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STRUCTURATIONAL ANALYSIS OF CROSS-CULTURAL DEVELOPMENT OF AN ACADEMIC REGISTRY INFORMATION SYSTEM IN MOZAMBIQUE

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This paper aims to produce an understanding of a particular information system development project which has involved teams with African and European backgrounds. This is done by applying a framework for structurational analysis in cross-cultural software production and use. The analysis uncovers actual and potential conflict, and the cultural heterogeneity that exists between groups of participants. The analysis furthermore reveals diverse measures of success by these groups, such as different prioritization of local involvement. Finally, the analysis offers a dynamic conceptualization of how culture can be both reproduced and produced in new ways through human action, and thus brings to attention both opportunities for, as well as barriers to, change. Implications for IS in developing countries include a focus on managing change, incremental development and persistence over time, backed by committed leadership.

1 Introduction

Information and Communication Technologies (ICTs) and more particularly Information Systems (IS) are considered by many authors as relevant to developing countries (Heeks, 2008). However, strategies for introducing IS that have worked in the developed world do not necessarily translate well in developing nation contexts (Reijswoud, 2009). There are many examples of failure and partial failure, and the challenge is to understand the difficulties and overcome them (Walsham & Sahay, 2006). IS-based innovations need to pay attention to the context within which they are embedded (Avgerou, 2001). Interpretive methods aim to produce “an understanding of the context of the information system, and the process whereby the information system influences and is influenced by its context” (Walsham, 1993, pp. 4-5). Prasad (2009) recommends a structuration perspective to understand the relationship between ICT and organizational performance in developing countries.

The objective of this paper is to gain an understanding of the different perceptions of success in a particular development intervention project, which was carried out by a cross-cultural team in the higher education sector of Mozambique, one of the world's poorest countries, located in Southern

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Africa. In this project an Academic Registry Information System (ARIS) was developed for several Mozambican universities. This project is analyzed in terms of Walsham's (2002) application of Giddens's structuration analysis (Giddens, 1984) to questions of structure, culture, conflict and change.

This paper is based on the assumption that to achieve success in IS projects such as the one described here, one must understand inherent contradictions that may eventually lead to conflict, and to subsequently search for ways to manage or avoid them. In the complex context of cross-cultural work groups, different measures of success by different actors are a potential area of conflict.

The paper is organized as follows: First, a literature review examining aspects of IS success; Second, a description of the project, starting with its historical context; Third, the research methodology is explained; Fourth, analysis of the case using Walsham's structuration analysis framework; Fifth, the findings are synthesized in order to highlight different success measures and discuss implications for IS projects in developing countries; and finally, contributions and conclusions are elaborated.

2 Literature review

IS projects in developing countries face particular pressures to be successful, one reason being high opportunity costs of investments in ICT (Avgerou, 2008). However, success is often hampered by two interrelated problems: difficulties in nurturing complex projects over long periods of time, and the limited impact the resulting ICT-based systems have on the organizational weaknesses they were intended to alleviate (Sahay & Avgerou, 2002). The success of an IS initiative has been characterized by Heeks (2002) as a situation where “most stakeholder groups attain their major goals and do not experience significant undesirable results” (p. 102). In contrast, total failure refers to initiatives that were never implemented or immediately abandoned after implementation. Between total failure and success there are several partial failure scenarios, such as sustainability failure, scalability failure and the achievement of goals for certain stakeholders but not others. Furthermore, evaluation of success is subjective, so that one person's failure may appear to be another's success (e.g. Odedra-Straub, 1993).

Writers have proposed a wide range of factors that lead to success in different contexts. For example, García-Sánchez & Pérez-Bernal (2007) compared and evaluated critical success factors from multiple papers and distilled a set of 14 factors of relevance to ERP implementation projects, including top management support, communication, project champions and user involvement. According to Bass (2009), projects need to align with both the strategic priorities of organizations as well as the personal priorities of team members. Furthermore, new skills should be nurtured incrementally. Gurstein (2003) emphasizes the active, productive engagement with ICT throughout development and use, in contrast to the passive notion of simply providing access to ICT. Krishna & Walsham (2005) emphasize the importance of the involvement of multiple groups, innovative organizational structures, a people-orientation in project selection and persistence over time, backed

by committed and knowledgeable leadership. Additionally, Joubert (2007) recognizes the importance of socio-political factors such as political support and community buy-in, but warns about the marginalization of critical technical issues.

DeLone & McLean (1992, 2003) draw attention to the distinction between causes and effects of success and present a model for measurement of IS success, which tries to impose some order on IS researchers' choices of success measures. The model, however, does not recognize that different participants may have different conclusions about success of the same IS (Seddon et al., 1999). Furthermore, Orlikowski (1992) cautions against undue determinism based on causal associations: “While expected relationships may hold empirically for certain organizations in certain historical and socio-economic conditions, the ever-present ability of actors to alter the cycle of development, appropriation, institutionalization, and reproduction of technology may undermine any causal relationships” (p. 34).

Alternatively, Heeks (2002) offers a contingency-based model called ITPOSMO where IS projects are more likely to be successful if gaps between designed technology and actual reality are small enough that they can be potentially bridged during the implementation of IS projects.

3 Historical background and project description

This section outlines the historical context that resulted in the initiation of the ARIS project and how the author got involved, followed by a description of the principal requirements and usage, and finally a summary of the IS development and implementation process.

