A Systems Theory View of Technology Management in a University: A Case from a Developing Nation

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Abstract

When an institution decides to incorporate technology in its operations, it is important to carefully manage this technology so that it is used in a way that helps to achieve intended objectives. Using a systems theory approach, this paper explores how technology is being managed at the University of Botswana. This university is found in a developing country and the intention was to find out how technology was being handled in this context. Data presented in this paper was obtained through document analysis. The paper indicates that generally, the intended objectives for using technology in the institution are being met; however, the main areas of concern are inadequate provision of resources and under-utilization of the available ones. The paper reveals people are not eager to innovate further and explore full capabilities of the technology. Issues such as lack of motivation, training and inappropriate technology were identified as some of the reasons for limited technology use. The paper recommends that the university put in place structures that would facilitate efficient use of technology and empower users with evolution capacities to expand their technology use. This paper brings to light some of the problems that developing countries face as they try to embrace technology which is often imported.

Keywords: technology management, systems theory, developing countries, resources, technology use, WebCT

INTRODUCTION

For universities to truly leverage technology there is need to have a sound management system that guides the ways in which the institutions should approach the use of technology. Technology has become an essential part in the development of universities and as Mingle (2002), points out, in today's world, an institution cannot reach its educational goals without utilizing technology. Worldwide, the 1980s saw dramatic growth in the incorporation of technology in the operations of universities and colleges. The benefits of technology have been recognized by institutions of higher learning as they strive to improve their day to day work with the goal of making their service delivery more efficient. Today, the use of technology can be seen everywhere even in the administration of universities (Jick & Peiperl, 2003). However, the use of technology needs to be systematically planned and well aligned

with the institutions' goals and vision. According to (Del Guidice, et al. 2010), technology management refers to the policies and practices that guide the use of technologies so as to optimize the tools in enhancing the capacity of a particular entity. In developing countries, one of the main challenges in using technology is how to manage it in such a way that it helps to meet the specific needs of a particular area. As UNIDO (2002) says that the industrialized world develops almost all the technology and developing countries as receivers need to adopt and adapt this technology to fit their contexts. However, many a times these countries fail to optimize technology due to inefficient management systems. Ramanathan (nd), says the process of international technology transfer is sometimes unsuccesful because in most cases the receivers do not have the skills to manage the technology effectively. Management techniques should be one of the major components of technology transfer because as the National Research Council (1987) says, technology management ensures that technological capabilities are used to mould and attain operational objectives of an organization. Research has shown that for institutions to excell in utilizing technology, they need to have a management structure that is committed to provision of resources, high quality training and guidelines, research and innovation which are relevant to needs of all stakeholders (Pirani, 2004; Vovides, et al. 2007). This paper explores how the University of Botswana (UB) which is situated in a developing country manages the use of technology in its operations. Systems theory was used as an analytic framework to establish how the university handles different aspects of technology ranging from provision of resources to the ultimate outcome of technology use. The word technology as used in this paper mainly refers to computers and computer applications.

UB is the only national university in the country with a total enrollment of about 15 000 students and is fully funded by the government. The university aspires to become a technology driven institution in its endeavour to achieve its vision of being a leading academic centre of excellence in Africa and the world (University of Botswana website). In 2001, UB formally implemented the use of technology in learning (Giannini-Gachago and Molelu, 2005). However, even before then, there were sporadic efforts by a few lecturers who used technology in their classes. But in 2001, resources were put in place and technology use formally launched in the institution. The main goals for technology implementation at the university as outlined by Thapisa (2006) were:

- To make technology part of the teaching and learning processes so as to enhance learning and equip learners with skills needed in today's world of work.
- To improve efficiency in the university operations and service delivery.
- To align the university to the national aspirations of the country which envision that "by the year 2016, the people of Botswana will be able to use and apply the potential of computer equipment in many aspects of everyday life" (Long term vision for Botswana, 1997, p.6).

This paper contends that it is important to understand how the university manages this technology so as to be able to establish whether the intended goals for using technology are being achieved.

