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Jyri Kemppainen

Appropriating IT Service Management Education in a Tanzanian University: Global and Local Perspectives

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JYRI KEMPPAINEN

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ABSTRACT

Technology transfer from developed countries to developing ones is not a straightforward process, because of the expertise required for using technology. Literature shows that education and transfer of expertise are necessary for technology transfer, but implementation of locally relevant education is a demanding process. Especially, the education of competent IT service management (ITSM) staff requires robust ICT infrastructure for facilitating their practical training but building, maintaining, and repairing those facilities requires competent ITSM staff. This is a challenge in many developing countries such as Tanzania where the researcher has gained his extensive working experience in various IT positions. Hence, the methodological foundation of the research is on the data obtained from action and design research patterns.

The dissertation presents a two tier approach to ITSM education design. The inner tier describes the organizational context of the ITSM. It is based on the ITSM core knowledge, identified from the literature, and analysis of the researcher's practical working experience in the Tanzanian IT sector. The outer tier of the approach describes how factors related to the broader educational context need to be taken into account when designing the ITSM curriculum in a given environment. The two tier approach takes into account the local realities and assists ITSM curriculum designers to overcome the discrepancy between IT graduates' educational and working milieux. The approach pays particular attention to pragmatic issues, which in most cases determine the success of ICT transfer between developed and developing countries. Still, the implementation of an ITSM Masters degree program in universities is a challenging task due to the need to instruct simultaneously both international certified professionals and professionals that meet local requirements. As the two tier approach guides, locally relevant ITSM curriculum requires the integration of an appropriate IT skill set and global requirements for IT graduates' expertise.

The approach proposes a new viewpoint on ITSM education beyond its original setting in a developing country. Enhancing ITSM education with systemic and contextual viewpoints can make the profession more challenging and thus increase its attraction among prospective students in developed countries, too.

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Preface

I would like to thank my supervisors Erkki Sutinen and Matti Tedre for their continuous support during the research process. Without Erkki's trust in my capability to perform well in computer science studies and Matti's guidance, advice, and patience in the writing process of the thesis' articles, I would never have reached this point. I am also grateful to Mike Joy and Andres Nilsson for their comments and advices during the review phase of the thesis.

My greatest appreciation belongs to my Tanzanian colleagues at University of Iringa where I learnt what action research and design research mean in practice. Thank you Dr. Hosea Mpogole, Mr. Fredrik Ngumbuke, and Mrs. Veronica Chuma, just to mention a few of them. I am also grateful for those Finnish PhD students, especially Mikko Vesisenaho and Minna Kamppuri, whose studies I was able to observe in Iringa and through which I started to believe in the usefulness of scientific research in the field of IT education.

I am thankful to my colleagues at the Finnish Evangelical Lutheran mission. Since 1998 I have had the honor of working with professionals who are living and working in companionship with people of developing countries.

I express my gratitude to the Academy of Finland and University of Eastern Finland for the opportunity to focus solely on the research between the years 2011 and 2012. In addition, I thank the Swedish Program for ICT in Developing Regions for funding the data collection of Paper IV. Without those grants my research would have continued for some more years to come. Special thanks go to Jarkko Suhonen. He has always friendly guided me through the necessary bureaucracy and helped me with practical matters.

I owe a special debt to my family. My late parents valued education and encouraged me to continue my formal studies for

as long as possible. I suppose I have now achieved much more than they ever imagined. My parents in law have shown me that the age does not prevent learning as long as you have the right attitude. Finally, it is difficult to find appropriate words to express my thankfulness and love to you, my wife Kati, and daughters Kaisli and Pihla. This academic achievement would be insignificant without your existence and support in my life.

I praise God that this period in my life is now over, and I pray that I will be able to use my skills for the benefit of the people in developing countries.

In Joensuu, 25 August 2014

Jyri Kemppainen

ABBREVIATIONS

ACM	Association for Computing Machinery
AIS	Association for Information Systems
BSI	British Standards Institution
CE	Computer Engineering
CS	Computer Science
EFA	Education For All
ICT	Information and Communication Technology
ICT4D	Information and Communication Technology for Development
IDC	International development Co-operation
IEEE	Institute of Electrical and Electronic Engineers
IEEE-CS	Institute of Electrical and Electronic Engineers-Computer Society
IS	Information Systems
ISO	International Organization for Standardization
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITSM	Information Technology Service Management
LAN	Local Area Network
LFA	Logical Framework Approach
MDG	Millennium Development Goal
ODA	Official Development Assistance
OOPP	Objective Oriented Project Planning
PCA	Principle Component Analysis
PRINCE2	Projects in Controlled Environments, version 2
RBA	Rights-Based Approach
RBM	Result-Based Management
SE	Software Engineering
SP	Special Publication
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UoI	University of Iringa
WSIS	World Summit on the Information Society

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on data presented in the following articles, referred to by Roman numerals I-V.

I Kemppainen J., Tedre M. & Sutinen E. (2012). IT Service Management Education in Tanzania: An Organizational and Grassroots-Level Perspective. Proceedings of the ACM Information Technology Education (SIGITE) 2012 Conference, October 11-13, 2012, Calgary, Alberta, Canada.

II Kemppainen J., Tedre M. & Sutinen E. (2012). A Tanzanian Perspective of the Technical Aspects of IT Service Management Education. Journal of Information Technology Education: Research, vol. 11, pp. 103 - 124.

III Kemppainen J., Parviainen P., Tedre M. & Sutinen E. (2012). Risk Identification Tool for ICT in International Development Co-Operation Projects. The Electronic Journal of Information Systems in Developing Countries, vol. 55, no. 3, pp. 1 - 26.

IV Kemppainen J., Mpogole H., Tedre M. & Chachage B. (2014). Validated Risk Identification Tool for ICT in International Development Co-operation Projects. The Electronic Journal of Information Systems in Developing Countries, vol. 64, no. 7, pp. 1 - 26.

V Kemppainen J., Tedre M. & Sutinen E. (2014). Development Projects and ICT: A Review of Non-Technical Aspects. The Electronic Journal of Information Systems in Developing Countries, vol. 63, no. 4, pp. 1 - 20.

The above publications are included at the end of this thesis by their copyright holders' permission.

OTHER PUBLICATIONS

- What IT Professionals Should Know About IT Work in Developing Countries, Tedre Matti; Kemppainen Jyri; Nkumbuke Fredrick. IST-Africa, 2011.

- Infrastructure, Human Capacity, and High Hopes: A Decade of Development of e-Learning in a Tanzanian HEI. Tedre, Matti; Ngumbuke, Fredrik; Kemppainen, Jyri. Revista de Universidad y Sociedad del Conocimiento (RUSC), Vol 7, No 1, 2010.
- The Implementation of IT-project at Tumaini University, Iringa in 2001-2003. Published as a poster paper in Proceedings of Fourth IEEE International Workshop on Technology for Education in Developing Countries. July 10-12, 2006, Iringa, Tanzania. IEEE Computer Society 2006.
- Contextualizing ICT in Africa: The Development of the CATI Model in Tanzanian Higher Education. Vesisenaho, Mikko; Kemppainen, Jyri; Islas Sedano, Carolina; Tedre, Matti & Sutinen, Erkki. Published as an article in African Journal of Information and Communication Technology, Vol. 2, No. 2, June 2006.

AUTHOR'S CONTRIBUTION

The publications selected for this dissertation are original research papers for appropriating IT service management education in a Tanzanian University.

The author was the primary contributor to the ideas and the manuscripts. The ideas for Paper I emerged through discussions with Professors Erkki Sutinen and Matti Tedre. The paper created the foundation for other papers. The ideas and the design for Papers II-III emerged through discussions with Professor Matti Tedre. In addition, Mr. Panu Parviainen designed the software for the risk identification tool presented in Paper III. The ideas for Paper IV came forth in discussions with Professor Matti Tedre and it was designed together with Dr. Bukaza Chachage and Dr. Hosea Mpogole. In addition Dr. Hosea Mpogole assisted the author with the statistical analysis. The idea for Paper V arose in discussions with Professor Matti Tedre.

Professor Matti Tedre appears as co-author with all papers and professor Erkki Sutinen as co-author with Papers I-III and V because of their contribution by commenting on paper drafts and giving ideas for improvements.

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1 Introduction

Computing Curricula 2005, The Overview Report by the Association for Computing Machinery (ACM), the Association for Information Systems (AIS), and the Institute of Electrical and Electronics Engineers Computer Society (IEEE-CS) describes five prominent computing degree programs and names them as *computer engineering (CE), computer science (CS), information systems (IS), information technology (IT)*, and *software engineering (SE)* [3]. The report's descriptions of the five programs indicate that CS, CE, and SE aim at professionals who are more oriented to project like work than IS and IT professionals. The work of CS, CE, and SE professionals is to develop, design and construct computing based solutions to the problems but IS and IT professionals focus on applying those solutions to organizational needs. More specifically, the report describes IS work as "integrating information technology solutions and business processes to meet the information needs of businesses and other enterprises" [3, p.14], and IT work as "ensuring that the organization's (IT) infrastructure is appropriate and reliable" [3, p.13]. The description of IS and IT works show that continuation of information and communication technology (ICT) services of organization play a key role in both professional's work.

Historically speaking, IT materialized as an academic discipline much later than IT professionals appeared in workplaces [3]. IT work that supports users and organizations in practical utilization of ICTs was a response to the increasing needs of organizations to use personal computers in workplaces in the 1980s. Everyday use of computers required full time professionals who concentrated on developing the necessary ICT services. Due to a lack of appropriate IT education, many employees learned their profession through practice instead of through a formal education [4]. In the 1990s, the situation

started to improve when IT educational programs developed. Today, developing countries[1] are undergoing a similar ICT proliferation that developed countries experienced 20 years ago, and it is important to avoid a similar kind of situation where IT education does not meet the actual needs of organizations.

The University of Iringa in Tanzania (UoI, formerly known as Tumaini University/Iringa University College, IUCo) acknowledged the importance of the local relevance of IT education and commenced a Bachelor of Science (B.Sc.) degree program in IT in 2007, using a contextualized curriculum [77,105]. The curriculum was anchored in six principles: context sensitivity, problem orientation, practicality, interdisciplinarity, international recognition, and basis on research. Those principles form a complex arrangement, and many aspects of the curriculum have been developed through research [77]. Such aspects include, for example, pedagogical approaches in the program, required level of specialization, and relevance of other academic disciplines and topics. Despite the careful planning, one crucial constraint remains in the B.Sc. program. The program curriculum has to cover a broad range of topics in only three years in order to be both internationally recognized and locally relevant. The available time—three years, as dictated by the national university system of Tanzania—is shorter than the recommended four years in the ACM/IEEE-CS's IT curriculum 2008 [4]. Furthermore, as a B.Sc. level program, the program does not aim at specialization in any specific branch of IT.

[1] The division between developed and developing countries is not straightforward due to a lack of commonly agreed definitions. In this dissertation, the definitions are derived from the Human Development Report of United Nations Development Program (http://hdr.undp.org/en/2013-report). The report ranks countries by Human Development Index into four categories named Very High Human Development, High Human Development, Medium Human Development, and Low Human Development. The term *developed countries* refers to the countries in the Very High Human Development –category and the term *developing countries* refers to the countries in the other three categories. In addition, the term *least developed countries* refers to the countries in the Low Human Development –category.

After five years of experience of contextualized IT education at B.Sc. level, and after the need for higher education was emphasized nationally [95], as well as locally, UoI started a development process for a Master of Science (M.Sc.) degree program in IT. The general structure of Masters degree education differs from that of a Bachelors degree as it aims at specialization (e.g., [22]). Masters degree programs typically concentrate on some well-defined areas of study, allowing more advanced concepts to be taught.

This dissertation is a part of a curriculum development process towards a new contextualized Masters degree program in IT at UoI, Tanzania. That M.Sc. program specializes in information technology service management (ITSM), and is designed from the local perspective, for local job markets, and for local organizational needs. The institutional goal for ITSM is to assure continuous access to information via ICT [6,20]. The emphasis on information assurance means that ITSM graduates must also be able to manage, maintain, and update ICT services instead of just constructing them.

In this dissertation I analyze contextual aspects of ITSM education in one specific developing country, Tanzania. Based on the analysis I present an approach for ITSM curriculum design where the local organizational context is recognized. Altogether, the dissertation summarizes the results of five original research papers (I-V) under six chapters as follows. Chapter 2 describes research background, i.e., its general context. Chapter 3 explains research questions and design. Chapter 4 summarizes the findings. Chapter 5 reviews the lessons learned, and, finally, Chapter 6 concludes the work and suggests future research activities.

