IT Service Management Education in Tanzania: an Organizational and Grassroots-Level Perspective

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ABSTRACT

Technology transfer from developed countries to developing ones is not a straightforward process. This is due to the expertise required for utilizing technology. Literature shows that education and transfer of expertise are necessary for technology transfer, but implementation of locally relevant education is a demanding process. Development of IT students' expertise requires adequate ICT facilities, but the effects of organizational support, human capacity, and the relevance of curriculum to the local context are crucial factors in IT service management education. This paper is based on fourteen years of experience in a Tanzanian university, and it shows the importance of the topics above for IT education in general. This paper also presents a two-tier approach to education of IT service management professionals: In that approach specific contextual factors of IT education complement generic perspectives of IT support.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: Curriculum

General Terms

Management, Design, Experimentation.

Keywords

ICT for development, ICT4D, IT education, IT curriculum development. IT service management, developing countries

1. INTRODUCTION

For decades various kinds of information systems and networks have played a central role in the organizations of developed countries [9,23]. Especially the use of information and communication technology (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 [4,7].

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. [25,26,33]).

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Despite the criticism towards technology transfer in general, today the focus of technology transfer has turned towards ICT, as its importance to various types of development is often emphasized [13,18,30]. 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 [15,25,26,28].

Technology can be seen as a tool towards a given purpose (e.g. [25,31,33]). Functional technology simplifies operations and improves productivity and quality. The precondition to 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”* [40]. 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 [27].

Hence, functional ICT, or successful ICT transfer, calls for information technology (IT) education that graduates local IT professionals who are competent in IT service management (ITSM) in a given context. This perspective is crucial for the relevance of IT education even beyond the context of developing countries.

1.1 Role of Education in ICT Transfer

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 [3]. 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. [19,40]). 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 [6,33,41]. 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 [24].

The traditional response to the expertise-related challenges of successful technology transfer has been formal education [37]. For example, individuals from developing countries have been

sent to study abroad in developed countries (e.g. [39]), and educational programs and curricula from developed countries have been transferred to educational institutions in developing countries [3,11]. 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. [32]). 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 [14]. 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.

1.2 ICT Infrastructure in IT Education

Research reports indicate that successful transfer of ICT from one context to another requires simultaneous transfer of knowledge and skills [6]. 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 ITSM education requires due to its inherent orientation towards practical problems. Learning the skill set that IT professionals should have requires that students use IT in practice. Development of local expertise requires and benefits from a heavy emphasis on practical training [19,40,42].

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. [6,18,28,40]). 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 [19,35]. 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 IT systems of organizations (e.g. [19,22]).

The two concerns above form a vicious circle: Education of competent ITSM staff requires robust ICT infrastructure that can facilitate practical learning—but building, maintaining, and repairing ICT infrastructure requires competent ITSM 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.

Our efforts to break the vicious circle in a Tanzanian university have given rise to the core question of this study: “*What are the salient features of well-functioning ITSM in a higher education institution in Tanzania?*” Answers to that question must take into account the complete economic, social, cultural, technical, and environmental context of developing countries.

In order to answer that question, we took a systemic view of ITSM requirements in Tanzania. Section 2 presents the research approach and methodological underpinnings for constructing that systemic view. Section 3 presents, from practical and organizational perspectives, the elements that ITSM education in our target country must take into account. Section 4 presents conclusions and our recommendations for ITSM programs in similar developing country contexts.

This paper introduces a two-tier approach to ITSM education. The approach complements the generic IT support viewpoints with aspects that determine educational requirements in a specific context of education. Hence, our approach helps educational experts and administrative personnel to match ITSM education with the expectations of IT in their own educational context.

2. RESEARCH APPROACH AND METHODOLOGICAL STANDPOINTS

This research study is a part of a curriculum development process towards a new contextualized Master's Degree program in IT at Iringa University College, Tanzania. That M.Sc. program specializes in ITSM, and is designed from the local perspective, for local job markets, and for local organizational needs. The first milestone of this process is to identify and develop the course selection, course contents, and pedagogical approach for a Master's Degree curriculum in ITSM. In addition to the ACM/IEEE curricula recommendations for IT [16], increasing the local relevance of such curriculum requires three to six supporting topics, depending on the context of education.