SYSTEMS THEORY

According to Heylighen and Joslyn, (1992), systems theory is a "transdisciplinary study of the abstract organization of phenomena, independent of their substance, type, or spatial or temporal scale of existence" (np). The theory was originally proposed by biologist Ludwig

von Bertalanffy in 1928 and has been adapted in various systems or organizations. This theory views an organization as a system and this system need to have goals that it is intending to achieve. The system is made up of four main elements, which are: inputs, transformation processes, outputs, and feedback and all of the four elements share feedback among themselves, see Figure 1 below. The inputs are the resources; both capital and human needed to run an organization. These resources need to be carefully planned, organized, motivated and controlled to meet the intended goals. Processes refer to the different rules and guidelines regarding the use of the resources. Processes provide a clear guideline and expectations of how various activities need to be carried out, it provides structure to an organization. Without this structure there will be chaos, abuse of resources and subsequently failure of the organization to achieve its intended objectives. Outputs refer to the products and services offered by the organization. The outputs of the system provide justification for the worthiness of the resources put in the system. When looking at the outputs, the overall objectives of the system needs to be revisited to find out whether they are being achieved. Feedback comes from the human resources carrying out the processes (employees) and many other areas affected by the organization. This is mainly done through research which measure improvements in different aspects of the system. Schoech (2004), says it is very important for a system to have a control mechanism that ensures that information from the system output is evaluated against the stipulated goals of the system and provide feedback on this evaluation so as to further inform the inputs. The systems theory provides a new way of viewing management because it provokes managers to look at their institutions from a broader perspective. According to this theory, it is important to pay close attention to the interrelations of different components of their organizations and not look at one thing at a time but as part of a whole.
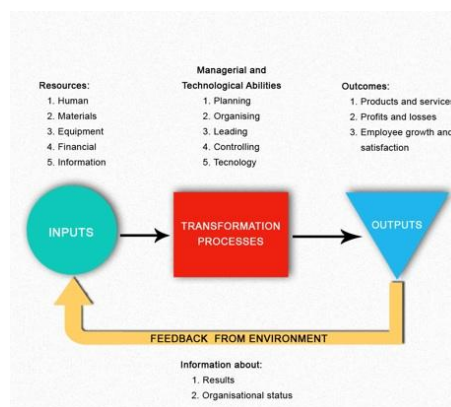

Fig. 1: A System View of Organization
Source: http://www.marks4english.staffs.com/Site_2/Systems_theory_files/System%20theory.jpg

METHODOLOGY

In this paper, the elements of the systems theory were outlined then used as a guideline to establish how UB handles the different aspects of technology. The data used in this process was collected through a review of available documentation on technology implementation at UB, this included policies, guidelines, reports and research studies conducted on the use of technology at the institution.

ELEMENTS OF THE SYSTEMS THEORY AND TECHNOLOGY MANAGEMENT AT UB

Inputs

In order to enable efficient use of resources in an institution, it is important for management at the foremost to have a vision and mission statement that articulates its plans and commitment to the use of technology in the institution and what is expected from the technology. This needs to be integrated into the wider organization mission. It is only then that it will be possible to identify and align the inputs for the organization. UB's vision is to be 'a leading academic center of excellence in Africa and the world' and its mission is to "advance the intellectual and human resource capacity of the nation and international community" (UB vision and mission, UB website). The university believes that technology has a crucial role to play in realizing these dreams. In outlining those elements that would assist to fulfil this vision and mission, technology is identified as one of them. The technological inputs that have been put in place to carry out technology related activities at UB are:

Technology infrastructure

Generally developing countries have scarce resources; therefore, it is important to invest in them wisely. The decision to invest in technology infrastructure at UB, had to be weighed against other pressing needs in the university and the country at large. However, the university is committed to providing state of the art infrastructure to its clients (UB IT Policy, 2003). According to the Digital Scholarship Report (2008), most of the computers on campus, are deployed at departmental levels and computer laboratories are owned by individual academic departments. Currently, there are 3300 computers connected to the UB network and 1700 of these are being used by students while 1600 are used by staff. The total enrolment of UB is around 15000 which therefore mean the ratio of student to computers is about 1:8. Students have limited access to computers and Internet based applications.