3.1 Historical context

The author has been involved as an action researcher in the ARIS project, which provides the empirical data for this study. This involvement had its roots in a position as development aid worker, sent by the Austrian NGO called HORIZONT3000, to the Mozambican Catholic university (UCM) in the form of a “long-lived relationship between consultant and partner organization” (Bass, 2009). The role was that of an adviser to introduce IS in the administrative domain at the university. The university had grown in the number of staff and students, and in this situation the university management considered IS relevant, particularly in the domains of accounting and student records.

Other universities in Mozambique had similar interests in finding better ways to manage their student records, and this was recognized by the Mozambican Ministry of Education and Culture (MEC). The Ministry itself also had an interest in improved student records management at universities in order to receive statistical information faster and in a better quality. This led to the formulation and negotiation of a development intervention project between MEC and Nuffic, the Dutch government-sponsored organization supporting higher education in developing countries. The project was carried out from 2005 to 2009. Locally unavailable expertise was provided by a Dutch university, using its in-house software development unit.

Mozambique had applied a policy that allowed a large number of universities to emerge, with more than 20 public and private universities operating at the time of writing. This development started in the early 1990s, related to the peace negotiations to end the civil war. Traditionally, higher education was only available in the country's capital, which is located at its southern tip, close to the border with South Africa. One of the conditions for peace was the provision of university education to the central and northern parts of Mozambique, which led to the foundation of the UCM (Universidade Católica de Moçambique) by the Catholic Church in 1995. Subsequently, other universities opened throughout the country, one of them the Muslim university UMBB in the North of Mozambique.

UCM, UMBB and three other Mozambican universities, representing various backgrounds and cultures, were invited to participate in the ARIS project. This project promised to be a useful intervention, since it sought to address a clear need by all five participating universities, as none of them managed student records efficiently. And external input was welcome, because local human resources were limited. On the one hand, the project progressed well by producing incremental versions of the software and evaluating them together with the intended users. On the other hand, it eventually became apparent that even though local participants were happy to be part of the project, their involvement outside organized meetings remained low, such as when they were asked for certain contributions between meetings.

The observation of these phenomena, together with a lack of literature that would give clear orientation on how to deal with such projects, triggered an accompanying research endeavor. Because both practical and research objectives were to be achieved, action research was considered appropriate (Davison et al., 2004). At this time a trusted relationship had already been established between the university and the author, and both sides sought continued cooperation.

3.2 Users and usage scenarios

The principal aim of the IS project was to enable effective administration of all student related information such as enrollments, courses taken, and exam results. Many different kinds of users were envisioned to be able to use the system, such as the academic registrars, teachers, deans, students, and eventually financial managers supervising fee payments. Academic registrars would maintain study program information, including the structure of exams and other forms of assessments. Teachers would be able to retrieve class attendance lists and enter marks. Students would build their study plans by choosing from a list of subjects. However, local work habits resulted in a concentration of many of these activities with the registrars.

3.3 Software development process

The Dutch university, which was entrusted with leading the process of delivering an appropriate IS, started this process with collaborative requirements workshops with Mozambican participants. Constructing the software system from scratch was initially not the preferred option, and an effort was

made to find and apply existing systems. But no system adequate to the Mozambican context was encountered. After it was decided to develop a new software system, an incremental and iterative development model was followed (Brandon, 2006; van Vliet, 2008). This allowed chunks of functionality to be built incrementally between joint workshops, and then test and discuss them. In order to ease client installation, a web based system was designed. For security purposes each user would receive a login and password, and be associated with a role that limited access to data.

Several attempts have been made by the Dutch partner during the project to involve local Mozambican developers, for example in the development of reports. To be able to collaborate on a common code base from both the Netherlands and Mozambique, a source code repository was used, which was accessible via the Internet. At UCM, a small development unit comprising the author and a local programmer was organized to contribute to the system. This was particularly useful through the implementation phase of the system development. The term "implementation" is used here in a "human and social sense, so that the system is used frequently by organization members or that it is considered valuable for work activities or coordination" (Walsham, 1993, p. 210).

4 Methodology

During several years as an action researcher a vast amount of observations was made, and interpreting these data is inherently subjective. Therefore, this section pays attention to how this study was conducted, partly by referring to Klein & Myers' (1999) principles for interpretive field research. Although Klein & Myers suggest not using their principles 'a la carte', and emphasize how each principle may vary between studies, their principles can be used to ensure high-quality interpretation of qualitative data (Weber, 2009).

The principle of the hermeneutic circle is considered by Klein & Myers as the most fundamental principle upon which the others expand. According to this principle, understanding a complex whole is achieved by iterating between considerations concerning the meaning of the parts and of the whole that they shape. This iterative form of understanding applies to a wide variety of objects such as the interpretation of written text. In fact, it is suggested that all human understanding is achieved in this form.

Previous action research cycles influenced the project and produced certain understanding of specific aspects relevant to the project. These cycles followed McKay & Marshall's (2001) model of pursuing both research interests and problem solving interests. An early assessment of appropriate technology for IS in developing countries had an impact on the project by emphasizing the local ownership of IS projects and the usability of resulting systems. Furthermore, involving local programmers in a collaborative software development structure was seen as a way to build local capacity. Another conclusion concerned the importance of a modular system architecture. Later research focused on long-term IS support, which highlighted institutionalization of support structures as a way of social capital creation.

