Migrating from Physical to Virtual Administrative Work Environment: A Case Study of a Sub Saharan African Higher Education Institution

Full paper

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Abstract

The purpose of this study is to understand how Higher Education Institutions (HEIs) in Sub Saharan Africa (SSA) can migrate from physical to virtual administrative work environment. Information systems (IS) research on virtualness in HEIs has focused more on teaching and learning and less on administrative work. Therefore, a knowledge gap exists on virtual work environment and how it emerges. This study focuses on the experience of an HEI in using an off-shore consulting agent to virtualise its administrative work environment. The study uses an interpretive case study approach as the methodology and activity theory as the theoretical lens to trace the HEI's attempt to virtualise the administrative work environment. The findings show how AT can explain IS development and implementation process through principal-agent relationship. This paper contributes to research and practice by offering critical insight into how HEIs in SSA can migrate from physical to virtual administrative work environment.

Keywords

Virtual Work Environment, Virtualisation, Activity Theory, Higher Education Institution

Introduction

The purpose of this study is to understand how Higher Education Institutions (HEIs) in Sub Saharan Africa (SSA) can migrate from physical to virtual administrative work environment. Over the years, organisations including HEIs have been migrating their process from physical to virtual platforms in an effort to reduce costs and offer greater flexibility to employees (Hurd 2011). The physical work environment (PWE) refers to a designated material work space such as traditional offices in physical buildings and use of material objects such paper documents, tables and chairs. People working within the PWE share a common workspace and may not necessarily collaborate using communication and collaboration tools such as email, videoconferencing (Schweitzer and Duxbury 2010). However, a virtual work environment (VWE) is an electronic work space through which people use information technology to communicate and collaborate without the need for face to face physical colocation (Martins et al. 2004; Townsend et al. 1998; Watson-Manheim et al. 2012). Migrating processes from physical to online space creates VWE for employees (Camarinha-Matos and Afsarmanesh 2005). Whilst the affordance of working in an online environment is enabled by advances in information and communication technologies, little is known about how the physical work environment in HEIs is virtualised.

While a plethora of research exists on virtualisation in HEIs (Keller 2009; Rae and Samuels 2011; Songkram and Puthaseranee 2015), the focus has generally been on virtual learning environment (VLE). As a result, less research attention has been paid to virtualisation of administrative work environment within HEIs. In many HEIs in SSA, the VLE or attempts to virtualise the learning environment has

preceded attempts to virtualise the administrative work environment. Though teaching and learning are the core activities of HEIs, administrative work provides the necessary support. It is thus important that IS research in higher education pays attention not only to learning environment but also to administrative work environment.

Also, from the practical perspective, virtualisation has been discussed from three viewpoints to include the technology virtualisation, work virtualisation and process virtualisation. The technology virtualisation involves creating logical computing resources from available physical resources by creating a layer of abstraction between workloads and the underlying physical hardware. This type of virtualisation covers virtual servers, desktops, networks and storage. Work virtualisation refers to the ability to work from geographically dispersed environment via computer network such as the case of telework (Waters 2015). Process virtualisation involves migrating physical processes to the virtual environment (Balci and Rosenkranz 2014; Overby 2008a). Of these three forms of virtualisation, this study is focusing on work virtualisation given the limited research on VWE especially in SSA. Therefore, the research question motivating this study is how HEIs in SSA can virtualise their work environment.

In addressing the question, the study uses an interpretive case study approach (Barrett and Walsham 2004; Walsham 2006) and AT (Engestrom 2000; Leont'ev 1978; Vygotsky 1978) to understand how the University of Ghana, a SSA HEI attempted to migrate its administrative work environment from physical to virtual environment through an off-shore consultancy engagement.

The rest of the paper is structured as follows: the next section reviews literature on information systems (IS) and virtual environment in HEIs in SSA. The theoretical foundation and methodology are then presented followed by the research findings. The discussion is then presented followed by the conclusion which outlines the paper's contribution, implications and suggestion for further research.

