Chapter 2

Background information on Mozambique, literature review and framework for analysis

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PART III: Framework for the analysis of the field results

Background information on Mozambique, literature review and framework for analysis

2.1. Introduction

In Chapter 1, we articulated the problem of ICT implementation in Mozambique and how this was shaped by broader processes of globalisation, development, transfer of ICT innovation, and micro-processes of change within organisations. This chapter presents background information on Mozambique and situates the question of ICT within development and globalisation processes. This background helps to sketch an organisational analysis, for which it draws upon actor-network theory, structuration theory and contextualist approach. This helps to design the framework for the analysis of the results case studies.

The chapter is organised into 3 parts. The first part describes the background information on Mozambique, including demography, existing ICT infrastructure and human resources. The second part is concerned with a review of social theory, with particular emphasis on actor-network and structuration theory, and aspects of change in organisations. The last part is concerned with the design of the framework for the analysis of the field results.

Part I: Background information on Mozambique

2.2. Background of Mozambique

The background information is presented under three headings. The first provides a review of the political situation. The second describes demographic conditions including geography and population. The third section describes the situation regarding ICT infrastructure in the country.

2.2.1. The country: an overview of the political situation overview

Mozambique, an African country, was colonised by Portugal for a long period of about five hundred years. Mozambique engaged in an armed struggle for its independence from 1964 to the 1974, and independence was gained on the 25th of June 1975 under *Frelimo* single party rule. Following independence, many skilled people and professional workers fled the country, unable or unwilling to endure the arduous adjustment to the new social and political conditions. For example, the only existing university in the country at that time had its academic staff reduced to 5 Mozambican professors (Eduardo Mondlane University (EMU), 1989). This exodus of skilled staff also took place in different socio-economic sectors of the country, like health and agriculture.

The new government based its vision on a centralised economy. During the first two years of its existence it launched a programme to nationalise different companies considered to be strategic for development. It was under this programme that the Electricity Company of Mozambique (EDM) was established as a result of the nationalisation of all companies that dealt with the production and distribution of electricity in the country.

Shortly after gaining independence, a civil war broke out in Mozambique which affected all aspects of development and led to millions of Mozambicans being displaced. This war, apart from causing serious loss of life, destroyed the socio-economic infrastructure in the country, such as schools, health facilities, telecommunication and electricity networks. In 1990, a new constitution was adopted in the country and a multiparty system was established. The country changed its official name from the People's Republic of Mozambique to the Republic of Mozambique (Governo de Moçambique, 1990). In 1992, after many rounds of negotiations, a peace agreement was signed between the parties involved in the civil war (Mozambican Government and the *Renamo* Movement) (Awepa, 1992). Since then the country has been in peace under a multiparty ruling system.

2.2.2. The country: geography, population and economy

Mozambique is a country situated in South-eastern Africa between the parallel 10 degrees 27' north and 26 degrees 52' south, and between the meridian 30 degrees 12' east and 40 degrees 51' west. It is bounded by the Indian Ocean to the east, Tanzania to the north, Malawi, Zimbabwe and South Africa to the west, and Swaziland and South Africa to the south (map 2.1). The total area of Mozambique is about 801,509 square kilometres. The northern and western regions are mainly mountainous and hilly. Parts of the central and the coastal region consist of large plains.

Administratively, Mozambique is divided into eleven provinces, with Maputo as the capital city of the country. The provinces are divided into districts and the districts into administrative posts. In total, the country has 128 districts, 23 cities, 387 administrative posts and 68 towns (International Institute for Applied Systems Analysis (IIASA), 2001)

Map 2.1: Map of Mozambique

The climate is predominantly tropical, with three main sub-climates: a humid tropical climate in the northern, central and southern coastal areas; a dry tropical climate in the south and the Zambezi valley; and a high altitude tropical climate in the mountainous regions in the interior. The country's flora is mainly open forest and savannah. The

climate is characterised by two principal seasons, the rainy season, which lasts from October to November and the dry season, which last through the middle of the calendar year from April to May. Mozambique has an average annual rainfall of between 1,000 and 1,500 mm.

Based on the census data from 1997, the estimated population of Mozambique in 2000 is about 17,242,240 inhabitants (Instituto Nacional de Estatistica (INE), 1999). The density of the population was approximately 21 people/Km². Nearly 75% of the population live in rural areas. About 45.7% of the population consists of children under 15 years of age. The average household size is 4.6 persons. More than 70% of the households are headed by men, (INE, 1999). Longevity, measured as life expectancy at birth, was estimated at 46 years for the population as a whole (ibid.).

Living conditions in Mozambique are poor. The majority of houses are without electricity, piped water and sanitation. Only about 5% of houses have access to electricity (25% of houses in urban areas and only 2% in the countryside), 15.3% of houses have access to piped water (2.4% inside the house, 6.1% outside the house and 6.8% stand pipe) (United Nations Development Programme (UNDP), 2000b). More than 60% of the population is illiterate. More than half of the male population is literate in contrast to little more than 20% literacy among female population. Total gross national product (GNP) for 1997 in Mozambique was estimated to be approximately US$2.4 billion, and per capita GNP was US$143 (ibid.).

In 2001, the United Nations Development Programme calculated the human development index (HDI) which comprised of three basic components of human development: longevity (life expectancy), knowledge (adult literacy and mean years of schooling) and standard of living (purchasing power based on real GDP (Gross Domestic Product) per capita). An index lower than 0.500 is considered a low HDI, an index between 0.500 and 0.799 is a medium HDI and an index equal to or higher than 0.800 is a high HDI. The HDI in 2000 for Mozambique was calculated at 0.341, categorising Mozambique as having "low human development". The country with the

highest HDI is Norway (0.939), and the lowest is Sierra Leone (0.258) (UNDP, 2001a). The ranking of Mozambique in HDI is 157 in a group of 162 (ibid.).

About 60% of the Mozambican population has a monthly income equal to or lower than US$20; the national poverty line, adjusted for differences in the cost of living in various parts of the country is about US$0.50 (fifty US cents) per person per day. At the national level the incidence of poverty is 69.7% (UNDP, 2000b).

2.2.3. The country: ICT infrastructure, utilisation and experiences

The UNDP, in 2001, introduced the concept of the Technology Achievement Index (TAI), which attempts to capture how well a country is creating and diffusing technology, and building human skills. TAI is not a measure of whether the country is leading in global technology development but focuses on how well the country as a whole is participating in the creation and use of technology. TAI has four components: creation of technology (capacity to innovate and creative adaptation), diffusion of recent innovations (for example, the Internet), diffusion of old innovations (for example, telephone and electricity) and human skills (indicated by mean years of schooling and enrolment of students in tertiary education in science, mathematics and engineering) (PNUD, 2001). These components taken together reflect the capacity of the nation to participate in technological innovations at the present time.

A TAI index below 0.20 is considered low (marginalised countries), between 0.20 and 0.34 is for dynamic adopters, an index between 0.35 and 0.49 is potential leaders and an index equal to or higher than 0.50 is a high TAI (leaders). The TAI for Mozambique was the worst in the world calculated at 0.066, reflecting a state of extreme marginalisation in terms of participation in the creation and use of technology. The country with the highest TAI is Finland (0.744) (PNUD, 2001).

In 2000 the Government of Mozambique conducted the first national survey on ICT infrastructure. The results of the survey indicate that the country is gradually entering

the global information society. However, the spread is very uneven with more than 50% of the ICT equipment and infrastructure being located in the capital city, Maputo (*Comissão Nacional da Política de Informática* (CPI), 2000). The present ratio of Mozambican inhabitants per computer is 3:1000 and in relation to Internet use, 2:10 000 (Gaster, 2001).

Telecommunication data

In Mozambique, telecommunication services are provided in a monopolistic arrangement through a public enterprise called '*Telecomunicações de Moçambique'* (TDM).

The national telecommunication density is around 0.46, indicating that many Mozambicans still do not have access to telecommunication facilities, particularly those who live in rural areas (TDM, 2001).

Table 2.1 below shows some telecommunication data in terms of services. Although the data show that the TDM is increasing its capacity in offering more telecommunication services to the Mozambican population in general, there is still much work to be done in order to extend these services to the majority of Mozambican citizens.

Table 2.1: Mozambique telecommunication infrastructure data (source: TDM, 2001)

	1997	**1998**	**1999**	**2000**
Installed capacity in telephone communication	104556	105612	113606	121754
National network connection capacity (circuit)	8745	8995	17017	20457
Primary external network capacity (par)	126049	129424	136459	147359
Secondary external network capacity (par)	171107	176177	185917	197231
Installed network line	9423	13319	13516	18354
Number of telephone lines	65606	75354	78072	85714
Mobile phones	2500	6725	12243	51065
Internet providers through telecommunication company (TDM)	5	5	5	6

The telephone system is relatively good in urban areas and a fair service can be found in rural areas. In 1995 Mozambique had just one provider for the Internet services, about 100 Internet users and in the year 2000 the figures changed to 10 Internet

service providers (ISP) and about 2: 2536 Internet users, (African figure 1:5000 and South Africa 1:65) (CPI, 2000). Currently, the country has 13 schools with access to the Internet, as part of the Schoolnet project (ibid.). These data show how unequal Mozambique is in terms of Internet access, i.e. its digital divide status. Digital divide refers to inequality of access to Internet. Access is only a precondition for overcoming the inequality in a society dominated by functions and social groups around the Internet.

The diffusion of Internet use is very rapid in global terms. Castells (2001) in his work on Internet access, presents data that show the level of Internet penetration in different regions of the world's population. These data refer to September 2000, and in this period there were approximately 378 million Internet users, representing 6.2 percent of the world's population. These percentages of users were distributed as follows: North America had 42.6%; Western Europe accounted for 23.8%; Asia region with Japan included had 20.6%; Eastern Europe 4.7%; Latin America 4%; Middle East 1.3% and Africa .6% (most of users are from South Africa).

ICT-related facilities

Table 2.2 shows the basic data of ICT obtained from the ICT national survey. From this table, it is clearly evident that the majority of Mozambicans are still far away from having access to computers and Internet-related technologies. There are also differences among provinces within the country and compared to the rest of the country the capital city Maputo has the best ICT statistics.