In the following, some examples are given to illustrate how Klein & Myers' principles have been applied. Specific characteristics of the conduct of this study include the rather strong involvement of the researcher into practical project activities, and his European heritage. Both affect the interaction between researcher and subjects. Researchers as well as all other participants can be seen as interpreters, "as they alter their horizons by the appropriation of concepts used by IS researchers ... and other parties interacting with them" (Klein & Myers, 1999, p. 74). This is particularly true in the IS project here, since the researcher gave his input to, and thereby influenced, different people involved in the project on various topics such as software development, collaboration between distant participants in Africa and Europe, and on the implementation of the IS at Mozambican universities. To report one's own role as an involved researcher is particularly challenging (Walsham, 1995). But at the same time this deep involvement prompted many rich observations of the project, as the research gained an insider view and participated in day-to-day activities (Prasad, 2009).

There have been a variety of different groups involved. First of all, there were five Mozambican universities with different forms of institutionalization: public, private, and some with a religious affiliation. Within the universities, different groups could be identified such as managers, users and technicians. Additionally, there was a technical team from the Netherlands, and an international project coordination team with members from both countries. Furthermore, aid workers assisted in introducing IS at UCM. Each of these groups had distinct interests and behaviors. This relates to the field study via Klein & Myers' principle of multiple interpretations, which emphasizes the consideration of multiple viewpoints in contexts involving multiple agents, and the reasons for these different viewpoints and how they may lead to conflict. The researcher had regular contact with all of these diverse project groups, which helped him to understand and compile their distinct and often divergent viewpoints.

Data was primarily collected through participant observation and informal interviews. In contrast to Western culture, written documents play a less important role for project coordination and management in the local culture of the project. Mosse & Sahay (2003) noted in a case study in the health sector in Mozambique that co-location and face-to-face interaction are the predominant means of communication. Even though their study was located in a more rural setting, the same tendency was also observed in this study. Hence, despite the existence of some formal project documentation, data was gathered mostly through direct communication, as well as during project workshops. Furthermore, relatively new forms of communication such as email and Skype also played a documentary role.

5 Structural analysis

In this section the intervention project is analyzed with the use of structural analysis. The theoretical basis of structural analysis will be outlined first, before the project is analyzed at different levels. The project participants at these different levels are depicted in Figure 1. They are

grouped into three levels. The international project coordination team consists of participants from local and external project partners. The middle level consists of the involved organizations. The lower level is concerned with groups within universities. At this last level, we will be concerned specifically with the users, technicians and managers within UCM.

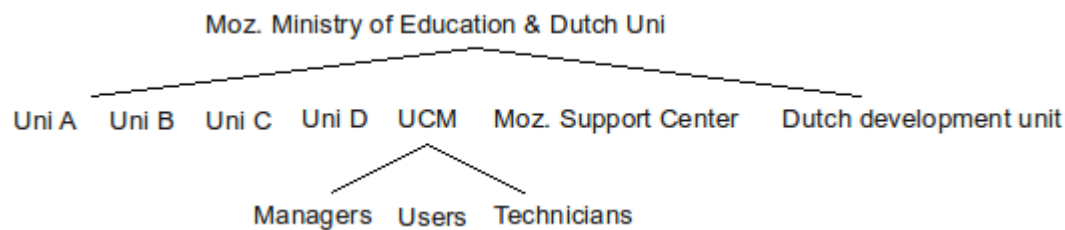


Figure 1. Participants in the project

5.1 Theoretical background

Structuration theory is a general theory of social organization, which has been promulgated by sociologist Anthony Giddens (1984). It has been used extensively in the area of IS research, even though one of its characteristics is “the almost total neglect of the technological artifact and its abstract” (Jones & Karsten, 2008, p. 128). Nevertheless, authors such as Orlikowski & Robey (1991) have applied structuration theory to analysis of IS. They argue for the relevance of structuration theory for IS research by referring to its potential to integrate subjective and objective elements of social phenomena. They theorize information technology to be both “the product of human action as well as a medium for human action” (p. 144). Information Technology both effects social structures and is shaped by users and developers. Walsham, who has richly applied structuration theory to IS, formulated a structural analysis framework of cross-cultural software production and use (Walsham, 2002). This framework, which is applied in the following subsections, considers four areas to be key to understanding such settings: (1) structure, (2) culture, (3) cross-cultural contradiction and conflict, and (4) reflexivity and change.

Structuration theory's central concept of duality states that human action (agency) and social structure are not separable, but are two aspects of the same, mutually constitutive, whole. Human action is guided by social structure, and action either reproduces existing structure or produces new social structure (Jones & Karsten, 2008). In structuration theory, *structure* is described as rules of behavior and the ability to deploy resources, and it exists in the human mind itself rather than as outside constraints (Walsham, 2002). For the analysis of structure three dimensions can be distinguished: systems of meaning, forms of power relations and sets of norms. Structure and IS are interlinked: “IS are drawn upon to provide meaning, to exercise power, and to legitimize actions. Thus they are deeply involved in the duality of structure.” (Walsham, 2002, p. 362)

The second key point, *culture*, is related to the fact that structure does not exist in the mind of a single person in isolation. People of the same cultural group share systems of meaning, forms of

power relations and sets of norms. Despite a lot of variation among people belonging to the same culture, there is enough “systemness” to be able to recognize shared symbols, norms and values.