IS and Virtual Environment in HEIs in SSA

Evidence suggest that there is an increasing introduction of IS in HEIs, but the literature has focused largely on e-learning (McGill and Klobas 2009) and virtual learning environment (Rae and Samuels 2011; Songkram 2015). On the contrary, not much research attention has been given to e-administration and the administrative work environment in general. Also, not much evidence exists in the extant literature on IS in HEIs especially in SSA to understand VWEs and how PWE in HEIs is virtualised. Although, the vast e-learning literature has investigated the e-learning environment (Dutton et al. 2004; Songkram and Puthaseranee 2015), the emphasis has been from the perspective of students largely. However, e-learning from the perspective of students is not considered as work. Work is a rationally prescribed set of activities that are carried out in an organization for compensation such as pay (Cummings and Srivastva 1977).

The administrative work environment is characterised by several boundaries which act as discontinuities to working in a physical setting (Watson-Manheim et al. 2012). These are in the form of physical boundaries and administrative boundaries. Physical boundaries are the most visible boundaries and very difficult to change. Typical examples are distance and time. The administrative boundaries are the hierarchical workflows that may sometimes act as impediments to work in the physical environment. The administrative boundaries may also involve some procedures that may or may not be legitimised by some authority. These unique features may affect the migration from the physical to the virtual administrative work environment because such unique features exist in the administrative work environment.

Though there is limited research on VWE in HEIs, there have been some studies on the virtual work environment in other types of organizations such as the financial service sectors and others (Carlson 2014; Hurd 2011; Ransone 2014). However, these studies do not examine how the virtual work environment emerges and assumes that the VWE exists. Considering the uniqueness of the HEI context in terms of academic tasks being functionally and loosely coupled (Musselin 2006) and administrative tasks crossing several units, departments, centres, directorates institutes and colleges, the processes of migrating may differ from many other organisational settings.

In the IS literature, there has been many studies on how activities and processes can be virtualised (Balci and Rosenkranz 2014; Overby 2008a), however, much of these has relied on the process virtualisation theory (PVT) (Overby 2008b). The PVT focuses much attention on deterministic factors of whether

activities or processes can be virtualised or not. Process virtualisation refers to the migration of physical activities to virtual environment so that these activities are conducted via the Internet and Web information systems thereby removing physical contacts between humans and objects. The PVT explains why some physical processes are amenable to virtualization and some are not using a set of constructs (Overby 2008b). Despite its popularity, the PVT is limited in explaining work environment virtualisation because it focuses more on quantitative determinants rather than process migration. Also, the PVT and IS literature has focused on explaining how the dynamic aspect of work environment such as workflows are virtualised and not the entire work environment which contains both the dynamic and static aspects such as an entire office space, its cabinets and folders.

Activity Theory

Activity Theory involves the understanding of human interaction through the use of tools. The basis of AT is activity which consists of a subject (actor) and an object (objective) which are mediated by a tool (Leont'ev 1978). Activities occur within a social context which consists of a community, rules and division of labour to support the collective sense of the activity's environment. All the different elements of an activity and its context exist in a network called an activity system (Engestrom 1987) as shown in Figure 1.
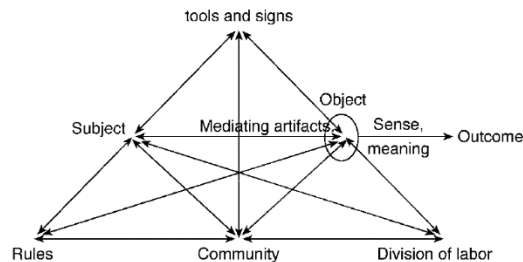

Figure 1:The Structure of an Activity System (Engestrom, 1987)

An activity system as unit of analysis is a key principle under AT. Contradiction is another principle drawn from the idea that activities do not exist in isolation, but are influenced by other activities and its environment and these influences may sometimes cause imbalances (Engeström 1987). When contradictions intensify, the activity system may get modified and the object and motive may go through an expansive transformation (Engeström 1987; Engeström 2014). AT can offer insight into the complex and sociotechnical nature of the virtualisation of an HEI work environment.

AT has been widely used in researching teaching and learning, especially to evaluate learning technologies (Isssroff and Scanlon 2002; Murphy and Manzanares 2008; Murphy and Rodriguez-Manzanares 2008; Scanlon and Issroff 2005) and understand the use of social networking in higher education (Hamid 2011; Hamid et al. 2010). However, AT in these studies examined systems already in existence and were being used. In contrast, this paper uses AT to examine a HEI's transformation of a PWE into a virtual one by using an off-shore engagement with an agent.

