



**Association of African Universities
Association des Universités Africaines**

اتحاد الجامعات الافريقية

**GUIDELINES FOR INSTITUTIONAL SELF-
ASSESSMENT OF ICT MATURITY IN AFRICAN
UNIVERSITIES**

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PREFACE

Many African universities, like their nations, have yet to build the basic infrastructures needed to take advantage of the information age. But unlike their counterparts in other developing regions of the world, African universities face a major challenge to re-invigorate the university enterprise in its entirety using the new and rapidly advancing information and communication technologies (ICTs) to build a pathway to the global information revolution. ICTs are formidable and can be cost effective as development tools. They can be used to reduce poverty, build capacities, enrich skills, and inspire new approaches to governance and conflict resolution. They are already making an important contribution to the economic and social development of African countries. But this contribution can be multiplied several times over.

Because communication and information are at the very heart of the educational process, African university leaders have long worried about the worsening lack of access and growing isolation of their students and scholars. They have addressed their concerns through the Association of African Universities (AAU) and at various fora facilitated by several development agencies particularly the Carnegie Corporation of New York and the United Nations Economic Commission for Africa. This report is an outcome of such collaboration between these agencies.

This study was initiated as a response to the recommendation of the Conference of Rectors, Vice-Chancellors, and Presidents of African Universities, meeting in Arusha, Tanzania in February 1999, that the AAU should undertake a survey and an assessment of the ICT capacities of African universities. The objective of the study was to synthesize the knowledge base of how African universities are using ICTs to improve their teaching methods, enhance learning, strengthen research functions, and manage library and other academic information services. The study would also provide a guide for assessing institutional capacity to integrate technology with pedagogy and to reform curriculum development.

With funding from the Carnegie Corporation and the International Development Research Centre (IDRC), a Working Group of Experts

(WGE) was established to examine the critical issues upon which to focus the AAU survey and provide an appropriate conceptual framework for promoting strategic planning in African universities for the introduction and application of ICTs. The Corporation commissioned John Daly, an independent consultant, to synthesize the knowledge base of global trends of ICT applications in academic settings, with possible case studies of experiences and best practices.

The synthesis report along with additional relevant published materials were disseminated to some thirty selected African and international scholars and donor representatives to facilitate their contribution to a three-week moderated on-line discussion in April 2000. The electronic forum identified the critical components that would need to be in place in the universities for them to achieve the integration and effective use of ICTs. The WGE met for three days in May, 2000 at the University of Dar es Salaam, under the chairmanship of Vice-Chancellor Matthew Luhanga. Other scholars are Olalere Ajayi (Obafemi Awolowo University, Nigeria) who moderated the three-week electronic forum discussion, Stanley Moyo (University of Zimbabwe), Magdallen Juma (Kenyatta University, Kenya), Eric Kluyfhout (Vrije University Amsterdam, the Netherlands), Henri Thairu (Jomo Kenyatta University, Kenya), Derek Keats (University of Western Cape, South Africa), Mumuni Dakubu (University of Ghana), Justin Chisenga (University of Namibia), Tolly Mbwette, Beda Mutagahywa and Abel Ishumi (University of Dar es Salaam). WGE members from development agencies were Maria Beebe (USAID, Project of Knowledge Exchange and Learning Partnerships), Yawo Assigbley and Mary Materu-Behitsa (AAU), and Akin Adubifa (Carnegie Corporation).

The WGE meeting centered on the establishment of guidelines for introducing and enhancing the use of ICTs to revolutionize how African universities teach, promote learning, conduct research, and manage institutions. The meeting explored parameters that universities could use to assess how effectively an institution is able to harness the potential of ICTs. It identified the broad outlines of the framework for institutional self-assessment and formulated a practical approach for conducting the exercise. But, following the Dar es Salaam meeting, it was the additional special effort of Beebe, Ajayi and Assigbley that refined the structure of

the framework by sharpening the description of the contents of the matrices presented here in chapter four.

The WGE produced two primary outputs: The first is a tool-kit for the step-by-step self-assessment of an institution's information and communication technology maturity. This tool-kit can be used optionally by institutions to construct their own specific assessment framework. The ultimate objective is to give institutions a practical and reliable means of assessing the parameters that would help them determine where they respectively fit along the tortuous and unfamiliar path towards the achievement of global standard for ICT application in higher education. The tool-kit is presented as a matrix that uses the characteristics of each stage of technology development to determine an institution's level of maturity based on applicable sets of variables. The idea for the matrix is based on the "CEO Forum STaR Chart: a Tool for Assessing School Technology and Readiness". The five stages of ICT development in the matrix are also based on the five phases of professional development indentified by Apple Classrooms of Tomorrow, and built upon by the CEO Forum.

A second output of the WGE is a detailed questionnaire, based on the identification of critical parameters above, to assist AAU plan and implement a comprehensive survey of ICT presence and prospects in African universities. The questionnaire is not included in this report, but it is available through the AAU. It will also be presented, in due course, to each university for the implementation of AAU Survey.