Cross-cultural contradiction is based on another concept of structuration theory, structural contradiction. Contradiction is the potential basis for conflict due to cultural differences, whereas conflict is actual struggle between actors. Conflict may result if actors feel that contradictions affect them negatively and if they are able and motivated to act.

Finally, *reflexivity and change* refer to the observation that human beings do reflect on their own actions and those of others, and on their intended and unintended consequences. Such reflection permits human beings to either reproduce existing structures or to produce new structures. Shifts in the minds of individuals and groups account for culture's dynamic nature.

5.2 Levels of analysis

The analysis in the following is concerned with various project groups. While many differences can be expected between participants of African and European heritage, Structuration Theory makes it possible to identify groups with recognizable interests and meaning systems on a smaller scale (Walsham, 2002). The first subsection will consider the global level of the project regarding the cooperation between Mozambican and Dutch actors. In the following subsections the focus moves to the level of Mozambican universities and finally to one particular university, UCM. An overview of the analysis at different levels is shown in Table 1.

Table 1. Overview of key issues of structural analysis at three levels

	<i>Overall project</i>	<i>Universities</i>	<i>Within UCM</i>
<i>Structure and culture</i>	<ul style="list-style-type: none"> ● Dutch team <ul style="list-style-type: none"> ○ Logic of intervention projects ● Mozambican team <ul style="list-style-type: none"> ○ Face-to-face communication ○ Many actors ○ Producer (N) – consumer (S) perceptions 	<ul style="list-style-type: none"> ● Variety of participant backgrounds ● Excitement about participation ● Wary of external consultants ● New system calls for additional work ● Source of funding ● Org.-specific requirements 	<ul style="list-style-type: none"> ● Autonomous faculties ● Registrars used to know students ● Learning of 'currently' needed features only ● External consultants
<i>Cross-cultural contradiction and conflict</i>	<ul style="list-style-type: none"> ● Hesitation to 'get hands dirty' ● Transfer of source code ● Extent of documentation ● Ownership of source code 	<ul style="list-style-type: none"> ● Activities parallel to project ● Conflicting requirements ● Inactivity ● SW developers trained but lost to project ● Short implementation phase 	<ul style="list-style-type: none"> ● Centralization of student records ● Usability ● Incident-based data collection ● Roles of users and technicians
<i>Reflexivity and change</i>	<ul style="list-style-type: none"> ● Joint workshops opportunities for 	<ul style="list-style-type: none"> ● Inter-university discussions 	<ul style="list-style-type: none"> ● Intensive face-to-face sessions at workplace

	reflexivity <ul style="list-style-type: none"> • Two-way learning between N and S • Stronger focus on implementation 		<ul style="list-style-type: none"> • Feedback cycles • IS institutionalization
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5.3 Structure and culture at macro level

Dutch team. On a global project scale, the meaning that was associated to the project by the European team was to develop and deliver an agreed set of technical artifacts, associated capacity building and training of local participants. This understanding followed from the early phase of project definition and negotiation, which had resulted in a written and signed agreement between the two sides, and the formation of a project management team consisting of representatives of both sides who are responsible to execute what had initially been agreed upon. The relatively small Dutch team comprised the project manager and a group of software development professionals. This team, in order to lead the development of the academic registry IS, regularly visited the Mozambican participants and used their knowledge of structured software development processes to create the desired technical artifacts. Opportunities for participation were made available through workshops for collaborative requirements engineering and discussions about incremental versions of the emerging software system. Furthermore, they used these encounters to repeatedly give training sessions to local users and developers.

Written form of communication. The approach to project execution by the European team as described here is consistent with the norm of fulfilling one's side of the contract on time, by providing the agreed deliverables, conforming to European business culture. Furthermore, their work routine made regular use of written documents and emails to communicate project related information. In terms of power relations, the Dutch project manager had the ultimate responsibility and had to make final decisions, but also sought the input of the technical team members in their areas of expertise.

User interface focus on detailed information. In the design phase of the software system a usability expert was consulted for the basic structure and layout of the user interface. This resulted in a consistent interface design. However, one problematic result was that the screens followed the database structure too closely. There were a large number of input fields, particularly the information concerning students and their study plans. In order to structure these fields, the user interface design provided groupings of fields into several tabs. There was no effort made to configure the visibility of fields, which resulted in users being overwhelmed and confused by displays of irrelevant fields. In defense of this design, it was argued by the Dutch developers that information that was not considered relevant at a certain time may become relevant later, and showing all possible options would offer users the power to work with that information at any time in the future.

Documentation of architecture. Documentation was considered a key element in the construction of

the software system and was published on the project homepage. In order to make the installation as easy as possible for Mozambican universities, step-by-step installation guides were written for different target operating systems. Use cases were documented, a user manual and an overview of the database structure were provided. Database and source code documentation were limited to basic information, so that the continually evolving source code and database structure would not become out of sync. Furthermore, programmers who intended to contribute were expected to be able to interpret the source code.

'Installation equals implementation' approach. Implementing the IS at the universities was a short-term activity. Technicians had been trained at different times during project implementation on how to install the system, detailed installation instructions had been provided, and the users had been repeatedly trained on the system's features. This focus resulted in the perception that the system would be immediately ready to use after its installation.

