2007). Lt. Col. Mengistu Haile Mariam assumed power as head of state and Derg chairman and communism was officially adopted with the promulgation of a Soviet-style constitution (Henze, 2000).

In 1991 the Derg's collapse was hastened by droughts and famine, as well as by insurrections, particularly in the northern regions of Tigray and Eritrea (Henze, 2000). In 1991 the Tigrayan People's Liberation Front (TPLF) merged with the Oromo Liberation Front (OLF) and other ethnically based opposition movements to form the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF) and advanced on the capital Addis

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Ababa (Young, 1993). Mengistu fled the country for asylum in Zimbabwe, where he still lives.

Also in 1991, the Eritrean People's Liberation Front (EPLF), assumed control of Eritrea and established a provisional government and two years later in 1993, Eritrea declared independence. Politically, Ethiopia is now a firm ally of the United States in its 'war on terror', as can be seen by its intervention in Somalia and allegations of its participation in the CIA's 'extraordinary rendition' programme (Economist, 2007).

Ethiopia is the only country in Africa that successfully resisted European colonization (Economist, 2007), despite the attempt by the Italian forces of Mussolini. As a result, Ethiopia has managed to keep her own culture and unique identity. Furthermore, Ethiopia is the only country where Christianity is defined through the Ark of the Covenant. Ethiopia was the first country to provide sanctuary to the followers of the Prophet Mohammed. Ethiopia is also the source of the Blue Nile, the foundation of life and civilization to the people of the Sudan and Egypt for over 5,000 years. Like many developing countries, Ethiopia is facing the problems of urbanisation (Economist, 2008b) where the government is trying to slow the pace of change.

Ethiopia is often seen as the land of faith with more than 20,000 churches and monasteries throughout the country. In addition, there are several mosques and Moslem holy grounds. Ethiopia has nurtured a tradition of rich civilization over a period of three thousand years.

Ethiopia's ancient scriptures, as well as the teachings of innumerable sayings, proverbs and sages constitute a profound literature of ideas, concepts and practices which are designed to address the process of building harmonious relationships among man, animal and nature. This literature is mostly based on IK experiences that have gathered momentum over generations and are being developed and standardised through experimentation and practice. The ancient elite developed a mechanism to percolate the

knowledge to the people and managed to produce an effective communication for activating the process of refinement in continuum.

The economy

The current government has embarked on economic reform, including privatization of state enterprises and rationalization of government regulation. While the process is still ongoing, the government remains heavily involved in the economy.

The Ethiopian economy is based on agriculture, which contributes 46% to GNP and more than 80% of exports, and employs 85% of the population. The major agricultural export crop is coffee, providing approximately 35% of Ethiopia's foreign exchange earnings, down from 65% a decade ago because of the slump in coffee prices since the mid-1990s. Other traditional major agricultural exports are hides and skins, pulses, oilseeds, and sugar and gold production has also become important in recent years (Economist, 2006).

Ethiopia's agriculture is plagued by periodic drought and soil degradation caused by deforestation, high population density, undeveloped water resources, and poor transport infrastructure. Yet agriculture is the country's most promising resource. Potential exists for self-sufficiency in grains and for export development in livestock, flowers, grains, oilseeds, sugar, vegetables, and fruits (Economist, 2007).

Gold, marble, limestone, and small amounts of tantalum are mined in Ethiopia. Other resources with potential for commercial development include large potash deposits, natural gas, iron ore, and possibly oil and geothermal energy. Although Ethiopia has good hydroelectric resources, which power most of its manufacturing sector, it is totally dependent on imports for its oil.

Dependent on a few vulnerable crops for its foreign exchange earnings and reliant on imported oil, Ethiopia lacks sufficient foreign exchange earnings. Very recently the

government has taken measures to solve this problem, including stringent import controls and sharply reduced subsidies on retail gasoline prices.

Ethiopia has vast areas of fertile land, a diverse climate, generally adequate rainfall, and a large labour pool. Despite this potential, however, Ethiopian agriculture has remained underdeveloped. Because of drought, which has persistently affected the country since the early 1970s, a poor economic base (low productivity, weak infrastructure, and low level of technology), and despite different governments' commitments, the agricultural sector has performed poorly (Djurfeldt et al, 2005; Economist, 2006). According to the World Bank, agricultural production dropped at an annual rate of 2.1 percent between 1980 and 1987 while the population grew at 2.4 percent per annum. Consequently, the country faced a tragic famine that resulted in the death of nearly 1 million people between 1984 and 1986. While infant mortality has dropped from 141 per 1000 live births in 2000 to 123 per 1000 in 2005, poverty remains a problem where 80% of Ethiopians live on less than $2 per day (Economist, 2007)

The Economist (2009) highlights the rain-fed nature of Ethiopian farming and shows how rainfall apparently correlates with GDP growth. In an earlier article, *The Economist* (2008a) shows the constraints in the Ethiopian infrastructure where, despite the crucial nature of rainfall, the country has only 38 cubic metres of rainwater storage capacity per inhabitant, compared with Australia, which has 5,000 cubic metres. Similarly, the country's poor roads further constrain economic activity (Economist, 2006)

1.5 Debre Berhan - *locating the research site*

Geography and Population- (based on information from the local municipality office)
Debre Berhan is located 130km north east of Addis Ababa. Being situated at the centre of the highland plateau of Shewa province, the town serves as an economic and political centre for the surrounding farming communities.
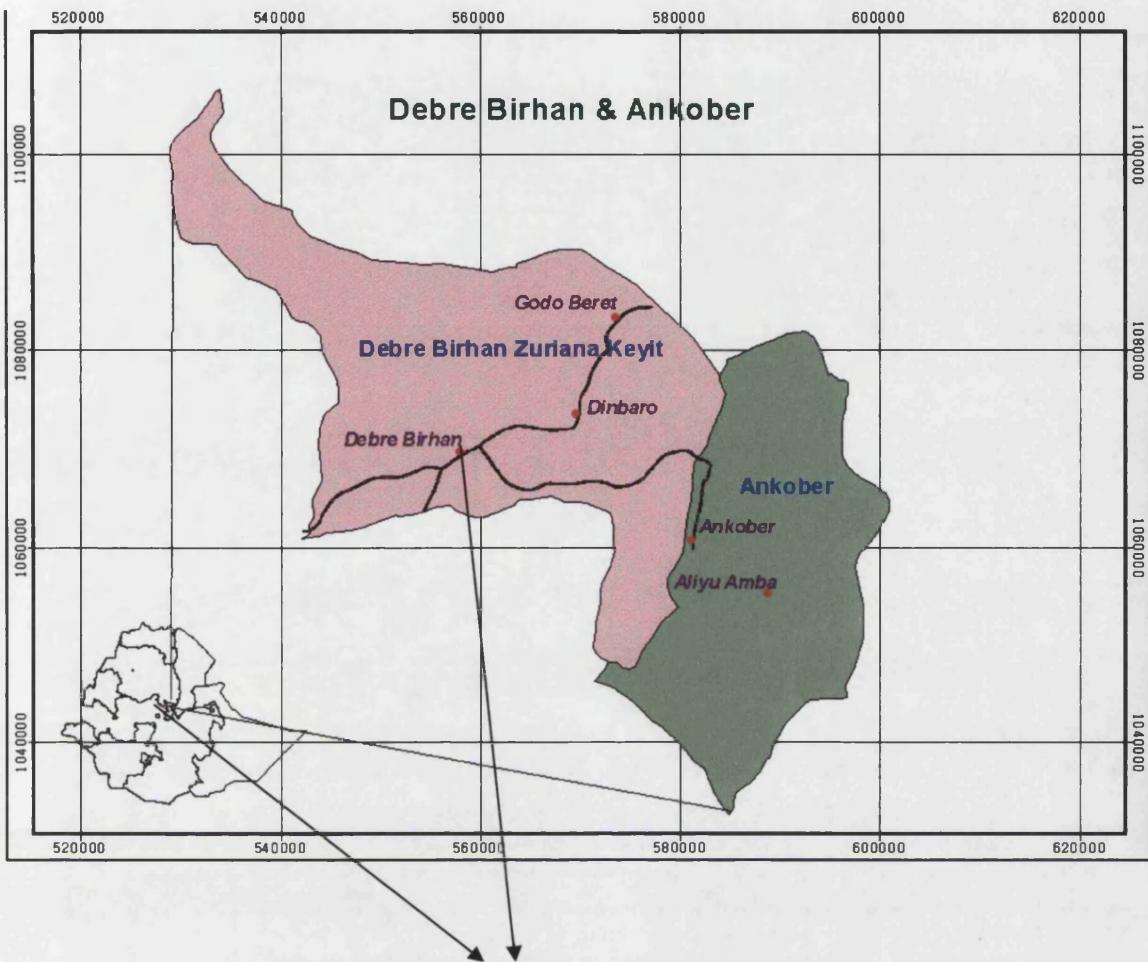
Figure 1 *Map of Debre Berhan, Ethiopia*

Before the restructuring of administrative zones in 1992, Debre Berhan was the capital of Tagulat and Bulga awraja (district) and is now the capital of North Shewa administrative zone. In addition to being the central political seat for the region as a whole, the proximity of the town to the indigenous and other farming communities in highland Shewa has made Debre Berhan into a kind of 'double capital' for the inhabitants of the smaller administrative units that encircle it. For farmers in Basso and Worana and Debre Berhan Zuria *woreda*, Debre Berhan also hosts the head offices of the *woreda* administrative council and many other state departments of the *woreda*.

Four different geographical areas have been described by Mesfin (1991) in northern Shewa: the plateau *woreda*; the valley *woreda*, the escarpment *woreda* and the lowland

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woreda. The indigenous villages in the highland plateau are generally characterized by rugged topography. However, one can observe significant variations in the landscape in the region. The landscape on both sides of the main road from Addis Ababa to Dessie is generally flat with an average elevation of about 2,714m (Mesfin, 1991).

The temperature is cold, the localities are *dega* (highland), and the people are referred to as highlanders. Deeper in the countryside there is rugged terrain, with mountain peaks and deep valleys, intersected by a few gentle slopes with plenty of small streams. There are perennial rivers and chains of mountain peaks among the valleys; although the temperature is fairly cold and varies from village to village. Communities within this zone are referred to as lowland or *kolla*. Inhabitants are referred to as lowlanders.

Highlanders live in large and compact villages usually located amid wide tracts of agricultural land and grazing areas. The density of communities living within a given area seems to be high. The lowlanders, on the other hand live in numerous isolated villages located in dots on gentle slopes or at the foot of high rising mountain tops.

The population in the *kola* areas appears to be sparse. The settlements of lowlanders have two categories of uncultivable land, the steep mountain tops and the deep valleys. They account for more than half the total land resources of the communities. Only a small portion of the *arah* land is used for grazing, since cattle are not well adapted to browsing on steep slopes and deep gorges.

Debre Berhan Zuria *Woreda* has 51 farmers associations under its administration. Two of these are covered in this study: Ankober and Debre Berhan Selassie. Some of the evidence presented does not refer exclusively to these two sites but comes from the wider Debre Berhan and surrounding areas.

Climate

The region has two rainy seasons, namely *meher* which refers to the long rains, usually lasting from June to the beginning of September, and the *belg* season which refers to the

short rains which usually fall between January and April. *Belg* production is very important in the high altitude zones of northern Shewa where frost is common during the *meher* season. However, the *belg* season is highly unreliable being characterized by variability, and delay or absence of rain. In some years, it falls only for few weeks and the *belg* crop cannot be harvested; in other years, the rains fall regularly for a reasonable period of time.

Agricultural production

In the highland communities of northern Shewa, mixed farming, i.e. crop production with animal husbandry, is the common practice. The main crops include barley, various types of wheat, horse beans, peas, lentils, teff and linseed.

The main livestock are cattle, sheep and goats, and draught animals such as donkeys, horses and mules. The area is self supporting in crops and the soil is *lem* (fertile) and *lemtaf* (semi-fertile). This year's *meher* harvest (2007) was not enough to feed the farmers' families and farmers had to purchase grain from the market by selling livestock. Some of them even sold their oxen, which will move them towards poverty.

Figure 2: *Debre Berhan Market – buying/selling pottery & other household items*

The main reason for the decline of their harvest was that the crops were badly damaged by frost during the growing season. There were sufficient rains, particularly at the beginning of *kiremt,* and at the time of the harvest as well. During the previous *belg* there was not enough rain and many farmers did not plant crops. But during this *belg* the farmers planted various kinds of crops including barley, wheat and cowpeas, and the fields have already become green.

Social structure

Amharic is the main language but many people speak Oromigna. The religion in the area is predominantly Christian Orthodox. There are some Moslems and Protestants but there has never been religious tension in the site.

Recent history

In 1936 the Italians invaded Ethiopia as that was the case in the whole country, the local people also raised arms and fought the invaders. They only returned to their villages to resume normal life in 1943 after the Italians were rejected from Ethiopia.

In 1974 the socialist military government (known as the *Derg)* came to power and nationalized land throughout Ethiopia. With the aim of improving the ailing economy, especially agriculture, the new government imported significant amounts of agricultural products including new fertilizers. Due to the application of imported fertilizer, initially there was a slight yield increase for most crops. Two years later Farmers Associations (FAs) were formed and a service cooperative was established in 1978.

Some of the indigenous farmers I spoke to could not see the benefit of being a member of the service cooperative but they had no choice but to register under the orders of the military government. A producers' cooperative was also established in the area but it was dismantled when the mixed economy was announced by the government in 1989.

In 1984 and 1991 there was drought around this area and people suffered as a result. Many people migrated to other big towns in search of food and work. In 1988 the *Derg*

started implementing its forced villagization programme and many people were forced to leave their homes. Most of them returned with the change of government in 1991.

The local economy - *Agriculture*

The main crops include barley, various types of wheat, beans, peas, lentils and linseed. The most important are barley and beans. Most production is for consumption; very little is sold. However, according to a local extension worker, farmers do not openly disclose information concerning their income from the sale of crops. Farmers traditionally classify their land holdings into plots for *meher* and for *belg*, depending on the soil texture.

In the region, *belg* production is risky because of variability, delay or absence of rain. Rain is highly unreliable. In some years, it falls only for a few weeks and the *belg* crop cannot be harvested; in other years, the rains start in a hot and dry month and continue to fall regularly throughout the period. Good yields can be harvested in such years.

According to the information from the local municipal office, most farmers employ risk-aversion mechanisms in the following ways. If the *belg* fails to come in February and March, then planting will be postponed to the next *meher*. A delay in the onset of *belg* rain beyond February means that the farmers cannot cultivate *belg* crops. A further delay of *belg* rain beyond March and April means that the land prepared for *belg* crops will be used for planting *meher* crops in July.

Similarly, land prepared for *meher* planting will be used for the next *belg* if there is a failure of the *meher* rains. In general, most informants tended to idealise the past in the sense that they appreciated the good harvests and living conditions. However, for various reasons, the agricultural yield has been decreasing over time and also the livestock herds have also been declining, vis á vis the fast-growing human population. The farming system in the area is labour intensive and the number of hours spent on agricultural activities during the *meher* season seems to be higher than during the *belg*.

Livestock

The main livestock include oxen, cows, sheep, goats, donkeys, mules and horses. Livestock is a very important component of the economy of the farming households around Debre Berhan. Oxen are needed for ploughing and cows for milk and milk products and for replenishing the oxen. Dung is used for fuel. A household largely depends on a small stock for generating cash to spend on clothing, taxes and other basic expenses. Donkeys and horses are mainly used for transporting grain and products such as firewood and pottery. People have a side income from the sale of livestock and animal products including milk, butter and dungcakes.

Figure 3: *Debre Berhan Market – transporting grain & firewood*

Figure 4: *Debre Berhan – some livestock*

The size of herds varies considerably between the highland and lowland communities. The highlanders have larger herds because of better grazing.

According to the elderly indigenous farmers, the overall size of individual livestock holdings has been decreasing over the last two decades due to the decrease in grazing. Some farmers asserted that raising livestock would be the most lucrative trade in this area if there were sufficient grazing land as the price of livestock has been increasing steadily for the past 15 years.

Land

Before the revolution of 1974, large tracts of farmland were occupied by a few rich landlords. Many indigenous farmers were tenants or landless and even those farmers with land had to pay a land fee to the landowners in cash and kind. When the land reform was implemented by the socialist government, land was nationalized and distributed by the farmers associations. As the population density increased, the size of the holdings grew smaller and, as a result, the majority of indigenous farmers occupy less than 2 hectares.

Now the government takes land from those who are very old and cannot use it and cannot pay tax and gives it to the newly married and those who do not have land. But it is becoming impossible to give land to all farmers who are establishing new families. They are forced to share their parents' land or have to participate in share cropping (*megazo*). This is a critical problem for the people in the area. Many landless people survive by sharecropping for women, whose husbands have died or migrated, and old men who have no one to help them work their fields. The landless include young newly married couples, returning soldiers and those who cannot afford to pay the land tax.

Before the 1974 revolution, children inherited land from their parents. If their parents did not own land, they used to contract land through sharecropping on the basis of a 3:1 tenant:owner ratio. Others used to gain access to land by renting from those with a surplus. After the land reform, land became the property of the state and there was no renting. Even old people who cannot cultivate their piece were not allowed to rent it out. The elders enter into sharecropping arrangements or give the land to strong farmers to cultivate it for them. However, while land rental is not practised legally, it is practised

under the cover of sharecropping. Sometimes the cultivator uses the land and gives a certain amount of grain per year to the landowner, whether he produces or not.

Labour

The tough task of ploughing, and digging steep slopes with the hoe are culturally defined as male tasks. Female labour is largely restricted to indoor activities such as food preparation, storage, looking after children, entertaining guests and the like. Women are responsible for fetching water from the nearest spring, river or other source. In addition, women take part in agricultural activities such as weeding, fencing, *gay* (the common practice of burning the soil to enhance its fertility) and sometimes harvesting and transporting the harvest to the threshing ground. While ploughing and preparing the land is solely men's work, fetching water and collecting dung cakes are exclusively women's work. Selling grain and dung cakes in the market, livestock herding, and taking grain to the mill are done by both sexes.

Indigenous farmers in the area accomplish different types of agricultural activities by organizing labour parties, that are clearly differentiated in terms of organizational complexity, cost entailed, and the nature of labour reciprocity:

1. *Debo*: This is a big work party involving many individuals and much cost. *Debo* has specific rules and regulations. A person calls friends and relatives for a *debo* if he is unable to accomplish the seasonal agricultural tasks of his household for reasons known to the community. The request is made some weeks in advance. The household prepares food and drink for the work team. The type and amount of the feast varies, according to the season and the nature of the work for which the work party is mobilized.

2. *Wonfel*: This is a labour organization which involves a few individuals often living in the same village. It is immediately returnable in the sense that the work team labours on the plots of all the members in rotation. Some *wonfel* parties require the host household to provide the party with lunch, if the party is to labour on the fields the whole day.

In most cases, however, the *wonfel* team retires for lunch in the middle of the day. Unless the host household has reasons to invite them, all members of the team will go to their respective houses for lunch. The party will then start working again after a few hours. Taking a rest at midday is a customary practice especially when the seasonal task is preparing the land with hoes, a tough job in farms in rugged terrain.

There are days when farmers do not work. On the 1st, 5th, 12th, 19th, 21st, 23rd and 27th days of the month farmers spend their time in church. Usually they spend half the day in church and the other half is free time. If they find people working on these religious holidays, selected elders will first advise them not to do so. If the person takes no notice he will be cast out of the community, and so no one breaks the rules.

Technology

Farmers use oxen, hoes, ploughs and sickles for harvesting and threshing. They use donkeys, mules and horses to transport almost everything, including harvest, firewood, and straw, both from field to home and to the market.

Cross-bred cattle were introduced in the area in 1978 by ILCA (International Livestock Centre for Africa). In Fagy and surrounding areas it is not uncommon to see cross-bred cattle. People are aware of the advantages and disadvantages of cross-bred cattle both for milk production and traction purposes. A cross-bred cow produces more milk than a local one and a cross-bred ox is stronger. However, according to some indigenous farmers, these cattle require more fodder and are more vulnerable to diseases.

Off-Farm Activities: Within the Community

Other economic activities that earn farmers income in the communities include sewing clothes, selling local alcoholic brews (*areke* and *tella*), weaving, tanning, pottery, trading in agricultural products, ecclesiastical services in churches, selling woodwork (mainly timber stools, chairs and other artefacts) and trees, in the form of charcoal, firewood, construction poles, doors, etc.

1.6 Problematizing the natural resource base in Ethiopia

In terms of natural resources, Ethiopia is one of the most well endowed countries in sub-Saharan Africa. Its location in the tropics, combined with varied altitudinal variations within short ranges, allows the country to enjoy both temperate and tropical climates and this gives a wealth of biophysical resources including rich biodiversity, relatively fertile soils, and huge fresh water resources. For millennia, this rich natural resource base has served as the foundation for agricultural development and for meeting the basic needs of millions of rural people.

Although the country is endowed with enormous biophysical potential, it has been affected by the interlinked and reinforcing problems of natural resource degradation and extreme poverty. This is further aggravated by high population pressure, top-down planning systems, climatic variability, lack of appropriate and/or poor implementation of polices and strategies, limited use of sustainable natural resource management practices, limited capacity of planners, researchers and land users as well as frequent organizational restructuring.

According to Zeleke and Kassie (2006) 1.9 billion tons of top soil are washed from the landscape (mainly from the highlands) every year, and a major part of this is believed to leave the country. The on-site effects of natural resource degradation, mainly in reducing agricultural production, is high, with estimated costs ranging from 2 to 6.75% of AGDP per annum (Mahmud, et al. 2005, citing estimates by FAO (1993), Hurni (1998), Sutcliffe (2003), and Sonneveld (2002)). The Environmental Protection Authority (EPA) (2007) also estimated that approximately 17% of the potential annual agricultural GDP of the country was permanently lost because of physical and biological soil degradation.

Despite differences in the above estimates, they all show the seriousness of the problem of natural resource degradation caused by soil erosion and loss of soil nutrients. Moreover, the country also suffers from the side effects of natural resource degradation (Mahmud et al, 2005) including siltation of dams, reservoirs, wetlands (Lake Alemaya, Adele, etc), lakes rich in biodiversity (Lake Tana, Lake Zeway and other Rift valley

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Lakes), and productive farmlands at foot slope areas (such as the Ambasel plain areas of Wollo).

As Zeleke (2006) argues, the causes of natural resource degradation are complex and have diverse natural and human dimensions. Although it is influenced by natural and socio-economic factors, in Ethiopia, the heavy reliance of the growing population on an exploitative kind of subsistence agriculture which tends to follow the top down approach has greatly contributed to natural resource degradation.

This is partly because agriculture in the country is characterized by a subsistence rain-fed production system with traditional methods of production which have prevailed for thousands of years. In addition, the farming system, particularly in the highlands, is dominated by cereal crop production, which accounts for about 73% of the total cultivable area (Ezra, 2006).

Most of these cereals, particularly teff and wheat, need fine seedbed preparation and provide little groundcover during the most erosive storms of June, July and early August. This situation, combined with the push of cultivation towards the commercialisation of increasingly marginal areas, contributes to the current level of natural resource degradation and to significant decreases in agricultural production.

Moreover, the exploitative nature of commercial farming has also contributed to the high rate of deforestation and left the landscape devoid of vegetative biomass, exposing it to high soil erosion.

According to the NRM literature, deforestation results principally from:
  i) commercialisation and industrialization, along with processes of urbanization, exploitation of natural resource, and increased competition for employment
  ii) the conversion of forests and woodland to cropland
  iii) the harvesting of forests for fuel to meet the energy needs of a rapidly growing population.

As a result, the high forest cover is said to have been reduced to about 2.4% of the total area, compared to an initial 40% coverage (Tedla & Lemma, 2002). Even then, the remaining forest is being depleted at an alarming rate. This is partly because nearly 95% of the total energy consumption originates from biomass fuels such as wood, cow dung and crop residue. Burning cow dung as a source of fuel instead of using it as a soil conditioner, due to the shortage of wood and alternative energy sources, is also considered to cause a reduction in grain production of some 550 thousand tonnes annually (EPA, 2007).

Similarly, livestock pressure and their poor management, which mainly depends on free grazing, is a major cause of natural resource degradation. Ethiopia has a high livestock population, including 35.3 million cattle (Ethiopia is 1st in Africa in cattle population, although the productivity is very low). Only 25% of the livestock grazes in the rangelands (lowland areas of Afar, Somali and Borena), which cover about 57.7 million sq km of Ethiopia's land area. Areas outside the rangelands are infected with tsetse fly and malaria, and growing moisture deficiency that limit livestock health and survival. The remaining 75% of the cattle graze in the highlands (above 1,500 metres), creating serious over-grazing problems in areas already under huge agrarian pressure (EPA, 2005).

In these areas, expansion of grazing beyond the capacity of the land takes place at the expense of natural vegetation and this leads to serious natural resource degradation. Furthermore, the growing livestock grazing pressure and the lack of protection of communal grasslands from extended free grazing are increasingly accelerating the natural resource degradation problem.

In many parts of the highlands the use of degraded land units for communal grazing has become normal practice. The animals are forced to stay on these land units, especially during the cropping season, although there is little for them to eat. As the population grows, land gets scarce and farming becomes more exploitative with much of the grasslands converted to cultivation. In this case, not only cultivation but also livestock

are pushed towards marginal lands, which eventually results in even more severe natural resource degradation.

Moreover, scarcity of grazing land and shortage of livestock feed has forced the widespread use of crop residues to feed the livestock. The removal of crop residue and the use of cow dung for fuel results in subsequent loss of humus and soil nutrients from the soil that would otherwise have been returned. This makes the nutrient cycle almost open and leads to a serious loss of soil quality, increased soil erosion and ultimately a reduction in soil productivity.

In general, the process of natural resource degradation, as a result of agricultural activity combined with population pressure and over-exploitation of the land, has led to the current depletion of natural vegetative cover, serious natural resource degradation problems and intensified poverty. This has led to a renewed interest in sustainable natural resource management.

Massive soil and water conservation and afforestation activities were initiated in the 1980s, aimed at sustainability, but were unpopular with many farmers. For instance, of the conservation measures implemented between 1976 and 1990, only 30% of soil bunds, 25% of stone bunds, 60% of hillside terraces, 22% of the planted trees, and 7% of the reserve areas survived (EPLUA, 2004). A recent survey in Shewa province (including Debre Berhan) showed that only 30% of the soil and water conservation structures of the past two and half decades has survived (EPLUA, 2004). The problems seem to be rooted in a lack of understanding of the important interface between the local indigenous community and natural resource conservation and agriculture.

However, despite the above negative trends, there are successes in different parts of the country. Some have a deep-rooted history of indigenous experience, such as the one in Debre Berhan. Furthermore, as shown in Chapter 5, there is evidence of extensive local innovation which demonstrates that indigenous knowledge is continuously refined and developed as the rural environment and climate change.

As in other parts of sub-Saharan Africa, in Ethiopia the use of indigenous knowledge is constrained not only by lack of appropriate systems to exchange local and home grown knowledge but by the indirect effects of modernization in three important ways:

- A decrease in labour resources, due to the urban migration of young men in search of more profitable sources of income. The increasing emphasis on education also reduces farm labour, as children are more likely to attend school than contribute to farm production.

- A decrease in land available for smallholder farming. This particularly complicated issue is exacerbated by population growth but has its roots in land policies of various governments that have worked to create land markets and the capitalization of land. The land use scheme that generates the greatest economic returns tends to discriminate against smallholders, unless they are protected by governments.

- Opening the country up to export markets. The shift to cash crop production has profoundly reshaped the average smallholder farming model, because this mode of intensive agriculture has typically come at the expense of biodiversity and the production of more locally appropriate crops. This has implications for a wide range of issues in the day-to-day traditional way of life, from diet and health, to soil fertility and water sufficiency, to traditional gender roles and time management.

Most of the knowledge governing traditional farming does not exist outside the collective memory of a community, which makes it vulnerable to the transformative forces of modernization. The historical non-necessity of literacy among traditional cultures, as well as the strong tradition of learning through oral history, presents a threat to indigenous knowledge that has never been documented.

This lack of record-keeping poses a number of problems today as NRM related activities are seen as one way to strengthen indigenous farmers in the face of modernization and the economic pressures of increasingly aggressive global markets. Furthermore, as cultures and traditions merge due to changing cultural norms regarding migration and urbanization, societies' hold over their indigenous knowledge weakens.

There is a risk that changing social patterns, combined with the rapid spread of imported technology and free market ideologies, will substitute this unrecorded knowledge, which maintained the indigenous way of life for millennia, with new ideas, for better or worse. The effect of this substitution is likely to be a gradual decrease in the use and recall of IK, so that much of it risks total deletion from the collective memory. Cultural preservationists would consider this problematic in itself, but there is a tactical issue that stems from the loss of IK.

With declining agricultural productivity threatening rural communities, development projects are increasingly aimed at increasing productivity for the millions of poor smallholders globally. As the harmful side-effects of industrial farming are becoming more apparent (for example, the effects of chemicals on the environment and the loss of wildlife habitats), there is increasing interest in developing sustainable solutions through a return to traditional farming methods.

After more than a century of importing Western farming models into sub-Saharan Africa, with its very different climate and culture, indigenous knowledge is increasingly being looked to for locally appropriate, resource efficient, and equitable models of agriculture.

This problem situation hence generates the research questions that are addressed in this study:
- How do different systems of knowledge, such as indigenous knowledge, operate around natural resource management?

and
- How do different categories of social agents associated with different systems of knowledge engage in the process of deliberation of NRM in Ethiopia?

However, as the research progressed, the questions were extended to include the following questions as well:

- What is the relationship between weakening systems of indigenous knowledge and degradation of natural resources?

- Who are the main stakeholders and what role do these stakeholders play in order to address the degradation of natural resources?

- What role have government based initiatives played in sustaining or eroding these systems of knowledge?

Chapter 2 - Literature Review

The chapter begins by outlining the relevant aspects of the field of natural resource management (NRM) before turning to a review of the literature on the characteristics of indigenous knowledge (IK) and its relevance to NRM practices. The chapter reviews the efforts currently being made to preserve IK as well as the problems faced by IK as a body of knowledge. It argues that further research is needed in the area but finds that much of the literature lacks an effective theoretical foundation. The literatures of information systems, knowledge management and innovation studies are reviewed in terms of their treatment of IK but it is concluded that, although the latter two are relevant, they provide very little coverage of IK.

2.1 Natural Resource Management (NRM)

There is an extensive literature on NRM, for example Norfolk et al (2003) and Pritchard & Sanderson (2002), but two particular issues are relevant to this study: firstly, the importance of participatory development and, secondly, the importance of knowledge management. There is widespread recognition (Bessette, 2004; Servaes, 2003; White, 2003) that participatory development is critical for achieving sound resource management but this means empowering local communities. Information describing the natural resources forms the base upon which sustainable development is built (Tabor & Hutchinson, 1994) and hence it is important to manage knowledge resources effectively. However, the local knowledge resources in many communities in developing countries are not codified in Western scientific terms but instead comprise what is known as 'indigenous knowledge'.

According to a World Bank report (1997), natural resources refer to a broad spectrum of 'environmental assets', including air, water, land, plants, animals and micro-organisms. Integrated individual assets are not isolated; they are linked together to form natural systems of varying scale such as rivers; lakes and wetlands; forests; fields; geological systems and resources.

Natural resources management reflects these linkages within and between natural systems. It integrates the management of social, economic and environmental values by involving the community in planning and other activities. NRM is fundamentally about people as its success is ultimately determined by the level of community involvement and the adoption of ecologically sustainable practices across the community (Ashley, 2000).

NRM aims at improving livelihoods, agro-ecosystem resilience, agricultural productivity and environmental services. In other words, it aims to augment social, physical, human, natural and financial capital. It does this by helping solve complex real-world problems affecting natural resources in agro-ecosystems (CGIAR, 2007).

According to Beagle (2001) NRM is concerned with the management of ecosystems for human purposes. However, Merchant (2003) has identified three ethical frameworks for explaining the relationship between people and their non-human surroundings – egocentric, homocentric, and ecocentric. According to Merchant, a person exercising an egocentric ethic seeks to maximize individual self-interest when making decisions concerned with environmental matters, seeing him or her-self as separate from their surroundings. On the other hand, a person using ecocentric ethics considers their duty to the ecosystem, and considers herself or himself as an integral part of that ecosystem.

Homocentric ethics emphasize the social component and focus on duty to other humans, ensuring the greatest good for the greatest number of people, while recognizing that interactions with the non-human components of the ecosystems on which we depend for survival are also critical to these human-centred concerns. The long term outcomes of NRM are therefore decidedly homocentric, constituting a mix of egocentric and ecocentric perspectives (Merchant, 2003).

Information describing the natural resources of any region forms the base upon which sustainable development must be built, according to Tabor & Hutchinson (2004). To manage natural resources in a sound manner, it is important to manage information and

knowledge resources effectively. Information is seen as data that has been given meaning whereas knowledge is the appropriate collection of information for decision-making (Tripathi & Bhattarya, 2004).

In the context of NRM, knowledge management focuses on the processes and the people involved in creating, sharing and leveraging knowledge among scientists, communities, resource managers and policy makers. Information management, in contrast, is more concerned with establishing processes and systems to gather, organize, summarize and package information, including its timely delivery to the right decision makers for the situation involved (Tripathi & Bhattarya, 2004).

There is widespread recognition that participatory development is critical for achieving sound resource management. However, this kind of development requires a more flexible and evolving process of planning for change, and poses new challenges for decision makers and evaluators alike (Adamson & Bromiley, 2008).

In particular, this requires responsiveness at the local level to empower and enable communities (Adamson & Bromiley, 2008). Because these programmes are designed to be responsive to changing community needs, one of the most pressing challenges is to develop participatory and systems-based processes based on the communities' local knowledge (Allen, 1997).

2.1.1 Sustainable natural resources

Natural resource management is central to the achievement of most of the Millennium Development Goals as natural resources provide food and a wide range of other goods (fuel, medicines, building materials, inputs to industries, etc). Natural resources provide services on which all human activity depends (including watersheds, carbon sequestration and soil fertility).

Natural resource exploitation provides the livelihoods for a high proportion of the world's population (Pimental, et al. (2002). This includes not only agriculture in rural

areas but also about 1.6 billion people rely on forest resources for all or part of their livelihoods (Mayers & Vermeulen (2003), while around 150 million people count wildlife as a valuable livelihood asset (LWAG, 2002), and 200 million derive part or all their livelihood from fishing (IUCN, 2003). Natural resources also provide opportunities for income generation through jobs and small enterprises (e.g. in forestry, tourism and wildlife trade).

Moreover, numerous studies have found that it is often the poorest people and households that are most dependent on these resources (Wynberg, 2002). Of the 1.2 billion people estimated to live on less than US$ 1 a day (i.e. those that are the target of MDG1), 70 per cent live in rural areas with a high dependence on natural resources for all or part of their livelihoods (LWAG, 2002).

But it is not just the rural poor who are reliant on natural resources – food, medicines and ecosystem services such as clean water supply also serve urban populations, and hundreds of millions of urban dwellers derive part of their income from urban agriculture (Smit et al., 2006) or from industries or services that depend on agriculture, forestry or fishing (Tacoli & Satterthwaite, 2003).

This dependency brings with it a theoretically strong incentive to conserve natural resources. But, in practice, given the weak access and tenure rights of many poor people, there is a strong potential for local overexploitation. Moreover, it means that the impacts arising from the loss of natural resources and ecosystem services fall most heavily on the poor (Bishop & Mainka, 2002), even though the cause of degradation may lie with richer or more powerful groups.

Despite the close inter-linkages between resource conservation and poverty reduction, there is still considerable polarization between the conservation and development communities. On the one hand, because the goods and services generated by natural resources are generally unaccounted for in national statistics, development agencies have often undervalued the potential role they can play in poverty reduction – as shown by the

decreasing emphasis on environment in the project portfolios of many donors and the limited integration of natural resource and environmental issues into national poverty reduction strategies.

On the other hand, conservation organizations have viewed poverty concerns as outside their core business. One study on wildlife and poverty linkages noted that:

> "*Much conservation money is still invested with only limited consideration of poverty and livelihoods concerns, despite a growing consensus that poverty and weak governance are two of the most significant underlying threats to conservation*" LWAG (2002).

2.1.2   Emergence of NRM issues

The emergence of 'natural resource/ecosystem management' (NRM) as a domain in international agricultural research has been paralleled by the appearance of new tools and instruments for data storage and processing through IT related technologies. At the same time, worries about food production and global hunger have been modified by increased public concern about the rapid deterioration of the Earth's ecosystems (particularly since the 1992 Earth Summit in Rio) and increasing levels of poverty.

In response to these worldwide concerns, and in recognition of the fact that agriculture depends on and affects the natural resource base (often causing side effects and environmental externalities), and competes and interferes with other sectors using natural resources, the international agricultural research community has broadened its research agenda (Janssen, 1995).

With new thinking on issues such as sustainability and poverty alleviation, a leading international agricultural centre, CGIAR, has altered its mission from a primary focus on agricultural productivity and commodity research to one that encompasses a more '*integrated natural resource management*' (TAC, 2001).

As human activity is the major destructive force in nature, improving natural resource management primarily requires changing human behaviour at 'grassroots' level (Röling, 1994, 1996, 2000). Today it is widely agreed that local people's perspectives need to be at the centre of research efforts for development and that innovations need to be 'owned' by the local land users, if changes in decision-making and behaviour leading to impact are to be achieved.

Such ownership can be created effectively through development and implementation of innovations by local people themselves in cooperation with outsiders (Hagmann & Chuma, 2002). As a result, over the last few decades, a wide variety of participatory research (PR) approaches, concepts and methods has evolved.

2.2   Indigenous knowledge

2.2.1   Introduction

Various scholars (Murdoch & Clark, 2005; Norgaard, 2003; Ulluwishewa, 1999) have argued that indigenous knowledge (IK) plays an important role in the sustainable management of natural resources and can also have an impact on issues of global concern. This recognition is directly related to the growing realization that scientific knowledge has contributed little to the development of certain communities and societies; rather it may have sometimes hastened the depletion of their social and natural resources (FAO 1997).

In Ethiopia there has been a longstanding tradition that the governors of the time collected information and this information was used to record customary patterns of land tenure and crop and livestock ownership. Since 1997 however, contemporary interest was revived further, first by an Ethiopian local NGO, the Association for Promotion of Indigenous Knowledge (APIK), and then by the Ethiopian Ministry of Agriculture (MoA). The inventory carried out by APIK showed that local people's knowledge and skills can be an effective means to increasing extension agents' sensitivity to local needs, and stimulating meaningful dialogue between all actors in community based NR management activities.

However, what is meant by 'indigenous knowledge' is by no means clear, and Table 1 shows the various terminologies and definitions available.