This report has been prepared in consultation with members of the WGE. Its main purpose is to encourage institutional arrangements that can help stakeholders in African universities make prudent investments in ICT and maximize benefits. Donors are called upon to encourage reduction of costs of access and facilitate sustained growth of ICT capacity. African institutions are urged to seek synergy among themselves in order to make well-coordinated responses to current and future challenges in the information age. The Working Group of Experts hopes that the information contained in this report can help the stakeholders and decision-makers of individual institutions make informed choices in their

strategies for the introduction, development and application of ICTs in their universities.

1. INTRODUCTION

Eventhough universities generally occupy the coveted ivory tower as the knowledge-generating strand within the fabric of society, they often also become some of society's most complex organizations. In Africa, their complexity is amplified by the depth of the continent's intricate problems. This poses greater challenge for African Universities to create innovative and indigenous approaches for mobilizing the collective talent and energy of their scholars, and providing appropriate solutions to the continent's developmental weaknesses. Towards this end, the primary mission of the African university is to produce graduates endowed with high level skills in an increasing variety of fields which will provide the human capital that African countries need in the new competitive global economy. Eminent scholar Donald Ekong¹ noted also that "the challenge for the African university is to contribute useful knowledge and application processes that derive from the African environment and draw from African experience and ingenuity".

There is no doubt that the information infrastructure in African higher education is terribly weak compared with the situation in developed countries, and much below the operating standard of counterpart institutions outside Africa. A greater threat now facing the continent is that the current weaknesses will become self-perpetuating as technologies become more advanced, thus widening the gap in higher education systems between Africa and the rest of the world.

Information and communication technologies (ICTs) are a diverse set of technological tools and resources used for creating, storing, managing and communicating information. The new digital ICTs are combinations of hardware and software, multimedia, and delivery systems. For educational purposes ICTs can be used to support constructivist-teaching methods including collaborative learning and inquiry. They enable collaborations between peoples and institutions in widely separated locations. They exist as common items that include desktop, notebook, laptops, televisions, digital cameras, local area networks, Intranet, the Internet, World Wide Web, and CD-ROMs. Their applications include word processing, spreadsheets, tutorials, simulations, electronic mail, digital libraries,

computer-aided designs, computer-mediated conferencing, and videoconferences.

The use of ICTs in education will continue to grow and recent advances are likely to also increase their range and application dramatically. Access to these tools thus becomes a matter of critical importance for any African university that seeks to become viable and effective in training its students, producing and disseminating knowledge, and preparing the next generation of citizens with adequate skills and the capacity to ensure national growth and economic development. Therefore, faced with the current crisis in African higher education, universities are offered ample opportunities and advantages through ICTs to educate more people more rapidly, to improve efficiency, and to improve academic quality.

The ultimate objective of integrating ICT into higher education in Africa, therefore, should be the transformation of the university into a knowledge and information powerhouse, with the ability, capacity, and necessary skills not only to educate students and to generate new knowledge, but also to systematically access, absorb, adapt, and use such information and knowledge for the advancement of national development. A substantial digital divide has already arisen between the higher education institutions in Africa and those elsewhere from the differences in ICT availability, access, affordability, and capacity. This digital divide can, and must be bridged. Further delay in taking the necessary steps to overcome it will only make it wider and more difficult to close.

2. BACKGROUND

Information and Communication Technologies in Africa

Recent Africa-wide conferences have underscored the importance of an electronic knowledge-based economy. For example, the first African Development Forum convened in October 1999 by the United Nations Economic Commission for Africa focused on the Challenge to Africa of Globalization and the Information Age. It emphasized the need to strengthen Africa's information infrastructure, and highlighted the policies and strategies that have enabled some countries to move faster in extending their infrastructure for broadcasting, telecommunications, computer hardware and software, the Internet and associated development of human resource. The meeting identified such positive initiatives as the development of public access centers, the introduction of smart cards, government sponsorship of content, development of support services, and expansion of the digital capacity of networks. It also identified negative forces which included high license fees for new entrants, slow licensing procedures, high import duties, and failure to ameliorate high call charges. Michael Jensen² noted that high cost of local or long distance line usage, scarcity of intraregional links for traffic, and high subscription costs limited the potential benefits of the spread of Internet access. In addition, he reiterated that political stability is a key element in attracting foreign investment for infrastructure. Meeting participants³ indicated the need to develop a positive environment, which would enable private financing to provide the basis for Internet development. They also suggested that the use of electronic commerce and the Internet would enable a major reduction in the isolation of African traders.

The African Ministers of Communication had also met in Cape Town in February 1998 to provide a road map for enabling Africa's launch into the Information Age. They identified five pillars on which to base their strategy:

- (i) *Sector restructuring* - Recognizing that telecommunications development was increasingly driven by the private sector,

particularly in Africa where there is little money to take on the costs of massive infrastructure, they declared as follows: “Clearly, if development is to be orderly and Africa is to be the beneficiary of this investment, clear rules and policies have to be introduced to regulate the market. Because markets in individual countries tended to be small regions needed to be identified to drive the process from the start”.