In addition to the above infrastructure UB has a Wide Area Network (WAN); Wi-Fi network accessible within campus; Blackboard and Moodle Learning Management Systems (LMSs) for hosting online courses; and Integrated Tertiary Software (ITS) systems for management of students and staff records. These are good initiatives; unfortunately at UB these systems and other equally important software applications are not integrated. For example, the ITS system and Blackboard LMS which both have huge amount of processing capabilities are working completely independent of each other. Lecturers using Blackboard cannot access class lists while in Blackboard and upload them to their courses. They have to go through a daunting process of download them first from ITS and sending them as Excel documents to the LMS administrator. According to Bakar (2003), in order for an institution to meet the challenges presented by today's competitive environment it has to find a way of linking together different computing systems and software applications physically or functionally because businesses nowadays need a global, an open and distributed computational capability the demand is for a large scale, complex and integrated systems. Upgrading and replacing of personal computers at UB is still a problem. The IT department has aimed that on average computers will be replaced every five years (UB IT Policy, 2003), but currently there are computers that have not been replaces since they were first installed about ten years ago.

Finance

It is an open secret that technology does not come cheap, and for developing nations this has far reaching implications which can impact them negatively with respect to the design and the cost of the physical infrastructure and other related costs. EDUCAUSE (2003), points out that in general technology costs are increasing at a rate that exceeds universities' ability to

pay, therefore, university management must be committed enough to be willing to fund technology related needs in the institution both in terms of human and physical resources. At UB, putting in place technology infrastructure required huge investments in equipment and in cable or wireless networks, followed by high costs for infrastructure maintenance, training, and technical support (UB IT Policy, 2003). Conversely, such essential innovations have resulted in major financial challenges for the university. Every year the budget for capital equipment and maintenance submitted to Finance Unit are so large that it quickly drains the university coffers. Sustainability of technology funding at the university remains uncertain. Currently at UB, the acquisition, maintenance and replacement of ICT infrastructure is funded through the university central budget (UB IT Policy, 2003). The vote is controlled by IT department because it has been given the mandate to provide, manage and maintain the ICT resources for the university. However, departmental services such as specialized laboratories are funded through departmental or faculty budgets. There are those departments such as Centre of Academic Development which charge nominal fees for non-university organizations that want to use their facilities. The money accrued is placed in a separate vote and is used for other things at the director's discretion and not necessarily to further develop and maintain the facilities. This tends to put a strain on votes billed for ICT infrastructural developments.

Human resource
Lack of technology skills and knowledge is often regarded as one of the major hindrances in fully harnessing the potential of technology in developing regions. At UB, before the university could launch technology use, it had to make sure that there is the necessary human capacity that would drive this innovation. The Information Technology (IT) department was established with trained personell who would be responsible for providing, managing and maintaining the ICT resources for the university. The department also provides technical support to all members of the university community. IT staff members are assigned to specific faculties and units so that they specifically deal with issues relating to that particular section. However, it is clear that this department still have a lot of shortcomings in their technical capabilities. For example, as mentioned before, the department is still strugling to bring together major systems in the university so that they can communicate and improve working procedures. In terms of technology implementation, the university appointed the Educational Technology Unit (EduTech) which is responsible for spearheading integration of technology in teaching and learning (Giannini-Gachago, 2006). The key performance ares of the Unit are:

- Research, develop and test educational technology applications and framework for developing environments.
- Develop appropriate procedures, policies and support structurers for educational technology acquisition and use.
- Consult in educational technology acquisition and use.
- Promote and provide leadership in the appropriate and innovative uses of educational technology.
- Create a learning community of competent users of educational technology (Thapisa, 2006, p.74-75)