Term, synonyms	Meaning, salient aspect, implicit significance, antonym
Indigenous knowledge (internationally the most widely used term)	Culturally integrated knowledge; knowledge of small marginal /non-western groups
Endogenous knowledge	Of internal origin, as opposed to exogenous or external knowledge
Native knowledge /expertise	Expertise implies knowledge of a natural character, closeness to nature
Local knowledge	Knowledge rooted in local or regional culture and ecology
Sustainable knowledge	Sustainable within the natural and cultural environment
Traditional knowledge	Handed down, old, oral (implying static, low level of change)
Autochthonous knowledge	Of internal origin, culturally integrated
People's knowledge	Broadly disseminated knowledge, knowledge as potential for political resistance, as opposed to elite knowledge
Folk knowledge, folk science, folk competence	Traditional, rural (in industrial societies)
Little tradition	Tends to denote oral knowledge, as opposed to great tradition
Community knowledge	Related to small social units
Cultural knowledge, cognition (in the restricted sense)	Culturally integrated and practice-oriented
Ethnic knowledge	Related to an ethnic "we"-group (ethnicity)
Culturally specific knowledge	Specificity, singularity, particularity
Ethno-science (used here to denote local knowledge; previously used to denote the field of research)	Scientific (systematic) character; examples are: ethno-botany, ethno-sociology, ethno-medicine, ethno-pharmacology, ethno-epidemiology
Cultural knowledge system	Systematic character, generating rules (if x then y) and structures
Cultural belief/meaning system	Means the same as "knowledge system" but implies a less scientific character
Everyday/practical knowledge, mundane cognition, vernacular, common sense, generalist	Informal, practical, applied, as opposed to academic, specialist, expert knowledge or as opposed to ritual knowledge
Science of the concrete	Based on that which actually exists/is visible
Experiential knowledge	As opposed to theoretical knowledge, speculation or trial-and-error, as opposed to controlled experiment
Farmers' knowledge	Knowledge relating to the farm as an economic unit
Peasant knowledge	As opposed to elite knowledge; implies experiences of dependency

Table 1: *Diversity of terms for indigenous knowledge and their various connotations. Compiled from the literature of the 1960s to 2000 – adapted from: Antweiler (2004)*

As summarised in the above table, the terms are often used interchangeably, but there is arguably enough overlap between their meanings to recognise the existence of a shared inter-subjective understanding with some related knowledge within a community that permits a sufficient degree of common-sense engagement to allow that they refer to the same focal semantic meaning.

Sillitoe & Marzano (2009, p14) find that IK "varies within and between societies, comes from a range of sources and is a dynamic mix of past tradition and present innovation. It is heterogeneous and complicated which is an inconvenience for development." It is also diffused 'skills as knowledge', held by various people within a society and communicated through various symbols, myths and rites in an apparently piecemeal everyday fashion. They argue that "it is neither static nor uniform but ever-changing and subject to continual negotiation between people ... it is a process featuring the acquisition and integration of current information and experience" (p15).

Berkes & Berkes (2009) emphasise the relationship between IK and the local natural world and note that IK comprises institutions, in terms of rules and norms, about how to treat the environment, as well as comprising a particular worldview that influences how they make sense of this natural world. They also emphasise the holistic nature of IK, compared to Western reductionism. Thrupp (1989) points out that, while at first IK was seen as a potentially useful source of mere 'technical ideas', it also extends to "non-technical insights, wisdom, ideas, perceptions, and innovative capabilities which pertain to ecological, biological, geographical and physical phenomena" (p.15).

One must not forget that IK is local knowledge that is unique to a given culture or society. It is the information base for a society which facilitates communication and decision-making. It is therefore important to understand that IK is the systematic body of knowledge acquired by local people through the accumulation of experiences, informal experiments, and intimate understanding of the environment in a given culture.

An IK system therefore provides the basis for decision-making, which is operationalised through indigenous organizations, and they provide the foundation for local innovations and experimentation. IK systems are therefore adaptive skills of local people, usually derived from many years of experience, which have been communicated through oral traditions and learned through family members and generations. Local people, including farmers, landless labourers and rural artisans are all stakeholders of IK systems.

Dewalt (2007) identified the following features of IK, which have relevance to NRM:

- *locally appropriate*: IK represents a way of life that has evolved with the local environment, so it is specifically adapted to the requirements of local conditions.

- *restraint in resource exploitation*: production is for subsistence needs only; only what is needed for immediate survival is taken from the environment.

- *diversified production systems*: there is no overexploitation of a single resource; risk is often spread by utilizing a number of subsistence strategies.

- *respect for nature:* a "conservation ethic" often exists. The land is considered sacred, humans are dependent on nature for survival; all species are interconnected.

- *flexible*: IK is able to adapt to new conditions and incorporate outside knowledge.

- *social responsibility*: there are strong family and community ties, and with them feelings of obligation and responsibility to preserve the land for future generations.

Furthermore, Grenier (1998) pointed out:

- IK is considered parochial, confined to a small area, and limited to what rural people can sense, observe, and comprehend using their own terms and concepts.

- IK is not uniformly spread. Individuals vary in their aptitude for learning, storing, and generating knowledge. Specialized knowledge often belongs to certain groups or individuals; for example, male elders, midwives, traditional healers (Eythorsson 2000).

- IK includes both explicit and implicit knowledge, some of it intuitively practiced through cultural rituals or revealed through stories and legends. .

- IK is embedded in culture

- IK systems can be complex. Attempts to "scientize" IK by removing it from its owners will tend to compromise the subtle nuances of this knowledge (Thrupp 1989).

Turnbull (2009), quoting a position paper from the World Summit on the Information Society in Geneva in 2003, argues that IK is the basis of people's cultures, identities, institutions and value systems and cannot be separated from their spiritual and material relationships with their lands. Furthermore, these cultures provide the rules for sharing and applying this knowledge.

However, it is very difficult to discuss different systems of knowledge and different cultures without considering the realities of political and economic power. Bryan (2009, p24) notes that "the very concepts used to identify certain kinds of knowledge as indigenous remain steeped in colonial power relations". He discusses the production of maps and, in particular, the difficulties of 'indigenous mapping' where the traditional relationships between a people and the land are often considered to be 'unmappable'. Nevertheless, he argues that indigenous people are in the position of having to "map or be mapped" (p24). Maffie (2009) critiques the notion that Western hegemony, reflected in the triumph of the Gatling machine gun, somehow demonstrates the superiority of Western epistemology. As he argues: "IKs have been defeated, not disproven, by Western technology" (p56).

IK is seen to be different from scientific knowledge and conventional wisdom has been that scientific knowledge is somehow more advanced and global than IK. However, the onset of 'global warming' and adverse climate change raises questions as to how advanced Western science actually is. Turnbull (2009) makes the point that scientific knowledge itself is 'local', based on the sociological notion that science is 'what scientists do' and is based on highly situated practices. Both knowledges are based on

observation, some form of experimentation and the desire to create order out of apparent disorder (Berkes & Berkes, 2009) and "in some sense we are all indigenous and all knowledge including science is local" (Turnbull, 2009, p.3). Similarly all knowledges are "the product of human movement, actions, practices and protocols. ... [they] are dynamic, heterogeneous, social and distributed" (p.3).

The knowledges have different epistemologies, with science based on evidence, repeatability and quantification while IK is often more related to spiritual and religious practices. However, there is no meaningful meta-theory to compare the different varieties. IK may be lacking in terms of scientific (positivist) epistemology but it rests on a very different epistemology. Furthermore, Sillitoe & Marzano (2009) argue that the distinction between IK and science is 'misleading' as, in practice, they borrow from each other.

In trying to 'square the circle' between IK and scientific knowledge, authors offer various solutions in terms of providing a space for different knowledges. Green (2009) talks about a 'duality' of IK and science, suggesting that different epistemologies, based on different 'moral economies' should be accepted, such that different knowledges are not seen as mutually exclusive. She argues for a 'reflective equilibrium' to compare the different epistemologies. Berkes & Berkes (2009) note a similarity between IK and 'fuzzy logic', a form of science proposed by Zadeh (1965) which is seen as being highly legitimate within, for example, the artificial intelligence community. Sillitoe & Marzano (2009) argue for a model comprising 'linked spheres of knowledge', in the absence of a single theory of knowledge that would link IK with science, while Maffie (2009) proposes a 'polycentric global epistemology' that would accept such practices as dance, song and ritual performance as legitimate knowledge mechanisms.

As may be the case in all developing nations, modern scientific knowledge of thought and lifestyle, exists alongside the traditional/indigenous knowledge systems in Ethiopia. The indigenous knowledge/traditional systems and the modern/scientific system are

common in almost all sectors of Ethiopian society, including agriculture, health, education, culture and even lifestyle.

In addition to NRM, indigenous knowledge is widely used in medicine and, according to Kaya (2009), 65% of poor people in sub-Saharan Africa depend on traditional medicine for basic health care. Furthermore, the commercialisation of traditional medicines is an important part of pharmaceutical research and development with world sales of herbal medicines reaching $30 billion in 2000 (Kaya 2007). This raises difficult issues concerning the division of profits and intellectual property rights.

During the early years, interest in the role of indigenous knowledge in development focused on the knowledge itself and how it could be used across taxonomies (World Bank, 1998). Today there is a growing recognition of the role that indigenous knowledge plays in local decision-making, the manner in which indigenous organisations facilitate the identification and prioritization of community problems, and the importance of searching for solutions which result in local-level experimentation and innovation

Although, from the Second World War onwards, the introduction of modern systems has tended to neglect indigenous knowledge, the majority of the Ethiopian population – especially those who live in rural areas - still heavily rely on indigenous knowledge systems. Thus the readily available IK continues to provide the building blocks for development in Ethiopia, while at the same time seeking cooperation with modern knowledge for the mutual benefit of the two systems.

Although, all the above definitions of indigenous knowledge may be relevant in certain contexts, for this research it is defined as:

> *A body of knowledge indigenous people have accumulated over time, which allows them to live in balance with their environment.*

This matches the view of Berkes & Berkes (2009), who see IK as "a body of knowledge built up by a group of people through generations of living in close contact with nature"

(p7). IK is therefore understood to be the starting point for natural resource management and a host of other activities in rural communities.

Many authors (Mathias, 2005; Labatut & Akhtar, 2005; Warren, 1995) have stressed the value of IK for development. But IK has its limitations (Bebbington, 1999; Reijntjes et al., 2005; Leach & Mearns (1988) and is not in itself capable of addressing all the issues related to sustainable development (Murdoch & Clark, 2005).

Sustainable development may well be better served by a system that incorporates both indigenous and scientific knowledge systems (Icamina, 1999). Organizations, like the International Union for Conservation of Nature and Natural Resources (IUCN, 1997) and the World Commission on Environment and Development (WCDE, 1987), also stress that the sustainable management of natural resources can only be achieved by developing a science based on the priorities of local people, and creating a technological base that includes both traditional and modern approaches to problem-solving (Johnson, 2005).

Incorporating indigenous and scientific knowledge could mean integrating information collected from farmers with scientific information and technology. This means that one has to find a process relevant to indigenous information in the same way as scientific information (Lawas & Luning, 2005).

2.2.2 IK for sustainable NR management

As may be the case in most developing countries, the overwhelming majority of the population in Ethiopia are small-scale farmers, each working less than one hectare of land. Furthermore, these farmers represent a number of distinct languages and ethnic groups. In most instances, the knowledge systems of these farmers have never been recorded systematically in written form; hence they are not easily accessible to agricultural and NRM researchers, extension workers, and development practitioners.

While to some extent remaining invisible to the development community, many indigenous organizations (e.g. farmers' associations) are operating in rural communities to identify solutions to community problems. Therefore one needs to closely look at recent studies of IK reflecting the changes in attitudes of policy makers and NRM planners in recent years, which have led to renewed interest in this type of knowledge.

NRM planners and policy makers and other stakeholders are beginning to recognize the need to understand existing knowledge systems and decision-making processes (WCED, 1997). There is a general agreement that agricultural innovations based on indigenous knowledge have been tested through time (Warren & Rajasekaran, 1993). Indigenous knowledge is a science that is user derived and experimented over a long period of time and its utilization in development efforts provides long-term advantages that complement the contributions of conventional top-down agricultural technologies.

Despite all the evidence available, there is scepticism about the relevance of IK for Natural Resource Management – this is partly because indigenous communities never record their accomplishments, never attach their names and patents to their discoveries and inventions. As a result, in most cases the history of natural resources development is written without reference to the main stakeholders (Kajembe & Wiersum, 2004).

According to FAO (1999), NRM has been much more concerned with conserving the resource without local communities. Protection of natural resources has at times been seen as necessitating disruption of the traditional ways of life of local communities. An effort has therefore to be made to incorporate social values into natural resource management systems and this incorporation has to be effective. It is through this incorporation that IK has a chance to be recognised and valued.

According to Baumann (1999) there are three perspectives on IK:
- Instrumental
- Interpretative
- Actor-oriented or Beyond Farmer-First.

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Instrumental Perspective

As discussed by Inglis (1993), the instrumental perspective is mainly based on ecological or technical points of view, in which the use of indigenous knowledge can be seen as contributing to a better assessment, management and conservation of natural resources and to forming a basis for new (ecological) scientific knowledge.

This perspective is called "instrumental" because the knowledge and skills of local people are used as an instrument in externally designed and top-down implemented development or natural resource conservation initiatives. In many situations where the transfer of technology is exercised (in Ethiopia for example), local people participate only in the implementation activities, not in decision making and evaluation activities.

In this perspective, indigenous or traditional knowledge is viewed as a static body or stock of skills and experiences resulting from a long tradition of direct interaction between local people and their natural environment, from which useful information can be taken away by outsiders.

Interpretative or ('Farmer First') Perspective

As a reaction to the instrumental perspective, the interpretative approach emerged, mainly advocated by Chambers, et al. (1989). This perspective is based on previous farming systems analysis of the complex, diverse and risk-prone situations in resource-poor agriculture and on the recognition of the importance of indigenous knowledge in these farming systems.

This perspective calls for a reversal in the relation between farmers and external (scientific) experts. It is argued that it is the farmers who should formulate research agendas and experiment and innovate, based on their own specific situation, and external experts should act just as facilitators.

This approach of empowering the indigenous communities places IK at the centre. Indigenous farmers' knowledge, problems, analysis and priorities should be the starting

point of any development efforts. Many case studies show the capacity of farmers to experiment and innovate (see, for example, Richards (1985); Kajembe (2003)).

This capacity is comparable to scientific experimentation and innovation. Any integration of (western) science and local knowledge should be based on this assumption. The role of the external actor such as the scientist and other extension workers is not to impose solutions from the laboratory in a top-down model, but to facilitate local initiatives by offering a "basket" of choices (like new varieties, technologies etc.) from which the farmer can choose the most appropriate.

Richards (1985) states that: "intellectuals, development agencies and governments have all pursued environmental management problems at too high a level of abstraction and generalization". Many environmental problems are, in fact, localised and specific and require local, ecological particular responses.

From this perspective it follows that research should not be directed towards further sophistication of scientific knowledge and the transfer of this knowledge as in a technology transfer model, but on a better understanding of indigenous management systems and technology. Then, from this understanding, research can seek for ways to build upon and strengthen local initiatives. Put simply, the role of external animator will be to find out what people are doing and help them to do it better.

An actor-oriented or beyond "farmer first" perspective
The third perspective moves beyond the Farmer First perspective, not only by rejecting its basic goals, namely: active participation of all actors or stakeholders, empowerment of the local people and poverty relief, but by deepening the concepts of knowledge and power in the analysis of NRM and by adopting a more actor-oriented approach, which allows for the recognition of development history (Kajembe, 2003).
From an actor-oriented perspective, institutionalisation only becomes real when introduced and translated by specific actors (including here not only the farmers but also others such as scientists, extension workers and politicians).

This implies that these 'basic' trends do not eliminate power within the local situation, nor do they eliminate an active role for the farmers involved. What they do result in is a shift in the basis of power relations, and also a shift in various definitions of the farmers' role. At the same time, increasing institutionalisation often results in the emergence of new structural discontinuities and hence in the creation of new points of leverage and space to manoeuvre which may become crucial in the interaction with various intervening stakeholders (Kajembe, 2003).

Giddens (1987) notes that 'agency' refers not to the intentions people have in doing things; social life is full of unintended consequences with varying ramifications but, to their capability of doing those things in the first place. Action depends upon the capability of the individual to 'make a difference' to a pre-existing state of affairs (Kajembe, 2003). In particular, all actors exercise some kind of 'power' even those in highly subordinated positions. As Giddens (1987) puts it, "all forms of dependence offer some resources whereby those who are subordinated can influence the activities of the superiors." And in this way they actively engage in the construction of their own social situation although the circumstances they encounter are not of their own choosing.

Considering the relation between social actors and structure, Giddens (1987) argues that the constitution of social structures, which has both a constraining and enabling effect on social behaviour, cannot be comprehended without allowing for human agency.

He writes:

> "In following the routines of my day-to day life, I help to reproduce social institutions that I played no part in bringing into being. ... They are more than merely the environment of my actions since they enter constitutively into what I do as an agent. Similarly, my actions constitute and reconstitute the institutional conditions of actions of others, just as their actions do to mine. My activities are thus embedded within, are constitutive elements of structured properties of institutions stretching well beyond myself in time and space (Giddens, 1987:11).

Human agency, or the capacity to devise ways of coping with life, plays a key role in the way actors create new possibilities for development by influencing others, or in other words, creating room for manoeuvre.

2.2.3 The dangers of disregarding IK systems

As documented by the International Federation of Agricultural Producers (IFAP), neglecting indigenous knowledge undermines farmers' confidence in their traditional knowledge and that in turn forces them to become increasingly dependent on outside expertise (Richards, 1985; Warren, 1997). IFAP also asserted that small-scale farmers are often portrayed as backward, obstinately conservative, resistant to change, lacking innovative ability, and even lazy (IFAP, 1990).

According to IFAP the reasons stated for these perceptions includes:

- a lack of understanding of traditional agriculture which further leads to a communication gap between promoters and practitioners giving rise to myths;
- the accomplishments of farmers often are not recognized, because they are not recorded in writing or made known;
- poor involvement of farmers and their organizations in integrating, consolidating, and disseminating what is already known.

One of the greatest consequences of the under-utilization of IK systems is the loss of indigenous acquired knowledge which results in the inefficient allocation of resources and manpower to inappropriate planning strategies which have done little to alleviate rural poverty (Atte, 2004). With little contact with rural people, planning experts and state functionaries have attempted to implement programs which do not meet the goals of rural people, or affect the structures and processes that perpetuate rural poverty.

Human and natural resources in rural areas have remained inefficiently used or not used at all. There is little congruence between planning objectives and realities facing the rural people. Planners think they know what is good for these 'poor', 'backward', 'ignorant', and 'primitive' people (Atte, 2004).

2.2.4 Preservation of IK

Indigenous knowledge, which has generally been passed from generation to generation by word of mouth, is in danger of being lost unless it is formally documented and preserved. According to Warren (2004), the future of IK, that reflects many generations of experience and problem solving by thousands of indigenous people across the globe, is uncertain. The loss of IK would impoverish society because, just as the world needs genetic diversity of species, it needs diversity of knowledge systems (Labelle, 1997).

The rapid change in the way of life of local communities has largely accounted for the loss of IK. Younger generations underestimate the utility of IK systems because of the influence of modern technology and education (Ulluwishewa, 1999).

If IK is not recorded and preserved, it may be lost and remain inaccessible to other indigenous systems as well as to development workers. Development projects cannot offer sustainable solutions to local problems without integrating local knowledge (Warren, 1991). IK is the key to local-level development (Schoenhoff, 1999) and ignoring people's knowledge is likely to ensure failure (Brokensha et al., 1997). Hence, one should not expect all the expertise for Third World development to come from developed nations, academic institutions, multinational corporations or NGOs. As Atte (1989) noted, in the face of dwindling resources available to African countries, and noting that even the industrialized nation governments cannot provide for all the needs of the people, it has been suggested that IK, and the technical expertise developed there from become vital tools for rural development.

Since IK is essential to development, it must be gathered, organized and disseminated, just like Western knowledge (Agrawal, 1995; Gonzalez, 1995; Warren et al., 1999). The main challenges to the management and preservation of IK are issues related to methodology, access, intellectual property rights and the media and formats in which to preserve it (Msuya, 2007). Underlying these challenges is the dilemma of whether to use the Western paradigm for collecting and preserving IK.

Some scholars (Ulluwishewa, 1999; Warren, 1999) recommend *ex situ* conservation strategies, i.e. isolation, documentation and storage in international, regional and national archives. In the 1990s, this strategy was used to document the healing practices of the Fulani pastoralists in the north-west province of Cameroon (Nuwanyakpa, 2006). On the other hand, those who advocate maintaining distinctions between scientific knowledge and IK have supported *in situ* preservation of IK (Agrawal, 1995). The merits and demerits of the debate surrounding the methodologies of preserving IK are however beyond the scope of this discussion.

The question of whether or not we can ever fully articulate knowledge, as posed by Tyler (1978), is equally beyond the scope of this thesis. According to Tyler, if the said consists of the saying itself, the construction of what was said and what remains unsaid, then knowledge cannot be isolated, transmitted, received, stored and translated. Collectors of IK and designers of knowledge management systems have demonstrated that knowledge neither eludes nor defies cognitive narratives.

It should be noted that the recording of IK is not new; for instance, missionaries and colonial district officers collected information on customary patterns of land tenure, crop and livestock ownership and traditional beliefs and rites.

Lawas & Luning (1996) point out that the collection of indigenous information is time-consuming and costly. Thus, proper storage and management must be provided if the information is to be made available for the benefit of the wider national and global communities. The major challenges to the management and preservation of IK identified by their study are collection development policies, accessibility, storage and preservation media, and intellectual property rights.

They argue that library and information professionals should design collection development policies for indigenous knowledge. However, it could be argued that the collection of IK in the field should be left to ethnographers, anthropologists, oral historians and related professionals. Instead information professionals should collaborate with national IK resource centres to enhance access to IK.

The prime role of national IK resource centres is to collect, document and disseminate IK (Ulluwishewa, 1999). Such centres include the Ethiopian, Kenyan, South African, Tanzanian and Zimbabwean resource centres for indigenous knowledge.

According to Ngulube (2002), library and information professionals should only become part of the IK management equation in so far as organizing the information and making it usable and accessible. However, most librarians who attended the fifteenth Standing Conference of Eastern, Central and Southern African Librarians (SCECSAL) did not seem to agree (SCECSAL, 2007). They contended that they should be involved in the whole process of gathering, evaluating and organizing IK. However, one might question whether they have the necessary skills and resources. The work of collection as well the training of personnel in gathering indigenous knowledge has cost implications that would overstretch their already scanty resources.

Moreover, Ngulube (2002) asserted that without a collection development policy one wonders where library and information professionals would start. Are they going to collect everything they perceive to be indigenous knowledge? Collecting for what clientele? If library and information professionals are not involved in directing the publishing of the journals and other materials they organize, why do they want to have a different approach when it comes to indigenous knowledge?

A major contentious issue in the management and preservation of IK is the protection of intellectual property rights, where these are the legal rights that can attach to information emanating from the mind of a person if it can be applied to making a product that is made distinctive and useful by that information (Posey & Dutfield, 2005). There is an emerging debate on how to protect the intellectual property rights of IK practices. In this regard, the United Nations Draft Declaration on the Rights of Indigenous Peoples underscores the fact that indigenous peoples have the right to own and control their cultural and intellectual property pertaining to their sciences, technologies, seeds, medicines, knowledge of flora and fauna, oral traditions, designs, art and performances (Valsala & Kutty, 2002). In the same vein, the Economic Commission for Africa

recommends that oral tradition and indigenous knowledge in African communities should be exploited in all their forms of expression, giving cognizance to the protection of intellectual property rights (UN, 2007).

Although most IK is held in the minds and practices of people, and is commonly held by communities rather than individuals, intellectual property rights that are intended to protect the ownership of the intellectual content of the works of an individual can be applied. In the Western tradition the intellectual property must be tangible, taking the form of a written document, a recording of music, a painting or drawing, and the like. Sometimes IK is tangible. For instance, there are songs, stories, music, statues, paintings, designs, processes and drawings that embody traditional knowledge. These areas of IK are capable of being protected either individually or communally.

Traditional medicines also come to mind when thinking of protecting intellectual property. Who can claim that traditional healers share their medicinal secrets with the whole community? Equally, who can deny that traditional healers in Oromo and Southern Ethiopia were among the few people who could easily acquire cattle because of their unique skills in and knowledge of medicine? There is currently a debate on whether pharmaceutical companies should pay traditional healers royalties for using active compounds of medicinal plants that they have always exploited.

In spite of the fact that sharing is the main means of disseminating IK, there is IK that is unique to certain individuals, although they use that knowledge for the benefit of the whole community. Upholding intellectual property rights should benefit indigenous communities by the commercial use of their traditional knowledge. This could be an area where information professionals could contribute.

2.2.5 Challenges and Limitations of IK

Although the knowledge of indigenous communities has been found to be very useful, the spread of industrialization threatens the preservation and continued development of IK systems (Sherpa, 2005). Industrialization, along with its attendant processes of

urbanization, exploitation of NR, and increased competition for employment, has set off a problematic chain of events. This modernisation has influenced indigenous traditional African society in many ways and Ethiopia is no exception.

IK can also be eroded by wider economic and social forces. Pressure on indigenous peoples to integrate with larger societies is often great and, as they become more integrated, the social structures which generate IK and practices can break down. Added to this is the commercial pressure by multinational agrochemical companies eager to break into new markets (Thrupp, 1989).

As Grenier (1998) puts it:

> *"the growth of national and international markets, the imposition of educational and religious systems and the impact of various development processes are leading more and more to the "homogenisation" of the world's cultures. Consequently, indigenous beliefs, values, customs, know-how and practices may be altered and the resulting knowledge base incomplete."*

As with scientific knowledge, however, IK has its own limitations and drawbacks and these must be recognized as well. IK is sometimes accepted uncritically because of naive notions that whatever indigenous people do is naturally in harmony with the environment. Thrupp (1989) argues that we should reject "romanticized and idealistic views of local knowledge and traditional societies" (p15). There is historical and contemporary evidence that indigenous peoples have also committed environmental sins' through over-grazing, over-hunting, or over-cultivation of the land. It is misleading to think of IK as always being 'good', 'right or 'sustainable'.

Quite often the overlooked feature of IK, which needs to be taken into account, is that, like scientific knowledge, sometimes the knowledge which local people rely on is wrong or even harmful. Practices based on, for example, mistaken beliefs, faulty experimentation, or inaccurate information can be dangerous and may even be a barrier to improving the wellbeing of indigenous people.

As Thrupp (1989) said, sometimes IK that was once well-adapted and effective for securing a livelihood in a particular environment becomes inappropriate under conditions of environmental degradation. Although IK systems have a certain flexibility in adapting to ecological change, when change is particularly rapid or drastic, the knowledge associated with them may be rendered unsuitable and possibly damaging in the altered conditions.

For example, a critical assumption of IK approaches is that local people have a good understanding of the natural resource base because they have lived in the same, or similar, environment for many generations, and have accumulated and passed on knowledge of the natural conditions, soils, vegetation, food and medicinal plants etc. However, under conditions where the local people are recent migrants from a quite different ecological zone, they may lack that experience. In these circumstances, some of their IK may be helpful, or it may cause problems. Therefore, it is important, especially when dealing with recent migrants, to evaluate the relevance of different kinds of indigenous knowledge to local conditions.

Doubleday (2003) pointed out that knowledge is power, so individuals are not always willing to share knowledge among themselves, or with outsiders. Knowledge is a source of status and income (as is the case, for example, with a herbalist) and is often jealously guarded. A related issue is that some indigenous peoples fear that their IK will be misused, and lacking the power to prevent such abuses, they choose to keep quiet. (Geusau et. al. 2002) found that interviewees disliked answering questions about their personal or economic affairs unless they believed that by doing so, their life would improve.

2.2.6 Importance of researching IK

For quite convincing reasons, timely attention is being paid to incorporating the indigenous knowledge of local people into the overall environmental and NRM processes in the developing nations. Before this, such knowledge was widely used by rural people for sustainable resource management. Over time, however, it was displaced

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by western-based knowledge but interest in its use has revived over the past decade due to the growing debate over environmental degradation of large development projects.

In North America, for example, indigenous perceptions of land-use and landscapes were transcribed in the form of maps, discourses on taxonomy and community economic base studies: areas of use and occupancy and sensitivity were formally mapped and indigenous interpretations of landscape and environment were once more seen to have value and relevance (see, for example, Brody (1982) and Reed (1997b)).

As Nakashima & Reed (2005) have also noted, IK has been applied to historical climatic research, geophysical research, rural land use and resource management planning. Indeed, the IK of local flora and fauna often exceeds that of western scientists both in geographical and temporal extent. However, while indigenous peoples have profound knowledge of local human ecology that is of great importance in identifying rural land-use, resource management and environmental priorities, the apparent informality of such information does not sit comfortably with the western scientific tradition.

This tradition underpins the conventional planning and resource management practices, and a major challenge facing environmental resources management planning in the developing nations is that of identifying the appropriate use of IK of local human ecology in NRM and developing a culturally sensitive framework for its utilization.

Sustained knowledge about the land identifies issues of immediate significance and encodes information about the environment in a language people at the grassroots level understand (Ramisch, 2002). Although scientific land-use information is essential, it is not easily communicated, perhaps fails to capture the true nature of the various issues, and often reflects 'alien' attitudes towards resource values and use.

As documented by Fenge & Rees (1987) the application and utilization of rural resource management planning calls for an organised approach to dealing with indigenous knowledge. The importance of the role of Canadian native indigenous populations in

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planning was acknowledged in agreements introducing the Northern Land Use Planning Programme and environmental assessment processes. Fenge & Rees (1987) go on to note that in practice, expectations that native perceptions of land use and environment and perspectives on resource management would play a central role in planning have not been fulfilled. This is partly attributable to the political context and partly to a failure to develop adequate frameworks for dealing with indigenous land-use knowledge.

Although a considerable amount of IK of local human ecology regarding rural resource management has been transcribed in the course of use and occupancy studies, land claim negotiations, research projects, indigenous language projects, consulting work, and community economic base studies, there is no proper or adequate inventory of this material. Equally, although some imaginative approaches to incorporating cultural values into a holistic perspective on planning have been suggested there is no rigorous or accepted way of incorporating indigenous knowledge of local human ecology regarding NRM into planning processes.

As can be seen from the above review of the IK literature, much of the debate is normative, political and pragmatic. This can be useful in making quick improvements to NRM but adds little to our deeper understanding of IK. Very little of the existing literature has much of a theoretical base and it is conjectured that progress could be made by exploring IK from the perspective of relatively modern disciplines, such as information systems, knowledge management and innovation studies.

2.2.7 Indigenous knowledge and information systems

Apart from knowledge management, discussed in the next section, IK has been explored a little within IS research and development projects, in particular geographical information systems (GIS), many of which have been concerned with NRM (Mbile et al., 2003).

There are important spatial aspects to IK and GIS offer the opportunity to facilitate the management of IK and enhance its usefulness and its inclusion in local decision making

(Lawas & Luning, 1996). Furthermore, Tabor & Hutchinson (2004) and Gonzalez (1995) describe the advantages of using GIS to document IK. Examples of the combination of IK and GIS include the Phillipines (Lawas & Luning 1996), American Indian reservations and New Zealand (Harmsworth 1995). Moreover, such tools can complement traditional IK systems, whereby an important role is reserved for the relationship with individuals, places, cultural activities, experience and the spoken word (Harmsworth, 1998).

However, as argued by Walsham & Sahay (1999), the use of GIS in developing nations provides a classic example of the utilization and transfer of technology problem, which typically involves the introduction of Western technical systems into developing countries. Furthermore, Sahay & Walsham (1997), in discussing the use of GIS in India, highlight various problems; for example the development of systems that are not considered relevant by users; the lack of continuity in project management practices; and inappropriate co-ordination between the various agencies.

Many approaches to integrating IK into GIS have been participatory in nature. These include Waldron & Sui (2003), Gonzalez (1995) in the Philippines and Rundstrom, (2006) and Jordan & Shrestha (2005) in Nepal. McConchie & McKinnon (2003) pioneered a technique called Mobile Interactive Geographic Information System, developed for integrating IK to produce community-based maps for collaborative NRM.

The method has been successfully tested in Thailand, China and Cambodia, is presently being used in Bangladesh and was to be tested in India (McConchie, 2003). While there is an increasing interest in using GIS in a participatory context (Abbot et al., 1998), there are fears that it could be misused, wrongly interpreted, or not used at all and, if poorly designed, it could dis-empower underprivileged groups (Jordan & Shrestha, 2005).

The major advantages and disadvantages of participatory GIS (Jordan & Shrestha 2005) are listed in the table below:

Advantages	Disadvantages
Viewed as a participatory process it can empower the community by involving them in the decision making process.	If the participatory process is not well structured the community does not feel to be a part of the decision making process
It can be used to effectively combine quantitative and qualitative approaches to community development	There is a potential risk of the focus getting shifted mainly towards extractive data collection
Spatial data in the form of maps and other resource information can be utilized by the community in their decision rather than having access to GIS making process	There is a likelihood of sensitive spatial information like cadastral maps being subject to unintended misuse if held centrally
Natural resource information can be easily put together, analyzed and returned to the community for use	Excluding disadvantaged groups from the 'mapping' process can have a disempowering effect on them
Useful information can be returned to stakeholders for informed decision making	Availability and knowledge of the technology itself encourages a centralized approach

Table 2: *Advantages and disadvantages of Participatory GIS*

Another benefit of GIS is that it can narrow the information gap between professionals and resource users by making indigenous information more transparent, understandable, and accessible to a wider audience. In one project, a GIS was taken into a remote field area in southwest China and data was collected, encoded, manipulated, and analyzed (Lawas & Luning, 1996). The results were immediately presented back to the villagers, who then checked the data, validated any translations, provided credibility to the database, and reviewed and critiqued the findings.

However, rather than within information systems, where IK can mostly only be found in GIS literature, it is within the field of knowledge management that IK can be more readily discussed.

2.2.8   IK in the context of knowledge management

The notion of knowledge management grew from the early predictions that we were entering a post-industrial society (Bell, 1973; Drucker, 1968) which would feature a knowledge economy (Reich, 1992; Prusak, 2001; Toffler, 1990). This, in turn, suggested that organizations should carefully manage their knowledge, much of which was beginning to be reflected in the growth of intangible assets appearing in company balance sheets (Spender & Scherer, 2007). Companies accordingly began to implement various knowledge management initiatives.

One of the most influential theorists in early knowledge management was Nonaka (Nonaka, 1994; Nonaka & Takeuchi, 1995) who built a theory of organizational knowledge creation, based on Polanyi's (1967) distinction between tacit and explicit knowledge.

According to Polanyi, tacit knowledge was based on experience, behaviour and skills, which is held in the brain of the person, whereas explicit knowledge is articulated and can be documented and stored on paper or electronically. Nonaka (1994) argued that knowledge was created within the firm through modes of interaction between tacit and explicit knowledge and these different modes acted together dynamically to form a spiral of knowledge creation. These modes of interaction are described in more detail in the following chapter.

Nonaka's model implicitly views knowledge as an object (Thompson & Walsham, 2004) that is constructed and can then be shared by others. This led to definitions, such as the one by Brooking (1997): "knowledge management is the activity which is concerned with strategy and tactics to manage human centred assets". However, Thompson & Walsham (2004, p.726) argue that "the meaning of any objective 'knowledge' will always remain the subjective product of the person in whose mind this is constituted, always relationally defined, and therefore does not transfer easily to others in a form which may be operationalized to the benefit of the organization". They also point out that Polanyi himself regarded explicit knowledge as self-contradictory.

The alternative approach to knowledge as object is to take a practice-based view (Blackler, 1995) where objective *knowledge* is considered more as an inter-subjective process, resulting in the recipient *knowing*. This also fits better with Weick's (1995) notion of sense-making and Lave & Wenger's (1991) situated learning. Thompson & Walsham (2004) emphasise the importance of the organizational context for these processes and they view *knowing* as "mediated, situated, provisional, pragmatic and contested" (p.743).

Habermas (2003) dismisses the notion of knowledge as the representation of reality but regards it rather as a competence to do something successfully in practice.

From an actor-oriented perspective, both scientific and indigenous knowledge are fragmentary, partial and temporal. Both scientific and indigenous knowledge are constantly being generated and constructed as products of dynamic processes of interaction between various actors with different cultural backgrounds and understandings (Katani 2005). Advocates of an actor-oriented perspective recognise that multiple actors do exist in natural resource management and rural development at large.

Knowledge is not just a commodity which can be transferred from one actor to another but the outcome of a process which is a result of negotiation on the 'social interface' between multiple actors (Long & Villareal, 1994). From this perspective, local stakeholders (individuals or groups) should be seen as situated agents (Kajembe, 2003). Within the limits of existing information, uncertainty and other constraints (e.g. physical, social and politico-economic), local actors are knowledgeable and capable (Chambers et. al., 1989). They attempt to solve problems, learn how to intervene in the flow of social events around them, and monitor continuously their own actions, observing how others relate to their behaviour and taking note of various contingent circumstances. Human agency, or the capacity to devise ways of coping with life, plays an important role in the way actors create new possibilities.

McAdam & McCreedy (2000) compare what they call the 'social paradigm' of knowledge construction, using Lave & Wenger's (1991) and Demerest's (1997) models, which emphasise practice, interaction and communication, with the 'scientific paradigm' (equivalent to knowledge as object), which produces a "canonical body of facts and rational laws" (p.158). For them, the social paradigm seems more useful within the business context. Sutton (2001) concludes that "knowledge may be codified into texts and artefacts but only functions in people" (p.87). Alavi & Leidner (2001) discuss the various conceptualizations of knowledge and go on to develop a framework (described

in more detail in the next chapter) comprising four sets of 'socially enacted knowledge processes':

- knowledge creation
- knowledge storage/retrieval
- knowledge transfer
- knowledge application

Lave & Wenger's (1991) work led to a growing research interest into 'communities of practice' (Amin & Roberts, 2008). According to Lave & Wenger, a community of practice is "a system of relationships between people, activities, and the world: developing with time, and in relation to other tangential and overlapping communities of practice" (1991, p.98). Such communities are seen as being hugely important for knowledge creation as they provide the interaction, the shared basis of understanding and the propagation channels for the creation and sharing of knowledge (Wenger, 1998).

These different conceptualizations of knowledge suggest different epistemologies and Spender & Scherer (2007), among others, argue for a tolerance of these differences and a 'pluralistic conversation' between them. Similarly, Schultze & Leidner (2002) argue that the ambiguity regarding the nature of knowledge, and the different types of knowledge, imply the need for different 'discourses' and they propose the adoption of the four discourse types of Deetz (1996) – normative, interpretive, dialogic and critical - in order to examine knowledge management.

The fact that indigenous people also hold a wealth of knowledge and experience that represents a significant resource for sustainable development is slowly dawning. According to Warren (1991) however, IK has been ignored in the management of information in Africa. Indigenous knowledge pertains to experiential, locality-specific knowledge and practices of medicine, as well as healing, hunting, fishing, gathering, agriculture, combat, education and environmental conservation developed by indigenous people over the years.

Thus, IK is local knowledge that is unique to a given culture or society (Warren, 1991). According to CSOPP[1] (2001), some 80 percent of the world's population depend on IK to meet their medicinal needs, and at least half rely on IK and crops for food supplies. Essentially, this means indigenous knowledge affects the well-being of the majority of people – especially in developing countries.

Although IK is derived from observation of the environment in a particular context, it can be widely applied in many scenarios. As Warren (1991) and Ulluwishewa (1999) point out, the utility of IK is not confined to the locality in which it evolves, but is useful to scientists and planners alike in designing development programmes. However, library and information professionals have not been at the forefront in terms of managing IK, in spite of the fact that it is becoming an important resource in planning and managing sustainable development projects.

The dominant information management model has been based on acquiring, organizing and preserving recorded and codified knowledge, which is largely generated by researchers, laboratories and research institutions.

Such a model of managing information has little room for IK, which is not formally codified and resides wholly in the minds of local people. Nevertheless, the growing importance of knowledge and knowledge management implies that IK should be accorded a suitable place in the pluralistic conversation of Spender & Scherer (2007).

