THE CREATION OF A VIRTUAL CAMPUS IN HIGHER EDUCATION: TWO CASE STUDIES

Karen Lazenby

Department of Telematic Education, University of Pretoria, South Africa.
email: klazenby@postino.up.ac.za
http://www.up.ac.za

ABSTRACT

Global trends in higher education point to significant changes taking place. The gradual shift is caused by numerous factors such as rapidly improving technology, an increase in population numbers and socio-economic factors. The Internet has brought global information dissemination to the doorstep, introducing the concept of distributed learning and free access to knowledge. This, combined with the fact that large industries and businesses are starting to provide their own accredited electronic training courses, poses a major threat to higher education institutions. In order to remain competitive and to find innovative ways of providing quality education without building brick and mortar, many higher education institutions are establishing virtual learning environments and virtual campuses (Rossman, 1993). This paper explores the creation of a virtual campus at two higher education institutions in South Africa, namely at Technikon SA and the University of Pretoria. The different processes followed at the respective institutions are compared from a theoretical technology innovation perspective. As a traditionally distance education institution with 85 000 students, Technikon SA was geared for the transition to incorporate a virtual campus, whereas the University of Pretoria possesses a physical and administrative infrastructure which is foreign to that required of a virtual campus. Various strategies exist in technology innovation (Tidd et al. 1997) that can be usefully applied to the implementation of a virtual campus. Including incremental, radical and rational strategies, their appropriateness needs to be weighed against the culture, infrastructure and vision of the particular institution. Subsequently, the strategies followed at the respective institutions are different and the reasons for this are highlighted.

KEY WORDS

Virtual campus, higher education, technology innovation.

1. INTRODUCTION

Inherent in technology is change, a concept signifying danger and growth – and possibly even total transformation of an institution. Essentially, transformation produces something that bears no resemblance to that which existed before the transformation took place. Some theorists postulate that the innovative kinds of teaching and learning empowered by emerging technologies, such as the WWW, virtual reality and media, could transform education into a paradigm of distributed learning (Dede, 1997).

Subsequently, the challenge posed to educational institutions is to manage technology in such a way that their strategic goals are achieved. Technology and technology applications should be relevant to particular learning and institutional needs as well as being compatible with existing technology systems within the institution. A strong case is made for the competitive advantage provided by innovative technology. Innovation within this context means change in

the products and processes of higher education institutions, because the ramifications of not embarking on technological innovation, such as the establishment of a virtual campus are profound. It is predicted that by the year 2000 the convergence of text, video, audio, animation and graphics, including telephone and television, will produce the world's largest industry (South Africa, 1996:16). This knowledge revolution threatens higher learning institutions' advantage in knowledge creation and dissemination (Ives & Jarvenpaa, 1996:33).

If one looks at what a virtual campus constitutes, it could be described simply as an electronic platform which provides existing institutional services, as well as additional products enabled through particular technology attributes. It has also been defined as "an institution, or a set of institutions, engaged in a delivery of degree granting programs in higher education, using technology and methodology outside a traditional classroom" (Lippincott & West, 1997:5). Due to the length limitation of this paper only a brief overview of the global shift in higher education is given and technology innovation strategies are discussed shortly. Similarly the case studies on Technikon SA and the University of Pretoria highlight the main processes of the innovation strategies.

2. GLOBAL SHIFT IN HIGHER EDUCATION

Harnessing the emerging electronic infrastructure will require that higher education institutions make radical changes. Implementing a radical change, in turn, requires a shared vision of the future of education. A vision of a future scenario can provide a basis for the discourse and begin to reveal institutional obstacles. Higher education globally is shifting towards an open, flexible model to adapt to social and economic changes. A flexible learning system entails progressively encompassing the entire higher education sector with a diversity of programme mixes, a range of distance and face-to-face delivery mechanisms and support systems, using appropriate, cost-effective combinations of technologies.