Symbioses between interventions. Intervention projects are particularly appealing if their results can be reused in other interventions. It indicates efficient use of the funds that went into the project. The software system that had been developed for Mozambican universities during this project was considered for a follow-up intervention project in Zambia. The system would be extended to include required features and implemented at two large Zambian universities. Ideally, the project would result in an open source framework upon which further collaborative evolution of the software system with the parties from Mozambique, Zambia and the Netherlands would be possible.

Mozambican team. The Mozambican team was more heterogeneous than the Dutch team. The Ministry of Education coordinated participants of five different universities from all parts of the country, and tried to establish a support unit that would assist Mozambican universities with the implementation of the IS in their institutions. A functioning support unit was considered a crucial task with respect to the sustainability of the IS after the end of donor support. A prevalent idea of local participants was that the foreign experts would deliver the solutions to local problems within the framework of the intervention project. An illustrative example is that of computer hardware, which is a technology produced abroad and transferred to local organizations. Software was similarly seen as an artifact to be delivered once ready to use. Because the development of the software system was an activity that spanned a large part of the project duration, the local participants found themselves in a “waiting seat” position – waiting for the final software product to be finished before getting involved.

Face-to-face communication. Face-to-face was the predominant local form of communication. This became visible in the regular joint workshops. Such encounters tended to be constructive with lively discussions taking place, facilitated by a general willingness to speak out in group settings. This led to a positive attitude towards the project and the system. Similar observations were made in personal talks with future users when assessing their opinion about the introduction of the new IS, and bringing to their attention some possible consequences for their daily work, such as the extra workload during the transition phase. Such talks were usually positive, especially if local participants were assured of

continued support and could sense that the implementation was a serious effort by university management. One academic registrar stated that the introduction of the new IS “is what we need and I will work very hard to make it work at my faculty, even working extra-hours if necessary”. Another user who had almost no computer literacy when first encountering the new system reacted to a careful explanation that all registrars would have to use this new system in the future by saying: “Sometimes it's necessary to move with times”.

There have also been more skeptical registrars, such as one who was afraid to store sensitive data about students and marks on anything other than her own USB flash drive which she only attached to her computer when the network cable was unplugged. It was against her understanding of security to store data in a web application which is out of her control. Attempts to convince her by outlining other dangers that she was confronted with – such as the possible loss of data on her flash drive – failed.

Enforcing power was difficult for the Ministry of Education. This was because the Mozambican participants belonged to different organizations, and the Ministry had a coordination role, but no formal authority. Much depended on the motivation of individual participants, for example to do their “homework” between workshops. The Ministry has begun to organize a countrywide support unit in order to gain more control. This unit is to be located in the computing center of Mozambique's longest standing university, the Universidade Eduardo Mondlane (UEM). This initiative was still an ongoing effort at the time of writing.

Ownership of project output. The project agreement stated that all project output would become the property of the Mozambican side. This was seen as important to the project coordination team at the Ministry of Education. Rather than simply having access to the source code, the source code repository was expected to be moved to the support unit.

Expect “full” documentation. Mozambican software developers wanted detailed documentation of the database and source code. This was seen as a precondition to understanding the inner workings and their ability to be able to contribute to the system's evolution.

5.4 Cross-cultural contradiction and conflict at macro level

Little effective use. Despite the intentions by the European team to involve local participants, there was a barrier to this involvement. The Dutch project team's intention was to involve the Mozambican team with common workshops and to give assignments between workshops. The Mozambican actors held the view that there was not much to be done until the system was ready to be implemented in production mode at Mozambican universities. This prevented local users from experimenting with the system and developing an in-depth understanding of its logic and its fit with each university. Such ongoing experimentation would have been beneficial in providing feedback and influencing the development of the system, for example by discovering missing features or weak usability. Another factor that jeopardized local skill building was the short implementation period, which left the users on their own to discover how to use the system features properly in their daily work.

The delay in getting locals involved – “getting their hands dirty” – also limited the ability to assess the local workload required for successful system implementation at a university. This was evident in the formulation by over-ambitious plans, such as the plan to introduce the system at 15 Mozambican universities within one year.

Transfer of source code and documentation. While one group viewed the emerging software system as something that is always ready to be experimented with, the other side held the view that at one point in time, when work on the software system is finished, its source code and full documentation will be transferred to Mozambique like a physical artifact. There were also conflicts regarding how much documentation is appropriate.

Ownership of source code. The logic of the Dutch intervention project has been to maximize impact and aid as many potential beneficiaries as possible. This conflicted with the Mozambican position of owning project output, because the Dutch team intended to implement the software system in a different project in Zambia.

5.5 Reflexivity and change at macro level

Communication of IS innovation is a process in which participants share information in order to reach a mutual understanding. It is a “two-way process of convergence, rather than a one-way, linear act in which one individual seeks to transfer a message to another in order to achieve certain effects” (Rogers, 2003, p.6). During the project there have been many meetings between project participants in workshops, training sessions and coordination meetings. Most of these encounters took place in Mozambique, and a few, such as an intensive developer training session, were done in the Netherlands. These meetings provided opportunities for change and the production of new structures of meaning in the minds of participants.

Local actors started to engage with the idea of collaborative software development using a shared source code repository. Open Source was discussed as a means to resolve the ownership dispute. The database-oriented screen design was recognized as not being an ideal solution and possible improvements to the usability were considered. For the follow-up project at Zambian universities the Dutch project team already put a stronger focus on implementation, and planned to install the system early in order to be able to react to feedback from local users, technicians and managers.

