E-government Implementation in Mozambique:

Transferring Lessons across the Public Sector

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Abstract

Although the implementation of computerized information systems in developing countries has been ongoing for decades, the diffusion process has been slow to achieve a state of active use in organizational settings, and examples of cross-sector sharing and learning remain very limited. This paper aims at demonstrating aspects that can be shared across sectors within the same socio-economic and political implementation context, and the potential benefits that can be achieved. Empirically, the paper draws upon experiences from the study of information systems implementation within the health and land management sectors respectively in Mozambique. The concept of "translation" drawn from Actor-Network-Theory (ANT) is used as a lens to analyse both experiences, and the similarities and differences are analyzed to draw specific inferences on potential domains of cross-learning. Specific learning concerns the issues around managing the scalability and sustainability of the implementation of e-government initiatives. Four key areas of learning identified through this analysis are: use of participatory and action research development; enrolment of the government; enrolment of local universities; and use of joined top-down and bottom-up implementation approach.

KEYWORDS:

District Health Information System, Land Management Information System, Translation, Learning across sectors

1. INTRODUCTION

Mozambique is engaged in the implementation of e-government applications to support processes of socio-economic development in different sectors. The government's initiatives include the production of the Mozambican ICT Policy in 2000, the ICT Implementation Strategy which was approved by the Council of Ministers in 2002; and the e-government implementation strategy in 2004. As examples of specific e-government projects, in 2002 the government started to build the Government Electronic Network (GovNet), the State Financial Administration System (e-SISTAFE) and the Land Management Information System (LMIS). These projects are running under a larger agenda of public sector reform in Mozambique, which is being advocated by the government, various political and research institutions and sponsored by international financing institutions.

While e-government initiatives in Mozambique are a relatively new phenomenon originating after 2000, ICTs initiatives in general have been ongoing since the late 1940s when the (Mozambican) Railway Company begun using mechanical tabulators for statistical purposes (Kluzer, 1993).The first computer (of unknown kind) was installed in 1964-65 in a Tobacco Company (ibid). The usage of ICTs has involved various sectors such as health and banking. The experiences gained through these efforts, we argue can provide an important basis of learning to guide ongoing e-government initiatives. Specifically, we argue that, there are significant similarities (and also differences) in the contexts across sectors, and there could be useful learning that can be shared across them. For example, the problem of scarce

human resources is universal in Mozambique, and effective strategies used to deal with this in one sector can provide useful learning to the others.

Heeks (2004) argues that ICTs have been in use in the public sector for more than 50 years with a growing number of public agencies in virtually every country attempting to use them for various purposes (UNDESA,[1] 2003). However, there are limited attempts to compare experiences across sectors despite the potential that exists to do so. The public sectors of many developing countries, including Mozambique, have experienced profound management, financial and governance crises in recent decades, and have in many cases become defunct in effectively responding to needs of the citizens and communities they serve, especially those countries that have been historically ravaged by colonial rule (Bangura and Larbi, 2006; Ndou, 2004). Many of these countries are now attempting to introduce public sector reforms, a process fraught with multiple challenges arising from the traditional bureaucratic paradigm, poor infrastructure (human and non-human resources), sometimes undue pressure of donors and politicians to reform using quick fix solutions without being sensitive to the local realities (Ndou, 2004; Heeks, 2004; Mhone, 2003). Within specific sectors, individual strategies and processes of reform are followed often dictated by the agendas of the donor organizations, more so in highly indebted countries such as Mozambique. Sharing of lessons, experiences and knowledge among sectors, and local academics, government officials and policy makers is almost non-existent with each

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[1] United Nations Department of Economic and Social Affairs

trying to recreate the wheel. Trying to stimulate such cross sector learning and sharing is a primary motivation of this paper, which we argue can probably contribute to the scalability and sustainability of such reform initiatives.

This paper aims at making a contribution to the debate on how and what kind of learning can be shared across sectors within the specific context of e-government in Mozambique. Specifically, we draw upon two case studies of ICT implementation in the health and land management sectors for the analysis.

The health sector example concerns the experience of implementation of the district health information system (DHIS), under the umbrella of the Health Information System Programme (HISP). HISP has the agenda to improve health information systems and management in developing countries. In Mozambique the implementation of HISP has been ongoing for nearly 10 years, and through its analysis we can draw important lessons for the more current implementation of LMIS in the land administration and management sector. Moreover, there can be learning for HISP that can be gained from the approach adopted in the LMIS case. The implementation of DHIS and LMIS are both taking place in Mozambique, a country characterized by severe shortages of skilled human resources and shaped by a very hierarchical organizational structure. These implementation processes, as we will argue, follow different approaches and experience both similar specific challenges. The concept of 'translation' from Actor-Network-Theory is used to describe and compare the implementation experiences from the two sectors, with a view to draw on lessons that can be shared across the sectors.

This article is organized as follows: the next section describes the concept of translation from ANT which provides the underlying theoretical basis for the analysis of the two sets of implementation processes. The third section presents the research methods used in this study. The fourth section describes the two case studies drawing upon the concept of translation. The analysis of both cases is presented next. Lastly, lessons learned and contributions from this study are presented.

2. THE TRANSLATION PROCESS

2.1 The notion of translation

This paper uses the concept of 'translation' from ANT, which has its roots in the "sociology of translation" (Callon, 1980; 1986) to understand the process of implementation of DHIS and LMIS. These implementation processes are immersed in a complex contextual and political environment involving actors and various other technical and non-technical elements.

The concept of translation is useful in analyzing actors within a network; how actors are identified, how their roles are defined, and how their interests are aligned in such a way that certain entities control others (Callon, 1986; Latour, 1987). ANT is also concerned with the creation and maintenance of co-extensive networks of human and non-human elements. In the case of information technology, these networks include people, organizations, software, computer and communications hardware, and infrastructure standards (Walsham, 1997). Furthermore, politics and governments represent non-human elements of the network which also shape the stabilization or not of the network.

ANT assumes both human and non-human actors are equal within the network, that is, there is no difference in the ability of technology, humans, animals, or other non-humans to act (and that there are only enacted alliances). Also, it does not account for pre-existing structures, such as power, but instead sees these structures as emerging from the actions of actors within the network.

ANT's focus on empirical case studies that provide a rich description of networks has been accused of ignoring the larger social and political context, and thereby undermining the possibility of effective social, ethical and political critique (Fuller, 2000; Star, 1991). Nevertheless, there has been an increase in ANT-based information systems studies (See e.g Avgerou, 2002; Macome, 2002; Madon *et al.*, 2004, Nhampossa, 2005; Cordella and Shaikh, 2006). In some of these studies the concept of translation has been used to explain the link between technological and non-technological elements of a specific network (Akrich, 1992; Macome, 2002; Madon *et al.,* 2004; Nhampossa, 2005).

According to Callon and Latour (1981), translation means understanding all the negotiations, intrigues, calculations, acts of persuasion and violence thanks to which an actor or force takes, or causes to be conferred to itself, authority to speak or act on behalf of another actor of force. Translation can also be seen according to Callon (1991) as the definition that every actor makes of the other actors in the actor-network. To translate is to displace, but is also to express in one's own language what others say and want: it is to establish oneself as a spokesperson. According to Nhampossa (2005), the translation perspective offers an alternative conceptualization to that of "diffusion" (Rogers, 2003) of the processes of technology transfer and the spread of innovations. The concept of translation is useful in exploring how a group of actors can be brought together around a particular goal, and the stabilization of the resulting network. The fundamental idea is that human and non-human actors interact to form the networks of heterogeneous entities of the world we live in.

Interactions between actors are the building blocks of networks. Ongoing translations at a variety of levels are a key source of social order, generating institutions, governments, organizations and agents that exist over time. But control by any given actor – even by the author of a network is necessarily limited because power is diffused amongst the actors (Latour, 1986). Negotiations are part of the translation process in which actors need to construct common definitions and meanings, define representatives, and co-opt each other in the pursuit of individual and collective objectives.

In ANT, every actor in a network is seen to have agency and capable of resistance or accommodation, so there must be some 'reason' that encourages them (actors) to be involved in a network. Each actor (whether a person, group, company, machine, nation) has its own diverse set of interests, thus a network's stability will result from the continual translation of interests. While between humans, translation is analogous to negotiation of common interests, between them and non-humans, the interaction will be through the design of scripts and how these are inscribed in the artefact itself. Furthermore, policies, behaviours, motivations, and goals are translated from one actor to another, and actors are themselves translated and changed in their interactions with others (Callon, 1986).