Such a shift is more in keeping with the way people learn – by facilitating interactivity, active engagement and inquiry – rather than passive reception. But educational institutions will have to guard their role as accreditation bodies, since commerce and industry are increasingly encroaching on this area by offering accredited courses electronically. Business, more than government, is instituting the changes in education that are required for the emerging knowledge-based economy. The reason is provided by Cairncross, who states that "the Internet has become the most powerful driver for innovation that the world has ever seen" (1997:118). Especially public providers of education are lagging behind the transformation in learning that is evolving outside them. Banking environments internationally are revolutionising their training environment through collaborative technologies such as *Lotus Notes*, which eliminates formalised training programmes. Materials are on-line in the form of self-serve offerings and just-in-time education from office desktops. Motorola University uses personal, computer-based virtual reality technology to teach employees to run assembly lines (Ives & Jarvenpaa, 1996:33).

Technology-based education can bring about improved access to and improved quality of course offerings, competitive advantage and increased market share while meeting legitimate public and institutional concerns about cost. Some of the principles which have emerged from the new education and training system in South Africa are as follows (South Africa, 1996:9):

- Redressing imbalances of the past through the implementation of new teaching and learning strategies for the effective and flexible delivery of services within various learning contexts and through the equitable distribution of technological and other resources.
- Enabling all people to value, have access to and succeed in lifelong education and training.
- Developing a problem-solving and creative environment in which new technologies are harnessed to produce knowledge, products and services.
- Integrating technology into strategies intended to reach these goals so as to advance South Africa's ability to harness new technologies in its growth and development.

3. TECHNOLOGY INNOVATION

It is clear that higher education institutions should align their strategies to incorporate virtual learning infrastructures. Danger within the context of establishing virtual campuses is epitomised by a lack of vision, leadership and sound management of the numerous variables that form a part of change within this context. Green (1996) reports that less than half (43.4%) of American colleges and universities have a strategic plan "identifying institutional goals, objectives, or implementation priorities for the role of information technology in instruction and scholarship", which could prove fatal to future success of educational institutions.

Maddox, Anthony and Wheatly (1987, cited in Porter *et al*., 1991:40), provide the following framework for technology innovation:

- Forecast the technology.
- Analyse and forecast the environment.
- Analyse and forecast the market/user.
- Analyse the organisation.
- Develop the mission.
- Design organisational actions.
- Put the plan into action.

A contentious issue regarding the innovation process is whether it should be linear or iterative. Tidd *et al*. (1997:58-63) mention the long-standing debate between 'rationalist' and 'incrementalist' strategies for innovation. A rationalist strategy entails the following linear steps:

- Describe, understand and analyse the environment.
- Determine a course of action in the light of the analysis.
- Carry out the decided course of action.

An incrementalist strategy entails the following iterative steps:

- Make deliberate steps (or changes) towards the stated objective.
- Measure and evaluate the effects of the steps (changes).
- Adjust (if necessary) the objective and decide on the next step (change).

The authors contend that real-life management is too complex to be prescriptive about using certain strategies and that managers often shift between both strategies, depending on the particular environment at the time.

A third strategy is radical innovation that is often marked by periods of discontinuity when major product or process changes occur. Utterback points out that "radical changes create new businesses and transform or destroy existing ones" (1994:158). Established institutions such as universities are risk averse and find radical innovation difficult and "ground breaking changes are seen as disruptive and even threatening, whilst incremental innovations are seen as reliably producing more predictable results more quickly" (Utterback, 1994:224).

4. TECHNIKON SA: A CASE STUDY

Technikon SA, a distance education institution with approximately 85 000 learners, envisions becoming a world class flexible learning higher education institution responsive to human development needs in Southern Africa. Critical issues that form part of the environment and market include equity, access, redress, quality, effectiveness and efficiency. Due to the fact that Technikon SA was already equipped with an administration and courseware design and development infrastructure suited to a distance education environment, a combination of rational and incrementalist strategies was adopted to phase-in a virtual campus architecture.

The flexible learning system adopted by Technikon SA is based on partnerships with other educational institutions, the community, industry and its corporate structures. The other components of the flexible learning system include its Integrated Learner-Centred Distance Education (ILCDE) strategy (Buitendacht, 1994), through which learner support is provided through tutors that are demographically spread throughout the country at Technikon SA's 27 regional offices and branches. Due to the increasing impact of technology and the need to manage it, the Integrated Technology Strategy team was established at Technikon SA in 1996. Environmental trends in higher education and technology were identified that directed the need for an integrated technology strategy. The team determined standards and protocols of various technologies and continually assessed its appropriate use, ranging across all functional divisions of the institution, i.e. management, administration, teaching and learning. Its primary function was to integrate and consolidate existing technologies, monitor and assess market trends in technology and advise on strategic and implementation implications of new technologies. The team also advised on strategic alliances with other institutions or private initiatives. In April 1997 a strategic management session was held in which a new vision and mission statement was determined, committing the institution to a flexible learning system in which technology plays an imperative and strategic role. Part of the mission statement subsequently reads that Technikon SA will use appropriate technology effectively for open and distance learning, delivery and service provision.