5.6 Structure and culture at university level

The universities that participated in the project are heterogeneous organizations, and the actors involved had a wide variety of backgrounds and motives for participating. Some had already gained experience from involvement in other intervention projects, while others had limited professional experience outside their immediate work place setting. For many participants there was a certain level of excitement in being part of an intervention project, e.g. some enjoyed working with modern technologies, while for others it was a possibility to travel and meet colleagues and eventually family.

Some were wary about the prospect of a new system. They suspected foreign consultants would be insensitive to the local context and would present them with locally unintelligible solutions. Another suspicion was that the introduction of a new system would result in additional work instead of making work processes easier. Some users saw the task of entering data into the system as an end in itself, particularly if they already had experiences with other IS projects in which the reasons for introducing IS were unknown or not made clear to the user.

For Mozambican universities the project provided a source of funding, e.g. for computer equipment. Universities were quick in spending these infrastructure investment funds. The relationship of universities towards the Ministry was one that can be characterized by a quote of a university manager: “Because we Mozambicans are poor, we are used to receiving from the Ministry. We do not normally contribute”. The mindset is one of receiving financial and material items without reciprocating or engaging in a two-way process of joint problem solving.

5.7 Cross-cultural contradiction and conflict at university level

The expectation by the Mozambican Ministry of Education and the Dutch project team had been that the five participating universities would be sufficiently interested in the IS to contribute their own resources in its implementation at their institutions. Opportunism to a varying degree on the side of the universities led to conflict several times. Soon after the project started one of the universities decided to buy and implement a commercial system from Brazil, even though they had committed themselves formally to the project. Moreover, the attempt was made to convince the other stakeholders to follow this example, which did not succeed. Another university repeatedly went into negotiations with commercial software providers, but never decided on a product. In a third case the university did not find the time and energy to implement the system. However, at the remaining two universities the system was in fact implemented, and relevant aspects of this implementation are elaborated in subsequent subsections.

Another conflict arose from the fact that local software developers were trained extensively in the architecture of the system, but were never given the opportunity to put their expertise in practice. Their university was reluctant to invest its manpower.

5.8 Reflexivity and change at university level

The two universities that implemented the IS worked together to a certain extent during its implementation. At both universities questions emerged when the system was put to use, many of which were brought to attention to the broader project management team.

5.9 Structure and culture inside UCM

UCM faculties. UCM was founded with the intention to provide higher education to the central and Northern part of the country, and therefore its faculties spread over a large geographical area. In many

respects the faculties acted rather autonomously, and there was little centralized information management concerning student records. Only statistics were compiled centrally, which were then provided to the Ministry of Education.

Academic Registrars, as the principal users of the system, played an important role in the implementation of the IS. Each faculty had its own academic registrar, which was considered a critical position since fraud would seriously undermine educational quality. To prevent fraud, predominantly Catholic sisters were put in these positions. The faculties varied in the student numbers, but one remarkable characteristic was that registrars used to know most students, meaning they could link name to face. With growing student numbers this became increasingly difficult, but in the day-to-day work it was remarkable to see how much student related information they were able to retrieve from their memories, e.g. about the study plans of students. This good memory often came in handy when gathering data for certain purposes, such as preparing certificates or student profile sheets.

A characteristic of the work patterns of registrars was that data used to be gathered only at the time needed. Some data used to be entered into Excel sheets, whereas other data was kept in printed form e.g. as paper student files and exam result sheets. Even though academic registrars were happy with the social aspects of being knowledgeable of students, most of them expressed their discontent about the shortcomings of the way information was managed.

It was observed that registrars tended to learn only enough to perform the task at hand. Instead of trying to get an understanding of the complete system, users first learned to enter student records only. At the end of the year they learned how to move students according to their academic success, i. e. assign them to the subsequent study year or to repeat certain subjects that they had failed. Some concepts were particularly difficult to learn, such as when curricula changed for new generations of students, and many users continued to live with an uncertainty about some aspects of the system. They would count on the availability of a qualified support person if they would encounter a difficult situation.

Technicians saw their role limited to technical system administration such as the installation and technical maintenance, and avoided assisting users build domain knowledge.

Development aid workers were present at UCM in different areas, such as in academic registry and accounting. Reactions by local counterparts varied when confronted with the perspective of externals arriving with new ideas concerning work practices, but often this was less of an issue when they realized that the externals would not be a threat to their positions, since the expatriates' presence was only temporary.

5.10 Cross-cultural contradiction and conflict inside UCM

One contradiction was the centralization of student records into one single database. Each user had its corresponding role and hence limited access to data. But a central database meant that the university management would potentially have access to all data, including data that used to be managed locally

at faculty level. However, there was only limited actual conflict visible to date.

For academic registrars, the usability proved to be weak for certain tasks, which had its causes in the database-oriented screen design mentioned earlier, and in the short implementation phase during the overall intervention project, which did not allow feedback from user experience to be integrated into the system's design.

Different paradigms of incident-based data collection versus timeliness of data entry formed another contradiction. The IS was built based on the assumption that information is recorded at the time when it becomes available. In this way reports and certificates could be extracted and printed based on correct data.