The quality of IT education depends on a large number of contextual factors [19,30]. Hence, a broad systemic understanding of the educational context creates a foundation for improvement of IT education. For this paper, we analyzed relevant literature, international curricula recommendations, such as ACM curricula guidelines, as well as our personal learning process during our work in the past fourteen years in Tanzania. The foundation of this research is in our own extensive work in a Tanzanian university, where we gained experience of various IT positions on all levels ranging from ITSM to IT education, such as IT support person, IT instructor, IT manager, IT advisor, IT director, adjunct professor, associate professor, and professor. We recorded our experiences in research diaries, project reports, email exchanges, work calendars, to-do lists, meeting minutes, research studies, and other documents. That data set consisted of roughly 9000 pages of records. In addition to our own documentation, our data sources include IT coverage in Tanzanian media, visits to educational institutions and IT project sites, and a great number of informal discussions with people who have been involved in IT work in developing countries as teachers, administrators, or project workers. This paper omits deeper data analysis and presentation, and the paper focuses on broad guidelines instead.

The research was based on the action research approach and was exploratory by nature [12]. Our work followed the action research pattern of continuous learning through experiences when working in the organization. Typical of the action research framework, our practical actions were based on our existing knowledge, our successes and failures were analyzed post-hoc, and through reflection those new experiences led us to merge former and newly obtained knowledge together. This learning process gradually developed our expertise in the research area. During the process, we used qualitative and quantitative methods of data

collection as well as data analysis. In addition, our modus operandi informally followed the design research approach, as we cyclically planned, observed, designed, prototyped, and tested numerous IT solutions based on initiatives and feedback by teachers, students, and administrative personnel of our college [20].

3. A TWO TIER APPROACH TO IT SERVICE MANAGEMENT EDUCATION

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 [1,5,7]. This dependency means that prediction and prevention of possible incidents that might hinder operation of ICT services play a key role in IT professionals' work. In order to fulfill its purpose, ITSM has to be well organized, follow transparent and predictable practices, and employ appropriate IT professionals. These requirements concerning ITSM call for a systematic approach from the people who are involved in the construction of an organization's ICT services.

This section introduces a two-tier approach to ITSM education. The approach is derived from our learning process in a Tanzanian university and it is supported by analyses of relevant literature. The approach systemizes the findings of the learning process, i.e., the salient features of well-functioning ITSM in a higher education institution in a developing country. The first tier, or the inner sphere, identifies the generic factors that influence the management of IT services of an organization, and their mutual interplay. The second tier, or the outer sphere, positions the generic scheme in the context where ITSM is learnt and taught, i.e., the educational context.

3.1 Tier 1: ICT Services of an Organization

An organization that recognizes the importance of ICT services in its operations normally describes its understanding about the role of ICT services for its operations in its ICT policy [1,5,34]. In addition, an ICT policy should define the governance and management structure for maintenance, operation, development, and implementation of ICT services. Therefore, the ICT policy creates the foundation for all use of ICT in the organization.

Practical implementation of an ICT policy depends on ITSM practices of the organization. For example, ITSM practices described in ITIL (2011 and 2007 editions) calls ICT policy by the name *IT Service Strategy* [1,8]. ITIL divides the management of ICT services to a number of phases: *service design*, *service transition*, and *service operation* [1,5,8]. Each phase is directed by *continual adjustment and change*. After implementation, when ICT services run on the service operation stage, those services are said to be at the phase called *continual service improvement*. From an educational perspective, ITIL fits well a problem-based learning process that aims at improving ICT services according to the goals of the organization.