The courseware at Technikon SA is print-based and project-management principles are applied. Project teams consist of desktop publishers, project managers, instructional designers, graphic designers, and language practitioners, who contribute during an iterative critical path. With the shift to a virtual campus, however, a strategy was necessary to incorporate electronic courseware.

4.1 TECHNOLOGY INFRASTRUCTURE

Technikon SA has a Sun E 5000 UNIX multiprocessing system on which a Solaris operating system and an Oracle database run. The student database, which is outsourced in the sense that ITS (Integrated Tertiary Software) supplies it, is carried on the Oracle database. The latter interfaces with terminals at the Technikon – from the main campus and from the regional branches and offices. The Internet and Intranet are carried on a smaller UNIX computer, with a Solaris operating system and an Oracle web server. A Novell network, which uses TCP/IP (Transmission Control Protocol/Internet Protocol) and has a fibre optic and copper backbone between the various buildings on the main campus, is in operation. ISDN lines (128 K) connect the main campus with selected regional offices for overflow and backup, and the others are connected with diginet lines (64 K). Standard software include *MS Office*, *Pegasus Mail*, *Windows 3.11*, *Windows 95* and a *Netscape Browser* (both *Navigator* and *Communicator*).

4.2 PROCESS

Functional requirements (Appendix A) were determined using available literature (marketing and technical documentation through Web searches), analysing the institutional infrastructure as well as information gleaned from virtual campuses that are already deployed on the Internet. Environment scanning identified companies that have the necessary expertise and resources to warrant further investigation. Owing to the expenses involved in the solution which was eventually selected, the decision was made to create the first phase, namely TSA-Online, through in-house development, using pl/sql (procedure language/standard query language) and Java script, thus following an incremental strategy. TSA-Online, which can be viewed at http://www.trsa.ac.za, consists of an interface in which guidance from the lecturer/tutor (which is essentially the same as the current tutorial letters that are sent to learners), courseware (study material), assignments, subject-specific bulletin boards, email addresses of lectures/tutors and library information are grouped together. Alongside is information on assignment status and marks, examination centres, examination results, learner biographical and financial information and general client services. The bulletin boards were written in Perl (CGI script).

Two workshops were held with a wide representation of staff members. The aim of the first workshop was to establish a common understanding of a virtual campus. Three questions were posed to staff, namely " What are the potential benefits of the virtual campus project?", "What are the key factors that could kill this project?" and "What needs to be done to prevent the killer factors from taking effect?" The summarised response of staff to the questions are provided in Appendix B. A follow-up workshop was held with representative staff from the institution to discuss three possible scenarios. Each scenario was brainstormed to allow every staff member present the opportunity to indicate perceived advantages and disadvantages (Appendix C). One of the dangers that was highlighted by staff is a possible lack of planning and the absence of an infrastructure to support a virtual campus. Therefore an infrastructure was required that can co-ordinate and sustain the electronic instructional, administrative, communication and marketing components – to name a few.

Feedback from staff members was taken into account when determining the possible structure for Virtual-TSA. Likewise, the institutional needs were considered and, as a result, a solicited business plan on a new centre, called the Integrated Technology Centre (ITC), was submitted (Van der Merwe & Lazenby, 1997). To ensure sound management and optimal functioning, the following units were proposed within the ITC:

- Electronic graphics unit,
- audio and video unit,
- multimedia unit,
- photographic unit,
- on-line unit.

Although it is premature to make any conclusive remarks, it seems as if following a combination of rational and incrementalist strategies proved to be successful in the Technikon SA culture. The Integrated Technology Strategy Team provided the initial direction required to plan a systematic phasing-in of a virtual campus, whereas the actual deployment followed an iterative, consultative path. Subsequently enough flexibility existed to accommodate dynamic changes and allow for swift decision making.