On the users end, there are staff members and students. The buy-in of academic staff members is very crucial as they are the ones responsible for the day to day use of technology, especially in the learning and teaching processes. Articlesbase (2009), states that engaging academics to appreciate technology is an important management issue in

institutions of higher learning and such a reform must engage them in actual learning of how to use the new technologies and coming up with ways of further promoting technology utilization in learning and teaching and creating self-initiative so as to build self-confidence and positive attitudes towards technology. When UB formally implemented the use of technology in learning in 2001, from the onset, the institution adopted the "Leadership, Academic and Student Ownership and Readiness (LASO) Model developed by Dr Phillip Uys in 2001 in undertaking this transformation, see Figure 2 below. This model advocates for integrated top-down and bottom-up approaches in integrating technology (Uys, 2001). It assumes that it is important for academic staff and students to be engaged in the decision making process of technology so that they have ownership of the process. It also emphasizes that the top management has to provide leadership and financial support for technology transformation to be realized.
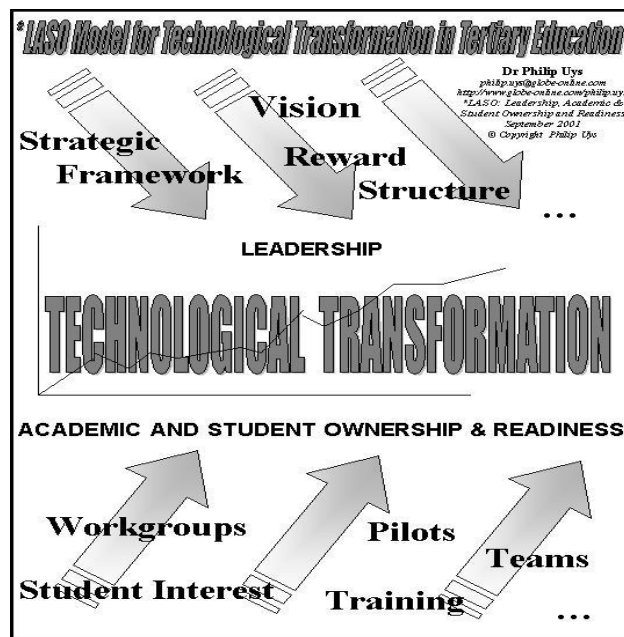

Fig.2: Leadership, Academic and Student Ownership and Readiness (LASO) Model

Processes

For technology to be used in a meaningful manner there has to be processes in place that regulates and guides its use to ensure that it is geared towards achieving the intended objectives. Resources need to be well organized and regulated to ensure equitable access and optimum utilization in carrying out responsibilities of an organization. It is important for organizations to provide a clear outline of how the activities will be carried out, including setting of guidelines that will regulate the operations. At the foremost, UB has an IT policy that guides the use of technology resources by both students and staff. This policy outlines how the resources should be accessed, used and managed to ensure optimum utilization and accountability. Two of the important elements contained in this policy are:

The appropriate use of resources. This stipulates acceptable and unacceptable ways of using technology by members of the university community, especially the use of the Internet. This element is very important to ensure that technology is used effectively, safely and ethically by all those concerned. (Dill & Anderson, 2003), say that institutional policies clearly outlining the parameters of acceptable technology use can assist all stakeholders to appropriately deal with issues that affect technology.

The second key element is training. The use of technology in education is relatively new in developing regions such as Botswana. Most staff members, academic and non-academic did not receive technology training during their studies, nor when they first started to work. Therefore it is important for institutions to put in place training programs that would equip these people with the skills they need to effectively integrate technology in their respective jobs. The IT policy clearly stipulates the training services that are available for both staff and students. This is crucial because studies often report lack of training as one of the major hindering factor in the use of technology by people (Mumtaz, 2000; Ahadiat, 2005). Technology training is also essential for influencing the culture of the university which is predominated by traditional teaching practices. The IT policy also states how users will be continually supported in their use of technology so that they know what kind of assistance is available for them and where. UB has adopted a comprehensive approach on technology training for both students and staff. Training for academic staff is provided in two main ways. First, the university offers monthly eLearning training workshops which are meant to equip staff with technology skills they need to carry out various activities in their teaching. Second, staff members can consult with Instructional Designers to assist with the design, development and delivery of their technology-based courses. For students, training services are done through orientation workshops and continuous support throughout the academic year.

In terms of technology implementation, when the university adopted the use of WebCT to carry out online learning, a blended eLearning approach was adopted whereby lecturers had to mix face to face sessions with online learning. The distribution of what percentage had to be face to face and what needed to be online was left to the individual lecturer's discretion. The university has since also embraced open source is using Moodle alongside Blackboard. Concerning the use of other technology resources, the university has no policy that stipulates how these should be used in teaching and learning, individual lecturers consult with Instructional Designers to come up with ways to infuse technology in their various courses. There is also no policy that binds lecturers to use technology, people do that on voluntary basis.