2.2.9   IK and Systems of Innovation

Innovation studies is a fast-emerging multidisciplinary field within the social sciences (Fagerberg & Verspagen 2009) and innovation is high on the agenda of most governments in their attempts to reinvigorate flagging economies. The literature is usually traced back to the work of Schumpeter (1934) who saw innovation as the driving force behind economic and social change. His work, which formed much of the

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[1] CSOPP is a Civil Society Organizations and Participation Program established in 2001

foundation of evolutionary economics (and also evolutionary dynamics), was continued by Arrow (1962), Freeman et al (1982) and Nelson & Winter (1982). Mytelka & Smith (2002) emphasise the shift over the years from viewing innovation as a process of discovery to seeing it more as 'a non-linear process of learning', based largely on the evolutionary ideas of Rosenberg (1976, 1982). Rogers's (1962) theory of the diffusion of innovation, based on an S-curve, is regularly referred to within the information systems literature.

Amabile et al (1996) define innovation as "the successful implementation of creative ideas within an organization" and this reflects the management literature that seeks to enhance and increase the innovative capacity of individual firms. According to Schumpeter (1934) innovation includes the introduction of new products, new methods of production, new markets, new sources of supply and new forms of organization.

Another strand of innovation research refers to national systems of innovation (Edquist, 2004; Freeman, 1987; Lundvall 1992; Nelson 1993), which is more concerned with the political economy of innovation at the regional, national and supra-national levels. Lundvall (1992) defines them as "elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge ... and are either located within or rooted inside the borders of a nation state". However, most writers (e.g. Niosi 2002) regard them more specifically as networks of firms, universities and government agencies. These networks include Triple Helix and Globelics, which have grown over the last seven years or so with the purpose of sharing and refining knowledge, learning and development, as well as linking the 'helices' of university-industry-government. It is this stream of research that has largely driven innovation policy and it has little to say about indigenous knowledge or community innovation.

Fagerberg & Verspagen (2009) categorise the innovation research community into five clusters:

- Management
- 'Schumpeter crowd'

- Geography & policy
- Periphery
- Industrial economics

Baskaran & Muchie (2008) offer a 'unified conception' of innovation systems which includes both the various ways of examining innovation systems (according to geography, type of firm, sector/technology and type/complexity of innovation) as well as the various factors (e.g. global, political, and economic) that influence them. Various authors (e.g. Ernst 2002; Kraemer-Mbula & Muchie 2005) have discussed innovation systems in developing countries mostly focusing on the networks of formal institutions.

There is clearly a considerable overlap between knowledge management and innovation studies. Swan et al (1999) offer a framework that maps process and product innovation against 'cognitive' and 'community' knowledge management. McAdam (2000) views knowledge management as a 'catalyst' for innovation within organizations and he goes on to fit innovation 'drivers' within a framework based on Demerest's (1997) model of knowledge management.

Sorensen & Lundh-Snis (2001) suggest that knowledge classification and codification are means for organizational learning and innovation. Chang & Chen (2004) distinguish between three approaches to national systems of innovation (culture and politics-bounded; technological/sectoral; and regional/local) in terms of knowledge links while Popadiuk & Choo (2006) discuss the relationship between knowledge creation and innovation.

A recent link between innovation and information systems research is the growing interest in 'open innovation', based on the ideas of Chesbrough (2003) and stemming partly from the success of open source development of software (Weber 2005). Open innovation refers to the notion that, rather than relying on internal sources, organizations should seek innovative ideas and projects externally, particularly through joint ventures and other partnerships with universities, small businesses and individual entrepreneurs.

Such partnerships are facilitated by knowledge sharing and improved communication using the Internet. Industrial leaders in open innovation include IBM and Procter and Gamble and these ideas have spread to many industry sectors (Christensen et al 2005).

Despite the use of the term 'indigenous innovation' by Lazonick (Lazonick & Mass 1995, Lazonick 2004) in discussing the economic development of Japan and China, there is very little mention of indigenous knowledge within the innovation literature. As noted above, the emphasis is mostly on formal networks of institutions or the more radical open innovation.

A rare exception is Kaya (2009) who discusses indigenous knowledge and innovation systems in public health in Africa, as well as noting the complementarity between traditional food and traditional medicine. He describes various research and development projects and initiatives in IK and innovation and repeatedly uses the phrase 'indigenous knowledge and innovation systems', suggesting that innovation is an inherent part of IK. He goes on to refer to the process where large multinational pharmaceutical, agricultural and biotechnological corporations patent IK techniques and products as turning "the owners of traditional knowledge into beggars" (p.103).

In adapting to changes in their environments, local people in the Sub-Saharan Africa not only vary products that they use, but also the practices they employ, the amount of labour they expend, as well as other socio-economic factors. The sources of the changes are not invariably 'outside' pressures or influences alone, but also changes engendered by the local people's own subsistence activities and experimentation.

A little recognised aspect of IK is its experimental and innovative nature. The term indigenous knowledge may create an impression of knowledge that is static, having been handed down through countless generations. However, in reality this knowledge is constantly evolving and being updated with new information. Various authors (e.g. Muchie, 2006) emphasise the importance for developing countries to build their own

innovation capabilities, rather than relying on the West for innovations that may not be appropriate for the local context.

Rhodes & Bebbington (2001) identified three kinds of indigenous farmers experiments: *curiosity experiments* (where farmers experiment simply out of curiosity to test new numbers and sizes of crops); or *problem solving experiments* (where farmers carry out experiments to solve problems); or *adaptation experiments* (where farmers can either test unknown technology in a known environment or test known technology in a new environment).

Studying experiments undertaken by rural people gives an understanding of their 'sense making' activities (Brouwers 2002). Scientists tend to regard an experiment as an enquiry during which all the variables are highly controlled except those under study. Local people differ from the scientific way in the sense that the experiment has to be included in daily circumstances (Kajembe, 2003). Richards (2002) concludes that in recent literature the experimenting, innovative, adaptive indigenous farmer is now accepted as the norm, not the exception. His own work has made a substantial contribution to this change of attitude. He has given numerous examples from West Africa, including labour organisation and rice cultivation in swamps.

Summary

This chapter provided a brief summary of the relevant literature from natural resource management, which serves as the context for this study. The chapter centred on indigenous knowledge as the focus of the research, particularly highlighting the practical and problem-centred literature from which the issues relevant to the lives of indigenous people emerge.

The literature suggests that IK is important in terms of supporting sustainable natural resource management for large numbers of (mostly poor) people around the world. Furthermore, it may offer promising solutions to many NRM problems as a complement to scientific knowledge although, as a body of knowledge, it is rather different from

science. However, much of the IK literature lacks a solid theoretical base from which to seek a clearer understanding. Information systems itself has little to offer in this way but the literatures of knowledge management and innovation studies are more promising. Knowledge management is largely concerned with knowledge processes at the level of the individual firm while innovation studies has two 'arms': the firm level and the national (institutional) level. However, neither literature has much to say about indigenous knowledge, which operates at a more local level but without the structures of an organization. In fact, it could be argued that there are significant 'gaps' in both literatures regarding indigenous knowledge.

Chapter 3 - Conceptual Framework

3.1 Introduction

A conceptual framework is needed to act as a lens, or conceptual tool, through which to view the problem of understanding indigenous knowledge, its role in the local community and its relationship with scientific knowledge. It was decided to take an existing framework from the knowledge management literature and modify it to fit the problem area.

This chapter starts by discussing and justifying the adoption of a knowledge management approach for the research and explains why other approaches were rejected. It goes on to differentiate tacit and explicit knowledge as this is an important distinction between indigenous knowledge, which is largely tacit, and scientific knowledge, which is mostly explicit. The chapter then briefly compares two frameworks for knowledge processes, those of Alavi & Leidner (2001) and the World Bank (1998), before describing in more detail the combined knowledge process framework that I developed for this study.

I adopted a process approach to studying indigenous knowledge because it seemed a systematic way of looking at a slippery concept and allowed cross-cultural comparisons between different knowledge systems. However, a process approach can be too mechanistic and tends to ignore the human aspects and, to balance this, I decided to add a stakeholder dimension to the framework. This chapter describes the basics of stakeholder analysis before showing in detail how I operationalised the stakeholder concept in terms of identifying four stakeholder groups within the problem situation.

3.2 Selecting a theoretical approach

The review of the literature in the previous chapter suggested that two bodies of literature, knowledge management and innovation studies, were relevant to IK, although neither offered strong conceptual support. Innovation studies, as its name implies, is concerned with new knowledge and has little to say about existing knowledge and,

considering that one of the main tenets of IK is the passing down of traditional knowledge from one generation to the next, I decided to base my theoretical approach within knowledge management.

Nevertheless, it is worth keeping in mind the strong bias of knowledge management towards organizational knowledge, as well as its predilections for IT-based solutions, as opposed to the more people-oriented organizational learning approaches (Swan et al, 1999).

I had already rejected taking a sociological approach as it tends to emphasise the 'differences' of indigenous life, whereas my concern was one of reflecting on IK as being somehow compatible with scientific knowledge, as interpreted by the local people themselves.

Similarly, I rejected the information and library science approaches, which are more concerned with indexing, categorisation and relevance. Knowledge management, for all its biases, offered a pragmatic approach to the problem of IK.

As discussed in the literature review, the concept of knowledge is typically treated either as 'knowledge as object' or 'knowledge as an inter-subjective process'. Considering the lack of tangible knowledge artefacts within IK, I adopted the latter approach in line with Blackler (1995). This also fits the research questions, which largely focus on the roles of social actors.

In terms of the scientific discourses for knowledge management, outlined by Schultze & Leidner (2002), I placed my study within the interpretive discourse. This emphasises the social aspects and regards actors as 'active sense-makers' and is compatible with ethnographic and hermeneutic research methods. It treats knowledge as situated practice (Thompson & Walsham, 2004), which is socially constructed.

3.3 Indigenous knowledge and knowledge processes

3.3.1 Tacit and explicit knowledge

One of the basic underlying tenets of knowledge management is the distinction between tacit and explicit knowledge (Polanyi, 1967). Tacit (or intangible) knowledge is defined by Nonaka (1994) as personal knowledge that is created through individual experiences. It is tacit knowledge because it is typically stored within people's heads and is not, or cannot be, explicitly recorded. It comprises the memories, mental maps, opinions, skills and attitudes of individuals based on their personal experiences. These may be positive or negative, such as learning from mistakes.

Much of this knowledge is of a 'how to' nature including such everyday knowledge as how to ride a bicycle or open a wine bottle. It also includes knowledge of 'who to' approach if an everyday problem is beyond the individual's capability of solving; for example, who to contact (an electrician) when the fuses blow.

However, tacit knowledge extends well beyond the quotidian and much has been written about the tacit knowledge of, for example, expert doctors, bankers or managers. In fact, any job that requires judgement, as opposed to following a prescribed routine, has its experts with their stores of tacit knowledge. Such knowledge, built up over years of experience, is typically too intuitive or context specific to record in a coherent documented fashion. And yet, this knowledge is tremendously valuable for organizations and seen as a key organizational resource promising sustainable competitive advantage (Spender, 1996). Thus, many organizations are starting to panic as the 'baby boomer' generation is about to retire and take its tacit knowledge with it.

Although, within the knowledge management literature, most of the discussions of tacit knowledge have focused on managers and other experts within organizations, it is clear that most indigenous knowledge is of the tacit variety. This knowledge is not normally written down but is passed down through generations or across communities through word-of-mouth. Hence, this knowledge is largely embedded within the culture and traditions of individuals and communities. It typically includes the sort of indigenous

knowledge of NRM practices that form the focus of this thesis and hence the notion of tacit knowledge is fundamental to the conceptual framework adopted.

Explicit (or tangible) knowledge, on the other hand, is recorded, documented or codified knowledge, widely conveyed through formal language, i.e. textual, electronic or digital. The manner in which this knowledge is presented has made its storage, conveyance and sharing easier. Databases and paper-based files are full of explicit knowledge. Within organizations, such knowledge would include organization charts, best practice instructions on how to carry out a particular task, the records of sales and production etc.

At the public level, central and local governments of most economically developed countries make easily available explicit records of regulations, laws, guidelines for citizens etc. Similarly, most scientific knowledge is explicit knowledge, recorded in books, monographs and journal articles. Although IK is largely tacit, notions of transferring it to other cultures, including the West, suggest a requirement for articulating it into explicit knowledge.

Nonaka and Takeuchi (1995), amongst others, caution that tacit and explicit knowledge are not entirely separate entities - they supplement each other. In particular, one usually needs a reasonable level of tacit knowledge in order to understand (especially specialist) explicit knowledge. For example, it is very easy for the amateur to retrieve a large amount of highly technical medical information from the Web, where it is publicly available, but without tacit medical knowledge and experience, it is very difficult to understand and apply.

In the previous chapter, I identified a strong argument in the literature for the need to capture, preserve and utilise IK, especially within natural resource management and it is the tacit nature of indigenous knowledge that particularly constrains such an endeavour.

3.3.2 Selecting a framework

Any research project requires some form of framework to act as a lens, through which to view the world, or a conceptual tool to perform an analysis. Considering knowledge as an inter-subjective process (Blackler, 1995), akin to sense-making (Weick, 1995) and situated learning (Lave & Wenger, 1991), involving multiple situated agents (Kajembe, 2003; Katani, 2005) led me to search for a process framework. A process can be defined as a series of actions/activities that transforms inputs (or resources) into a desired outcome. The inputs or resources are not necessarily tangible and, furthermore, knowledge can be seen as a process of applying expertise (Alavi & Leidner, 2001).

This led me to two, fairly similar, process frameworks by Alavi & Leidner (2001) and the World Bank (1998). Each framework categorises (slightly differently) the processes involved in knowledge management. I started the research using the Alavi & Leidner framework but because it didn't perfectly fit the context of indigenous knowledge, I supplemented it with the World Bank (1998) framework. In this section I briefly outline each framework and describe how I combined the two frameworks before describing the combined framework in more detail in the following sections.

Alavi & Leidner (2001) see knowledge as:

> "information possessed in the mind of individuals: it is personalized information (which may or may not be new, unique, useful or accurate) related to facts, procedures, concepts, interpretations, ideas, observations, and judgements." (p.109)

They recognise that knowledge does not exist apart from in the mind of a person (an agent) and is the result of the cognitive processing of information. When it is articulated, it is converted back into information in the form of words or symbols. They adopt the perspective of knowledge as a process, focusing on the application of expertise (Zack, 1998).

It then follows that knowledge management is also a process and one that comprises, at the minimum, four basic sets of socially enacted 'knowledge processes':

- knowledge creation
    - o the construction of knowledge within organizations
- knowledge storage and retrieval
    - o the recording and retention of knowledge so that it is not forgotten
- knowledge transfer
    - o the communication of knowledge between individuals or organizations
- knowledge application
    - o the use of knowledge within organizational processes.

The simple logic underlying the framework suggests that knowledge is first created, then stored, retrieved and perhaps transferred before being finally applied.

Alavi & Leidner (2001) claim that their framework originates in the sociology of knowledge (e.g. Berger and Luckman 1967) and is based on the view of organizations as social collectives and knowledge systems. It is fundamentally aimed at knowledge management in the context of organizations and was published within the management literature with a view to facilitate the use of information technology for knowledge management.

Although this framework was originally directed at knowledge management within organizations, with the implicit assumption that the organizations are operating in developed economies, I would assert that the framework can equally be applied to IK within communities. There is nothing fundamentally 'organizational' about knowledge creation, storage & retrieval, transfer and application, nor about the theories underlying the framework: knowledge as a process, rather than an object, and the importance of cognitive processing. Hence, I believe that this framework from the management literature is transferable to the context of IK, with just minor modifications.

Alavi & Leidner's framework concerns 'business' knowledge and makes the implicit assumption that it is easily transferable within the 'culture' of a particular industry. However, as noted in the previous chapter, there are powerful arguments for trying to transfer IK from local societies to other cultures. Hence there is a need to 'capture' this knowledge in a more explicit form, such that it can be identified, recorded, documented and preserved along the lines discussed in the previous chapter.

The other framework, by the World Bank (1998), is part of a proposal for exchanging and utilising IK within the Partnership for Information and Communication Technology for Africa project. It is presented as a depiction of the six steps for knowledge exchange of IK among developing countries and between developing and industrialised countries. As such, it is based on development practice rather than on a theoretical foundation. Nevertheless, it is very similar in the 'later' processes to the theoretical construct of Alavi & Leidner but it is more comprehensive in the 'earlier' processes.

Based on a similar logic to Alavi & Leidner (2001), it recognises the following six sets of knowledge processes:
- knowledge recognition and identification:
- knowledge validation
- knowledge recording and documentation
- knowledge storage
- knowledge transfer
- knowledge dissemination

The processes of knowledge recognition and identification, validation and recording and documentation are particularly relevant to the context of indigenous knowledge where, unlike the organizational context, considerable effort needs to be expended on finding indigenous knowledge, checking its accuracy and relevance and recording and documenting it.

Neither framework was perfect for my research but each had its advantages and drawbacks. However, because they were compatible in terms of their basic units of analysis, I resolved to combine them together in the following combined framework:

- knowledge creation:
- knowledge capture
- knowledge storage and retrieval
- knowledge transfer
- knowledge application

I retained the knowledge creation category of Alavi & Leidner (2001) as it recognises innovation and the construction of new knowledge, which is neglected by the World Bank (1998). Furthermore, I combined the latter's categories of knowledge recognition and identification, validation and recording and documentation into a category named knowledge capture. Finally, I retained Alavi & Leidner's categories of knowledge storage and retrieval; knowledge transfer; and knowledge application, preferring 'application' to the World Bank's (1998) category of 'dissemination' as the former seems more oriented towards useful implementation. The following sections describe each of these categories of knowledge processes in more depth.

3.3.3 Knowledge creation

Alavi & Leidner (2001) argue that knowledge creation involves developing new knowledge or replacing existing knowledge through social and collaborative processes as well as individual reflection. Perhaps because of their emphasis on the potential application of information technology, they have little to say about reflection but concentrate instead on the four 'modes' of knowledge creation identified by Nonaka (1994).

These four modes, depicted in Figure 1, focus on the creation of new knowledge from the combination of existing knowledge. They comprise: *socialization, combination. externalization and internalization.*

The *socialisation mode* refers to the conversion of tacit knowledge to new tacit knowledge through social interactions and shared experience while *combination* refers to the creation of new explicit knowledge by merging, categorizing, reclassifying, or synthesizing existing explicit knowledge. The other two modes involve interactions and conversion between tacit and explicit knowledge: *externalisation* refers to converting tacit knowledge to new explicit knowledge while *internalisation* refers to the creation of new tacit knowledge from explicit knowledge (e.g. the interpretation of explicit knowledge using tacit knowledge to create new knowledge).

Figure 5: *Knowledge Creation Modes (Source: Alavi & Leidner, 2001)*
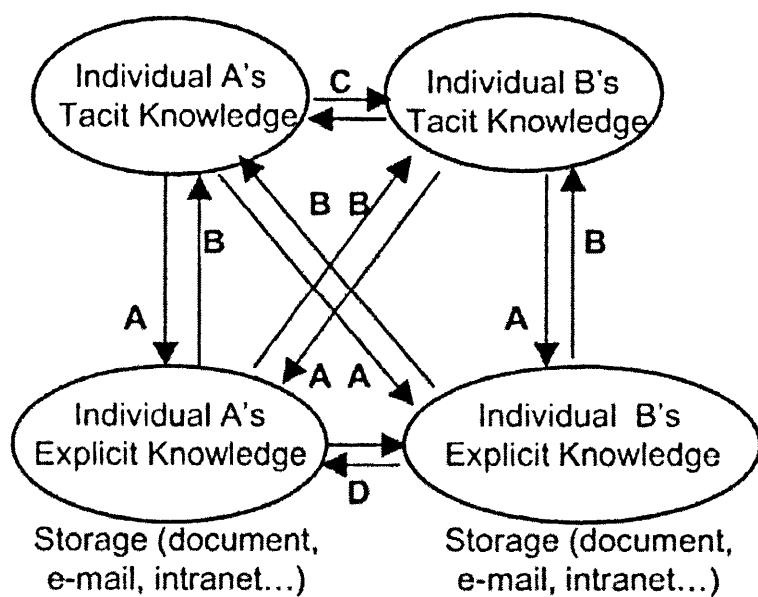
Legend:
      Each arrow represents a form of knowledge creation.
      A—Externalisation; B—Internalisation; C—Socialisation;
      D—Combination

The arrows in the above figure indicate the intertwined nature of knowledge creation processes and, in particular, their social nature, such that knowledge creation usually involves more than solitary reflection. Thus, two individuals, A and B, can 'create' knowledge using various processes, conforming to particular modes.

Traditionally, socialisation would be the main social channel for creating indigenous knowledge with the indigenous communities sharing knowledge and know-how socially to create new knowledge, in the sense of people 'knowing' more than they did before. Within Alavi & Leidner's (2001) version of the framework, externalization refers to the conversion of tacit indigenous knowledge to new explicit knowledge but, as argued above, this is often a difficult process in IK that requires differentiating from knowledge creation itself. Internalisation and combination, although highly relevant to organizations and the potential for applying information technology, are of less immediate applicability in the local context of indigenous knowledge, although they are relevant for transferring IK beyond its immediate locale.

Alavi & Leidner (2001), citing Nonaka & Konno (1998), go on to argue the importance of the conditions and environments that facilitate new knowledge creation in terms of establishing a common place or space for creating knowledge ('ba' in Nonaka's terminology). In the context of organizations, they identify four of these common places, corresponding to the four modes of knowledge creation:

- *Originating place* facilitates the socialization processes where individuals share experiences mainly through face-to-face interactions, perhaps through a 'brainstorming' meeting in a coffee bar.

- *Interacting place* is associated with the externalization mode of knowledge creation and refers to a space where tacit knowledge is converted to explicit knowledge for later sharing through dialogue and collaboration. This assumes an environment where writing or structuring is facilitated, suggesting a quieter space with IT facilities.

- *Cyber place* supports the combination of different sets of explicit knowledge and could involve sophisticated IT systems, such as data mining.

- *Exercising place* supports internalisation and would emphasise effective reading or listening.

Of these common places, only 'originating places' seem of immediate relevance to the local exchange of indigenous knowledge, although the others are possibly relevant for the wider dissemination of IK.

3.3.4   Knowledge capture

The set of processes in this category originate in the World Bank (1998) framework and sums up the processes needed for the preservation of IK, as recommended by writers such as Agrawal (1995) and Warren (2004). In the World Bank framework it comprises:

- Recognition and identification
- Validation
- Recording and documentation

Recognition and identification can be problematic as IK is typically embedded within cultural values and practices and is not necessarily explicitly labelled as 'knowledge'. Hence, for example, the customs of when and how to sow particular seeds may be deeply embedded within religious or ritualistic calendars and it is thus easy for a researcher seeking IK to overlook such knowledge. Harvesting may begin on a particular day, or following particular signs, for these cultural (apparently non-scientific) reasons but this may represent the 'knowledge' concerning the optimum time for harvesting.

Validation involves some form of appraisal of the significance, relevance, reliability, functionality, effectiveness and transferability (World Bank, 1998) of the knowledge. In other words, some knowledge can be classed as trivial, irrelevant, accidental, impractical, inefficient or restricted to a particular geographical area and is of little value elsewhere.

Recording and documentation is particularly important for indigenous knowledge as it is largely tacit. Hence, it needs to be accurately captured as a first step before it can be transferred and applied elsewhere. If the 'owner' of the knowledge can articulate it verbally in a language that the researcher understands, then recording and documentation may merely comprise writing it down or tape-recording it. Where this is not possible, the researcher may video (or sketch) the owner practising the knowledge, for example, sowing seeds in a particular pattern.

However, one must not overlook the very special features of indigenous knowledge, which makes it distinct from other types of knowledge. Much of it is local in that it is

rooted in a particular community and situated within certain cultural norms; it is a set of experiences generated by people living in those communities. Therefore, when transferred to other locations, there is a greater risk of dislocating it. Hence, care needs to be taken in the capture of IK in that a simplistic approach risks losing some of the properties of the knowledge that are provided by the local cultural context.

In the context of IK, knowledge capture is particularly urgent regarding the rapid changes in the physical, social, political and economic environment affecting indigenous people. As noted in previous chapters, there are real dangers that their indigenous knowledge will be lost forever.

As noted above, these issues are rarely relevant within the Western practice of knowledge management but are of particular concern when dealing with indigenous knowledge.

3.3.5 Knowledge storage and retrieval

As Alavi & Leidner (2001) argue, effective storage and retrieval is important to prevent organizations from 'forgetting' their knowledge. Stein and Zwass (1995) discuss this in terms of organizational memory, which includes both the explicit knowledge, held in databases and filing cabinets, and the tacit knowledge of individual employees.

This knowledge includes organizational culture, processes, structures and roles and can be divided into semantic and episodic memory. Semantic memory refers to meanings and is usually explicit whereas episodic memory is more context-dependent and situated and thus more likely to be tacit. Alavi & Leidner (2001) also distinguish between individual and group memory, where individual memory is based on a person's observations, experiences, and actions (Argyris & Schon, 1978), while group memory stretches further back in time and can refer to knowledge outside the organization or community (Walsh & Ungson, 1991).

Clearly, knowledge needs to be stored in such a way as to facilitate retrieval and some form of digital storage offers obvious advantages, assuming that issues of classification and indexing can be dealt with effectively. However, Alavi & Leidner (2001) make clear the dangers of focusing too much on the mechanics of storage and retrieval as too much reliance on (old) knowledge can be harmful in terms of decision-making bias (Starbuck & Hedberg 1977), maintaining the status quo and the development of cultures that are resistant to change (Denison & Mishra, 1995).

There would appear to be no reason to suppose that within a local indigenous community (as opposed to an organization) the distinctions and transfers between semantic and episodic memory and between individual and group memory do not hold. A particular concern with IK is integrating this knowledge with scientific knowledge, where each paradigm may have very different knowledge structures, units of analysis and primitive constructs. This is an interesting area but beyond the scope of this thesis.

However, on the positive side, IK is practice based rather than theoretical, which means it is a product of trial and error that is tested 'rigorously' over a long period of time. It is learned through repetition and a product of constant change while being produced and reproduced. Hence, it is less likely to become obsolete due to this adaptive quality.

3.3.6 Knowledge transfer

In their framework, Alavi & Leidner (2001) expanded Figure 5 above, based on knowledge creation, into Figure 6, which considers knowledge transfer. This figure depicts how knowledge is transferred, not only between individuals, but also between individuals and groups and stores of explicit knowledge (e.g. databases and documents).

Figure 6 - Knowledge transfer among individuals in a group (Alavi & Leidner, 2001)
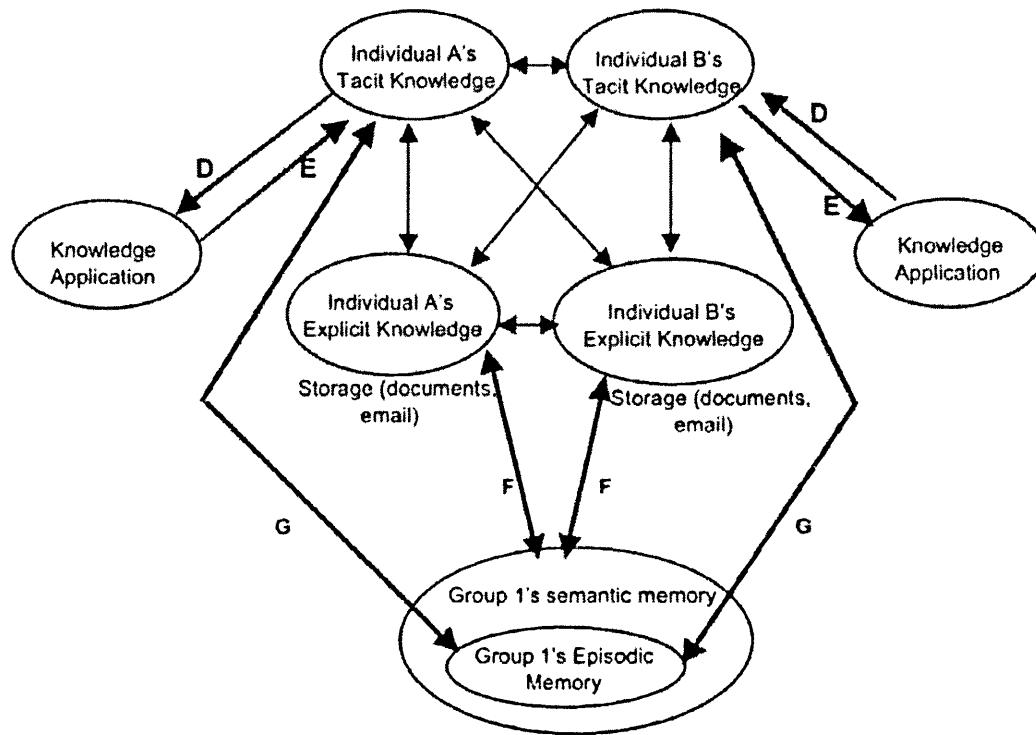
Legend:
>   D-The Process of Knowledge Application
>   E-The Process of Learning
>   F-The Transfer of Individual Explicit Knowledge to Group Semantic Memory and vice versa
>   G-The Transfer of Individual Tacit Knowledge to Group Episodic Memory and vice versa

According to the authors, the arrows labelled D represent the process of knowledge application (discussed below) and those labelled E represent the learning (or new knowledge creation) that takes place as individuals apply knowledge and observe the results. The arrows labelled F represent the transfer of an individual's explicit knowledge to a group's semantic memory through circulating a document or placing a report on a group's server.

According to Alavi & Leidner (2001):

>   "*The arrows labelled G represent the possible transfer from individual tacit knowledge to group episodic memory. Individuals may likewise learn from the group semantic and episodic memories, reflected in arrows F and G. Indeed, the*

group episodic memory is critical in helping an individual interpret and learn from the group semantic memory. "

In addition, knowledge transfer takes place through seminars and informal meetings both within and outside organizations.

Alavi & Leidner (2001) also reproduce Gupta & Govindarajan's (2000) framework of knowledge flows to underline the varying effectiveness of knowledge transfer, suggesting that much depends upon:

- The perceived value of the source unit's knowledge – some sources are more respected than others
- The motivational disposition of the source - their willingness to share (often expert) knowledge
- The existence and richness of transmission channels – face-to-face conversation is 'richer' than a telephone conversation which, in turn, is richer than email
- The motivational disposition of the receiving unit – their willingness to listen to (acquire knowledge from) this particular source
- The absorptive capacity of the receiver – the ability of the receiver to understand the knowledge being transferred.

In the context of indigenous knowledge, transfer traditionally takes place orally and usually over relatively small areas. The introduction of ICTs and the prevalence of scientific knowledge suggest that researchers should now be considering:

- Knowledge transfer between indigenous peoples separated by large distances and, perhaps, cultural barriers
- Knowledge transfer between indigenous peoples and the scientific community on a two-way basis.

In this context, the above framework of effectiveness becomes particularly crucial:

- Perceived value of source – how much trust exists between different indigenous peoples and between indigenous people and the scientific community?

- Motivational disposition of source – in particular, are indigenous people willing to share their knowledge?
- Transmission channels – are there effective channels linking these various communities?
- Motivational disposition of the receiver – are the various communities willing to listen to each other?
- Absorptive capacity – even if communities are prepared to listen, are they able to understand each other?

Every viable community has the necessary conventions and norms to deal with these issues internally but it is much more difficult to deal with them across communities, especially where there is a history of colonialism, distrust and perhaps even war. Thus, knowledge transfer within a community, where providers and recipients speak the same language and share the same cultural values and norms, is much more easily accomplished than transferring tacit knowledge across different cultures.

3.3.7 Knowledge application

In discussing knowledge application, Alavi & Leidner (2001) stay well within their organizational boundaries and focus mostly on mechanisms common to (large) organizations.

Hence, they focus on:
- Directives – sets of rules and standards for carrying out tasks where the tacit knowledge of experts is compiled into instructions to be followed by non-experts.
- Organizational routines – focus on the organizational conditions that allow experts to apply their knowledge effectively.
- Self-contained task teams – problem-solving groups, mostly made up of experts, which can be used in situations that are too uncertain or complex for directives or organizational routines.

Although the context of indigenous knowledge lacks the discipline and uniformity of organizations, the principles may still hold. For it to be at all useful, the knowledge has to be applied and appropriate 'systems' (in the broadest sense) implemented. Furthermore, it seems reasonable to assume that some, relatively straightforward, knowledge could be applied without the presence of 'experts', purely by 'following the instructions'.

Other knowledge applications may well require the presence of the experts themselves and the conditions needed for effective application (the organizational routines) could include, for example, the provision of interpreters. Similarly, one can envisage complex situations where a team of experts is needed, including specialists on plant science, engineering and climate patterns.

Alavi & Leidner (2001) go on to discuss the potential for applying IT solutions in these cases. Again, considering the context of IK, directives could certainly be implemented electronically, assuming that they are fairly simple but there seem fewer prospects for the use of IT in organizational routines or self-contained teams here.

As noted above, the World Bank (1998) version of this category focuses more on dissemination ('getting the knowledge out there') rather than application, in terms of its actual implementation.

Summary

The combined knowledge processes framework, described above, seems to fit the context of indigenous knowledge and could offer a clarification and systematisation of the processes involved in exploiting indigenous knowledge. It thus seems a worthy vehicle to test in practice in a real setting and it was decided to use this for the study in Debre Berhan.

3.4 Stakeholder analysis

While there is a strong argument for examining the issues surrounding indigenous knowledge through the lens of knowledge processes, this approach brings with it certain disadvantages. Perhaps the worst of these is that it tends to be mechanistic in the sense that it takes no account of people. People are excluded from the analysis and processes can be treated almost like automated 'factory' operations. And yet, especially in the context of indigenous knowledge, most of which is held tacitly within the heads of indigenous people, people are particularly important. This is even more the case where humanitarian disasters (such as famines) and the political problems surrounding them paint a stark backdrop to the study. Hence, in order to 'give people a voice', I opted to 'counterbalance' the process analysis of the combined knowledge process framework with a much more people-centred approach, that of stakeholder analysis.

Stakeholder analysis is a political approach to examining human situations where stakeholders have been defined as: "all those parties who either affect or who are affected by an organization's actions, behaviours and policies" (Mitroff, 1983). This definition indicates the business and management background of the approach.

Perhaps a more relevant definition for my context comes from the FAO (2005), which sees a stakeholder as:

> "an institution, organization, or group that has some interest in a particular sector or system. Also: individuals and constituencies contributing, either voluntarily or involuntarily, to wealth-creating activities, and who are therefore potential beneficiaries and/or risk bearers of its operations".

Stakeholders typically have different interests, agendas, goals and objectives (Pouloudi & Whitley, 1996) that sometimes conflict with each other and, at other times, converge.

I interpret a stakeholder as an individual or group, or any social actor in a community or in an institution of any size that acts at one or more levels (i.e. local, regional, national, international) and who has a significant and specific stake in a given set of resources,

and can affect or be affected by natural resource management problems or interventions. This seems to fit the notion of stakeholder 'salience' (Mitchell et al, 1997).

Stakeholder analysis comprises the examination of complex situations, histories and future alternatives from the perspective of the stakeholders involved. It implies the identification of all stakeholder groups involved in natural resource management activities and understanding their interests, problems, potentials, etc.

According to UNDP (2003) stakeholder analysis in NRM serves to identify:

1. the stakeholders involved in a competition or conflict over natural resources

2. stakeholder values and views on NRM problems and conflict-management strategies

3. the multiple interests and objectives of stakeholders in relation to particular NRM systems

4. the actual resources, influence, authority or power that stakeholders can bring to bear on particular NRM initiatives

5. the networks that stakeholders belong to and patterns and contexts of interaction between them, be they collaborative or conflictive

6. the distributional and social impacts of NRM policies and projects (potential trade-offs and conflicts), hence the risks and viability of particular NRM interventions;

7. the appropriate type or degree of participation by primary and secondary stakeholders (internal, external), at successive stages of a project cycle

8. feasible coalitions of project sponsorship and ownership aimed at efficient, equitable and sustainable livelihood strategies (based on compromises between public goals and divergent stakeholder interests)

The origins of the approach go back a very long way in the history of business and management thinking and practice; the term 'stakeholder' was apparently first recorded in 1708, to mean a bet or a deposit (Freeman, 1987) and the notion can be seen in the beginnings of industrialisation, as well as the 19th century cooperative movement and

mutuality. According to Brugha & Varvasovszky (2000) stakeholder theory reappears in business and management discussions of the 1930s while more modern exponents include Mitroff (1983) and Freeman (1987). Mitchell et al (1997) offer a theory of stakeholder identification and salience to help in the problem of identifying 'who and what really counts'. Writers like Preston and Sapienza (1990) see stakeholder analysis as a more ethical approach to management problems rather than solely aiming to improve the fortunes of a company's shareholders.

Within information systems, stakeholder theory has been used mostly to account for the organizational problems leading to systems failure (e.g. Pouloudi & Whitley, 1996; Pan, 2005). For example, Lyytinen & Hirschheim (1987, p263) define IS failure as: "the inability of an information system to meet a specific stakeholder group's expectations". They note that such groups develop attitudes towards information systems according to their beliefs about whether the system will further their interests. More recently, Boonstra et al. (2008) use stakeholder analysis to examine the problems underlying the implementation of an electronic patient record system.

Stakeholder analysis is an attractive approach in the context of development-related studies such as mine. The World Bank sees it as a "prerequisite for understanding poverty and social impacts and responds to the question: which interests matter in policy reform." It also fits with the view that issues of sustainability, growth and equity cannot be dealt with through technological means alone. Thus, when tackling the wider NRM issues of environmental degradation, manmade and natural disasters, power relations and conflicting interests of stakeholder groups must be addressed. It allows for all 'interested parties', including the indigenous people and government agencies to be identified and their contributions and objectives examined.

It is also a flexible approach that helps focus attention on specific problems, actors and opportunities for change. This is particularly relevant in the context of NRM where complex relationships of power and interdependence concerning the utilisation and control of natural resources prevail.

Stakeholder analysis can also be seen as the first step towards stakeholder participation, which is widely believed to be essential where resource issues overlap different administrative, social, economic and political systems operating at various levels (e.g. local, national, regional). It should counteract stakeholder under-representation and act as a framework for considering trade-offs between stakeholder groups in balancing issues such as sustainability and economic growth.

According to Rubiano (2004), stakeholder analysis has post-modern, pluralist and constructivist leanings, such that its notions of 'social actors' are more attractive than positivist methodologies. As Burgoyne (1994) argues, the fact that different stakeholders do not perceive environmental problems in exactly the same way means that different solutions and different criteria of assessment may be required. Given its focus on people's intentions and self-identified interests or stakes, the method emphasizes processes of social construction and economic interests are assigned not to objective systems but rather to agents and socially-positioned perspectives on social and natural reality. As such, it can highlight inherent structural problems and offers a good alternative to conventional economic analysis, which tends to lack a proper focus on how costs and benefits are distributed among different stakeholders, both winners and losers.

According to ILEIA (1999) stakeholder analysis provides an approach to better anticipate and deal with stakeholder opposition and conflict, and to better incorporate various interests, especially those of weaker groups.

However, stakeholder analysis is not without its dangers. Rather than using it as a conceptual tool, as in this thesis, it can easily be confused with techniques to facilitate stakeholder involvement or input in managing NR projects or conflicts (Grimble et al. (1995). Roy (1999) similarly argues that while stakeholder analysis may be part of the stakeholder approach to management, it is not synonymous with it and care must be taken not to lose sight of the precise goals of the analysis.