2.2 Moments of Translation

Callon (1986) describes translation as consisting of four moments derived from studying *problematization, interessement, enrolment and mobilisation*. Table 1 presents a summary of the 4 moments which are described below.

Problematization is the first moment, during which primary actors negotiate questions such as: What is the problem that needs to be solved? Who are the relevant actors? It is in this moment when delegates that will represent groups of actors need to be identified and an Obligatory Passage Point (OPP) established, so that the proposed solution becomes indispensable. The OPP refers to the node in the network through which all the actors who have interest in the problem have to pass. The primary actors make the OPP indispensable to other entities by forcing them to accept this as a way forward.

The moment of *interessement* is aimed at getting the actors interested and negotiating the terms of their involvement. Interessement involves a process of convincing other actors to accept definitions of the primary actor and the creation of incentives. The primary actor works to convince the others that the roles it has defined are acceptable. Other actors become interested in the solution proposed. They change their affiliation to a certain group in favour of the new actor-network. Furthermore, the actors then need to be isolated to limit external influences that could challenge the legitimacy of the solution. The primary actors seek to lock the others into place by interposing themselves and defining linkages between the others.

Enrolment is the third translation moment during which the principal actors define the roles that are to be played and the way in which the others will relate to one another within these networks. Actors accept (or not) the roles that have been defined for them during interessement. For enrolment to be successful it requires more than just one set of actors imposing their will on others; it also requires these others to yield. Finally, in the *mobilisation* moment, the relevant actors borrow the force of their passive agent allies and turn themselves into their representatives or spokesperson. A spokesperson speaks on behalf of others, the entities he, she, or it constitutes (animals or machines who do not speak or masses of humans who defer to the spokespersons). Thus, spokespersons simplify networks of others (who may or may not consent) by representing their interests, attributing identity, establishing roles, and advancing a course of action.

Table 1. Summary of the 4 moments of translation

Moment of Translation	Definition
Problematization	The primary actor defines the problem, the solution and identifies the relevant actors.
Interessement	The primary actor convinces other actors that its solution is better than other solutions.
Enrollment	Roles are assigned to the actors accepting the solution.
Mobilization of Allies	Actors become spokespersons.

The notion of translation is an important tool to describe and analyze how the actor-network grows, changes and stabilizes (or not) during the process of ICT implementation.

Within such a conceptualization, the effectiveness of the deployment of the technology is thus dependent on how the actor-network (people and things) is created and strengthened overtime (Callon, 1986; Latour, 1999). Continuous chains of translations along the links in the network are necessary to align and keep the actors involved and to create and stabilise the actor-networks (Latour, 1987). Translation leads to the alignment of the different actors and gradual institutionalization or routinization of information systems ultimately leading to development of durable networks (Braa *et al.*, 2004).

In this study, we discuss the four moments of translation in the implementation as inferred in the two cases and examine the similarities and differences, and also the related outcomes. This helps to understand what is the mutual learning that can take place and how.

2.3 The concept of translation as used in IS research

Various studies on IS implementation have drawn upon the concept of translation to understand how the process of translation unfolds and the associated outcomes. For example, in the context of Mozambique, Macome (2002) in her analysis of 3 cases studies of implementation of ICT – telecentres, bank, and in the energy sector - discussed factors that contribute towards either stabilising or unsettling the OPP. Her findings emphasize the importance of the role of the actor's involvement and their efforts to introduce new actors, the importance of good communication skills in the problematization and interessement moments of translation to convince and persuade other actors to transit the OPP. Consequently, the enrolment depends on the capacity for negotiations of the initiators to convince other actors to enrol in the initiative, which Macome argues is fundamentally based on communication skills.

In a study conducted by Macadar and Reinhard (2005) in a case of implementation of e-citizenship project in Brazil (São Paulo), tried to understand the interplay between actors involved in the development of an organization for telecentres network management. They found that the involvement of NGOs was important and provided the know-how required to reach the objectives of the project. The authors advised a kind of top-down approach at the beginning of the creation of the network and a bottom-up one after a while. This means that in the problematization moment a top-down approach should be used, followed by a bottom-up one during the subsequent translation moments. This strategy is useful for political reasons such as getting earlier in the project people with know-how and with powerful decision-making capabilities.

Silva (2007) viewed the translation from a power perspective. In his analysis of the implementation of land information systems in Guatemala, he found that it is important in the problematization phase to build a common understanding of the problem and solution between the initiators, that is, to construct the OPP to have similar meanings in the actor network. The solution has to address practical and tangible problems, which in turn will influence the success of the problematization. In later moments of translation, cooperation and coordination among the organizations involved is important.

The above cases outline different strategies to deal with the implementation of ICTs through the four moments of translation, which are summarized in Table 2 below, along with some other examples.

Table 2. Key elements of translation in IS in developing countries

Translation Process (Moments)	Strategies Reported in IS studies	Author
Problematization	Good communication skills of primary actors to convince and persuade other actors. Reach a common understanding between others.	Macome (2002) Silva (2007)
Interessement	Good capacity for negotiations of the primary actors. Isolate the actors from other influences.	Macome (2002) (Madon *et al*. 2004)
Enrolment	Enrol NGOs at the begging of the project. Make extensive use of media and professional advertising campaign.	Makadar and Reinhard (2005) Madon *et al*. (2004)
Mobilization of Allies	Meet the actors' needs and expectations; provide incentives for actors. Keep alliances stable.	Madon *et al*. (2004) Silva (2007)

3. RESEARCH CONTEXT AND METHODOLOGY

This study is empirically grounded in an ongoing research on e-government implementation in Mozambique. Epistemologically it falls under the category of an interpretative study, as the aim is to understand the phenomena of implementation via meanings that people assign to it. Different people's interpretation of the same situation differ (e.g the informants' and the researchers'), and the aim is thus not the construction of an "objective" account, rather a more relativistic one (Orlikowski and Baroudi, 1991). Rather than attempting to generalise from a setting to a population, an understanding of the deeper structure of a phenomenon is sought, "aimed at producing an understanding of the context of the information system, and the process whereby the information systems influences and is influenced by its context" (Walsham, 1993: 4-5).

The study uses a comparative approach to identify common factors and particularities that have contributed in shaping the implementation of DHIS and the land information system, including an understanding of the respective contexts, the strategies adopted around the individual systems, and the capacity available to stabilize the network. This approach explores features and factors of each system that might have contributed to the *status quo* situation of the networks.

While the present research on land information system started in 2006, I have been researching e-government projects being implemented in Mozambique since 2004, in the land and financial sectors. The case of the land information system has been interesting since land in Mozambique is an important asset in the government strategy for poverty alleviation and the land information system is considered as a flagship e-government system. Also, given the history of colonial rule and civil war in Mozambique, land becomes a much contested issue and thus subject to various interests and agendas. Empirically I have tried to understand the interplay between land, poverty alleviation and e-government.

Data collection methods used in the research were formal and semi-structured interviews, review of documentation, direct and participatory observation. I conducted interviews with managers of the land information system, technicians, system users in the land administration sector and e-government managers. I also had the opportunity to visit some sites (provinces) where the system was being implemented and to talk to the users. In this study, I played the role of a direct participant observer, spending days in the office with systems' users, observing what they were doing and how. In addition, the surrounding existing and new organizational procedures were also observed. For example, in one month while conducting research in one of the provinces – Maputo, I used to spend the first part of the day observing the users of the systems and other workers recording what they were doing in the office and the manner in which they were interacting with the system. I even spent 2 days learning how to enter data in the system and practising its use. In Cabo-Delgado and Sofala province, I spent one week in each place interviewing and observing various system users.

At the top level, appointments with managers were difficult to obtain and strict time slots was allocated for the interviews. Thus time spent in the offices and interviews with the managers was relatively short (about one hour with each manager). A summary of interviews conducted is presented in Table 3.