UB is just beginning to put in place some incentives that would encourage lecturers to use technology in the delivery of their courses. This is being done through the Performance Mangement System (PMS) which is a contract that staff members sign at the beginning of the year stating the tasks that they would be performing throughout the year. In these contracts, lecturers are rewarded for using technology in their courses. There are efforts to integrate technology into departmental strategic plans to enable staff to develop interest.

Outputs
As mentioned earlier in this paper, the goals that UB intends to achieve by using technology are to enhance the teaching and learning processes and improve efficiency in the services offered by the university. The intention was to encourage lecturers to make technology part of their teaching repetoire to assist produce graduates who are equipped with needed skills in today's world of work, such as application, analytical and critical thinking skills. Studies and reports on technology use at the university indicate that technology is being used in the teaching and learnig processes at UB, but not at the rate at which it was anticipated. Data obtained from the Educational Technology Unit annual reports on usage of Blackboard indicates that there is a steady annual increase in the number of online courses. For instance, in 2002 there were only seven online courses and the numbers increased as shown in Figure 1 below such and currently there are 466 active online courses.
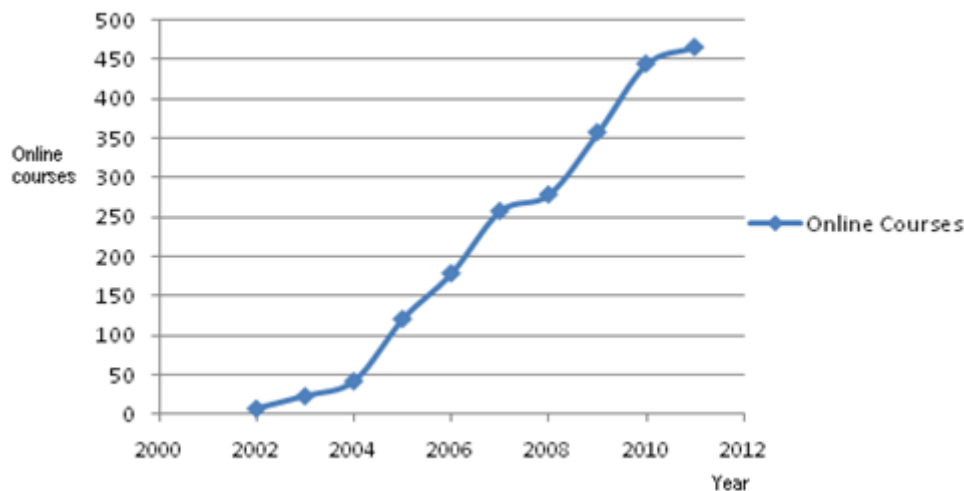
Fig. 3: Number of online courses per year.

Concerning the use of other technologies which are not necessarily online (such as power point, video conferencing and document cameras), the Educational Technology Report (2010) indicates that very few lecturers use any of these in their course delivery. As mentioned before, part of the reason why the university decided to introduce technology was to help meet national objectives of equipping citizens with technological skills that they can apply to different aspects of their lives. It is clear that some lectures do not use technology at all in their courses, which means there are students who are missing out on these skills.

In terms of service provision, the university through the IT department provides a number of technological services to both students and staff. There is the Helpdesk where people report IT related problems, secure and easily accessible e-mail services to both learners and staff, state of the art computer lab facilities, ITS Student iEnabler System that enables learners to access institutional, programme/qualification and personal information using a web browser, ITS Lecturer iEnabler System that allows academic staff to view class timetables and class groups assigned to them and Blackboard Learning Management System that hosts online courses. Many other administrative services at the university have been computerized, these includes application of leave services, PMS, students' assessment of lecturers and many others. Service offered to the public is also been improved through the university website by making it more user friendly and interactive.