Another problem is the difficulty in identifying and classifying stakeholders (Mitchell et al, 1997; Pouloudi & Whitley, 1996). While, in society, 'everything is connected to everything else' and it is tempting to add stakeholder groups, no matter how peripheral they are to the immediate issues, this tends to over-complicate the analysis. Similarly, there is a temptation to start with a solution to the problem and 'force' the stakeholder group that owns the solution into the analysis. One can also over-complicate the analysis by trying to cluster groups at too fine a level of detail; for example, should one talk about 'indigenous people'? Or should one separate out the men from the women, and the young from the old? These issues are context-dependent, depending upon the type and level of analysis. My own operationalisation of stakeholder analysis is described in the next section.

In summary, I have incorporated stakeholder analysis into my conceptual framework because it highlights the importance of people and should further the investigation of their roles in indigenous knowledge processes. It highlights the local actor perspectives on conflicting interests and alternative strategies aimed at promoting equity and sustainability in national resource management systems.

3.4.1 Operationalisation of stakeholder analysis

As noted above, the identification of stakeholder groups can be problematical but, having worked previously in NRM in Ethiopia, I had good background knowledge of the people involved. After some thought, I grouped them into the following categories:

i)   *Indigenous farmers*

ii)   *The government and its development agencies and other regulatory agencies*

iii)   *Agricultural & environmental education institutions and other research institutions*

iv)   *Donors and local/international NGOs*

During the course of the research, I kept an open mind regarding this categorisation but found no reason to change it. The above groups play major roles and significantly influence the use and promotion of NRM practices and approaches in the Debre Berhan

area. In the following sections I describe the characteristics and role of each of these groups in the context of natural resource management practices. Although this chapter discusses the theoretical framework used for the research, I have incorporated some material that I discovered in the field for purposes of clarity regarding the characteristics of the groups.

3.4.2 Indigenous farmers

This group includes both farming families who have been in the area for generations plus some relative newcomers who have migrated from other parts of Ethiopia. This group includes both men and women. These farming families make up at least 75% of the population of the area and include around 110 farmers who have been categorised as indigenous experimenters, in terms of developing new know-how and knowledge.

In the past, these independent farmers have used indigenous knowledge to operate their farms and manage the natural resources of the area. It could be argued that, in principle, they should be allowed to continue to have the final decisions in this context. However, according to the local farmers in Debre Berhan, this decision making role has been reduced with the expansion of extension programmes by the government and NGOs, which are often top-down in nature; population growth; changes in policy; and ever reducing farm sizes etc.

As a result, in many instances, NRM measures have been introduced without the (whole-hearted) consent of the local farmers. In their view, this approach, and its poor implementation, has contributed towards the poor sustainability of NRM practices and negatively affected natural resources. It has led to negative attitudes towards certain practices, such as soil conservation initiatives. For example, indigenous farmers in Ankober, which is classified as a 'high potential area'[2], confirmed that poor quality work done on their plots without their agreement had indeed negatively affected their natural resources. However, elsewhere, where INGO-assisted initiatives have used participatory

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[2] High potential areas also referred as food secure, non-moisture stressed and surplus producing areas.

approaches and linked soil conservation with income generation, indigenous farmers have been keen to adopt new NRM practices (e.g. the WFP MERET project which introduced improved seed varieties).

For simplicity I have grouped together both men and women farmers although, as in most rural societies, the women have particular roles. In Ethiopia they look after their immediate families; prepare meals and represent the first line of health care; and convey community values to their families. They carry much of the burden of farm labour and arrange for firewood and water. During periods of hardship, they know which minor plants to cultivate in order to provide emergency meals for their families. At the community level, they are engaged in local trade, health, and employment. Like many societies, despite their essential contributions, indigenous women in male-dominated Ethiopia still face many constraints in exercising influence over their lives.

The findings chapters present cases where indigenous women's knowledge helps them, their families, and communities to address local challenges through local solutions.[3] These chapters also document their substantial contribution to maintaining agro-biodiversity. During droughts and famines, indigenous women have developed coping strategies to maintain food security for their families. They often rely on minor crops and plants which are more tolerant to droughts, providing useful resources for extended periods of hardship.

Their role in relation to farm animals is also underestimated. Although animal ownership in Ethiopia is associated with men, it is often the women who collect fodder for the cattle, attend to their health, milk them, and collect and use the dry cow dung as fuel. As a result, according to EARO (2005), indigenous women have acquired a substantial stock of husbandry and ethno-veterinary knowledge that complements scientific knowledge.

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[3] (See the findings section where: indigenous women practising rain-fed farming and specializing in poultry – including the innovation of incubating chicken eggs in dry cattle dung. Other innovations related to crops include fig pollination techniques and the use of plastic bottles for the water-efficient irrigation of melons etc.)

3.4.3 The government and its development agencies

This group comprises the federal Ministry of Agriculture (MoA) and the recently formed Ministry of Agriculture and Rural Development (MoARD), the regional (RoARD), zonal (ZoARD), and district bureaus (DoARD), and the community level development agents (DA) commonly known as extension workers (EW).

These government bodies play a big role in the promotion of sustainable natural resource management practices, determining the approach, types of NRM practices and technologies to be promoted, and the amount and mechanisms of implementation. Despite some intervention by local administrations, the planning, implementation, and monitoring and evaluation, commonly known as ME processes, are largely carried out by these agencies.

Since the 1980s, they have been widely involved in natural resource rehabilitation initiatives with the aim of arresting and overcoming natural resource degradation and improving rural livelihoods. Such initiatives have had only limited success, which may be due to their top down planning approach, lack of experience and capacity and lack of awareness.

Also in this group are the regulatory agencies, including the newly formed Environmental Protection Agency (EPA) and Natural Resources Administration Authorities, which are established at different levels. These institutions tend to lack experience and expertise and are understaffed[4]. Nevertheless, EPA has formulated a number of initiatives and strategies and the regional authorities have begun to implement them, including Debre Berhan and the surrounding regions[5]. However, these central strategists seem very distant to the local indigenous farmers who regard them with suspicion.

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[4] According to the MoA officials at Debre Berhan the reason for this could be a lack of university or college courses on natural resources administration and environmental protection.

[5] According to the MoARD officials, it is hoped that this will increase natural resources, tenure security and improve investment in natural resource management.

3.4.4 Agricultural & environmental education institutions

The Higher Learning Institutions (HLIs) such as agricultural universities and colleges are responsible for training agricultural and environmental specialists. Over recent years, the number of these institutions and their graduates has increased substantially. However, the quality of education is not always widely respected.

Many indigenous farmers have complained and asserted that these graduates are neither rich enough in theoretical knowledge, nor practical experience to promote sustainable NRM practices or to make a meaningful contribution to promoting IK. Some farmers referred to their knowledge as 'artificial', having only been learned at school.

According to one senior lecturer at the Development Studies Centre at the Addis Ababa University (the centre which also advises the MoA), improvements in the quality of education and the curriculum itself are needed at all levels. Moreover, there may be a need to redefine or develop a new curriculum to address sustainable NRM issues.

Research institutions include:

- Institute of Agricultural Research (IAR),
- Ethiopian Agricultural Research Organization) EARO,
- Regional Agricultural Research Institutions (RARIs)
- Ethiopian Development Research Institutions (EDRI),
- Federal and regional agricultural research centres,
- Higher learning institutions (HLIs)
- International research centres such as International Livestock Research Institute (ILRI) formerly known as International Livestock Centre for Africa (ILCA).

Their roles with regard to managing natural resources are mainly to generate agriculture based technologies that are appropriate to the different agro-ecology zones (AEZ) and to undertake systematic studies to facilitate the implementation of NRM practices with the aim of helping policy makers to make informed decisions, assisting extension workers

(EW) to be equipped with the required information and mechanisms of promotion, assessing impacts and suggesting possible areas of improvement.

This group has also the responsibility to collect and disseminate national and international experiences and technologies that have proved to be effective and are likely to fit local conditions. There are some research outputs that have national and local implications. [6]

However, the research institutions in general have been constrained by lack of capacity and experience. Many stakeholders I have spoken to stated that the research system has not been very effective in rendering required outputs (e.g. economics of NRM and mechanisms of up-scaling NRM practices) and services to check natural resource degradation and promote NRM practices. There are also problems of integration among disciplines and institutions.

3.4.5 Donors and local/international NGOs

Although support for natural resource management has been relatively limited, compared to other humanitarian aid, several donors (including Germany's GTZ, the World Food Programme, USAID, World Bank, Oxfam) have supported the promotion of sustainable NRM practices in different parts of the country. However, in the past, they have tended to overlook the knowledge and role of indigenous communities and are sometimes not heavily involved in the implementation process.

However, at Debre Berhan, the INGOs provide extension workers with both resources and hands-on technical support and have strong links to the implementing institutions. Home-grown NGOs, such as APIK, actively promote the use of local indigenous knowledge and are seen by most people as neutral agents. One problem is that most donors and NGOs have their own, rather bureaucratic, financial procedures that create problems for the efficient utilization of their support.

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[6] (Critics however says that these research institutions tend to focus/advocate only Western experiences)

Moreover, most donor-supported initiatives on NRM are highly concentrated in degraded parts of the country and tend to focus on fire-fighting. It could be argued that it would have been preferable to focus earlier on preventative measures through training, field and office equipment, running costs, etc., which is cheaper than the fire-fighting of rehabilitation. Often this environmental rehabilitation is the major involvement of NGOs' agricultural development.

This group are thought to be capable of applying innovative methods and approaches to promote NRM, such as integration of sustainable NRM with income generation, credit, value adding and marketing and, as a result, there are some examples of successful projects.

However, NGOs have various limitations. They often address very limited areas and it can be difficult to maintain continuity after the end of a project. This is partly related to their relatively capital intensive approach, such as building cement check dams and high cost gabions. Some projects seem to produce unfulfilled promises that raise the expectations of communities but lack strong institutional linkage and produce relatively high overhead costs and little accountability.

Summary

This chapter has described and justified the theoretical approach adopted for this study and discussed how the conceptual framework was constructed and used in this research. It showed how the combined knowledge processes framework was developed from earlier work by Alavi & Leidner (2001) and World Bank (1998). It also gave a brief description of stakeholder analysis and showed in detail how this was operationalised for this particular study.

The conceptual framework can be seen as an example of a 'Type 1 Theory for Analyzing' (Gregor, 2006), which is used to analyse 'what is happening', as opposed to providing rigorous explanations of causality or predictive generalisations. As such, it

goes beyond mere description but seeks to analyse and classify relationships and is particularly relevant to areas where relatively little is known.

Chapter 4 - Research Methodology and Design

This chapter is intended to give the reader a sense of how I did what I set out to do. It begins with my personal context which includes my background, how I came to this particular project, and a brief discussion of my own perceived biases. I then continue by discussing the process and theoretical foundation for the ethnographic fieldwork, before turning to the specific research design. I conclude the chapter by appraising the research design according to the theoretical criteria of ethnography.

4.1 Personal context: *Personal Background*

In September 1999 I completed my M.Sc. in the Analysis, Design and Management of Information Systems at the LSE. The title of my thesis was "Impact of Information and Communication Technology (ICT) on Development" in which I researched how the Sub-Saharan African nations could harness ICT for their development programmes, using Ethiopia as an example.

Since then I have been drawn into the topic of indigenous knowledge and discovered that I have a great interest in researching how people could live in more sustainable manner. As my interest in IK developed, I decided to further my research into a PhD. I wanted to perform research in an area that I was passionate about, to offer my work to further societal and technological knowledge, meet my academic requirements, and also to make a contribution to those who were the focus of my research.

Through my studies in information systems, it became apparent that my interest was focused cross-disciplinarily on initiatives that attempted to take into consideration systems thinking, knowledge management and issues related to sustainable development. This led me to the topic of indigenous knowledge and, after considerable reflection and discussion with my supervisor and other research students, I decided to adopt the ethnographic research method.

4.2 Ethnography

Ethnographic research comes from the discipline of social and cultural anthropology (Myers, 1999), which is usually recognised as one of the four 'branches' of anthropology (the other three are biological anthropology, linguistic anthropology and archaeology).

According to Rajpramukh (2005), its two strands focus on:

- Culture in terms of objects, tools, techniques, ideas and values
- Social structure and social organization, i.e., the network of relations between groups, classes and categories.

Ethnography has been the dominant research method in social and cultural anthropology for more than a century as it provides an excellent holistic treatment and holism is one of the basic tenets of anthropology. In the 19th century, studies were largely directed at 'primitive' societies, which shifted in the 20th century to a study of 'different' societies, and more recently to the use of ethnography to provide a different perspective to research on modern Western society (Adler & Adler, 2008). Seminal ethnographies in social and cultural anthropology include the work of Malinowski (1932) in the islands of the Pacific Ocean and Radcliffe-Brown (1931) in the Andaman Islands. More recently, Bourgois (1995) produced an ethnography of 'crack dens' in Harlem. Geertz (1973) pioneered the notion of 'thick description' within ethnography, where considerable attention is paid to the context as well as human behaviour.

However, ethnography is not the sole preserve of anthropology and is widely practised in sociology (e.g. Collins, 1991; Fine & Holyfield, 1996) and the notion of 'workplace ethnographies' crops up in industrial relations (e.g. Edwards & Belanger, 2008). Adler & Adler (2008) identify four 'genres' of ethnographic writing: classical, mainstream, postmodern and public ethnography. Much recent IS research has focused on the social and organizational contexts of information systems (Avison et al., 1993); (Lee et al. 1997); (Ngwenyama et al., 1999), (Nissen et al., 1991) and ethnographic research has

emerged as an important means of studying these contexts (Harvey & Myers, 1995, Myers, 1997a, Prasad, 1997).

One of the key features of ethnography is the 'depth' of study, where an ethnographer is required to spend a significant amount of time in the field. Ethnographers are expected to immerse themselves in the life of the people they study (Lewis, 1985) and seek to place the phenomena studied in their social and cultural context.

Ethnography provides a detailed exploration of group activity and may include literature about and/or by the group. It is an approach which employs multiple methodologies to arrive at a theoretically comprehensive understanding of a group or culture. The issue for the observer is how the particulars in a given situation are interrelated. In other words, ethnography attempts to explain the web of interdependence of group behaviours and interactions. Ethnography is the study of people in their own environment through the use of methods such as participant observation and face-to-face interviewing.

As Sidky (2004) suggests, ethnography documents cultural similarities and differences through empirical fieldwork and can help with generalizations about human behaviour and the operation of social and cultural systems. Because anthropology is holistic (meaning it looks at the past, present and future of a community across time and space), ethnography as a first hand, detailed account of a given community attempts to build a comprehensive understanding of the circumstances of the people being studied. Ethnographers, then, look at and record a people's way of life, as seen by both the people and the anthropologist; they take an emic (folk or inside) and etic (analytic or outside) approach to describing communities and cultures.

Ethnographic research looks at what may be considered ordinary to those living within a community whether they are indigenous or new to the area. The researcher spends time with the people under study to get a sense of how they live, how they practice their beliefs and rituals, and their interactions with each other and with their neighbours.

Ethnographic research is seen as descriptive and interpretive; descriptive, because detail is so crucial, and interpretive because the ethnographer must determine the significance of what he observes without gathering broad, statistical information. Geertz (1973) is famous for coining the term 'thick description' in discussing the methodology of the ethnographer. In essence, ethnography comprises getting the story of a people from those people and has also been referred to as 'culture writing.'

According to Yin (1994), the main differences between case study research and ethnographic research is the extent to which the researcher immerses himself in the life of the social group under study. In a case study, the primary source of data is interviews, supplemented by documentary evidence such as annual reports. In ethnography, these data sources are supplemented by data collected through participant observation. Ethnographies usually emphasize detailed, observational evidence. The difference between the types of study can be illustrated from the IS literature.

The case study method was used by Walsham & Waema (1994), who studied a UK building society. Their principal method of data collection was in-depth interviews and they did not use participant observation. The ethnographic method was used by Orlikowski (1991) who studied a large, multinational software consulting firm over eight months. Data was collected via participant observation, interviews, documents, and informal social contact with the participants.

Although ethnography blossomed in IS research in the mid-1990s (Harvey, 1997, Harvey & Myers, 1995, Lee, 1991, Myers, 1997a, Myers, 1997b, Wynn, 1991), it followed early ground-breaking work such as Wynn's (1979) study of office conversations, Suchman's (1987) work on human-machine communications and Zuboff's (1988) research into factory automation.

There are various sub-categories of ethnography: Sanday (1979) proposes holistic, semiotic and behaviouristic schools where holistic ethnographers live with their subjects for many months and ideally learn the local language. Hence, they 'go native'. On the other hand, Geertz (1973) emphasises the symbolic (semiotic) aspects of cultures

without the need to empathize with the subjects. Harvey & Myers (1995) point out the move within IS towards 'critical ethnography', which is more focused on the underlying meanings within different cultures. For this study, I have taken a relatively holistic approach to ethnography.

Specific examples of ethnographic IS research studies demonstrate the contexts studied and the time required in the field. Like Orlikowski (1991), Levina (2005) also spent eight months on her study, in her case examining a web-based application development project. Corbitt (2000) spent five months with a corporate finance institution, studying their development of an e-commerce strategy, Nandhakumar & Avison (1999) examined an executive information system project for six months, and Surendra (2008) spent 18 months in a finance company studying agile development practices. Stanley (2003) spent eight months in a classroom observing adult IT education in a poor community while Hampton (2003) spent two years living in a community in order to study the relationship between ICT and social networks.

In the context of information systems in developing countries, Walsham & Sahay (1999) spent three years studying geographical information systems in India and, more recently, Kuriyan et al. (2008) conducted an ethnographic study of computer kiosks, also in India.

The different approaches to ethnography are also apparent within IS research. Myers and Young (1997) explicitly adopt a critical ethnography for their ten month study of a health sector project while McBride (2008) uses a performance ethnography in terms of presenting the stories attached to the development of software quality procedures. In her eight month study of knowledge workers, Schultze (2000) emphasises the confessional aspects of ethnography in her self-reflexive account of a Lotus Notes development in a US manufacturing company.

Ethnography is also discussed as a method whereby multiple perspectives can be incorporated in systems design (Holzblatt & Beyer, 1993). In the design and evaluation of information systems, some very interesting collaborative work involves

ethnographers, designers, IS professionals, computer scientists and engineers (Star, 1995). For example, a project at Lancaster University used the ethnographic method to understand human cooperation in air traffic control (Bentley et al. 1992; Hughes et al. 1992).

Like any other research method, ethnography has its benefits and limitations. As argued by Myers (1999), one of the most valuable aspects of ethnographic research is its depth. Because the researcher is 'there' for an extended period of time, the ethnographer sees what people are doing as well as what they say they are doing. Over time the researcher is able to gain an in-depth understanding of the people, the organization, and the broader context within which they work. As documented by Grills (1998a), by going to 'where the action is; the researcher develops an intimate familiarity with the dilemmas, frustrations, routines, relationships, and risks that are part of everyday life.

Myers (1999) further asserts that knowledge of what happens in the field can provide vital information to challenge our assumptions. Ethnography often leads the researcher to question what we take for granted. For example, Hughes (1992) shows how ethnographic studies led researchers to question widely held assumptions about systems design. They found that the information obtained by ethnography provided a deeper understanding of the problem domain and that conventional principles normally thought of as 'good' design may be inappropriate for cooperative systems. Likewise, Orlikowski's, (1991) ethnographic research showed how the use of new IT led to the existing forms of control in one professional services organization being intensified.

One of the main limitations of ethnographic research is that it takes much longer than other kinds of research (Myers, 1999). Not only does it take a long time to do the fieldwork, but also it takes a long time to analyse and write up the material. Although ethnographic research takes longer, it can nevertheless be very 'productive', considering the amount and likely substance of the findings. Furthermore, Myers (1999) points out another disadvantage of ethnographic research: it does not have much breadth. Unlike a survey, an ethnographer usually studies just one organization or one culture.

Investigating information systems with ethnographic research therefore leads to in-depth knowledge only of particular contexts and situations.

Ethnography is also demanding in terms of the behaviour and character of the researcher, perhaps more so than other research approaches. Fine (1993) outlines 'ten lies of ethnography' as the 'underside' of the approach. These are ethical assumptions normally taken for granted by readers of ethnographies and Fine lists them as follows:

Classical virtues

- *The kindly ethnographer* – the assumption that the researcher is sympathetic

- *The friendly ethnographer* - the assumption that the researcher 'likes' everyone

- *The honest ethnographer* – assumes the researcher does not 'trick' the subjects into gaining access and obtaining information by lying about, for example, the motivations behind the research

Technical skills

- *The precise ethnographer* – the assumption that field notes are 'accurate'

- *The observant ethnographer* - the assumption that the notes are complete and comprehensive

- *The unobtrusive ethnographer* – the assumption that the researcher is not influencing the data

The ethnographic self

- *The candid ethnographer* – the assumption that, in presenting the research, the researcher is open about his failings

- *The chaste ethnographer* – the assumption that the researcher will not get 'emotionally involved' with the subjects

- *The fair ethnographer* – the assumption that the researcher presents the work in an objective and balanced fashion

- *The literary ethnographer* – the assumption that the real ethnographic 'story' is not lost through 'over writing' or other poor written presentation.

4.2.1 Justifying the ethnographic method for this research

There are many methodologies that have been, and could be, used to explore information systems. Avison & Myers (1995) suggest: conceptual study, mathematical modelling, laboratory experiment, field experiment, surveys, case studies, futures research, phenomenological research/hermeneutics, ethnography, longitudinal study, and action research. Due to my interest in culture and society, I selected the ethnographic method.

This research therefore was conducted through ethnographic fieldwork in Debre Berhan, Ethiopia, studying indigenous communities in their own social contexts, rather than, for example, as a purely statistical investigation without interaction between the researcher and the researched. It is through this fieldwork that I gathered information about the people and their natural resources related activities at the grassroots level.

My experience as well as my readings led me to the view that the central work of the ethnographer in fieldwork is to become immersed within the culture in such a way as to develop an 'insider's' perspective. This generally means taking on the role of participant observer, a role "instrumental to understanding and accurately describing situations and behaviours ... in contrast to a priori assumptions about how systems work from a simple, linear, logical perspective - which might be completely off target." (Fetterman, 1989)

This role is not an easy one (Fetterman, 1989; Faithorn, 1992) and there are dangers of either becoming a 'blank slate' or 'sponge' for culture, or alternatively entering the fieldwork full of theories and hypotheses to test. The researcher needs to maintain a reflective distance from the culture in order to consider the ethnographer's own impact on the culture and 'situatedness'. Clearly, this makes its own particular demands on the researcher. Schultze (2000) argues that "ethnographic research is thus highly dependent on the individual [researcher's] unique knowledge and experience, and his/her actions as a thinking agent who brings his/her subjectivity to bear on the construction of information and knowledge" (pp.7-8).

The work of Avison & Myers (1995) is invoked by Richards (2003), who argues for a reflexive anthropology "where it is recognized that the interpretation of culture(s) is in fact part of a process of construction" and says that anthropologists themselves "are similarly part of a broader socio-historical process." They go on to argue that ethnographers, in their attempt to 'go native' and understand other cultures 'in their own terms,' deny the interpretive act of the analyst. I acknowledge my situatedness in the assumptions of my 'home culture,' in the new cultural context, and (being an IT person trained in the UK) as part of a broader socio-historical process. How can I immerse myself in and learn about a specific indigenous culture while being subject to the assumptions and biases of my own (city oriented) culture? Harvey & Myers (1995) argue that the ethnographer should be aware of these biases and try to make them explicit in the process of learning about cultural differences (see also Spradley, 1980).

In my study I am applying what Faithorn (1992) calls a 'transcultural perspective.' This approach recognizes and celebrates the particularities of cultural diversity while also exploring shared aspects of the human experience. As Avison & Myers (1995) write: "culture is seen as contestable, temporal and emergent, it is constantly interpreted and reinterpreted, and is produced and reproduced in social relations".

4.3   Research Design

In this section, I discuss what motivated this research, the process involved and the outcomes in terms of the amount of data collected and analysed.

4.3.1 Biases

Seeking to work with marginalized people such as the indigenous people of Ethiopia in the context of promoting their knowledge reveals a natural bias not uncommon in this type of research. Through my readings I became familiar with indigenous practices from various parts of the world. These cultures that have lived in close relation with the natural resources over many generations seem to possess a place-specific, grounded knowledge base that could be invaluable to the creation of new systems of design,

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planning and management we need today in order to live in more balance with natural forces and resources.

It did not take me very long to realise that what people in the West label as a new field of integrated resource management has for centuries been a way of life for many indigenous people. There seems to be one tendency in 'modern' society to romanticize native peoples, while another seeks to obliterate these native cultures because they are seen as 'backward'. In the light of these perspectives it is appropriate to proceed with respect and curiosity, yet with a critical attitude, in pursuit of a clearer understanding of the lessons that indigenous peoples may be able to provide.

As I was excited about the many implications of this indigenous knowledge in a modern context, so I was also fascinated by the implications of recent research into knowledge management for a developing country like Ethiopia – especially to indigenous communities.

Through my preliminary study, I felt that knowledge management could support the diffusion and sharing of knowledge in different contexts. Furthermore, as argued in the literature review, if IK is not recorded and preserved, it may be lost. The mixed enthusiasm and caution I feel for knowledge management is based on the perceived potentials and limitations apparent in the literature, as well as the recent change of attitude and acknowledgment of the importance of IK.

4.3.2 Staging the research

This project appealed to me because it was daring, comprehensive and genuinely attempted to investigate a knowledge system which governs our own natural resources and how different categories of social agents, associated with different systems of knowledge, engage in the process of deliberation of such a knowledge in Ethiopia.

In order to establish a viable research area, in May 2000 I contacted Dr Dejne Arado, author of *Indigenous Knowledge Systems in Ethiopia*. He informed me that he was

running the 1st National Workshop on Indigenous Knowledge Systems in Addis Ababa the Ethiopian capital. The workshop raised various interesting issues, as a result of which my interest developed further.

Prior to my contact with Dr Dejene, I had the opportunity to talk with officials from the Association for Promotion of Indigenous Knowledge (APIK) in Addis Ababa about the role of APIK, their documentation centre and research programmes. These conversations provided valuable insights.

Initially, I envisaged a multifaceted programme of research and a key consideration was to identify a group of individuals, especially indigenous people, who would be willing to share their knowledge and experiences. I thought of this based on my previous visits to the area when I used to work as a Research Associate for the International Livestock Research Institute (ILRI - formerly the International Livestock Research Centre for Africa, ILCA) that used to have a research station in Debre Berhan.

I was encouraged by the feedback I received from various people, who stated that my research proposal was the first of its kind by an individual researcher and would be likely to receive support. My initial reaction was to conduct a broad survey of IK but I never got beyond communicating with various stakeholders and receiving YES or NO answers. After some frustration, I did make headway by systematically approaching various stakeholders using the channels of my former employers (i.e. ILRI formerly known as ILCA).

During the field research, I communicated with various stakeholders (i.e. the regional NRM Officer, Director of Research, and local MOA administrators). My project started slowly but surely. At the outset, I was made aware of some legal concerns regarding publication of the results of the study. I however managed to convince MoA and other officials of my academic aims, which addressed their concerns.

I rewrote and sharpened my proposal and got back in touch with the various people. I managed to get permission to conduct the research at the farmers association and in their fields and I began work immediately.

4.3.3 Summarizing the sequence

This section summarizes the sequence in which the empirical data was collected. I began familiarizing myself with the area and people. The aim was to build a good understanding of the local communities and to find a way to communicate effectively with them and also to gain an initial understanding of the social dynamics within the local organizations, as well as getting to know the physical layout of the field site.

I began by walking around the fields and ventured out into the community to conceptualize the surrounding area. Since understanding the main NRM activities is important, I shifted my focus to understanding the indigenous communities. I also made efforts to identify and locate the key players within the farmers association and their relationships with the MoA and APIK. However, neither the farmers association nor APIK or MoA was my primary interest. I wanted to learn about the informal social relationships in the village.

Once I was familiar with the area and managed to identify some IK practices in the community and some well known local personalities, I began to introduce myself and engaging in initial conversations. This established my relationship with the community and the local association but I had to be very careful until I was fully accepted and people were no longer afraid of my intentions.

In the initial weeks, I would just wait around at the farmers association and the APIK office and begin informal conversations with the local people who were participating in various natural resource management activities. This was a natural approach where I simply stayed around and asked questions about what people do and why they visited the farmers association centre etc.

As I learned more about the surrounding areas and the indigenous people, I selected knowledgeable key informants, based on their willingness to share their experiences and knowledge. As Bernard (1995) suggested, while this approach is less rigorous than surveys, this type of approach is typically used for locating key informants in ethnographic research.

My early weeks in the research consisted mostly of informal interviews and observation of various NRM activities with the aim of building a rapport with the informants and discovering the lived experiences of the participants. However, the data I managed to collect during this initial stage was quite unfocused. Nevertheless, I continued to collect every piece of information that I thought may become relevant.

Here my aim was to start engaging with the main stakeholders (i.e. indigenous communities) and then to follow this up with other stakeholders, namely the government and their development agencies; agricultural/environmental education institutions and research institutions and other development partners such as local/international NGOs.

During the empirical data collection, I regularly examined the data, in a cursory analysis, looking for keywords and phrases but without much close or critical interpretation. My plan was to learn as much as I could about the indigenous communities and their knowledge practices, and to discover themes worthy of more intense investigation in the coming months. These keywords and phrases were invaluable for reformulating my interview questions and were also very useful during the data analysis.

A second technique that I used was a log book. As I thought about questions that needed to be asked or people that I needed to meet, I recorded this in my log book. This document became my 'to do' list for activities that I needed to conduct, questions that I needed to ask, and practices that I needed to observe. Recording my plans helped me to focus my plans for each day in the field.

After three weeks in empirical data gathering, I collected further data in a systematic way as I was familiar with my surroundings and I was fully accepted as an independent researcher by my informants. This particular period was very productive as I was spending the days with observation and the nights filled with writing and summarizing my field notes.

After a further three weeks in the field, I took a break from data collection and started to reflect on the insights gained up to this point. It was around this time that I had a 'breakdown', as it is known in ethnographic research Agar (1986). This is a time when the researcher has to re-evaluate some of their basic assumptions because of the data that they are collecting. I started the study with the intention of investigating whether IK still existed outside of the minds of elderly villagers. I expected to find IK lingering at the periphery of village life and becoming increasingly obsolete.

My 'breakdown' was the realisation that IK is still central to the indigenous people and features remarkable examples of innovation (recounted in the next two chapters that describe the findings). Rather than being a dying corpus of old knowledge, I was surprised to find that IK was being reinvented and extended by farmer-innovators. However, I also found that, as well as being highly important and very much 'alive', IK was also under threat from various social and economic trends. Such 'breakdowns' of assumptions are also mentioned by Schultze (2000) and Surendra (2008) in their ethnographic studies.

I then re-thought and re-planned my priorities for the time remaining in the field. I returned to the field refreshed and more focused on exactly what kinds of further data I had to collect. I had specific topics that I needed to discuss with my informants, and I found myself spending less time just waiting around. I attended numerous meetings and continued observing the everyday occurrences at the farmers association, the APIK centre and MoA bureau.

After a total of eighteen weeks in empirical data gathering, I reached what I felt to be a saturation point and I began to lose interest in taking further notes – perhaps, it was time to close down and go home. I let my hosts know that I was leaving, and expressed how much I appreciated their hospitality. I held an additional meeting with the farmers' association members, APIK and MoA officials to make arrangements for follow-up interviews to discuss the research findings. This dialogic approach in which the informants are given the opportunity to review and critique the findings was my attempt to strengthen the authenticity and accuracy of the final portrayal of results.

4.3.4 Detailing the data collection and analysis procedures

This section details the manner in which texts were collected, analysed, and interpreted to answer the research questions of the thesis:

- How do different systems of knowledge such as IK operate around natural resource management?

- How do different categories of social agents associated with different systems of knowledge engage in the process of deliberation of NRM in Ethiopia?

However, as the research progressed, the questions were amended and my questions were geared to find answers to the following questions as well:

- What is the relationship between weakening systems of IK and degradation of natural resources?

- Who are the main stakeholders and what role do these stakeholders play in order to address the degradation of natural resources?

- What role have government based initiatives played in sustaining/eroding these systems of knowledge?

4.3.5 Identifying stakeholder participants

As Fontanna & Frey (2000) suggests, there is no single way to go about selecting and gaining access to participants. In a way, this gives the researcher freedom to develop an approach to present himself to the participants in such a fashion as to conduct productive interviews with all the key individuals without alienating anyone.

The aim in selecting participants was to achieve a cross-section of actors and perspectives. I therefore chose potential participants in a number of different ways but strictly based on the stakeholder groups identified at the research planning stage:

1. *Indigenous farmers*

2. *The government and its development agencies and other regulatory agencies*

3. *Agricultural & environmental education institutions and other research institutions*

4. *Donors and local/international NGOs*

Stakeholder Groups	People/organizations visited
Indigenous farmers	Indigenous farmers & other community members at Debre Berhan and Ankober
	Indigenous farmers and other community members at Sululta
	Indigenous experimenters at Debre Berhan
	Voluntary Associations of Farmers members
	Association of Women of Ankober for the Protection of the Environment (AWAPE) members
Government & its development partners and regulatory agencies	Ministry of Agriculture (MoA)
	District office of Agriculture & Rural Development (DoARD)
	Ministry of Agriculture and Rural Development (MoARD)
	Environmental Protection and Land Use Authority (EPLUA)
	Zonal Agriculture and Rural Development (ZoARD)
	Environmental Protection Authority (EPA)
	Ethiopian Metrology Authority (EMA)
Agricultural & environmental academic institutions	Ethiopian Agricultural Research Organization (EARO)
	Ethiopian Development Research Institution (EDRI)
	Addis Ababa University (AAU)
	Rift Valley Agricultural Development Project (RVADP)
Donors and local national/international NGOs	Association for Promotion of Indigenous knowledge (APIK)
	Achieving Basic Education and Literacy (ABEL)
	African Union (AU) formerly known as (OAU)
	Economic Commission for Africa (ECA)
	Wolliso multi-purpose community Tele-centre
	Participatory Audio-Video Technology (P-AVT)

Table 3: *Researched stakeholder groups*

One of the selection methods was through an analysis of the network of natural resource management groups based on the above categories. Through a close examination of the various NR related plans in Ethiopia, a number of key participants were identified. These individuals were chosen because of the role they play in setting up local NR policy implementation and management. Another method used was indirect, whereby key informants were asked to recommend other interviewees. This allowed me to identify, contact and interview representatives from the key groups. The representatives of these stakeholders and their stakeholder category are identified in Table 3 above.

I then began to introduce myself by engaging in initial conversations and informal communications. This was used to establish my relationship within local communities and their associations. Other stakeholder groups, in the government, NGOs and academic/research institutions, were contacted either by telephone or e-mail to ask their consent to participate and indicating that I would contact them again to discuss my research in more detail. I then sent a consent form to those who agreed by outlining ethical issues such as: how the data would be used and how the respondents would be referred to.

I found the above approach very productive. However, some potential participants in government institutions proved to be difficult to contact. Typically, e-mails were not returned but telephone calls were more fruitful. Participants were also more ready to suggest and recommend other possible participants when they could provide a name of an organization but were unwilling to give out further contact details, not wanting to volunteer someone else to be interviewed. This approach to contacting participants reflects the focus of the research at individual, community and organizational level.

In line with the nature of the subject, the qualitative research method adopted is inherently multi-method, reflecting an attempt to secure an in-depth understanding of the phenomenon in question. As Denzin & Lincoln (1998) suggest, multiple methods, empirical materials and analytical perspectives in a single study are best understood as a strategy that adds rigour, breadth and depth to any investigation.

Once I identified the rationale and research objectives, it was necessary to select the data collection techniques. The most appropriate approach to investigate the social reality seemed to be through interviews but, to gain greater insight than that available through a single technique, this thesis adopts a multi-method approach. Sorrell & Redmond (1995) identified two techniques for investigating human behaviour and action through qualitative research: to ask questions and to observe behaviour.

According to the above authors, while no other method provides the detailed understanding that comes through engaging in participant observation, it is not practical in all situations. Furthermore, participant observation offers few insights into the feelings, intentions or behaviours and actions. A more relevant approach for me was therefore to ask questions through interviews.

As Henderson (1992) suggested, there are many advantages of the interview as a research technique but it should not be selected as the only technique without examining its shortcomings, such as the collection of biased information when there is a mismatch between what people say and what they do or really believe. Therefore, the data was also compared with that gathered through other data collection techniques, including review of the literature, published institutional documents, participant observation and government and NGO based debates and policies.

The empirical evidence was collected via unstructured and semi-structured fact finding techniques (such as interviews), document review and informal conversations with the various stakeholders: the indigenous/other local men/women farmers; the government and its development agencies and other regulatory agencies; agricultural & environmental education/research institutions and also donors and local/international NGOs staff and participants.

Background and historical data on the APIK, MoA, MoARD and EARO initiative was obtained through published documents (newspaper articles, meeting minutes, and strategic planning reports) as well as interviews with the staff.

The empirical evidence was collected primarily from the local indigenous farmers through the farmers association, which provided access to the main IK practices. I spent several weeks conducting participant observation and informal interviews in the farmers association's fields, and additional weeks conducting semi-formal interviews and informal discussions with the APIK, MoA, MoARD and EARO staff. Over the entire data collection period, I observed and socialized with my informants as much as possible.

Empirical Evidence
110 formal and informal interviews (planned and opportunistic)
200 pages of field notes
100 documents (reports, strategic plan, news articles, forms, fliers)

Table 4: *Ethnographic Data Trail*

Stakeholder group	No. of people interviewed	Percentage of people interviewed
Indigenous farmers	58	52.7 %
Government & its development partners and regulatory agencies	27	24.5 %
Agricultural, environmental academic institutions	16	14.5 %
Donors and local national/international NGOs	10	8.2 %

Table 5: *Breakdown of the interviews*

4.3.6 Observing and interviewing informants

In the study, the empirical evidence was gathered primarily through interviews and participant observation. As suggested by Bernard (1995), I had to get close enough to the informants and make them feel comfortable enough in my presence so that I could observe and record information about their lives.

Great care was taken to convince the informants that I was an independent researcher rather than a paid consultant working for the government or any other agents. I went to the farmer's association centres and their farmlands at least three days a week, but I limited my fieldwork to between two and five hours daily because I did not record interviews. Therefore, I had to rely on field notes and memory to reconstruct the activities which I thought were relevant. However, I still spent much time observing what the local people were doing and why they were doing it. Through participant observation, I witnessed and participated in the interactions as much as I could with the indigenous farmers in their own natural settings. These relations were exhibited in the mundane aspects of daily life, conversations and social practices.

As people became less curious about my presence, they took less interest in my comings and goings and my informants also became less informative over time because they assumed that I knew more. Nevertheless, as suggested by Agar (1986), I continued observation because doing so was a good means of capturing the habitual and tacit nature of practice.

Authors such as Fontana & Frey (2000) describe a number of interview types that can be used in data collection including face-to-face individual as well as group interviews and also telephone interviews. In deciding what approach was appropriate, I considered the number of participants as well as access to participants in advance.

The literature, such as Patton (1990), suggests that the way a question is worded is one of the most important elements in determining how the participant will respond. In

particular, it recommends open-ended questions that are not worded in such a way as to lead participants towards a particular answer.

Rather than reflecting a preconceived order, interviews were scheduled around the times the participants were willing to meet me. At times, I spent days and weeks organizing an interview only to have it cancelled at the last minute or people arrived very late or forgot about it altogether.

Furthermore, it was evident that most government based institutions were going through a period of transition as part of the new Ethiopian government initiatives for capacity building and business process re-engineering. During this period, members of MoA and EARO changed and so did the focus and direction of the institutions. During this restructuring period, some staff were either unavailable or not prepared to raise their opinions openly until the uncertainty surrounding their job security had reduced. Once things stabilized, the interview was often very productive.