Unfortunately, structured and well-organized practices for ITSM—such as those described in ITIL—are rarely achieved in organizations of developing countries, [1,11,18,21,36,38,42]. The reasons vary, but the most common challenges are related to the lack of a proper ICT policy and the low level of IT professionalism. Weaknesses in these two areas easily lead to improvised “ad hoc” implementations and inadequate

maintenance procedures of ICT services. Even more, those IT professionals who try to improve the situation may face resistance due to disagreement with co-workers about the role of ICT in the operations of the organization. Therefore, IT professionals often have to start from attitude changes towards a situation where the significance of ICT as a tool for the success of organization is recognized. This work necessitates various kinds of advocacy skills, for which IT professionals are rarely trained. Educational programs do include topics that are aimed at the management of an IT project's life cycle but they hardly ever include leadership or management aspects where continuation of IT services plays a key role [16,17].

Our research indicates that IT professionals should recognize the role of organizational support as a key factor for developing the ICT services of that organization. It is difficult for IT professionals to design, implement, operate, and maintain ICT infrastructure appropriately without strong organizational and managerial support. In addition, ITSM work is impossible unless the leaders are willing to invest on ICT equipment, spare parts, and human capital. This means that ITSM education should address the necessary advocacy skills. IT professionals must know how to understandably present and justify ICT requirements of organization, and how to assume an active role in discussions that concern the ICT services of organization.

In addition to organizational support, employing experienced IT professionals can be a challenge for the organization's management [6,18,29,39]. For example, at our college it has been a decade-long process to educate and commit an adequate number of IT professionals. The most difficult challenge has been the lack of well-educated and experienced IT professionals who are committed to settle in a rural educational institution. This is a special issue for ITSM because its vacancies are normally full time posts, which gives few opportunities for extra earnings. For example, it has been a common practice in our college that educators teach part-time in other educational institutions during their normal working hours. This kind of arrangement is not possible for ITSM staff due to their heavy workload.

Technical requirements set another cornerstone for reliable ICT services [18,32]. ICT infrastructure that consists of a large number of ICT devices requires continuous maintenance to function reliably. Maintenance of ICT equipment requires adequate work force, appropriate tools, and experience of good practices of ITSM. This is a challenge to ITSM because inadequately educated IT workers may ignore the importance of maintenance work to the continuation of ICT services and they are rarely able to do preventive maintenance [6,18,29,39]. The role of preventive maintenance is especially important in developing countries where procurement and delivery of spare parts can take a long time. In practice, ITSM cannot organize preventive maintenance without the capacity of IT professionals to anticipate incidents that may cause ICT equipment to malfunction and fail. For example, only through experience will an IT professional start to notice atypical sounds which may indicate an imminent hard drive or fan failure—both of which may harm ICT services, lead to loss of data, and cause a long disruption in services [18]. IT graduates' capacity to do contextually appropriate preventive maintenance is a goal that IT education must address, and for that goal adequate laboratory resources for problem-based learning are essential.

Figure 1 brings together the factors that affect ICT services in a higher education institution through ITSM. In addition, the figure

presents interplay between the factors and uses the systemic approach of ITIL in terms of ITSM. The factors are identified in our research and also reported in various literature sources [1,2,5,10,12,20,23,32,35,37,38]. Although the factors have been identified in a developing country context, they are generic to any context.

Figure 1. Context of IT service management

3.2 Tier 2: Context of IT Service Management Education

The context of ITSM (Figure 1) sets the scene and determines the structure of the ITSM curriculum, but that is not sufficient for high quality of ITSM education. ITSM must also be appropriately integrated into its broad educational context. Figure 2 summarizes a number of contextual factors that affect the quality of ITSM education. Those factors are collected from a number of sources [1,2,5,10,14,16,20,23,32,35]. Many of the aspects are straightforwardly justified. For instance, it is obvious that without financial, administrative, and academic resources, IT education cannot meet international standards. Still, resources alone do not guarantee contextually relevant ITSM education.

Our ITSM perspective to IT education differs from related educational approaches that are found in the literature. For example, Selinger's model considers the challenges of applying ICT to education—in general, not only to IT education—in developing countries [38]. Her generic approach hence differs from the more specialized approach of ITSM. ITSM education takes place in a particular context, and issues such as curriculum contents, its practical implementation, and organizational support need to be adjusted to the competences that are required from and expected of an IT professional in that very context. However, the design of relevant IT education needs both approaches.