Organisational changes are traditionally initiated by management and with or without external engagement. Where change in an organisation is internally driven, the cooperative development of the activity may be threatened (Haapasaari et al. 2014). Many organisations today, design and implement systems with external engagement. This raises the issue of the concept of agency in AT (Haapasaari et al. 2014). Agency in AT is described as the breaking away from a given frame of action and undertaking initiatives to transform it (Engeström 2006). By searching for a new and cooperative way of executing an activity through an external engagement, there is a shared transformative agency (Virkkunen 2006). In this study, the concept of agency in AT involves outsourcing parts of an activity to an external agent. Though traditionally, the concept of transformative agency has been confined to understanding work activities ascribed to management and specialists, the concept is appropriated here to study principal-agent engagement in an HEI's quest to transform its work environment. Here, the HEI breaks away from working alone and takes the initiative to engage an independent off-shore consultant to migrate the HEI's work environment.

Research Setting and Methodology

The study was conducted at the University of Ghana (UG). UG was selected for a number of reasons. First, the researchers are Ghanaians and are in the case study organisation and their knowledge about the country and the organisation as well as their social networks there facilitated gaining research access. Second, UG has recently gone through a process of migrating its physical work environment.

An interpretive case study method (Walsham 2006) was adopted. Interpretivism facilitated the researcher's understanding of the migration from physical to VWE by assuming that as various actors within and outside UG interacted with the world and with each other they created subjective meanings through their interactions (Orlikowski and Baroudi 1991). This meant that virtualisation of the work environment as a reality could only be understood through social constructions (Myers 1997; Myers 2013) and through the meanings that the HEI and the external agency assigned to the reality (Orlikowski and Baroudi 1991).

Data was collected through interviews, documents and participant observation (Myers 2013). Interviews using open-ended questions was employed to access the interpretations of the participants (Walsham 1995). The number of participants were arrived at heuristically (Guest et al. 2006) and included project consultants (4), the local project team (4), users and management (15) identified through purposive sampling**.** Documents such as minutes of meetings, email correspondence, requirements documents and project reports and user manuals were reviewed. The first author observed and participated in the requirement gathering process as well as the user acceptance testing. In all, the first author visited 20 administrative work environments of UG with the project team to understand the workflows, filing procedures and all other aspects of the work environment. These offices were purposively sampled.

The data collection and the data analysis was concurrent (Myers 2013) and inductive. Hermeneutics as the mode of analysis (Myers 2004) provided concepts to interpret and understand the meaning of text. The *hermeneutic circle* was the key concept and it meant that the whole phenomenon of virtualisation only became clear from the understanding of the individual parts and the meaning of the individual parts also became clear from the understanding of the whole (Myers 2013).

Case Study Description

At UG, the PWE consist of physical offices, physical workflows and mostly face-to-face interactions. In each office two components of work environment are visible. The first is the physical (static) part and comprises a fixed office location usually in a building of very permanent nature, metallic or wooden filing cabinets, physical files and folders, a fixed land line telephone and a desktop computer. The second is the workflow (dynamic in nature) that are followed to accomplish the task in the work environment. The workflows are largely physical and characterised with minimal virtual interactions. The delivery of mail and parcels within UG are also sometimes handled through an office messenger who would deliver letters or parcels physically and in person.

UG had been managing its workflows physically for a long time. However, in 2014, UG embarked on a project with an offshore consultant to develop and implement an intranet portal to serve as virtual administrative platform. The project is funded by China EXIM bank and facilitated by Government of Ghana. The main aim is to digitalize the current paper records and automate their existing manual workflows. The system allows creation of template based virtual offices and virtual cabinets with the required access rights to help manage records and documents. In UG, every office falls under one of the categories of central administration, directorates, colleges and support services. This same concept was used in the implementation of the project to facilitate the creation of virtual offices under specific categories as per UG hierarchical structure. Office files are managed under each folder by the office members based on the access rights given by the office administrator. The system also provide collaboration between staff using Liferay's collaboration features like message board, wiki, polls, calendar, chat, records management and reporting whilst Alfresco is used for content management and provides Application Programming Interface (API) for web services integration. Both are open-source technologies. Though the project's key milestones have been achieved and the system is functional, its wide use has not started. Six months after the system went live, only three of the six offices (Intern Audit, legal office and the Registrar's office) that were selected and had its staff trained had fully set up their virtual offices and cabinets. UG and its agent went through requirements elicitation, design, and development, User Acceptance Testing (UAT) before a Go-Live. Throughout these stages, the UG and external consultant have been working collaboratively, however, there are times when the UG or external

consultant has played a leading role. For instance, whilst requirements gathering, testing and the go-live was done on site with the physical involvement of the HEI and the agent, the development was done offshore with no physical involvement of UG.