I also learnt that there is no specific guideline when to stop conducting interviews. However, in this research, the interview process stopped when all of the key participants' interests and roles in natural resources management activities had been covered and when no new information was appearing from the stakeholder groups.

At the beginning of my first interview with each informant, I went through an introduction suggested by Lofland & Lofland (1995):

- Explain the purpose and nature of study to the respondent, telling how or through whom he became to be selected.
- Give assurance that the respondent will remain anonymous in any written reports and that their responses would be treated in strictest confidence.
- Indicate that they may find some questions far-fetched; the reason being that questions appropriate for one person are not always appropriate for another. Since there aren't right or wrong answers, they are not to worry about these and

do the best they can with them. I am only interested in their opinions and personal experiences.

- Clarify that the informant is perfectly free to interrupt, ask for clarifications, criticize a line of questioning, etc.

- Begin with an introduction in which I tell the informant something about myself - background, training, and interest in the area of inquiry.

My style of fact findings included jotting down important insights from casual conversations. This technique was used throughout the course of the study to retain rapport and to uncover new topics of interest.

My questions were focused on how my informants viewed IK and how they used it as part of their everyday life. I encouraged interviewees to relate 'narratives' of their use of IK, in order to get at the underlying processes involved. As such, I did not adopt the more recent technique of 'story telling' or 'life histories' (Lewis, 2008). Although such an approach can add to the description and texture, as well as adding an important historical dimension, making it a 'good ethnography' (Geertz, 1988), I was concerned about getting too much irrelevant data. Story telling and life histories are probably a good way of getting 'terse' Europeans to expound their thoughts but in the village of Debre Berhan, once you have the trust of the locals, they tend to speak at great length (and with lack of focus) anyway.

In fact, in many cases, their style of responding to questions concerned recounting particular anecdotes or stories, even though I did not adopt this technique explicitly. However, on reflection, I would certainly be prepared to experiment with story telling in the future as it constitutes an interesting epistemology.

I kept my interviews to 30 minutes in length and relied on my ability to recall the conversations. During the interviews, I focused by jotting down key phrases that I would use to jog my memory. Immediately after each interview, I looked over my notes and wrote down everything that I could recall. I would jot down field notes on the interview

itself, insights and reflections about the interview. An entry for scheduled interviews was then added to the log and the personal profile that I created for each informant. However, the overwhelming majority of my interviews were opportunistic, casual conversations.

During each interview, I tried to remain friendly, maintaining a sociable chat and making sure that all relevant and important questions I had were answered by ensuring that the participants felt as comfortable as possible. This approach was vital especially when interviewing indigenous women. Women were harder to pin down, as they were busy with their endless domestic responsibilities and at times they seemed to be uneasy with the male dominated Ethiopian culture.

Furthermore, I found out that remaining distant from the participant led to a poor return of information. In many cases, if I did not reflect awareness and take the lead to talk about wider natural resource management issues, the participants answered questions in a broad or general way, not getting to the 'core' of the issues.

Typically, demonstrating my knowledge was achieved by discussing technical information about various NRM issues - thanks to my past experience working for (ILRI) (i.e. International Livestock Research Institute (ILRI) formerly known as International Livestock Centre for Africa, (ILCA). Once I demonstrated my awareness of the issues, participants became more involved in the interview and actually seemed to enjoy discussing their interest and the complexity of their role, and their concerns on specific as well general natural resource management issues.

At the completion of my fact findings mission, a number of people thanked me for asking questions, as it gave them the opportunity to critically look at their role, the role of other participants, and the relationships between them. One participant commented that although his organization has a significant impact on the way natural resources are managed, he had never been asked before to articulate how the organization incorporates these issues into the actual decision-making. At the end of some interviews, I received

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encouraging comments such as: "I think you have asked some good questions"... "I am glad somebody cares and is asking those sorts of questions" ... "I am really glad because it will certainly make them [the authorities] think".

Right at the outset, I was aware that while knowing what kind of questions to ask is paramount, it is equally important to interact with the participants to understand their experiences in relation to certain critical issues. I initially thought it would better to use a tape-recorder. However, I also felt that some participants did not feel at ease and furthermore, I found that transcribing the data was very time consuming. I therefore decided against recording.

Most participants were happy to answer all of my questions and discuss all the issues openly. However, there were occasions when participants asked for certain comments to remain confidential. I also found that the key to achieving an open discussion is to actively listen and maintain good eye contact. In general most participants were very co-operative and found that some participants enjoyed describing the complexities and challenges of NRM. Some participants, especially the local indigenous communities, viewed the discussion as an opportunity for reflection on how NRM is undertaken at Debre Berhan while some, especially at the research institutions, saw the interview as an opportunity to educate and convince me their understanding and opinions of NRM problems.

4.3.7 Interpreting, reducing and analysing data

The raw data in terms of interview notes and observations were interpreted according to the underlying theories of knowledge management and the conceptual framework that categorised knowledge processes in the context of NRM. While this was relatively straightforward for the processes themselves, I also accumulated a considerable amount of valuable data concerning the content and context of indigenous knowledge.

I soon realised that the mass of data that I had collected through observation and interviews was too much to include in the thesis itself and so I had to be selective. I

decided that the interviews were relatively more important than my observations because they represented the voices of the people concerned with less of my own bias. I held the observations to one side to use to fill in the gaps among the interviews.

Focusing on the interviews, I initially 'cleaned up' the data by resolving any anomalies or ambiguities and chased up any 'loose ends' that remained. I removed any evidently extraneous material, including gossip and jokes, and structured the material from each interview so that it made sense and 'told a story'. I did not focus the descriptions solely on processes but carried forward the important content and contextual material as part of the interview descriptions.

I coded each interview according to the stakeholder group and the process types and formed a concept (or index) card catalogue, whereby each interview was represented initially by one card. Where an interview clearly covered a number of processes, or topics, I made copies of the card concerned. Then it was a case of arranging the cards in various ways to form the structure of the findings chapters. After a number of attempts, I found a structure that seemed to work and wrote up the findings accordingly. While writing up the findings, I added extra themes to the concept cards, where appropriate, in the case of key ideas or issues that fell outside the process framework.

With such a large amount of data, there was an element of subjectivity regarding the selection of the data to be used. In some cases, where I'd initially rejected some material, while writing the findings chapters I realised its relevance and had to go back to my notes of the original interview to salvage the material concerned. In other cases I rejected material while writing because it then became clear that it was inaccurate or unclear. I found that the writing process itself forced a certain order or narrative on the data. There is a trade-off here between readability and comprehensiveness that all researchers have to make.

The analysis itself was relatively straightforward as the stakeholders and process types were fairly well defined in advance. However, as always, when applying a theoretical

framework to 'real world' data, the coding process was to a certain extent subjective. Some processes that I observed did not easily fit into a single category but tended to straggle across categories. Other processes didn't seem to fit anywhere and required further consideration as to whether they were unrelated and should be discarded or whether I had originally misinterpreted the data or the framework. Again, I was able to structure the analysis using the concept cards.

4.3.8 Ethical issues

Ethical issues such as confidentiality and who would have access to the data were outlined in an information sheet given to each participant, along with the consent form, prior to the interview. I also brought copies of the information sheet and consent form to the interview. Before the commencement of the interview I ensured that the participant understood the ethical issues relating to the research and consented to participation. At this time, the participants were also given an opportunity to discuss any issues about confidentiality that they thought may not have been fully addressed.

Information regarding confidentiality was provided prior to the interview in order to protect participant confidentiality and, given the sensitive nature of research into stakeholders' relationships and the politics of natural resources management, I decided that participants would not be identified within the body of the thesis unless agreed otherwise.

This decision was made to encourage participants to be open in discussing sensitive issues, and to provide confidence that they would not experience negative consequences for participating in this study. The participants did not typically raise ethical concerns with the exception of one participant who was concerned about confidentiality and who sought clarification as to how the information he and others provided would be referred to in the thesis. Other participants provided their name and stated that they did not mind their name being mentioned. Therefore, based on participants' wishes, I mentioned some by name within the thesis.

4.3.9 Limitations of the study

As discussed above, this research is subject to the limitations of the interpretative approach in terms of generalisation and also the influence of my own bias. This can be traced to the research focus, the choice of the framework adopted and the research method. Having direct access to the research site resulted in the collection of valuable information but created the problem of subjects being conscious of their behaviour in various situations. Being conscious of these problems, a triangulated approach was adopted in data collection, using multiple sources such as interviews, observation, printed documents and informal meetings.

Another limitation is the duration and geographical location of the chosen field site. Although I am an Ethiopian by birth and call myself Ethiopian, I work, live and raise a young family in London. This meant, I had severe restrictions on the time I could spend at the field site. I therefore feel that I did not get to spend enough time with the indigenous communities in order to see all the IK based innovations in action and to follow through all the implications. Furthermore, I would have liked to have the opportunity to communicate with other indigenous groups.

In addition, the pragmatics of arranging the field research, as well as domestic and other commitments in London, meant that I was unable to spend as much time as I would have liked in preparing the study and learning more about the indigenous culture before engaging in the field.

These limitations prevented me from going more in depth into the various issues that interested me. Nearly all the subject matter I covered was extremely stimulating, and I wish I could have painted a clearer picture to my readers, so that they too could share the excitement of the learning process I have gone through.

4.3.10   Appraising ethnography and the research design

Unlike positivist science with its deeply entrenched tenets of what constitutes rigorous research, a comparable body of commonly held beliefs does not exist for interpretive

fieldwork. However, Myers (1999) provides four principles (see Table 6 below) that offer useful guidelines.

Principle	Description
Has a significant amount of material been collected?	The hallmark of ethnography is participant observation over a reasonable length of time. The researcher must demonstrate evidence of his involvement in the organization.
Is there sufficient information about the research method?	As the ethnographer is the primary research instrument, the researcher must demonstrate the 'validity' of his findings. It is important that the reader knows what the researcher did and how.
Does the author offer rich insights?	Because of the intensive nature of the ethnographic approach, the ethnographer must demonstrate a high level of engagement with the informants in the field. The ethnographic text must be believable and plausible, and challenge or contradict conventional wisdom and commonly held assumptions.
Is this a contribution to the field?	The ethnographer's main challenge is to convince the reader of the worth of the study. This can be judged by the extent to which the author provides new insights to the research community.

Table 6: *Guidelines for Evaluating the Study - adopted from* Myers (1999)

Taking each of these guidelines in turn:

Amount of material

- As noted above, the data collection involved 110 interviews and countless hours of observation over a period of four months, augmented by large amounts of documentation in terms of research reports, internal and published studies from organizations such as MOA and APIK, press clippings and other secondary material.

Information about the research method

- Covered in depth in this chapter

Rich insights

- These can be found in the following three chapters which recount the findings and analyse them in detail. One insight that can be mentioned at this stage, which

does challenge conventional wisdom, is the extent of innovation within the indigenous community.

Contributions

- These are detailed in the concluding chapter.

Prasad (1997) argues that writing believable texts is the key consideration for ethnographers. For this I employ Golden-Biddle & Locke's (1993) conventions (Table 7) used in prior IS research (Schultze, 2001; Walsham & Sahay, 1999).

Epistemic Value	Authenticity	Plausibility	Criticality
Underlying Questions	o Has the author been 'there' in the field? o Has the author been genuine to the field experience?	o Does this make sense to me? o Does the study offer something distinctive?	o Does the text activate readers to re-examine assumptions underlying their work?
Research strategies	o Particularizing everyday life o Delineating the relationship in the field o Depicting the disciplined pursuit and analysis of data o Qualifying personal biases	o Normalizing unorthodox methodologies o Drafting the reader o Legitimating the atypical o Smoothing the contestable o Differentiating findings o Building dramatic anticipation	o Carving out room to reflect o Provoking the recognition and examination of differences o Imagining new possibilities

Table 7: *Ethnographic Portrayals – Adopted from Golden-Biddle & Locke (1993)*

In terms of *authenticity*, I was certainly 'there' for four months and I have done my utmost to be genuine to the field experience, within the limitations of my biases mentioned above. I have focused on everyday life within the indigenous community and attempted to describe and analyse what I observed in a disciplined fashion. Regarding *plausibility*, the study is distinctive in providing an information systems/knowledge management perspective on indigenous knowledge while fitting the research approach to the particular context in such a way that I believe is acceptable to readers.

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Finally, in terms of *criticality*, I believe that the thesis is sufficiently insightful to make readers question their earlier assumptions about indigenous knowledge within farming communities in Ethiopia and imagine new possibilities.

Summary

This chapter describes the research approach, ethnography, that I believe was most appropriate to understand the wider NRM issues and to explore the indigenous knowledge of the local community around Debre Berhan, Ethiopia. It presents a discussion of ethnographic research in terms of its theoretical underpinnings, as well as relating this study to similar ones in the information systems literature.

The chapter describes the research design in terms of how I operationalised the ethnographic approach to my particular study. It recounts how the study was staged, in terms of gaining access, data collection and analysis. It also shows in detail how the interviews were carried out and how ethical issues were covered. It highlights my own personal bias and other limitations of the research before evaluating the research design according to the accepted criteria of ethnography.

As a postscript, I can assure the reader that, in carrying out the data collection, I followed the practical 'rules' for ethnography, recommended by Myers (1999):

- Write up field notes regularly
- Write up interviews as soon as possible
- Regularly review and develop ideas as the research progresses.

Chapter 5 - Findings *(Part one)*

5.1 Introduction

The extensive data collection involved 110 interviews with a wide range of people from indigenous farmers to bureaucrats in Addis Ababa. These resulted in a considerable quantity of data, leading to a variety of findings. For ease of access and readability, these have accordingly been divided between this chapter and the following one.

This chapter records the views and opinions of the interviewees, who represent all the stakeholder groups involved in NRM related activities and echoes their voices as well as I am able to. Hence, the chapter contains the views of indigenous farmers; the government; agricultural and environmental education and research institutions and local NGOs, although priority is given to the farmers.

The chapter begins with the nature of indigenous knowledge (IK), according to the views of the local stakeholders. This serves to complement the Western view of IK, which has been recounted in the literature review. This is followed by a description of various local examples of IK that I encountered in this research with special attention paid to local innovations. I then address the relevance of IK through a narrative of a failed IK initiative before presenting the views of stakeholders concerning the relationship between IK and NRM, and IK and scientific knowledge.

The chapter thus comprises the following sections:

- Local views of indigenous knowledge,
- Examples of indigenous knowledge,
- Indigenous innovation,
- Relevance of indigenous knowledge,
- Indigenous knowledge and natural resource management,
- Indigenous knowledge and scientific knowledge.

The following chapter goes on to present the findings concerning the various processes involved in the creation and dissemination of indigenous knowledge.

5.2 Local Views of Indigenous Knowledge

According to various indigenous people, four factors have to be present for a person to be recognized locally as knowledgeable: intelligence, experience, communication and putting information into practice.

One group at Debre Berhan said:

"…. being knowledgeable about something means knowing its value and its use, holding its secrets and showing a sustained interest in it".

Fifteen indigenous farmers (about a quarter of this stakeholder group) specifically considered knowledge to be a gift from God and another five stated that it comes from experience. The others felt knowledge also comes from being well-informed and having gone to school, although they considered this knowledge to be 'artificial' in some circumstances. This suggests that around half of the farmers felt that a combination of IK and 'school' knowledge was desirable.

The group further pointed out:

"whatever the source, a person must use the information to be recognized as knowledgeable. For example in the case of medicine, a person will be recognized as a healer if he or she is capable of curing diseases. Thus, the knowledge of a healer is revealed through his/her actions as a healer. Or, a person who has planted many species of trees and then takes good care of them will be recognized as being knowledgeable about trees".

When asked about their individual versus collective knowledge six local farmers emphasized the problems of exchanging knowledge and the innate differences between people. In the words of one indigenous farmer:

"... we have diverse knowledge because we do not have the time and place to exchange our knowledge. Having meetings where we could learn from each other would allow us to have collective knowledge".

One elderly farmer said:

".... knowledge starts at birth because God does not equip everyone with equal intellectual abilities ... There is a difference in the knowledge passed on by ancestors. Whether someone becomes a farmer, blacksmith, healer of human or animal diseases or a carpenter depends on education and training provided by parents ... Some people have a feeling for experimentation and research and are constantly tinkering in search of new knowledge and technologies, others are happy with what they have and know. The wellbeing of a person or circumstances also affects knowledge ... As rich farmers with bigger land have more opportunity to experiment and acquire knowledge."

When asked about the existence and perception of IK in the region, four village elders answered:

"..in our communities we value three things in our indigenous systems:

1) Knowledge is a resource. People who lived in this area for a number of years know the rainfall patterns and when to plant crops to produce better yields.

2) The knowledge base determines the supply and distribution of food, as well as the division of labour

3) IK is essential to our very existence – we depend on it for the continuous supply of resources in order to live in a sustainable fashion."

The four elders further asserted:

".....our system is a knowledge base for us for determining food production and labour division between men and women and different age groups. IK is therefore a part of our life and our own survival is associated with it".

One of the MoA officials for the region highlighted the importance of IK for land preparation, livestock management, grain selection, planting, harvesting, grain storage etc..... The MoA extension worker for the region added that "IK is the most valuable resource the indigenous communities possess." He asserted that some vegetables had been attributed with medicinal properties but little is known about their other properties and their importance in the agriculture system.

5.3 Examples of indigenous knowledge

It may be helpful at this point to consider some examples of IK that have been encountered in the research.

5.3.1 Kebera technique

This plant-pit system, popular in the region, was invented by local farmers after the drought of the eighties in order to enhance agricultural productivity.

The leader of the indigenous experimenters explained:

> "We apply the Kebera technique to recover crusted land. Pits are dug during the dry season, organic matter is added and, after the first rainfall, the matter is covered with a thin layer of soil and the seeds placed in the middle of the pit. The excavated earth is ridged around the semi-circle to improve the water retention capacity of the pit."

The regional MoARD official added that the technique fulfils three functions: soil conservation, water conservation and erosion control for encrusted soils. The experiments suggested that the production could increase five-fold if properly executed. (This figure was also confirmed by an MoA official). The MoARD official explained that various governmental bodies and INGOs had provided support for scaling up the dissemination of the technique and the MoA and APIK also collaborated with the local farmers.

Regarding its effectiveness, one farmer from Debre Berhan Selassie stated:

".. this technique helped me to recover the land which I had abandoned for several years because of the hardened surface."

The regional MoA and APIK officials noted the implications of the successful implementation of Kebera. They stated that it demonstrated the capability of farmer experimenters for developing large numbers of significant and original technologies, suggesting that the collection and dissemination of similar technologies in other regions could be very useful.

5.3.2 Doldal technique

This technique involves building dams to trap silt and water. I was fortunate enough to encounter a well known, charismatic and resourceful, 'indigenous experimenter', who happened in Debre Berhan town proudly explained that the Doldal technique was developed by the Irob people in northern Ethiopia Tigray region. They used to be a pastoral people, moving with their goats and cattle from the mountains to the lower plains. It was not until two or three generations ago that they began to pay more attention to cropping, because they could no longer obtain enough cereals in exchange for their livestock products. Irob-land suffers from extremes of weather including: droughts and floods, frost and scorching heat, and the people, in trying to survive and cultivate crops in this harsh environment, have proved to be extremely inventive.

Over four decades, they developed appropriate methods to capture soil and water for cropping. They built a series of check dams in the seasonal watercourses and raised and lengthened the walls every year. In this way, they created step-like terraces that are now about 8m wide and up to 10m high, with about 20m between dams. This innovation is known in Irobigna as *Doldal*. It requires year-round effort over many years.

He asserted further on how the Irob-land innovation became a well known practice:

"Ok to tell you the whole story.... I came from Awo village near Alitena, the 'heart' of Irob-land and there was an old man called Ato Gebray, from Daya near to my village

Awo, who dreamt up a new idea about 50 years ago. In an attempt to catch the soil and water that rushed down the slopes, he had piled stones and earth across the stream's path in order to make a field for sowing grain.

> People in the neighbourhood saw his hard work and pitied him as they thought he was slightly demented. But he told them: 'Tomorrow you will all be as crazy as I am." The others laughed but a seed had already been planted in my mind. That seed began to grow when another Irob man returned home as an ex-soldier. He had seen traditional soil and water harvesting by farmers near Tripoli, the Libyan capital. In a valley beside his home, he imitated the North African farmers by constructing a small dam, much like the one that Ato Ghebray had built. I then observed this with interest and decided to experiment with the idea myself."

Using their indigenous skills, they continued to improve the practice. Although building and maintaining the dams and cropping in the small pockets of harvested soil and water is very labour-intensive, it will be necessary for their survival as long as they want to remain in this rugged area, to which they have a strong cultural and emotional attachment.

5.3.3 Indigenous women & their local innovations

In Ankober (20 miles from Debre Berhan), twelve indigenous women are involved in almost all the activities associated with both livestock and rain-fed farming. They have developed various indigenous innovations in livestock farming, mainly related to the feeding of sheep and the keeping of poultry, bees and cows.

Wzo Abeba Lema is a 70-year-old woman practising rain-fed farming and specializing in chickens. Her innovation consists of incubating chicken eggs in dry cattle dung. She puts the eggs with some straw in plastic bags to preserve humidity. She then puts the bags in small holes dug in the manure, covers them with a piece of cardboard to protect them and covers the cardboard with a thin layer of manure. She began experimenting in

1995 when one of her chickens, whose eggs were about to hatch, died unexpectedly. She decided to put the eggs into a pile of dried cattle dung. To her delight, after some days the eggs hatched. She has now mastered this technique and produces numerous chicks.

Other innovations relate to fig pollination techniques and the use of plastic bottles for the water-efficient irrigation of melons. Wzo Senait, who is over 60 years old, uses 1.5-litre plastic bottles to irrigate melons. She buries each bottle in the soil with the cork downwards. In the cork she makes small holes with a needle so that water is released beside the plant. She fills the bottles with water from a cistern fed by run-off rainwater.

The water infiltrates slowly into the plant roots and thus escapes evaporation. She started this innovative practice in the 1997-98 growing season. She used to carry water in a bucket, but now the Indigenous Soil and Water Conservation (ISWC) programme has supplied her with a water tap and a rubber hose to facilitate her work.

When asked the main reason for her innovation she replied:
> "We women innovate not only to increase income, but also to decrease our workload. For instance, economizing on the use of water for irrigation reduces the time and energy spent on fetching water."

Eight women asserted that their innovations grew out of their own ideas or were a chance discovery. Most of these innovations are rooted in local indigenous knowledge but adapted (in design, materials or use) to the new environment and context. The regional MoA official said:
> "the innovations of women for women have a far reaching effect because when women derive a benefit, the whole family derives benefit"

According to APIK, women's innovations are simple, practical and low-cost and therefore have a good potential for widespread dissemination. Some innovations are quickly known to all females of the community. Others remain known only to specialists. One innovator, Wzo Bere Negatu did not share her knowledge and

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experience with her neighbours, but she did agree to ISWC-Ethiopia's request that she present it on radio (in a regional program called 'Agriculture and Innovation') and later on television as well.

5.2.4 The Endod plant

Ato Mersha, a botanist who works for the MoA, explained that Endod is a plant of Ethiopian origin which is now widespread throughout arid and semi-arid tropical regions of the world. It is a drought-resistant perennial, living up to 50 years and growing on marginal soils. Its seeds contain about 35% of non-edible oil. Currently Ethiopia has about 10,000 km of Endod hedges with a growth rate of 2,000 km per year, which represents a potential of 1,700,000 litres of oil per year. The average length of these hedges, in those regions of Ethiopia where they are most prevalent, is between 2 and 15 km per village, with a maximum of up to 40 km per village.

Five local farmers stated that Endod has long been recognized as a useful plant. If carefully planted, Endod hedges not only protect gardens from hungry livestock but also reduce damage and erosion from wind and water. Traditionally the seeds were harvested by women and used for medical treatments and local soap production.

The local MoA official stated that, as far back as the end of the 1930's, the oil's potential as a fuel source was recognized. Currently, it can be used to substitute for the 'gazoil' mixtures that drive grain mills and water pumps in rural areas. The high-quality oil extracted by engine-driven expellers or by hand from the oil purification process can be used for larger-scale soap making in rural areas, giving local women the chance to gain additional income and thus strengthen their economic position. The press-cake is another extraction by-product that can be used as a high-grade organic fertilizer.

The local APIK official added that, according to their record, the value of Endod was further enhanced in 1987 by German Technical Assistance (GTZ) through the framework of a renewable energy program. This project ran from 1993 until 1997, aiming to produce an 'Endod System', which focused on the multiple uses of Endod,

rather just treating it as a fuel. The objective was to produce a renewable cyclic system that would both solve the fuel problem as well as providing other economic and income-generating effects, especially for women.

Ato Mersha, the botanist, pointed out that the government and NGOs had provided rural women with mechanical grain mills to ease their work but these mills needed external resources of fuel, lubrication oil, spare parts and maintenance. However, using locally produced Endod oil for fuel and lubrication minimized the external resources required by local villagers.

An elderly indigenous farmer stated that traditionally most women in the community used Endod as a medicine (to stop bleeding and against infections) as well as a soap to wash clothes. Normally, soap-making is very labour-intensive and only produces small amounts of soap. However, when Endod oil is used, either alone or in combination with other plant oils such as shea butter, larger amounts of soap are produced. Using Endod, they could make enough soap to sell in local markets and nearby towns and hence increase their income. Because of its usefulness, people in rural areas still plant large numbers of Endod hedges.

5.3.5 Groundnut shell manure

Dr. Getachew, an agricultural economist in charge of overseeing the rural Ethiopian development initiative, had a keen interest in IK practices and provided a good example of how IK can be transferred from one part of the country to another.

He used the indigenous practices of soil improvement as his example. He explained that crop production in dry regions is dependent on the unexpected and uncontrollable events of Keremt (the rainy season in Ethiopia). Low rainfall regions exhibit reduced yields as well as declining soil productivity. Furthermore, the cost of production using external inputs is constantly rising, making farming in these situations uneconomical. The basic challenge is to make better use of available biophysical and human resources which can

be done by minimizing the use of external inputs and by utilizing and regenerating local resources more effectively.

Soil fertility never used to be a major constraint due to the well-known practices of recycling agricultural residues. However, in these days of inorganic fertilizers and quick returns, the problem of soil management and its related constraints are surfacing. In this context, indigenous practices related to soil and water conservation, known as 'resource-conserving technologies' need to be documented in a systematic way and also to be analyzed and introduced to potential new areas. The preparation of valuable manure from groundnut shells spread on the floor of the cattle shed is one such indigenous practice followed by farmers in Wollo province (northern Ethiopia). This age-old practice is still practised by the farmers of this region.

He asserted that spreading groundnut shells under the cattle as bedding in the cattle shed generated groundnut shell manure. After the shell becomes soaked with cattle urine and mixed with dung (1-2 days), it is removed and heaped. This process continues throughout the year depending upon the quantity of material available. With the onset of the rains, manure from the heap is spread in the fields just before preparatory cultivation.

According to him practising this technique for the past two decades helped farmers reap a better harvest even during a drought year when the whole area was affected. Besides meeting the nutrient requirements of the crop, shell manure had beneficial effects such as improving the soil structure. The application of groundnut shells loosens the soil. Therefore, peg penetration for example becomes easier and weeding and harvesting become more manageable and also spreading of shells as bedding ensures hygienic conditions.

He stated that a preliminary survey was conducted to select villages based on the prevailing crops and cropping systems, and the practices related to the management of soil through organics. The majority of small and marginal farmers cultivate mostly sorghum, groundnut, and maize during the Keremt (rainy season) and groundnut again

in the post Keremt season with minimum irrigation. The farmers know the importance of organic manures and are applying half to one ton of farmyard manure per acre, whenever it is available.

One farmer from a nearby village came up with the idea of putting the soaked layers one on top of the other in the cattle shed whose floor is made of soil. The reason he gave was that the layer below would not get dry and would not lose the goodness (i.e. nitrogen). This experience showed that the farmers could still improve the practice locally.

Dr. Getachew explained that the farmers were very enthusiastic about the advantages of utilizing crop residues for recycling. In place of water for composting, which is a constraint in the dry lands, cattle urine is being used as a renewable energy source for quicker decomposition. Also, a dry environment would be provided for cattle besides acting as an absorbing material and facilitate cleaning of the floor.

5.3.6 Indigenous innovation

As can be seen from the examples above, much IK is not handed down over many generations but is rather the result of recent innovation and experimentation. In fact, some farmers are recognized locally as 'indigenous experimenters' (the literal translation from Amharic).

An MoA and MoARD officials from the Northern Region's agricultural bureau stated that, as a result of the work of some twenty agricultural development agencies across thirty programmes, hundreds of indigenous experimenters (IEs) had been experimenting totally on their own. This meant that, by the early 2000s; Ethiopia was the leading nation in terms of its per capita concentration of IEs who had been experimenting without any institutional support.

The MoARD official further explained that in 1999 the Association of Sustainable, Ecological and People-Centred Agriculture (ASEPA) interviewed 50 IEs to find out what innovations they had been developing and how these innovations could best be

disseminated to other farmers. They only counted those innovations that small farmers had developed on their own and that had not been promoted or known within the country prior to the IE's discovery. They counted 52 new innovations, predominantly related to natural resources and agriculture. An APIK official concluded that this study showed that IEs are capable of developing significant and original innovations, providing evidence that collecting and disseminating them is a useful endeavour.

These innovations were documented on an APIK database and classified as:

Category A: innovations that seem valuable enough in terms of farmer benefits accrued and width of applicability among other farmers to render them worthy of further validation and potential dissemination.

Category B: innovations that might be worth validating

Category C: innovations that are probably not worth disseminating.

The APIK official stated that, of the 52 innovations developed, 28 had been classified as Category A, 13 Category B, and 11 Category C.

Two IEs asserted that although they may be aware of certain types of technologies they could work with, they may not perceive them as being of a very high priority. For instance, they were aware of the profitability of tree crops but felt that the payback would take too long and there were other technologies with a quicker payback.

An MoA official provided the following examples of innovations developed by the IEs:

- A solution of leaves from a eucalyptus tree was found to be very good as a fungicide for tree nurseries in addition to the traditional method of boiling the eucalyptus leaves to treat colds and flu (similar to the Vicks pharmaceutical product extracted from eucalyptus leaves).

- One farmer found he could disinfect the soil in a nursery by cultivating the soil well and then covering it with clear plastic so that it heated up thoroughly under the midday sun.

- Another IE noticed that leaf-cutter ants did not like living near neem trees. By planting neem trees immediately over several troublesome nests of leaf-cutter ants, he was able to get rid of them (they moved their nest elsewhere).

- IEs observed that some aphids died if they dried out. They therefore tried using wheat flour diluted in water to spray on fruit trees in their tree nurseries, and found they could control aphids and other similar sucking insects fairly easily this way.

- Sugary and slightly salty water, applied to the growing tip of the plant, was tried successfully as a way of controlling the corn borer.

- Foliar fertilizers were developed using either animal manure, the leaves of several common weeds, or even wood ashes (the last one also proving to be very useful in disease prevention).

- Both spraying crops with wood ashes dissolved in water, as well as placing wood ashes around the stems of plants, have been found to control plant diseases.

The MoARD official pointed out that these discoveries are low-input, environmentally friendly or ecological innovations and, in many cases, totally organic innovations that benefit the planet. Similarly, the APIK official viewed these innovations as highly appropriate for poorly resourced/capitalized villager farmers. By and large, they are cheap and inexpensive as they use locally available resources, they do not increase risk, they provide fairly quick, recognizable returns, most are highly cost-efficient, and most are fairly widely applicable too.

5.4 Relevance of indigenous knowledge

Much like scientific knowledge, IK needs to be of continuing relevance to the indigenous people, if it is to be used. Just as IK can be characterised by innovation, as the examples above show, it can also demonstrate obsolescence. This section recounts the example of medeb (raised fields) where an attempt was made to reintroduce an unused and overlooked indigenous technique but this attempt was unsuccessful.

Ato Ayele, an agronomist, explained why this raised field irrigation system was reintroduced and how it worked. Northern Ethiopia (which includes Debre Berhan) is prone to flooding, and thus difficult to cultivate. In this situation, raised fields made up of huge amounts of soil are more effective. Medeb are elevated platforms of earth, 1 to 20 metres wide, ten to hundreds of metres long, and 0.5 to 1 metres high. Digging out the earth for the platforms provides the opportunity for canals to surround the fields.

According to archaeologists, medeb has a long history in the region. Farmers began constructing raised fields at some point before 1000 BC. Raised field agriculture thrived in the northern regions of Ethiopia during the Axumite civilization but fell into disuse around 1100 AD. Most of the fields were later converted into pasture and then became government cooperatives in 1978 when the military government came to power

The local farmers' association leader stated of medeb:

> "Medeb resolved many of the problems that affect our day-to-day activities – especially at high altitude. The approach combines the rehabilitation of marginal soils, drainage improvement, increased water storage and minimising the effects of frosts. The raised platform allows us to double the depth of topsoil for crops, and provides dry surfaces in the wet and often flooded lake and river terrain.

> The water-filled canals adjacent to the platforms provide moisture during the hardship period i.e. droughts. Sun heats the water in the canals during the day, which protects the crops against the killing frost that is often present at high altitude".

These effects were confirmed by an official from APIK and are documented in the APIK database.

Following an apparently successful experiment, Ato Ayele stated how he and some colleagues had begun a small-scale development project to rehabilitate raised field agriculture in a few indigenous communities of the Lake Tekeze basin, in Northern

Ethiopia. By the late 1980's four NGOs and two government agencies also began to promote raised field rehabilitation projects by providing funding and assistance for their rehabilitation. It was estimated that farmers in this region rehabilitated between 500 and 1,500 hectares of raised fields in the years before 1990. A restoration project supported by CARE-Ethiopia began in 1991 to continue using the irrigation in northern Ethiopia.

However, these projects were inefficiently run and proved to be costly to the government and NGOs. There was also a tendency by local farmers to abandon the management of the raised fields despite the technique's effectiveness for production. According to Ato Ayele, this was because of competing demands for labour, indigenous fallow cycles (and the corresponding competition with livestock) and political instability exacerbated the problem. Raised fields were not a structural and institutionalized part of agricultural life in northern Ethiopia before their rehabilitation at the end of the 1980's.

The MoA official argued that this traditional irrigation technique had been re-introduced into farmer communities after centuries of disuse and was not deliberately ignored by the farmers who knew that raised fields could improve the crop yield. Furthermore, he suggested that because both RONE (Rehabilitation of Northern Ethiopia) and CARE's projects were financed by a combination of national and international funds, this led to farmers remaining financially dependent on these organizations to continue raised field agriculture.

A local farmer's association member agreed that the expectation of continued funding of these projects resulted in limited motivation from the farmers themselves to consolidate their knowledge of how raised fields were built and managed. The MoA official stated that when the outside funds were suspended there was not a sufficiently solid justification and foundation in the community for the raised fields to be maintained. He concluded that the abandonment of raised fields and the inefficiencies of NGO participation demonstrated that any activities in a community were more likely to bear fruit "when they are initiated and maintained within the community itself rather than promoted by detached third parties".

5.5   Indigenous Knowledge and Natural Resource Management

The relationship between IK and NRM was sought at Debre Berhan and it was observed that some farmers actively innovated in order to improve their natural resource base, which in turn improved their plant/vegetable production. It has also been learned that these innovations were used by the villagers to compensate for the lack of modern agricultural inputs, such as fertilizers and pesticides. This research therefore deepened the enquiries to focus on how the indigenous population were attempting to improve soil quality.

According to six village elders, prior to the 1970s, they used to predominantly produce traditional vegetables, such as potatoes, onions and carrots for their own local consumption. At that time local farmers did not produce 'exotic vegetables', such as cauliflower, cabbages, tomatoes and lettuce which were produced on plantations and mainly consumed by foreigners or city dwellers.

According to one APIK official, these traditional vegetables were grown because:

i)   While some of these plants were cropped, others were readily available and harvested in their natural environment, lending some support to the idea of their 'indigenousness'.

ii)   Many of these plants had been consumed for countless generations, signifying their importance in local culture. In some instances, the fruit, leaves and roots of a plant were all consumed.

However, after the Second World War, farmers had started producing fruits and vegetables such as oranges and pineapples for commercial purposes. Three village elders stated that the previous two governments used to encourage them to produce exotic fruit and vegetables as a cash crop and this practice still continues with the current government with more and more land allocated for government preferred farming.

According to an MoA official, after the overthrow of the feudal system of Emperor Haile Selassie, the population living in Addis Ababa and other cities increased greatly,

drawing in new residents from the countryside. This increased the demand for traditional vegetables and resulted in a number of popular varieties being grown as cash crops for the urban markets. These migrants preferred traditional vegetables, which were also cheaper than exotic ones. They are also an important source of nutrition for the vulnerable urban (and rural) poor, being rich in vitamins A, B and C, proteins and minerals that are needed for normal growth.

Seven village elders explained how the farmers grew up to twenty different varieties of traditional vegetables for household consumption as well as cash-crops. Together with exotic fruits and vegetables, the proportion of land allocated for traditional vegetables with a commercial value has steadily increased since the 1970s, although the premium prices of exotic fruits and vegetables attracted greater land allotment.

A group of indigenous people stated that despite selling both exotic and traditional cash-crops at the market in Addis Ababa, most of them did not have enough money for agrochemical inputs, such as fertilizer, pesticides, herbicides and fungicides. They spent the bulk of their income on education for their children, health services, groceries and other commodities that are not produced in the area. Only a few farmers could afford to purchase and apply agro-chemical inputs and they did so sparingly and predominantly for exotic vegetables. Most indigenous farmers had to rely on local resources to substitute for agro-chemical inputs.

The local MoA official commented that manure, which they often used as a substitute for chemical fertilizer, was scarce. The political uncertainty and subsequent conflicts that engulfed the country during the two decades after the overthrow of the Emperor had decimated the livestock herds. Although the farmers were rebuilding the herds, manure was still scarce and a more readily available local alternative was required. One alternative, the periodic resting of soil, was a good strategy to maintain soil quality and to restore nutrients. However, the indigenous farmers seldom practised this method because of their intensive farming systems and the need to maximize the use of their small plots of land.

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The local MoA official explained how in collaboration with the indigenous farmers (especially with the indigenous experimenters) and through a process of experimentation, they found that by reworking organic plant matter into the soil after harvest, they managed to improve the nutrient content of the soil. They found that vegetable crops planted in soil in which organic matter had been reworked had a higher yield than the same crops planted in soil which had not been treated.

After further experimentation, they concluded that when the organic matter of traditional vegetable crops was reworked into the soil, the subsequent yield was greater than when organic matter from exotic vegetables or other crops was used. They also realised that uprooting the entire plant, as opposed to picking the fruit and leaves, reduced the availability of organic matter.

Thirteen other farmers pointed out that they rotated various exotic vegetable crops with traditional vegetable crops because they observed that the former crops grew better when this was done. Experimenting with crop rotation provided benefits to the soil and improved the yields of crops. The MoA official explained how further experimentation led the farmers to conclude that by rotating specific exotic vegetables with specific traditional vegetables, the exotic crops grew better and produced a higher yield compared to those planted in soil that had not previously hosted the specific traditional vegetables.

An IAR (Institute of Agricultural Research) official explained how rotating green beans and tomatoes was important because the green beans seemed to add goodness to the soil that made the other two crops grow better. The green beans neutralized the soil, preparing it for the tomatoes. He pointed out that some exotic and traditional vegetables extracted nutrients from the soil, which are essential for the continued optimal growth of these crops. The rotation of specific traditional and exotic vegetables seemed to replace lost nutrients, resulting in better yields of both crops.