5. UNIVERSITY OF PRETORIA: A CASE STUDY

The University of Pretoria is a residential institution with 27 000 students on campus. An additional 26 000 distance students are enrolled for Diploma courses at the University. Through partnership, these courses are accredited by the University, but are delivered (paper-based) by National Private Colleges.

For some time the University has practised a limited mixed mode of delivery, including interactive broadcasting, videoconferencing, multimedia and Web-based courses combined with contact sessions. On 22 July 1997 the University Council approved telematic education as a mainstream activity of the University and the Department of Telematic Education was established. The mission of the telematic education initiative is to create flexible learning environments by making use of a wide range of delivery modes.

In light of technology forecasting reports by the Institute for Technological Innovation (Van Harmelen et al., 1997), the Internet, and consequently the creation of a virtual campus, was identified as a major strategic enabler for the university. A project manager was appointed at the Department of Telematic Education to manage the establishment of the virtual campus of the University of Pretoria. Owing to the primarily residential culture at the University, the innovation process combines radical and incremental strategies. Whereas Technikon SA possesses a centre for courseware design and development and a culture of distance education, the University of Pretoria has a predominantly residential culture. Most lecturers at the university are familiar with contact education and the creation of courseware is foreign to them. Hence change management constitutes a large part of the initial strategy. Instead of moving from a residential institution to a typical distance education institution using paper-based courseware,

a radical change is expected of transforming the university into a virtual university that is integrated with existing infrastructure to service remote and residential students. The aim of the virtual campus is to establish a Web-based environment that is integrated with the existing infrastructure of the university, where students can have access to their course material, communicate with their lecturers/tutors, and perform all academic (assignments, tests, examinations), administrative (application, registration) and financial (payment) activities.

5.1 TECHNOLOGY INFRASTRUCTURE

The University of Pretoria uses a *Novell* network with an ATM (Asynchronous Transfer Method) backbone. Microsoft products are supported on campus. 64 K Diginet lines and 128K ISDN lines connect the university with its four satellite campuses. *NT* and *Linux* Web servers are used and *Netscape* and *Internet Explorer* as browsers. *Netware* is used for all fileservers. It has a *VN* mainframe and shares a student administration database (*Adabas*) with two other residential universities, namely the University of Stellenbosch and the Potchefstroom University for Christian Higher Education. This aspect proved to be a constraint because the database is not ODBC (Open Data Base Compatible), which means that additional software (*I-Express*) needed to be purchased to operate as an interface with the envisaged Web-based infrastructure of the virtual campus. As a result the University of Pretoria is collaborating with the other two institutions in the creation of the technical backbone and it was necessary to persuade both institutions to adopt similar strategies for the establishment of a virtual campus. In this light a decision was made to also collaborate in the implementation of the same Web solution (student management system) to contribute to mutual courseware exchange and cost savings. The student management system will provide an integrated architecture that will be accessible to staff and students – information access will depend on their various roles and authorisation. The systems under evaluation are as follows:

Librarian, Personal Learning System, WebCT, Top Class, Manager's Edge, Oracle Learning Architecture, Lotus Learning Space and Blackboard.

5.2 PROCESS

In March 1998 a concept document was distributed at the University of Pretoria which details the strategic reasons for a virtual campus, as well as the various possible components of a virtual campus. Subsequently, many information sessions, workshops and road shows followed to align the vision of staff members.

A matrix project management approach is followed, with task teams representative of the entire institution. Compared to the process followed at Technikon SA, the matrix management project approach followed at the university is considerably more inclusive and wide-ranging. A Work Breakdown Structure was scheduled by the project manager in conjunction with the various task teams.