Table 2.2: Basic data from the ICT survey (source: CPI, 2000)

Designation	Cabo Delgado	Niassa	Nampula	Zambézia	Tete	Manica	Sofala	Inhambane	Gaza	Maputo Province	Maputo City	Total
Number of existent Computers	65	172	402	337	348	203	880	79	118	712	8201	11516
E-mail access	18	16	66	90	13	122	110	13	17	768	4 024	5257
Internet access	9	15	50	36	13	17	78	11	14	64	2 229	2536
No. of ICT professionals	12	9	32	82	37	13	154	3	5	25	693	1064

As Castells (2001:269) stated:

> The fundamental digital divide is not basically measured by the number of
> connections to the Internet, but by the consequences of both connection and lack
> of connection. Because the Internet, as shown in this book, is not just a
> technology. It is the technological tool and organisational form that distributes
> information power, knowledge generation and networking capacity in all realms
> of activity.

Castells argued that presently there is unlikely to have worldwide development
without Internet-based support.

> Because without an Internet-based economy and management system, there is a
> little chance for any country to generate resources necessary to cover its
> developmental needs on a sustainable ground – meaning economically
> sustainable, socially sustainable, and environmentally sustainable. (Castells,
> 2001: 269).

Zuboff (1996) argues that the notions of an information economy and
informated organisations will not be taken place if traditional actions and
procedures about management, work are simply included in new ways.
She explains as follows:

> An information economy requires more than infrastructure investment. It
> requires a new social moral vision, binding members of the firm together in
> ways that contrast profoundly with the well worn emotional pathways of the
> industrial hierarchy. Until these matters are seriously engaged by the leadership
> in a majority of our business organisations, the notion of an information
> economy is much like the foolish emperor of fairy tale fame, naked and very
> much at risk (ibid.:2).

ICT Policy and its implementation strategy

In 1999 the government of Mozambique created an official commission under the
leadership of the Prime Minister with the task of designing a national ICT policy. For
the composition of the commission, see Appendix 2.1. This policy was developed
through a participative process in which citizens representing various groups were
involved over several months.

The ICT policy describes the framework to integrate ICT issues into overall national development strategies. It outlines guidelines, principles and objectives to enable this integration to take place.

In terms of the policy it is argued that ICT efforts need to be integrated with the country's different developmental aspects, such as programmes for the reduction of dire poverty, the improvement of the basic living conditions of the citizens, enhancing educational and knowledge development, improving the quality of services in public and private institutions, and increasing the participation of citizens in democracy and political life. The ICT policy was approved by the government in December 2000 (Conselho de Ministros, 2000).

The main objectives of the ICT policy were defined as follows:

- To raise awareness among Mozambicans of the potential role of ICT in sustainable development.
- To contribute to the elimination of dire poverty and to the improvement of the living conditions of Mozambicans.
- To provide universal information access to all citizens.
- To contribute to increasing quality in public and private institutions.

The role of different stakeholders in achieving the above objectives was clearly defined in the ICT policy, including government, the private sector, higher education and research institutions, and society at large, as well as international development agencies. The policy also defined the following priorities:

- Education and Human Resources
- Health
- Universal Access to Information
- ICT Infrastructure
- Governance.

Other areas include agriculture, natural resources, tourism and environment, public security and electronic commerce, etc.

In 2001, the Mozambican national commission for the development of ICT policy also developed an ICT implementation strategy in the defined priority areas. The ICT implementation strategy consists of defining and designing programmes and projects. Within each area of intervention, different high priority projects were identified to be launched in the short term (2001 to 2004) and long term (beyond 2005) (CPI, 2001).

ICT Utilisation and experiences

The use of ICT in Mozambique can be traced back to the second half of 1960s, when the first computer (of unknown type) was introduced into a tobacco company (Kluzer, 1993). However, the Railway Company had begun using mechanical tabulators for statistical purposes on transit trade in the late 1940s. In the sixties the main objective of using computers in different companies was to support the provision of administrative and accounting operations (ibid.).

The situation now has changed quite significantly, and ICT tools can be found in various areas of socio-economic development and in society in general, both at home and in workplaces (CPI, 2000).

One example is the pilot project on ICT utilisation in health care. This involves the use of GIS (Geographical Information Systems) for mapping malaria areas in the country; health information systems at the district level to strengthen the management of health facilities; tele-medicine so that patients in remote areas can have consultations where specialised medical services are not available.

In the area of education, there are experiences of using ICT-based tools in the learning and teaching process. For example, within the *Acacia* programme there is a Schoolnet project, the aim of which is to introduce and use Internet-based tools in pre-secondary schools in Mozambique (schools which provide 11th and 12th classes). EMU is currently preparing a project proposal for the introduction of distance education in the country, with the aim of using ICT as an enabler for the process. Presently, a national NGO '*Fundação para o Desenvolvimento da Comunidade*' (FDC) is involved in an initiative to establish networks for primary schools in the rural areas (6th and 7th grades). These examples have strong records of investment in human capital.

However, the Mozambican Government, supported by other development agencies and the private sector, will continue to allocate resources to the education network.

Currently, the country is experiencing a process of testing the use of ICT and related technologies insofar as they contribute to rural development. The establishment of Telecentres is an example of this initiative. Additional information related to the Telecentres experience in Mozambique is provided in Chapter 4 of this thesis.

Different public and private institutions are implementing ICT-based solutions in order to improve the quality of provision of their services. In Chapter 4 of this work, a description of two case studies is presented, addressing the adoption and use of ICT-related initiatives in the banking and electricity industries.

Human resources – specifically, IT

In recognition of the key role of human capital as an engine of the global information economy (UNDP, 1999, 2000a, 2000b, 2001a, 2001b), the Mozambican ICT policy has identified the area of human resources as a priority for development (Conselho de Ministros, 2000). Strategies for ICT education and human resource development are considered critical, and only by developing skills and capacity can the country succeed socially and economically (CPI, 2001).

According to recent statistical data, only about 40% of the Mozambican population are classified as literate, while a further 10% have received tertiary training, and less that 1% the overall population has ICT skills or experience (Massingue, 2001). From Table 2.2 it is clear the there is a shortage of ICT professionals countrywide. This tremendous shortfall in ICT skills is reflected in the fact that since the inception of the informatics degree course in 1987 at the EMU, only around 100 students have graduated (Departmento de Matemática e Informática (DMI), 2002). This tremendous shortage emphasises that the ICT skills shortage has been and will continue to be one of the most serious challenges to the process of adoption and use of ICT within the country, and in particular, in public sector organisations.

After presenting the overview of the background of Mozambique, the next part of this chapter will review the different theories that constitute the pillars of this research work.

Part II: Literature review

2.3. Social theory

2.3.1. Actor-network theory

The objective of this section is to provide a brief overview of actor-network theory (ANT) in IS studies and also to demonstrate its applicability to this study.

This section is divided into three subsections. The first subsection covers ANT concepts and the sociology of translation in particular. This is followed by a sub-section which articulates the role of ANT in IS and, finally, the third subsection highlights the limitations of ANT.

2.3.1.1. Actor-network concepts and the sociology of translation

Actor-network theory is an alternative approach to the theory of social construction of technology for the conceptualisation of the role of technology in micro-studies.

Drawing on the key concepts and the assumptions for the social shaping of technology, Callon and Law (1989) make use of the actor-network approach to emphasise the interrelated and heterogeneous character of all components (social and technical). Actor-network theory is mainly concerned with researching the social and technical issues related to technology. The theory assumes that social and technical factors are inextricable. This means that people and artefacts have to be analysed within the same framework and context (Latour, 1987; Akrich, 1997; Akrich and Latour, 1997). The symbolic boundary between people and ICT is in a constant state of flux across a wide spectrum of contemporary work and leisure activities, and actor-network theory offers one way to research the issues and dilemmas in this new world.

Work in the sociology of scientific knowledge and social studies of technology has contributed to an understanding of technology as an integral part of social life (Barnes *et al*., 1996). In actor-network theory as articulated by Latour (1987; 1991, 1997b) and Callon (1986; 1991), technological innovation is viewed as an attempt to build

and stabilise a diffuse system of allies composed of both human and non-human entities. The idea of an actor-network centres around the notion that the development of technology involves the building of networks of alliances between human and non-human actors. This corresponds to a breakdown of the clear division between science and society, and it argues that there is no such thing as a social problem that does not have technological components, nor is there a technological problem that does not have social components. No project is purely technical, nor is it purely social. Actor-network theory proposes the use of networks of interrelated human and non-human actors who shape the way things are, as 'actor-networks'. This renders possible the circumvention (avoidance) of technological determinism in which technical projects and innovations proceed naturally unless they are actively stopped, and replaces it with the idea that things do not happen unless human and non-human actors make them happen.

One of the strengths of the actor-network approach is the systematic avoidance of what can be called 'methodological dualism': the drawing of *a priori* distinctions between what is 'technical' and what is not (and is therefore by implication 'social') (Bloomfield and Vurdubakis 1997:85). 'Rather than assuming that we are dealing with two separate, but related, ontological domains - technology and organisations - we propose to regard them as but phases of the same essential action' (Latour 1991:129). The presumed separation between technology and organisation is a sense-making device, one of the means by which we orient ourselves in the world (Bloomfield and Vurdubakis 1994). In ANT, identities are negotiated through the deployment of various human and non-human intermediaries, which thereby mediate the relationships between actors. Intermediaries are passed between actors. This can imply a distinction between actors who have agency, and intermediaries, which are seen as essentially passive. However, it should be noted that attributions of agency versus passivity are context-dependent, made for particular purposes (Bloomfield and Vurdubakis 1997). For instance, in the case of the use of IT in the NHS (National Health System) studied by Bloomfield and Vurdubakis (1997:89), the intermediation between the domain of technology and the (social) world of the organisation is interlinked with the intermediation between the professional groups of management

and clinicians, and their respective rationalities (medical/administrative). Thus, in addition to constituting/negotiating the boundary between the 'technical' and the 'social', the IT-review at the NHS is an intermediary device which effects translations between the worlds of management and medicine, the commercial ethos of management consultancy and the public service orientation of the NHS (Bloomfield and Vurdubakis 1997).