5.6 Indigenous Knowledge and Scientific Knowledge

During the field research, it was learned that the National Metrological Services Agency (NMSA) have been making an effort to assess and evaluate the weather forecasting abilities of the indigenous communities. I wanted to understand how the efforts of the NMSA, which rely heavily on modern technology, can work with the knowledge and experience of the indigenous communities. I therefore approached the National Metrological Services Agency (NMSA) and one official Wzo Marta to discuss their activities. Sululta is a village in Shewa province where most inhabitants draw their livelihood from rain-fed farming of grain and leguminous crops, combined with some livestock production, petty trade, and labour migration to Addis Ababa.

The official Wzo Marta emphasised that in recent years meteorological science had made enormous progress in predicting the climate. The realization that sea surface temperatures influence global atmospheric circulation enables scientists to formulate forecasts of seasonal rainfall. These are presented as the probability of total seasonal rainfall being above normal, below normal, or normal compared with a thirty-year average. In East Africa, including Ethiopia, seasonal rainfall relates to the months of July, August, and September, during which 90 percent of total annual rainfall occurs.

She explained that rather than conceiving IK and scientific knowledge as absolutely incompatible, her institution's research shows that farmers are used to operating in multiple frameworks and that they are also interested in receiving scientific forecasts because they perceive local forecasts as becoming less reliable due to increasing climate variability.

According to Wzo Marta:

> "But to effectively convey scientific forecasts we need to understand how people think about rainfall, including how they perceive and predict variability. Understanding local cultural models is essential for effectively communicating research products and development technology."

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A local indigenous farmer explained that in this region rain falls during a single season lasting mainly from June to September, characterized by extreme and erratic distribution. The indigenous farmers therefore have to decide what, when, and where to plant, according to their expectations for seasonal rainfall. They always try to minimize risk by combining the water retention capacity of different soil types and field positions with the water requirements of various crop varieties.

A local MoA extension worker stated that indigenous farmers' forecasting knowledge encompasses shared and selective experiences. Experienced (mostly elderly male) indigenous farmers formulate hypotheses about seasonal rainfall by observing natural phenomena, while cultural and ritual specialists draw predictions from speculative visions or dreams.

Wzo Marta stated that environmental indicators that farmers use to predict seasonal rainfall can be observed at different times of the year. Among the earliest and most widely relied upon indicators are the timing, intensity and duration of cold temperatures during the early part of the dry season (between October and January).

Five elderly farmers also stated about this weather phenomenon in the region and they explained that intense cold during this time corresponds to abundant rainfall during the rainy season and that, if this cold period begins early or ends late, the rains will do likewise. Following the cold-dry period is a hot-dry period (February–May) and intense heat at this time is also believed to predict good rainfall.

Another elderly indigenous farmer argued that the most common forecasting indicator is the production of fruit by certain local trees, which occurs between April and June. According to him, good yields from trees predict a favourable season. On the other hand, farmers link abundant fruit production by some draught resistant plans such as agam and kulkual to drought. The trees/plants are used as signs for the approaching rains or the presence of water. When kega like plants are fruiting, farmers know that they should get ready for planting. Fig trees grow where the water table is near the soil surface.

Therefore, they signal to herders where to dig wells to water their cattle and show farmers where they can plant water-demanding crops, such as cotton.

The local MoA extension worker added that another indicator that becomes available at the onset of the rains is the water level in streams and ponds. If it remains consistently high after the first rains, it is believed that the season will be favourable, since heavy rains at the onset are believed to be a good sign. Herders who pasture animals in the bush watch the nesting of a small quail-like bird (known as Denbit) and believe that when nests hang high on trees then the rains will be heavy; when nests hang low, the rains will be scarce.

While signs are observed throughout the dry season, it is at the onset of the rains that farmers consolidate their expectations for the rainy season. An early onset, especially with a regular succession of rains that enable good crop establishment, is the most widely considered indicator of a good season. The number of times farmers can plant is also key in evaluating the nature of a season and predicting crop performance. For example, when a drought affected the region in 1997, farmers had known a food crisis loomed ahead by the end of planting time (early August), half a year before official famine early-warning systems registered distress signals.

Four village elders also stated:

> "We are able to interpret stars' movements and the moon phases. For instance, we consider the visible phases of the moon, especially the full moon, to be more likely to be dry than dark phases because moonlight exerts a force that prevents rain from falling. Stars also signify suitable planting periods for different fields and crops. The appearance of ergeb (pigeons) in early May indicates that it is time to prepare valley bottom fields for planting. The change in the position of the chereka (moon) marks the start and end of the period for planting sorghum. The appearance of Orion in July coincides with heavy rains in spring that favour maize planting.

According to eight local farmers, although environmental signs are available to most indigenous farmers, other spiritual practices are the gifts of selected groups or individuals. One elderly farmer asserted that his brother, who is a spiritualist, foresaw the 1997 drought. Their predictions have implications for the potential role of scientific forecasts as well. His brother admitted having had dire premonitions during the dry season, but he did not reveal them.

The MoA official for the region commented that spiritualists sometimes tend not to publicize dire predictions because to do so "would be like launching a curse" against those under their authority. Verbalizing negative forecasts may lead them into an inevitable outcome by voiding any possibility for supplication and negotiation with the spirits. The failure may also undermine the credibility of spiritualists responsible for interceding between the living and the spirits.

According to Wzo Marta, Sululta's farmers recognize that both society and climate have undergone significant changes in the last few decades. Traditional leaders regret that formal education and modernization ideologies have diminished their authority, especially among the youth. More importantly, climate variability has also weakened indigenous farmers' confidence in their forecasting ability.

According to three village elders:
> "Elders in the past were able to predict the onset of rain so accurately that we could mobilize the family labour and plant on dry soil, knowing that the rains would soon follow, but now our sons refuse to go to the field until it actually rains".

However, according to Wzo Marta, this does not mean that farmers perceive government information as a threat to local culture. On the contrary, because they perceive local forecasts to have become less reliable, farmers are keenly interested in alternative sources of information.

The MoA extension worker of the region stated:

> "However, we at the MoA believe that the wealth of the IK system should be identified and appropriate mechanisms should be found to complement rather than compete with other knowledge systems such as with scientific knowledge systems. ... Since I have started working with the indigenous people in this region, the main lesson I have come to learn is that the various development partners should start by investigating what the indigenous people know and have; then, if there is a room for improvement, to develop and improve further upon indigenous technologies".

Summary

The field research and visits to Debre Berhan and the surrounding areas allowed me to collect a wide variety of expert and relevant views concerning IK for this research. In many ways, IK is 'alive and well' in Ethiopia with extensive evidence of local innovation and IK engagement by the indigenous farmers and interest in, and respect to, IK by many central and local government officials. As the village elders of Debre Berhan explained:

> "....traditional plants and vegetables are becoming increasingly known for their importance in providing food security to so many Ethiopians in rural and urban areas".

This is discussed in more depth in Chapter 7 as the next chapter deals with the my findings concerning the processes surrounding IK.

Chapter 6 - Findings *(Part two)*

6.1 Sharing IK

When the indigenous experimenters were asked whether they shared their discoveries (e.g. crop rotation) with the surrounding districts they stated that they had no formal network or farmers' association and therefore no formal means of sharing agricultural information. However, they asserted that innovations were shared informally. Three village elders also stated that a farmer would share information with a neighbour, family members or friends, who would in turn share this with their neighbours, family members and friends. Also the presence of an extension worker in the district, who occasionally convened meetings, provided an opportunity to share information. Two other farmers indicated that they had shared information with farmers from other parishes and districts when they met at the Addis Ababa market.

However, other farmers pointed out that agricultural extension services only started to reach them in the mid-1990s and they had developed, and continued to develop, a number of strategies to improve their cultivation of traditional and exotic vegetables. These innovations need to be communicated and their usefulness verified more widely.

The APIK official also argued that government researchers must consider how they can collaborate with indigenous farmers in order to improve on these local innovations.

The official went on to say:

> "Local innovations should not be regarded merely as parts of a stock of knowledge that can be extracted and simply moved to another site or transferred to another group of farmers. Information gathered by us [APIK] indicated that the use of many agricultural products and the manner in which they were produced involved various rituals and social taboos. Ignoring or overlooking these could make the innovations impractical when they are exchanged".

6.2 Achieving indigenous involvement and IK

According to one MoARD official, many parts of the government are supportive of IK and note the shortcomings of NGOs in appreciating and harnessing the Knowledge of local people.

The official, from the MoARD headquarters in Addis Ababa, asserted:

"We believe indigenous communities in Ethiopia have always maintained a certain formidable power that guards their indigenous institutions and knowledge systems, thereby maintaining some level of self-reliance. This power is based upon the capacity to resist what they do not have a voice in. We have witnessed various failures of our development partners' visions for sustainable development for the last two decades."

When asked why these visions fail, the MoARD official replied that it was not because of a lack of commitment but because of a failure to involve indigenous communities fully in the process of development. He asserted that the rural people should be regarded as actors, and not just as beneficiaries, as they have the power to resist development initiatives. He insisted that this issue needs to be considered if a meaningful relationship is to be established. This capacity for local control only happens, however, when people are allowed to work from, expand and change their own institutions and knowledge systems and let their voice be heard in activities which affect their lives.

The official believed that the potential from bringing together IK systems and natural resource conservation is immense but so are the challenges and the related dangers. He stated that the MoA intended to identify and define the dangers, so that they may be avoided, and define the opportunities so that they may be more thoroughly and solidly developed.

Ato Bekele an MOA official also stated about the progress his ministry had made and the approaches taken to achieve grassroots participation. He explained that a lot had changed in terms of clarifying the problems.

He further asserted:

> "The necessity for sustainability has accomplished what equity and basic human needs concepts, despite their efforts over several decades, have been unable to do - make the case that people-oriented, participatory development is not only preferable from a social justice perspective, but is also necessary to make it effective. However, this emerging consensus on the nature of the problems, does not necessarily indicate similar agreement on how to solve these problems, and indeed there is no such agreement".

Regarding various stakeholder involvements, he stated that the MoA had outlined and created a number of categories, classified according to the amount of control which rests with the participants. This classification is based upon the measurement of power transfer by explaining how different participatory strategies work and what they can be expected to accomplish from the perspective of various stakeholders.

He explained that for sustainable results, the critical question is: Where does the control rest? The strategy of 'mobilization' keeps control solely in the hands of people who control the resources required, and is therefore easy to initiate and manage. But this is only the case if the resource management processes adequately match indigenous styles and the output meets a strong community need, such as improved water supply.

He further asserted that the danger is that, in order to work effectively with IK systems, both negotiation and empowerment strategies must be used and sustained for long periods of time. This should not only be at the grassroots level, but at all levels.

6.3   Linking indigenous knowledge and IT

Further data was sought from Wolliso village which is about 115 kilometres from Addis Ababa where a Multi-Purpose Community Tele-centre which was built in this semi rural area in the last three years.

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Wolliso city has a population of around 50,000 of which half are women. The community uses mostly oral communication and does not have an established reading culture. Prior to the opening of the tele-centre, newspapers were only available in the next town, few miles away.

The tele-centre is part of a chain of such centres supported by the British Council through the UK Department for International Development (DFID). The deputy manager explained that Wolliso was chosen because of its strategic location, from Addis Ababa on the main highway. The overall objective of the project was to support rural development by facilitating access to information, learning resources and communication technologies to Wolliso and surrounding communities and to support improved medical services through ICT. The low agricultural growth in the area had been attributed, among other things, to poor research-extension and farmer linkages and ineffective technology delivery systems, including poor or inefficient information and communication packaging and delivery systems.

He further explained that the functional role of the technology included Internet, e-mail, telephone, fax, library, and photocopying, as well as other services for young people. While the tele-centre aims at serving the entire community, it focuses particularly on the following groups: youth, medical workers, teaching staff, farmers, local and other government workers. The content and programme of the tele-centre has therefore been tailored primarily towards meeting the needs and aspirations of these groups.

He claimed that the participation and involvement of the local communities, whether they are indigenous or not, is central to the implementation of the tele-centre's activities. Since it was started, the community has been at the centre of the planning and execution of all activities.

A local committee was elected from and by the community representing each of the core target groups and the aims were to:
- supervise the tele-centre's daily activities

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- mobilize the community to participate in all activities and programmes, and
- steer community ownership programmes and involve the community in any activities that promote the sustainability of the Tele-centre, including organizing fundraising activities.

In terms of benefits to the local communities, he suggested that the local community now has access to various electronic and other library materials that provide them with all the information they require. The internet, telephone and fax services are being utilized to conduct local business activities and the computer training has provided jobs for the youth, who now have access to national and international journals and books.

Regarding meeting the needs of the indigenous farming communities, he asserted that, although progress had been very limited, with the help of the MoA and MoARD, some farmers' associations had begun to engage in online trading and used the tele-centre to receive and disseminate information about various farming techniques and crop prices. The tele-centre had begun to implement an IK programme in collaboration with indigenous farmers, which could be utilized as an effective focal point to conduct community to community exchanges. Farmers are now requesting the market rates and general market trends regarding the crops they grow.

The local MoA representative added that his ministry aims to use the Wolliso tele-centre to find ways to:
- increase overall agricultural productivity
- support agricultural extension workers in providing information and guidance to the farming community
- directly link research work and farmers' units, thereby enhancing the flow of information from both sides.

The deputy manager asserted that international, national and local institutions would be linked to the tele-centre as the hub in order to provide agricultural consultancy in the

form of agri-counselling. The tele-centre also provides a forum for experimentation on the use of ICT to deliver timely agricultural information to those who need it.

When asked how specifically the indigenous community would be served by the tele-centre, the deputy manager explained that from the beginning, the centre established a special section in the library to gather and disseminate IK-related useful practices, which was used to increase the responsiveness of indigenous/local farmers to changes in government policy with a view to improving NRM and agricultural productivity at the regional level. They have a photographic display that demonstrates various traditional approaches to NRM and informal transfers of such knowledge.

He stated that over the last three years, through a process of trial and error, all stakeholders involved had been trained to encourage a high degree of adaptability. Several community-based workshops and study tours were organized to train indigenous farmers in order to exchange various practices and know how.

According to a British Council staff member, extension agents and some local NGOs and EWs are well-trained in the use of ICT. Relevant agricultural information is accessed and developed in collaboration with various research institutions in the country. Types of technologies and crops include post-harvest bananas, coffee, horticulture, root crops and cereals. In order to facilitate the training, manuals, information brochures, leaflets and posters have been developed.

He further commented that, in addition to agriculture, the tele-centre has developed a series of projects that utilize the knowledge and expertise of indigenous and other local communities particularly in the fields of NRM and healthcare. This includes an innovative tele-medicine programme being developed in collaboration with the Debre nearby Hospital. It is hoped that this will link local patients with doctors in Addis Ababa and other cities. This could prove to be an effective forum to facilitate the use and dissemination of indigenous and traditional medicine. In this way, the tele-centre could serve as a platform for capturing and documenting IK and disseminating it from one local community to another.

When asked about lessons learnt from the project, the British Council staff member replied that involving and consulting the community at an early stage in the planning and implementation of the project had helped to mainstream tele-centre issues into the general activities of the community. Localizing the ICT applications to a level that is understandable to all community members had helped to sell the tele-centre service as well. This was achieved through translating information into Amharic.

An APIK official also commented that Wolliso may be a successful example of transferring the maintenance costs from donors to the local communities, thereby moving towards sustainable local ownership.

Regarding the "challenges ahead" the APIK official asserted that in a new initiative like the tele-centre, there is a critical need for documenting IK. Technology offers numerous tools that could be effectively used to document the rich diversity of IK in the region. This process has begun by training researchers in various research methods and developing a methodology for data gathering and recording in a databank. This is being achieved through the use of audio-visual tools as well as traditional note-taking.

The deputy-head of the tele-centre expressed his views on the future plans regarding IK and said that the next step was to develop a framework for information dissemination and sharing. The process had begun through forging practical linkages with ICT initiatives in various parts of the country. The tele-centre had begun a plan to share documentation systems and record keeping with other tele-centres involved in the pilot programme.

Additional programmes are being developed to enhance the knowledge captured by the tele-centre, including the wider trade and other business practices. He further said that he believed that the programme would empower local traders including farmers with the ability and insight to appreciate and critically analyze their commercial environment, with a view to cultivating and controlling the exchange of commodities and expenditure. The focus will be on documenting and spreading useful indigenous practices.

6.4   Communicating IK among the main stakeholders

According to one international symposium, "Underutilized Plant Species for Food, Nutrition, Income and Sustainable Development", held in Tanzania, the link between the documentation (or capture) of IK and the dissemination of useful local technologies to indigenous farmers is generally weak. As pat of this reaeach a number of questions was raised with a various stakeholders to understand the capture and application process for indigenous knowledge.

According to an APIK official in Addis Ababa, a sizeable amount of IK has been documented, but in most cases, such information is not made available to indigenous farmers in a form they can make use of to improve their natural resource management and agricultural production. In the cases where information is available, it is often too general and/or does not relate to the targeted groups' culture and way of doing things.

I asked whether any efforts had been made to minimize this gap and the official replied that there are various initiatives. For example, the Rift Valley Agricultural Development Project (RVADP) has been working with indigenous farmers to document their knowledge related to Natural Plant Protection (NPP) and to spread this knowledge to other farmers in the area using locally relevant educational materials and farmer-led training workshops. The approach involves the local community throughout the process of collection of the knowledge, documentation and dissemination.

He quoted the example of Arsi Negele, a division in Guji Zone, in southern Ethiopia, situated on the slopes of the Rift Valley Mountains. The climate is subtropical and allows the production of a wide range of horticultural crops: cabbage, cauliflower, peas, lettuce and other various exotic fruits. An accelerated agricultural development initiative has been in operation there since 1993 with the aim of improving agricultural productivity and specifically focussed on small-scale farmers in the area.

The initiative works as an integrated agricultural development project using multidisciplinary approaches and is implemented with a collaborative effort between

government and donor agencies. The extension workers of MoA who are in charge of crop development activities in the area have already undertaken several micro-research projects on NPP involving the use of botanical pesticides; trap crops and organic fertilizers on the RVADP demonstration plots and subsequently replicated in farmers' managed plots.

Before the introduction of industrial inputs, the farmers in Negele depended solely on natural crop protection (NCP), utilizing parts of certain indigenous plants prepared in various forms for crop and plant protection and against animal diseases. However, after the introduction of agro-chemicals, farmers rapidly abandoned the traditional ways of controlling insect pests and diseases and opted for industrial agro-chemicals.

The local MoARD official stated that this was mainly due to pressure from the World Bank and IMF: the government gave subsidies for farm inputs including agro-chemicals; chemical pesticides require less time for preparation and application; and initially the chemicals proved more effective than botanical pesticides. However, the government has now stopped the subsidies and the cost of agro-chemicals is very high. Furthermore, due to ongoing campaigns on environmental conservation, farmers in the region are becoming more aware of the side effects of industrial agro-chemicals.

In collaboration with government extension staff in the area, the RVADP encouraged farmers to go back to NCP. Since IK on NPP has started to disappear from farming communities, the indigenous plants that provide the raw materials for NPP have lost their value and are also disappearing. The first intervention by RVADP was to campaign for the safe use of chemical pesticides while encouraging farmers to experiment for more effective botanical pesticides through farmer-managed trials.

The local farmers' association member asserted that most farmers involved in these kinds of initiatives were IEs (indigenous experimenters), who devoted a portion of their land to produce organic vegetables. This is because they own enough land and either have knowledge of NPP themselves or have access to local knowledge of the uses of

botanical pesticides. RVADP, using demonstration plots located in the village, also conducted experiments simultaneously with farmers. RVADP staff also helped farmers to organize and monitor the results. Farmers were trained on how to compare traditional and new methods of pest management and data collection.

An MoA official explained that, in Negele, as in many other parts of Ethiopia, extension personnel are trained to encourage farmers to reduce the use of industrial agro-chemicals due to their adverse effects on human health and the environment. However, it is hard for them to do so since knowledge of natural protection practices is limited to only a few members of the community and also because the communities have no other alternative.

One of the farmers' association members asserted that in his village most farmers believe that the botanical pesticides are there to be used by old people and farmers who cannot afford chemicals, not by young and better-off farmers. The local MoA official agreed and stated that this reluctance to use botanical pesticides is a key factor in reducing the spread of NPP.

When asked how the new policy on NPP is communicated, the APIK official asserted that RVADP developed visual materials (posters, booklets and leaflets) with very simple instructions about the use of botanicals and with illustrations in a style suitable for local traditions. The illustrations were created by local expressionist artists whose objective was to make them relevant and attractive to local tastes.

For the purpose of reaching as many farmers as possible, workshops were organized at the sub-village level and in the district primary schools. The posters were placed in public areas such as markets, government offices and local shops. All participants (volunteers), including indigenous farmers, were allocated a few villages near where they lived, where they would train their fellow farmers using posters already developed as a guide.

6.5 Documenting IK using audio video technology

I had a detailed discussion with Dr Dereje, (an Ethiopian expatriate who returned after 25 years in the USA and is an active advocate for indigenous communities' rights), indigenous people and MoA, MoARD and APIK officials.

Dr Dereje strongly advocates the use of P-AVT (Participatory Audio-Video Technology) and argues its use and process is extremely simple and the equipment required is increasingly widely available and affordable. He further argues that a lot of people in a community, with minimal education, can use video to communicate and exchange their ideas.

He stated that

- Indigenous people could easily learn how to use video equipment through games that suit their interest;
- Facilitators could help local groups to identify and analyze important issues in their community and to plan how to show this on video;
- Video messages are directed and filmed by the local groups;
- The footage is shown to the wider community at weekly screenings in a convenient setting in order to facilitate a dynamic exchange of ideas.

He stated that P-AVT is a potentially strong complement to existing farmer-to-farmer and community-to-community communication for exchanging information, such as story telling and local markets. The recorded message can be used to promote awareness and exchange ideas within the same or other communities. P-AVT provides a channel for farmers to communicate their ideas, innovations, theories and decisions not only to each other but also to researchers and development agents. The films can also be used for lobbying and advocacy purposes by sharing them with policymakers and other development partners at local, national or international level.

P-AVT presents an 'inside' view in a lively way. The message can be easily understood and can stimulate the interest of people at all levels. The video medium is easily transportable and easily shared.

According to Ato Feleke, the local MoARD official at Debre Zeit, 50 km from Addis Ababa, a good example of P-AVT was carried out in 2003, with support from various donor organizations in association with the Economic Commission for Africa (ECA), programme.

Between 2001 and 2003, ECA had set up five Voluntary Associations of Farmers (VAFs). The aim of the P-AVT activities was to help strengthen these fledgling community-based organizations. The approach was to enable members from two VAFs to communicate what was involved in setting up such an association and what they regarded as the benefits. By explaining the aims and objectives to local and national audiences such as indigenous farmers, researchers and international donors, the idea of farmer-led innovation was promoted and support for the VAF concept gained. This process also helped villagers to identify present challenges and opportunities for development and to further explore ideas for the future.

One of the main problems identified not by ECA but by the villagers themselves was that many of them had little knowledge of family farming. For more than a generation, a centralized state-farm system had prevailed, in which each person's task had been very specialized. With the collapse of the Derg regime in 1991 and the gradual deconstruction of the state farms, villagers now leased land from the state and are responsible for every aspect of the farming process, including irrigating and cultivating their land as well as growing and selling the produce in the newly-emerged free market.

Twenty-one indigenous farmers emphasized their keenness to exchange their experiences, expertise and knowledge with other farmers and to share experiences in conserving water, storing produce, drying fruit etc.

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One elderly farmer said:

> "Our knowledge is still here and theirs is over there and held by a small number of individuals. There are lots of people who are knowledgeable in our village but they only apply their know-how to their own piece of land which is no good if we all want to prosper".

Dr Dereje wanted to make a short film, involving his neighbours, friends and relatives, to explore the benefits of using greenhouses to maximize production on small household plots. He started his film by interviewing his cousin, the first in the region to build a greenhouse nearly (over 2 decades ago) and now successfully growing roses and cut flowers for the local market. His cousin explained the importance of sharing experiences since there was so much to learn.

He also emphasized the need for the farmers to access greater scientific understanding and he argued:

> "We need to analyze the composition of our soils. If we knew how to do this, we could adjust the type and quantity of fertilizer used and increase productivity by up to three times!"

Dr Dereje then arranged a filmed discussion between him and his neighbours, in which they calculate that one fifth of the total yearly income from greenhouse-grown products (which sell for five times the price of seasonal vegetables) can cover all associated costs. Dr Dereje ended his film by explaining that, despite obvious financial benefits, not many farmers can use greenhouses because of lack of funds for building materials. Dr Dereje's point of making this film was to demonstrate that locally-made videos could be used to convey information to the farmers, and that small, short-term loans should be made readily available to help them start.

According to Dr Dereje, some members of the VAFs were quick to appreciate the potential for video to record and disseminate the various kinds of knowledge more widely and to give less experienced farmers the chance to learn from the village experts,

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innovators and keepers of indigenous knowledge. Within a very short time, they were already planning and shooting their own short training films, showing tools they had developed, explaining how they were made, giving tips and advice on how to care for particular plant or tree and so on. He further commented that, in collaboration with the indigenous farmers, they also plan to make a film with a local elder who was highly regarded as an innovator and specialist in growing flowers to sell on the market.

Dr Dereje also stated that, during the process of making these short films, footage was shown to the community in evening screening sessions. The villagers (the farmers) were proud to see themselves and their neighbours in the films and felt that their knowledge and experience were being recognized and valued. These community screenings also generated a local exchange of ideas and experience and encouraged others to become involved in the P-AVT project.

P-AVT can also be used in overcoming the gender gap. According to one APIK official, in a traditional country such as Ethiopia, it is often a challenge to include women in the process of community activities. He asserted that the team that was facilitating the use of P-AVT included a female trainee, who came from Baher Dar (North Western Ethiopia)

Dr Dereje explained that as the trainee asserted that the P-AVT methods were able to achieve results in situations where other methods of participatory rural assessment were not so successful. She gave an example of the first workshop which local women attended where the women didn't want to draw anything or discuss any issues.

She stated "they (i.e. the indigenous women) were too busy and wanted to go home. But when she started to use participatory video tools, the indigenous women became very excited. They played the 'Name Game', where each person has the chance to be interviewed on film and speak into the camera. When they all watched it together, they found it very entertaining and interesting and were proud of what they had achieved"

After that the trainee also said:

> "the indigenous women became more confident and appreciated the team's efforts. Then they invited the team to their house and gathered more women. Local women were soon taking the video equipment around the village and conducting interviews with other women villagers. They also produced short films, one of which focused on the mini milk processing plant installed by ECA (i.e. Economic Commission for Africa). Milk production and processing is an increasingly important means of income generation".

According to an MoARD official, not all women know how to produce high-quality products and many are inexperienced in dealing with the needs and opportunities of a free market. Once again, video in the hands of local people was able to illustrate and share the ways in which old and new knowledge is equally important. These and many other essential aspects of village life and IK could not have been represented without the full participation of local women.

Dr Dereje described how they used the videos as workshop tools. Within a month, the P-AVT facilitator compiled an edited collection of the short videos. This version was first shown to villagers in the communities where the films had been made. It was then used in other villages as a tool to provoke self-evaluation and analyse the situation. The villagers could identify with the video messages made by people in the same situation as they were in. There was a huge applause and approval amongst the men in the audience when one farmer in the film displayed the tools he had developed for working in his greenhouses.

Animated discussions followed the part of the film when a woman describes to her husband behind the camera how they prevent flies from damaging stored grapes by smoking them with a special plant (this method was not practised, or had perhaps been forgotten, in this other village). Copies of the video were left with key people in the villages and with local video-lending shops.

The P-AVT facilitator also arranged a screening of the completed film to 30 guests in Addis Ababa, including high-level representatives from the government; other international donor agencies, embassies and other local organizations interested in promoting good NRM practices. The reaction was very positive, a lively discussion followed and several donor agencies pledged to continue supporting the development of VAFs throughout Ethiopia.

Dr Dereje asserted that a few days after the film screening, the OSCA (Organization for Security and Cooperation in Africa), whose headquarters is in Addis Ababa, invited the P-AVT facilitator to take part in a discussion group where plans were made to develop a micro-credit scheme in a number of farming communities. This was largely motivated by his film. The film was also shown to two senior officials in the MoA, who were very interested in his work and expressed their support for the continued spread of P-AVT.

Regarding the potential of P-AVT to promote local innovation, Dr Dereje argued that P-AVT is a medium based on visual and verbal communication and, as such, it has great potential to enhance indigenous means of communication - also primarily visual and verbal. Although special equipment is needed to make and show videos, a growing number of NGOs and even community-based organizations now have their own video-players and cameras which can be utilised to promote indigenous and other home grown innovations.

6.6 Promoting the integration and dissemination of IK

This section is based on an illuminating discussion with an ECA (Economic Commission for Africa) official, Mr. Abdul-Jamal, a former Sudanese agriculture official.

Mr. Abdul-Jamal began by explaining that he had been involved with a World Bank mission in early summer 2001 to three SSA (Sub-Saharan Africa) nations, Ethiopia, Sudan and Kenya and so his concerns are not only with Ethiopia but with the whole sub-region. His knowledge is based on interviews with public and private sector counterparts

involved in different facets of IK promotion. The situation in each country was different — a function of its own history and the challenges and opportunities it faces; yet there were important commonalities as well.

He stated that much is going on in relation to IK in the SSA countries, both in the public sector and among NGOs and other community-based organizations. Activities are cropping up across multiple domains such as: NRM, agriculture, education, health and other cultural affairs.

He provided the following examples:
- An NGO in Ethiopia devoted to recruiting students from across the Horn of Africa to attend seminars on the dynamics of IK and to carry out first hand research, particularly in the agricultural zone of the MoA of Ethiopia on how local farmers have adapted traditional understandings of crop fertility and production to the exigencies of commercial operations;
- A centre in rural Sudan that gathers together over 400 traditional healers to exchange methods and test the efficacy of their ministrations with modern medical diagnosis;
- The Ministry of Culture & Art in Kenya, through its "Direction of Cultural Heritage," a series of local museums devoted to preserving indigenous crafts;
- A researcher at the Natural Products Research Foundation in Djibouti (the tiniest country in the region) who has carried out, under AU (African Union) sponsorship, an ethno-botanic survey of traditional uses of plants etc.

According to Mr. Abdul-Jamal, IK now appears to be a 'hot' topic. There are sources of funding, both private and foreign aid-based, for studies and initiatives in this area, and it is increasingly politically correct to endorse related efforts. Cross-country undertakings are therefore not uncommon and the popularity of IK had initiated wider support and funding, attracting a variety of contributors.

He stated that the Ministry of Culture in Kenya recently held an international colloquium of traditional hunters from several SSA countries to discuss indigenous methods of natural resource preservation; and the NGO dedicated to the promotion of traditional medicine in Sudan has joined forces with similar organizations or created branches of its own structure in twelve other African countries. Hence, any further efforts in these countries must take careful account of what has already been initiated.

However, he cautioned that despite the increasing substance in the domain of IK in the three countries visited, it remains unevenly developed in a number of respects. Despite the creation of Ministries of Culture (as in Sudan and Ethiopia), the preponderance of activities remains with international and local NGOs and other voluntary sector organisations. The cultivation of IK is seldom part of the policy or practices of government bodies. In Sudan, for example, almost all of the experiments with traditional medicine have been carried out under private initiatives and their proponents have had limited success in interesting the mainstream medical system in these initiatives.

There is also a marked divergence between what might be called the 'hard' and 'soft' development sectors. Most IK initiatives have been undertaken in areas like health, culture and education with rather fewer in agriculture and NRM. The further one moves from the focus of social development towards engineering, finance and the more technical aspects of development, the fewer people one finds who understand the role of IK or are ready to take it into account. However, NRM perhaps is a special case which needs to be addressed properly.

He recounted some of the obstacles to the further dissemination of IK. Firstly, the use of African languages is in many cases closely related to efforts to record, develop, and incorporate IK but practices in this regard are conditioned by other issues. For example, it is typically more difficult to promote them in countries with hundreds of African languages compared to those Sahelian countries with a limited number of tongues or those predominantly Arabic speaking. Sudan, for example, must deal both with official

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(Arabic-English) bilingualism and numerous African languages and is therefore still struggling with its policy regarding the use of the latter in the educational system.

Secondly, he noted that dominant customs and culture are difficult to change and the more technical the domain the more it is tied into international norms of procedure and performance. Furthermore, IK is naturally a phenomenon where rhetoric and practice tend to diverge. More often than not, while there is a political payoff to endorsing it, there are political implications in doing something concrete about it. Nevertheless, the NGO sector provides a good testing ground for experimenting with innovative approaches before trying to incorporate the most successful into public policy.

When asked about which (and whose) IK is selected for support and promotion, he asserted that in a multicultural society, whose IK will be given prominence is a difficult question, just like the issue of which African language or languages will achieve official status. There are good reasons for advancing slowly with such decisions.

Hence, one outcome of this uneven development is a lack of coherence and coordination in the IK sector. Actors in one group do not know what those in another are doing, there are few commonly accepted standards for work, and there is a good deal of competition. This is not all bad, though. The multiple aspects of efforts at least favour the emergence of new ideas and create a variety of approaches that can be rationalised and consolidated with experience.

Mr. Abdul-Jamal further pointed out that as a result of their increasing experience with the development of IK is an increasing sophistication in understanding the various meanings and applications of IK. Based on this, he distinguished three different approaches:
1) IK as a heritage from the past to be carefully conserved and respected;
2) IK as an embodiment of a different and specifically African mode of thinking;
3) IK as a means and process for articulating what local people know, and involving them in the creation of the knowledge required for development.

The main points of these three perspectives seem to have a great potential for stimulating widespread respect for IK but examples are rare, although the language people use increasingly reflects a compound perspective. His approach is referring or having regular recourse to IK in building new models for development, rather than simply applauding it. Many people were sensitive, moreover, to the third approach, which makes IK an active process, rather than purely a question of artistic work and museums, and ties it to an agenda of popular participation and decentralization.

Regarding the challenges to future IK development, he believes that the biggest missing link in all the sites he visited lies in the inability or insufficient opportunity to inject the results of IK initiatives into the practice of local development; to move from successful forums towards encouraging experiments and actual changes in procedures and standard practice. He explained that this situation is reflected in all three countries he is actively involved in, as well as in the donor organizations such as the World Bank. IK concerns, if more frequently recognized now than in the past, tend to be segmented in specialized services or agencies that have this mission but have little effect on procedures in the working sectors of development.

At the national level, there may be a ministry or agency devoted to culture, yet operating largely in a vacuum without influence on the practical issues of wider socio-economic development. In donor organizations, programmes for the promotion of IK may flourish but intersect little, if at all, with those mainstream offices that determine aid policy and practice. Overcoming this divide remains a major challenge.

He argued that strategies and plans must be developed country by country, although accompanied by various means for cross-national exchange. The first step forward might best be a sort of sector assessment carried out by national researchers in order to identify and compare the varied initiatives under way in a given country and what is known of their results. This would serve as an introduction and criteria for prioritizing future efforts. For example of two of the powerful agents, e.g. government ministries and donor organizations, should be a part of this scrutiny, which would it make it important

to their own policies with respect to local participation in development planning and utilization of IK.

Mr. Abdul-Jamal concluded by asserting that in all three countries IK has become an increasing activity with huge potential. Support from donor communities therefore can help greatly to strengthen existing efforts, and focus on the most promising initiatives from the many now under way, but host country policy decisions must finally govern the norms of development.

6.7 Capturing IK

I visited the APIK headquarters in Addis Ababa and interviewed various people and visited their documentation centre. My aim was to understand the objectives of APIK, to discuss what they identify as IK and to understand their methods of capturing IK.

The APIK vice chairman asserted:

> "We had to admit while we all know that IK is embedded in community practices, institutions, relationships and rituals, it is often difficult to exclusively pin down due to its tacit nature. With the rapid increase in globalization, here in Ethiopia we have recognized the threat of losing IK and we put together several initiatives aimed at the preservation, revitalization and promotion of this valuable resource."

He went on to explain how the initiative came into existence. A group of Ethiopians launched a scheme to identify and document indigenous/local knowledge. Every attempt was made to examine the socio-cultural and economic activities of each provinces and different ethnic nationalities in Ethiopia, beginning with the origins of Ethiopian society up to the current time. In this process, the purpose was to study the cultures and traditional practices of various ethnic nationalities and capture, categorize and document these for subsequent preservation and publication with the aim of promoting it further. This initiative was divided into two phases: the collection of IK and its detailed validation and analysis.

The first phase has seen significant progress. Their collection method focused on the study of one region at a time. Each region took between eighteen months to two years and the entire IK collection process was conducted in four stages. The semi-structured fact finding methods, using a questionnaire as the initial information gathering tool, is a living document and has changed constantly, the last revision having been made in 2000.

Ethiopian society has slowly been changing while the experience of the APIK collection team grew during the same period. An astonishing aspect in their endeavour has been the strong desire by the elders (bearers of knowledge within the different ethnic nationalities) to preserve and revitalize their culture and traditions for transmission to the younger generation. Contrary to normal assumptions, it was the elders who never gave up on APIK. Their keenness and perseverance was the driving force in keeping the lengthy IK collection process going.

The IK collected is mainly in the form of volumes of raw data. However, some sections of the population have managed to access parts of this collection in an isolated and sporadic manner, resulting in an indirect impact.

6.8 Promoting IK

I also paid several visits to the APIK resource/documentation centre where the knowledgeable documentation centre manager further explained APIK's attempts to document all the known indigenous practices in Ethiopia.

She asserted that, at least historically, it could be acknowledged that indigenous people were rather irrelevant to libraries and that in turn means libraries are rather irrelevant to indigenous people. However, she strongly believes that libraries, including electronic documentation and access, are now very relevant to indigenous people, and indigenous people and their input are just as relevant to libraries.

The APIK documentation centre manager further explained that their documentation centre had therefore to reflect:

- the differences between knowledge for indigenous people, about indigenous people, and by indigenous people and the content of information;

- the placement of and access to sensitive information, secret, restricted and sacred knowledge, that is contained in some of the archives or in various reports etc;

- the offensive information in the historical (and contemporary) archives;

- the subject headings through which indigenous information is categorized and accessed

- the emerging trend to document and record IK which belongs to a complex oral tradition.

She stated that, maybe in the future, their under-funded resource centre can overcome all the hurdles but at the moment they feel that Ethiopia as a nation has made very encouraging progress in this field even though the use of all the documents they have is needed by a very limited number of the indigenous population.

She further stated that anyone can now understand how cynical indigenous people could be when their knowledge is all that they have left to them and when millions of birr (Ethiopian currency) are being made by pharmaceutical companies on the back of indigenous knowledge and resources without acknowledgement or compensation to the original knowledge bearers.

She stated:

> "Here at the APIK, we therefore have to increase awareness and advocate the fact that knowledge is their last resource, and sooner or later it is bound to arouse some passion".

6.9 Nurturing natural resources

Here, my specific goals were to understand the activities related to nurturing NRM in the Debre Berhan reserve in Ankober district. The natural reserve of Ankober is situated 25 kilometres south of Debre Berhan. This area of a former national forest covering roughly 25 hectares was set aside by government decree in the early 1980s in order to protect

endangered animals indigenous to Ethiopia and to shelter the migratory route of birds that follow the Red Sea coast of East Africa.

According to an MoA official of the region, the area had been severely damaged over preceding years by the effects of drought (aggravated by global warming), increased grazing, and firewood harvesting. The altitude of Debre Berhan Selassie nonetheless makes it a favourite tourist destination – especially for Orthodox Christians. But this activity has not greatly benefited local people and a growing population has put heavier pressure on a deteriorating resource base.