Table 3. List of conducted interviews

Period	Province	Title/Position of the interviewee	Institution	Content of the Interview
7	Maputo	ICT and Planning Advisor	UTICT	ICT strategy and policy e-government in Mozambique ICTs and development

From February to August 2006	Maputo	ICT and Planning Advisor	UTICT	e-government in Mozambique
		Training and Certification Adviser	UTICT	e-government projects in Mozambique
		Director	DINAGECA (National Level)	The history of LMIS Challenges and Opportunities of LMIS e-government for development
		Cartographer (Perform analysis of land tenures)	DINAGECA (National Level)	The history of LMIS and usability Procedures of acquisition of land tenures and registration
		Cartographer (Enter data in electronic systems)	DINAGECA- (National Level)	The history of LMIS and usability Procedures of acquisition of land tenures
		5 users of LMIS and LHAS (graduated and not graduated in different areas)	Provincial Directorate of Agriculture (DPA)	System use; potentialities; problems and Procedures of acquisition of land tenures and registration; System Demonstration (LMIS AND LHAS)
		3 Cartographers	DPA	Procedures of acquisition of land tenures and registration; ICT knowledge; Curriculum of the school of Geodesy and Cartography; land mapping; GIS at school and work.
		4 Representatives of different Institutions dealing with land tenures within DINAGECA	DPA	The role of different institutions in attribution of land tenures; Use of ICTs for land registration and management.
		Chief of DINAGECA at the province level	DPA	ICTs at the province level Challenges and Opportunities of LMIS Land registration and Management:
		6 workers of DINAGECA dealing with land tenures	DPA	ICTs at the province level Procedures of acquisition of land tenures and registration: daily life and challenges.
		1 cartographer 1 land-surveyor	Distrital Directorate of Agriculture (DDA)	ICTs at the district level Procedures of acquisition of land tenures and registration: daily life and challenges at the district level.
		1 cartographer and "head of a ward"	Administrative Post	Cartography and Land Registration in the colonial time; The process of land demarcation and consultations to the community for land attribution.
		Computer Network Specialist	UTICT	e-government infrastructure hosting LMIS
From January to February 2007	Maputo	3 Geographer	DINAGECA- National Level	Mapping and Land survey LMIS GIS courses at the university degree;
		1 Geographer + 4 recent graduates in Geography	National Institute of statistics (INE)	GIS knowledge and application in work practices; mapping land survey; knowledge and use of maps in daily life; Mozambican culture on maps; INE relationship with other public organizations;
		4 lectures	UEM	GIS knowledge and use of maps
		Manager of LMIS	DINAGECA- National Level	LMIS implementation Challenges and Opportunities System Demonstration (LMIS)
	Cabo-Delgado	1 Director	DPA	e-government LMIS Land registration and Management
		3 users of LMIS and (graduated and not graduated in different areas)	DPA	LMIS Land registration e-government
		5 workers of DINAGECA, but and non users of LMIS	DPA	Knowledge on ICTs, maps, GIS and LMIS
	Niassa	1 Director	DPA	e-government LMIS Land registration and Management
		4 users of LMIS and (graduated and not graduated in different areas)	DPA	LMIS Land registration e-government
		5 workers and non users of LMIS	DPA	Knowledge on ICTs, maps, GIS and LMIS
Total Number of		*61*		

Interviews				

Each province in Mozambique has no more than 6 users of LMIS. LMIS is being implemented by the National Directorate of Geography and Cadastre (DINAGECA), a government institution that is responsible for land management and administration, with offices at the national level, province and districts. The number of users officially trained in the use of LMIS for each province by DINAGECA is 3, except in Maputo. Interviews for this paper were conducted in three provinces, Maputo, Sofala and Cabo-Delgado. Maputo being the capital and the hub for ICT projects was thus important to study, and Sofala and Cabo-Delgado represent the Central and Northern parts of the country respectively. Suggestions for the focus in these three provinces came from the LMIS manager based on his view of representativeness of the project issues.

For the case of DHIS, I was a member of the HISP project during my master's course that started in August 2001 and was framed within the HISP philosophy of action research and participatory approach. I participated in some training sessions in the provinces and also in meetings and seminars conducted by HISP at the province, district and MoH levels. I also participated in the customization of DHIS and in the process of introducing data into the DHIS. I had the chance to practically observe some of the implementation dynamics in certain facilities.

After completing my master's thesis in 2003 I continued to indirectly follow the HISP activities through discussions with other HISP members and a reading of the masters and doctoral theses and other publications produced through this project. In addition to my own primary work during 2001-2003, I studied various documentation based on articles published in journals and conferences about implementation of DHIS in Mozambique. Examples of some of these publications are summarized in Table 4, which gives an overview of the kinds of issues addressed.

Table 4. Summary of HISP publications about Mozambique

Author (Year)	Published by	Type of Publication	Issues addressed
Braa *et al.* (2001)	EJISDC[2]	Journal Paper	The Status of ICTs in the Mozambican Health Sector and the Potential Usage of ICTs at the district and provincial level.
Chilundo (2004)	IFI[3]	Phd Thesis	Sustainability and Integration of different health information systems in the context of donor-dependant country.
Mosse (2005)	IFI	Phd Thesis	Communication Practices and Social Identity shaping the implementation of computer-based health information systems in Mozambique.
Nhampossa (2005)	IFI	Phd Thesis	Technology transfer and DHIS translation in the context of Mozambique
Lungo (2003)	IFI	Master Thesis	Legacy systems in the HIS; Suitability of DHIS in supporting effective decision-making process through provision of data with good quality; developing gateways to link legacy systems with DHIS.
Skobba (2003)	IFI	Master Thesis	Legacy and Systems development in Mozambique
Saugene (2005)	IFI	Master Thesis	Use of Spatial data within the public health sector; the integration of DHIS with GIS systems; developing migration data software.
Mavimbe *et al.* (2005)	BioMed Central (BMC) Public Health	Journal Paper	Implications of poor data quality and information systems in the provision of efficient health care services, especially immunization programmes.
Braa *et al.*(2004)	MISQ	Journal Paper	Building the network of HISP; Factors contributing or not to the sustainability and scalability of HISP.

[2] Electronic Journal on Information Systems in Developing Countries

[3] Department of Informatics of University of Oslo

In summary, the interpretation of HISP that I bring into discussion is a result of years of participant observations of the implementation of DHIS followed by secondary analysis of research findings. This is different from the land system where I have been engaged in taking notes of the interviews and observations. In the case of the LMIS there were distinct periods of observations separated from the interviews.

Analysis of data entailed drawing out key themes. Successive reading and reflection of my hand written notes from the interviews, observations and summaries of literature reviews constituted the source of information to build themes. Eccentricities and repeated issues from the interviews inspired the creation of themes. The historical perspective which I had on the HISP initiative helped to further give meaning to the themes. Themes within and across the cases were compared to develop implications for learning across sectors.

4. THE CASE STUDY

4.1 The Case of the DHIS implementation in Mozambique

4.1.1 Background

The implementation of the paper based Health Information Systems (HIS) in Mozambique was first established in 1979 to cover all levels of the health services (national, province and district) including the different health programs such as malaria, tuberculosis, mother and child health, and family planning. Nationally, the implementation of HIS was a response to the need for restructuring of the health sector in the post-independence period. Internationally, following the Alma Ata Conference in 1978 there was an expressed need to adopt the primary health care (PHC) approach as a strategy to extend health services to the most peripheral areas in the country (Lippeveld *et al.,* 2000). The PHC strategy of implementation was through the district health model advocated by WHO as it was seen to be the most effective way of providing both community and patient-specific services that are both specific and local (Amonoo-Larstson, 1989). An important aspect of the district–based model was to develop a computer based HIS that could support analysis and use of information for decision-making and management (Braa and Hedberg, 2002), and thus contribute to enhancing the effectiveness of health services delivery (Lippeveld *et al.,* 2000).

In 1992, the Ministry of Health (MoH) revised the HIS, which resulted in the integration of various health programs, reduction of the number of the data collection instruments from 60 to 12 forms and the introduction of a computerized HIS (called SISPROG) in all the provincial health offices and at the national level (Braa *et al.,* 2001). This approach did not follow the WHO advocated district model, and also SISPROG suffered from various technical constraints. As a result, many of the other health programs started to develop their own independent systems on different platforms and funded by different donors to cater to their needs unmet by SISPROG. For example, Nhampossa (2005) reports that in order to address the problem of fragmentation contributed and not addressed by SISPROG, a foreign expert employed at the MoH developed an integrated spreadsheet system called SIMP in 2002 that was subsequently implemented in all provinces and at the national level (MISAU, 2003).

Even today, SISPROG, SIMP and a variety of other computerized systems are present in the health services involving different technological solutions built upon DBASE, Visual Basic, Access, Excel, Lotus and operating systems such as MS-DOS and MS-Windows. HISP was presented as the possible solution for the problems caused by the fragmentation of various systems and their inadequacy to meet the informational needs of the health services.

After this brief historical overview, I describe the implementation process of HISP through the lens of the four moments of translation.