- (ii) *Development of a financing system* - They agreed that the route to finance would involve forming government or regional partnerships with development agencies, international financial institutions and the private sector.
- (iii) *Human resources development* - This was emphasized thus: “Without this element, the growing distinction between the information-rich and the information-poor would continue to widen.”
- (iv) *Identification of priority projects* - They agreed to pursue large projects that would bring investment and stimulus, and small projects that would link poor communities, particularly in remote rural areas, to each other and to the world.
- (v) *Special program for the least developed countries* - They would explore cost effective and appropriate technologies to address universal access in consultation with least developed countries.

In his address to the National Summit on Africa in Washington, D.C., February 2000, K. Y. Amoako, Executive Secretary of the Economic Commission for Africa, argued that information and communication technologies offer some of the most exciting possibilities for Africa in the new millennium. He stated that “for once, we have affordable (and increasingly cheaper!) forms of technology capable of benefiting Africa, rather than making the continent even more marginal. With new ways to communicate we can leapfrog through several stages of development; cut the cost of doing business; and narrow the gap of huge distances. A few years ago, only a handful of African countries were connected to the Internet. Now all are connected! E-commerce, regional radio and television, telecenters and computers in schools are starting to make an impact around Africa.” Then, he concluded: “we want to make sure that Africans are drivers, not passengers, on the information superhighway.”⁵

The United Nations recently adopted an international ICT action plan, which recognizes the importance of ICT in national development plans, and calls for a much higher profile for ICT in official development assistance portfolios. It specifically calls for public and private sector initiatives as well as bilateral and multilateral action to re-examine current ICT policies and ensure that equal opportunities are being provided to all sectors of society.

A number of infrastructure building initiatives are also known to be underway in Africa. For example, Jensen⁶ reports on the United Nation's *Program of Harnessing Information Technology for Development* that is expected to substantially improve the Internet infrastructure before the end of the year 2000.

ICTs in Higher Education

In offering a sketch of the current status of ICTs in Africa, particularly within the milieu of African university systems, John Daly⁷ shows Africa to be at a growing disadvantage within a global context. He also demonstrates that the continent is in a position to improve its ability to capitalize upon new technologies. The task, however, is how to rearrange the policy initiatives and priorities of the key players to fashion out a practical and achievable development agenda for the introduction and application of ICTs in these institutions. Such an agenda needs to be guided by a deeper understanding of the lessons discerned from current experiences.

Daly argues that the digital divide is comparable to the income divide between developed and developing countries, but the Internet is likely to rapidly widen the gap. For Africa, which still mostly lacks adequate infrastructure for utilizing these new technologies, the ICT revolution offers both great opportunities and great risks. With limited resources, African nations will have to allocate resources to ICTs effectively in such a way as to achieve equitable social and economic growth. Otherwise Africa will suffer more economic damage if it is unable to participate fully in international activities arising from ICT-induced globalization, or if

competitors utilizing the technology more effectively take international markets away from African producers and jobs from indigenous workforce.

The higher education information infrastructure is itself an important part of the national information infrastructure, and can be especially important in directing application with major social and economic development consequences. The universities have the potential to serve as gatekeepers and diffusion agents, transferring and adapting information and communications technologies to suit African needs – the academic community can serve as steersmen, helping Africa to utilize the technology in humane and effective ways. Moreover, universities and other institutions of higher education will have to prepare the intellectual leadership in Africa to deal with the information revolution.

The Information Infrastructure of African Higher Education

African universities are struggling to emerge from a decade of crisis. Rapid growth, the brain drain, frequent labor strife, campus closures, institutional deterioration, waning relevance and declining educational quality have produced a generation of graduates less capable and qualified than they were ten years ago. Research has virtually ceased. At stake is whether African nations will be able to guide their own development and manage their own affairs in the years ahead

– Working Group on Higher Education

Association for the Development of Education in Africa

The above description of the state of higher education in Africa was expounded upon by UNESCO whose data provides the following picture:⁸

In 1995, gross enrollment ratios in tertiary education were about 58 percent in high-income countries and three percent in low and middle-income countries in Sub-Saharan Africa. Twenty-six percent of adults in high-income countries had some higher education; only two percent of adults in Sub-Saharan Africa did. African enrollment rates and attainment rates are still the lowest of any continent.

In his synthesis paper, Daly provided some comparative analysis with the situation in the United States, where in 1998, 44% of college classes used e-mail and one-third of all courses utilized the Internet as part of the syllabus. Indeed, as many as 45% of college students reportedly now use the Internet on a daily basis. Moreover, high-speed networks are rapidly emerging; Internet will link the institutions at speeds 45,000 times faster than the best telephone modems now in use. In Africa, computers are scarce, and many of the units are older models using 386 and 486 processors. In 1998, an AAU survey found that only 52 of the 232 African academic and research institutions responding to its questionnaire had “full Internet connectivity”, while the 180 others had access that was “inadequate”. Growth of the Internet was limited by low levels of telephone connectivity, and telephone costs were high relative both to those in the United States and to African budgets. Bandwidth serving universities was limited: while more than 200 universities in the US now have 45 MBPS Internet and more than 85 percent of elementary schools have 1.5 MBPS Internet, the Leland Initiative of USAID is providing only 128 KBPS Internet to two dozen African countries.