2 Background

For decades various kinds of information systems and networks have played a central role in the organizations of developed countries [21,64]. In particular the use of ICT has spread to most areas of society. Computerization of society has been a fast process, and today ICT in its various forms creates an economic and productive backbone in the developed world. ICT plays a central role in terms of productivity as well as quality of production [12,18].

Due to the extensive diffusion of technology in developed countries' economies, development aid donors have, for a number of years, considered technology transfer to be a key element in development assistance to developing countries (e.g., [66,67,80]). Despite the criticism of technology transfer in general (e.g., technology dependence and inappropriate technology [70]), today the focus of technology transfer has turned towards ICT, as its importance to various types of development is often emphasized [38,49,76]. Unfortunately, as historical accounts from a number of developing countries show, the impact of transferred technology on the economies of developing countries has often been insignificant despite sustained technology transfer efforts [66,67,72].

Technology can be seen as a tool towards a given purpose, and functional technology simplifies operations and improves productivity and quality (e.g., [21,66,70,1]). The precondition for functional use of technology in an environment has been summarized as follows: "the precondition for embedding … technology successfully in the local environment is the proper training and orientation of local experts, who can operate, maintain and repair the technology without reference to donor sources" [106]. In addition, it has been argued that the sustainability of new technology (when transferred to developing countries) requires the involvement of beneficiaries

and their capacity building for managing change [70]. Hence, functional ICT, or successful ICT transfer, calls for IT education that supports local IT professionals who are competent in a given context.

The "appropriate technology" movement emphasizes technological choices that are environmentally friendly and user-centered [8,35]. In that movement, people's capacity to master technological solutions is considered to be a central factor for appropriateness of technology in a given specific context of use [35,73,105]. I use the term "appropriate" in that broad meaning where local capability to design, construct, and maintain technical solutions is a core issue in the self-sustainability of ICT services. The term ICT refers to advanced digital equipment that is used to handle information and/or aid communication. That description is derived from the targets of the World Summit on the Information Society (WSIS) for ICT development until the end of 2015 [87]. In the WSIS targets, ICT is seen as a tool that allows everyone's participation in the information society [87, p.11]. ACM/IEEE-CS's Information Technology 2008 curriculum defines that IT (as an academic discipline) "is concerned with issues related to advocating for users and meeting their needs within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies" [4, p.9]. I use the term IT with that meaning.

2.1 CONTEXT OF INTERNATIONAL DEVELOPMENT CO-OPERATION PROJECTS

The current international political consensus for development co-operation can be summarized by three concepts: *sustainable development, millennium development goals* (MDGs), and *international human rights* (e.g., [94]). Those concepts should be recognized in all international development co-operation (IDC) projects.

The definition for the term "sustainable development" is still debated and a number of competing definitions have evolved during the past decades [48]. In spite of disagreements, the IDC community usually discusses sustainable development in terms of three components: social development, economic development, and environmental protection [91]. Development is considered to be sustainable when each of those three components is addressed.

The United Nations Millennium Declaration proclaimed issues such as dignity, freedom, equality, and a basic standard of living as rights of every individual [93]. That declaration emphasized rights of individuals, and assigned the international community to be responsible for supporting those rights. That political process led to the proclamation of Millennium Development Goals (MDGs). MDGs were concretized in 2002, when midterm targets for 2015 were agreed upon [92]. Hence, since 2002, the purpose of IDC has been to assist developing countries to meet the midterm targets of MDGs [89].

A challenge with MDGs in the educational sector is that, for example, the second MDG (Achieve universal primary education) emphasizes the quantity of primary education but not its quality [92]. Therefore, a global movement named Education for All (EFA) led by United Nations Educational, Scientific, and Cultural Organization (UNESCO) has agreed about six education goals as completing MDGs [100]. In addition to the quantity of primary education, EFA goals address quality of education, and youth and adult education. For example, the EFA global monitoring report 2013/2014 discussed the achievements concerning the sixth goal (Improve the quality of education) via pupils/teacher ratio and quality of teaching materials [101, p.5]. A report finding is that the youth and adults education has been neglected [101, p.3], and the report calls for an agenda after 2015 where governments must consider education as an investment on sustainable development. My current understanding is that the agenda should address an educational sector as a whole in a country and youth should be able to graduate to a locally

valuable profession. That calls for a situation where the global and local requirements for certain education are in a balance. I use the term appropriating to describe that situation.

Lastly, political consensus about the importance of international human rights as a foundational element in development co-operation has increased the use of human rights-based approaches (RBA) in IDC project design [89,13]. In RBA the aim of an IDC project is to support people's rights rather than fulfill their needs. Hence, IDC project designs should be explicitly linked with rights-based issues, such as gender equality and rights of vulnerable groups.

In addition to the above mentioned three concepts, and because the effectiveness of IDC has been frequently questioned on the global political forums, the IDC community introduced the concept of national strategies for poverty reduction in the 2000s aiming at improving IDC efforts in each developing country [43]. In addition, four political declarations addressed the improvement of IDC—the declarations of Rome in 2002, Paris in 2005, Accra in 2008, and Busan in 2011 [13,84]. In those declarations, IDC stakeholders agreed to harmonize their procedures and practices, to coordinate their actions and avoid duplication of efforts, to increase authority and responsibility of beneficiary countries, to strengthen participation of civil society, and to aim at mutual accountability.

2.2 CHALLENGES OF ICT PROJECTS

Flynn [33] categorized failures in information system projects into quality problems and productivity problems, and Bennet et al. [12] described those categories through eight perspectives. The four perspectives for quality problems are addressing the wrong problem, neglecting the project context, having incorrect requirement analysis, and carrying out the whole project for the wrong reasons. The four perspectives for productivity problems are that changes in user requirements cause project requirements to drift, that external events change the project

environment making already designed solutions invalid, that the management is poorly organized and resources are wasted, and that designed implementation is not feasible in the specific context of use. That categorization of failures applies to ICT in IDC projects, too.

Hoffer et al. [41] argued that all projects have risks, and showed that understanding of their sources and types creates a foundation for project assessment. Similarly, Bennet et al. [12, p.25] argued "An understanding of potential problems is an essential precursor to information systems analysis and design". In addition, Bennet et al. [12] showed that the explanations for failures in information system projects depend on the perspectives of end-users, managers, and developers. This variety of explanations indicates that the risk identification process depends on people's understanding of a certain project milieu [74]. Even more, because ICT projects may fail due to a number of reasons, various risks can be considered characteristic of project work. Therefore, risk identification is always an essential part of project planning.

The International Organization for Standardization (ISO) defines, in its ISO 31000 standard, a risk as "the effect of uncertainty on objectives" [45]. ISO 31000 presents arrangements and guidelines for practices required in risk management. According to ISO 31000, risk management means identification, assessment, and management (avoidance, reduction, sharing, and retention) of risks. The use of ISO 31000 in project management requires careful planning of risk management tasks, responsibilities, activities, and budget. Other standards, such as ISO 27005:2008 [44], BS 7799-3:2006 [17], SP 800-30 [71] and Risk IT [46], describe several processes for managing ICT risks. For example, ISO 27005 defines processes called context establishment, risk assessment, risk treatment, risk acceptance, risk communication, and risk monitoring and review [44].

Business originated project management frameworks are rarely used in development projects, but their contribution to risk management is noteworthy. For example, the PRINCE2

(Projects in Controlled Environments, version 2) framework aims to isolate the project's management aspects from specialist aspects [88]. That isolation is aimed at presenting project management procedures that are independent of project scale, type, organization, geography, or culture. That separation means that project management staff organize, supervise, and control specialist work throughout the project's lifetime. The underlying assumption is that many of the necessary management skills are the same everywhere. PRINCE2 defines a continuous procedure for risk management, where possible negative effects (threats) and positive effects (opportunities) are identified and assessed, and where responses are planned and implemented.

When applied appropriately, PRINCE2's risk management procedures are comprehensive. The challenge is that the separation between managerial and specialist jobs easily hinders management professionals' capacity to appraise the work of other specialists, and therefore the assumed risks in a project plan might become irrelevant. That challenge materializes easily in those ICT projects where unprepared IT professionals from the Global North enter projects in the Global South. In addition, even though the management procedures are similar between projects and they are somehow independent from jobs of substance experts, a project management framework should not ignore the local context. For instance, PRINCE2 is based on the Western, paper based reporting culture and it works poorly without staff who are well-educated in project management. In developing countries, such an assumption means that it is impossible to win funding for a development project without expensive project organization.

Risk management does not necessarily contain risk analysis, but risk management is sometimes constructed on the information gathered during the risk analysis phase [74]. For example, in ITIL (Information Technology Infrastructure Library), risk analysis collects information about possible threats and vulnerabilities, and appraises their significance compared to values of assets [6,14]. Risk management monitors and re-

evaluates possible risks, and decides countermeasures when appropriate. ITIL is not a project management framework, but focuses on collecting and connecting the good practices of ITSM together, hence, its contribution to this dissertation is vital. ITIL's main aim is in the design of ICT services that fulfill organization's requirements: all ICT services that are constructed in an ICT project are aimed at fulfilling organizational goals and they should be self-sustainable later. In the history of ICT-oriented development co-operation there are numerous examples of ICT projects where ICT services are technically advanced, but locally unmanageable without continuing support from foreign experts and funding (e.g., [10,97,27]).

The analysis above shows that ICT risk management procedures require complex arrangements in the project organization, as well as a staff member who is responsible for analyzing, recording, and mitigating potential threats. Even if those processes are vital parts of ICT risk management as a whole, their implementation unduly complicates ICT projects, diverting management resources from other project activities into bureaucracy. In addition, such arrangements are rarely possible in IDC due to the scale and scope of those projects. Development projects employ IT specialists for some weeks or a few years at most, and they cover a wide variety of topics in all areas of human life.

2.3 CHALLENGES OF ICT ORIENTED DEVELOPMENT CO-OPERATION PROJECTS

Smillie [70] argued that technology offers a solution to the poverty problem, but the history of development initiatives shows that it is inappropriately used in international development work. In addition, Smillie argued that technology is a product of a certain social and historical context, and therefore its transfer from one context to another always requires modifications. Yet, that problem is not specific to

developing countries: local modifications of ICT are rarely possible in industrialized countries either, due to lack of necessary technical capacity [41,82]. ICT design, manufacturing, and re-design require skills, resources, and specialization that are not available in most locations. In addition, localizations of ICT are not always economically profitable and they are often limited to certain features only.

The notions about the challenges with ICT projects in developing countries is not new. In the late 1980s, anthropologist Marja-Liisa Swantz [73] recognized that formerly identified general challenges related to development projects and especially to technology transfer can be found in ICT projects, too. The common challenges were too narrow a focus of the projects and were missing connection to the broader context, which undermined project sustainability. In addition, continuity of external investments was not taken into account when external funding ended, projects were planned on donors' terms and they did not integrate in the needs of societies, and new technology was finally underused due to the lack of local skills, indicating dependency on foreign experts (similarly, Smillie [70]).

The literature shows that the characteristics of IT work in developing countries differ greatly from the characteristics of IT work in industrialized countries and the lack of technical IT expertise is a barrier for economic development of developing countries [16,49,70,72,78,97,10]. In addition, self-sustainability of ICT projects in developing regions is often questioned. For example, Surana et al. [72, p.12] noted that the long-term sustainability of transferred ICT solutions is poor in developing countries. Furthermore, Tedre et al. [77] showed that IT professionals in all countries face challenges that are unique to their specific socio-cultural, economic, geographic, environmental, political, and technical context. Therefore, the characteristics of IT work that specialists face in one country differ from the characteristics they face in another country [79]. As a result, consideration of the characteristics of an unfamiliar

context of use becomes a crucial element in IT professionals' work [47].

Various stakeholders in IDC have presented frameworks for managing IDC projects and their risks, such as Logical Framework Approach (LFA), Objective Oriented Project Planning (OOPP), and Results Based Management (RBM). For example, LFA describes the connections between a project's inputs, activities, and outputs, aiming at a certain purpose and goal in a table. The table rows describe how progress and performance are monitored and the columns describe relationships between inputs, activities, and outputs. In addition, the columns specify the main risks that might prevent the project from meeting its purpose and goal. LFA defines a risk as "an external factor that may negatively influence the realization of objective(s)". It uses an objective-based risk identification method and the risks are always related to the project's assumptions (e.g., [75]). The successful use of LFA in ICT-related IDC projects depends on planners' and donors' earlier experience in the particular location of development and their experience in LFA itself because LFA does not specifically address characteristics of IT work in developing countries.