The theory (ANT) is not a stable body of knowledge that can be used by researchers in an unproblematic way, since its developers themselves have frequently revised or extended elements of it (Braa, 1997; Walsham, 1997, 2001). However, there are some basic concepts of ANT that have remained relatively stable over the last few years. From the work of Walsham (1997, 2001) and based on Latour's viewpoints (1996, 1997a), Table 2.3 presents some key concepts of this theory.

Table2.3: Summary of ANT key concepts (source: Walsham, 1997, 2001)

Concepts	*Description*
Actor or actant	Actor network is the heterogeneous network of aligned interests including people, organisations and standards
Enrolment and translation	To create a body of allies, human and non-human through a process of translating their interest to be aligned with the actor network
Delegates and inscription	They are actors who 'stand in and speak for' particular viewpoints which have been inscribed in them
Irreversibility	The degree to which it is subsequently impossible to go back to a point where alternative possibilities exist
Black box	A frozen network element often with properties of irreversibility
Immutable mobile	A network element with strong properties of irreversibility and effects which transcend time and place

Based on an overview of actor-network theory, Walsham asserts that:

> ANT examines the motivations and actions of actors who form its elements, linked by associations, of heterogeneous networks with aligned interests. It is also recognised that a key future of the theory is that actors (or actants) are taken to include both human beings and non-human actors such as technological artefacts. A major focus of the theory when applied in particular contexts is to try to trace and explain the processes whereby relatively stable networks of aligned interests are created and maintained, or alternatively to examine why such networks fail to establish themselves (Walsham, 2001: 46).

Sociology of Translation

One of the main concepts of ANT is translation, which means that an entity A defines B. There is no difference if B is human or non-human, collective or individual. B might be endowed with interests, projects, desires, strategies, reflexes or afterthoughts. All translations must be collected in the network. There should not be a difference between those that are reasonable and those that are considered unrealistic. All entities and all the relationships between these entities should be described, for together they make up the translator. Translation is concerned with the process of definition and inscription. The relationship between actors and their networks is never finally resolved.

The sociology of translation is based on Latour's (1991) alternative to technological determinism, in which things do not happen unless other actors make them happen. It implies that each actor who takes the project further may take it in a different direction than that intended by the previous actor. Latour (ibid.) uses the term 'translation' to describe this effect, playing on both of its meanings. The innovation is translated or carried from one position to another in the sense of a mathematical manipulation; the innovation is also interpreted or transposed from one position to another in the linguistic sense of the word 'translation'. Translation operates between actors: an actor gives a definition to another actor, imputes to him/her/it/them interests, projects, desires, strategies, reflexes and afterthoughts (Callon, 1991). An actor might be the company that has conceived, produced and distributed a machine, and another actor its users. The translation operation is regulated by conventions that are more or less local, and are always revisable (Callon, 1991). The final shape and position of the innovation is unlikely to be that of the original developers. In each stage of its life, the project is taken and adapted by the actors that become involved in it. Only in the rare case when the future users can be persuaded to follow the initial goals, does the innovation proceed as originally planned. All too often, however, the issue becomes unfocused and unintended effects occur.

When an innovation is introduced into an organisation, it creates a new meaning and therefore disturbs the circuit of social integration. The new meaning is fixed in the obligatory passage points. An obligatory passage point (OPP) occurs in an actor-

network linked by discourses presenting the solution of a problem in terms of resources owned by the agent that proposes it. An OPP will allow the creation of alliances and control over resources that agents need to achieve their outcomes. The concept of OPP was developed within the sociology of translation and actor-network theory (Callon, 1986; Latour 1987, 2000). Callon (1986) characterizes four moments of translation through the following concepts:

a) The problematisation or how to become an indispensable actor

Certain actors, or initiators, attempt to impose their definition of the situation on the others. Thus, they seek to be indispensable to other actors by defining the nature of the problems and suggesting that these problems would be resolved if actors negotiated the 'obligatory passage point' suggested by them. This includes

> ➢ The inter-definition of the actors and
>
> ➢ The definitions of the obligatory passage points.

In the problematisation phase, a primary actor or initiator problematises an issue. Initiators define the problems and identities of other actors in a way that makes the former an obligatory passage point for the solution of the problems or issues. It is a stage in the process of network building where certain actors are concerned with defining their identity and other actors' identities in the network.

b) The devices of 'interessement' or how the allies are locked into place

This is a series of processes by which the initiators seek to lock the other actants into the roles that are proposed for them in that programme or initiative. At the general level of '*interessement*' is 'actions by which an entity attempts to impose and stabilise the identity of other actors it is defined through its problematisation' (Callon 1986: 207-8). This means that one actor (or certain actors) raises issues and defines the identities of other actants. The initiator achieves this by making himself indispensable to the actors and indispensable to the solution for the problem. After the identities of the actors have been defined, those experiencing the problem must be isolated. This isolation consists of impeding any other possible alliances or interference that might

challenge the legitimacy of the OPP. If the *'interessement'* is successful it will confirm the validity of problematisation and the alliances.

c) Enrolment: How to define and co-ordinate the roles

Enrolment is a set of strategies in which the initiators seek to define and inter-relate the various roles they allocate to other actors. It requires the initiator to convince other actors to join him. Thus it is a multilateral power process. Intentions and intentional influences are of central importance in organisational life. This is emphasised in what is labelled as 'ideological control'. This control takes place by influencing ideologies held by organisational actors, shaping their ideas of what reality is about, how reality should be, and how the desired state can be achieved. Ideological control in organisations tends to be based on authority rather than on motivation. Thus motivation is central to enrolment since enrolment has to do with binding elements together. Successful networks of aligned interests are created through enrolment of a sufficient body of allies, and the translation of their interests so that they are willing to participate in particular ways of thinking and acting that networks maintain. Enrolment can be seen as a successful outcome of problematisation and the *'interessement'* processes.

d) The mobilisation of allies: the spokespersons as representative

During the mobilisation stage, the initiators use a set of methods to ensure that spokespersons for relevant collectives are able to represent those collectives properly, so that the initiators are not betrayed by the spokespersons. This step consists of establishing the legitimacy of the spokesperson.

The movement between each step is called displacement and when displacement occurs power is exercised. Information systems can be viewed as OPPs. For example, in practice some commercial airlines force travel agents to use their reservation systems. Those airlines have converted their systems into successful OPPs that travel agents must traverse if they want to sell airline tickets.

Of particular interest are the related concepts of stability, irreversibility, convergence and obligatory passage points. Network building is a search for stability which is

made possible to the extent that changes set in train during network construction become irreversible (Callon, 1991; Law and Callon, 1997); either because it would be too costly to reverse them or because to do so becomes unthinkable. According to Callon (1991), convergence and irreversibility of techno-economic networks are both involved in the acts of translation and the networks that they sometimes succeed in forming. Convergence is the degree of accord (alignment and co-ordination) engendered (provoked) by a series of translations, i.e., convergence measures the extent to which the process of translation and its circulation of intermediaries leads to agreement. Controversies are translation as betrayal. The network is constructed according to the translation's own logic. A translation is irreversible in that it is impossible to return to a previous situation. Convergence can increase or decrease, and the same holds for irreversibility. The impossibility for other (past or future) translations developing and imposing themselves is a battle, a fight that is never definitely won. Irreversibility taken as the predetermination of translations and as the impossibility of a return to competing translations, is synonymous with normalisation. A network which irreversibilises itself is a network that has become heavy with immutable, durable devices (frozen elements or 'black boxes') and inscriptions, norms of all sorts and which, as a result, slips into a codified methodology and information system. If there are numerous and heterogeneous actants interrelated in the network, there will be a need to have a greater degree of network co-ordination. This will lead to a greater probability of successful resistance to alternative translations.

In summary it can be said that actor networking mixes humans and non-humans with inscriptions of all types. It can be understood through the study of translation operations, which inscribe the mutual definitions of relevant actors in the intermediaries in circulation. In this type of network it is clear that the behaviour of an actor is not fixed. It changes with the state of the network, which is also a product of previous actions. In this situation, it seems important to start the analysis of the network from the perspective of the actors and their changeable conditions.

The difference between the adoption and use of ICT from the traditional and ANT perspectives is presented in Table 2.4 through reinterpretation of the key concepts of the Rogerian diffusion theory, using ANT vocabulary.

Table2.4: Diffusion reinterpreted as translation (source: McMaster et al. 1997)

	Diffusion	**Translation**
Innovation	A technology perceived to be new by the adopter	A technology yet to be 'black-boxed'
Communication	Channels (cosmopolite/localite) (mass media/interpersonal) through which innovations are transferred	Inscriptions and translations are made
Time	Speed of decision to innovate; earliness of adoption; rate of adoption	Network dynamics enrolment, control and dissemination
Social system	Homophily - sharing of interests of human actors	Interest - between actants (human and non-human 'actors') and goals - black boxes from when interests move in the same direction
Technology	Changes are made to the form and content of technology as a result of experiences of implementation (reinvention)	The technology changes (are translated) through being enrolled, regardless of whether the form or content of the technology is modified
Socio-technical stance	Social system and technology are separate - diffusion is adoption of technology by social system (technology transfer requires the bringing together of social and technical elements)	Social system and technology are inseparable - successful technology transfer gives the appearance of separation, but this is merely evidence that the actor network has stabilised

2.3.1.2. The role of actor-network theory in IS

Some of the above concepts can be related to understanding attempts to build socio-technical information systems, which are adopted within an organisation. This cannot be explained 'solely by recourse to mere "technical" factors. Nor can it be explained by reference to the supposed effects of some powerful social forces which were "always there" but somehow mysteriously overlooked' (Bloomfield *et al.* 1997:130). Instead, to explain these deviations in information systems development, use and

implementation, we can consider several of the processes inherent in the building of heterogeneous actor-networks. The notions of intermediation and translation were used to good effect in the research on IT at the NHS by Bloomfield and Vurdubakis (1997). Attempts to apply actor-network theory in other disciplines were also presented in the 'Actor-Network Theory and After' conference in July 1997 at Keele University. These attempts were in such fields as sociology (Barry and Elam, 1997), health ethics and policy (Berg, 1997), ecology (Cussins, 1997), cultural studies (Hatt, 1997), urban planning (Murdoch, 1997), and linguistics (Myers, 1997). A selection of the conference papers has recently been published as a monograph (Law and Hassard, 1999). A special issue of *Organisation,* including a themed section on actor-network theory and managerialism, has been published in which several papers discuss how actor-network theory can be used for organisational analysis (Hassard, Law and Lee 1999). The use of ANT in IS research is increasing, e.g., Scandinavian academics are applying the sociology of translation and inscription to study information infrastructures (Monteiro and Hanseth, 1996; Hanseth and Monteiro, 1997; Monteiro, 2000). Organisational theorists at Gothenburg University are applying ANT, and in particular the sociology of translation, to organisational processes, institutional transformations, management and organisational identities (e.g., Czarniawska, 1998; Adolfsson, 1998; Dobers, 1998).