Daly’s paper also indicates that more than 140 public and private institutions currently provide tertiary distance education services within sub-Saharan Africa, relying mainly on print media. Some also use national broadcast radio, audiocassettes, and more recently, e-mail. These programs focus on skills upgrading for in-service teachers and business management or information technology training for employed workers. The World Bank has been funding the development of the African Virtual University (AVU) since 1996. The project is now moving into its operational phase, delivering lectures to add some value to the curricula of undergraduate degree programs in science and engineering in several universities.

There are significant differences among African nations in readiness for distance education. Saint⁹, in a study of 22 nations, finds South Africa, Tanzania, Zimbabwe, Ghana, and Zambia the most prepared, in that order. Daly notes further that institutions of higher education play a critical role as knowledge gatekeepers, keeping track of knowledge generated and used in other countries, and selecting, adapting and

applying useful knowledge from abroad to local needs and demands. Specifically, universities have been key gatekeepers for technological knowledge about ICTs. They are often first adopters of new ICTs in their countries, and train the professionals who make such decisions. This function of African higher education has become increasingly difficult, both as the amount of knowledge generated worldwide has exploded, and as African universities have had increasing financial difficulties in purchasing journals and other sources of information. To carry out this function, African universities need access to relevant cutting-edge information and communications technologies, and need resources to fund acquisition of such technology beyond current research and teaching needs.

Apart from their use in libraries which are important repositories and sources of knowledge, ICTs have also been applied to the administration of universities, particularly for the following services:

- ❑ Admissions testing, recruitment, and enrollment;
- ❑ Student and faculty scheduling, classroom allocations, other schedules;
- ❑ Examinations, record keeping and analysis of student performance;
- ❑ Placement of graduates, alumni relationships;
- ❑ Purchase of books, food services, and other general logistics of community welfare.

Building University ICT Capacity

Despite policy pronouncements by governments, the status of ICTs in Africa shows that the continent is at a growing disadvantage with respect to the global information and technological revolution. More critically, the institutions in Africa which should be in the forefront of ensuring Africa's participation in the revolution are themselves unable and ill-prepared to play such a leadership role, because the information infrastructure of African higher education is poorly developed and inequitably distributed. African universities are thus poorly positioned compared with their counterparts in Europe, North America, and non-African developing regions, to benefit from the global information economy and knowledge systems. The development and application of ICTs for African institutions therefore becomes crucial and urgent if the

continent is to be able to reduce the knowledge, technological, and economic gap between itself and the rest of the world.

It is neither possible nor advisable to generalize about African universities. Each institution is unique, reflecting the characteristics of the nation and its people, its culture, and its own history. Knowledge about the application of ICTs to the work of the university is very broadly held in the university community. Each faculty will possess specialized knowledge about the applications of ICTs to its specialty that is not found in other faculties. Ultimately, therefore, strengthening the use of ICTs in the university curriculum, selecting ICT applications from abroad, and introducing ICTs into the larger society should be seen as an institutional responsibility. Therefore, opportunities and incentives to innovate must be widely distributed in the university, and rewards for success should be provided through recognition and promotion.

It is useful to analyze a number of African experiences and to draw lessons that may be instructive for future endeavors in this field even though these experiences are limited and varied. While many institutions remain at various stages of planning and infrastructural development, some have achieved regular Internet connectivity. None, however, has access to adequate bandwidth. The development cycle from conceptualization through funding, installation, and operation has taken different turns in the institutions, with varied successes. Case studies are now underway to document and analyze the valuable experiences of selected universities* in order to draw out lessons and best practices, as well as to identify potential pitfalls.

*

National University of Lesotho
Obafemi Awolowo University (Nigeria)
South African universities
University of Dar es Salaam (Tanzania)
University of Ghana
University of Swaziland
University of Zambia

Current information from these studies show that the ICT initiatives which emanated from an overall strategic plan for the university's development flourished while those that were adhoc and not integrated into the institutional development framework only achieved limited objectives that were not sustainable. Other lessons include the following:

- Institutional development showed a lot of similarity in the establishment of ICT with local variations depending on the prevailing circumstances in the university and in the country.
- It is necessary for all institutions to declare ICT as priority in budgetary allocation, because of its importance as a major utility after water and electricity.
- Financial and technical assistance, especially in the form of human resource development, was significant in the success of a number of projects.
- ICT strategic policy, plans and implementation documents are essential. The strategic plan should derive from the overall developmental plan of the university.
- There is the need for a unit within each institution to facilitate integration of technology into the learning, research, and management.
- Lack of adequate telecommunication infrastructure and utilities such as electricity, lack of a National Information Communication Infrastructure (NICI) policy, plans and strategies in addition to political instability in the country as well as instability in the institution, could constitute obstacles to the use or development of ICT.
- Institutions must not only develop ICT and utilize the facilities; as knowledge gatekeepers they are expected to champion the national ICT development in the country.
- There is the need to transform the library from its present conventional book-oriented service provision into a new Information Services Unit.