4.1.2 Problematization of the HISP Initiative

Initiated in South Africa, HISP aims at supporting HIS and decentralization, and is ongoing in various developing countries including Mozambique, India, Tanzania, Ethiopia, Malawi, Botswana and Nigeria. According to Braa *et al.* (2004), the primary goal of HISP is to design, implement, and sustain HIS following a participatory and action research approach to support local management of health care delivery and information flows. For that, HISP used a Scandinavian approach in information systems implementation. The Scandinavian approach relies on the participatory development of technology and the creation of knowledge. It is based on action research with an explicit, political agenda of boosting the capacity of the workers and the unions in their negotiations with management (Braa *et al.*, 2004). This approach was motivated by a perceived threat from technology, the need for developing knowledge about the technology in question, and actively propose alternative to the management (Nygaard, 1979). In this perspective there is a guaranteed sustainability and the escalation of the actor-network. Action research is in general used with the aim of improving organization strategies, practices, and knowledge of the environment within which they practice. Consequently, action research improves the quality of an organization and its performance.

The goal of HISP encompasses processes to support the improved use of information; organizational and human resources development; and developing theoretical and practical knowledge about the challenges of implementing HIS in developing countries. Parallel to this, HISP has developed a computer database known as the district information software (DHIS) to help health workers in the analysis and dissemination of information (Braa *et al.*, 2004).

DHIS is a database system first developed at the University of Western Cape, South Africa, as an open source software package based on Microsoft Office 97 (Braa and Hedberg, 2002). Microsoft Office is widely prevalent in Mozambique thus enabling its easier spread (Kaasbøll and Nhampossa, 2005). DHIS is an integrated health management information system for registering and processing routine data, semi-permanent data, and survey data, with a strong emphasis on using information for local action. The software is distributed free of charge on a CD or the Internet from the developers in Cape Town. The open source code also provides free redistribution and ability to rework the source code.

In Mozambique, HISP is based at Eduardo Mondlane University (UEM), and was established in 1998 as a collaboration between the Mozambican MoH, UEM, University of Oslo and the University of Western Cape. The Norwegian Council of Universities' Committee for Development Research and Education (NUFU) initially sponsored the HISP initiative. These actors showed aligned interests in computerizing and improving the health information system in Mozambique.

DHIS was problematized by HISP after a survey conducted by them on the use of ICT within the health sector, which led to a recommendation for the need for the development of a district-based health system to support the PHC approach. The primary actor in this case is HISP who studied the problem and proposed a solution. Then, DHIS was positioned by HISP as the OPP for solving the HIS problems, and they wanted actors such as the MoH (decision makers), health services at province and district levels (end users) other donor agencies and UEM to accept, and be enrolled in the network. The enrolment of the MoH was crucial for obtaining official sanction and its subsequent institutionalization of the DHIS as the national system. The

role of UEM (informatics and faculty of medicine) within the network was to provide computers, IS and public health expertise who could develop and implement the system through an action research project. Incentives of masters and doctoral scholarships were provided from the universities to enrol their interests. The need for enrolling other donors was to largely pre-empt them trying to introduce other systems. By enrolling the end-users, the aim was to ensure a demand side push for the system, and to try and make DHIS as the OPP for their HIS routine reporting needs. The system was enabled in the local language of Portuguese so as to help this enrolment process, and make the software "speak on behalf" of the end users.

The DHIS was positioned as a solution responding to both globally and locally defined problems. The global problem stems from the unfulfilled WHO mandate of developing decentralized HIS, and locally it represented the problem of poor informational support for health services delivery. Computerized information systems were positioned by the government as a necessary tool to respond to the need and problems of implementing reforms.

4.1.3 Interessement

After the positioning of DHIS as the solution to the problem of poor HIS and the need for reforms, the next step was to try and convince other actors to be enrolled in the network. Through a number of meetings organized by HISP and MoH, in 1999 both actors signed a formal agreement in which three pilot settings were established for the implementation of DHIS. While through this agreement, formal cooperation was established, the MoH did not provide the official sanction required to the end users to engage with this new system. A chicken and egg situation resulted with the MoH wanting HISP to demonstrate results on the ground before giving such official orders, but without these orders it was almost impossible for HISP to show effective results. This situation resulted in part too, by technical concerns that DHIS data entry screen did not have the same layout as those in paper forms which health staff were used to. And also, DHIS did not have a functionality that could import data from a legacy system – SIMP.

Through the work of master students, the old SIS-PROG database was analyzed, migration tools were developed and data was exported into a full national DHIS database (Skobba, 2003; Lungo, 2003). Further customization on user interfaces, improvement of reporting tools and stable links to SIMP were done as requested by the Department of Health Information at the MoH (Aanestad *et al.,* 2005). HISP, then replicated exactly the data entry forms, elements and reports as they are in the manual system, so that users did not fear that something would be lost through the change over. Furthermore, through the inscribed features of flexibility and local control, and available functionalities for conducting local analysis (such as through the generation of graphs and charts), the HISP team tried to demonstrate the value add as compared to SIS-PROG, and a solution to the problems that were undermining the national HIS such as the fragmentation of different legacy systems. Integration through the means of technological solutions such as gateways were created, which however, could not get the required institutional acceptance in absence of formal MoH orders.

In parallel with the customization of DHIS, in the absence of such an official order, HISP tried to convince also the health workers and managers about the value of DHIS through large scale training sessions which focussed not only on issues of computer awareness and DHIS, but also on data quality, and use of information for local decision-making. In some of these activities, the MoH staff was also fully involved in facilitating HISP's activities.

The multidisciplinary HISP team in Mozambique that conducted the training was composed of senior IS researchers, PhD students in computer sciences and medicine and international masters' students in IS and public health. According to, Nhampossa and Sahay (2005) PhD and master courses were conducted within a framework of action research where the project work would provide the empirical basis of the research and would aim at solving real life problems. This was another incentive provided by HISP both to the students and also the health services.

Furthermore, the HISP team played an important mediating role in facilitating interaction and communication between the MoH staff and province and district level field workers. Such interaction has historically not existed in the past and the presence of the HISP team seen as being relatively "neutral", helped to diffuse some of the historically existing gaps due to power structures (Puri *et al.,* 2004).

Notwithstanding, the lack of a functional HIS had also implications at the international level. For example, in 2004 the European Union (EU) sent to the MoH a Consultant in Informatics to work on behalf of them. This consultant developed a software with the requirements provided by MoH which directly challenged the DHIS. The consultant made a technical assessment of the DHIS in which he strongly criticized it, thus creating a space for his own software to be introduced. The software developed by this consultant is currently being used at all the provincial directorates.

Many other challenges were faced by HISP. For example, the "image" members or students and not professionals undermined the credibility of HISP in the eyes of the MoH. Also, South Africa was positioned as the main developer of DHIS and source for technical support to the implementation of the DHIS in Mozambique. This reflected a lack of local technical capacity of the HISP team.

4.1.4 Enrolment

During the implementation of DHIS, the three pilot settings (provinces of Inhambane, Gaza and Niassa) were first to be enrolled in the network. Furthermore, HISP's strategy provided opportunities for the staff at UEM to upgrade their educational qualifications (Masters and Doctoral), to conduct action research and contribute to solving real country problems. Health workers, especially those working at the statistical and information department were enrolled in varying degrees based on their aptitude towards computers, through the intensive processes of training and capacity building conducted by the HISP team.

The strategy of HISP to enrol more people was through demonstration and customization of the DHIS and how it could help address their local needs. Through allowing users to apply the system to local analysis and action, an attempt was made to empower the workers through information, and

with it to attempt to improve the coverage and quality of primary health care services. However, these local attempts were in our view inadequate to create a robust and stabilized network in the absence of "orders from the top." There were various other challenges such as poor infrastructure, heavy workload of staff, inadequate resources, large geographical distances (Chilundo, 2004; Mosse, 2005; Nhampossa, 2005).

4.1.5 Mobilization of Allies

In spite of HISP being a network and not an individual that could provide support to the implementation of DHIS, mobilization has been to some extent difficult due to many problems including the existence of competing systems such as the one of the EU consultant. Nevertheless, HISP in Mozambique has helped to create at least a set of people who now believe in the value of DHIS and its potential role in supporting the local use of information. However, this group is limited to the 3 provinces where the pilots have been carried out and to a certain extent in the MoH. The HISP team in Mozambique whose spokesperson is UEM is still negotiating with the MoH (a spokesperson of HIS users, pilot provinces and state's interests on the health sector) to get the DHIS to be accepted as the national data base for data analysis and reporting. UEM became the spokesperson as HISP in Mozambique was hosted there. Internally (in HISP) there is a team representative who speaks on behalf of the whole team members selected under the team rules. The MoH became a spokesperson as officially the unique organization to deal with the health sector and the respective information systems. Internally, the department of Information systems at the MoH is the spokesperson in the negotiations.