In a discussion of actor-network theory and IS research, Walsham (1997) observes that software devices can be seen as network elements which display strong properties of irreversibility and are mobile across time and space. He also reviews several recent applications of actor-network theory to IS empirical research, some of which were contained in the proceedings of the IFIP Working Group 8.2 Conference in Cambridge (Orlikowski *et al.,* 1996). They were as follows: the inscription of work in a classification scheme for nursing work (Bowker *et al.*, 1996); the process of translation in activity-based costing and accounting technology (Boland and Schultze, 1996); the processes of inscription and translation in the role of standards in EDI systems in the Norwegian health sector (Monteiro and Hanseth, 1996); and the attempted translation of interests in a car parking system (Vidgen and McMaster, 1996). Included was Walsham's own work with Sahay (Walsham and Sahay 1999),

which describes how and why the attempts at translation and alignment of interests around the development and use of administrative geographic information systems in India were a relative failure.

Walsham comments that some IS and actor-network researchers either explain the technology at the expense of social interactions, or conversely portray social interactions without giving detailed descriptions of the technological inscriptions. Walsham (1997) also outlines some of the existing criticisms and limitations of actor-network theory and classifies them into four broad strands: limited analysis of social structures; amoral stance; the problem of generalised symmetry; and the problem of description. The next subsection will draw and expand on Walsham's paper and bring in other authors' critiques of actor-network theory, which are relevant to information systems research in general and to this thesis in particular. The aim, as suggested by Walsham (1997), is to correlate the methodological approach and conceptual ideas of actor-network theory with insights and analysis drawn from other social theories.

ANT as an IS research method

As a constructivist theory, actor-network theory is, according to Monteiro and Hanseth (1996), an effective way of describing how minute, technical design solutions are interwoven with organisational issues; and as claimed by Walsham (1997:477), 'ANT can be used to illuminate the results from the field research.'

Walsham (1997:469) says that 'actor-network theory is both a theory and methodology combined', in that it allows the researcher to 'trace and document network elements, both human and non-human, processes of translation and inscription, the creation of black boxes or immutable mobiles and the degree of stability and irreversibility of networks and their elements' during his or her empirical work. This is no small task for a complex network (ibid.: 470). Walsham (1997:476) claims that actor-network theory studies produce an actual mass of detail which often leads to book-length outputs – for example Latour's monograph on *Aramis* (1992) but also Vaughan's (1996) book which is typical of in-depth sociological case study. On the one hand, it is stated that IS research is lacking in research-based books such as

those, and that studies based on actor-network theory could offer a contribution there (Walsham, 1997). On the other hand, as Mitev (2000b: 35) recognises, 'the delivering of this type of books is extremely labour-intensive and time-consuming, for instance Vaughan spent nine years researching and writing her book on *Challenger'*.

Some IS researchers have found that 'only a rich, integrative view of IS implementation does justice to the complex realities of social life in an organisation' (Myers, 1994:198) and that implementation can only be understood in terms of its wider social and historical context. Furthermore, Harvey and Myers (1995:23) argue that 'generalisable knowledge is often neither relevant nor meaningful, in which case we are better off understanding specific contexts', and what is needed is 'a rigorous approach to the analysis of the institutional contexts of IS practices, with the notion of context being one of the social construction of meaning frameworks' (Harvey and Myers 1995:21). Sauer (1993:3) recommends studying all the cases so as not to reject any part of them as irrelevant and to come closer to a realistic understanding of the adoption of information systems in organisations. In this way a more holistic and interpretive approach which captures the full reality of organisational behaviour in 'its setting' has therefore been proposed and is increasingly being employed in IS research (Walsham, 1993).

The following are the research questions of this thesis: 'How do we understand the interplay between the dynamics of the ICT-related innovations (applications) within organisations and rural communities and the development of Mozambique in terms of the globalisation trend?' 'What can we do to make the use of ICT more effective?' 'To what extent is ICT contributing to the development in developing countries in general and in Mozambique in particulary?' If one breaks these questions down into two levels of analysis the following questions are asked: How do the various Mozambican actors (mainly government, but also other categories, e.g. managers, community leaders, etc) perceive the role of ICT in the country's development in the context of global integration? At the micro-level, the implementation of ICT innovation in the three cases is going to be analysed. The important question for this level of analysis is: 'How does the ICT initiative relate to the developmental aspirations of the various

stakeholders (owners, managers, custumers, community leaders, etc.) as actors involved in network formation to achieve particular developmental objectives?' In the light of the characteristics of an interpretive research study that will be discussed in Chapter 3 in this dissertation, it seems appropriate that an interpretive epistemology should be adopted in this research work, from the perspective of actor-network theory. The justification for the use of ANT as one of the pillars of this research work is based on the fact that it provides theoretical concepts as a form of viewing elements in the real world. At the same time it suggests how these elements need to be traced in empirical work, and it is concerned with the investigation of social and technical issues of technology in a specific context.

2.3.1.3 ANT Limitations

Actor-network theory has its critics and limitations, as any theory does. In brief, the four broad strands of criticism identified by Walsham (1997) are as follows: Its disregard for social structures, its levelling and neutralising of the role of human actors, its lack of political and moral analysis, and its descriptive power as opposed to its capacity for explanation. These limitations point to a need to complement it with some form of social theory and contextualist approaches.

Social structures

Actor-network theory has been criticised for concentrating on how things get done to the detriment of how broader social structures shape socio-material practices, for giving interesting accounts of local contingencies and material arrangements, without taking into account macro-social structures, which influence the local ones. Different researchers (Reed, 1995; Law, 1994; Walsham, 1997) have voiced this criticism. In response to these criticisms, Latour (1991) has replied that the actor-network methodology can be used to move between levels of analysis, that the macro-structure is made of the same 'stuff' as the microstructure, and that macro-structures can be investigated with the same methodological tools as microstructures.

Humans and non-humans

The symmetry between human and non-human actors, which is related to the symmetry between the social and the technical, society and nature, politics and science, values and facts, has been criticised for having gone too far in erasing all distinctions and reducing people to the status of things. In other words, levelling human and non-human differences has political implications.

Moral and political issues

The disregard for macro-structures has led to criticisms of actor-network theory, and of strong social constructivism and relativism in general, for being amoral and apolitical in that it leads to ignoring the political biases that can underlie the spectrum of choices for relevant actors (Winner, 1993). This problem does not only occur in relation to ANT, it also exists in social construction theory. ANT does not give specific guidelines for examining the ethical and moral implications of IT (Walsham 1997; Bijker, 1993). Star (1991) refers to the 'networks of the powerful' and talks about how irreversible networks are only stable for some and discriminate against those who do not belong to the community of practice, those who use and maintain the network. Latour (1991) responded to criticisms of apoliticism and moral relativism:

> Refusing to explain the closure of a controversy by its consequences does not mean that we are indifferent to the possibility of judgements that transcend the situation. For network analysis does not prevent judgement any more than it prevents differentiation. Efficiency, truth, profitability, and interest are simply properties of networks, not of statements. Domination is an effect not a cause. In order to make a diagnosis or a decision about the absurdity, the danger, the amorality, or the unrealism of an innovation, one must first describe the network. (Latour 1991:130).

Latour (1999) provides a counter-argument to the amorality of ANT studies of science and technology. He uses many of the key ANT concepts referred to in Table 2.4, but adds some new ideas, and takes a fairly political stance in advocating the need for the citizens' engagement in the debates about science and technology in society.

Description

The argument put forward by Latour is that social constructivism is not in itself amoral, and that describing the network is not only a prerequisite, but also the only way to get explanations:

> The explanation emerges once the description is saturated; if we display a socio-technical network - defining trajectories by actants' association and substitution, defining actants by all the trajectories in which they enter, by following translations and, finally, by varying the observer's point of view - we have no need to look for additional causes. Explanation is the stabilisation of a network. If one is capable of explaining effects of causes, it is because a stabilised network is already in place. (Latour 1991:129).

This is related to the criticism that actor-network theory is a method for describing, but not for explaining. Callon's answer (1991) is that these explanations are only offered by networks which increase their convergence and irreversibility (an agreement getting firmer), and that the descriptions delivered by intermediaries turn into explanations (and even predictions). This still leaves us with the question of how to examine the ICT innovation in a local context and also understand the interplay between ICT innovation and developmental aspirations and perceptions of the different actors within a specific context such as Mozambique. Walsham (1997) observes that identifying all the heterogeneous associations within an actor-network is difficult enough, without all those overlapping networks.

2.3.2. Structuration theory

This section of the thesis will provide an overview of structuration theory (ST) and its application in the field of information systems. For this research ST is applied in order to gain an understanding of how new structures that are built through the adoption and use of ICTs contribute to development.

This section is divided into four subsections. The first subsection outlines the key elements of ST. The second subsection covers the use of structuration theory in information systems research. After this, the third subsection discusses the limitations

of structuration theory and, finally, the fourth subsection outlines the relation between ANT and ST in information systems studies.