In an analysis of the context of ITSM education, organizational support can be considered to be the crucial element underlying all other factors, since organizational stakeholders are strongly involved in employing teachers, choosing students, developing curricula, and organizing facilities for the IT program. In addition, the quality of education services benefits from broad collaboration networks.

Besides the organizational stakeholders, other elements of human capacity also have to be recognized. The quality of education depends on teachers' professionalism and on a sufficient number of teachers in relation to the student body. Curriculum designers also have to consider the balance between designing the IT curriculum to the needs of surrounding society and designing the IT curriculum to meet international standards. In addition to organizational and curricular considerations, training responsible

professionals is impossible without talented and motivated students.

Figure 2. Context of IT service management education

It is also logical from the ITSM perspective that up-to-date facilities, such as classrooms, laboratories, library, and ICT infrastructure are valued as crucial elements to the quality of IT education. Facilities and rest of the learning environment must be well aligned with the curriculum and pedagogical approach, and facilities must support them. There again, curriculum and pedagogy are aligned with the educational goals of the educational institution.

The two tiers presented above must intertwine together when ITSM education is developed in a certain context. For example, *humanpower* is presented as a contextual factor of ITSM in Figure 1. Firstly, in that regard, the teacher must gain enough understanding about the issue. This relates the *humanpower* factor to the *teachers* aspect in Figure 2. Secondly, the teacher has to consider the students' backgrounds to facilitate students in a particular context. This adds the second aspect in Figure 2 (*students*) to the interplay. Thirdly, the teacher has to adapt the content of education to reflect the local job markets but also general professional qualifications. This adds the third aspect in Figure 2 (*curriculum*) to the interplay. Finally, education requires facilities, such as a library or simulation equipment to extend the students' views regarding the *humanpower* factor. In addition, a collaboration network is often a useful resource in all phases.

Similarly, the two tiers intertwine when students are educated about *advocacy skills* (Figure 1) as a contextual factor of ITSM. Firstly, in the two-tier approach, in addition to understanding about internationally recognized management practices and leadership styles, teachers must have appropriate understanding about their organizational role and position in the local context.

This way the *advocacy skills* in Figure 1 relate to the *teachers* aspect in Figure 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 2—*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 Figure 1.

4. CONCLUSIONS

ICT services play a key role in everyday operations of organizations today. Hence, the importance of the quality of ICT services has increased. A central factor behind the quality of ICT services is a reliable ICT infrastructure that fulfills the organization's requirements. Organizations' dependency on ICT services has changed organizations' view on IT professionals' expertise and their formal education.

Research literature shows that adequate ICT infrastructure in educational institutions is essential for developing IT students' expertise to an adequate 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 ICT education is normally achieved when the curriculum covers a sufficient number of elements in some internationally recognized IT curriculum such as ACM/IEEE IT 2008. 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.

Our analysis of aspects of ITSM found that the role of organizational support is essential for the quality of ICT services. This emphasis highlights the contextually relevant advocacy work within the organization as a vital element in the work of IT professionals. This means that management, leadership, and communication skills are a vital part of IT professionals' expertise when management of ICT services in an organization is considered.

Based on the analysis of our 14 years of experience of teaching and IT work in the Tanzanian IT sector, we have compiled an approach to ITSM education that takes into account the local realities. Our approach to IT education assists one to overcome the discrepancy between IT graduates' educational and working milieus. 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, our approach pays particular attention to pragmatic issues, which in most cases determine the success of ICT transfer between developed and developing countries.

Our approach consists of two tiers. The inner tier (Fig. 1) is the ITSM curriculum, which is based on the ITSM core knowledge, identified from the literature and on our analysis of experiences in the Tanzanian IT sector. The outer tier (Fig. 2) 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.

Our approach to ITSM education serves as the foundation of a corresponding Master's program. However, as a product of an action research study, it suffers from the limitations set by a particular research environment. Therefore, its accountability requires continuous and close work with the relevant stakeholders.

Our approach proposes a new viewpoint to 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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