However, the negotiations have also been influenced by delays originated by changes in the political structure and other internal reasons. For instance, with the last presidential elections held in 2005, the new government has made changes in the personnel and structure of governance including the Minister of Health. The new leadership came with its philosophy and changes within the MoH. For example, people from MoH that were initially negotiating with HISP on the implementation of DHIS were all moved from their positions at the MoH. In the meanwhile, HISP is currently making efforts to fully customize the DHIS so that it can comprehensively support the national HMIS needs.

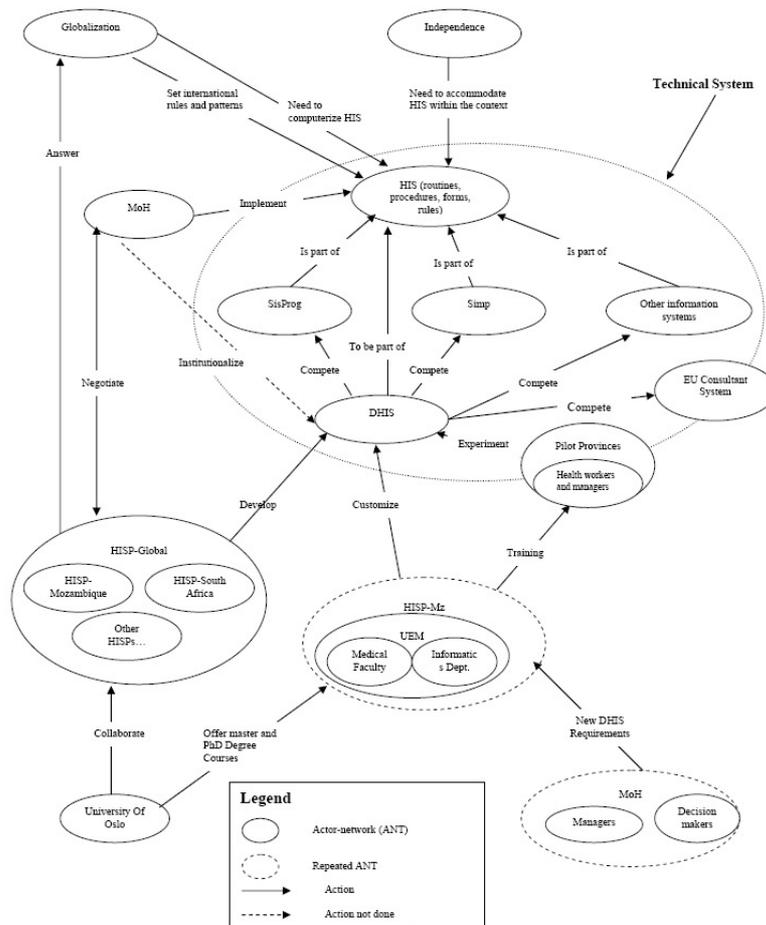Figure 1, summarizes the DHIS actor-network.

Figure 1. DHIS actor-network

The DHIS actor-network presented in Figure 1 is composed of both technical and non-technical components.

The technical part is composed by the HIS implemented by the MoH, the software supporting HIS, namely the paper

based system, SISPROG, SIMP, and other computerized information systems. The DHIS is competing with the software being used including the new one developed by the EU consultant. DHIS is developed by HISP and customized by the local team (HISP-Mozambique). Customization includes the accommodation of the new requirements set by the MoH. This team is also responsible for training users of DHIS in the pilot provinces.

The implementation of HIS is influenced by globalization in general, which sets international rules and patterns ruling HIS. The need for computarization of HIS, given to the development of ICTs around the world is another factor influencing the HIS. Locally, the need to accommodate the HIS within the context of the country is another factor that has shaped the current HIS.

The University of Oslo is the coordinator of the global HISP team which offers master and PhD Degree courses for HISP team members. Negotiations of the implementation of DHIS take place between HISP global and the MoH. The philosophy of HISP in implementing DHIS is to respond to the mandate of the globalization, specifically the creation of district health information systems that can respond to the local needs of information for decision making.

4.2 The Case of a Computerized Land Management Information System

4.2.1 Background

The National Directorate of Geography and Cadastre (abbreviated to DINAGECA[4] in Portuguese) under the aegis of the Ministry of Agriculture and Rural Development, is an executive and government institution in Mozambique responsible for national mapping (topographic and thematic), land administration and management (national land cadastre and related archives). DINAGECA is responsible for establishing, providing and maintaining the national geodetic network, national maps series, national cadastral atlas, administration and management of all land rights concessions process. DINAGECA is also responsible for information and data on land use and land cover for better planning and decision making; definition of policies; standards, norms and procedures on geo-referenced data and information.

The Constitution of the Republic of Mozambique states that land belongs to the State and cannot be sold, or transferred, or mortgaged, or given as collateral. National and international citizens are only given by the state the right to use the land not to own. This is done through local procedures of land concession. In each province of the country, the Ministry of Agriculture and Rural Development has its own directorates, where the Serviços Provinciais de Geografia e Cadastro (SPGC) is located. At the district level, there is a representative of DINAGECA in the Distrital Directorates of Agriculture and Rural Development (DDA). The whole country is administratively divided into 10 provinces, 128 districts, 394 administrative posts, 1042 localities and 68 villages. From the national level down to the administrative posts, DINAGECA has its representatives.

Little is said, written and known about the LMIS from the period between 1975 (when Mozambique gained independence) to 1991. PASS[5] (2003) states that, many (though not all) of the land records and the geodetic information was destroyed after the independence. During my research, I observed some maps designed during the period between 1920s and 1960s still in use.

The land management system during the period 1975-1990 was completely manual. There were numerous overlapping land requests and land use concessions, many of which were in competition with existing community lands (PASS, 2003). Consequently, the land registry became defunct, and this resulted into conflicts over land.

The government became increasingly aware of the growing proliferation of land use conflicts, for example, the fact that such a climate was not favourable for investments in agriculture. Land conflicts were also of great concern to international donors. To deal with these conflicts over land and to develop new land policy, the Ministry of Agriculture created a commission composed by nationals, international agencies, NGOs, UNDP and FAO (PASS, 2003).

Land conflict was seen to result from the lack of proper functioning institutions and information systems for efficient land registration and management. As a result, a modern, efficient and reliable electronic system was seen as a tool that could solve the existing problems relating to the collection, archiving, processing and administration of land records.

4.2.2 LMIS Initiative

In 1991, with aid from SIDA[6], a new electronic system was built, including the development of basic knowledge on computer awareness. A Swedish developer was in charge of the difficult task of developing the computerized system called Land Application Handling System (LAHS). In 1997, the first version of the system was installed in all the 10 provincial directorates of DINAGECA, and at the national level. However, according to some of the respondents, the system did not include graphic and map data. Data from the provincial directorates was transferred to the national offices through CDs and diskettes leading to data duplication and missing data in many cases. Furthermore, the Year 2000 (Y2K) problem also influenced the functioning of the system, as it was not Y2K compliant. Consequently, the system was prone to many errors.

To address these problems and to incorporate the new e-governance mandate, in 2004, DINAGECA contracted a South African consultant to build a new system called LMIS. This South African consultant used the old system LAHS as a reference. LMIS was developed as a web-based system that is now currently running under the government network (GovNet)[7], and is considered an e-government system. Broader aims of LMIS are to provide online services to the citizens such as information about land, submissions of the land application through the internet; follow up of the applications, etc. Furthermore, LMIS aims at linking the

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[4] Direcção Nacional de Geografia e Cadastro has recently changed to Direcção Nacional de Terras e Florestas (DINATEFE)

[5] Programme of Advisory Support Service

[6] Swedish International Development Agency

[7] Network (Intranet) intended to connect all of the government institutions and the use of some Internet services.

different ministries and institutions (22 in total) that deal with land issues in the country.

After this brief introductory review of the context, I describe the implementation process through the translation lens.

4.2.3 Problematization

The implementation of the computerized land registration and management system was problematized by DINAGECA (primary actor) as the need to have an efficient instrument that could provide required information for DINAGECA and other land decision makers. This information would be important for DINAGECA as the country's land administrator for efficient land conflict management. The information would also be used as the basis for decision making for investments in agriculture, a fundamental sector for national development. The system was turned into an OPP for DINAGECA and for the Government to conduct decision making on natural resources, and also for the private investors who needed to invest. The Director of DINAGECA personally played a crucial role in shaping negotiations with other actors and in defining the specification of the system's requirements.