2.3.2.1. Key elements of structuration theory

'Structuration refers abstractly to the dynamic process whereby a structure comes into being' (Giddens, 1977:121). Giddens (1979:66) states that structuration means 'conditions governing the continuity or transformation of structures, and therefore the reproduction of systems.' Giddens (1984) also characterizes two major schools of sociological enquiry: those predominantly concerned with structure and those predominantly concerned with agency. The key concepts of ST are as follows below:

Agency

Human agency in Gidden's formulation is the 'capacity to make a difference' (Giddens, 1984:14) (also known as 'transformative capacity'). It is intimately connected with power; in fact, this is one of its characteristics, since the loss of the capacity to make a difference is also powerlessness. As Walsham and Han wrote in their work on structuration theory and IS research:

> … the model of human agency in the theory views human beings as *monitoring their conduct and its results in a reflexive way* in which, together with an emphasis on the inevitability of *unintended consequence of intentional human conduct*, implies that all actions carries within the seeds of change; thus all action can both transform as well as reproduce existing structure. (Walsham and Han, 1991:78) (Italics are from the quotation).

Structure

Giddens (1984:17, 377) defines structure as 'rules and resources recursively implicated in social reproduction; institutionalised features of social systems have structural properties in the sense that relationships are stabilized across time and space'. Structure can be 'conceptualised abstractly' as two aspects of rules - normative elements and codes of signification. Giddens (1984) claims that structure exists only in memory traces, the organic basis of human knowledgeability, and is instantiated in action. For Giddens (1984) structure refers, in social systems, to the structuration properties allowing the binding of time and space in social systems, the

properties which make it possible for discernibly similar practices to exist across varying spans in time and space and which lend them a systemic form. To say that structure is a 'virtual order' of transformative relations means that social systems as reproduced by social practices do not have structures, but rather exhibit structural properties and that structure exists as time-space presence, only in its instantiations in such practices and as memory traces orienting the conduct of knowledgeable human agents. Giddens (ibid.) considers structure not merely as constraining, but also as enabling.

The duality of structure

The key principle in ST is the duality of structure. It is composed of two main concepts - structure and agency. These concepts are dependent upon each other and recursively related – human action is enabled and constrained by structure, but structure is also the result of human. Thus, the duality in ST refers to the way in which action and structure presupposes each other.

As Lyytinen and Ngweyama(1992) say:

> All social activity, including work processes, can be viewed as enbled and constrained
> by social structures that are produced and reproduced via human agency. (Lyytinen and
> Ngwenyama, 1992:21).

The structural properties of social systems are both medium and outcome of the practices they recursively organise (Giddens, 1984). Giddens (1979) isolates three dimensions of institutionalised social structure: signification, legitimisation and domination. He also considers three key processes of human actions during interaction, namely communication, the exercising of existing power and sanctioning of conduct. The dimensions of structure are linked to the processes of interaction (the two poles of the duality) by means of three modalities; interpretive schemes, facility and norms. The dimensions of the duality of structure are given in the following diagram (Figure. 2.1).
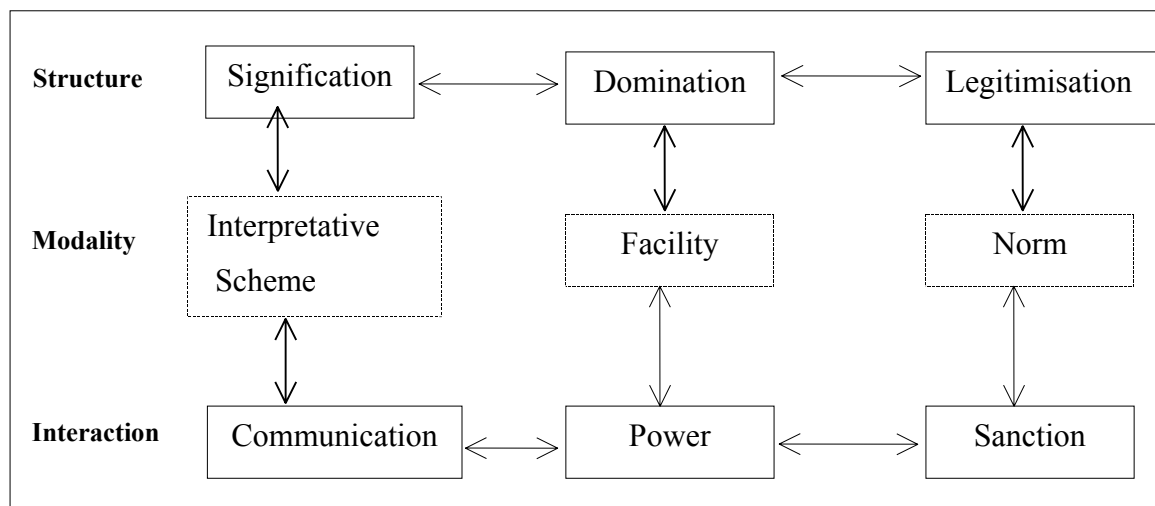
Structure	Signification	⟷	Domination	⟷	Legitimisation
Modality	Interpretative Scheme		Facility		Norm
Interaction	Communication	⟷	Power	⟷	Sanction

Figure 2.1: Dimensions of the duality of structure (source: Giddens, 1984)

Social structure and human interaction are broken down into three dimensions (solely for the purpose of analysis) and the recursive character of these dimensions is illustrated by linking modalities. Thus, as human actors communicate, they draw on interpretative schemes to help make sense of interactions; at the same time those interactions reproduce and modify those interpretative schemes, which are embedded in social structure as meaning or signification. Similarly the facility to allocate structures of domination and moral codes (norms) helps to determine what can be sanctioned in human interaction, which iteratively produces structures of legitimisation. It is important to consider that the separation of structure and interactions into three dimensions is merely a helpful analytical device since dimensions are inextricably interlinked; for example, although signification is structured by language, language uses also expresses aspects of domination and has normative force. This signifies that social action can reproduce existing structure, but also produce a new structure.

In Giddens's view, structuration is the process whereby the duality of structure evolves and is reproduced over time and space. Agents in their actions constantly produce and reproduce the social structures, which both constrain and enable them. Thus structuration theory provides a connection between human action and social structure (Giddens, 1979, 1984). The key principle in structuration theory is the duality of structure: human action is enabled and constrained by structure, but

structure is also the result of human action. Thus, the duality in structuration theory refers to the way in which action and structure presuppose each other.

Social integration and system integration are two concepts that are part of structuration theory as Cohen (1990) stated, as quoted by Scheepers and Rose (2000:5):

> Whereas social integration refers to face-to-face reciprocities between agents who meet in circumstances of co-presence, and therefore preserves a concern for *praxis in situ*, system integration refers to reciprocities between absent agents, i.e. agents who are physically absent and/or temporarily situated in different settings which admit the possibility of intersituational articulations of systems patterns.

Giddens (1984:376-377) defines social integration as reciprocity of practices between actors in the context of co-presence, understood as continuities in and disjunctions of encounters. And he considers system integration as reciprocity between actors or collectivities across extended time-space, outside conditions of co-presence.

Time-space distanciation refers to the 'stretching of social systems across time and space on the basis of mechanisms of social and systems integration' Giddens (1984: 377). As the recursive and reflexive structuration of social action extends between people over geographical distance and time, so the embeddedness or bite of those practices increases.

Summary of structuration theory

Clark (1990) sums up structuration theory as a series of interrelated propositions:

1. The main substantive focus of social enquiry is not individual action and the experience of the individual actor (methodological individualism), nor the existence and requirements of some types of societal totality (structural-functionalism and to a certain extent, Marxism), but social practices. It is social practice that lies at the root of the constitution of both individuals and society.

2. Social practices are created by knowledgeable human agents with causal powers, i.e. powers to make a difference. Human agents are neither cultural dopes nor simply the product of class forces. They have a capacity for self-reflection in day-to-day interaction, a practice of 'tacit' consciousness of what they are doing and the ability under certain circumstances to do it.

3. However, these social practices are not random and purely voluntary, but ordered and stable across space and time. In short, they are *routinised and recursive*. In producing social practices, which make up the visible patterns which constitute society, actors draw upon 'structural properties' (rules and resources) which themselves institutionalise features of societies.

4. Structure is therefore activity-dependent. It is both medium and outcome of a process of stucturaction - the production and reproduction of practices across time and space. This process is what Giddens has called the 'double hermeneutic', the double involvement of individuals and institutions. However, the following quote perhaps makes it clearer: 'we create society at the same time as we are created by it' (Giddens 1984:14).

Giddens' own summary of structuration theory can be found in Giddens (1984:1-40).

2.3.2.2. Structuration theory and information systems

Structuration theory has been applied in different studies within the field of IS (Barely, 1986; Orlikowski, 1991, 1992, 1993; Walsham, 1993; Scheepers and Rose, 2000).

Walsham and Han (1991) and Jones (1999) reviewed the literature concerning IS and structuration theory. Walsham and Han (ibid.) analyse the literature under the headings of operational studies, its use as a *meta-theory* and the use of specific concepts from the theory. Jones describes some of the key issues related to ST and reviews the ways in which ST has been used in the IS field. The reviews help to conceptualise the use of theory from one field (in this case social theory) to another

(information systems). From these two reviews a classification of the use of ST in the field of information systems can be done with three different purposes:

- To theorise - to re-conceptualise or theorise on aspects of the new field of information systems.

- To analyse: as an analytical framework for the retrospective understanding of empirical situations or cases.

- To operationalise: providing operational guidance for practitioners (in this case IS practitioners).

Theorizing

Different researchers have adapted ST in the field of information systems over the last decade (Orlikowski, 1991; Orlikowski and Robey, 1991; Walsham, 1993; Karsten, 1995; Walsham and Sahay, 1999). The work done by Orlikowski is an attempt to theorize aspects of the IS field using ST. In Orlikowski and Robey (1991) and Orlikowski (1991, 1992, 1993b), structuration theory is applied to the relationship between IT and organisations.

The duality of structure in interaction can be understood as follows: Agents communicate, exercise power and sanction their own behaviour and that of others by drawing on modalities (stock of knowledge, rules and resources) and in doing so produce and reproduce structures of signification, domination and legitimisation. Indeed, ST provides an important overarching framework for theorising about relationships between technological change, beliefs, action, and structures (Orlikowski, 1991, 1992). In ST, technology is viewed both as constructed and enacted by humans and as having institutional properties that constrain and enable human action (Orlikowski and Robey, 1991).