Analysis of Findings

Figure 2 presents the activity system of the PWE's virtualisation. The upper triangle in Figure 2 represents how the subjects (UG and external consultant) uses tools (internet, Alfresco, Liferay, etc.) to act upon the object (development and implementation of a VWE) to achieve the outcome (a virtual administrative work environment) and represents the technical aspect of the activity system. The lower part in the triangle of Figure 2 represents the social aspects and shows how UG and external consultant (subjects) are governed by rules and social norms to perform tasks. The subjects are also constrained by the division of labour which defines what each actor does. Apart from UG, there are other stakeholders engaged in this activity such as external consultant, the Government of Ghana and China Exim Bank. They constitute the community.
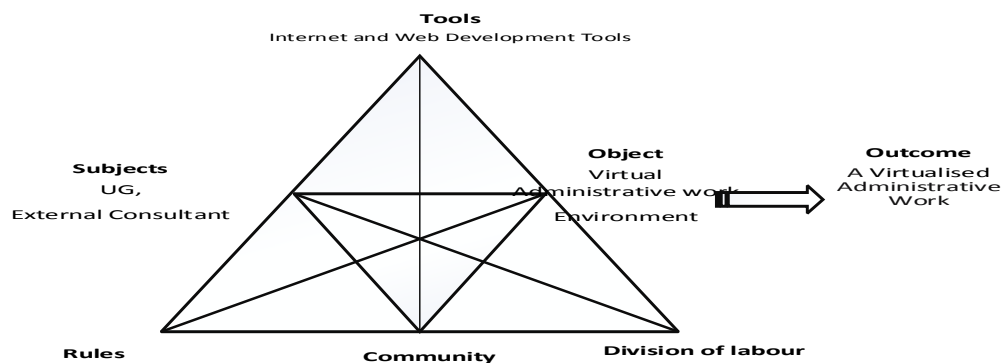

Figure 2: Virtualisation of Work Environment Activity System

UG and external consultant have a shared objective of a virtual administrative work environment, and the shared transformative agency from the UG and external consultant collaboration may lead to the realisation of a shared objective as indicated in Figure 3. Two key relationships are crucial in the virtualisation process. The first is the relationship between UG and external consultant (Subjects) and the objective (Object) of developing and implementing a VWE system. The second is the relationship between UG, external consultant, China EXIM bank and Government of Ghana (GoG) (Community) and the objective (Object). The mediators for these two relationships are; tools, rules and division of labour. In the virtualisation activity, the analysis considered how the tools, rules and division of labour mediated the virtualisation activity in the UG context. Analysis using sub-activities are presented below.

Tool Mediation

There are two relationships from the analysis of this sub-activity system. The first is how the tools were used by both UG and external consultant (Subject) in the development of virtual administrative work environment (Object). For instance, the external consultant Business Analyst (BA) used an interview guide as a tool to gather user stories, UG used the internet and some support staff as tools to send letters to notify various offices to set up meetings to elicit requirements. Alfresco and Liferay (tools) were key technologies that were used for the development by external consultant. The open source nature of Alfresco and Liferay (tools) allowed for input of the UG Project team (Subjects) to be easily factored and captured in the development of the VWE (Object). Though open source, both Alfresco and Liferay were customised to meet the unique requirements of UG as an HEI. In the words of the external consultant Business Analyst, this project is unique because:

"External consultant has been consulting for large organisation for a long time but the UG project was the first of its kind that external consultant was executing in Africa and for an educational institution"

The second was the tools mediating between the community and object. The Liferay, Alfresco and the internet was used by the developers (external consultant as community members) in a customised way to

achieve the object. Similarly, UG is using scanners to scan their archive documents and make it available in the virtual environment.