This information would be provided by the electronic system that was primarily called LHAS, first developed in Access. The first operational version released in 1997 was very problematic. In practice it did not have the graphic component and only allowed the entry of text data of land tenures. Various attempts were made using different off the shelf solutions, such as Access, Excel, GeoMedia Professional, etc. but none of them gave satisfactory results. LHAS was also prone to many errors, the database was not relational; the system was stand alone; it was not possible through the system to keep track of users modifying data in the database; the system was dependent on a foreign designer and developer, there was no local support; the system allowed data duplication and many functionalities were missing; and the project that was funding the development of the system ended. These problems were aggravated in 2000 with the Y2K problem in which LHAS showed to be not compliant.

Later on, in 2000, due to the constraints that this solution was facing in responding to the DINAGECA needs, LHAS became another problem, of which the solution was the creation of LMIS. LMIS, problematized by DINAGECA, was then brought into the network to bring stability that LHAS did not reach. LMIS is a software built upon a front-end application in Microsoft Visual Basic with map object oriented, Oracle 9i and ESRI ArcGIS and ArcSDE products. LMIS was pointed as an OPP within the e-government domain. In re-problematizing the land information systems, DINAGECA's interest was in part to solve the unfinished problem of LHAS and to respond to the new mandates of e-government advocated by international agencies. More broadly LMIS aimed to help the government to address ongoing land conflicts. Two conditions were key to the responses.

The problematization of land was shaped by post-independence reform efforts in which the government tried to re-structure the public sector by centralizing the power and decision-making. Subsequently, during the nineties and later, the government tried to modernize the public sector by introducing "new public management" including

transparency and good governance, driven primarily through the vehicle of e-government, represents a broader global trend especially to public sector in developing countries.

During the first phase of restructuring, different actors were involved, such as DINAGECA, the government, SIDA, and other users of the system. Within the subsequent phase of problematization, new actors such as the government, UTICT[8], and the South African developer came into play. The government and UTICT both were dealing with the political parts of ICT implementation. International agencies like G8, Italian Government, the Development Gateway Foundation acted as supporters of the e-government idea for good governance in general and for LMIS in particular, jointly with the National Program for Agriculture (PROAGRI). The aligned interest inscribed in these actors was the modernization of the land information system and development of an aid tool for solving land conflicts.

4.2.4 Interessement

In the case of implementation of the LMIS, given that the basic idea for it came from within the organization, DINAGECA did not have much work on convincing either the decision–makers or the end-users of the system as it was mandatory for them to use the system. As argued by Macome (2002), there is a pervasive and accepted Mozambican cultural principle that dictates that subordinates must obey their senior managers. Thus the official mandate of the government to use the LMIS meant a remote possibility of it being rejected.

The development of LHAS was conducted under the cooperation of DINAGECA and SIDA who were also involved in supporting various other development projects in Mozambique. SIDA was thus already sensitive to the issues around land conflict in Mozambique, and they too were in agreement with the government's decision to introduce the electronic land system.

Primarily, the first end-users of LHAS were convinced by the Director (who knew the users before) to work at DINAGECA. One of the respondents said:

> *"…when the director started to work here at DINAGECA, he invited me and other colleagues to work with him. He wanted to build a team technically strong for working at DINAGECA."*

We might not forget that just after independence, DINAGECA had problems of retaining qualified staff. During this time Mozambique experienced an exodus of Portuguese nationals, including civil servants from DINAGECA. Over the next decade, DINAGECA relied heavily on expertise from socialist countries, including the Soviet Union, who in turn exited suddenly in 1991. In 1996, DINAGECA's staff had decreased from 477 to 326, of which only 16 were university graduates, with 15 located in Maputo and 1 in a province. In 1998, in one of the weakest provinces, there was 8 staff including 3 medium level technicians, 2 basic level, 2 cartographers and 1 administrator (PASS, 2003). Today after a decade of capacity building efforts, the situation has changed slightly but yet, not enough for the demand.

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[8] ICT Policy Implementation Technical Unit

Interessement of the users of the system was done through training that was provided by the developer of the system. When computers were introduced at DINAGECA, they were new for many Mozambicans, and the users were convinced to use the system due to their enthusiasm to try the new tools. The workers hope that the computerized system would solve most of their land registry related problems also motivated them. However, since the co-operation between the Land Management sector with SIDA ended, the developer's work stopped as well. As a result there was no local continuation in training taking into consideration that no local experts were enrolled who could provide training.

Since solving land conflicts was seen as a fundamental strategy towards poverty alleviation, the government defined land registration and management through electronic means as being a key development priority. The government in turn was convinced to implement LMIS due to internal reasons such as sensitive problems in managing land conflicts, modernization and reforms in the public sectors, and externally by international donors endorsing the agenda of e-government as a way forward for development. In this political context, DINAGECA was the key executor of the government's initiatives around land. UTICT, another key player in the regulation of government ICT policies was also supportive of the land initiative as it was based upon ICTs.

Lastly, the South African developer was enrolled in the project through virtue of the well paid contract he had signed with DINAGECA.

4.2.5 Enrolment

SIDA had an official cooperation agreement with the government since 1975, but its history of support stretched earlier when it had supported through humanitarian aid Mozambique's independence from the Portuguese dictatorship. To achieve the development goal, SIDA tried to narrow the gaps in cooperation through NGO's, local government, embassies, the private sector, and civil society.

These historical trends paved the way for a Swedish consultancy firm to be engaged in 1991 to provide support and services within a long-term programme financed by SIDA which sought to strengthen DINAGECA's capacity to carry out cadastral activities and topographic mapping. SIDA supported institutional development and capacity building processes of DINAGECA and its provincial offices. Special attention was paid to assist in human resources development, organizational matters and in development of legislative support and procedures for land allocation and property registration and mapping. Within various activities developed by SIDA, a key one concerned the development of a computerized system for cadastre registry. The mechanisms of support to DINAGECA were through finances, training of staff, improving the Machava Technical Training School (the only school of geodesy and cadastre in Mozambique) in terms of equipment and curriculum (Nichols *et al.*, 1997).

It was from within SIDA, that the developer of the first computerized system (LHAS) for land registry came from. In the system development process there was limited participation from the Mozambican side, since there were no trained people, and so the system was based totally on the Swedish conceptualization of a land management system for Mozambique.

In the second phase of implementation of the land management system, a South African developer was enrolled through negotiations with DINAGECA headquarters. The contract of the developer had ended in 2006, and the government was trying to find another developer. However, the South African developer continued to give some support to DINAGECA.

Interviewees engaged in the implementation of ICTs in general and LMIS in particular revealed that in order for strategies of such initiatives to go ahead there is a need for the government's authorization. One respondent said:

> "It is necessary to sensitize the leaders of the government about the ICTs at the most high level. They are not going to give the money but they will assist the processes and facilitate it through doing things such as signing documents, issuing letters,… that are needed for the progress of the projects. *ICT consultant at UTICT (06/07/05)*

> "One of the problems with ICTs is the existence of low awareness of ICTs even at the top level. There are government authority members not *confident* in using computers for example. Therefore we started conducting training in the *usage* of ICTs at the top level, so that we could raise consciousness and awareness of the need for ICTs." *ICT consultant at UTICT (06/07/05)*

> "We conducted a training *course* for the government authority members at the top level, for them to know how to use LIMS. We know that most of them are not going to use it in their daily basis, but it is important to get them committed with the implementation of the LMIS". *LMIS manager at the national level (09/02/07)*

The above expressions show how the training provided to the top-level government leaders was a strategy to enrol them in the network. Given the strongly hierarchical nature of the Mozambican public sector implied that the enrolment of the top managers would help to support the project.

4.2.6 Mobilization of Allies

The proposed solution of the LMIS was generally accepted by all the actors in the network which rapidly progressed towards stabilization, and its expansion to all the provincial directorates of land and forestry. Despite the computerized system being unfinished, users are routinely entering data in the system, especially the textual part of the land tenures. The graphical part of the system is still working only at the national level, therefore, users send scanned maps of the land tenures via email. I observed during my field work, for example that even when there was no electricity in one province directorate situated in Maputo, the users moved to the central offices of DINAGECA to enter data into the system. Also, when the network – of e-government is not working, the system is switched to work under other available network.

However, the interviews conducted with users of the system in January/February 2007 revealed that the system did not change much of the end-users' tasks, by the contrary the job was duplicated since they had to deal with both the manual and computerized systems. The users preferred the computerized to the manual system as searching for land records was easier.

The LMIS was institutionalized in the country, and was strongly advocated by the government as its flagship e-government initiatives. Furthermore, the alliances between DINAGECA, the government and UTICT have been strengthened as they have jointly negotiated funds from donors to support the initiative and to build the physical infrastructure.