In addition to project management frameworks, ICT for development (ICT4D) scholars have presented several models for assisting IT professionals in appropriate utilization of ICT in unfamiliar contexts of use [39,105,11,96,9]. For example, the COCPIT (Coordination/control systems, Objectives and values, Capabilities, Processes, Information, and Technology) model[2] aims to identify locally relevant tacit knowledge necessary for successful implementation of project [39]. The CATI (Contextualize, Apply, Transfer, Import) model is a four-level approach for designing, implementing, and analyzing the necessary expertise for transferring technology between

[2] In that literature, the word "model" is used when a tool has to be applied to a situation, and the word "framework" is used when a tool defines specific practices, procedures, or output for a situation.

countries [105]. The LACASA (Levels of Analysis, Categories of Analysis, and Scopes of Analysis) framework aims to address context-specific topics in information systems development [96]. The design-reality gap model aims to reduce the possible gap between design and reality by identifying key dimensions of the context of implementation [11].

The use of the models presented above for use of ICT in unfamiliar contexts of use is impractical due to the models' generality, to their assumption that the models' users have deep understanding about the particular context of implementation, and to ICT projects' inflexible timeframes. In optimal circumstances, where designers have already gained experience in multicultural projects, use of the models above help to guide the design and implementation process to a sustainable direction. The contribution of those models to IDC projects strongly depends on IT professionals' earlier experience in similar kinds of situations. In practice, this means that the models' contribution to IT professionals' work is negligible compared to commonly applied project planning and management frameworks.

The project frameworks and models above leave risk analysis under the control of project staff. The frameworks present general procedures for risk management, and the models assist in considering typical differences between contexts of use. All of them expect that specialists are able to estimate and define risks in specific project contexts. However, that assumption is strongly related to the specialists' education, earlier experience and their understanding about project context (e.g., [49]). For example, one specialist might consider low education of maintenance staff to be a threat to the project's self-sustainability, and therefore recommends focus on staff education. Another specialist in the same situation might conclude that the complex technology is a threat, and therefore recommend technical design that recognizes the earlier expertise of local staff. Such differences of approach are common and they are a source of debates concerning the appropriateness of the technologies.

The specific challenges of development projects have led to the development of numerous risk analysis tools that are designed for risk analysis in various project areas in IDC (e.g., [56,57]). Their methods vary, but they all are based on some common practices, such as objectives-based risk identification, scenario-based risk identification, taxonomy-based risk identification, common-risk checking, and risk charting. For example, Danida Environmental Screening Note is a list of questions for Danida's field staff when they assess environmental impacts of a development project [57]. That list is based on the common-risk checking method, and it is a part of Danida's environment guide for IDC. The challenge is that the project management staff of development projects are typically management experts but rarely experts in appraising the risks of ICT projects (e.g., [31]). If IT specialists are not familiar with the characteristics of IT work in the project milieu, their risk assumptions might not be relevant for a project's continued self-sustainability.

2.4 EDUCATIONAL CHARACTERISTICS OF DEVELOPING COUNTRIES

The literature does not paint a very promising picture of the quality of education in developing countries (e.g., [70]). The World Bank Task Force on Higher Education [90, p.93-94] stated that higher education contributes very little to economic development of developing countries. More specifically, it has been argued that universities in developing countries have not successfully provided their students with a strong practical understanding of technology [11,51]. This is due to substandard technical conditions, such as frequent power outages, poor Internet connections, and lack of equipment.

Therefore, the above-mentioned preconditions of technology transfer—appropriate training and orientation of local experts—seem to be rarely met when transferring high technology, such as ICT, from developed countries to developing countries [11].

The most challenging aspect of the technology transfer process is the need for local expertise to use and maintain the new technical solutions (e.g., [106,50]). In this light, the main question regarding technology transfer turns out to be "How can technology be transferred in a way that its users gain a sense of ownership of technology?" People should be able to use the new technology to solve problems they define in their own communities [16,80,107]. It has been shown that acceptance or rejection of a new technology depends on actual needs that the users' perceive, users previous knowledge about the technology, observability of the benefits of technology, and the relative advantage, compatibility, trialability, and low experienced complexity of the new technology [65].

The traditional response to the expertise-related challenges of successful technology transfer has been formal education (e.g., [98]). For example, individuals from developing countries have been sent to study abroad in developed countries [105], and educational programs and curricula from developed countries have been transferred to educational institutions in developing countries [11,29]. In spite of the advantages, both methods also have well-known disadvantages: the competences that are needed in developed countries are not always useful in a developing country (e.g., [79,70]). In addition, graduates of developing countries' own institutions have often been professionally trained for developed countries' labor markets only, which frequently results in them searching for job opportunities abroad (e.g., [23]). As education abroad as well as imported curricula both face a number of disadvantages, there is a need for a different approach to the expertise-related challenge.

The literature indicates that successful transfer of ICT from one context to another requires simultaneous transfer of knowledge and skills [16]. However, one can hardly transfer IT knowledge and skills without having ICT infrastructure that facilitates the learning process of IT knowledge and skills. The ICT infrastructure of the school can serve as a real-life learning milieu that IT education requires due to its inherent orientation

towards practical problems. Learning the skill set that IT professionals should have requires that students use ICT in practice. Development of local expertise requires and benefits from a heavy emphasis on practical training [50,106,108].

Therefore, successful IT education requires well-functioning ICT infrastructure that can facilitate learning of IT skills. However, several studies show that the construction of ICT infrastructure in the context of a developing country—including its educational institutions—is challenging due to the lack of local IT expertise (e.g., [16,49,72,106]). Those studies argue that in addition to challenges during the planning and implementation phases of ICT projects, the local stakeholders and beneficiaries of ICT projects are rarely able to operate, maintain, and repair the infrastructure without outside support. In addition, it has been argued that IT professionals who work in a developing country context need more profound knowledge about the factors affecting technology than IT professionals who work in a developed country do [16,79]. Without broad and fundamental knowledge about complete technical systems, IT professionals in developing countries cannot ensure that the ICT infrastructure fulfills its purpose (which is to provide services for its users at an acceptable level). East Africa currently has a shortage of IT professionals who can design, implement, and maintain ICT systems of organizations, i.e., there is a lack of ITSM professionals [50,62].

The two concerns above form a vicious circle: Education of competent IT staff requires robust ICT infrastructure that can facilitate practical learning—but building, maintaining, and repairing ICT infrastructure requires competent IT staff. In addition, implementing ICT-facilitated IT education is an expensive undertaking. The price tag is particularly relevant in developing countries, where financial resources are scarce and ICT is expensive.

3 Research questions and design

The roots of this research date back to year 1998, when I took an oversee position of Finnish Evangelical Lutheran Mission (FELM) as an IT employee of UoI, Tanzania. The work consisted of leading the IT support department, and teaching IT Literature courses and developing content for them [49]. There I recognized a gap that existed between the challenges of IT work in Tanzania and my IT expertise. Finnish education in engineering and ten years work experience in various ITSM positions in Finnish companies had not prepared me very well for the requirements of the Tanzanian context. Due to that observation, I played a key role when the collaboration in IT education research between UoI, University of Eastern Finland (formerly, University of Joensuu) and University of Southern Denmark was initiated. The collaboration has led to a number of novel initiatives in IT education and publications (e.g., [105,47,77]). In addition, the observation guided me to continue studies on the field of computer science education.

The characteristics of IDC projects have been present in my work in Tanzania since the very beginning [49]. ICTs are expensive to procure and scarce financial resources constrain organizations of developing countries to seek funding for their investments from outside sources. That societal context of developing countries led to the situation where I managed IDC projects in UoI, too. In addition, IDC projects have played a major role in my work since 2007 when my work as FELM coordinator for development co-operation in the East African area began. The position's responsibilities contain two aspects of IDC projects: to monitor implementation processes, and to advice and to support co-operation partners with FELM and

Ministry for Foreign Affairs of Finland requirements for project design, management, and reporting [83].

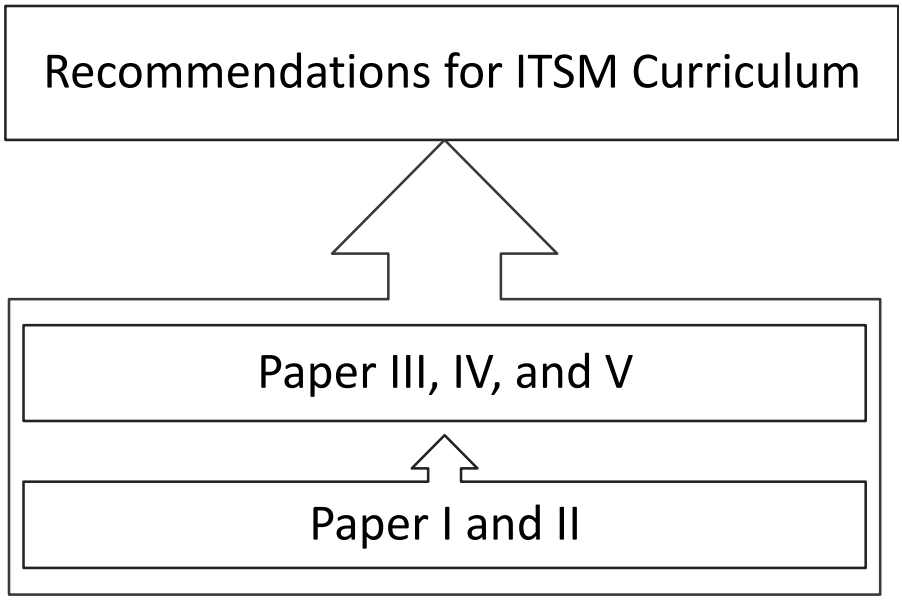

Figure 3.1: The research process

The research process of this dissertation is described in Figure 3.1. Papers I and II address IT professionals' work from organizations' perspective, and Papers III, IV, and V widen that perspective to a societal context of developing countries. As a whole the papers cover the milieu where IT professionals operate, which then creates the basis for the recommendations for an ITSM curriculum. This dissertation does not address pedagogical aspects of ITSM education due to their cultural dependence and the wideness of the field. Covering them would require another research project.

This research answers four research questions:

Q1) *What are the salient features of a well-functioning ITSM in a higher education institution in Tanzania?*,

Q2) *What are the characteristics of IT work in Tanzania that IT education should explicitly address?*

Q3) *How can IT professionals be prepared for the possible challenges of IT work in an unfamiliar working environment?*

Q4) *What are the vital non-technical aspects of IT work in international development co-operation projects?*

The dissertation concludes with lessons learned from the answers for the ITSM Masters degree curriculum. Paper I answers Q1 by presenting a two-tier approach to ITSM education. Paper II answers Q2 by summarizing locally relevant technical aspects for ITSM education in the Tanzanian context, Paper III, and Paper IV answer Q3 by summarizing the challenging aspects of IT professionals' work milieu in developing countries, and Paper V answers Q4 by reviewing the societal context of IT work in developing countries.

ACM/IEEE-CS's IT curriculum 2008 defines [4, p.9]: "Information Technology (IT) in its broadest sense encompasses all aspects of computing technology. IT, as an academic discipline, is concerned with issues related to advocating for users and meeting their needs within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies". Hence, this dissertation emphasizes the role of ICT as a practical tool of organizations and its overall goal is to connect the research results to Masters degree program in ITSM. The connections between research questions, papers, and methods are presented in Table 3.1.

The dissertation addresses topics that are ontologically subjective because they are mind-dependent i.e. they do not exist without human experiences [25,81]. It answers research questions (Table 3.1) by analyzing IT professionals' working milieu in Tanzania, and its base is in an action research approach due to the researcher's participation in the researched processes. Hence, the pronoun "I" is used instead of "he", "the author" or similar. The standpoint led to an epistemologically intersubjective research setting and pragmatism when research methods were chosen [24,81]. The methodology of Papers I-V is described more specifically in sub-chapters 3.1-3.4.

Table 3.1: *Connections between research questions, papers, and methods*

	Research question	**Papers**	**Method**
Q1	What are the salient features of a well-functioning ITSM in a higher education institution in Tanzania?	I	Action research with design research approach
Q2	What are the characteristics of IT work in Tanzania that IT education should explicitly address?	II	Literature analysis, Action research with systemic approach
Q3	How can IT professionals be prepared for the possible challenges of IT work in an unfamiliar working environment?	III, IV	Literature analysis, participant observation, statistical measures
Q4	What are the vital non-technical aspects of IT work in international development co-operation projects?	V	Literature analysis

3.1 Q1: WHAT ARE THE SALIENT FEATURES OF A WELL-FUNCTIONING ITSM IN A HIGHER EDUCATION INSTITUTION IN TANZANIA?

The efforts to break the vicious circle (education of competent ITSM staff requires robust ICT infrastructure for facilitating learning—but building, maintaining, and repairing ICT infrastructure requires competent ITSM staff, explained in Chapter 2.4) in a Tanzanian university suggested the core question of Paper I: "What are the salient features of a well-functioning ITSM in a higher education institution in Tanzania?" In order to answer the question, a systemic view of ITSM requirements in organizations was taken. That standpoint led to the situation where some weaknesses of IT education in a developing countries' context were recognized. Paper I showed that the answer for the question must take into account the complete economic, social, cultural, technical, and environmental context of developing countries. Hence, the paper's results guided four other studies aiming at identifying and justifying topics besides the traditional technology aspect of IT education.