Rule Mediation

Two relationships emerged here. The first are the rules mediating the subject and the object. The master service agreement (MSA) and the statement of work (SOW) contain the rules mediating between UG and the object of developing a VWE and serves as a guide for both UG and external consultant in the project execution. UG work norms and practices (rules) were also key in shaping how UG responded to the introduction of this new system. In gathering requirements, the SOW helped in eliminating user stories that were out of scope. During design and development, the software requirement specification guided the design and development through an iterative and agile process. The second is the relationship between the community and object mediated by the rules. The project contracts between UG and external consultant also contain rules about the development and implementation of the virtual environment and another contract about how the project is financed. The second is a contract between GoG and the China Exim Bank. All these documents serve as rules that determine the role of all of the community.

Division of Labour

First, the division of labour allowed UG project team to concentrate on using the knowledge and experience of the UG context to direct external consultant in the development of a best-fit VWE. Specifically, the UG project team played a lead role in the planning, requirement elicitation, design and testing. The UG team directly contributed in the design of the theme for the portal, the nature of the landing pages of the portal as well as the virtual offices and the general look of the portal. During testing, the UG team participated in an online and live video demonstration session and provided feedback. The division of labour also mediated between the community and object through the involvement of community members. For instance, the UG team organized local project activities, and the financial arrangement was made by Ministry of Finance of GoG and the China EXIM bank. Coordination of tasks within external consultant was done through the project manager for both the onsite and offshore teams. At external consultant, the project manager had the responsibility of assigning and reassigning team members whilst the UG project manager had a similar responsibility of ensuring onsite stability of the project. This was seen in the way the UG project manager assembled and coordinated the support team to help the onsite team, and establishing liaison between UG and external consultant whilst providing clarity for the offshore developers. The mediation in this sub systems occurred in a shared transformative agency towards achieving the shared objective (See Figure 3).
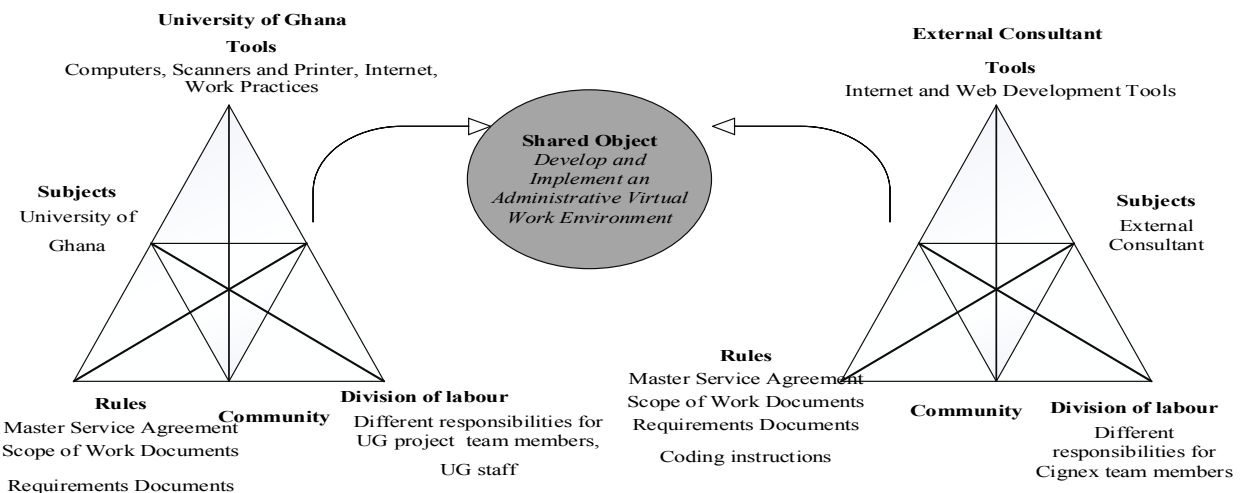

Figure 3:Network of Activity System depicting a shared Objective in transformative agency

Discussion of Findings

The sections discuss how the research question is answered using AT as the theoretical lens

Virtualisation of Work Environment Activity System

The concept of activity system and its sociotechnical nature caters for the static and dynamic aspects of the work environment which is not explained by other theories like PVT. For instance, in the VWE, the virtual office, virtual cabinets, virtual folders and files which were static in the TWE are now tools in the VWE and form part of the technical components of the virtual work IS. The physical workflows however, which were dynamic in the TWE are catered for by the rules and division of labour that is inherent in the virtual work IS and form part of the social. Next are the tensions between and within elements of the activity systems which either constrained or enabled the virtualisation process.