According to Callon (1986), during the mobilization moment, there is a need for a spokesperson or delegate who represents a certain group of actors, or more clearly "Who speaks in the name of whom?" The stability of both the network and the OPP depends on the strength of the relationship between the spokespersons and agencies. In the DINAGECA case, the director has been the main spokesperson in the process of finalizing requirements and communicating those to the developer, and for finding more developers. He said in one of the interviews that he usually travels around the world to see other land systems and collects experiences on how the Mozambican system should look like. The director's position at DINAGECA, his awareness of the importance of a LMIS for the country and commitment to its implementation has made him to become the main spokesperson of LMIS within DINAGECA.

Although the system is institutionalized, functionally there is a lot of scope for development as it currently only allows the registration of the application for land tenures, and no reports can be produced for decision making. Furthermore, modules for graphical data entry still need to be incorporated at the province level. Moreover, 3 systems for land administration and management are working at the provincial level: the manual system; the LAHS; and, the e-government system (LMIS). Officially, the previous electronic system (LAHS) has been abolished but in practice data is still being inputted into it, and is also used to verify the status of some of the applications of land tenure.

At the time of writing this paper, not all the aims were achieved. Currently the maps that are part of the land tenures (instrument to update the national cadastre) are sent from the province level to DINAGECA at the national level, via email. At the national level, these maps are introduced in the system and the national land cadastre (the graphic part) is updated.

Figure 2 summarizes the land information system actor-network.
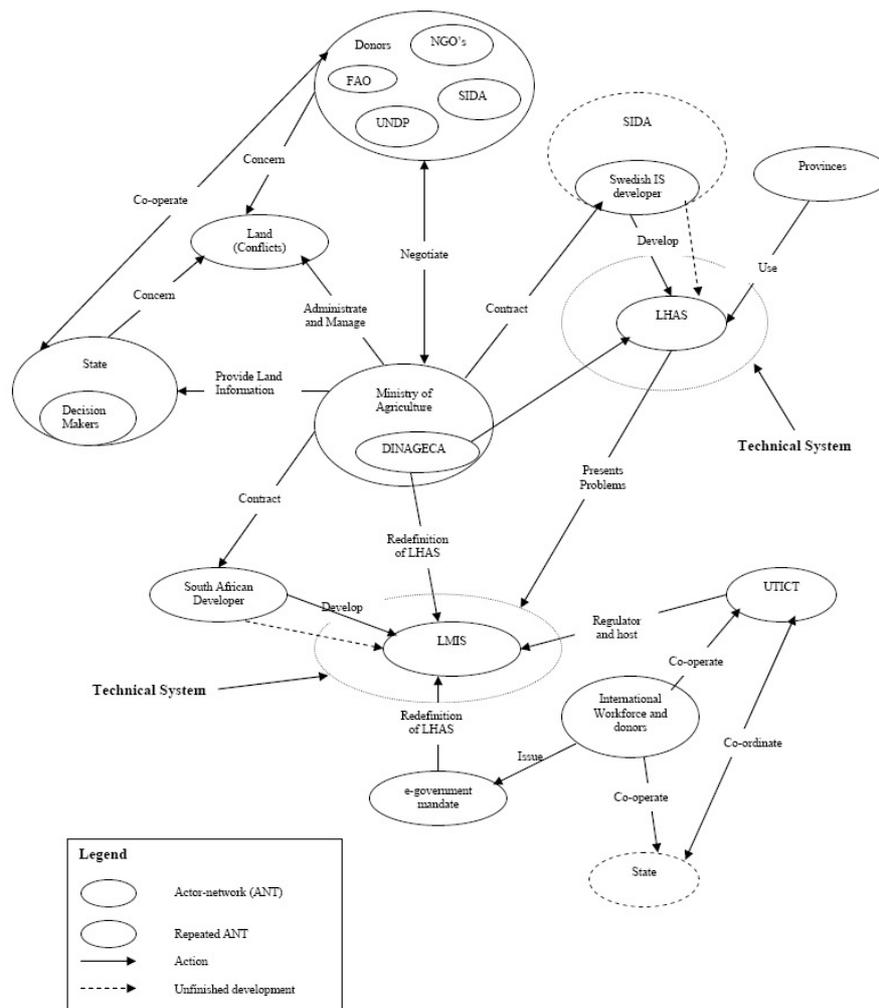

Figure 2. Land Information System actor-network

In the land information system actor-network, presented in figure 2, the land issue constitutes the main concern for both the state and donors. The emergence of land conflicts has forced DINAGECA to the respective solutions. DINAGECA is an institution subordinated to the Ministry of Agriculture. DINAGECA administrate and manage land, and its role is to provide land information to the government for decision making.

Land conflicts were a great concern of donors and the state which together with DINAGECA worked to find solutions. LHAS was initially found by DINAGECA as a technical solution for the problem of land conflicts which had a great support from the Swedish co-operation. However, later on, given the problems that LHAS was facing DINAGECA had to find new solutions, in which the South African developer contributed greatly through the

development of LMIS. The new solution was designed to respond to the e-government mandate set by the international workforce and donors. Therefore, LMIS was called an e-government application. UTICT plays a role of ICTs regulator in the country and technically provides the network platform that hosts the LMIS. UTICT and the government work together to conciliate the broad government policies with those of ICTs and e-government in particular.

5. ANALYSIS

In this section, both the experiences of implementation of DHIS and LMIS are analysed and compared drawing on the translation perspective. Key features around the four respective moments of translation are first summarized in table 5 and then discussed.

Table 5. A comparison analysis of both translation processes

Translation Moments	Health Information System	Land Information System
Problematization ▪ Primary Actor ▪ What is the problem ▪ Problem Solution ▪ OPP ▪ Relevant Actors	Fragmentation of health information systems and empowering of decision making at local levels were seen by HISP as the main problem. HISP pointed to DHIS as the solution.	The government, because of the internal pressure to address land conflicts positioned LHAS as the solution. This solution was subsequently reproblematized as e-government (LMIS).
Interessement (Convincing Actors and getting actors committed) ▪ Who to convince ▪ How to Convince ▪ How to isolate competing solutions	The strategy used by HISP to convince the MoH was based on demonstrating functional value by the customization of DHIS and its subsequent demonstrations to MoH and other competitors. Training in IS and DHIS for health workers, and post graduate courses for UEM staff was other strategies used by HISP to try and keep the MOH looking for other competing solutions and also to ally directly with potential competing solutions.	DINAGECA with political support of other government institutions and also in the absence of other competing solutions convinced potential users nationally to use the system.
Enrolment (Actors accept to be part of the Network) ▪ Agreement of the exact role of the actor ▪ Benefits that actors will afford	DHIS was not formally endorsed by MoH, therefore it was not used as a country wide system. However, the HISP team continued benefiting from enrolling in post degree courses. Team members continued to engage in customizing DHIS and training health workers in the pilot settings.	The use of the system was made mandatory, and thus had to be used, and this was also helped by the good will around it. SIDA accepted its role as consultant because of its prior sensitivity to the development problems in Mozambique. UTICT and government followed the new international political agenda and foreign support that was pushing forward e-government.
Mobilization of Allies (Actors become spokesperson; legitimacy of actors; network stabilized)	UEM is spokesperson of HISP and there is no spokesperson of DHIS at the MoH and for the users (health workers and managers). The network is not stabilized.	DINAGECA was a spokesperson for themselves and the other users of the system. UTICT was a spokesperson for the government and its new e-government mandate. The network is stabilized with all the actors in the network agreeing that LMIS is the solution for land management and administration.

5.1.1 Problematization

External problematization, the academic pursuit and establishment of technical credibility can be inferred to be the three factors that differentiated the rational of problematization in both cases. While in the land sector the problem was defined by internal organizational actors (DINAGECA), in the health sector there was an attempt to

external problematization with HISP trying to position DHIS as the solution for the fragmentation and centralization problems. The ownership of both the problem and the solution influenced the results of the implementation process. With internal problematization, the people concerned believed that the problems constrained their lives and belonged to them, and were motivated to engage in

finding solutions. This is illustrated by the case of the land management system, where the government felt land conflicts was its problem and therefore endorsed the institutionalization of the computerized system as a solution. Although the existing computerized systems (SISPROG, SIMP and others) within the health sector did not respond to the sector's needs, the MoH did not yet endorse DHIS as a formal solution which came as a result of an external problematization.