Obstacles

The Working Group of Experts identified a number of common obstacles to the introduction and utilization of ICTs in the selected universities:

a. External obstacles—factors that define the environment in which higher education institutions operate and that shape their ability to use ICT

- Poor national telecommunications infrastructure (especially inadequate telephone access)
- Lack of enabling environment, including highly regulated telecommunications industry, unsatisfactory performance of Internet Service Providers, and absence of incentives to promote innovation and risk-taking.
- In some countries, the hostile social climate and political instability prevent opportunities of international collaboration and support.
- Absence of national information communication infrastructure (NICI) policy.
- Internet points of presence in several countries are not easily accessible to university communities, even with high-speed telephone systems.
- Internet traffic congestion or saturation due to limited bandwidth.
- Non-reliability of electricity supply.
- High Internet Service Providers (ISP) fees.
- Inadequate and irregular funding of ICT initiatives.
- Prohibitive importation costs of ICT equipment, often compounded by high national import tariff levels.

b. Internal obstacles

- Poor organizational self-awareness and response to change.
- Lack of coherent institutional plans and strategies for introducing and developing ICT's in universities.
- Poor and unreliable maintenance of ICT facilities.
- Insufficient computer facilities for staff and students.
- Absence of coherent ICT policies.
- Low-level awareness and utilization capacity among faculty and staff.
- Incomplete local area networks.
- Low level priority accorded by institutional leadership to ICT development and applications.

c. Human resources-related obstacles

- Uncertain availability of trained technical and support staff.

- ❑ Inadequate external and internal training programs for critical skills to manage and support ICT functions.
- ❑ Institutional promotion criteria that do not recognize staff efforts and innovation in ICT functions.
- ❑ Absence of systematized plans for integrating technology into teaching and learning.
- ❑ Inadequate human resources base for implementation of technical projects, particularly in the rapidly advancing ICT field.
- ❑ Inability of institutions to ensure the retention of skilled staff due to poor remuneration.

In general, the dearth of financial resources and the uncertainty of donor funding may be the most daunting obstacles to the aspirations of African universities to become active players in the global knowledge revolution spurred and underpinned by ICT's. With very few exceptions African universities are poorly funded, and many of them are unable to meet the basic requirements for academic growth. Their record for income generation has been poor. Indeed, most institutions will have to rely on some measure of external assistance in order to remain functional as centers of knowledge. It should be noted, however, that ICTs raise the operating costs of the institutions, even as they improve their efficiency and effectiveness. If new sustainable financing mechanisms are not found, then external support for ICTs could increase an institution's dependency.

3. VARIABLES FOR THE ASSESSMENT OF ICT MATURITY IN AFRICAN UNIVERSITIES

Given the above obstacles and experiences the WGE concluded that there is need for a concerted effort to build capacity of higher education institutions in Africa in the use and application of ICT. Each institution must be able to assess its current situation with regard to its capacity to use ICT in teaching and learning, research outreach and professional services, as well as to achieve internal administrative efficiency. Success in achieving such an objective will allow the institution to realize its potential to participate in the global knowledge-driven economy. For this purpose the WGE identified relevant sets of variables for each of nine areas of assessment. It is expected that this framework will be used by each institution as an internal assessment questionnaire. The variables are described below:

1) Planning and Monitoring Tools

Effective institution-wide application of ICT starts with proper planning. A major indicator of ICT maturity is the way in which the ICT planning and monitoring function has been formalized. In this respect it should be stressed that important outcomes of the information policy planning process are the resulting plan and the planning process itself: the latter aids in creating awareness and consensus which are absolutely necessary for the effective implementation of the Information Policy Plan (IPP). The IPP should be directly linked to the institution's strategic priorities. As such an IPP can either be part of the university strategic plan, or be derived from it in the form of a separate plan. In those cases where the IPP only contains ICT priorities and high-level guidelines, their implementation may be further specified in an Information Master Plan and Information Services Project Plans. Variables to be used in the assessment are:

- ❑ Availability of University Strategic Plan
- ❑ Availability of Information Policy Plan derived from the Strategic Plan
- ❑ Availability of Information Master Plan based on the Information Policy Plan
- ❑ Availability of Information Services Project plans

Important aspects in each of these plans are how explicit they are , and whether or not they are shared by the institution's stakeholders.

2) Application of ICT to Teaching and Learning

Teaching and Learning is one of the core processes of higher education. If ICT tools are to improve institutional effectiveness and efficiency, it is obvious that their application in support of teaching and learning should be seriously considered. However, investments in this area should always be carefully balanced against other ways in which teaching and learning may be improved and strengthened! ICTs are used in this field to:

- provide basic computer literacy skills in general;
- provide basic computer literacy skills specific to respective academic disciplines;
- improve student motivation;
- improve access to remote resources;
- improve communication skills;
- improve higher order thinking skills;
- provide content (e.g. CD-ROM's, web);
- support teaching methodology (e.g. group work tools for group assignments on the Intranet);
- improve course management (both in the regular curriculum and in distance education); and
- collaborate in online teaching and learning functions with other faculty and students from around the world.

For each of these it is important to assess their availability and the quality and extent of use by students and faculty.