The method of Paper I was based on an action research approach and it was exploratory by nature [24,52]. The work followed the action research pattern of continuous learning through experiences when working in the organization. Typical of the action research framework, the practical actions of the researchers were based on the existing knowledge, the successes and failures were analyzed post-hoc, and through reflection those new experiences led to merging former and newly obtained knowledge together [52]. This learning process gradually developed the researchers' understanding in the research area. During the process, qualitative and quantitative methods were used in data collection as well as data analysis. In addition, the modus operandi informally followed the design research approach, as numerous IT solutions were cyclically planned, observed, designed, prototyped, and tested based on initiatives and feedback by teachers, students, and administrative personnel of UoI [53].

3.2 Q2: WHAT ARE THE CHARACTERISTICS OF IT WORK IN TANZANIA THAT IT EDUCATION SHOULD EXPLICITLY ADDRESS?

The challenges of IT work in Tanzania and my incapability to overcome them brought forth the core question of Paper II: "What are the characteristics of IT work in developing countries that IT education should explicitly address?". Paper II focused on technical aspects of ITSM professionals' work in the Tanzanian context and concludes with recommendations on how those technical characteristics should be taken into account in ITSM education of developing countries.

The method of Paper II was based on the action research approach where I systematically analyzed the special threats that jeopardized the functionality of ICT infrastructure in Tanzanian work context. I valued the solutions for ongoing problems by their practical consequences [52]. The research data included recorded field notes, email exchanges, research diaries,

work calendars, to-do lists, meeting minutes, research studies, and projects' documentation since 1992, when my involvement with ICT oriented IDC projects in Sub-Saharan Africa began. The data set consisted of nearly 9000 pages of records in the end of 2012.

The analysis of data was inductive and the categories of challenges were build from the bottom up [24]. The analysis aimed at understanding and eliminating harmful external factors that affect ICT equipment. First, the threats were organized into meaningful groups based on their sources when immediate surroundings of ICT equipment is considered. That viewpoint was chosen because surroundings constrain implementation choices, and it poses challenges for IT professionals who design, construct, or maintain ICT services for organizational use. For example, all challenges originated from ICT users were included in one group. Secondly, the systemic approach was used when threats and their solutions were compared to the content of IT education.

3.3 Q3: HOW CAN IT PROFESSIONALS BE PREPARED FOR THE POSSIBLE CHALLENGES OF IT WORK IN AN UNFAMILIAR WORKING ENVIRONMENT?

The challenges of IT work in Tanzania and my incapability to prevent them brought forth the core question of Paper III and IV: "How can IT professionals be prepared for the possible challenges of IT work in an unfamiliar working environment?" The focus of the papers was on risk identification process of ICT oriented IDC projects due to the societal context of developing countries. Such projects might aim at wider development goals, such as improved quality of education, but their success depends on some ICT aspects. The societal context of developing countries where financial resources are scarce force their institutions and IT professionals to seek funding for ICT investments from outside sources. That standpoint affects

necessary expertise of IT professionals and should be recognized in ITSM education, too.

The method of Paper III was based on a systematic analysis of the researchers' own documentation and literature review. It was grounded on the researchers' own work experience in a number of different positions in development co-operation organizations, including positions such as development coordinator (country coordinator), project manager, project coordinator, technical expert, chief technical advisor, and software designer. The data set was the same as with Paper II. Paper III systemically amended researchers' experiences with literature review. In addition, it used the data from participant observations from Kenya, Mozambique, Zambia, and Uganda. As a result, Paper III presented the risk identification tool for ICT in IDC projects.

Paper IV complemented Paper III by validating the risk identification tool with empirical data from Tanzania [24]. The data were used for testing the reliability and validity of the risk identification tool's questions, the questions' grouping, and the question-scoring scheme. In the validation process, a sample of 83 IT professionals from 30 organizations, institutes, universities and international development co-operation projects in Tanzania were collected by questionnaire. The mode value of the Likert-scale questionnaire answers was used to adjust the question-scoring scheme, and SPSS's Reliability analysis was used to measure the internal consistency of the questions' grouping. The questions' validity was considered together with the reliability analysis.

3.4 Q4: WHAT ARE THE VITAL NON-TECHNICAL ASPECTS OF IT WORK IN INTERNATIONAL DEVELOPMENT CO-OPERATION PROJECTS?

The aim of Paper V was to summarize non-technical aspects of IT work in IDC projects which play a major role in success or failure of those projects. That way the paper intended to identify

societal aspects of IT work in developing countries for ITSM education. The focus on the IDC projects was justified due to the practical project situation in the least developed countries of Africa. The most of the funding for ICT projects is channeled through official development assistance (ODA) there. Hence, the knowledge about those non-technical aspects can be seen as a part of IT professionals' expertise.

The method of Paper V was based on systematic analysis of relevant literature on IDC and ICT4D. The findings of the literature survey were complemented with practical recommendations. Those recommendations were derived from the researchers' field experiences in IDC projects.

3.5 RELIABILITY, VALIDITY AND GENERALIZABILITY OF THE RESULTS

Cuba and Lincoln [26] suggested that reliability of qualitative research should be measured through dependability and objectivity through conformability. Both viewpoints refer to the repeatability of the research with the same results. Even if it is impossible to repeat the historical context of an action research or a design research setting of this dissertation, the documentation of IDC projects is public. For example, IDC projects' documentation of FELM related to Papers I, II, and III is located in the archives of FELM in Helsinki, and it is accessible for other researchers on request. In addition to public material, I have used my personal records such as email exchange, field notes and diaries (see Annex B). Such data contains personal information and, hence, is not publicly available. However I can show it if requested. The original data of the article IV is in the archives of the University of Iringa, and it is accessible for researchers by permission of the university. The article V is based on publicly available literature. Because the data of the dissertation is available and it is possible for other researchers to follow the process in an identical manner,

the work is consistent fulfilling the criterion of reliability in qualitative research [24,52].

Validity of qualitative research is measured through credibility and transferability of the results [26,52]. Credibility of the results describes how well the respondents agree with the results and transferability describes how general the results are. The results of this dissertation are derived from the IT requirements of organizations in the Tanzanian context and it aims at improving IT education's local relevance there. Hence, the results' credibility is supposed to be high. Even if the research results are aimed at ITSM education in the Tanzanian context, they are general in a sense that IT professionals in organizations always require a locally appropriate set of technical, management, and leadership skills [28,10]. That skill set plays a key role in ITSM professionals' work and those skills are, at least in some degree, related to one's personal characteristics and society's internal dynamics. This means that ITSM education must recognize the whole interacting society in its curriculum design. In addition, an important viewpoint to ITSM education beyond its original setting is that ITSM education with systemic and contextual viewpoints can make the profession more challenging and thus increase its attraction among prospective students in any context including developed countries. However, as a product of an action research study, the results suffer from the limitations set by a particular research environment, and their accountability require continuous and close work with the relevant stakeholders [52,69].

3.6 ETHICAL DELIBERATIONS

This research complies with the ethical guidelines of the Finnish Advisory Board on Research Integrity. The Board divides the ethical principles of research to respecting the autonomy of research subjects, avoiding harm, and privacy and data protection [32].

All those ethical aspects have been carefully considered throughout the research process. The main ethical concern in Papers I, II and III is the question of privacy of personal information and that data is not made publicly available as it is explained in Sub-section 3.5. The data of Paper IV was based on questionnaire. The informants' participation was voluntary and they gave their consent to the use of data for scientific purposes (Paper IV, p. 20). In addition, I emphasize that ACM Code of Ethics and Professional Conduct has been followed [2].

4 Findings

The seven years of my IT work in a Tanzanian university culminated to the first research question (Q1) "*What are the salient features of a well-functioning ITSM in a higher education institution in Tanzania?*" It was inevitable that in addition to technology, the quality of ICT service of an organization depends on a large number of contextual factors [49]. Hence, it was first necessary to gain a broad systemic understanding of the organizational context of ITSM. Secondly, it was vital to integrate the organizational context of ITSM appropriately into its broad educational context.

The answer to question Q1 is presented in Paper I by analyzing the relevant literature (e.g., [6,9,15,22,34,53,64,90,102,41]), international curricula recommendations (such as ACM curricula guidelines [3,4]), and the researchers' personal learning process in various IT positions of a Tanzanian university (e.g., [98,99,49,78,79]). The literature analysis showed that adequate ICT infrastructure in educational institutions is essential for developing IT students' expertise to an appropriate level. In addition, research literature describes a number of specific challenges related to the construction of ICT infrastructure in the developing country context. IT education everywhere has to find a balance between international recognition and local relevance. International recognition of IT education is normally achieved when the curriculum covers a sufficient number of elements in some internationally recognized IT curricula such as ACM/IEEE-CS's IT curriculum [4]. Locally relevant aspects of education are more challenging to discover, and they always require deep understanding and careful consideration of the local environment and circumstances.

Based on the analysis, Paper I presents an approach to the design of ITSM education that takes into account the local

realities. The approach consists of two tiers (Figure 4.1). The inner tier (Tier 1 as a subfigure in Figure 4.1) describes the context of ITSM in an organization, which is based on the ITSM core knowledge, identified from the literature and on the analysis of experiences in the Tanzanian IT sector. The outer tier (Figure 4.1) shows how factors related to the broader educational context need to be taken into account when designing the ITSM curriculum in a given environment. The two tiers interact with each other in order to guarantee a balance between the inner tier—representing the universal or general curriculum—and the outer one, representing the particular or specific expectations set for the curriculum.

The interaction between the two tiers is obvious, for example, when students are educated about *advocacy skills* (Tier 1 in Figure 4.1) as a contextual factor of ITSM. Firstly, teachers have to be familiar with internationally recognized management practices and leadership styles and they have to have understanding about those skills organizational role and position in the local context. This way the *advocacy skills* in Tier 1 relate to the *teachers* aspect in Tier 2. Secondly, the teacher has to combine those two notions to locally relevant knowledge and take students' pre-understanding into account. This way the pedagogy and course contents are culturally relevant, and meet global and local requirements. In this sense, three aspects in Figure 4.1—*teachers, curriculum,* and *students*—are tightly interrelated. Finally, the education aims at training ITSM graduates who are able to apply management procedures and leadership skills in the local context. This way the interplay between the tiers returns to the *advocacy skills* factor in Tier 1.

The approach assists ITSM curriculum designers to overcome the discrepancy between IT graduates' educational and working milieux. In most cases, IT students in Tanzania have not had transparent access to those types of ICT infrastructure that they should be building in their work. To solve this dilemma, the approach pays particular attention to pragmatic issues, which in most cases determine the success of ICT transfer between developed and developing countries. The approach serves as a

standpoint of a corresponding master's program for education of ITSM professionals. It aims at complementing generic perspectives of IT support with specific contextual factors of IT education.