Another constraining factor was that the MoH perceived the HISP team to be primarily engaged in academic activities while in the DINAGECA case, the developers were bound by formal professional contracts. Furthermore, HISP's approach was very much focused on demonstrating functional and technical value and building long term capacity, DINAGECA's project was initiated through political support and technical efficiency was not seen as a primary concern.

5.1.2 Interessement

In the interessement phase the importance of historical links, the role of the change agent and the use of top-down approach can be seen to be the factors that contributed to the *status quo* in building both the respective networks. Although, in both cases the systems were not completely developed, historical links played a key role in the acceptance (or not) of the proposed solutions. Trust in the relationship between actors can also be defined through previous links. While in the land sector, strong historical co-operation existed between SIDA and DINAGECA, HISP had no prior links with MoH that made its proposed solution to lack the desired credibility and trust.

Nonetheless, there were also technical constraints in the DHIS which further undermined the MoH confidence. For example, DHIS could not produce reports and forms as was required in the health sector, and the software was not seen by the users to be friendly, both for data entry and report generation.

Another factor that made a difference during interessement was the role of the change agent. While strategies for implementing DHIS were negotiated between HISP, UEM and some local managers at the MoH, in the land sector the negotiations were driven by a top level manager from within the organization. For example, the director of DINAGECA was the one discussing the requirements of the system with the developers on one side and, on the other side discussing the budgeting and implementation strategies with the government and donors. Furthermore, given the priority of the e-government agenda generally and for the land sector specifically, helped the DINAGECA champion to convince the other actors. The lack of such a champion to make HISP as part of the health sector reform agenda contributed to the lack of take up on the DHIS.

Finally, the top-down approach employed can also be seen as a key factor. While the approach in HISP was participatory and action research oriented, in the land sector the approach was driven by a restricted group of senior individuals with relevant political power and the capacity to drive the institutionalization of the land system. In contrast, HISP's strategy was to change things on the ground through awareness building and training. HISP's focus on data analysis may have been a little pre mature as the basic

systems for data collection had not been adequately addressed. HISP's field level approach helped to change this condition to a limited extent – in some regions and a selected group of users. The multi-disciplinary HISP team were competent to lift the quality of the HIS, but their mandate was rather limited.

5.1.3 Enrolment and mobilization

While in the land sector, the actors appeared to have accepted the benefits promised by the system and agreed to the role they were assigned to by DINAGECA, HISP did not manage to convince the MoH, reflecting the state of weak enrolment. The MoH seemed to be unclear about the benefits to be achieved through HISP given its perceived primary focus on the academic domain.

The existence of competing systems and surrounding political agendas served to create a vicious cycle influencing the enrolment of HISP. While in the case of the land sector, there were no competing systems to LMIS, the health sector was littered with legacy systems and also attempts to introduce new ones, including DHIS. In the land sector, political support helped to open up opportunities for the demonstration of results of the system, which in turn helped to strengthen political support. In the HISP case, politically these opportunities were never created and with it the chance to demonstrate results, which weakened the already limited support – creating a vicious "chicken and egg" cycle.

6. TRANSLATING LEARNING ACROSS SECTORS

6.1 Translation as a political technical-process

During interessement, in addition to good communication skills and the capacity to isolate the influence of competing actors, it was important to convince the right actors at the right moment. The land sector case demonstrates the importance of having government and political actors to support the creation of the network in the context of the public sector, where institutionalization is key. The government with the political will has the power to institutionalize even incomplete systems, and without it even potentially technically efficient systems can fall by the wayside. With institutionalization, inefficient systems can potentially be improved in the future, but without it that opportunity is never created.

HISP largely emphasised the technical aspects in creating the network, and building educational capacity through enrolment of the team members in masters and PhD. This strong academic but weak political approach of HISP was seen by the MoH to be too futuristic, and not meeting their immediate short term and pressing problems. In contrast, the strategy in the land sector emphasised the creation of political support which helped to offset some of the technical limitations.

A technical limitation in the land sector case was the reliance on the individual and not a team as in the case of HISP. However, the team approach of HISP may have helped to diffuse the responsibilities towards implementation where everyone but no one seemed responsible to respond to the MoH requests. In contrast, the responsibility of the

technical development in the land sector case could easily be zeroed down to one individual.

This analysis highlights the rather political nature of the public sector context in developing countries, where maybe the political needs to be emphasized over the technical. While adequate technical skills and people are indeed necessary, they can also become sufficient with the required political support.

6.2 Balance between action and research

The establishment of a network in principle entails doing both action and research, and creating their interlinkages. Through this, new knowledge about implementation strategies can be developed, applied and revised in practical settings. The creation of an adequate balance between the two is a non trivial task. Both the initiatives can be argued to have got it wrong in this regard. HISP was seen to have limited action, while the opposite was the case in the land sector. An excessive focus on action may lead to the perception of the problem at hand being "solved" but does not ensure the creation of knowledge which does not augur well for longer term processes of developing sustainability and scalability in the networks. The contrary case of HISP shows an excessive focus on the creation of theoretical knowledge with limited application, may lead to the perception of it being a wasted effort since the problems on the ground continue to remain as problems.

Creation of the balance can be seen as a process which can be cultivated over time. The HISP approach should have tried to create an opening through vigorous action in order to get an opening and to subsequently balance it with more research. The land case, we will argue, needs to infuse its approach with stronger research to ensure the new knowledge being generated is spread out more broadly to develop stronger sustainability mechanisms.

6.3 Problematization as an ongoing process

The changing socio-political context as a characteristic of the public sector setting in developing countries ensures problematization is never a fixed end, and it continues to evolve and be reproblematized. The reproblematization of the land sector case to one of e-government is a case in point. New opportunities and conditions create the potential of reproblematization and with it new socio-technical-political networks. The infusion of money and political willingness in the land sector case through the new e-government agenda created new opportunities which were well exploited by DINAGECA. Another example of the changing environment was the new government formation, which affected the HISP initiative negatively because of the status quo situation (lack of decision to formalize HISP) it helped to promote. The perceived lack of action of HISP in fact got magnified, much to the detriment of the entire initiative. In the case of the land system, because the previous solution did not work out and also the new context involved e-government, the problem definition and solution had also to be changed (see figure 3). Therefore, changes in the context needs to be closely monitored, and strategies be developed to re- problematize the solution where it is needed.

The translation process represented in figure 3, shows the normal phases of translation namely, problematization,

interessement, enrolment and mobilization of allies. Further, the figure shows that after the mobilization process, the network can either be stabilized or not. When the network is not stabilized, the problem can be redefined (reproblematization). New requirements can also emerge during the life of the network that can lead to the reproblematization of the network in both cases (network stabilized and not stabilized).

7. CONCLUSIONS

Theoretically, the translation process needs to be seen non-linear as contrasted to the earlier research focus on it as being linear within a template of the sequential phasing of the four moments. Taking a non-linear conceptualization of translation helps to focus on the ongoing changes, opportunities and also threats that always accompany ICT projects in the public sector context of developing countries.
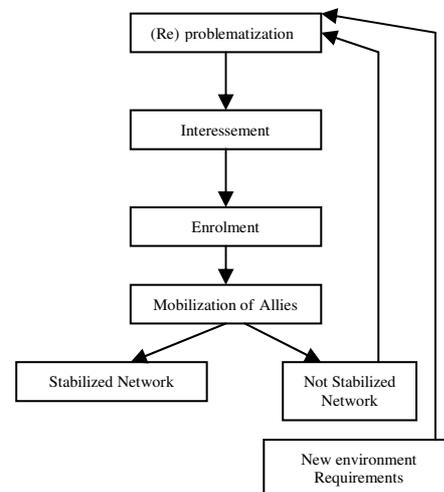

Figure 3. The translation process of the implementation of the Land Information System

Earlier empirical studies have emphasized the importance of the capacity for conducting negotiations, need for good communication skills, co-operation and co-ordination amongst actors to develop robust actor networks. This study contributes to this body of research in at least two distinctive ways: to find an appropriate balance between the top-down and bottom-up approaches, and also between action and research. In finding this balance, the importance of the political over the technical has been emphasized given the public sector setting in developing countries. For example, a balance between top-down and bottom-up approaches during the enrolment phase can help to gain both the top political engagement and the bottom user involvement which can help provide the demand pull. A mere focus on only one end can be seen to be a potentially non-working strategy. Similarly, a balance between participatory research and action, within the context of appropriate political timing, can be more effective than a primary focus either on action or research.

In conclusion, this paper makes a small, but arguably important, step in the direction of encouraging thinking about how to learn across experiences of ICT implementation in public sector settings of developing countries. This emphasis should be taken into both the world

of e-government practice and also research of ICT for development.

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