While users did not have technical knowledge, technicians did not enter the subject domain of academic registration but saw their mandate limited to technical system administration. This disjuncture had not yet led to conflict, due to the presence of external development workers who were able to link the two areas. But the potential for future conflict exists.

5.11 Reflexivity and change inside UCM

The intensive joint work between development workers and academic registrars at the registrars' offices led to the latter recognizing the value of well-organized, up-to-date information. The inherent limitations of local ways of administering student records were an additional motive for being open to other ways of working.

An important element for user acceptance was the possibility of integrating feedback from the users into system improvements. This was possible because of the availability of a small software development team at UCM.

Central university management had been hesitant about the creating a central unit for academic registry, because of intended autonomy of the faculties. But this changed slightly over time because the new system still allowed decentralized working. Therefore it was agreed upon to look for proper staff, both an academic registrar as well as an IS expert who could link the subject and the technical areas.

6 Discussion

In the following subsection, cross-cultural contradictions and conflicts will be discussed in terms of how different groups of actors applied different measures of success to various aspects of the project. This is the basis for uncovering the implications discussed in the following subsections.

6.1 Different measures of success

Table 2. Cross-cultural contradictions and conflicts linked to design-actuality gaps and differences in measures of success by project participants

<i>Contradictions & conflicts</i>	<i>Design – actuality gaps</i>	<i>Differences in success measures</i>	<i>Related success dimension</i>
Hesitation to 'get hands dirty'; Inactivity; Extent of documentation	Processes; Objectives and values	Consuming artifacts and services vs. active participation	Local involvement
Transfer and ownership of source code	Objectives and values; Management systems and structures	Getting hold of artifacts and services vs. sustainability through collaboration	Resource sharing
Activities parallel to project; SW developers trained but unavailable	Staffing and skills; Management systems and structures; Other resources (time)	Short vs. long term solutions	Sustainability
Conflicting requirements	Technology	Separate solutions per org. vs. single adaptable solution	Scalability
Centralization of student records	Information	Security through physical protection vs. system provided means	Data confidentiality
Short implementation phase; Usability	Staffing and skills; Other resources (time)	Delivery of agreed outcomes vs. impact	Effective use
Incident-based data collection	Information; Processes; Other resources (time)	On-demand vs. timely data entry	Information quality
Roles of users and technicians	Staffing and skills	Existing separation of roles vs. interdisciplinary IS role	Effectuating change

Structurational analysis of the project revealed a set of cross-cultural contradictions and conflicts, as shown in Table 1. The ITPOSMO model (Heeks, 2002) is used here to analyze gaps in several dimensions between IS design and actual reality, i. e. differences between the actuality before IS introduction and the assumptions that guided IS design. According to the ITPOSMO model, the dimensions of relevance to design-actuality gaps are information (data stores and flows); technology (hardware and software); processes (the activities of users and others); objectives and values; staffing and skills; management systems and structures; and other resources (such as time and money).

Table 2 lists dimensions of design-actuality gaps related to previously identified contradictions and conflicts. Furthermore, the table shows related differences in success measures by different actors. Finally, corresponding success dimensions are listed. Different participants put different priorities on these dimensions. For example, the logic of intervention projects favored the delivery of agreed outcomes, which gave low priority to effective use. On the other hand, local organizations could only achieve impact if effective usage patterns could be established. The dimensions are briefly elaborated

in the following.

Various issues indicated a disparity in the prioritization of local involvement. Local participants tended to classify themselves as receivers who waited for the delivery of artifacts and services. Such a delivery indicated success. On the contrary, the project coordinators associated success with high levels of local engagement throughout the project. These different positions represented gaps in objectives and values of both sides, and in the activities carried out by different participants in IS development.

A related issue was the extent of ownership of project outcomes such as source code, and the willingness and ability to share resources with other universities. There was clearly a locally observed desire for ownership, whereas the external project team envisioned sharing of the limited resources of each of the local universities.

Time was relevant in several dimensions. First, locally there was a preference for quick solutions, whereas external experts considered it more relevant to develop local capacity and adjust organizational structures and processes – activities that require a relatively long time. Secondly, time was a limited resource during the project, and implementation did not receive enough focus. Local organizations desired organizational impact, which conflicted with the intervention project's limited time span. Therefore, external project management measured success of their own activities to a certain extent in the delivery of hardware and software artifacts and services such as training. Thirdly, the processes that underlie information management by the registrars used to be incident-based, whereas timeliness was an implicit, unspoken assumption of system design.

Conflicting requirements of various universities, such as different student number formats and report designs, presented a rather minor issue. Previously, most users had their own home-made spreadsheets and documents, whereas the new IS was expected to be locally adaptable to specific settings. In this project, the issue could be resolved technically.

Concern was repeatedly articulated by local participants regarding data confidentiality, since traditional ways such as exclusive physical access had to be traded for other techniques such as authentication and trust in technical system administrators. Finally, for the implementation of the IS there was a discrepancy in what staff members, i.e. managers, users and technicians, saw in successfully executing their job roles, compared to what was necessary to achieve the intended organizational impact.

In order to achieve total success, local universities as well as external experts would have had to pursue numerous shifts in their skills, organizational structures and their views of what constitutes success. Given such major challenges, it is understandable that universities were only partially able to achieve their goals.

6.2 Implications for IS in developing countries

In the following implications are discussed with respect to three perspectives: design and

development, use, and management.