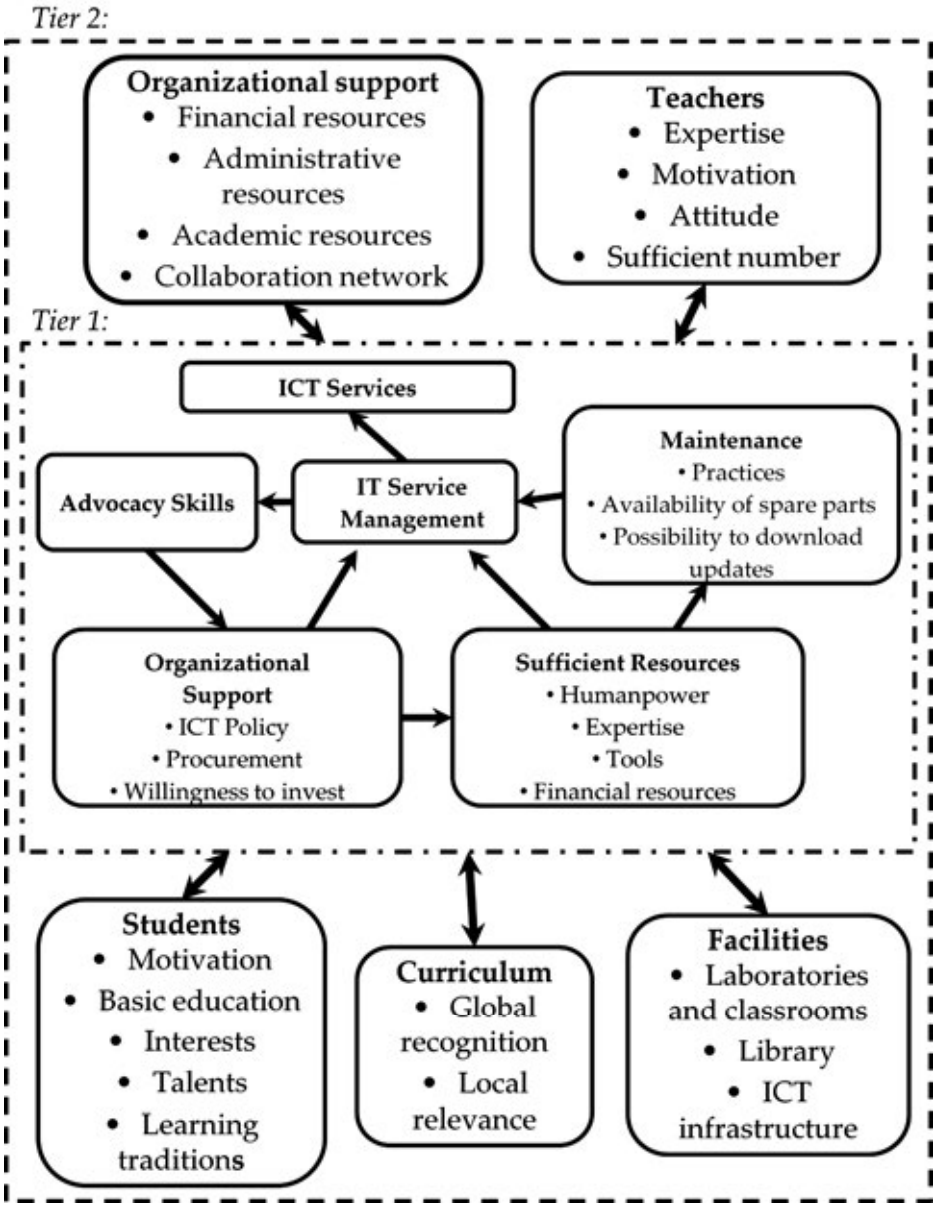

Figure 4.1: *Context of IT service management education*

The outcome of Paper I raised the need to answer three other questions of the dissertation. The answers were needed for clarifying necessary contextual aspects of ITSM education in the Tanzanian context. The answer to Q2 (*What are the technical characteristics of IT work in Tanzania that IT education should explicitly address?*) aimed at summarizing the differences between technical aspects of IT work in developing and developed countries, and how those aspects should be taken into account in ITSM education. The answer to Q3 (*How can IT professionals be prepared for the possible challenges of IT work in an unfamiliar working environment?*) was expected to summarize challenges that IT professionals face in an unfamiliar work milieu, and what kind of education might prepare them to those kinds of situations. The answer to Q4 (*What are the vital non-technical aspects of IT work in international development co-operation projects?*) was expected to summarize the most common aspects of IT professionals' work in the societal level of developing countries. In addition, ITSM in organizations is impossible unless the leaders are willing to invest on ICT equipment, spare parts, and human capital. Hence, the answer to Q4 focuses on IDC projects due to the ODA's position as the main source of IT project funding in a number of developing countries such as Tanzania.

4.1 A TANZANIAN PERSPECTIVE OF THE TECHNICAL ASPECTS OF IT SERVICE MANAGEMENT EDUCATION

Paper II answered question Q2 by summarizing the threats that jeopardize the functionality of an organization's ICT infrastructure in the Tanzanian context. Based on the analysis, it presented a number of practical recommendations on how those threats should be taken into account in ITSM education. The recommendations about the locally relevant technical topics for ITSM curriculum are presented in Table 4.1. The categorization of topics aroused from researchers' experiences [98,99] and from supporting literature [16,49,70,72,97]. The first column

summarizes the locally significant technical knowledge areas, and the second column summarizes corresponding practical skills necessary for IT students to learn.

Table 4.1: *Knowledge areas and corresponding skills*

Knowledge areas	**Corresponding skills**
Climate conditions on the site:	
Operating and non-operating ranges of ICT equipment Effects of UV radiation to equipment Local climate conditions	To evaluate and minimize the possible effects of local climate conditions to ICT infrastructure To ensure safe operating and non-operating environment for ICT equipment
Physical security on the site:	
Security arrangements Cultural issues Security procedures	To evaluate requirements for physical security arrangements related to ICT services To advise and negotiate practical improvements when weaknesses in security arrangements might threaten the quality or continuity of ICT services
Characteristics of premises:	
Technical characteristics of buildings (e.g. internal threats, such as power issues, and external threats such as insects and small animals)	To analyze drawings and electrical diagrams of premises from the viewpoint of ICT services To design and protect ICT infrastructure with appropriate technical solutions
Characteristics of rooms:	
Characteristics of ICT equipment in their context of use (e.g. temperature ranges, furnishing, electromagnetic interference)	To plan placement, install, and protect ICT equipment according to their specifications To document necessary requirements of ICT infrastructure for responsible actors
Quality of electricity:	
Applied knowledge about technical specifications of ICT equipment (e.g. voltage ranges), physics (e.g. thermal expansion), electrochemistry (e.g. galvanic corrosion), and electrical wiring (e.g. grounding principles)	To measure characteristics of electric power such as voltage level and ground resistance To estimate sufficiency of an electric power system for power consumption To advice responsible actors when an electric power system might threaten ICT services

Knowledge areas	**Corresponding skills**
Local area network:	
Installation requirements of LAN wiring Preventive and distance maintenance Applied knowledge about physics and electrochemistry	To design and construct ICT infrastructure appropriately for its context of use To maintain ICT services in line with organizational goals
Peripherals:	
Technical specifications and standards Quality requirements	To analyze and measure characteristics of electrical circuits of ICT equipment To protect ICT infrastructure against inappropriate use of peripherals and possible vulnerabilities arising from low quality products
ICT users:	
Organizational requirements Principles of ergonomics ICTs' appropriateness for the users	To identify and define organizational requirements for ICT services To merge requirements of organization and ICT users for design of ICT infrastructure To maintain and improve ICT infrastructure continuously in line with organizational goals

First, Table 4.1 shows that ITSM education in Tanzania should provide students with deep understanding about the sensitivity of ICT equipment to various environmental factors and they should learn how to protect ICT installations against those threats. Such knowledge creates a solid foundation for locally valuable IT expertise there.

Secondly, Table 4.1 shows that arrangements concerning physical security play a central role in protecting ICT equipment against crime. ITSM professionals should be able to analyze possible threats to ICT services derived from security arrangements and recommend alternative solutions when appropriate. Even though organizational security procedures are important, they are rarely adequate against internal threats. This means that IT professionals should understand and be able to use opportunities that local cultural values, such as communalism, offer for security arrangements.

Thirdly, Table 4.1 shows that characteristics of premises and rooms that affect the construction, usage, maintenance, and life-time of ICT infrastructure play an important role in the availability of ICT services. In Tanzania, proper ventilation arrangements and installation requirements of ICT equipment are often ignored when new buildings are constructed. Similarly, when rooms are reallocated, requirements of ICT equipment, such as air circulation needs, are rarely noted.

Fourthly, Table 4.1 shows that power problems pose threats to ICT infrastructure in Tanzania. The operation of ICT infrastructure depends on reliable power supply and this dependency indicates that IT graduates must reach significant expertise in power protection. IT professionals should be able to estimate the quality of electrical wiring on the site, as well as its sufficiency related to total power consumption. What is more, students cannot reach this level of expertise without appropriate knowledge in chemistry and physics.

Fifthly, Table 4.1 shows that LAN wiring and electrical wiring give rise to a number of similar challenges. For example, IT graduates should be able to prepare and evaluate tenders for procuring new material or equipment. These skills are required mainly due to widely spread counterfeit products, but suppliers' capacity to fulfill orders should be noted too. In addition, the threat of harmful insects and small animals to wirings should be carefully considered during the design phase of ICT infrastructure.

Sixthly, Table 4.1 shows that ICT security requires broader understanding from IT professionals in Tanzania than it does from IT professionals in developed countries. The security threats are similar, but specialized support is rarely available in Tanzania. This means that IT professionals should be able to develop alternative ways to localize generally used practices, such as centralized download procedures of security updates, for minimizing threats.

Seventhly, Table 4.1 shows that carelessly used peripherals create significant risks to other ICT equipment. This challenge is typically related to pirate product manufacturers' neglect of the

industry standards. In addition, peripherals are sometimes misused due to users' lack of ICT knowledge. Therefore, it is vital that IT graduates are able to advise and educate organization's ICT users about a number of basic technical topics.

Based on the analysis of Paper II, it is possible to argue that IT professionals cannot successfully design, construct, or maintain ICT services of organizations in Tanzania without a deep understanding about the technical topics presented in Table 4.1. This means that weaknesses of IT education in the presented knowledge areas hinder graduates' capability to guarantee self-sustainability of constructed ICT services. Hence, those knowledge areas—summarized in Table 4.1—should be taken into account when the local relevance of ITSM curriculum is considered.

As a summary of Table 4.1, the following list presents the corresponding capabilities and competencies for ITSM graduates:

- *Climate conditions on the site* - To be able to protect ICT equipment against environmental factors.
- *Physical security on the site* - To be able to estimate security arrangements of an institution and advice improvements when necessary.
- *Characteristics of premises* - To be able to apply understanding about drawings and electrical diagrams of premises in practice when managing ICT infrastructure.
- *Characteristics of rooms* – To be able to comply with specifications of ICT equipment in concrete circumstances.
- *Quality of electricity* - To be able to guarantee the continuity of ICT services in spite of power problems.
- *Local area network* - To be able to evaluate appropriate alternatives when designing and maintaining local area networks.

- *Peripherals* - To be able to analyze peripherals' effects to other parts of ICT infrastructure and to implement appropriate preventive actions.
- *ICT users* - To be able to design and maintain ICT services that fit for their purpose of use.

Paper II showed that locally appropriate ITSM education requires integration of certain locally relevant technical skills in the global requirements of IT graduates' expertise. Local and global perspectives are vital aspects in ITSM curriculum design, because academic programs do not only prepare students for a particular job in a specific context as, for example, vocational training does, but they prepare students for academic learning and further education, too. Therefore, IT curriculum designers should carefully consider the aspects of their own local context and expand their ITSM curriculum with appropriate topics from various other fields. Inclusion of locally needed topics in education prepares students to overcome common challenges particular to their future working milieu.

In addition to technical skills, the results of Paper II indicated that the technical skill set of IT professionals is inadequate when aiming at sustainable ICT services in an organization. Hence, ITSM education must address some other locally appropriate non-technical issues in curriculum design, too. Those issues were studied in more detail in Papers III-V.

4.2 RISKS IN ICT-ORIENTED INTERNATIONAL DEVELOPMENT CO-OPERATION PROJECTS

Paper III answered question Q3 by analyzing the significance of the characteristics of IT work in developing countries to IT professionals' work. The literature analysis showed that in addition to the fundamental technical and project management skills learned in formal IT education, IT professionals in developing countries require additional knowledge related to their own context (e.g., [16,49,78]). Tedre et al. [79] named that

knowledge as characteristics of IT work in developing countries and used five groups: institutional, educational, socio-cultural, environmental, and technical for classification, as presented in Figure 4.2. In addition, those groups were divided into twenty-four categories. Those categories presents the issues that IT workers might face when undertaking projects in an unfamiliar context.