Enablers and Constraints within Elements

The contradictions within the elements of the activity system are denoted by the lightning bolt at each node of the activity system (see figure 4) and these are called primary contradictions.
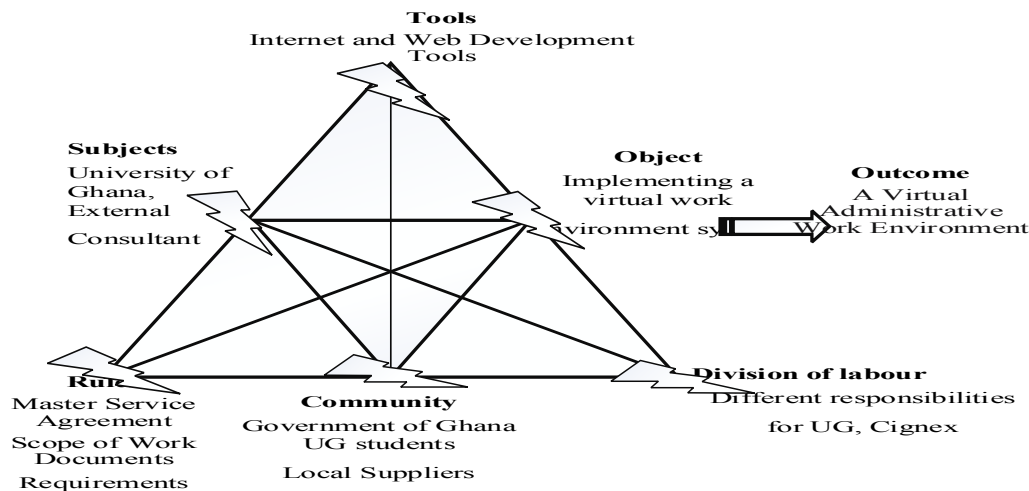

Figure 4:Primary Contradictions in the Virtualisation of Administrative Work Environment Activity System

Tension exists because of the effects that the object (implementing a VWE) will have on the UG community. For instance, if the virtual environment is implemented, staff have to work in a virtual environment and this means learning new tasks. The tension exists because developers are not aware of some interdependencies and work practices that existed in the TWE and how these work practices are eliminated or affected by the virtual environment they are developing. One administrative staff expressed the fear that;

> *"There will be no need for my job because when the processes are streamlined in the virtual environment my duties will be taken up by the system and I may probably be made redundant".*

UG ensured that the external consultant understood the work practices in order for the development in its agile nature to take cognizance of the existing work practices. This ensured that the system being introduced is to complement and not replace staff. This assurance created an enabling atmosphere for the Project team engage staff in open discussions during the requirements gathering stage thereby creating a positive environment for the virtualisation of the TWE.

Reliable internet connection and electricity supply (other tools) hampered training sessions on two occasions and it had to be postponed. For some who had internet connection, they could not log on because their credentials could not be verified against what was in the active directory (AD). These were probably because their credentials were missing in the AD or not properly captured. The AD issues triggered a sense of determination for the UG team to ensure the resolution of similar issues for some staff from 20 offices that were selected for the pilot of the system. The resolution is providing a smooth uptake of the system by these office members at a future date.

Within the UG, there seems not to be the will power to enforce office uptake of the system. This is evidenced in the lack of timelines within UG as to when the system will be used as the official platform for work. Apart from the timelines in the project delivery in collaboration with external consultant, there is

no written and agreed timelines that UG project team must work to ensure that the systems become fully utilised by all offices. The support staff who are assigned to work on the local training of staff do not have any official communication that ties them to the project. As a result, the support staff deal with issues of the project in some intermittent basis in addition to their full time roles and these is affecting delivery at the local level.