3) Application of ICT in Research

Research is another core business of the university. Traditionally, ICT was used in this area to analyze data. These days the use of the Internet to locate data, exchange data, and disseminate data between researchers is becoming increasingly important. Distance research collaboration has been made possible using ICT, with virtual laboratory technology making it possible for researchers located in different geographical regions to participate in joint projects.

- ICT is used in research:

- as a research tool (statistical packages, simulation software, etc.);
- to collect academic information (e.g. web, discussion groups, on-line catalogues, etc.);
- to disseminate academic information (e.g. web, electronic publishing houses, etc.)
- to collaborate with other researchers worldwide;
- to 'advertise' research plans and efforts to create networks and to find donors and resources on the web.

4) Application of ICT in Academic Information Services (Library)

The traditional library is soon becoming a thing of the past. With much more, often cheaper and more up-to-date academic information available on the Internet, libraries are faced with an immense challenge. Their capability to transform themselves into forward looking, service-oriented academic information processing units will determine their chance to survive. For each of variables listed below it is important to assess their availability and the quality and extent of use by both students and staff:

- On-line public access catalogue (OPAC):
 - available in the library
 - available on campus (through campus network)
 - available on the Internet
- If library is linked to campus network
 - access for library staff
 - access for academic staff
 - access for students
 - access for external clients
- If library is linked to Internet
 - access for library staff
 - access for academic staff
 - access for students
 - access for external clients
- Academic information-provision services of the library:

- provide academic information (e.g. journals) through CD-ROM's
- provide academic information through the Intranet
- provide access to virtual libraries
- provide electronic documentary delivery
- Academic information-collection services of the library:
 - assist students in collecting information on the web
 - assist staff in collecting information on the web
 - assist students in using subject-based information gateways
 - assist staff in using subject-based information gateways
- Academic information-dissemination functions of the library:
 - electronic publishing of research outcomes, theses, etc. on Intranet
 - electronic publishing of research outcomes, theses, etc. on Internet.
- Provide training for academic information retrieval on the web:
 - to staff
 - to students
 - to the public

5) Application of ICT in Administration and Management

Under pressure by a variety of audiences to be accountable and transparent, administrators need to be strengthened in their ability to use ICTs to maximize efficiency and accuracy.

ICT is being applied in:

- personnel/human resources management
- student administration
- financial system
- assets and maintenance
- communication (e.g. e-mail)
- office automation
- supporting management decisions

6) ICT Infrastructure

The ICT infrastructure is the basis on which all other ICT applications run. As such the following variables are to be used in the assessment:

- Type of infrastructure:
 - stand alone computers
 - Local Area Networks (LANs)
 - campus-wide backbone connecting LAN's
 - multi-campus backbone connecting LAN's

- Type of carrier technology:
 - VSAT
 - wireless radio
 - fiber-optic
 - unshielded Twisted Pair (UTP)
 - coaxial

- Providing the following functionality:
 - e-mail
 - internet/web access
 - conferencing/group work tools
 - video

- Accessibility:
 - computer-student ratio
 - computer-staff ratio
 - organization of access (free vs. regulated)

- Actual use (as compared to accessibility):
 - staff use (average hours per week)
 - student use (average hours per week)
 - number of staff accounts
 - number of student accounts

- Operating system:

- freeware
- proprietary

7) ICT Organizational Support (Infrastructure)

As with the technical infrastructure, the organizational infrastructure determines the success or failure of ICT application in higher education institutions. Some relevant issues are: defining responsibilities at strategic, tactical, and operational levels; matching responsibilities with mandates; and involvement of top-management in case of conflicts between ‘users’ and ‘technical staff’. Variables to be used for the assessment include the following:

- Committees/units available with some or all the following mandates:
 - define and monitor institution-wide ICT policies and standards;
 - carry responsibility for management and maintenance of the shared ICT infrastructure;
 - consider ICT users’ needs;
 - support administrative units in use of information systems;
 - support academics in the development and application of ICT-based teaching and learning materials; and
 - support academics in the use of ICT tools for research.

- Support responsibilities:
 - centrally available;
 - decentralized in users’ units and departments;
 - availability of primary and secondary line support structures;
 - define support services in the form of Service Level Agreements.

- Staff in the following technical ICT areas:
 - network management
 - administrative system analysis and design
 - Intranet and internet application development
 - database management
 - hardware maintenance and repair
 - help desk

- Staff in the following ICT functional areas (within the user organizations):

- systems administration (e.g. library and archives system, finance, student registration system, human resources, etc.)
 - systems maintenance and control (e.g. library and archives system, finance, student registration system, human resources, etc.)
 - primary system of user support
- Staff for online teaching and learning
 - system administrator for online courses
 - instructional technology (to combine pedagogy with technology)
 - primary system of user support

8) ICT financing

Closely linked to organizational and technical sustainability is the issue of ICT financing. Insufficient insight in (long-term) ICT costs and failure to match responsibilities with financial mandates are potential areas of weakness. Variables to be used in the assessment are:

- Availability of separate ICT budget
- ICT budget votes with specific provisions for the following:
 - hardware acquisition (for upgrading or replacing existing system)
 - software acquisition (for upgrading or replacing existing system)
 - hardware depreciation
 - software license fees
 - hardware maintenance
 - system development
 - ICT technical staff training
 - ICT user training
 - ICT staff salaries
 - communication fees (ISP, bandwidth)
- ICT budget allocations:
 - fully centralized
 - fully decentralized
 - mixed

9) Training, Research and Development in ICT

Variables to be used in the assessment include:

- Training for ICT human resources development
 - short courses
 - certificate courses (e.g.. professional certification)
 - diploma courses
 - undergraduate
 - graduate

- Research on ICT
 - basic research
 - applied research
 - ICT policy development
 - collaborative research (networking, virtual laboratory, etc.)