The following action plans were determined:

Table 1

The Virtual Campus Action Plans

Information technology	
Provide the required network capability on campus and to the satellite campuses. Establish what will be required for staff and students accessing the virtual campus from remote locations.	Provide and maintain the server for the virtual campus, which will be the integrated interface for teaching, learning and research activities via the Web.
Provide access to this server from the various servers used by departments	Provide an upgrade plan to provide connectivity for all staff members, which (currently) means a pentium with a web browser.
Assist in determining the protocols for the integrated system, i.e. what will be required at the client server side for staff and residential and remote students, security measures that are aligned with best practice internationally.	Provide a plan on the location of computer centres where students will have access to the virtual campus, whether through network ports provided or through fully equipped centres.
Assist with the integration of the virtual Academic Information Service and the virtual campus in terms of database access.	Assist Academic Administration in the process of integrating the student administration database with the virtual campus.
Assist Financial Administration in determining which Banking institution or electronic commerce company provides the required security protocols for handling online payment via credit card and smart cards.	Assist in the evaluation of the most appropriate virtual campus solution (student management system) for the virtual campus.
Academic Administration	
Determine the protocols for full registration via the virtual campus in terms of viability, security, feasibility: capacity. What kind of expert system will be required to fulfil the needs of individual departments? What are the security issues for remote students, new students and students that are reregistering?	Provide an updated yearbook and investigate a more sophisticated system that could be linked to requirements, checks and validation procedures as a first-phase implementation of the registration process.
Develop a contingency plan to accommodate telematic projects via the Web that are already in operation.	Develop a framework of recognition of prior learning in consultation with departments that can be used for articulation purposes.
Academic Information Service (library)	
Establish work stations and laboratories in Academic Information Service where students can access the virtual campus.	Determine and deploy a procedure and infrastructure to integrate electronic information delivery systems with the virtual campus.
Determine and deploy a procedure and infrastructure to scan articles and other information such as study guides, exam papers and FAQ (only master copies) required for courses.	Integrate existing databases on the network and integrate them with the virtual campus. Link the electronic retrieval engine with the virtual campus and provide for an interface for enquiries via the virtual campus that staff and students can access.
Determine copyright procedures of all types of course-related information, whether from an internal or external source that will be accessed via the virtual campus.	Determine budgeting and pricing implications for departments and students of providing/accessing online information such as prescribed books, photocopying costs and copyright costs.

Make recent exam papers available on the virtual campus.	Link all Academic Information student financial transactions with the online student payment system that Financial Administration will put in place.
Assign AIS staff members to Telematic project teams.	Train staff and students to use abovementioned services.
Financial Administration	
Provide specifications on online banking to banking institutions.	Evaluate the services provided by banking institutions in terms of online banking, including electronic commerce companies.
Submit a proposal on the most appropriate banking institution/company, including a comparative evaluation of various solutions and the financial implications, cost savings/benefits of the identified solution.	Assist Academic Administration to determine how payment for online courses will be structured.
Telematic Education	
Provide the infrastructure to design and develop educationally sound courseware for the virtual campus through project-based instructional design processes.	Conduct continual action research and development in instructional technology and flexible learning.
Academic staff in a virtual campus	
Become facilitators and managers of learning in a context where they are no longer the bearers of all knowledge.	Use the technologies to manage the administrative and research component.
Focus on remaining subject experts in their respective fields.	Be sophisticated users of various technologies, not in the creation of systems or products, but in utilising technologies for synchronous and asynchronous learning facilitation.

The main constraints of the matrix project management approach is that task team members are in different line functions and have full work loads to cope with. As the change management process evolves though, the momentum of the project is increasing and more support and resources are ploughed in. The radical shift from a residential institution to a virtual institution is proving to be an effective tool to transform the university and to align the vision of staff and students. A great benefit is the ownership experienced by staff as they contribute to the innovation process. As the project develops, students will become more involved as formative evaluators and as active participants.

6. CONCLUSION

There is no fixed recipe for technological innovation. However, innovation strategies do provide useful guidelines that can assist in the creation of a virtual campus. In both case studies the leadership of the institutions are in favour of the innovation process and provide the necessary support in terms of resources. The competitive environment faced by higher education institutions globally is impacting directly on the way they deliver their services and products. The extent to which they have aligned their processes to accommodate a new vision and an innovative and technologically advanced approach to their core business will determine the appropriate selection of innovation strategies.