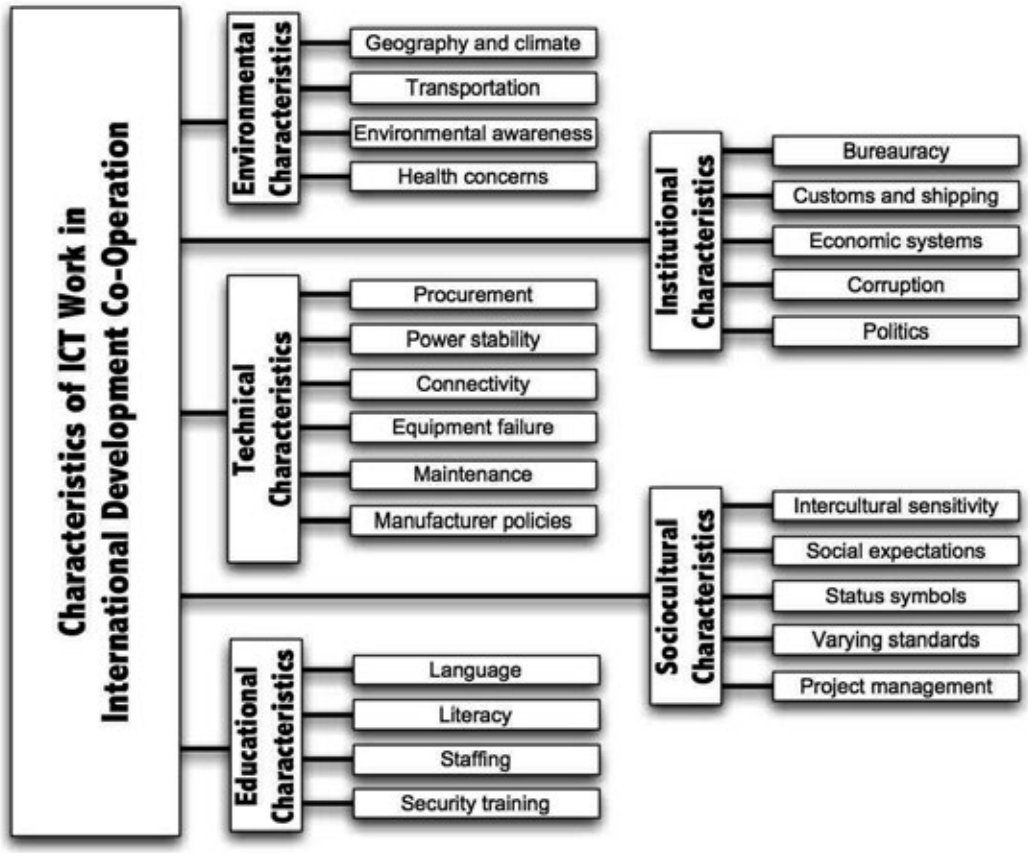

Figure 4.2: *Characteristics of IT work in developing countries, adapted from Tedre et al. [79], printed with permission*

When the most commonly used risk management methods of IDC projects were analyzed, an obvious weakness was noted. In spite of the different approaches to risk management, all frameworks assume that technical professionals are able to

identify and evaluate all dimensions of the project. The literature analysis of Paper III showed that the assumption is invalid in situations where IT professionals operate in an unfamiliar context, and those kinds of situations are common in IDC projects.

Therefore, based on the Tedre et al. [79] classification (Figure 4.2), Paper III presented a taxonomy-based risk identification tool for ICT in IDC projects. The tool consists of 55 quantified yes/no-questions, and of their impact analysis. Each question's quantification specifies the significance of each issue to project success. The question-scoring scheme describes each factor over two dimensions: generality of that factor and how directly that factor influences the work of project staff (Figure 4.3). Consequently, the score measures both the significance of each factor to project success, as well as the capacity of project staff to overcome challenges that may emerge. For example, the existence of procurement policy is a general institutional factor that directly influences the project staff work. All projects of a well-organized institution must follow that institution's standard practices, which directly influences the practical work of project staff. Therefore, the existence of procurement policy adds three points to preparedness score, whereas non-existence of procurement policy gives zero points. Based on the responses, the tool calculates that project's risk level and recommends appropriate countermeasures.

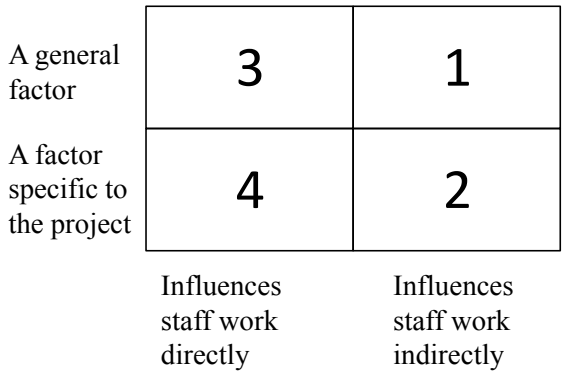

Figure 4.3: *The scoring scheme for the questions*

The aim of the risk identification tool is to assist IT professionals in their preparation process for an unfamiliar project milieu in IDC projects. The tool can be used, for example, for tailoring IT professionals' preparation period for mitigating the probable future risks or for developing organization's capacity for managing IDC projects. Above all, the tool can assist IT professionals and organizations to plan countermeasures for risks in specific ICT project milieux.

In addition, Paper III showed that risk identification tool addresses eight perspectives of quality and productivity problems in information systems projects presented by Flynn [33] and Bennett et al. [12]. The quality problems (wrong problem is addressed, a project context is neglected, requirement analysis is incorrect, and the whole project is carried out for the wrong reasons) are addressed when, first, the tool measures appropriateness of the project's goal to the end users. Secondly, the tool measures an ICT system's suitability for its environment by measuring the implementers' knowledge about the project environment as a whole. Thirdly, the tool measures ICT system's appropriateness for the project's purpose. Strong local support and an adequate number of professionals increase the probability that the constructed ICT system fulfills its purpose. Fourthly, the tool measures project's sustainability by emphasizing the commitment of local stakeholders. The productivity problems (user's requirements change, external events change the project environment, the management is poorly organized, and designed implementation is not feasible in the context) are addressed when, fifthly, the tool measures the adequacy of the project organization's management practices in a particular context and the project's practices vis-à-vis the practices of the international development co-operation community. Sixthly, the tool measures the project's flexibility in relation to external events. Seventhly, flexible project design also allows the recognition of changes in user requirements. Finally, the tool addresses issues related to the ICT system's technical and financial maintainability in the context.

Even if the risk identification tool addressed potential risks via 55 questions, it had two weaknesses. First, its question-scoring scheme was designed based on the authors' own experiences in developing countries without a wider empirical evidence. Secondly, its grouping for questions was derived from Tedre et al. [79] without a wider empirical analysis. Hence, Paper IV aimed at validating the tool in those two aspects.

The study of Paper IV was conducted to adjust the question-scoring scheme and the grouping of the risk identification tool with empirical data from Tanzania. Based on the data, obtained from 83 respondents from 30 organizations, institutes, universities and IDC projects in Tanzania, the questions' grouping and scoring were adjusted. In that process, the question-scoring scheme was statistically fine-tuned, two of the original categories of questions were combined with three remaining ones after reliability analysis, and two questions were combined together when the questions validity was considered. Finally, the validated risk identification tool for ICT in international development co-operation projects was presented (Tables 4.2-4.5). The tool consists of three categories, namely, institutional, societal, and technical characteristics. Those remaining categories have 54 questions for determining the risk level of the prospective project. The risk level (high, medium, or low) of a project may affect its overall performance.

Table 4.2: *Institutional characteristics*

SN	Item statement	Yes	No
Organizational Preparedness for Development Project:			
1.1	Is a project manual available?	3	0
1.2	Is a financial management policy is available?	3	0
1.3	Is a procurement policy is available?	3	0
1.4	Is an anti-corruption policy is available?	3	0
1.5	Is a staff policy is available?	3	0
1.6	Is a fixed asset policy is available?	3	0
1.7	Are there mechanisms for monitoring and/or evaluation? (For example, planning, monitoring, and evaluation mechanisms are defined and utilized according to organization's long-term goals/plans/programs, and the project has precise objectives with success indicators)	3	0
1.8	Does the local partner organization have managed development funding before?	1	0
1.9	Is there a support mechanism for helping with investors'/donors' bureaucracy?	1	0
1.10	Are there any incentives set for minimizing the risk of brain drain during the project?	1	0
Staffing:			
1.11	Does the project have a responsible project manager? (Full-time or part-time but there are a formalized position and an allocated budget)	4	0
1.12	Does the project have sufficient financial staff? (For example, an accountant is appointed to the project organization)	4	0
1.13	Are there expert(s) appointed for consultation on immigration and labor laws?	4	0
1.14	Are there expert(s) appointed for procurement?	2	0
1.15	Are procurement staff members experienced with bidding invitations for ICT equipment?	4	0
1.16	Have sufficient resources been allocated for preparing local staff for the investors'/donors' project practices?	1	0
1.17	Will the project pay locally appropriate salaries to local staff? (The local salary structure is recognized in the project)	2	0
1.18	Is the foreign experts' role in the project organization a support role instead of a leading role? (Note! The answer should be "yes" if a foreign leader has lived in the context a number of years)	4	0

Security and medical preparedness:			
1.19	Do foreign employees have a basic understanding about the necessary security measures in their new environment?	4	0
1.20	Is (are) the local partner organization(s) prepared to provide necessary security measures for the project? (For example, project site's physical security is properly organized and issues such as site's security fence, and 24/7 guarding are exist)	1	0
1.21	Are the staff members informed about the necessary insurances concerning medical treatments? (For example, employer's responsibilities concerning health issues are defined precisely)	3	0
1.22	Are the staff members informed about the necessary vaccinations, health risks, and prophylactic medication? (For example, what kind of antimalarial medication is recommended)	1	0
1.23	Are the staff members informed about preventive health care practices in the project area? (For example, how to process safe drinking water)	3	0
1.24	Are the staff members informed about the available and reliable acute care units, and about the local procedures concerning health services?	1	0
	Maximum score for the institutional preparedness is 62 points		

Table 4.3: *Societal characteristics*

SN	**Item statement**	**Yes**	**No**
Project Ownership:			
2.1	Is the project supported on the national level? (For example, the project is in line with national strategies for development, or the project has a high-level patron on the national level such as a minister or a member of parliament)	3	0
2.2	Is the project supported on the local level? (For example, the project is in line with local priority areas for development, or the project has a high-level patron on the local level, such as a high-ranking regional officer)	3	0
2.3	Is the project goal(s) supported in the local community? (For example, the project started on the local initiative, or the planning is based on a participatory approach)	4	0
2.4	Is the project plan flexible? (For example, if an unexpected internal or external event changes the project environment, the project plan can be adjusted accordingly)	4	0

Staff Preparedness to Multicultural Work:			
2.5	Have foreign employees been educated in development studies (or related)?	1	0
2.6	Do foreign employees have a basic understanding about the local culture? (For example, they have participated in orientation training)	1	0
2.7	Are foreign employees able to communicate in the local de facto language? (Sometimes the official language might not be the common working language)	2	0
2.8	Do the foreign staff members have experience working in multicultural teams?	3	0
2.9	Do the local staff members have experience working in multicultural teams?	3	0
2.10	Are the foreign staff members educated in development work? (For example, training course for development workers is a part of the project staff` orientation period)	2	0
Project Milieu:			
2.11	Are there commercial banks operating normally in the project area? (For example, it is possible to open a separate bank account for the project, and it is possible to use credit cards for purchases)	1	0
2.12	Are statistics about climate conditions in the site available? (For example, rainfall, snowfall, humidity, and maximum and minimum temperatures)	1	0
2.13	Is target area reachable around the year? (For example, roads are passable during rainy season or regular flights, trains, buses, or taxes operate in target area or between the site and a major city in the area)	4	0
Maximum score for the socio-cultural preparedness is 32 points			

Table 4.4: *Technical characteristics*

SN	Item statement	Yes	No
Preventive Measures:			
3.1	Are up-to-date drawings of site buildings available?	4	0
3.2	Are up-to-date electrical diagrams of site buildings available?	4	0
3.3	Are statistics about the quality of electricity in the site area available OR is the project prepared for significant power problems?	2	0
3.4	Does the site have a power source? (For example, the site is connected to the national power grid or it has	3	0

	a well-maintained power source such as local diesel generator or solar power system)		
Local maintenance Preparedness:			
3.5	Has a local IT expert been involved in the project design?	4	0
3.6	Are there more than one local IT companies present in the project area?	3	0
3.7	Are there more than one local Internet service providers available?	3	0
3.8	Can ICT equipment be bought locally?	4	0
3.9	Are the necessary tools and accessories available locally? (For example, cabinets, cable chutes etc.)	4	0
3.10	Does the local partner organization have permanent IT staff for IT service Management? (For example, IT support and maintenance is organized in the project site, and IT staff is permanently located there)	3	0
3.11	Are the crucial parts of ICT infrastructure maintainable locally? (For example, a Linux expert and an electrician are working for the organization, or their services can be contracted locally)	4	0
Adequacy of Project Management Procedures to Project Milieu:			
3.12	Is the project manual practical? (For example, the manual has clear advice and templates for work plans, narrative reports, financial reports, etc)	4	0
3.13	Are the instructions for financial management practical? (For example, there is a written policy for staff concerning authorization of expenditure)	4	0
3.14	Is the procurement policy practical? (For example, the policy defines procedures for inquiring quotations and selecting suppliers)	4	0
3.15	Is the staff policy clear and unambiguous? (For example, every job description includes clear statements of the job's responsibilities)	4	0
3.16	Is the fixed-asset policy practical? (For example, the policy defines the use of vehicle's logbook, a format for the fixed-asset register, and people responsible for keeping such things up to date)	4	0
3.17	Are relevant environmental issues acknowledged in the country and by the project? (For example, waste management is organized, and used batteries are recycled. Project documentation includes environmental impact assessment if necessary)	1	0
Maximum score for the technical preparedness is 59 points			

Table 4.5: *Project's risk status*

Question group	Project Score	Maximum Score	High-risk	Medium-risk	Low-risk
Institutional characteristics		62	< 31	31 – 49	> 49
Societal characteristics		32	< 16	16 –25	> 25
Technical characteristics		59	< 29	29 – 47	> 47
Project's Total Score		153	< 76	76 - 122	> 122

Papers III and IV showed that every project takes place in its own unique milieu that affects its design and implementation. That characteristic of project work may challenge IT professionals due to their educational background. IT professionals are not often educated in fields out of their specialty, and that unpreparedness may reduce their capacity to operate in unfamiliar situations. The papers show clearly that IT professionals in many developing countries require wide understanding about their working milieu because the probability of unexpected issues to materializing is higher there than in developed countries. Hence, the ITSM curriculum in developing countries should recognize the need for that wider expertise and include appropriate studies of the curriculum, such as development studies in Tanzanian case.