6.2.1 Incremental development and frequent evaluation

According to structuration theory, structure cannot be inscribed or embedded in technology (Jones & Karsten, 2008). Nevertheless, technological properties, together with institutional context and the power, knowledge and interests of human actors, do influence possible interpretations of technological artifacts by users (Orlikowski, 1992). But interpretations of users are hardly predictable, and the system development process needs to ensure the appropriateness of the produced technical artifacts.

In the project, system development followed an incremental and iterative approach (Brandon, 2006; van Vliet, 2008). Regular evaluation by future users of increments of the system being developed had several positive effects: First, it helped to stay focused on iteratively developing relevant functionality and improving usability. Secondly, it kept local actors involved and allowed for mutual learning, thereby reducing design-actuality gaps.

6.2.2 Recurring use

Structuration is dynamic; social practices evolve over time and space. They must replicate even to stay the same, but often they evolve as they are reproduced (Rose & Scheepers, 2001). The interpretation of the information system by users follows the same logic. Baark & Heeks (1999) identified typical attempts to establish meaningful usage patterns, including user training, consulting and assimilation through day-to-day use. They considered day-to-day use as crucial, due to its longitudinal character. Over time, through repeated reinforcement by users, such practices become reified and institutionalized (Orlikowski, 2000). However, without user support which helps enable fruitful interpretation of the technology, initial usage patterns can congeal quickly, and may even result in the rejection of the system.

Persistence over time in face-to-face sessions at the users' workplaces and the feedback of user experiences to system designers were important enablers for institutionalization of effective IS use and evolution of the technical artifacts.

6.2.3 Integrate design and use to leverage change

Users tend to view technology as closed, immutable systems when design and use are accomplished in different organizations. However, even the most "black box" technology has to be apprehended and activated by human agency, and in such interaction users shape technology and its effects (Orlikowski, 1992).

As already described, integration of user feedback helped to develop the information system's appropriateness-to-context and usefulness. An important enabling factor was the presence of a local change agent who brought together users and designers – backed by committed leadership. In the

absence of a change agent the danger was that the different participants tended to assume that “change management is the job of someone – or something – else” (Markus & Benjamin, 1997, p. 66). Since change cannot be effectuated from a distance, but requires personal, longitudinal contact, at UCM this role was suitably taken over by aid workers.

7 Contributions

IS research in developing countries distinguishes itself in its attention to the local context of IS innovation and the developmental role of IS innovation (Avgerou, 2008). By considering several levels of analysis, this paper has contributed to an understanding of how historical and social conditions of different participants in a cross-cultural setting have influenced the IS innovation process, and how IS innovation and culture mutually reconstituted each other over time through reflexivity and learning.

Historically constructed differences in, e.g., attitudes to hierarchy and forms of communication have been found to affect participants' success measures along various dimensions. These success measures were not only diverse and conflicting, but sometimes volatile, and could even undermine initially agreed project objectives. Furthermore, contextual differences have been found to limit the involvement of future users, which enforced the time-space-distance between consumers and producers and hampered flexible interpretation of the technology (Orlikowski, 1992).

Despite partial failure of the overall project, the analysis has shown conditions where structures have emerged in participants' minds that enabled successful IS production and use. Such an enabling environment was typically created by reflexivity and learning activities that involved the evolution of both technological properties and patterns of technology use (Orlikowski, 2000).

For practice, implications have been drawn based on the emergent nature of culture and IS innovation. They concern both IS production and use. The software development process requires a feedback of the multiple ways users interpret the IS in their institutional environment. Particularly during the early use of the IS innovation the interpretation and change process needs to be nurtured.

8 Conclusions

The paper has attempted to analyze the process and the context of a particular cross-cultural IS development project targeting the Mozambican higher education environment. The analysis has included three levels, from global to inter-organizational to intra-organizational and has led to insight about success being a multi-faceted issue. This is illustrated by the statement of the Mozambican overall project manager that “compared to other projects this one has been successful, with good output”. In contrast, out of five local universities that participated in the project only two have implemented the information system. Looking even closer at these two universities reveals that implementation has only been partially accomplished – only a subset of features, by a subset of faculties, are being used, mostly in parallel with traditional methods like Excel sheets. Additionally,

future support for these universities has not been secured yet which puts a question mark on sustainability. The contrast between the quote above and this short assessment indicates a wide variety of possible viewpoints of what constitutes success. The positive attitude of the manager can be related to experiences in other projects with less output, and to the future potential that he sees in implementing the software system in other Mozambican universities, which are suffering the same difficulties with respect to the administration of student records.

The paper has drawn implications based on a discussion of different measures of success that were attributed to the IS by different participants in the project. IS introduction always goes along with change, often regarding different dimensions. Such personal and organizational change needs to be managed, taking into account people's abilities. To accomplish change, persistence and committed leadership are instrumental. As IS are developed and evolved, frequent evaluation of system increments facilitates relevance and usability, and provides opportunities for reflexivity and mutual learning. Both at project selection and during execution it is beneficial to identify and focus on those local participants who are genuinely interested in the designed change that the IS intends to achieve.

Further research is suggested to cover later phases of IS production and use, with a more diverse base of user organizations. Relevant topics include the institutionalization of support structures. The described IS is currently being improved and implemented in further Mozambican and Zambian universities.

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