7. APPENDIX A

Internet architecture for Technikon SA

(i) Technical standards

The technical standards are based on the existing software, hardware and expertise at Technikon SA and are as follows:

- Learners must not have to download/obtain special software to access Technikon SA's Extranet, i.e. the learner must be able to use any generic Internet Access Software (web browsers, email, ftp and usenet software) to access appropriate information.
- Only HTML (HyperText Markup Language), the language used by World Wide Web software, must be accepted by the Web Server, which in turn must do the necessary conversions to communicate with Technikon SA's existing Oracle database. Once data has been extracted from the Oracle database it must again be converted to HTML for the return answer, thus adhering to an *HTML in-HTML out* protocol.
- The system must cater for other web programming languages such as Java, C++, Perl and other CGI scripts.
- The import of computer-based courseware developed in authoring tools with web capability such as Macromedia's Authorware Professional must be possible.
- The server must be able to talk to Technikon SA's Oracle database, using existing business and validation rules, checks and verifications.
- The delivery structure/backbone programming and maintenance must be easy and cost effective.
- The provider must have the necessary resources to effect proper implementation and long-term maintenance of the system (on- and off-site), and must furthermore be in a position to train Technikon SA staff if required.
- Software pricing must be competitive and the system must be robust.
- The cost of learner access must be affordable.
- It must be accessible from anywhere in the world.
- Learners must have access to the system from public places such as community centres, libraries, Internet Cafés and other providers.
- Student tracking and administration must integrate seamlessly with Technikon SA's current student, financial and database systems.
- The system must enable Computer Services at Technikon SA to utilise expertise of current staff, such as the database administrators, system administrators and system programmers where possible.
- The new system must be compatible with the existing software infrastructure.
- Technikon SA staff must be able to utilise the system using software that is already at their disposal such as MS Word, Netscape and Pegasus Mail.
- The system must be able to incorporate existing programs without having to rewrite them or having to go through extensive re-engineering to make them suitable.
- An upgrade path is essential to prevent redundancy and to cater for changing technological environments.
- A high level of database security is imperative.

(ii) Instructional standards of interactive courseware were based on a constructivist approach:

- Embedded cognitive skills and mental models can be designed through software where appropriate.
- Viability in terms of a structure in which to compile a needs assessment, target population analysis, content analysis and media analysis.
- Compatibility with an outcomes-based curriculum in terms of how granules (including assessment) can be structured according to unit standards.
- User-friendly, interactive interface which guides the learner by means of multi-dimensional paths.
- Capable of accommodating multimedia applications used in standard authoring/ programming languages.
- Compatibility with C++ and Java applications to allow for a rich learning environment that can be manipulated and customised by the learner.
- Software that allows for remedial, diagnostic, immediate or delayed feedback.
- Software that allows for multilingual capabilities/conversion.
- Software that is compatible with electronic performance support systems such as MS Word and Excel.
- Tracking, bookmarks and record-keeping are essential features.
- On-line communication with lecturers and tutors must be possible (synchronous and asynchronous).
- Variable learner control should be possible.
- Virtual reality, especially for simulations.
- An integrated learning system that integrates communication, learning and administration functions.
- A system that can deal with the submission and marking of on-line assignments.
- Learner reporting facilities and on-line annotations should be possible.

(Lazenby & Van der Merwe, 1996: 7-10).

8. APPENDIX B

VIRTUAL CAMPUS WORKSHOP 1: TECHNIKON SA

i. "What are the potential benefits of the virtual campus project?"

Staff indicated that it would result in improved response time to learners and would consequently reduce queries. It would also provide a 24-hour access service to learners, which will add to a more flexible learning system and improved service. Furthermore, it would streamline the institution's administration, improve cost effectiveness and promote the formation of international partnerships.

Such a venture would result in increased flexibility of learning options, especially in terms of course design, as well as providing more interactive learning opportunities. Due to the inherent attributes of web-based courseware, international competition would ensure high-quality courseware and provide global exposure and access to a bigger market.

ii. "What are the key factors that could kill this project?"

Poor planning and ad hoc management, a lack of co-operation and a lack of commitment from management, ignorance of staff, lack of initiative and slow implementation or total lack of implementation can all terminate the project.

Another danger is that of creating expectations amongst students and then not being able to meet their expectations. Staff listed resistance to change and apathy as major factors which could impact negatively.

Other possible dangers include the lack of student access to the virtual campus, a lack of funding, no physical infrastructure and insufficient technical expertise.

iii. "What needs to be done to prevent the killer factors from taking effect?"