Orlikowski (1992) proposes a model derived from Giddens's structuration theory to investigate the relationship between technology and organisations. This proposal is grounded in the concept of the duality of structure. She (Orlikowski, 1992:405) sees the technology as structure:

I propose that it should be considered as one kind of structural property of organisations developing and/or using technology. That is technology embodies and hence is an instantiation of some of the rules and resources constituting the structure of organisations.
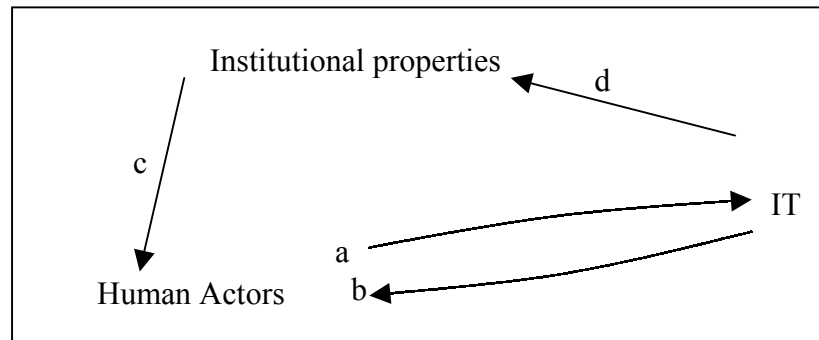

Figure 2.2: Structurational model (source: Orlikowski, 1992)

a) IT as a product of human action

Technology is an outcome of such human action as design, development, appropriation and modification. Thus, the claim that IT is a product of human action does not limit itself to the simple fact that designers often play a crucial part in the creation of IT. It also includes the production that takes place in use.

b) IT as a medium of human action

Technology facilitates and constrains human action through the provision of interpretative schemes, facilities and norms. IT, thus, can function as a resource for, as well as a restriction upon human action. This is, in essence, the duality of technology. IT can not only enable and simplify certain actions, but can also restrict and hinder certain patterns of action.

c) Institutional conditions of interaction with technology

Institutional properties affect the human actors in their interaction with IT. The rules, norms and procedures that, taken together, create a specific culture in an organisation are institutionalised over time. This affects the human actors and is also reflected in the use of technology.

d) *Institutional consequences of interaction with technology*

IT affects the institutional properties, either by reinforcing them or by changing them. As was seen above, the construction and use of IT is conditioned by the organisational stock of knowledge, resources and norms that constitute an organisation's systems of signification, domination and legitimisation.

These four relationships between IT and organisational dimensions that constitute the structurational model of technology operate simultaneously, not sequentially. The model of technology integrates the micro and macro-levels of social analysis by demonstrating the relationship between human agency and institutional properties. Examining selected relationships (e.g., studying how IT influences users, without understanding how users appropriate the IT, or the conditions within which the mediation occurs) can only result in a partial understanding of how IT interacts with organisations.

The contribution of Orlikowski's structurational model is that the model allows us to understand the interaction between technology and organisations at various levels such as inter-organisational, group and individual level. For this research the ST will contribute to the macro-level of analysis of the developmental issues in the Mozambican context. In doing so the following question will be addressed in detail: 'How do the various Mozambican actors (mainly Government, but also other categories, e.g., managers, community leaders, etc.) perceive the role of ICT in the country's development in the context of global integration?'

Analysing

Analysing involves applying theory in order to gain insight into an empirical situation. Barely (1986) described the introduction of computer tomography (CT) scanners into the radiology departments of two different community hospitals in Massachusetts, USA. The research study conducted by Barely was aimed at exploring how the actions of the actors and institutionalised traditions within the organisations influenced each other as 'occasions for structuration'. Although Barely, in his description of the cases does not refer directly to the terms of the duality of structure, its three dimensions can be discerned in the case study where Barely explains aspects

of communication/signification, power/domination and sanction/legitimisation. Another example of the use of ST occurs in Karsten, (1995) where Lotus Notes implementation in three organisations is analysed. Brooks (1997) adds the Orlikowski and Robey (1991) structuration framework of systems of development to the analytical armoury in reporting upon CAD (Computer-aided design) systems. Jones and Nandhakumar (1993) go further in their analysis of the development of an Executive IS by reflecting upon the theory. Jones (1994) uses ST in the analysis of the process of the IS strategy formation and implementation in a UK District Health Authority.

Walsham (1993) offers a sustained longitudinal case study analysis covering issues related to IS strategy, development, implementation and evaluation in three different organisations. Walsham's book can be considered as research that provides an explicit theory base, a well-developed case study analysis and well-justified conclusions.

Drawing on Giddens' concept of the duality of structure, Walsham (1993) states that information systems and organisations are both constrained by the context, but at the same time they can change it. In Walsham's model, context plays the role of the structures and information systems the role of actions. Structuration theory, especially its modalities, interpretative schemes, facilities and norms, is adopted by Walsham to conceptualise the linkage between context and process in social systems. For Walsham (1993:64) the contribution of structuration theory in the field of IS can be seen as follws:

> A theoretical view of computer-based information systems in contemporary
> organisations, which arises from structuration theory, is that they embody
> interpretative schemes, provide coordination and control facilities, and
> encapsulate norms. They are thus deeply implicated in the modalities that link
> social action and structure, and are drawn on in interaction, thus reinforcing or
> changing social structures of signification, domination and legitimation.

Walsham and Sahay (1999) used structuration theory with actor-network theory to investigate problems in developing Geographical Information Systems (GIS) in an Indian government department. Their focus was analytical, and they took care to specify the relationship between the two theoretical bases, with Giddens providing

meta-theory and actor-network theory providing 'a more detailed methodological and analytical device.'

In this research ST is only one of a number of theoretical ideas employed. A mix of ideas ranging from actor-network theory, the human environment model, structuration theory and the contextualist perspective will be used in Chapter 5 to conceptualise an 'analytical framework' mainly drawn from Giddens (1984), Pettigrew (1985), Callon (1986,1999), Du Plooy (1998), Latour (1999) and Law and Hassard (1999).

Operationalizing

Information systems being an applied discipline, it is reasonable to expect that researchers should attempt to distil their theoretical and analytical expertise into forms that a practitioner in the IS field might adopt as guidance for practice (Mumford and Henshall 1979; Checkland, 1991). From the literature, it seems that there are some research works that have been done in this regard, based on Giddens' work. Walsham (1993) offers an overview of the future of IS which sums up what has been learned from the research projects and presents it as guidance for practitioners, researchers and educators.

2.3.1.3. Structuration theory critique

Some criticisms levelled against structuration theory have been addressed by other social theorists. Barely and Tolbert (1988) claim to have many reservations about ST regarding the conflation of structure and agency or *vice versa*. For them conflation creates a problem of reducing structure to action or *vice versa* and it is consequently difficult to document an institution dissociated from action. Archer (1982) argues that conflating structure and agency weakens their analytical power.

Orlikowski (1993c:8) in her tutorial on how ST can inform the social study of IT, summarises the criticisms of ST as follows:
- No conventional program of cumulative research
- Few guidelines for empirical research

- Obscure language and ambiguous concepts

- Uneven exposition and incomplete work

- No universal generalisations

- Recursiveness of agency and structure is a vicious circle and cannot be studied

- Individuals are so influenced by their social context that the notion of human agency is untenable.

Other criticisms regarding the use of structuration theory in the IS field concern subjectivism. Monteiro and Hanseth (1996) criticise the application of structuration theory in IS, particularly the works of Orlikowski (1991) and Walsham (1993). They acknowledge the insights from structuration theory, especially regarding the duality of technology. However, they argue that it does not go far enough towards explaining how organisations relate to information systems. Despite being very convincing, there is a 'lack in precision regarding the specifics of the IS' (Monteiro and Hanseth, 1996:326); and the explanations 'are not fine-grained enough with respect to the technology to form an appropriate basis for understanding' (ibid.: 328). They consider a major problem related to structuration theory being used in the field of information systems, to be the fact that those proposing structuration theory do not describe in detail the characteristics of the information systems they are studying. For example, Orlikowski (1991, 1993b) does not describe the productivity tool introduced for developing systems, despite the fact that such tools vary greatly. Walsham (1993) does not go into detail in one of his cases where discrepancies arose as a result of two competing architectures: centralised and decentralised *vis-à-vis* IBM and non-IBM systems. Without describing information technology and information systems in detail, it seems difficult to establish which aspects of them affect organisations. Monteiro and Hanseth (ibid.) also disagree with Orlikowski's claim that the distance between designer and users is directly proportional to interpretive flexibility. They claim that the fact that designers of tools are close to users makes it easier for the former to control the latter (distance also constitutes a difficulty in controlling discretion in the use of technology, as is illustrated by Law (1991)). Walsham

(1993:70) also recognises the limitations of structuration theory in doing research on information systems:

> Structuration theory offers a subtle and detailed view of the constitution of social life, but the analytic dimensions of the duality of structure and its associated modalities could be considered as detailed and complex for empirical analysis in some instances.

2.3.2.4. Information system, actor-network theory and structuration theory

Walsham (1997) acknowledges that Latour's extreme position is useful in forcing us to rethink issues and is a valuable analytical device, and that describing the network in detail is a good contribution of actor-network theory to building an empirical base. However, he thinks that it does not contribute directly to the debate on moral and political issues. He asks the question: 'where do the moral judgements come from if not from ideas that transcend the situation?' and adds that political and ethical theories cannot come from the basis of the network alone (Walsham 1997:475). He suggests complementing actor-network theory with Giddens's structuration theory which, he asserts, offers sophisticated models of social action and structure from individual to global levels: structure constrains actions, but at the same time, human action serves to establish structure; while modalities link action and structure.