4.3 DEVELOPMENT PROJECTS AND ICT

Paper V answered question Q4 by analyzing non-technical aspects of IT professionals' work when they are involved in ICT oriented IDC projects. The approach was chosen due to the situation of developing countries where ICT projects are typically funded through ODA. The presented non-technical aspects are derived from the relevant literature on IDC (e.g., [23,30,65,58,48,61,42,5,70]) and ICT4D (e.g., [60,40,37,103,10]), and they reflect the researchers' field experiences in a number of the least developed countries of Sub-Saharan Africa.

The summarized first three non-technical aspects emphasized the political context of IDC projects. First, IT professionals' familiarity with international political thinking and agreements was highlighted because that forms the foundation of IDC. Regarding international agreements and consensus, three central keywords are *sustainable development, international human rights, and millennium development goals*. Most IDC projects are tightly linked in that political framework and ICT projects are not exceptions. Secondly, IT professionals' awareness about the role of ICT in development was underlined. The design of ICT oriented IDC projects necessitates knowledge about the digital divide, the existing ICT4D research, the expectations set by IDC community for the use of ICT, and the special characteristics of IT work in developing countries. Thirdly, IT professionals' capability to reflect on their work within the political and legal context of the host country was emphasized. The political situation in the collaborating countries inevitably affects IDC projects, and clear national strategies and policies of the target country are a precondition for smooth local co-operation. Still, issues such as political or legal instability may cause unexpected challenges to project work and IT professionals should be prepared for those kinds of issues.

The next two summarized non-technical aspects are strongly connected to project management practices of IDC donors. Thus, fourthly, Paper V highlighted IT professionals' familiarity with the practices of IDC donors. Each donor has their own guidelines that regulate the practices of design, management, and implementation of IDC projects. The guidelines typically necessitate the use of structured design approaches, specific management procedures, and particular implementation methods. Therefore, IT professionals often face the challenge that although ICT4D research studies present various tools for designing ICT projects in unfamiliar contexts, those tools focus only on ICT and contextual design issues and they are not easily usable within the structured design approaches of IDC that donors demand. In addition, IDC project designers should be able to build certain flexibility in project design because, in spite

of planning, stakeholders' attitudes towards project change, failures and misunderstandings do happen, and those events normally shift requirements. Hence, most IDC project initiatives benefit from participatory approaches and IT professionals should be able to choose an appropriate participatory method depending on the project milieu. Fifthly, Paper V emphasized IT professional's capability to design appropriate indicators for summative and formative evaluations of their projects. Project stakeholders demand efficient and effective IDC projects and project staff must continuously report project progress towards its purpose and goals. That is possible only if project staff are able to self-evaluate their work, update their knowledge in relevant on-going issues, and allow those observations to guide their work. In that process, a functional monitoring mechanism for formative evaluation is essential, and appropriate indicators create the foundation for summative evaluation and impact assessment.

The sixth presented non-technical aspect highlighted IT professionalism and lifelong learning skills in the context of IDC. From that perspective, Paper V stated that IT professionals should stay in touch with international political discussions related to IDC and the role of ICT in that context. IDC is a value-based domain where the current political debate is centered on the balance between human development and environmental protection. Hence, it is possible that the current debate will lead to broader development goals than MDGs, and IDC professionals should be prepared to that situation. In addition, Paper V stated that IT professionals should be able to combine their professional knowledge about new ICT solutions with the results of ICT4D research studies. That kind of expertise enables IT professionals to apply lessons learned from other project contexts to their project designs, and may assist to develop locally appropriate ICT innovations.

Paper V presented altogether six non-technical aspects for IT professionals to improve their IDC projects. The paper described a standpoint where the development of personal skills and lifelong learning is seen as a fundamental professional value.

The standpoint is not vital for IT professionals due to rapid development of ICTs only, but because they must be able to recognize variations between different contexts when designing, operating, maintaining, and repairing ICT services. More specifically, the summarized non-technical aspects indicate that IT professionals in developing countries need strong communication, management and leadership skills to be able to justify ICT needs of an organization and to be able to apply funding for desired investments. Hence, the development of that kind of skill set should be recognized in the ITSM curriculum, too.

5 Lessons Learned

The design process of a university degree program's curriculum is always a challenging task and ITSM curriculum is not an exception. That is because educational programs on university level should at the same time meet international educational standards and recognize local needs. The integration of those two aspects in an IT degree program requires that curriculum designers master global requirements for IT graduates' expertise, and that they are able to combine those requirements with the locally appropriate IT expertise. Hence, IT curriculum designers for a Masters degree program should recognize the following.

- The program aims at global recognition and scientific goals, but needs of local job market must be taken into account.
- The program must fit in local university system. For example, in Tanzania, Masters degree programs are two years long due to local regulations. In addition, precondition for the entrance is that applicants have a Bachelors degree in a proper field.
- The program aims at graduates in a specific professional area. Therefore, they should gain necessary expertise from that area during their studies.
- Lifelong learning skills are a vital part of IT professionalism.
- Pedagogical approach affects the content.

International educational standards or global recognition of IT education is typically achieved when the curriculum covers a sufficient number of elements in some internationally recognized IT curriculum such as ACM/IEEE-CS's IT curriculum 2008 [4]. In addition, when ITSM curriculum is considered, the global recognition requires recognition of international ITSM

standards such as ISO/IEC 20000 [85] and de facto ITSM standards such as ITIL [20] in the curriculum.

Locally relevant aspects of IT education are more challenging to discover, and they require deep understanding and careful consideration of the local environment and circumstances [76]. Appropriate recognition of local needs is especially important when ITSM education is considered. That is because the goal of ITSM is to manage the ICT infrastructure that delivers the ICT services of an organization, and to guarantee continuous operation of ICT services because many vital functions of organizations depend on those services [6,15,18,85]. This dependency means that prediction and prevention of possible incidents that might hinder the operation of ICT services play a key role in ITSM professionals' work. That kind of IT expertise is not possible without deep contextual understanding about the milieu where ICT infrastructure operates. In addition, ITSM of an organization has to be well organized, and follow transparent and predictable practices [20]. These requirements concerning ITSM call for a systematic approach from the people who are involved in the construction of ICT services. Therefore, in addition to global requirements, an ITSM degree should be designed from the local perspective, for local job markets, and for local organizational needs.

The integration of the rather practical skills presented in Table 4.1 to an ITSM degree program is sketched in Figure 5.1. Figure 5.1 illustrates, how technical aspects of ITSM in Tanzanian context can be combined together with IT body of knowledge presented in ACM/IEEE_CS's IT curriculum 2008. It proposes that the IT body of knowledge in the curriculum should be complemented with certain topics from the fields of electrical and civil engineering. That way the ITSM curriculum recognizes the global requirements for IT graduates' technical expertise but it also values the locally appropriate skill set. That kind of combination of global and local expertise is vital for ITSM professionals because those academic programs do prepare students for scientific goals, but they also aim at a particular field or a job. Hence, ITSM curriculum designers

should carefully consider the aspects of their own local context and expand their ITSM education by appropriate topics from other fields—electrical engineering and civil engineering in the Tanzanian case.

In addition to the integration of appropriate technical skills to the ITSM education, it was shown that ITSM education's inherent orientation towards a practical skill set necessitates a real-life learning environment. That is an essential viewpoint because the development of ITSM students' expertise requires a heavy emphasis on practical training through problem orientation.

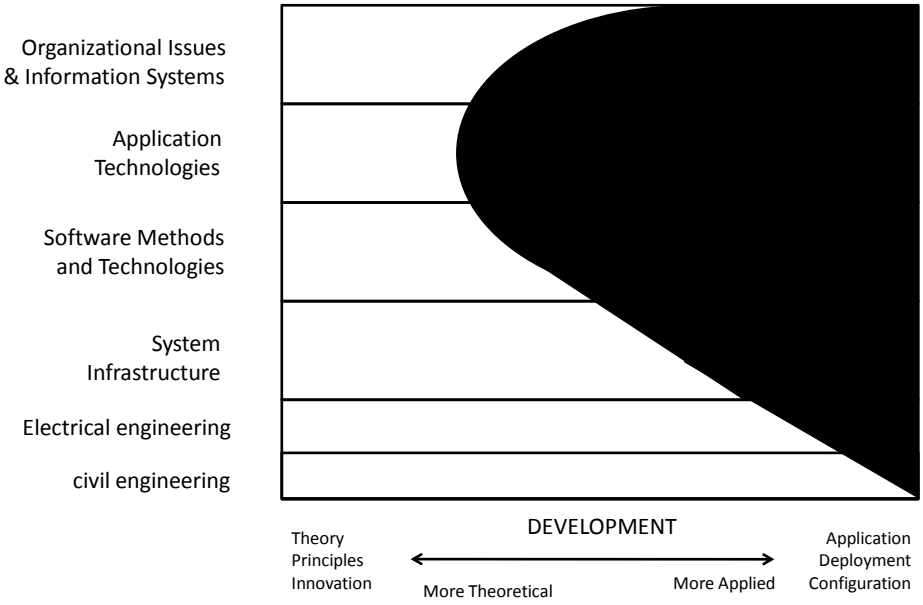

***Figure 5.1**: ITSM body of knowledge for Tanzania*

In the analysis of the context of ITSM education, Paper I emphasized the importance of organizational support for self-sustainability of ICT services and called IT professionals to do contextually relevant advocacy work within their institutions. It

is widely accepted that organizations exist to achieve some goals, and it is their leaders' responsibility to guide organizations toward those goals [63,7]. Therefore, in theory, IT professionals' work in organizations is straightforward because ICTs aim at assisting the organization to meet its goals. In practice, the situation is more complicated. First, this is because changes in ICTs often affect an organization's structures and work culture, and if that change is not properly led and managed, employees' resistance is guaranteed [63,19,41]. Secondly, in addition to the organization's leaders, successful deployment of new ICT services requires that the majority of an organization's staff is committed to its ICT development [12]. Thirdly, ICTs develop rapidly, and therefore IT professionals have to have a strong professional identity, where they emphasize service orientation, and value lifelong learning [6].

ICTs' purpose to assist an organization to meet its goals emphasizes the role of good management practices and leadership skills in ITSM professionals' work [20,86]. When the aim of IT work is to connect rapidly developing and global ICTs to a local working milieu, it is a duty of the organization's ITSM to get things done in a commonly agreed way [63]. This duty requires that an adequate number of resources is allocated in the right place at the right time. This calls for ITSM practices that are appropriately tailored for the use of an organization [20,86,6]. This tailoring process of the management practices is not possible without IT professionals who have, in addition to technical knowledge and strong professional identity, understanding about leadership aspects of their work, knowledge about good management practices, and appropriate communication skills.

These non-technical aspects of ITSM work are more challenging to integrate in ITSM curriculum than above explained technical issues because in addition to international ITSM standards the curriculum has to recognize the needs of organizations and peoples in a context. The necessary topics related to leadership and management aspects are already sketched in ACM/IEEE-CS's IT curriculum 2008, but still, it is a

demanding task to implement them in practice. The current international trend in leadership research does not separate leadership and management aspects when organizations' functions of planning, organizing, leading, and coordinating activities are studied (e.g., [63,7,68]). In that trend, management in organizations refers to the set of practices for administrative purposes, and leadership refers to the directing function. There is a danger that an organization's capacity to learn deteriorates, and there might not be space for innovations, if leaders become only managers. Similarly, without proper management practices, an organization might lose its learning focus – an organization's aim is to meet its goals. Hence, it is important to tie management practices and leadership skills together.

It has been argued that Western leadership models are not perfect fit in Sub-Saharan Africa because they underestimate the social nature of collectivist cultures [55]. Even though, leadership research has studied many opposite viewpoints [36, p.509], the results based approaches are currently dominant in West. For example, such approaches as lean management and result based leadership focus on the creation of value for customers and for the organization's owners. Therefore, they concentrate on the improvements in activities that add value, and the elimination of activities, that do not. Their focus is on certain things, not on the role of staff in the process. This focus can be seen as a weakness in collectivist cultures because when leaders focus on things, they easily forget the most fundamental value of collectivism—personal relationships.