Staff proposed that academics needed to be trained in the use of new technologies through active involvement. Other suggestions included ensuring institutional commitment and an implementation plan with deadlines and no excuses. The point was also made that management must be prepared to take decisions and provide a proper structure for design and development of on-line courseware

9. APPENDIX C

VIRTUAL CAMPUS WORKSHOP 2: TECHNIKON SA

i. Virtual-TSA committee scenario

Loose description: design and development of web-based courseware is done by academic staff. A committee comprising V-TSA representatives from all the directorates, departments and regional offices manages V-TSA.

Results:

Staff feedback in this regard indicated more disadvantages than advantages.

The main advantages were indicated as inclusivity, the development of broad expertise across the institution and greater "ownership". Disadvantages included fragmentation, possible lack of standardisation, politics and the fact that committees often fail to function well because of lengthy decision-making processes. Furthermore, a lack of interest could lead to failure.

ii. New Virtual-TSA unit scenario

Loose description: a new unit is established to manage V-TSA. Expertise involved in the design and development of web-based courseware will reside in the unit and will liaise very closely with all departments, directorates and regional offices.

Results:

An almost equal balance between advantages and disadvantages were indicated for this scenario.

The main advantages identified were good control, fastest decision making, high standards and quality of products, pooling of planning, costs and expertise, and the fact that academic staff would not have to spend time on technical issues which are not relevant to their functions. The main disadvantages were the lack of ownership of centralised decisions by stakeholders and possible empire building.

iii Virtual-TSA unit scenario

Loose description: V-TSA will remain a virtual unit, managed by one person plus an administrator. Depending on the requirements/deliverables, expertise from within (Computer Services, CCDD, Print Production) or outside the institution will be contracted in, based on project management principles. This relates especially to courseware. It will also see to the integration of administrative functions and other matters relating to V-TSA.

Results:

More advantages than disadvantages were listed. The incorporation of most central role-players in the core group, standardisation, cost-effectiveness and more manageability were noted as advantages, whilst a possible slow coordination process, less ownership by academic staff and less capacity-building were indicated as disadvantages.

10. REFERENCES

Buitendacht, A.J.H. 1994. *Integrated learner-centred distance education: TSA's winning asset for the RDP*. Technikon SA.

Cairncross, F. 1997. *The death of distance: How the communications revolution will change our lives.* Boston: Harvard Business School.

Davis, S & Botkin, J. 1994. The coming of knowledge-based business. *Harvard*

Business Review, 72, 170, September-October.

Dede, C.J. 1997. The transformation of distance education to distributed learning. [On-line]. Available URL: http://www.gsu.edu/~wwwitr/docs/distlearn/index.html. 09/06/97 16:54:17.

Green, K.C. 1996. *Campus computing 1996: The seventh national survey of desktop computing and information technology in higher education*. CA: Campus Computing.

Ives, B. & Jarvenpaa, S.L. 1996. Will the Internet revolutionise business education and research? *Sloan Management Review,* 37:3, 33.

Lazenby, K. & Van der Merwe, D. 1996. Proposal on the Implementation of an Internet Solution as an enabler for on-line learning via the Internet. Technikon SA, October.

Lippincott, J. & West, R. 1997. *Current issues for higher education information resource management.* Cause/Effect*, 20:1, 4-7.*

Porter, A.L., Roper, A. T., Mason, T.W., Rossine, F.A. & Banks, J. 1991. *Forecasting and management of technology*. New York: John Wiley & Sons.

Rossman, P. 1993. *The emerging worldwide electronic university: Information age global higher education.* London: Greenwood.

South Africa. 1996. *Technology-Enhanced Learning in South Africa: A Discussion Document.* Report for the Minister of Education. Pretoria: Government Press.

Tidd, J., Bessant, J. & Pavitt, K. 1997. *Managing innovation: Integrating technological, market and organisational change*. New York: Wiley.

Utterback, J.M. 1994. Mastering the dynamics of innovation. *Boston: Harvard Business School.*

Van der Merwe, D. & Lazenby, K. 1997. Integrated technology centre proposal. Technikon SA, September.

Van Harmelen, T. 1997. *Guidelines for technology-enhanced education at the University of Pretoria*. Volume I, ITI Working Paper, No.ITI-97-9, June, Institute for Technological Innovation.