Feedback
There are various studies that have been conducted on the use of technology at UB and several of these studies have indicated that insufficient resource is still a problem at the university. For example, in a study conducted by Batane and Mafote in 2007 to investigate students' perspectives on the impact of WebCT on their learning, students reported lack of computer access as a major obstacle preventing them from benefiting from WebCT. Other studies have also raised a similar concern (Ikpe, 2011; Gachago, et.al. 2007). In terms of human resource, the biggest problem facing technology use at UB is the limited number of staff in the IT department which is responsible for provision, maintance and technical support to the entire university. This is a small department that is expected to serve the entire

university population. This problem was also highlighted in 2010, when a newly established Digital Scholarship implementation committee approached the IT department with several recommendations that IT needed to undertake so as to kick-start digital scholarship in the university. The IT department flatly refused to carry out these activities because they were already over-stretched and did not have enough human capacity to do so (Digital Scholarship report, 2008).

It has already been indicated that one of the main reasons for adopting the use of technology in the academia was to improve the quality of learning in the institution and in turn produce high quality graduates. Studies that have been done indicate that use of technology for learning and teaching have a positive impact at UB (Batane and Mafote, 2007; Mutula, et al. 2006; Oladiran and Uziak, 2009). In a study conducted by Ikpe (2011), to evaluate efficacy of eLearning an instructional and assessment tool in humanities education, he argued that, despite the many difficulties encountered in trying intersect eLearning in humanities education, it is still a viable tool in the teaching and assessment process in this discipline. According to Batane and Mafote (2007), students reported that using technology in learning, particularly WebCT, greatly improved their learning in that it made available course material that they would otherwise struggle to get through searching the library or difficulty writing extensive notes in class. It also enabled them to participate in online discussions that greatly contributed to their course understanding. Furthermore, learners indicated that technology generated interest in the course, enhanced learning and understanding of course material, provided useful feedback on assignments and improved interaction between learners and the lecturer (Oladiran and Uziak, 2009). In their study Oladiran and Uziak found out that majority learners indicated that Blackboard enhanced their IT skills, enabled them work effectively either individually or in groups, helped meet deadline and assisted in keeping track of marks obtained in the course. The students attributed these positive outcomes to the use of some tools in WebCT which enabled learners to communicate more than traditional face-to-face approaches. However, despite these reported positives, there are still concerns that most online courses do not optimize the services offered by the Learning Management System. Most online courses basically use the LMS as a repository for course material and rarely engage the use of other services in the platform. (Educational Technology Annual report, 2010; Batane & Mafote, 2007). This indicates that there is still a big gap between the real ways in which technology is being used and the ideal way which fully explores all its capabilities. Users have also not demonstrated any ability to innovate further in their technology use. There are no inititives on campus demonstrating people experimenting with innovative ideas of using technology to facilitate learning. Most instructors take what they have been taught at one-stint training workshops and use it over and over without improving on it. The country is also rich in indegenous knowledge which could be transformed through technology and applied in the teaching and learning processes and none of this is currently being explored.

Also, even though there is a steady increase in the number of WebCT courses, when judged against the total number of courses offered at the university, this number still falls short of expectations. Currently, there are approximately 1554 courses offered at UB, and only 446 of these are online, which means about 30% are online. This is not value for money considering the expenses the university incurs on WebCT licensing annually. Some of the reasons advanced by lecturers in various studies for their lack of participation in online learning are: lack of incentive for those engaged in eLearning; increased administrative duties to the

disadvantage of core academic activities; inadequate access to ICT in general for students and lack of appropriate technology to use for their specific courses.

It has been reported that the university provides staff training on technology through eLearning workshops and instructional design support. According to Gachago, et al. (2007), lecturers find these workshops rewarding since they are now able to integrate some technology to enhance their teaching and their students' learning experience. According to the Task Group on UB and Digital Scholarship (2008), there is still much that needs to be done to motivate staff to develop the habit of using technology in order for technological transformation to take effect in UB. For instance, the task group recommended that a credible reward system be introduced for innovative teaching with technology. However, this should assume a multi-faceted approach. Rewards may include awards and rewards for excellence and innovation in teaching; promotion opportunities based on teaching achievements; and an environment in which the risks associated with trying new teaching approaches are supported and rewarded rather than ignored or punished. Ramsden et al. (1995) accentuated that the responsibility of quality of teaching where technology is utilized should be shared between lecturers and the university. Equally important, a strong leadership and management is essential in that incentive, reward and support structures need to be adjusted to new realities and a well coordinated workflow needs to be designed.