Monteiro and Hanseth (1996) claim that actor-network theory is more effective for describing how minute, technical design decisions are interwoven with organisational issues. In their study of information infrastructure standards, actor-network theory proved useful in 'accounting for how standards acquire stability, how they become increasingly 'irreversible'.' (ibid.:327). Another important aspect of actor-network theory for Monteiro and Hanseth is its 'potential to account for how restricted interpretative flexibility across great distances can be obtained' (ibid.:332). Nevertheless, they believe that the superiority of actor-network theory over structuration theory only applies to the issue of 'being specific about the technology' (ibid.:330) and they conclude that actor-network theory cannot properly deal with institutions (ibid.:339). More recently, Hanseth and Monteiro (1998) have coupled actor-network theory with new institutionalism, after Powell and DiMaggio (1991), in

order to understand how institutions become stable and reproduce themselves. They have also coupled it with Bourdieu's theory of practice (Bourdieu, 1977) and his notion of '*habitus*' to account for the stability of action, in order to examine the design and use of electronic patient records in Norwegian hospitals.

One of the difficulties anticipated in using actor-network theory to analyse the BM, EDM and Telecentre case studies, is how to deal with not only one, but large numbers of actor-networks and how they connect and interact.

After this review of social theories, which will from the basis of this study, the next section discusses different context-based approaches in the IS field.

2.4. Context-based approaches

The increasing emphasis on the organisational context of IS has been accompanied by a change in focus from the use of computers within a specific organisation to a broader perspective analysing inter-organisational factors that influence IT use (Reekers and Smithson, 1996) and more recently to a focus on national and international factors that influence the use of ICT in organisations (Barrett, et.al., 1997; Walsham, 1998; Chriysochos, 1999; Bada, 2000; Avgerou and Walsham 2000). These developments reflect an increased understanding of the diverse factors that influence the use of ICT and the appropriate approach required for studying them. Two such approaches that are increasingly being adopted are the contextualist approach and situated analysis.

2.4.1. Pettigrew's contextualist approach

Pettigrew's contextualist approach is a research approach that studies the interaction between a particular phenomenon and the context within which it takes place. In 1985, Pettigrew introduced the contextualist approach when studying organisational change and explained its usefulness over earlier approaches to organisational change.

According to him, a contextualist study focuses on two levels of analysis - vertical and horizontal levels - and the interconnections between the two levels over time. The vertical level refers to the environment - i.e. the national environment or the international environment within which the change is taking place. The horizontal level refers to the successive interconnections of events in historical, present and future time. Thus a useful way to think about ICT and organisational change is Pettigrew's contextualist approach, and it has been employed in studies considering the consequences of introducing ICT-related initiatives in organisations (Madon, 1992, 1994; Madon and Walsham, 1995; Nelson and Dowling, 1998; Bada, 2000).

The central message of the contextualist framework is to provide a theory for research into change, which can also guide practice. This theory must help to examine change as a process in a historical and contextual way. This approach makes a distinction between the object of change (the content – 'the what of change'), factors or issues in the environment in which the change occurs (the context – 'the why of change') and how the change process unfolds in a temporal manner (the process – 'the how of change'). As Walsham (1993: 53) stated:

> It is important to see organisational change as linked to both intra-organisational and broader contexts, and not to try to understand projects as episodes divorced from the historical, organisational or economic circumstances from which they emerge. The management of organisational change is not seen as a straightforward, rational process but as a jointly analytical, educational and political process.

A contextualist approach to the study of ICT-based initiatives and organisational change focuses on the interaction of multi-level structures and systems within which ICT is implanted and the process of change that takes place over time (Walsham, 1993; Braa, 1997). However, this approach lacks an adequate theoretical underpinning and a conceptual model for linking the external context and the internal organisational context (Walsham, 1993).

2.4.2. Change as an emergent process

Planned change initiatives in the form of ICT-enabled organisational change can be viewed as strategic change (DeCock, 1996). In the literature on strategic management literature, some strategic views question the extent to which change can be planned in advance and carried out in a rational linear fashion. They point to the emergent nature and hence, the subjective character of change which technical/rational models are unable to account for.

Emergent change is the realisation of a new pattern of organising in the absence of explicit, *a priori* intentions. Such emergent change only realises in action and cannot completely be anticipated or planned. Because they are abstracted from the ongoing and grounded activities of organisational actors, the planned and technological imperative approaches do not easily account for emergent change. Nowadays, the notion of emergence is particularly relevant as unprecedented environmental, technological and organisational developments facilitate patterns of organising which cannot be explained or prescribed by appealing to *a priori* detailed plans and intentions.

The important tenet of the emergent perspectives is that change is a function of the interaction or combination of a number of factors that often produces some unintended consequences (Mintzberg and Waters, 1985). In other words, change cannot always be planned in advance but occurs in an emergent fashion and the result is not always what was intended. According to Mintzberg and Westley (1992), change mostly occurs through inductive learning within organisations, which means that ideas for change can also evolve in a bottom-up approach from within the lower level of the organisation and not always from the top management (Quinn, 1980; Westley, 1990).

The emergent change view might be particularly useful in the study of change, because it allows us to focus not only on the planned initiatives relating to change, but also on the various patterns of action, some deliberate as a result of the intentions and

others emergent, arising outside of the deliberate plans. In addition, the distinction between intended and realised change helps us to consider the gap between the two as an opportunity to understand what ICT and organisational transformation has shown: that planned and deliberated approaches do not capture the true reality of how organisations function. The 'object' of organisational change consists of both the deliberated initiatives of management as well as the realised decisions and actions that may differ from what was intended.

2.4.3. The situated change perspective

The situated change perspective is an additional perspective that provides a method of examining and explaining technology-based organisational change. Situated analysis or the situated change perspective can be viewed as a change to the practice of organising and hence as enacted through the situated practices of organisational actors as they improvise, innovate and adjust their work routines over time. Within this perspective, change is emergent from everyday practice and inseparable from the ongoing actions of the members of the organisation (Orlikowski, 1996; Monteiro and Hespo, 1998).

According to Ciborra (1999) improvisation is situated performance where thinking and action occur simultaneously and on the spur of the moment. It is purposeful human behaviour, which seems to be ruled at the same time by chance, institution, competence and outright design. Improvisation is intentional, but looks extemporaneous and without known causes or relationships.

In the situated change perspective, organisational change can be seen as an ongoing improvisation enacted by organisational actors trying to make sense of and act coherently in the world. The improvisation metaphor is used to view organisational change as a continuous activity with different and varied origins, multiple actors with multiple interpretations and actions, which combine to make up the change process (Weick, 1993).

In the notion of situated change each variation of a given form is not an abrupt or discrete event, neither is it, by itself, discontinuous. Rather, through a series of ongoing and situated accommodations, adaptations and alterations (that draw on previous variations and mediate future ones), sufficient modifications may be enacted over time so that fundamental changes are achieved (Orlikowski and Gash, 1994; Orlikowski, 1996; Orlikowski and Hofman, 1997).

A view of organisational change as situated change is grounded in assumptions of action, not stability. Organisations are enacted. Orlikowski (1996) outlines a situated change perspective as inherent in everyday practice and as inseparable from the ongoing and situated actions of organisational members. Such a perspective emerged as central to the analysis of an organisation implementing and using new information technology.

From the improvisation perspective organisational change is situated in the history and tradition of doing things within the organisation. The importance of history and tradition in shaping the organisational process is illustrated by seeing change as a 'bricolage' and change agents as 'bricoleurs'. A 'bricoleur' is someone who makes use of whatever resources are available to perform any task at hand (Weick, 1993). The concept of bricolage has implications for the management of change as such tasks are not limited to a set of predefined tools and materials. The management of change relies on an understanding of established ways of doing things and how this can be deployed innovatively to facilitate the change process.

There are different models of technological-based organisational transformation, planned change and technological imperative. Each makes a number of assumptions about the nature of agency, context, technology and change, which are appropriate to an organising practice premised on stability (Orlikowski and Gash, 1994). Current demands on organisations require them to be flexible, responsive and capable of learning required practices to deal with an ongoing change. Thus the situated change perspective has to be seen as an additional perspective on organisational change that avoids the strong assumptions that have characterised previous change perspectives. It

focuses on the situated micro-level changes that actors enact over time as they make sense of and act in the world (Orlikowski, 1996).

Based on this view, the main aim of this thesis is to attempt the development of a conceptual framework that can guide the analysis of the implementation of ICT-related initiatives for development shaped by globalisation trends in the context of a developing country. A situated perspective helps to analyse the conditions under which ICT-related initiatives lead to organisational changes and support broader development of the country.

While local improvisations are necessary to enable the fruitful transfer of technology to take place in the context of a developing country, they need to be integrated within a planned change perspective. An effective balance between the local actions and global visions can help to achieve more optimal utilization of resources, which is of particular concern in a poor country like Mozambique.

The next part of this chapter introduces the initial framework for the analysis of the results of the case studies in Chapter Five.

Part III: Framework for the analysis of the field results.

2.5. Initial framework for the analysis of the results of the case studies

The initial framework for this research work is based on the research questions given in from the previous chapter and also on the literature review on the various aspects of the problem. Figure 2.3 shows the main aspects of the problem pertaining to the adoption and use of ICT in organisations and communities. From the figure it can be seen that the process of ICT innovation is interrelated with different aspects, ranging from people and organisations to local and global environments.