Enablers and Constraints between Elements

The contradictions between the elements of the activity system (Engeström 1987) are denoted by the lightning bolt between two node of the activity system (See Figure 5) and these are called secondary contradictions.
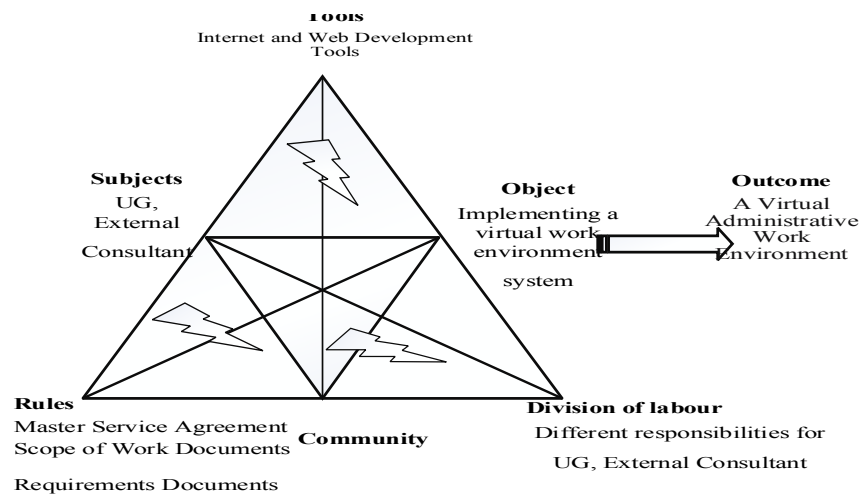

Figure 5: Secondary Contradictions in the Virtualisation of Administrative Work Environment Activity System

Contradictions can occur between the subject and tools when there is a mismatch in either the tools or the subject. For instance, six months after the system went live and the training of 6 offices, only three of the offices (Intern Audit, legal office and the Registrar's office) that were selected and trained had set up their virtual offices and cabinets for full roll out. This stage of the project needs full cooperation of offices to set up and begin to use the system. However, the various offices are not actively participating in the uptake of the system use. Whilst the number of trainers (four trainers) may seem adequate at this stage of the project, the will-power for office staff to follow up and set up their various offices in the system is lacking. Adequate training staff and willingness of office members is critical in the uptake.

Contradictions between the object and community emerged in the software development activity. For example, when the VWE is developed and implemented it will be necessary to also change other artefacts such as office management procedures and manuals. This will change the work practices of the various offices and the entire organisation. If this is not done, there will be inconsistencies because some of the traditional work practices cannot be sustained in the VWE.

Engeström (2009) discusses a kind of transformations through learning that is different from the traditional forms of learning where actors know in advance what is to be learnt. In this new form of learning, actors learn as the process unfolds. This idea of learning is explicated here in the virtualisation of the administrative work environment in a shared transformation agency where an external agency is contracted in a principal-agent relationship to collaborate to develop and implement a VWE. A process of learning by expanding occurred where the UG and its agent went through a process of learning in which they constructed a solution through a process of customising an open source technology through an iterative process in order to meet the complex needs of UG.

Conclusion

This study investigated how an HEI in a SSA can migrate its administrative work environment to a virtual one through a collaborative engagement with its agent to develop an administrative VWE. The authors used the AT as the theoretical framework to make sense of the case. This framework is appropriate as it covers multiple levels and stresses the mediating role of technological tools in human behavior. The use of AT allowed the authors to explain the complex sociotechnical and process changes involved in the migration from physical to virtual work environment. The study contributes to both IS and HEI literature as a first attempt to offer rich insight into the experience of a HEI from a SSA context in work environment virtualisation. This topic is significant for the vast world of developing countries as many are still in the transition from paper to digital work environment. Yet most studies are conducted in more advanced countries. This study fills in the gap of literature by adding more insights from another perspective. It also offers implications for research and practice. For research, the study enjoins IS in HEI and virtualisation research to move beyond examination of migration from traditional learning environment to virtual learning environment to explore the work environment in HEIs through theories such as AT which can be used to explain both sociotechnical and process change. For practice, the findings suggest that tensions between designers and implementers as well within rules, the division of labour and the larger community in which a HEI belong are critical in shaping an HEI migration to a virtual work environment. Although limited by its single case perspective in one developing country, the findings provide insight into how AT through transformative agency can be used to explain an IS development and implementation process in a principal-agent relationship. The findings provide practitioners insights on how to address that relationship among users, designers and implementers. In particular, they suggest the critical success factors in the migration process in terms of social rules, division of labor and communityFuture research can compare the experience of different HEIs as well as from a developed country perspective in order to account for contextual and social idiosyncrasies.

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