Anectodal evidence suggests that the university does not optimize the available technology in the services it offers to its customers. One such situation is the student registration process. The university still uses the traditional system where students manually register for courses. This results in very long lines that students have to sit in throughout the registration process. In fact, student often refer to the registration process as their worst experience whenever they are surveyed about their university experience. The university needs to fully explore the capabilities of the various software they have so as to improve efficiency in its operations.

The university produces graduates who in turn join the workforce in the country. Therefore, feedback from the world of work on the quality of graduates they receive from the university is very crucial. The university and the school in general in Botswana have often been criticized for producing graduates who are not well prepared to participate effectively in the world of work. The graduates have been mostly criticized for only possessing intellectual knowledge (predominantly abstract ideas) with very little application, analytical and critical thinking skills (Tabulawa, 2009). This has often resulted in graduates needing re-training in the work place. Since the formal introduction of technology use at the university, there has not been any study that obtained feedback from the industry to find out what they think about the university graduates and whether they see any improvement in the quality of the new employees they get from the institution. This feedback is very crucial to assist the university evaluate whether the use of technology has any impact both in the institution and in the environment in which it is operating.

CONCLUSIONS AND RECOMMENDATIONS

This paper outlined how technology is managed at UB. The systems theory approach was used to describe how different aspects of technology such as resources, policies are being handled. The paper reveals that in general, the university is committed to providing resources (inputs) needed for technology implementation, however, these resources are not yet sufficient, specifically computers and IT personnel. The paper reveals that even though there is a steady increase in the number of people adopting technology use, in their teaching, this

number is still a far cry from reasonable expectation when considering the amount of money the university is spending in providing technology resources. More needs to be done to motivate staff to use technology effectively. The outputs and feedback outlined in this paper indicate that the intended objectives for using technology in the institution are being met; however, there are certain areas where the university is still lacking behind such as underutilization of resources and lack of innovativeness in using technology. This paper recommends that the university develop an eLearning policy that makes it compulsory for every lecturer to use of technology their teaching so that all students can benefit from this innovation. Lecturers also need to be trained further so that they can develop their technology use and be innovative. The university needs to carry out tracer studies to find out what employers think about the quality of graduates they receive from the university. This would help establish whether the university is achieving its intended goal of producing graduates who are well skilled for the world of work. The issue of appropriate technology is a crucial one as it raises questions as to whether people do indeed find the technology identified for them to use suitable for their needs and this has implications on their usage level. Therefore the paper also recommends that the university take a step back and explore the social context of the university so as to identify the best technology that can help advance the vision of the university.

REFERENCES

Ahadiat, N. (2005) Factors that may influence or hinder use of instructional technology among accounting faculty. Campus-wide Information Systems. 22(4).

Articlesbase, (2009). Managing ICT transformation in University Education in Uganda: Justification, Problem and Way forward. [WWW document] http://www.articlesbase.com/education-articles/managing-ict-transformation-in-university-education-in-uganda-justificationproblem-and-way-forward-885324.html#ixzz0oMIpRPX4 (accessed 11th August, 2011).

Batane T. and Mafote S. (2007 The impact of WebCT on learning: a students' perspective, in IASTED International Conference on Computers and Advanced Technology in Education (Beigin, China, 2007); ACTA Press. 248-252.

Bakar, Z.A. (2003) Benefits of systems integration: Qualitative or quantitative? Malaysian Journal of Computer Science 16(2): 38-46.

Del Guidice, M., Della Peruta, M.R, Carayannis, EG. (2010) Knowledge and the family business: The governance and management of family firms in the new knowledge economy, London: Springer.

Digital scholarship report, (2008). University of Botswana, Gaborone

Dill, B.J., & Anderson, R.E. (2003) Ethics-related technology policies in schools. Social Science Computer Review 21(3): 326-339.

Educational Technology annual report, (2010). University of Botswana, Gaborone

EDUCAUSE, (2003) Funding Information Technology: An EDUCAUSE Executive Briefing.\ [WWW document] http://net.educause.edu/ir/library/pdf/PUB4002.pdf (accessed 28th June, 2011).