According to an official from the Northern Natural Heritage Bureau, although the constitution of the nature reserve helped to stop further degradation of the environment, the vegetation of the region had already been so severely damaged that more intensive efforts were clearly needed to restore its ecology and attract the sort of tourist activity that would benefit the local population.

That, in any case, was the conclusion reached by a group of women from the village of Debre Berhan Zuria, who decided to create AWAPE (the Association of Women of Ankober for the Protection of the Environment). The group was composed initially of 35 women and one man, who just happened to be present at the inaugural meeting. During the following eight years, AWAPE used first its own resources and then additional ones provided by donor organizations interested in restoring natural resources.

Measures implemented by the association included the construction of green firebreaks, replanting of native species furnished by a nursery that the women established at the same time, and organization of workshops where young volunteers from nearby secondary schools were brought in to learn nature conservation and perform much of the physical labour required for free. In addition, AWAPE members rapidly put their efforts into restoring and preserving the environment from deforestation due to the collection of firewood by the population of villages throughout the area.

The leader of AWAPE stated that they resolved on the following measures to provide alternative sources of energy and make the communities self-sufficient in firewood and cooking fuel:

1. Establishing a cooperative distribution network for wood and charcoal to regulate consumption and help their members provide for household needs.
2. Establishing a village tree nursery and a community forest to begin enhancing the supply of local firewood.
3. Organizing the collection of household wastes and trash for composting both in order to stem public health threats arising from inadequate disposal facilities and to produce compost for the nursery.

In doing so, they not only succeeded in progressively reconstituting local natural resources and restoring the natural vegetation of the area, but their efforts also contributed to the reappearance of animal species not seen in the region for years.

The AWAPE member further explained that their efforts soon reached a level where restoration of the regional environment could not be guaranteed without broader participation from surrounding villages. The programme and the example of AWAPE had, in fact, awakened an increasing amount of interest among people in neighbouring communities. Rather than simply expand AWAPE, members of the Debre Berhan Zuria association decided to encourage women in nearby villages to start their own organizations and establish their own nurseries.

Eight communities eventually affiliated with the Debre Berhan Zuria under the guidance of a commonly-elected coordinating committee, and the overall membership grew from the 35 members initially involved to over 275. Tens of thousands of new tree seedlings are now produced each year by these associations.

At the same time, the AWAPE groups added new dimensions of activity to their programme. Three complementary directions have developed, thanks in part to substantial support from the European Union and the World Bank. The AWAPE

member proudly stated that to help alleviate the poverty that led to repeated degradation of the environment, as a result their association began creating saving schemes and small irrigated vegetable farming enterprises in their village.

6.10 Communicating research results to indigenous communities

When I visited the MoA HQ in Addis Ababa, I was overwhelmed by the sheer volume of IK related hard copies of research materials at MoA information centre. I therefore approached the MoA's documentation centre in order to understand their methods of dissemination of research results to people at the grassroots level. As a result I managed to discover a project funded by USAID and the ABEL (Achieving Basic Education and Literacy) initiative whose aim is to come up with methods for dissemination of agricultural and NRM research to these lower levels. I was advised to directly approach the project participants to gain a wider picture not only about Ethiopia but also about the people in the Horn of African regions.

The member stated an active member of the initiative explained that the project involves disseminating research results carried out by researchers around the scheme for decentralization and local capacity-building. This is being done in a manner that includes both the disseminators and the target receivers in critiquing the studies, documenting and analyzing their own related experience, and drawing practical conclusions from the results. The original studies were conducted between 2001 and 2003, through previous ABEL funding by teams of African researchers in several countries.

Ato Aweke stated that this approach was innovative in a number of ways, notably by the highly developed form of subcontracting. Rather than engaging the researchers to carry out studies directed by a Western institution, the entity with the ABEL contract contracted with research teams on a fixed-price basis to propose and carry out studies on

a series of topics. The topics were drawn from a list of priority research targets established by the Working Group on Non-formal Education (WG/NFE) of (AHRDA). [7]

The aim of the policy was to invite Ethiopians and regional research teams to submit proposals on one or more of the topics selected, and to enter into agreements with those able to do research through a performance contract mechanism. This approach required the researchers to produce high quality work within defined time limits and gave them a great deal of flexibility (necessary under the uncertain conditions for research in the region) in order to decide how best to allocate the sums to achieve those ends. Strict accountability for expenditures was required ex post.

According to Ato Alemayehu (a researcher in the ABEL initiative), a number of very interesting studies were conducted, several of them spanning more than one country and including portions carried out by separate research teams, who then had an opportunity to compare results.

Subjects investigated include:
- the acquisition of skills in the informal sector of the urban economy,
- the practical uses of religious literacy,
- means for building competencies in indigenous cooperatives,
- new formulas for NGO-government cooperation in non-formal education,
- experiments in informal primary schooling.
- getting the word out etc....

He explained further and stated the main questions were how to disseminate this research to those at the local level who would use it. With ABEL funding, a series of studies on skill acquisition in indigenous cooperatives and the problems encountered in meeting their management challenges had been done in Northern Ethiopia as well as

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[7]AHRDA is a consortium of all African Ministers of Education and representatives of all principal donor agencies. It functions primarily through working groups of different sub-sectors of education.

Southern Sudan in 2001-2002. The results were compiled, written up, reported in conferences, and made available both in hard copies and via the Internet.

He pointed out that these modes of distribution did little for indigenous communities in similar situations across the region who might benefit from the Ethiopian and Sudanese experience, but who evidently did not attend professional conferences, nor had access to the Internet. Hence, the project staff decided to think 'outside the box' in developing the dissemination phase. The idea was to involve researchers in other potentially interested African countries to:

- identify studies most relevant to local problems in each country
- propose target audiences who might benefit from the research results
- develop a methodology for making people aware of the results and helping them to compare and draw conclusions from the Ethiopian and Sudanese experiences

The intermediate institutional structure to accomplish this task was the newly formed (WG/NFE) i.e. National Working Group on Non-formal Education, a consortium of public and private agencies (NGOs) involved with non-formal education and affiliated with the Association for the Human Resources Development in Ethiopia (AHRDA).

According to Ato Aweke, in Ethiopia the WG/NFE went through the entire collection of studies done by African researchers under Phase I of the ABEL Initiative and selected three area of interest to local educators:

- skill creation in indigenous cooperatives,
- the practical uses of religious schooling (*documented in APIK database*), and
- knowledge acquisition in the informal sector of the urban economy.

It then invited its own groups and other teams of researchers to propose methods for disseminating these studies in the field. Researchers took a summary of the nature and results of the study to leaders of the different cooperatives and made a first discovery.

Out of more than 100 entities listed as members of the network, only 21 were actually indigenous-directed enterprises. Out of these, the research team identified ten that would be interested in the exercise and available to carry it out. They proceeded to develop a methodology for presenting the essential nature and results of the Ethiopian and Sudanese studies to members of each of the ten cooperatives. They then gathered their leaders to discuss how the experience of these two other countries compared with that of Southern Kenya and what practical conclusions might be drawn from the exercise.

He concluded by pointing out that the activity provoked a genuine effort of self-evaluation by the groups and their brothers.

6.11 Indigenous people as partners in knowledge development

In order to understand how the knowledge of indigenous people is recognized for development purposes, a detailed discussion was held with a senior lecturer at the Development Studies Centre at the Addis Ababa University, the centre which also advises the MoA.

The senior lecturer stated that it is fashionable to talk about partnerships and stakeholders. Unfortunately, the main stakeholders, the indigenous farmers, are often overlooked in the process of the search for and development of knowledge despite their extremely rich knowledge. He further explained that most if not all indigenous people have tacit knowledge which can be shared. He believes indigenous people possess vital knowledge, especially in relation to natural resources. However, "scientists" often pre-determine ignorance largely because they have little interest in externalizing indigenous farmers' tacit knowledge.

Indigenous farmers as major stakeholders have significant differences in their objectives, concerns, resources, and levels of control and power, which render the partnership shaky at best and infeasible at worst. He argues against the objectives of 'scientists', which are generally to produce 'new' technologies which are high yielding (often for the person concerned), bringing benefits to them in terms of publications, recognition, scientific

progress, etc. For several institutions (especially international agricultural research institutions), this has been a deliberate strategy, in line with their mandate to develop such technologies.

From the viewpoint of indigenous people, any technology, especially a new technology, can be sustainable if it passes the acid tests of: (a) technical feasibility within the current/potential absorptive capacity of the indigenous farmer; (b) being relatively less risk-prone; (c) economic profitability; (d) social acceptability; and (e) environmental friendliness.

As far as he is concerned an ideal technology for indigenous farmers, for instance, would naturally be the one which, from their standpoint, combines all these virtues to the greatest extent possible. The weight given by indigenous farmers to these characteristics would vary according to resource availability, social condition, family priorities, etc.

One also must understand that there is no single technology which would be perfectly suitable and acceptable to every indigenous farmer within a region or a locality. However, it can be assured that nearly ideal 'new' technologies are likely to be those which are a refinement of existing technologies familiar to indigenous farmers, for which additional preconditions of adoption (input supply, marketing, etc.) are assured.

He concluded by saying that the development of such technologies requires learning from indigenous farmers, analyzing the reasons for their present practices, building upon IK, finding their constraints, cooperating with them, accommodating their innovative potential and carefully assessing their absorptive capacity etc.

6.12 Limitations/constraints on IK

According to an official from MoARD, many international development agencies and NGOs have renewed their efforts to provide and promote IK orientation in development planning and practice. These efforts emphasize IK systems and practices as valuable

resources in global development. However, there are a series of institutional constraints in adding value to local knowledge innovations. These institutions represent organizational structures, ideologies, adherence to particular practices/approaches, internal and external networks and explicit as well as tacit value sets and beliefs. Also, institutions follow established rules and regulations and adopt certain mechanisms to ensure the enforcement of rules.

In terms of institutional constraints, the MoA official asserted his ministry identified three major constraints:

1st: Family and community constraints:

Many local innovators face opposition from immediate family members and/or broader community members. In some cases, for example experimental agricultural plots on existing farmland, family members may not be happy to invest years of hard work as well as forgo immediate income without a clear sense of the final outcome of crop innovations. Community members do not adapt innovative farming practices unless the benefits are well-known in the short run and the innovative product is well-established in the market. In many cases, poorer indigenous farmers also do not have access to farm land for seed and technology experimentation.

2nd: Seasonal constraints:

The greatest local constraint in reviving and modifying innovative IK is seasonal factors. A group of indigenous farmers around Ankober pointed out that their investments in agriculture and herbal farm experiments have often failed due to poor Keremts (the rainy season) and consequent droughts, lack of drinking and irrigation water, loss of livestock and labour migration.

Another critical dimension is understanding the historical context within which an indigenous/traditional practice was viable, for example the size of land, land-people ratio, food patterns etc.

3rd: Formal institutional constraints:

Certain formal institutional constraints identified by community members reflect local people's lack of access to 'new social networks' such as agricultural technology and extension agencies, higher education and research institutions, financial institutions, political parties, NGOs and international organizations, as opposed to the village based and community specific traditional social networks.

APIK officials also stated that their research identified a range of institutional constraints that reflect their limited access or lack of access to established formal and informal institutions and associated social networks.

The MoA official in Addis Ababa however commented that the major limiting factor of IK is its lack of recognition and documentation. This lack of documentation and recording means that, for example the knowledge of indigenous plants and their local names is declining rapidly.

The IK system is also limited by its lack of proven scientific procedural explanations. The IK system is also in a precarious position because it depends on those who have the knowledge sharing it with others. It is also viewed by many young people as obsolete and out of date – especially when they compare it with dominant Western cultural knowledge and practices.

When asked about any limitation to their knowledge the indigenous people at Debre Berhan explained that their major problem is the recurrent droughts, and the lack of grass in grazing lands which have made it difficult to rotate grazing as is the traditional practice.

One elderly farmer added that the government attempt at urbanization is threatening their way of life and our IK system.

The leader of the farmers' association at Debre Berhan Selassie pointed out that their problem is that indigenous farming methods have been substituted with mechanized methods of farming and the crops which they traditionally grew have been replaced by cash crops.

Chapter 7 - Analysis and Discussion

7.1 Introduction

This chapter takes the findings from the previous two chapters and analyses them according to the combined framework developed in Chapter 3. The purpose of this is to draw out certain themes, based on knowledge processes, from the mass of rich data that was collected in the field.

This analysis is followed by a brief summary concerning the stakeholders and what has been learned about them through the findings. This acts as a 're-cap' for the following discussion. The latter comprises reflections on the theory and literature, based on the findings and the initial analysis, using the framework. Then, a brief discussion is provided concerning external threats to the IK system of Debre Berhan. This sets the theoretical material within a pragmatic context. Then, the chapter returns to a more theoretical perspective by showing how the notion of processes, and the process framework, can be used to reconceptualise the notion of an IK system and how it interconnects to the scientific knowledge system. The chapter concludes with some implications that follow from the analysis and discussion.

The next sections analyse the knowledge processes surrounding indigenous knowledge, beginning with knowledge creation, or innovation.

7.2 Knowledge Creation

Knowledge creation processes comprise the first category of knowledge management processes, according to the combined conceptual framework described in Chapter 3. These processes concern the various knowledge activities involved in innovation.

As can be seen from the findings, one of the most interesting and, for surprising discoveries was the extent of innovation apparent amongst the indigenous farmers around Debre Berhan. Indigenous knowledge (IK) is not only handed down over many generations, it is also the result of continuous innovation and experimentation. In Debre

Berhan, some farmers are recognized locally as indigenous experimenters (IEs) because of their desire and commitment to finding local solutions to local problems. As reported by the local MoA and MoARD officials, hundreds of IEs had been experimenting totally on their own. As a result, by the early 2000s Ethiopia was a leading nation in terms of its per capita concentration of IEs who had been experimenting without any institutional support (Personal communication from MoARD official).

As a result of experiments, 52 natural resource related innovations have been identified. The local APIK official also commented that their study showed that indigenous communities are capable of developing significant and original innovations, providing evidence that collecting and disseminating them is a useful endeavour.

Included within my own findings are a number of examples of such innovation. Firstly, the innovatory plant-pit system known as *Kebera* was invented by local farmers after the drought of the 1980's, in order to enhance agricultural productivity. Secondly, the *Doldal* technique, which involves building dams to trap silt and water, is another example. This was originally developed by the Irob people in Tigray but the innovation was transferred to Debre Berhan when one of its advocates moved to Debre Berhan. Another indigenous innovation from Wollo, the use of groundnut shell manure was also brought into the area.

Other innovations by indigenous women farmers include incubating chicken eggs in dry cattle dung, innovations relating to fig pollination techniques and the use of plastic bottles for the water-efficient irrigation of melons.

Hence, in this region at least, there is considerable evidence of independent innovation by the indigenous farmers. Some of these innovations were achieved by individual trial and error and a longstanding engagement with the local land and climate. Many innovations were facilitated through local dialogue among the farmers through informal meetings or farmers' association functions. In other words, there is evidence of the positive influence of local socialisation within knowledge creation as indicated by Alavi

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& Leidner (2001). In terms of the 'common place' for knowledge creation, in this case, it was through the regular social gatherings such as at church or the farmers association.

While the indigenous farmers were busy with knowledge creation, it is pertinent to ask about the roles and contributions of the other stakeholder groups in these processes. The government and its development agencies and other regulatory agencies provide extension workers through outreach programmes. These extension workers encourage innovation through providing up-to-date information concerning market conditions and product trends. Agricultural and environmental education institutions and other research institutions provide scientifically based advice also through the extension workers. Local NGOs also facilitate knowledge creation by providing advice based on their experience elsewhere. Of course, all these stakeholder groups conduct their own (self-contained) innovation and knowledge creation but this is beyond the scope of this study.

The anecdote in my findings concerning the versatile endod plant is an interesting example of multiple innovations by various stakeholder groups. Central government, research institutions, international NGOs and local innovators all contributed to its development as a fuel oil, medicine, soap and protective hedge for fields.

The local APIK representative emphasised that, according to their database, the value of endod was particularly enhanced in 1987 by the International NGO (German Technical Assistance, GTZ) through the framework of a renewable energy programme, after which the research programme, which ran from 1993 until 1997, focused on its multiple uses. Hence, what was originally developed as a fuel by a research institution resulted in multiple benefits, not the least of which were the economic and income-generating effects for rural women of producing and selling the soap and medicine in local markets.

However, such examples of collaborative innovation seem fairly rare and much useful work is being done by the farmers themselves, with relatively little assistance. Innovation and knowledge creation can be resource intensive in the sense that often trial and error testing is required. Hence, the local innovators would benefit from additional

funding. They would also benefit from assistance and advice concerning the marketing of their innovations, both locally and on a wider scale.

7.3 Knowledge capture

According to the framework in Chapter 3, knowledge capture comprises:

- Recognition and identification
- Validation
- Recording and documentation

Traditionally indigenous communities do not record their accomplishments, nor attach their names and patents to their inventions. This is the *raison d'etre* of this group of knowledge processes within the framework in this particular context. Although the indigenous farmers do not normally record their knowledge, the wider recognition of the value of IK has led to considerable efforts by the other stakeholder groups to try to capture this knowledge in order to preserve it and also as a first step towards its storage, transfer and application elsewhere.

As noted above, APIK has been fairly conscientious regarding the identification and documenting of indigenous knowledge. As shown in the findings, APIK has documented the 52 innovations and classified them as:

- *Category A*: innovations that seem valuable - 28
- *Category B*: innovations that might be worth validating - 13
- *Category C*: innovations that are probably not worth disseminating – 11.

An MoARD official recognised these innovations and discoveries as low-input, environmentally friendly or ecological innovations and, in many cases, totally organic innovations that benefit not only the indigenous communities but also the rest of the country and beyond. Similarly, the APIK official viewed these innovations as highly appropriate for poorly resourced village farmers. By and large, they are cheap and inexpensive as they use locally available resources, they do not increase risk, they

provide quick, recognizable returns, most are highly cost-efficient, and most are widely applicable too.

Some agricultural experts working for EARO stated that they appreciate pluralistic notions of NR innovation and knowledge creation in a wider natural resources field and recognise the socio-economic and cultural complexities of indigenous farmers in adopting new technologies. However, others appeared reluctant to accept the knowledge of the indigenous farmers as authentic knowledge in agricultural development and commented on their lack of 'well defined standards' which makes it impossible to integrate with other science oriented innovations.

This traditional lack of recognition of indigenous knowledge matches the previous emphasis on imported technical interventions relying on the use of external inputs to improve agriculture, as documented in various governmental policy and strategy papers.

Local experts asserted that these efforts were bound to fail as they were inappropriate for rain-fed farming under marginal conditions such as in Debre Berhan. Some interviewees at the Addis Ababa University Development Study Centre agreed that most rural development efforts in Ethiopia have failed to mobilize and enhance the indigenous communities' human capital. According to them, this was mainly attributable to the dominant approach of 'transfer-of-technology', based on the assumption that knowledge is created by 'scientists', to be packaged and spread by extension and to be adopted by farmers. This approach tends to deny and suppress local initiatives and innovations.

However, APIK favours alternative approaches to research and development which can capitalize on the knowledge, creativity and management capacities of local people by linking IK and external knowledge in some kind of joint exploration and experimentation. APIK officials argue that this could commence by identifying what farmers are already doing and promote action learning by farmers and other supporting agencies to develop the local innovations and complementary techniques further. Identifying local indigenous innovations would be a first step towards changing the way

development workers regard indigenous farmers and interact with them. This in turn would help development workers to see farmers as partners with something to offer, not just to receive.

As documented in the findings, there are some limited initiatives to capture the knowledge of the indigenous communities. However, as the APIK vice-chairman explained:

> "... while we all know that IK is embedded in community practices, institutions, relationships and rituals, it is often difficult to exclusively pin down due to its tacit nature....."

An interesting example of a novel approach to documenting IK is the use of P-AVT (Participatory Audio-Video Technology) used by Dr. Dereje, an active advocate for indigenous communities' rights. He argues that one of the great advantages of this type of technology is the way it can be used in a participatory manner. Furthermore, the technology is sturdy, simple to operate and becoming increasingly widely available and affordable.

There is also evidence from the interviews with the local farmers that they are very willing to share their indigenous knowledge and hence facilitate knowledge capture. This is discussed in more detail in the section on knowledge transfer below.

7.4 Knowledge storage and retrieval

While the knowledge capture of IK is clearly a difficult area with the problems of identifying, validating and documenting tacit knowledge, the physical aspects of its storage and retrieval are not especially complex. APIK, amongst other organisations, uses database technology without difficulty. Even when such knowledge needs to be held in graphics format, the falling price and increasing capacity of digital storage means that this presents few problems.

Somewhat more complex is the categorisation and indexing of the indigenous knowledge in such a way that it can be integrated with scientific information and retrieved easily. This represents a challenge when the indigenous knowledge does not easily fit into scientific knowledge 'slots' and there remains a danger that, even if the indigenous knowledge is preserved digitally, it will be ghettoised by being kept separately from its scientific counterpart. The World Bank (1998) suggests that meta-information be used to facilitate the retrieval of indigenous knowledge from databases, supplemented by indexed abstracts and directories of experts and applications.

As discussed in the findings, a particular practical case of combining scientific and indigenous knowledge concerns weather forecasting. For a country like Ethiopia, where droughts are common, such knowledge is absolutely crucial, especially concerning the onset of rain. I interviewed both farmers, who have traditionally relied on indigenous techniques for forecasting, and an official from the Ethiopian Meteorology Authority. In this context, the majority feeling was that the two knowledge systems complemented each other and both were needed, especially now that climate patterns are more fragile and unstable.

An additional complication regarding the storage and retrieval of IK concerns potential social constraints on the portability (or transferability) of this knowledge. Not all IK can be extracted and simply moved to another site or transferred to other people and places. The reason, according to APIK's experience, is that the use of many indigenous agricultural products and the manner in which they are produced involved various rituals and social taboos. Ignoring these could make the innovations impractical when they are exchanged. Such knowledge, if stored digitally, would have to somehow be suitably qualified with this additional information.

Another issue concerns access to such databases of indigenous knowledge. Whereas scientists are accustomed to accessing databases and have the requisite skills and equipment, this is not the case with indigenous communities. Although such

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communities may, in principle, be given access rights, they lack the skills, computers and telecommunication connections to take advantage of them.

For such communities, storage and retrieval using some form of P-AVT would be more accessible. Thus, video (or audio) 'programmes' of practical indigenous knowledge could be held by libraries and the knowledge 'retrieved' through the simple medium of watching (or listening to) the appropriate tape.

Furthermore, it is not just indigenous knowledge that the local farmers need to access. Dr. Dereje (the P-AVT proprietor) emphasized the need for the farmers to access greater scientific understanding and cited his greenhouse-grown products as an example and argued:

> "..... we need to analyze the composition of our soils for example. If we knew how to do this, we could adjust the type and quantity of fertilizer used and increase productivity accordingly".

One possible solution to these problems would be further tele-centres such as the one at Wolliso described in the findings. Such centres offer Internet access and educational facilities and can become local centres for information and learning. The focus of the Wolliso centre on women and natural resource management is particularly impressive, as are its programmes that reach out to young people and encourage innovation and experimentation with IT. A number of these local tele-centres have been set up across the country, largely funded by INGOs but many more are still needed.

7.5 Knowledge transfer

As shown in the findings, many indigenous groups at Debre Berhan possess knowledge of a technical or economic nature that is of great value for developing natural resource management further, provided that such skills and know-how is made available or transferred to others. However, the flow of this knowledge between different groups and communities is often inadequate.

This can be understood in light of the following statement one indigenous farmer made when he was asked about their individual versus collective knowledge:

> "... we have diverse knowledge because we do not have the time and place to exchange our knowledge. Having meetings where we could learn from each other would allow us to have collective knowledge".

Fairly naturally, within rural communities such as Debre Berhan, specialised knowledge is usually the prerogative of a particular individual or family such that one person in the village would usually be the expert on, for example, plant diseases. However, he would normally apply his knowledge freely through the village.

Furthermore, as also demonstrated in the findings, years of experimentation by both the indigenous communities and official research stations (such as EARO) have provided individuals with much local NR related knowledge. Unfortunately, however, this knowledge is seldom easily available to the wider community on a collective basis (through for example a local 'library'). Similarly, much of the valuable knowledge accumulated by scientists (as I have witnessed at the MoA headquarters in Addis Ababa) is fragmented, held in different databases, and consequently is not readily available, even to other governmental institutions.

As one agricultural expert put it:

> "....because of the lack of efficient technology dissemination mechanisms for NRM practices, even for us, most of our own finished research results often remain on the shelf".

According to interviewees at the MoA, this information often remains fragmented because they do not have the mechanisms to disseminate it. However strong emotions associated with information sharing also create barriers to its availability. This problem can be exacerbated among scientific researchers where much personal self-worth and commercial value is linked to the information generated. Various individuals at the MoA and MoARD fear misrepresentation, which affects the willingness of researchers to offer

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their information for use in systems over which they have no future control. Other stakeholders may have similar fears, with some justification, that their information might be used incorrectly, or against them, if released.

In terms of transferring scientific knowledge to indigenous communities, the ABEL initiative (described in the findings) is of interest. The initiative itself was concerned with basic education and literacy skills, rather than scientific knowledge, but the dissemination of the results is of more relevance. Recognising that the results would not reach indigenous communities through the conventional media of journals, conferences and seminars, the group developed a methodology for disseminating such research to local indigenous cooperatives.

Based on my interviews, the indigenous communities are very willing to share their knowledge with others. The vice-chairman of the farmers association stated that, despite the difficulties, there was a strong desire by the bearers of the knowledge (especially the elders) to preserve and revitalize their culture and traditions for transmission to the younger generation. When some indigenous farmers were asked whether they shared their knowledge, such as on crop rotation, with others they stated that they shared their discoveries with people in the surrounding districts informally.

The village elders stated that a farmer would share information with a neighbour, family members and friends, who would in turn share this with their neighbours, family members and friends. The locals also asserted that the presence of an extension worker in the district enabled the farmers to convene meetings and this provided an opportunity to share experiences with others and sometimes they exchange their know-how when they meet up with other farmers from different districts at the market or at religious functions.

A number of indigenous farmers emphasized their keenness to share and exchange their experiences and knowledge with other farmers and they mentioned conserving water, seed multiplication, and drying fruit as examples. One elderly farmer said:

"Our knowledge is still here and theirs is over there and held by a small number of individuals. There are lots of people who are knowledgeable in our village but they only apply their know-how to their own piece of land which is no good if we all want to prosper".

This willingness to share knowledge with the neighbours is not of course universal, as can be seen from the case of the woman innovator in the findings chapter who, though not prepared to share her innovation locally, was more than happy to present it on television and radio.

However, according to an APIK official in Addis Ababa, although a sizeable amount of IK has been documented, in most cases it is not made available to indigenous farmers in a form they can make use of to improve their NRM activities. In the cases where information is available, it is often too general and/or does not relate to the group's culture and ways of doing things.

I asked whether any efforts had been made to minimize this gap and the official mentioned various initiatives. For example, the Rift Valley Agricultural Development Project (RVADP) has been working with indigenous farmers to document their knowledge related to Natural Plant Protection (NPP) and to spread this knowledge to other farmers in the Rift Valley using locally relevant educational materials and farmer-led training workshops. The approach involves the local community throughout the process of collecting, documenting and disseminating the knowledge. He further stated:

"..... RVADP developed visual materials (posters, booklets and leaflets) with very appropriate instructions about the use of botanicals and with illustrations in a style suitable for local traditions. The illustrations were created by local expressionist artists whose objective was to make them relevant and attractive to local tastes".

Regarding the use of P-AVT, Dr Dereje argues that some members of the farmers' association were quick to appreciate the potential for video to record and disseminate the

various kinds of knowledge more widely and to give less experienced farmers the chance to learn from the village experts and innovators. He further asserted that within a very short time, the indigenous farmers in the village were proud to see themselves and their neighbours in the films and felt that their knowledge and experience were being recognized and valued. These community screenings also generated a local exchange of ideas and experience and encouraged others to become involved in the P-AVT project. According to one APIK official the P-AVT can also be used in overcoming the gender gap, as well as appealing to the story telling culture of the indigenous people.

This suggests that, in terms of the knowledge transfer issues highlighted in the combined framework, the situation is 'patchy' but work is continuing and would benefit from continued incremental development, as shown in the Table below.

Knowledge Transfer Issue	Problem in Practice	Current Situation	Potential Solutions
Perceived value of source	Trust between communities	Variable but improving	Further promotion of IK
Motivational disposition of source	Willingness to share knowledge	Indigenous people may be more willing than some scientists	Increased transparency in science
Transmission channels	Existence of effective channels	Variable	Increased resources for technical & non-technical solutions
Motivational disposition of receiver	Willingness to listen	Variable but improving	Further promotion of IK
Absorptive capacity	Ability to understand	Variable but improving	Additional resources for education

Table 8: *Knowledge Transfer*

7.6 Knowledge application

Clearly, the actual application (or implementation) of knowledge in order to solve a problem or somehow provide other benefits or advantages is a crucial set of processes. There is little point in creating, capturing, storing, retrieving and transferring the

knowledge if it is not going to be used or if its use is unsuccessful. Alavi & Leidner (2001) emphasise the competitive advantage achievable by companies from successful knowledge application while the World Bank (1998) emphasises the learning achieved by both the source and the receiving communities, as well as any intermediaries, of successful knowledge transfer.

Referring to my findings, there was evidence of the successful implementation of indigenous knowledge, both that created locally (e.g. Kebera) and indigenous knowledge that had been transferred from other parts of Ethiopia (e.g. Doldal).

There was also the unsuccessful case of medeb where a long-forgotten indigenous technique of raised fields was reintroduced following a successful experiment. Although the technique itself offered benefits, the implementation was a failure because of the way it had been implemented in terms of the financing and institutionalisation.

In the context of village life, where informal and social work arrangements are the norm, the distinction made between directives and organisational routines discussed in the conceptual framework becomes fairly meaningless. Here, it is the norm for neighbours to help each other and work collectively. This is very different from the formal structures of Western businesses which form the basis of Alavi & Leidner's (2001) work. Similarly, where there are complex local problems to be solved, normally all the local 'experts' will be involved, again on a community basis, and this approximates to 'self-contained task teams'.

For the application of knowledge in the field of natural resource management, an awareness of the issues and their importance is essential. Hence, it is relevant to mention here the activities of AWAPE (the Association of Women of Ankober for the Protection of the Environment) as described in the findings. This impressive initiative to restore the natural resources of the area used its own resources plus those of donor organisations to restore and preserve the environment in the face of deforestation. The initiative became an exemplar, to be copied by eight nearby villages.

As noted in the findings, an ECA (Economic Commission for Africa) official believes that the major challenges for IK development lay in the difficulty in injecting the results of IK initiatives into the practice of local development – in other words, knowledge application. Based on his visits to Ethiopia, Sudan and Kenya, he argued that strategies and plans must be developed country by country and for this to happen "Two of the powerful and resourceful agents, government ministries and donor organizations, should be a part of this scrutiny".

7.7 The Stakeholders

While the findings chapters show the results of the interviews and the analysis examines these results in terms of knowledge processes, I feel that it's useful at this point to summarise my impressions of the four stakeholder groups. This is based on my observations in Debre Berhan and Addis Ababa and thus is not the result of a large-scale survey. Therefore this is a qualitative picture that provides some insight into the people themselves but may not be generalizable to the whole of Ethiopia, or beyond.

Indigenous fFarmers

In terms of IK and NRM, these are clearly the main problem owners and the ones who use IK in the practice of NRM. In macro terms, they are the backbone of Ethiopia's largely agrarian economy.

Despite the 'pull' of the cities and urbanisation, there is still a representative cross-section of age groups among the farmers. They are mostly Orthodox Christians, with some Muslims, and in the area of Debre Berhan, they speak Amharic, the national language of Ethiopia. The families are large by Western standards with an average of around six children, the majority of which go to school until they are 13 or 14 years old. Thus, the younger farmers are literate but many of the older ones are not.

Most of the farmers own a small piece of land on which they live in houses typically constructed of corrugated iron, wood or mud and they travel around by mule or donkey and cart. They would not normally employ paid servants. Their main economic objective

is for their families to survive with perhaps a few extra comforts. In local terms, they are relatively prosperous but they normally do not have bank accounts and any extra money left over after buying essentials would be spent on clothes and household goods. They contribute to local 'savings schemes', such as *ekub*, where money is provided on a rotating basis to families to spend on relatively major works, such as replacing the roof.

The farmers receive various resources from the MoA, including fertiliser, cement and digging and ploughing equipment. 'Vulnerable' farmers are provided with an extra 'safety net' in terms of additional help from the MoA.

Farmers are conservative people who prefer their children to marry early and stay in the locality, rather than going away to big towns in search of jobs or education.

The Government

In the villages the government, in the form of the MoA and MoARD, is represented by extension workers, who are mostly young, male, unmarried graduates, employed on a monthly salary and sent to a particular area for a number of years. By local standards the salary is 'reasonable' and they are able to save money because the living costs in the villages are much lower than in Addis Ababa.

The extension workers live in the same villages as the farmers but would typically live in better houses. With a regular monthly salary, they are also seen as 'better off' than the farmers. They have authority over the distribution of certain resources, such as fertiliser, and this earns them some respect from the farmers. Often three or four extension workers would club together to 'share' a paid servant for housekeeping duties. For travel, they use government vehicles when they are available. Most of their work is conducted through the farmers' associations.

The Universities

They typically collaborate with the MoA and MoARD in problem-solving, especially in dealing with droughts, diseases or other serious issues. They are research-oriented, as

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opposed to teaching, and they adhere to scientific paradigms. Their staff are relatively well paid, by the government, and have access to government vehicles. They normally stay in the city and would not appear in the villages unless there is a major problem or a major development project. Thus, they are relatively 'distant' from the farmers.

The NGOs

The key NGO in the field of IK is APIK, which acts as a high-level pressure group and advocate to promote IK. They also promote the eradication of harmful practices such as female circumcision through education programmes.

APIK's efforts are divided between preserving IK, through documenting and storing knowledge, and promoting the wider application of IK. Its efforts go well beyond NRM and include IK in health, education, child rearing and women's development. Much of its promotional activity is directed towards the government and so much of this activity is centred in big cities such as Addis Ababa.

APIK is funded by INGOs, such as the World Bank, and is based in Addis Ababa. The staff are Ethiopian graduates who are well paid and provided with relatively good facilities. They are also less encumbered by bureaucratic regulations than the government-employed extension workers but, like the latter, in the villages they mostly work through the farmers' associations.

Relationships between the stakeholder groups

Within the village, the extension workers have 'fairly good' relationships with the farmers. The extension workers are the representatives of the government, and are seen that way by the locals, and there seems to be mutual belief that both groups need to work together. However, the relationships are not particularly close and the extension workers usually interact with the farmers through convening a meeting of the farmers' association. The farmers do not trust the lack of experience of fresh graduates and are initially suspicious of any newcomer. The farmers' often roundabout way of answering straightforward questions can be frustrating for people more used to the pace of city life.

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The farmers recognise APIK staff as being useful advocates for local culture and IK. However, within the village, APIK staff have to compete with the extension workers for acceptance and there is a certain amount of rivalry between the two groups. Some extension workers, perhaps jealous of the better facilities and lack of bureaucracy enjoyed by APIK, feel that APIK staff are merely 'creating jobs for themselves'.

7.8   Reflections on the Theory and the Literature

This section revisits the theory and literature concerning indigenous knowledge in the light of the findings and the analysis. In most cases my work in Ethiopia supports the existing literature, as examined in the literature review chapter but in some areas there is a divergence and this section discusses those differences.

Indigenous Knowledge

The findings suggest that there is considerable support for indigenous knowledge within communities such as Debre Berhan. The local villagers I spoke to recognised and respected this knowledge, many attributing it to a gift from God. Although many also respected scientific knowledge learnt in school, some regarded this as 'artificial'. IK is still the basic knowledge that drives the community and, as such, it is respected and practised on a regular daily basis. Within Debre Berhan, IK is not a set of half-remembered adages and traditions but there is evidence of extensive local innovation that is ensuring that indigenous knowledge is continuously refined and developed as the rural environment and climate change. As noted elsewhere in this thesis, this innovation came as a personal surprise to me and is an important factor for the continuing health of indigenous knowledge.

As noted by many authors, including Sillitoe & Marzano (2009), IK exists very much in terms of skills. In Debre Berhan this could be seen in the predominance of traditional ploughing, planting and harvesting skills and a noticeable absence of modern technology. These IK-based skills extend to weather prediction, which determines the timing of the planting of seeds, and the technique where seeds are mixed with charcoal

to protect them from birds. Thus, IK is the traditional basis for decision-making. Such skills are passed on by parents to their children.

Sillitoe & Marzano (2009) also talk about IK being communicated through symbols, myths and rites and Berkes & Berkes (2009) mention this in terms of rules and norms. These manifestations were very prevalent in Debre Berhan where animals are decorated, by having their horns painted, to give thanks for a good harvest. There is a belief that animals should be treated well and kept happy. Cows, for example, are shown considerable respect and derogatory expressions in English, like 'silly old cow', make no sense in Ethiopia. Cows are not hit with sticks and farmers prefer to sell their animals rather than slaughter them. There are various songs praising animals and some farmers will still share their (large) rooms with cows, sheep and goats. There is a saying in Amharic, "*Gemel be and gemed yemitazazew le kibir sil bech new*", meaning 'It's respect and kindness that allow one to lead a bull with a tiny piece of thread'.

As suggested in the literature, this type of behaviour and culture implies a respect for nature and the environment. This can also be seen in the custom of kissing the *injera* (the ubiquitous pancake eaten with most meals) before starting to eat. While such customs are carried on often unconsciously, the AWAPE initiative described in the findings suggests that increasing awareness of NRM threats and problems can lead to significant local initiatives to promote sustainability.

As noted by Dewalt (2007), IK is locally appropriate. For example, long-haired sheep are reared in Debre Berhan, where temperatures can fall quite low. They are sheared of their wool to make clothes. In warmer areas, this practice would not be followed. There is evidence of restraint in exploiting resources, such that farmers try to only plough the fields needed for food production and allow others to remain fallow. During the rainy season, wells are dug to store the precious water and prevent evaporation. There is a strong element of social responsibility within communities, which can be seen in the *edir* practice where villagers club together when someone dies to pay for the coffin and the funeral ceremony.

Specific IK is held by particular people within the community. Thus, one individual (or family) would be the expert on treating sick animals – he may also treat people who are ill. This knowledge is transmitted from the parents to the children, who learn about symptoms and medicine from an early age. Such specialist knowledge stays within the family but is shared willingly for a small payment. This local sharing of knowledge and expertise is widely accepted and there is a saying in Amharic, *"Eweket ena ye chaka wef yemyammesaselashew be ande saw beacha selmaiyazu new"*, which means 'knowledge is like the bird in the forest: one person alone can never catch it'.

At the grassroots level, IK co-exists with scientific knowledge; sometimes easily and sometimes less so. Farmers want solutions to their local problems and have a preference for traditional IK solutions, to which they are accustomed. There is a saying that 'you can only plough the land with local oxen' and there is some justification for this. Hybrid animals have been tried but, although they give more milk, they are also more susceptible to infection; they eat more and cost more. Nevertheless, when local solutions are inadequate, scientific solutions are welcomed. As described in the findings, increasing climate variability has made weather forecasting particularly difficult and the views of both local spiritualists and meteorologists are considered.

Similarly, when plagues of insects become unbearable, the spraying of insecticide by helicopter is welcomed. Also, fertiliser is widely used, although the cost and side-effects compared to animal manure are widely recognised and farmers have to make those trade-offs. Boiling eucalyptus leaves to produce an inhalant to treat colds is clearly equivalent to packeted cold-cures from the West.