- ICT Design and Development
 - software development
 - hardware development
 - network development

4. GUIDELINES FOR INSTITUTIONAL SELF-ASSESSMENT OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) MATURITY

ICT maturity is defined here as the ability of an institution to identify its current ICT profile; to define its objectives for integrating ICT in teaching, learning and research, for providing academic information services, and for efficiently carrying out institutional administration and management; and to plan for ICT resources accordingly.

The assessment of ICT maturity can be used by higher education institutions to accomplish the following:

1. Set benchmarks and goals—Institutions can use this tool to identify their current ICT profile and set goals for the future as part of the institution's strategic planning. They can use it to determine funding priorities. They can also use it to determine where funds are needed to fill gaps.
2. Apply for grants and fundraise--Institutions can use this tool to identify the institution's ICT maturity level (profile and objectives) when applying for technology related grants;
3. Create new assessment tools -- Institutions can use the assessment of ICT maturity tool as a basis for constructing their own institutional technology assessments.

Determination of Institutional ICT Maturity

This assessment of ICT maturity tool is a guide, not a definitive measure, of an institution's effectiveness in planning for ICT resources and in integrating ICT in teaching, learning and research; academic information services; and administration and management. The tool suggests looking at nine (9) sets of variables under five (5) stages of ICT development. Depending on the variable an institution may fall within a wide range of ICT development. Such mixed results are to be expected since this tool is intended to be a guide. The following steps are suggested:

1. The assessment should be conducted by the leadership of the institution. The assessment could be done within each faculty or school or department (especially if there is a wide range of variation) and then aggregated to show a profile for the whole institution.
2. For each column in the matrix, find the box that most accurately describes the faculty or school or department.
3. After determining where the faculty or school or department falls compare the variables with the ones listed in the column for the invention stage (which represents an ideal scenario).
4. Read the corresponding explanation for all the nine sets of variables for each of the five stages of ICT development.
5. Use the findings to start discussions with the institution's leadership, faculty, staff, and students.
6. Write up the findings and the next steps, including benchmarks and goals for ICT integration, to provide a base against which to assess whether the institution is achieving its ICT goals and objectives.

Matrix of Variables by Stages of ICT Development

Stages

The guidelines offered in this chapter for the institutional self-assessment are framed as matrices that relate each variable to each of the five stages of technological development which are described below:

1. **entry** stage: institutions create awareness and teach staff and students to use the technology.
2. **adoption** stage: institutions use technology to support traditional instruction.
3. **adaptation** stage: institutions use technology to enrich curriculum.
4. **appropriation** stage: institutions integrate technology and use it for its unique capabilities.
5. **invention** stage: institutions develop entirely new learning environments that use technology as a flexible tool; learning becomes collaborative, interactive, and customized.

Variables

The following nine (9) sets of variables have been defined in chapter 3. They will be used in the matrix for assessing an institution's capacity at each stage of ICT development:

1. Planning and monitoring tools: availability of university strategic plan, derived information policy plan, derived information master plan, and derived information project plans.
2. Application of ICT in teaching and learning: teaching objective for using ICT, professional development of academic (teaching) staff, technology access and usage patterns of academic staff, and technology access and usage patterns of students.
3. Application of ICT in research: research objective of academic staff and students for using ICT.
4. Application of ICT in academic information services (library): extent of access to online public access catalogue, services in academic information management, and training in academic information management.
5. Application of ICT in administration and management: extent of ICT application for administration and management functions.
6. ICT infrastructure: type of infrastructure as well as accessibility and usage patterns.
7. ICT organizational (support) infrastructure: staff responsibilities in technical as well as functional areas.
8. ICT financing: funding for ICT internally and via fundraising; with distinction within budget votes or budget line items.
9. Training, Research and Development in ICT: training for ICT human resources development (workforce and leaders).

Set 1: Planning and Monitoring Tools

Relevant variables

- Availability of University Strategic Plan
- Availability of derived Information Policy Plan
- Availability of derived Information Master Plan
- Availability of derived Information Project plans

Important aspects in each of these plans include how explicit they are and how widely institutional share holders share them.