The ICT innovation should be seen as an outcome of human action in terms of its design, development, appropriation, modification and use. Human action is also influenced by ICT innovation, i.e., ICT innovation influences organisational properties through the interaction of human actors with the ICT innovation. The organisational rules and procedures affect the way in which the ICT-related initiative will be institutionalised. The local context within which the ICT innovation takes place also influences the whole process of ICT innovation. This means that there is a need to accommodate the local context of the ICT innovation. ICT innovation is part of the global market. The global context should therefore also be considered in the process of studying ICT innovation.
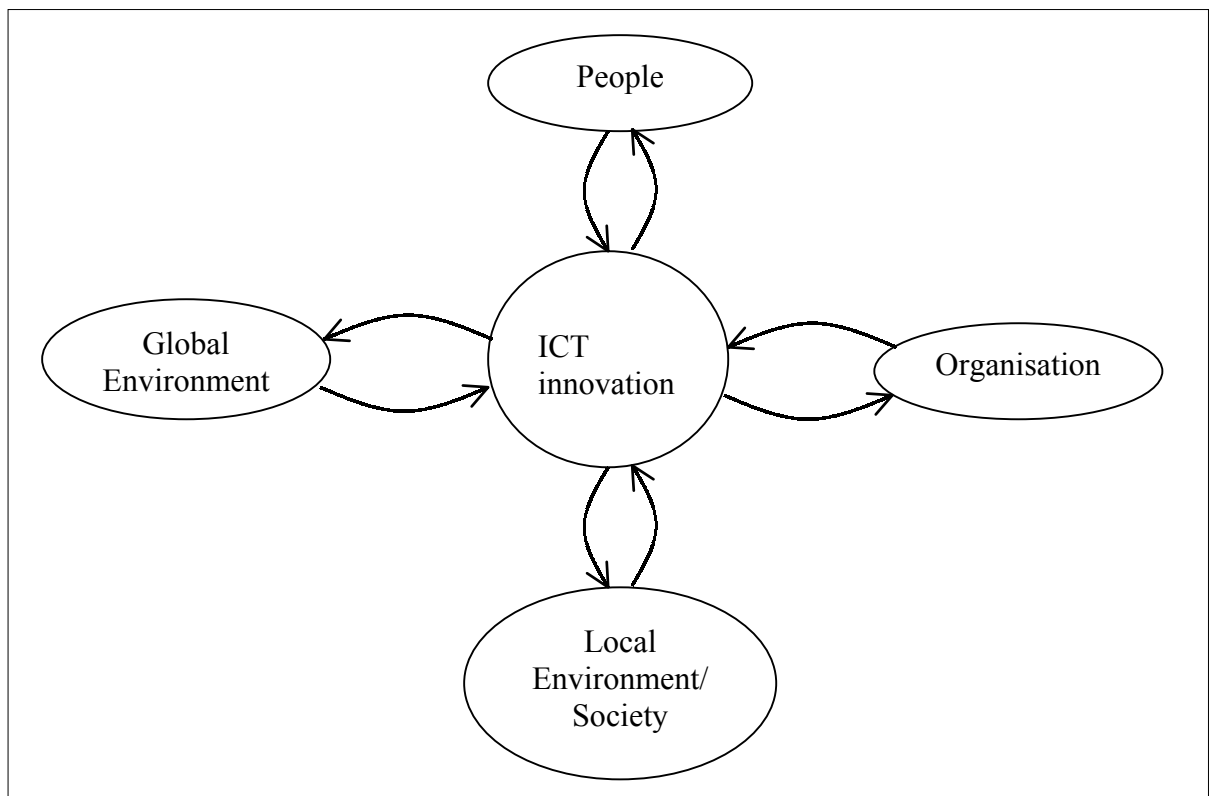
Figure2.3 Aspects of the research problem

The point of departure for the development of the framework for the analysis of the results of the case studies is the Human Environment Model (HEM) for the adoption and use of ICT, which was developed by Du Plooy (1998). The human environment model for ICT adoption and use must be seen as an integration of the social contexts of people, organisations, groups, tasks, environment and technology. The mixture of human and non-human actors has to be viewed as a collective network, which is tied by the notion of a human environment consisting of their social contexts. In the HEM there is no distinction between humans and their artefacts, or between humans and their structure. Instead they are viewed as 'two sides of the same coin'. The HEM represents the local context within which the ICT-related initiative is introduced, adopted and used, i.e., institutionalised.

Figure 2.4 presents the human environment model of ICT adoption and use. In this model the six characteristics portray the full social context for adoption and use. All

of them together constitute the essence and the substance of information and communication technology adoption and use.
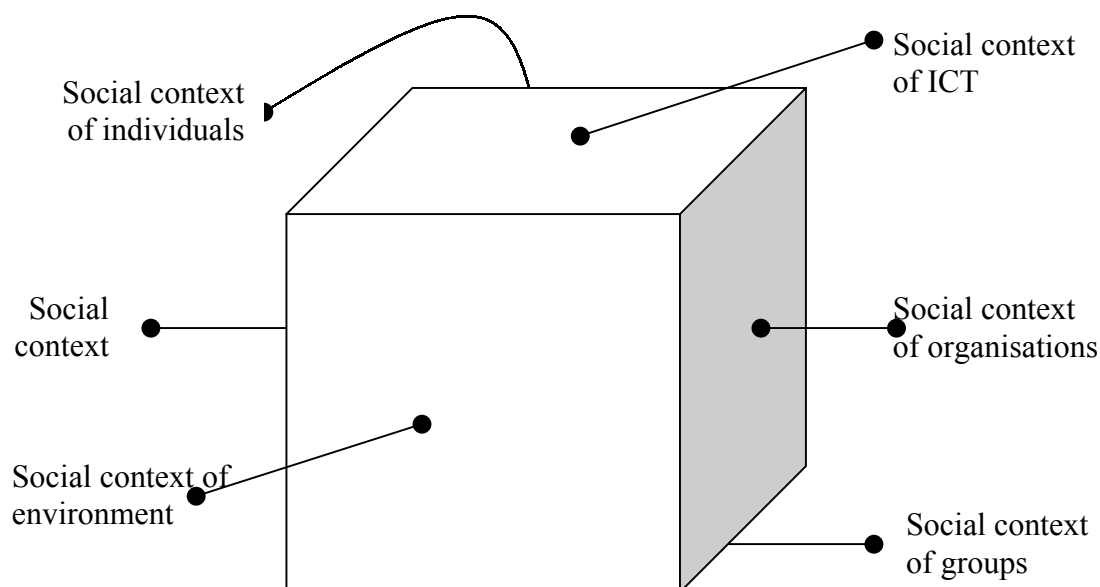

*Figure2.4: The human environment of information technology adoption and use
(source: Du Plooy, 1998)*

Bearing in mind that, on the one hand, ICT-related initiatives influence an organisation in different ways, and on the other hand that an organisation determines and shapes the ICT-related initiatives, it is important to have the relationship between organisation and ICT-related initiative encapsulated within the human environment model for the adoption and use of ICT-related initiatives. In this research work, it is assumed that the influence of the ICT-related initiative on organisations and communities takes place in different social contexts of the HEM. The ICT-related initiatives and organisations and communities are intertwined. Figure 2.5 illustrates the idea of encapsulating the ICT-related initiatives within the HEM.
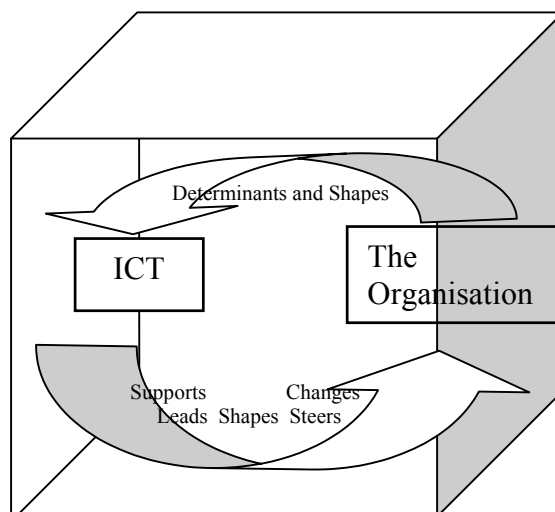
Figure 2.5: The human environment encapsulating information adoption and use
(source: Du Plooy, 1998)

The contexts of organisational change include the internal organisational context, which consists of a resource-based organisation, its history and culture, operational procedures and rules. Such influences could either be in the form of enabling changes to take place or inhibiting the change process. Besides the internal contexts that influence organisational change, there are also the outer contexts, which include the social and cultural expectations of the wider societal sector. In contemporary times, as a result of the globalisation of economic and social relations, this wider context includes influences from both the national contexts and the global (international) contexts.

In this work, cultivating and nurturing a receptive human environment means that information technology must be perceived by all actors to be a means of achieving empowerment and partnership, both functionally and democratically. The process of cultivating and nurturing the human environment needs to take into account the inner and outer context of the local site at which the ICT institutionalisation (adoption and use) takes place.
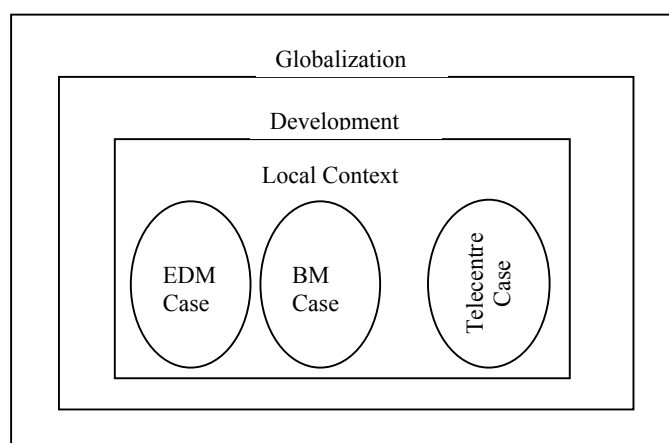
Figure 2.6: A multi-level initial framework for analysis

The first level of analysis examines the case studies, in Chapter 5, in the light of ANT in order to understand the process of building, growing and stabilising the network in the course of the adoption and use of the ICT-related initiatives described in Chapter 4. The second level of analysis interprets the process of adoption and use of ICT initiatives in the three case studies by considering the social and local context in which the process is taking place, and is based on the HEM. The final level of analysis interprets the results in terms of the contributions made by the adoption and use of these ICT initiatives to the sustainable development of the country within the context of global integration. This level of analysis will be theoretically guided by structuration theory.

2.6. Summary

This chapter presented the background information on Mozambique, reviewed theories and also described a framework for the interpretation of the results of the case studies. The background of the country clearly shows that Mozambique is a country with many basic human development problems. In terms of its participation in the creation and diffusion of technology in the network age, Mozambique belongs to the list of marginalised countries. The Government and other national and international organisational bodies are trying to change this situation by establishing ICT programmes that are aligned to the country's development programmes.

The development perspective assumed in this thesis is based on the view that development must encompass not only economic growth but also the social and human components of well-being. This implies that there is a need to have a perspective of horizontal interdependence of development projects at the local level, and that these should be vertically complementary with others at a higher level.

The theories reviewed in this chapter will be used in Chapters 4 and 5. The next chapter introduces the research methodology applied in the research work.