As noted in the findings, IT is beginning to be used a little within the context of IK and NRM. APIK maintain a database of IK, although this a SQL-driven structured database and the IK stored is categorised according to scientific classifications. The tele-centre described in the findings is noteworthy, although it should be recorded that this operates in an area that is home to the Gurage tribe. This tribe is famed for its entrepreneurial skills and behaviour. Hence the business benefits of up-to-date information on

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commodity prices and demand were probably more important in gaining acceptance rather than an appeal to preserve local IK. The experiments with participatory audio-video technology seem to be promising and are discussed further below. Finally, the MoA utilises a geographical information system for the early warning of disease, drought and sudden population migration.

In terms of the stakeholders and their 'trust' in the alternative knowledge systems, the following seems to be the case:

Farmers	Trust IK, suspicious of the resource implications of scientific knowledge
Government (MoA)	Trust science, with which their graduate staff are more familiar
Universities	Trust science but becoming more aware of its sometimes harmful side-effects
NGOs	APIK, by definition, is highly supportive of IK and its INGO donors, such as the World Bank, seem sympathetic. Most NGOs however are likely to be very sceptical of IK

There is evidence within the cities of a romanticised and idealised view of IK; a danger noted by Thrupp (1989). It is becoming fashionable in Addis Ababa, for example, to replace Western style furnishings with indigenous ones and this is indicative of a growing interest in local agrarian culture. It is impossible to say whether this is just a passing fad. APIK naturally try to capitalise on such trends in their promotion of the benefits of IK.

There is evidence that some indigenous customs are wasteful at best and, in some cases, harmful. For example, sheep or goats with 'joined' eyebrows are considered to be cursed, as are cows bitten by hyenas. These animals must be killed and not eaten. The Orthodox Christian prohibition of eating pork, despite its historical justification, is

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perhaps unhelpful in modern society. Similarly for the Orthodox Christians the taboo on working on the farm on particular saints days in every month (e.g. St. Michael's Day on the 12th of each month, St Gabriel, on the 19th, St Mary on the 21st and St George on the 23rd day) reduces the flexibility of production and could be seen as being generally unproductive. In many areas of Ethiopia, deforestation has been exacerbated by excessive demand for wood for house-building and fuel, even where alternatives are available. Similarly, it is hard to defend female circumcision and child marriages.

Although there is considerable support for researching IK, because of its potential benefits, there are also many deeply ingrained barriers and constraints. When there is a sudden, desperately urgent demand for food, it is hard to resist the temptations of high productivity mechanised farming and much of the government remains committed to agricultural industrialisation as stated by their Agriculture Led Industrialisation Development policy (ALID). Furthermore, the agro-chemical companies continue to promote their products through the medium of government agents selling to the farmers.

Knowledge management

Using Polanyi's (1967) distinction between tacit and explicit knowledge, IK is completely tacit, when considered within the traditional indigenous knowledge system as it is held within the brains of the local farmers and passed down orally between generations. APIK's efforts to preserve IK by documenting it and storing it in a database seem to threaten this tradition but here the intention seems to be to preserve (or freeze) the knowledge, having interpreted it and categorised it within a conventional scientific frame of reference.

Perhaps a more fascinating development is the use of participatory audio-visual technology where the farmers explain their skills and traditions and this is captured on video in a form that is more accessible to other farmers than a SQL-driven database. This knowledge, held on videotape, is not codified but is otherwise relatively 'explicit'.

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This predominance of tacit knowledge within IK systems implies that the only sensible conception of knowledge in this context is that of Blackler (1995) who proposes treating knowledge as an inter-subjective process. IK is not conducive to the 'knowledge as object' conceptualisation.

In terms of the knowledge management processes, according to the framework used in the analysis, this study raises issues for all the types of process. Socialization remains the standard method of knowledge creation for IK as individual farmers exchange views and information concerning NRM. This may be done in the market or at other social occasions, such as *debo* (the get-together when someone is ill) or *wonfal* (the systematic rotation of work parties around the families within the community).

The other modes of knowledge creation are little used in IK systems. Internalisation is likely only to feature indirectly when, for example, an extension worker reads out and explains a document at a farmers' association meeting. Externalisation is similarly indirect and typically only occurs when farmers explain their practices to APIK staff, who then document them. The final mode, combination, seems totally irrelevant to IK.

The extent of knowledge creation in terms of the innovation of new processes and techniques is apparent from the numerous examples (such as *kebera*) described in the findings, the 52 examples documented by APIK and the recognition of the indigenous experimenters. The importance of this issue for innovation studies is discussed further below.

Knowledge capture, in terms of the recognition and identification of relevant IK, and its validation, recording and documentation, is largely the preserve of APIK. However, this 'operational' role is not their main purpose, which is the 'promotion' of IK. Where they do carry out knowledge capture, this is performed very much within the scientific paradigm by their young graduate staff. Nevertheless, it appears that their efforts contributed to the recognition of the various benefits obtainable from the endod plant, for example, described in the findings.

In traditional IK systems, there is no knowledge storage and retrieval as such, nor is there any knowledge transfer from an individual farmer's explicit knowledge to the group's semantic memory (see Alavi & Leidner, 2001). However, where an individual farmer addresses a group of other farmers in a meeting (perhaps at the farmers' association) knowledge transfer could take place from the individual speaker's tacit knowledge to the group's episodic memory. Similarly, when an extension worker addresses a meeting of farmers, this would constitute knowledge transfer as he tells them about, for example, a change in government policy on an issue affecting them. Arguably IK knowledge transfer can also take place through migration. Hence, the *doldal* technique was transferred to Debre Berhan by the individual who migrated from the Irob lands.

Participatory audio-visual technology, although still at the experimental stage, would seem to offer the potential for indigenous knowledge storage and retrieval, as well as its transfer to other indigenous communities.

While APIK store IK in their database, access (and hence retrieval) is not appropriate to indigenous people as most indigenous people communicate orally. APIK mainly use the knowledge either to advise government or to promote IK in general. Thus IK transfer to other indigenous people is not facilitated by APIK. Even if the farmers did have physical access through the Internet to the database, this is only one part of a wider problem of access to online resources, which is discussed by Boast et al (2007) who argue that "knowledge, authority, and modes of framing/classification have always been culturally distributed and have frequently been epistemologically incommensurable" (p.398). In other words, the indigenous people would require a good knowledge of Western epistemology to be able to access indigenous knowledge online.

The initiative aimed at communicating research results to indigenous communities, funded by USAID and ABEL and described in section 6.10 of the findings, may help but its emphasis on education and literacy, not to mention its multi-national focus, would seem to make it rather ungainly in terms of effective knowledge transfer.

While the other stakeholders (APIK, INGOs, the government/MoA and the universities) have a common protocol and communication channels, this barely extends to the farmers down on the ground. These other stakeholders share a common epistemology, in terms of Western science, that underpins their communications, as well as being located together in the cities. APIK may promote IK but its staff are graduates who have been educated within the scientific tradition and will use this tradition in their dealings with INGOs, the government and the universities. The fact that the farmers speak Amharic, like the other groups, counts for little when the underlying epistemology is different.

Regarding knowledge application, despite their natural conservatism, the farmers appear to be open to new ideas and are happy to apply new knowledge, especially new IK. However, mention here should be made of the failure of the *medeb* project discussed in the findings. Despite the benefits of the technique, it was not adopted by the farmers, although this seems to be more a failure of the implementation through excessive outside intervention and the consequent expectations the farmers had that the 'outsiders' would continue to maintain it.

Innovation Studies

With very few exceptions (e.g. Kaya, 2009) the field of innovation studies seems to have ignored indigenous innovation altogether. As noted in the literature review, innovation is usually studied either within the firm or as part of national systems of innovation, where the latter typically comprise universities and firms, suitably supported by government policy. There is scarcely any mention of innovation in a community like that of Debre Berhan. It seems that a firm, or some other publically constituted commercial body, is a necessary prerequisite for labelling a new idea that has been implemented as an innovation.

And yet this does not match the reality on the ground within the villages that depend upon IK. As shown in the findings chapters, many new ideas have been developed and implemented within indigenous communities. These include *kebera*, *doldal* and the use of groundnut shell manure, as well as the idea of incubating eggs in dry cattle dung and

the use of plastic bottles for irrigation. As noted above, APIK documented no less than 52 such innovations. Many of these are simple and cheap and are not going to make their developers (or their intermediaries) huge amounts of royalties but nevertheless they can make a considerable difference to the lives of poor communities.

One can only speculate as to why such community innovation has been largely ignored by researchers. It may be that the separateness of IK systems, with their different epistemologies, makes them inaccessible and unattractive for study. Nevertheless, various pharmaceutical companies have been active in trying to acquire indigenous medicines, especially from the Indian sub-continent. As noted in the literature review, there has been much debate concerning the intellectual property rights surrounding such developments. However, it is not clear what such questions of ownership and reward mean within an indigenous knowledge system where such knowledge is freely shared within the community.

7.9   External Threats

Within Debre Berhan indigenous knowledge seems to co-exist quite happily with scientific knowledge and there is a good record of innovation within IK. Furthermore, IK is firmly rooted in the local culture. However, there are various 'external' forces from outside the village that threaten both the local culture and its corresponding IK.

One of the biggest problems in Ethiopia is land scarcity, exacerbated by the nationalisation of land by the Marxist government in 1975. Following the overthrow of the Marxists, the land still remains the property of the state and farmers are not allowed to sell or modify the leases, except through inheritance. Which means the small piece of land available to the local farmers provides little or no access to credit and sometimes inappropriate for farming. The size of these patches tends to lead to over-farming and the depletion of critical nutrients from the soil, leading to land degradation. This in turn adds to the problem of declining agricultural productivity as land is lost to drought and desertification.

At the same time, Ethiopia has experienced decades of rapid population growth, putting further demands on the hard-pressed agricultural industry. In Debre Berhan, the fertility rate remains high and farmers are forced to sub-divide their land continually between their sons or face the migration of their sons to the cities. Young men increasingly move to the cities, often leaving their wives behind to run the household and look after the children. In some cases, the men return with sexually transmitted diseases, including HIV/AIDS, and infect their wives. This spreads disease from the city to the countryside as well as increasing the stress and instability of family life.

Modernisation projects, driven by government policy and sponsored by donors, typically aim at the industrialisation of agriculture through the provision of tractors and combine harvesters. However, in some cases little thought has been given to their fuel and maintenance needs. Similarly, the provision of fertiliser and hybrid varieties of seed may improve short-term productivity but at the expense of long-term sustainability. The increasingly variable climate, caused by global warming, adds to this 'cocktail' of agricultural instability.

The expansion of primary education has undoubtedly been of benefit to rural communities but poor subsistence farmers must now make a trade-off between sending their children to school and the traditional practice of using them as labour on the farm. Where the able-bodied male adults have migrated to the city, this is not an easy trade-off to make. Similarly, family planning programmes have met resistance where the schemes are seen as aimed at decreasing poor families' earning power as opposed to relieving the pressure on agriculture and the environment.

These demographic, economic, social and environmental threats put considerable pressure on rural communities by threatening their traditional way of life, forcing them to question the relevance of their long-established norms of behaviour and the indigenous knowledge that underpins them.

7.10 Indigenous Knowledge as a Knowledge System

One can consider IK within the village as being a relatively self-contained simple system made up of just three of the types of process from the conceptual framework. These comprise:

- Knowledge creation

    This occurs where an individual 'invents' a new innovation or, through socialization, where the individual (often in the role of a parent) shows another individual (often a child) how to carry out a particular (agricultural) process. The recipient has then gained a particular skill (knowledge as skill) and can refine it further through experience and experimentation. Another example of knowledge creation through socialization would be where a small number of individuals 'brainstorm' a problem and come up with a solution.

- Knowledge transfer (tacit)

    This occurs when an individual addresses a local meeting and shows the audience how to solve a particular problem or develop a skill.

- Knowledge application

    This occurs when individuals actually put the skills into practice.

Thus, within this simple knowledge system, there are no knowledge capture, knowledge storage or knowledge retrieval processes. Within the village this knowledge system can, *ceteris paribus*, continue as long as the community supports it. Importantly, this system is not static but will evolve as circumstances change. Thus, obsolete skills will gradually be forgotten, particularly as the old people die off, and new skills will be developed through innovation, as can be seen from the innovations developed in Debre Berhan.

Treated this way, the knowledge system is an isolated system separate from the global system of scientific knowledge and with only tenuous links to other IK systems, as shown in Figure 7.
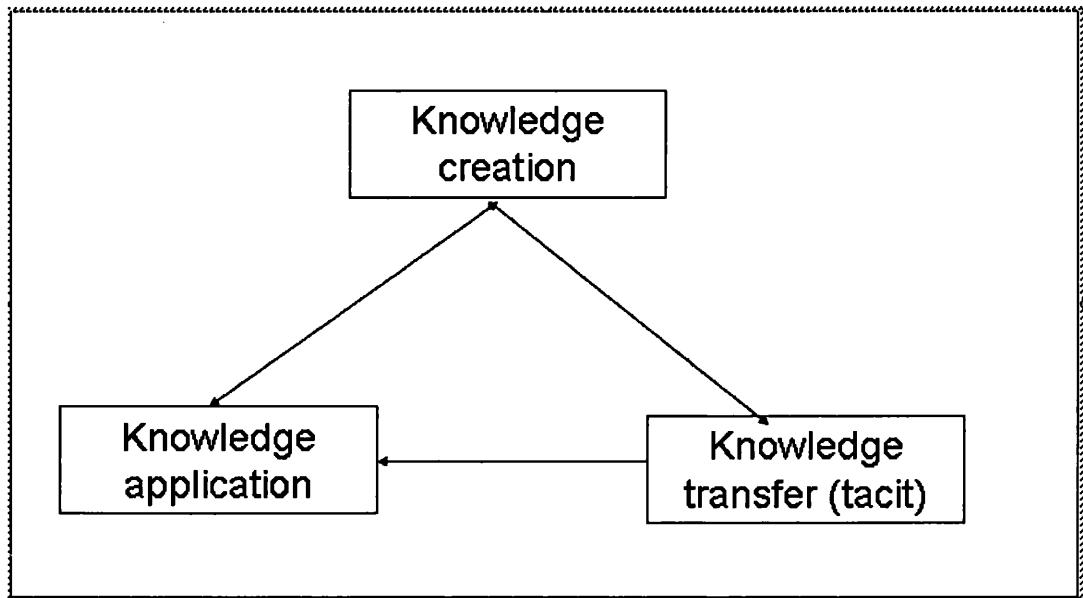
Figure 7: Indigenous knowledge as a system of processes

However, taking into account the potential benefits of the more widespread utilisation of IK, as well as the external threats discussed above, one could argue that much IK should be preserved and disseminated more widely. However, this is not straightforward as much IK is 'sticky' (Isaksen, 2001) in that it is informal and tacit and deeply rooted in the local culture and practices and so "cannot easily be isolated from its individual, social and territorial context" (p.106). This is where the processes of knowledge capture and knowledge storage and retrieval become relevant, as well as the broader type of knowledge transfer obtainable through the dissemination of explicit knowledge. These processes can hence act as a 'bridge' between the IK system in question and the scientific knowledge system, as well as other IK systems, as shown in Figure 8.

A more detailed consideration of these 'bridging' processes and considerations of best practice are beyond the scope of this thesis and should be the subject of further research.
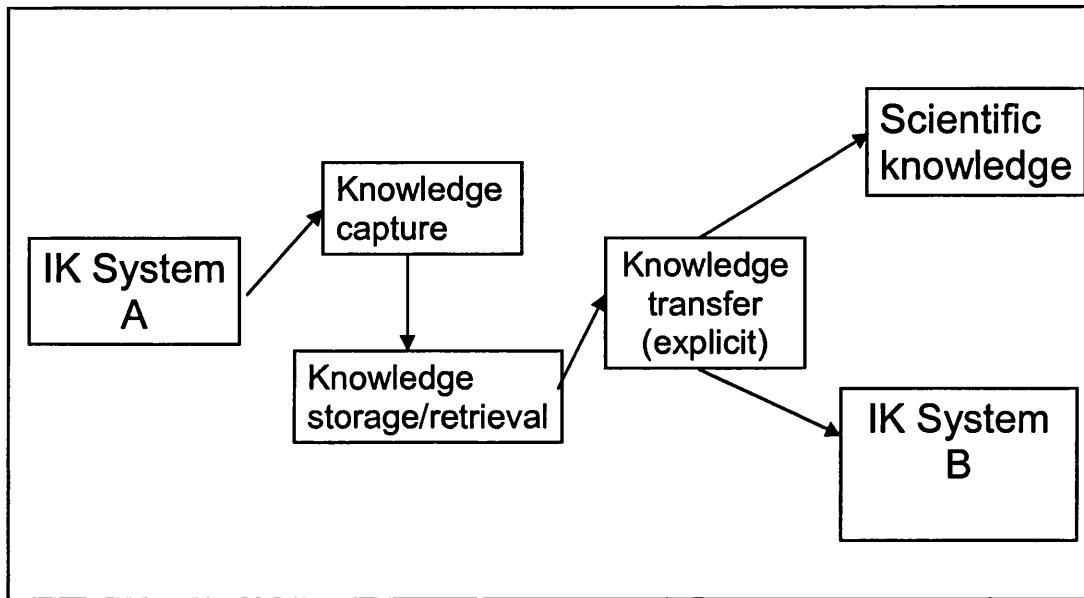
Figure 8: Processes involved in the transfer of indigenous knowledge

7.11 Implications

While the decisions to preserve and utilise indigenous knowledge remain policy decisions, beyond the scope of this thesis, there are a number of implications that can be drawn from this study.

Firstly, using the notion of processes allows the reconceptualisation of indigenous knowledge in terms of a system of processes. These processes fit the conceptual framework constructed from combining the Alavi & Leidner (2001) and World Bank (1998) frameworks. As such, the process analysis fits and complements the theoretical basis of knowledge management employed by Alavi & Leidner, including the work of Polanyi (1967), Nonaka (1994) and Blackler (1995). This provides a solid theoretical basis for further research. On the other hand, the 'fit' is less good with the innovation studies literature, especially considering the importance of innovation both in practice and theory. Additional research is required in this area.

Secondly, the process analysis, augmented by the notion of different knowledge systems based on different epistemologies, demonstrates the relative separateness of an IK

system but, importantly, it clarifies a little the processes that are needed to link an IK system with scientific knowledge.

Thirdly, this conceptualisation demonstrates the importance and engagement of the local stakeholders of the IK system (in this case, the farmers) with any attempts to change or link to the system. Arguably, this goes beyond a discussion of the merits, or otherwise, of stakeholder participation.

Fourthly, the analysis shows the roles of the current stakeholders within indigenous knowledge. As can be seen, these stakeholders have very different backgrounds and objectives, which occasionally conflict. The current allocation of roles may not be ideal and the necessary coordination among the stakeholders may not be easy. Rather than calling altruistically for improved coordination, perhaps a re-evaluation of roles, based on the underlying processes could be beneficial.

Chapter 8 - Conclusion

8.1 Introduction and summary of the thesis

The aim of this research was to investigate further the phenomenon of indigenous knowledge, where this is defined as: 'a body of knowledge indigenous people have accumulated over time, which allows them to live in balance with their environment.' The context of the study is natural resource management in an area of Ethiopia known as Debre Berhan.

The intellectual justification for the study is the need to locate indigenous knowledge within the broader field of human knowledge and in particular to study its position with respect to (Western) scientific knowledge. This is particularly intriguing as it could be argued that the world as a whole is becoming a knowledge society, driven by a knowledge economy. A more pragmatic justification is to provide some scholarly support, albeit very minor, to poor rural people dependent upon natural resources that are under pressure from socio-economic and climate changes leading to resource degradation.

The introductory chapter describes the objectives of the study and the overall problem situation, as well as describing the local context of Debre Berhan. The literature review provides a brief outline of the relevant NRM literature, which forms the background context of the research. A more extensive review of the IK literature describes its characteristics and highlights the potential benefits for NRM. However, much of this literature is descriptive and normative and theoretical support is sought elsewhere. This is found in the knowledge management literature, where the work of Polanyi (1967), Nonaka (1994) and Blackler (1995) provides useful theoretical concepts for studying the practical application of knowledge.

However, this literature is largely confined to knowledge management within organizations, as opposed to within communities. The innovation studies literature is briefly surveyed but this tends to focus on formal institutions, such as firms, research

institutions and government policies, and says little about indigenous innovation. Thus, a sizeable gap is demonstrated in both literatures.

Adopting the notions of tacit and explicit knowledge (Polanyi, 1967), Nonaka's (1994) modes of knowledge creation and Blackler's (1995) conception of knowledge as an inter-subjective process, a conceptual framework is constructed by combining the work of Alavi & Leidner (2001) and the World Bank (1998). This framework categorises knowledge processes into five types: knowledge creation, capture, storage & retrieval, transfer and application. It is argued that the notion of process focuses on 'what people do' and depends less on particular epistemologies. Indigenous knowledge is largely tacit and the processes involved are also 'people-intensive'. Therefore, it makes sense to bring the stakeholders explicitly into the study and they form the second 'dimension' of the framework.

The research methodology adopted was ethnography as this provides a holistic approach to the study of communities, at the cost of the researcher 'immersing' himself within the community for a period of months. Chapter Four discusses the benefits and difficulties of this methodology, as well as describing the research design employed for this study. Data collection comprised interviews and observation and was carried out over four months.

The study yielded extensive amounts of data and this is presented in Chapters Five and Six. The former describes how the stakeholders view IK, as well as providing examples of the IK used in practice within Debre Berhan, while the latter focuses on knowledge management processes as applied to indigenous knowledge.

The findings are analysed using the framework in Chapter Seven before moving on to a reflection on the theories and literature in the light of the findings and the analysis. This leads to a reconceptualisation of IK as a knowledge system and a brief consideration of the implications that follow.

8.2 Addressing the Research Questions

As noted in previous chapters, the research questions posed at the beginning of the study evolved as the study progressed to form the following set:

- How do different systems of knowledge such as IK operate around natural resource management?

- How do different categories of social agents associated with different systems of knowledge engage in the process of deliberation of NRM in Ethiopia?

- What is the relationship between weakening systems of IK and degradation of natural resources?

- Who are the main stakeholders and what role do these stakeholders play in order to address the degradation of natural resources?

- What role have government based initiatives played in sustaining/eroding these systems of knowledge?

These questions are 'big, important' questions that do not lend themselves to easy answers and I was aware of this from the beginning of the study. I knew that it was not possible to provide comprehensive answers but I felt that it would be worthwhile to address these important questions in an attempt to make incremental progress towards their eventual resolution by others in the future.

Knowledge systems and natural resource management

As shown in the discussion in the previous chapter, it makes sense to treat knowledge as a system comprising various entities interacting together and engaged in particular knowledge processes. This conceptualisation seems clear and meaningful. As is apparent from the findings, the analysis and the discussion, there are three, fairly separate, knowledge systems involved in NRM in Debre Berhan.

The IK system involves the local farmers interacting together for the purposes of NRM, through processes of knowledge creation, knowledge transfer and knowledge application and the knowledge that they utilise is almost wholly tacit knowledge. There is also a scientific knowledge system working in the village, driven by the extension workers of

the MoA, but still involving the local farmers, as the farmers are the ones who must apply the knowledge. This system is largely geared towards knowledge transfer and knowledge application as scientific knowledge created elsewhere is applied in the village. This scientific knowledge 'enters' the village in both tacit and explicit forms but is transferred from the extension workers to the farmers' 'stocks' of tacit knowledge. The third knowledge system that is apparent in the village operates in a rather different direction as researchers from APIK periodically capture IK in order to use it and promote it elsewhere in the country. The APIK staff are largely involved in knowledge capture, storage, retrieval and transfer.

Disregarding the external threats discussed in Section 7.9, these three knowledge systems coexist fairly well together. The IK system's power comes from its deep roots in the local culture while the 'rival' scientific knowledge system calls on the resource allocation power of the MoA. To some extent, depending upon the health of the local economy, the farmers are the final arbiters as to which knowledge is actually applied to a particular problem. Apart from some minor conflicts of access, the APIK system does not clash with the other two systems.

The IK system, operated by the farmers, has its own knowledge creation processes, in terms of innovation and learning, and is often able to provide solutions to everyday NRM problems. Much of the IK system emphasises issues of sustainability and care of the natural environment. Scientific knowledge is especially useful in providing solutions to more extreme problem situations, such as major droughts or crop diseases, but some of its more quotidian products have little regard for sustainability. Thus we can say, *ceteris paribus*, that currently the different knowledge systems complement each other, within the village, in a form of balance.

Social agents, knowledge systems and natural resource management
Within the village, as noted above, it is largely the local farmers and MoA extension workers who deliberate about NRM problems. The farmers meet and discuss NRM issues either at meetings of the farmers' association or at local social events. The

extension workers typically attend meetings of the farmers' association. At such meetings, the farmers, with their IK but lack of formal education, and the extension workers, mostly graduates from the cities, represent the two systems of knowledge. They typically negotiate local solutions based on both knowledge systems.

At a national (or regional) level, deliberations are performed by the government (in the shape of the MoA and/or MoARD), the research community (typically the universities). Often the MoA considers itself as the owner of NRM related problems and seeks advice/collaboration with agricultural universities. The universities usually offer solutions based on scientific knowledge while NGOs such as APIK may counter with IK based solutions. The MoA, as resource holder, must then decide how to proceed. Traditionally the MoA has been staffed by graduates who follow the scientific knowledge tradition but increasingly they are becoming aware of the harmful side effects of such solutions and seem to be more open to IK.

The relationship between weakening systems of IK & natural resource degradation
This refers to the discussion of external threats in Section 7.9 of the previous chapter. As discussed above, the IK system seems to have the capacity for innovation, as well as a long 'memory' of local conditions, and could normally cope with a slight degradation of the local soil etc. The local farmers show an ability to innovate for survival that can probably cope with normally bad seasons.

However, it could be argued that the threats of land scarcity, urbanisation, over-population and climate change due to global warming are far from normal everyday problems. They threaten both the community, and hence the IK system, as well as the quality of the land and livestock, and there is the danger of a spiral of decline. The break-up and stresses on the community is likely to weaken the IK system, which becomes unable to cope with the increasing natural resource degradation, which in turn puts further pressure on the community and IK system. Scientific solutions could be applied to the NRM problems but they may further weaken the IK system. It should be

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made clear that this is currently **not** happening and represents a worst case future scenario.

It is not within the power of the local community to stem these external threats and any remedies are the responsibility of the government. It may be the case, and this is just speculation based on very little evidence, that a rejuvenated IK system could provide a basis to halt the degradation of natural resources and reverse any spiral of decline.

The roles of the main stakeholders in addressing natural resource degradation

This study has identified four main stakeholders: the farmers, the government (through the MoA and the MoARD), the universities and the NGOs (mostly APIK). Based on the findings, the analysis and the discussion, their roles would seem to be as follows:

The farmers:

- Apply existing IK, and the scientific knowledge transferred into the village by extension workers, to manage natural resources in such a way as to ensure the survival and prosperity of their families and the community.
- Develop new innovations, through knowledge creation, that address sustainable NRM.
- Maintain the IK system so that future generations can practise sustainable NRM.

The government (through the MoA and MoARD)

- Allocate the resources needed to combat natural resource degradation in an efficient, effective, equitable and sustainable fashion.
- Obtain expert advice as to how to combat natural resource degradation.
- Monitor the degradation of natural resources locally and nationally.
- Through the extension workers, coordinate with local farmers to implement solutions and monitor their effectiveness

The universities and other research institutions

- Advise government regarding solutions to natural resource degradation.
- Carry out research into natural resource degradation.

NGOs – largely APIK

- Promote indigenous knowledge based solutions to natural resource degradation
- Capture, store and disseminate relevant IK-based solutions

Role of government based initiatives in sustaining/eroding systems of knowledge

Ethiopia is a large complex country with many chronic socio-economic problems that the government is endeavouring to address. With indigenous knowledge bound up with the local culture and way of life, at one level, any significant government initiative in any field (e.g. education, health and even foreign policy) is likely to produce social change and hence impact the communities and their knowledge systems. The effect may be direct or indirect, intentional or unintentional, and hence it's beyond the scope of this study to provide a comprehensive answer to this question. As a postscript, during the four months research in Debre Berhan, I was not aware of any specific initiative from the government that was significantly troubling the local people.

In some ways the extension of formal education, based on a scientific epistemology, threatens the IK system as a 'pure' system of knowledge. However, the practicalities of farming in villages like Debre Berhan mean that the farmers tend to use both knowledge systems in order to solve problems, such that the local IK system evolves to incorporate relevant scientific knowledge.

Within the field of NRM, on the one hand, the MoA's efforts at industrial farming and mechanisation are helping to erode the IK system but, on the other hand, there was evidence from this study that the MoA and MoARD had been very supportive of innovations such as the *kebera* technique, the developments of the endod plant, and the tele-centre at Wolliso. All of these could be seen as helping to sustain the IK system.

Furthermore, the MoA seemed to be enthusiastic about the experiments with participatory audio visual equipment.

Supporters of IK would doubtless argue that the government could, and should, do more to support IK but it is beyond the scope of this thesis to analyse the conflicting demands on government resources.

8.3 Contributions

This section summarises the contributions and implications of this research in terms of theory, research methodology and practice.

8.3.1 Theoretical contributions

Perhaps the most important contribution to theory is the new conceptualisation of indigenous knowledge in terms of a system of processes as outlined in Section 7.10. This simple model, comprising knowledge creation, knowledge transfer and knowledge application, makes IK accessible to scholars of knowledge management, as well as emphasising the local and sustainable nature of the system. It shows IK as a living and evolving knowledge system, giving prominence to knowledge creation, through learning and innovation, rather than portraying IK as an almost defunct collection of irrelevant traditions and superstitions. It implicitly acknowledges the ownership of the knowledge by the local people and hence the roots of the knowledge within their culture.

The same notion of knowledge processes allows the model to be extended to take in the processes of knowledge capture, knowledge storage/retrieval, and knowledge transfer that are needed for IK to be incorporated within scientific knowledge or to be transferred to other indigenous knowledge systems. The model demonstrates how the roles of the stakeholders interact within the field of indigenous knowledge and helps to explain 'why things are the way they are'.

The model treats the IK system as a separate knowledge system parallel to the more familiar scientific knowledge system. Despite the different epistemologies, the similarity

of knowledge processes should allow for the 'pluralistic conversation' recommended by Spender & Scherer (2007).

Using theories and frameworks from the knowledge management literature, the research extends the scope of knowledge management beyond the realm of individual organizations and into communities. As such, it creates a path that other knowledge management researchers can follow in extending their research into new areas of application.

The research also highlights the gap in the innovation studies literature, where community innovation seems to be largely ignored in favour of a concentration on firms, research institutions and government policy. The extent of innovation within a relatively small area in Ethiopia, demonstrated by this study, suggests that this could be a fruitful area for researchers in innovation to extend their activities.

Much of the findings and analysis confirm and support previous research into the characteristics of IK. Indigenous knowledge is almost completely tacit and skills based. It is local, deeply rooted in the culture of the society, drives much local decision making and in general shows respect towards the natural resources that the community depends upon. At village level it co-exists with the scientific knowledge imported by the government extension workers and the trade-offs are typically made by the farmers themselves who form their own judgements regarding the merits of the alternative solutions emanating from the different knowledge systems. It is underpinned by the local culture, which shows strong elements of social responsibility within the community.

Where this study departs from much previous IK literature is in its emphasis upon local indigenous innovation. It gives examples of local farmers ignoring obsolete IK and adopting local innovations in order to survive and prosper. It also demonstrates how indigenous people, in the right circumstances, are prepared to adopt new technology, in the form of participatory audio-visual technology and tele-centres. This certainly argues

against considering indigenous societies as 'backward or Luddite' and demonstrates a pragmatism by the local people towards technology.

More depressingly, the discussion of external threats, albeit speculative, highlights the dangers local communities, and their systems of indigenous knowledge, face from the cocktail of land scarcity, urbanisation, over-population, climate change and resource degradation.

8.3.2 Methodological contributions

This research has contributed to the field of methodological literature through its account of the use of the ethnographic approach to enhance our understanding of the phenomenon of indigenous knowledge within local communities. This study uses ethnography within the broader interpretivist approach to provide a better understanding of indigenous communities' practices and the role of knowledge.

This research combines an interpretive approach with a systematic framework to provide a clearer understanding of subjective realities. This reality is constructed through negotiated meanings, traditions, values and norms, and the study demonstrates how ethnography was used to 'get at' the meanings attached to knowledge within indigenous communities. It facilitated the process of tracing the meanings behind various practices that led to the richness of the findings.

The selection of the ethnographic approach, and its constituent elements of immersion and thick description, not only resulted in a better understanding of the research topic but also helped in identifying the benefits of using this type of approach for similar studies. Empirical data gathering based on ethnography has been used before within the field of information systems and this thesis confirms its benefits in providing valuable insights.

In this study triangulation was achieved by using multiple data collection techniques, including interviews, observation, printed documents and informal meetings, as well as

multiple sources in terms of the various stakeholders. These stakeholders were identified and characterised in terms of profiles, comprising their educational background and personal objectives, which allowed their responses to be compared and interpreted accordingly.

The use of ethnographic studies for understanding societal values and norms is already established. In this study, immersion within the community and extensive observation greatly facilitated the interpretation of the responses of the interviewees. Hence, I was more easily able to understand the role and meanings of indigenous communities and their IK practices.

This study helps to highlight the time period issue within ethnography. On the one hand, my existing knowledge of NRM and the local culture and language meant that I could collect a considerable amount of data much faster than 'foreign' researchers but, on the other hand, I still had to spend four months working intensively in the field. This suggests that there can be a certain flexibility for an ethnographic study regarding the time spent in the field but I would certainly feel uncomfortable in undertaking a similar study in less than four months.

I believe that this study carries forward the pioneering tradition of ethnographic studies in anthropology to the field of information systems. It demonstrates how the ethnographic approach of immersion allows the researcher to become very close to the research subjects and to be able to trace the meanings they attach to their work practices and the knowledge that they use. The study re-establishes the contribution of the ethnographic approach in providing a holistic picture and 'thick description' of the research topic and context.

8.3.3 Practical contribution

The conceptualisation of indigenous knowledge as a system of processes and a similar conceptualisation of the linking of IK systems with other knowledge systems could provide a basis for rethinking the policies of government and NGOs towards indigenous

knowledge. This model, supported by a detailed analysis of knowledge processes and how they are currently carried out, together with an analysis of the roles of the relevant stakeholders, could provide policy-makers with a tool through which to consider a redesign of these roles and processes, in order to improve their effectiveness. Such an evaluation was not within the scope of this study but I did get the impression that such improvements would be feasible and beneficial. This would allow a better use of scarce resources.

In particular, APIK's role in promoting IK does not seem to fit well with the role of disseminating IK. These are very different processes that call for very different skills. Similarly, the role of research institutions and universities seems needlessly constrained to the national level, while the position of the extension workers from the MoA with regard to the practices of indigenous knowledge should be clarified. A further analysis that concentrated on the basic knowledge processes, the techniques used and the resources available would be beneficial.

The study reveals a remarkable level of local indigenous innovation that should be recognised and supported by policy makers. Many of the innovations are simple and cheap and would require little in the way of resources to develop further and disseminate more widely.

Standard information technology solutions, based on structured databases and scientific epistemology, seem to offer relatively little, although the use of participatory audio-visual technology and the selective development of tele-centres seems more promising. Furthermore, in the medium-term, consideration should be given to research into the employment of Web 2.0 techniques in the field of indigenous knowledge. This includes the setting up of folksonomies, or social classifications, (Funk, 2009) that may allow the technology to support the epistemology used by indigenous knowledge. Currently this is very speculative but, given the resources, it could be worth exploring.

The study shows that, in Debre Berhan at least, the IK system remains at the heart of community life and that it is 'alive and well'. This should give policy makers confidence in supporting IK further. Furthermore, it demonstrates how local indigenous farmers use (and refine) their knowledge for natural resource management, which should also give policy makers confidence in extending its use in this area.

Nevertheless, the discussion of the external threats demonstrates the vulnerability of local communities and their IK systems to these threats and it hoped that this contributes to the awareness of policy makers for the need for action if these systems are to be secured.

8.4 Limitations

Although I was satisfied with the work I did in Debre Berhan, constraints of time and other resources did limit my stay to four months and my focus was very much centred on the indigenous community in the village. With more time and appropriate access I would have liked to have examined the strategies of the large organisations involved (government agencies, NGOs and research institutions) and interviewed senior people such as the Minister of Agriculture and directors of international NGOs. This would have given me a better understanding of their intentions towards indigenous knowledge.

Similarly, if I had had more time I would have liked to have spent perhaps a month within each of the large organisations in order to appreciate more their objectives, norms and constraints.

With just one visit to Debre Berhan, I was only able to obtain one snapshot of the situation at a particular time. Repeated visits over the course of a year would have given me a clearer picture of how the farmers managed and behaved in the face of different climate conditions and this would have allowed me to 'tell a longer story'.

Like most ethnographic studies, the research was limited to the community around a single site, Debre Berhan. I believe that this village is representative of many others

across Ethiopia, and perhaps much of Sub-Saharan Africa. However, there are constraints on generalising from a single study, especially in a large, complex and multi-ethnic country like Ethiopia.

My background in both NRM and the language and customs of Ethiopia allowed me to adapt quickly to the community and I worked diligently to collect data. However, I cannot be sure that I didn't miss data of importance. For example, for any researcher, it is very difficult to notice 'things that are not there' – in other words, one does not notice the absence of, for example, conflict, extensive fuel supplies or particular products in shops. Despite my efforts at triangulation, as in most interpretive research, it is up to the individual researcher to interpret the data and we all bring our particular biases and expectations to any site or problem situation.

8.5   Directions for future research

This study is very much an exploratory one that, I believe, opens up various avenues for future research. The model of knowledge systems based on processes has only been outlined in this research and further conceptual refinement and rigorous 'testing' would be beneficial.

Then, I believe that this study could be extended and replicated, particularly in line with the limitations above, and I would recommend studies employing the conceptualisation of IK as a system, a similar conceptual framework and an ethnographic approach would be worthwhile in:

- Other villages and indigenous communities within Ethiopia and other parts of Africa and beyond. These would be useful in themselves as well as for comparison with my own results.
- Studying in detail the knowledge processes of the large stakeholder groups (e.g. government) that were rather neglected with my focus on the indigenous communities and their knowledge.
- Examining in more detail individual knowledge processes within indigenous knowledge; for example, knowledge creation and knowledge transfer.

- Examining more carefully the relationship between indigenous and scientific knowledge with a view to improving the two-way transfer of ideas and knowledge between the two systems.
- Extending this type of study to other spheres of indigenous knowledge, such as medicine.

This study has revealed a significant gap in the innovation studies literature regarding the position of indigenous innovation. I believe that this needs to be filled, both conceptually and empirically, for indigenous innovations to be more widely recognised and disseminated.

Similarly, I believe that it could be fruitful to extend knowledge management studies outside the boundary of the individual firm (or industry) and consider knowledge management within the community. Again, this requires both conceptual and empirical research.

As noted above, information technology tools are currently little used within IK but it seems that new tools, such as Web 2.0, are now becoming available that could perhaps cope with the different epistemology of IK. This would seem to be a fertile area for further research.

More generally, the potential benefits of exploiting IK further do appear to be attractive and further research, in terms of a short-term and long-term comparison of the tangible and intangible costs and benefits of IK and scientific solutions to particular problems would be welcome.

Finally, the potential enormity of the external threats to indigenous communities and their knowledge systems justifies further research, at both the regional and local levels, in order to learn more about the threats and determine ways of alleviating them.

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