The literature analysis indicates that the collectivism based traditional African leadership model demands management practices that allow participation in decision-making process for all individuals (e.g., [59]). This participation aims at an atmosphere where a collective personhood and morality can develop. When this atmosphere exists, it assists the goals of individuals to align with the goals of the organization. As a result, this atmosphere is very similar than the one in Senge's learning organizations [68]. I argue that the collectivism based leadership model and Senge's vision about learning

organizations aim at similar practical situations in organizations. That conclusion is in line with Littrell's [54, p.66] argument that "there are no such thing as a specific African leadership paradigm". In addition, the atmosphere is in line with the foundational premises of Service-dominant logic when ITSM professionals collaborate with their IT customers in organization's value creating process [104]. However, for ITSM education this means that management and leadership skills should be taught in a culturally sensitive way. Therefore, ITSM curriculum designers should carefully consider the pedagogical approach at least when the presented non-technical aspects are taught and expand their ITSM curriculum by appropriate topics from other fields when necessary—with development studies in Tanzanian case, as Paper II proposes.

In addition to the appropriate curriculum content, one should not underestimate the role of instructors in the practical implementation of a curriculum (by pedagogy). That is because the quality of formal education depends strongly on instructors' professionalism and their sufficient number compared to the student body. The lessons learned for ITSM education of Tanzania are summarized in Annex 1. It drafts course selection, course contents, and pedagogical approaches for the ITSM Masters degree curriculum for UoI.

6 Conclusions

The foundations of this dissertation are my own working experiences in Tanzania. I started my IT work as assistant lecturer of computer science and IT support person in Tumaini University at Iringa in the end of 1998 (currently, University of Iringa). Soon I learned that my Western education in engineering and my extensive working experience in ITSM gained in Finnish companies were inadequate for the challenges of IT work in Tanzania. After seven years of learning process in Iringa, I decided to continue my formal education in the field of computer science at the University of Joensuu, Finland (currently, University of Eastern Finland). After returning to Tanzania as a Masters degree holder I still recognized a gap between my expertise and the IT realities of a developing country. The learned skill set designed for labor market of Finland did not meet the requirements of a Tanzanian organizational context. That observation guided me to this ongoing research process.

Based on the analysis of the requirements of ITSM in the Tanzanian setting, Paper I compiled a two-tiers approach to the ITSM education design and answered research question Q1 (*What are the salient features of a well-functioning ITSM in a higher education institution in Tanzania?*). The inner tier (see Tier 1 inside Figure 4.1) described the organizational context of ITSM, which is based on the ITSM core knowledge, identified from the literature and the analysis of my practical working experiences in the Tanzanian IT sector. The outer tier in Figure 4.1 showed how factors related to the broader educational context need to be taken into account when designing the ITSM curriculum in a given environment. The two tiers interact with each other in order to guarantee a balance between the inner tier—representing the universal or general curriculum—and the outer

one, representing the particular or specific expectations set for the curriculum.

The implementation of an ITSM Masters degree program in universities is a challenging task due to the need to instruct simultaneously both international certified professionals and professionals that meet local requirements. Both dimensions—local and global—are important, because academic programs do not only prepare students for a particular job in a specific context, but they prepare students for academic learning and further education, too. As a two tier approach guides, locally relevant ITSM curriculum requires that an appropriate IT skill set is integrated with the global requirements for IT graduates' expertise.

The two-tier approach takes into account the local realities and assists ITSM curriculum designers to overcome the discrepancy between IT graduates' educational and working milieux. In most cases, IT students in Tanzania do not have transparent access to those types of ICT infrastructures that they should be building in their work. To solve this dilemma, the approach pays particular attention to pragmatic issues, which in most cases determine the success of ICT transfer between developed and developing countries.

In this dissertation, I presented the analysis of locally appropriate aspects of ITSM curriculum on three different levels: technical, institutional, and societal. Paper II presented the technical aspects of ITSM education in the Tanzanian context and answered question Q2 (*What are the technical characteristics of IT work in Tanzania that IT education should explicitly address?*). The analysis showed that ITSM education that is based on ACM/IEEE-CS's IT curriculum 2008 [4] must be complemented with appropriate topics from civil and electrical engineering to be technically relevant in Tanzania (see Table 4.1 and Figure 5.1).

Paper III and IV explicitly studied the wider organizational context in Tanzania by analyzing the possible ICT risks in international development co-operation projects. That approach for answering research question Q3 (*How do IT professionals can*

be prepared for the possible challenges of IT work in a foreign working environment?) was chosen due to a typical situation in developing countries—most of the ICT investment there is funded by official development assistance. The papers showed that in addition to technical skills and normal project management skills, IT professionals should gain appropriate knowledge about the characteristics of IT work in their own context—in the Tanzanian case that means certain topics related to development studies.

Finally, Paper V indirectly studied the wider national and international context in Tanzania by reviewing non-technical aspects of IT work in IDC projects. That approach was chosen because Tanzania is a developing country where national policies are guided by international development community. That guidance affects IT work even out of IDC projects' context. The paper answered research question Q4 (*What are the vital non-technical aspects of IT work in international development co-operation projects?*). As a result, Paper V reaffirmed the importance of development studies in ITSM education. In addition, the results support an emphasis of Paper I where the role of organizational support for ITSM was seen as a foundational element for the quality of ICT services of an organization. That emphasis highlighted the contextually relevant advocacy work within the organization as a part of an IT professional's work. Hence, management, leadership, and communication skills are a vital part of IT professionals' expertise in developing countries and ITSM education must address them in an appropriate way. However, the contextual dimensions of those skills are challenging to address, and further studies are needed before it is possible to conclude their scope in ITSM education.

The presented approach to ITSM education and the presented analysis of educational context of Tanzania serve as the foundation of a corresponding ITSM Masters degree program. However, as a product of an action research study, it suffers from the limitations set by a particular research environment and its accountability and validity require continuous and close work with the relevant stakeholders. In

addition, the approach proposes a new viewpoint on ITSM education beyond its original setting—even to the development of ITSM education in developed countries. That is because enhancing ITSM education with systemic and contextual viewpoints can make the profession more challenging and thus increase its attraction among prospective students.

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Annex A. Draft ITSM Curriculum for University of Iringa

Proposal for the ITSM Masters degree curriculum is sketched in the following list. The curriculum includes compulsory studies (90 credits) and selectable studies (30 credits), and together they form a complete ITSM curriculum for a Masters degree level.

The curriculum recognizes the international expectation's set for Masters degree education by its orientation to IT research. In addition, the curriculum fulfills requirements of IT curriculum 2008, ITSM standards, and de-facto ITSM standards in its requirements for ITSM graduates' capabilities and capacities.

The curriculum addresses contextual issues on three levels. Firstly, its scheme guides students to learn how to apply the theoretical knowledge of ITSM into practical situations in local working milieux. Secondly, the learning goals of courses are aimed at guiding the course content design towards contextual relevance. I propose the use of the contextual design approach for learning the local ITSM context when the course content is designed. For example, representative IT users and IT professionals of organizations can be interviewed and observed in their work milieux. Afterwards the content and practical implementation of the course can be decided in appropriate interpretation sessions. A later course evaluation may lead to further development. Thirdly, the curriculum aims at the use of problem based approaches when appropriate. The approach together with the selectable studies hopefully increases students motivation due to the studies contextual relevance.

It is possible to implement the ITSM curriculum online, but it is recommended that communication skills are exercised in face-

to-face situations. That is vital due to the nature of ITSM where collaboration with other members of the organization plays a significant role.

Compulsory studies, 90 credits (required hours of study is between 2250-2700 hours):

- ***Introduction to ITSM, 2 credits***
  The course presents the structure, basic concepts, purpose, and terminology of ITSM. Students gain competence to pass the foundation level examination of ITIL qualification scheme.
- ***ITSM ethics and professionalism, 2 credits***
  Ethical and professionalism aspects of IT work are considered. Students gain capability to consider ethical dimensions of the IT service strategy of an organizations, to analyze the appropriateness of ICT services to the goals of an organization, and to advocate the necessary changes .
- **Service lifecycle models, 4 *credits***
  ITSM models such as ISO standards and ITIL are studied. Students gain capability to use ITSM models in various organizational contexts.
- **Good ITSM processes and practices, 6 *credits***
  Good ITSM processes and practices in organizational contexts are presented. Students gain capacity to implement and run necessary ITSM processes and practices in various organizational contexts.
- **Information assurance, 5 credits**
  Information assurance models are presented and their practical applicability is considered in local and global perspectives. Students gain capability to protect organizational data and to ensure its availability via ICT.

- **ICT for Development, 4 credits**
  ICTs' role in development is considered. Students gain capability to consider and to apply appropriate technological solutions in their working milieux.
- **Leadership and management, 3 credits**
  Leadership theories are presented and their applicability to local ITSM context is discussed. Students gain capacity to lead, define necessary roles, responsibilities, processes, dependencies and interfaces related to the ITSM in an organization.
- **IT business in a context, 4 credits**
  Local business opportunities are analyzed, especially legislations and regulation for companies. Students gain capacity to analyze IT business opportunities in their context and capability to start IT companies .
- **Latest ICT solutions in organizations, 5 credits**
  Latest development of ICT solutions are explored. Students gain capacity to seek the newest solutions for ICT needs of organizations and capability to apply those solutions based on the requirements of organizations.
- **Philosophy of science and research methodologies in IT, 5 credits**
  Introduction to scientific thinking and methodologies in IT research. Students gain capability to design qualitative, quantitative, and mixed methods research. In addition, students gain capacity to analyze philosophical assumptions influencing research design.
- **A project work in IT, 10 credits**
  Practical ITSM project in an organization. Students should gain an expertise level where they are able to apply their IT knowledge in real life situations and to appropriately document their work.

- **Communication skills, 10 credits**
  Students gain capability to write, report, publish, and present scientific publications. Students show their competence by writing a conference paper, getting it approved in an international IT conference, and presenting its results there.
- **Master's Thesis, 30 credits**
  A research project in IT is proceeded. Students gain capability to do IT research on international scientific level

Selectable studies, 30 credits (required hours of study is between 750-900 hours):

A personal study plan is created for all students based on their own interest centers during the first semester. In addition to academic goals, the personal study plan enables a situation where a student is able to achieve the ITIL Expert level certificate before his/her graduation as ITSM Master degree holder (if that is seen appropriate in the local context).

Annex B. Primary Sources in Author's Personal Possession

Documentation of ICT oriented IDC projects:

- Internet Project Strategic Plan Project, (2001-2003). Tumaini University, Iringa University College
- Extension of Internet Project Strategic Plan Project (2004). Tumaini University, Iringa University College
- Library Facilities Improvement Project (2001-2002). Tumaini University, Iringa University College
- Library DBMS project (2003-2004), Finne, Auvo; Kemppainen, Jyri
- Extension of the Library Facilities Improvement Project (2005-2007). Tumaini University, Iringa University College.
- Establishment of Sustainable Digital Information Service Project (2009-2012). Tumaini University, Iringa University College.
- Computerisation of Data Collection and Analysis in Health Facilities (2009-2010). Evangelical Lutheran Church of Tanzania, Common Work.

Documentation of IDC projects with ICT component:

- Managed Health Care Program project, Phases I-III, 1998-2012. Evangelical Lutheran Church of Tanzania, Common Work.

- Makumira University College Faculty of Humanities and Social Sciences, Phases I-II, 2003-2009. Tumaini University, Makumira University College.
- Empowering Education – Processing Diaconia (2007-2010). Tumaini university Iringa University College.
- Secondary School for the Deaf and Vocational Training Centre, 2007-2009. Evangelical Lutheran Church of Tanzania, ELCT Njombe School for the Deaf, Mission of the Deaf.
- Development of Secondary and Vocational Education for the Deaf, 2011-2013. Evangelical Lutheran Church of Tanzania, ELCT Njombe School for the Deaf.
- The project plan for Capacity improvement of ELCT's dispensaries and health centers in the Lushoto area, Tanzania, 2014-2016. Evangelical Lutheran Church of Tanzania, Northeast Diocese.

Other ICT related documents:

- Documentation on all ICT courses that were contacted during the years 1998-2001 in Tumaini University at Iringa.
- Internet Project Strategic Plan for Tumaini University/Iringa Unyiversity College (1999). Ashford, Richard.
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Appropriating IT Service Management Education in a Tanzanian University: Global and Local Perspectives

The education of competent IT service management staff requires robust ICT infrastructure for facilitating their practical training but building, maintaining, and repairing those facilities require competent staff. This is a challenge in many developing countries such as Tanzania. This thesis presents an approach for assisting curriculum designers to overcome the discrepancy between IT service management graduates' educational and working milieux.

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