Gachago, D., Mafote S., Munene-Kabanya, A. and Lee, M. (2007) Assessment of the effectiveness of the CAD eLearning Certificate at the University of Botswana; International Journal of Education and Development using Information and Communication Technology, 3(4): 71-88.

Giannini-Gachago, D. & Molelu, G.B, (2005) Facts, figures and experiences with the introduction of eLearning in a higher education institution in developing environments: The case of the University of Botswana.LONAKA. p30-35.

Giannini-Gachago, D. (2006) Services of the educational technology unit. LONAK. P40-46.

Heylighen, F. & Joslyn, C. (1992). What are cybernetics and systems science. [WWW document] http://www.isss.org/primer/002whats.htm (accessed 3rd September, 2011).

Ikpe, I.B. (2011) eLearning platforms and humanities education: An African case study. International Journal of Humanities and Arts Computing, 5(1): 83–101.

Jick, T. D. and Peiperl, M.A. (2003) Managing change: Cases and concepts. Boston: Irwin/McGraw-Hill.

Long term vision for Botswana, (1997) Botswana: Government Press.

Mingle J. (2002) Technology can extend access to postsecondary education: An action agenda for the South. Electronic Campus.

Mumtaz, S. (2000) Factors affecting teachers' use of information and communications technology: A review of the literature, Journal of Information Technology for Teacher Education. 9(3).

Mutula, S., Kalusopa T., Moahi K. and Wamukoya J. (2006) Design and implementation of an online information literacy module: Experience of the Department of Library and Information Studies, University of Botswana; Online Information Review. 30(2).

Oladiran, T. & Uziak, J. (2009) Assessment of e-learning course delivery for mechanical engineering students', Journal of Baltic Science Education, 8(1): 44–53.

Pirani, J. A. (2004) Supporting e-Learning in higher education. [WWW document] http://net.educause.edu/ir/library/pdf/ERS0303/ecm0303.pdf (accessed23th March, 2011).

Ramanathan, K. (nd) An Overview of Technology Transfer and Technology Transfer Models. [WWW document] http://www.business asia.net/Pdf_Pages/Guidebook%20on%20Technology%20Transfer%20Mechanisms/ An%20overview% 0of%20TT%20and%20TT%20Models.pdf (accessed 17th July, 2011).

Ramsden, P., Margetson, D., Martin, E. and Clark, S. (1995) Recognising and Rewarding Good Teaching in Australian Higher Education: Canberra, Committee for the Advancement of University Teaching.

Schoech, S. (2004). Concept paper: systems theory. [WWW document] http://wweb.uta.edu/faculty/schoech/cussn/courses/5306/coursepack/theory_systems.pdf (accessed August 11th, 2011).

Sharif, N. (1993) Technology Management Indicators for Developing Countries. Thailand Development Research Institute Quarterly Review. 8(2): 17-24.

Tabulawa, R. (2009) Education reform in Botswana: reflections on policy contradictions and paradoxes. Comparative Education. 45(1): 87-107.

Thapisa, A.P.N. (2006) Functions and mandate of the centre for academic development. LONAKA. P. 70-76

UNIDO (2002) Developing countries and technology cooperation. an industrial capacity-building perspective [WWW document] http://www.wbcsd.org/web/publications/technology-cooperation.pdf (accessed 17th July, 2011).

University of Botswana website. [WWW document]: http// www.ub.bw

University of Botswana, IT policy (2003) [WWW document] http://tirisano/Shared%20Documents/Management%20Documents/IT_Policy.pdf (accessed 24th July, 2011).

Uys, P.M. LASO (Leadership, Academic & Student Ownership and Readiness) model for technological transformation in tertiary education. [WWW document] http//www. Globe online.com/philip.Uys/LASOmodel.htm (accessed 24th July, 2011).

Vovides, Y., Sanchez-Alonso, S., Mitropoulou, V. and Nickman, G. (2007). The use of e-learning course management systems to support learning strategies and to improve self-regulated learning. *Educational Research Review*. 2(1), 64-74.