Suggested matrix for assessing planning and monitoring tools using the characteristics of each stage

Planning and monitoring tools	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
University strategic plan	Minimal; limited goals, not explicit; not shared/known by various stakeholders	Some; clear goals; ICT may be mentioned as a means to improve efficiency of administrative and management support processes	Continuous improvement. ICT mentioned as a means to improve overall information provision	Vision for meeting expanding goals. ICT is identified as one of the institution's strategic resources	Strategic planning. ICT is identified as a resource to gain market share and/or change the institution.
Information Policy Plan	Minimal; limited goals; emphasis on hardware (computers) instead of the institution's application, no link to institutional priorities	Some; clear goals; emphasis on improving efficiency of administrative procedures through administrative systems	Continuous improvement; emphasis on communication, sharing of information, integration, networks; building up of ICT support structure; separate ICT budget	Vision for meeting expanding goals is built around information & communication services, related to core business, as a catalyst for reform	Information policy planning around information and communication services for dynamic growth of the institution: document often integrated with University Strategic Plan
Information Master Plan	Minimal; limited goals; basically a hardware acquisition and installation plan defined and executed by technicians	Some; clear goals; basically a system selection and installation plan defined and executed by technicians together with some users	Continuous improvement; attention for (network) infrastructure, systems, ICT support structure, ICT budget defined mainly by users, executed by both technicians and users	Vision for meeting expanding goals is built around information and communication services to improve teaching, learning and research; to	Information planning around ICT for dynamic growth of the institution; ICT master plans often at decentralized level, within

				increase decentralization and accountability as a catalyst for reform; top-management is ICT change agent	boundaries of institutional ICT guidelines
Information Project Plans	Minimal; limited goals; not available	Some; clear goals; separate software installation plans	Continuous improvement; projects aiming to improve various services through the use of ICT as a tool (technology not an aim in itself anymore)	Vision for meeting expanding goals is built around technology as a catalyst for reform; ICT as part of process redesign.	Information planning around technology for dynamic growth of the institution; ICT applied in new and innovative ways; ICT innovation projects instead of development projects.

Set 2: Application of ICT in Teaching and Learning

Relevant variables

- Teaching objective for using ICT
- Professional development of academic staff
- Technology access and usage patterns of academic staff
- Technology access and usage patterns of students

Suggested matrix for assessing application of ICT in teaching and learning using the characteristics of each stage

ICT in teaching and learning	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Teaching objective for using ICT	To provide basic skills in ICT tools and applications	To use technology for traditional teaching (e.g. drill and	To use ICT for increased learning relevant to respective	To accomplish a variety of instructional and management goals (e.g. group	All teachers select, use and evaluate ICT tools as needed:

		tutorial)	academic disciplines (e.g. use of word processors for student writing)	work tools for group assignments on the Intranet)	to create lesson plans and communicate and collaborate with students, peers, experts, parents and community.
Professional development of academic staff	Content of training for academic staff is on how to use basic technology tools and applications	Content of training for academic staff is on how to use basic technology tools and applications plus limited introduction to the Internet	Content of training includes how to use ICT for presentation	Content of training includes how to integrate technology into the curriculum and how to use technology for classroom management	Subject of training is customized to the needs of individual academic staff
Technology access and usage patterns of academic staff	-Most academic staff do not have access to appropriate technology in the institution's work areas -A few academic staff use technology to enhance personal productivity - Technology used as substitute for manual work	-Some academic staff have access to appropriate ICT in the institution's work areas -Some academic staff use ICT sporadically as an add-on, supplementary educational tool -Internet use is limited and sporadic	-Most academic staff have access to appropriate ICT in the institution's work areas -Most academic staff use ICT for chat rooms, threaded discussions, etc with colleagues and for interacting with students	-Most academic staff have access to appropriate ICT in the institution's work areas -Most academic staff use ICT to develop teamwork, communication and problem solving skills of students -Most academic staff use ICT for online course management	-All academic staff have access to appropriate technology in the institution's work areas -All academic staff select, use, and evaluate information technology tools as needed -Technology is fully integrated into the curriculum and changes process of teaching and learning.
Technology access and usage patterns of students	-Most students do not have access to	-Some students have access to ICT -Mastery of	-Greater information resources available	-Greater access to information resources available for	-Universal access to greater information

	ICT -Students learn how to be computer literate	basic skills through drill and tutorial software	through the Internet and CD-ROM but constricted due to lack of access -Most students use ICT for chat rooms, threaded discussions, etc	research and education -Most students use ICT to develop teamwork, communication, and problem solving skills -Most students demonstrate improved higher order thinking and research skills	resources available for research and education from Internet -Student-centered authentic project-based learning -Most students demonstrate improved higher order and thinking skills
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Set 3: Application of ICT in Research

Relevant variable

- Objective of the application of ICT by academic staff and students

Suggested Matrix for assessing application of ICT in research using the characteristics of each stage

ICT in Research	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Objective of the application of ICT by academic staff and students	-To aid “non-interactive” research (e.g. statistical packages, simulation software, etc.)	-To collect academic information (e.g. web, discussion groups, on-line catalogues, etc.)	-To disseminate academic information generated by academic staff and students (e.g. web, electronic publishing houses, etc.)	-To collaborate with other researchers worldwide -To 'advertise' research plans/efforts	-To create research networks

Set 4: Application of ICT in Academic Information Services (Library)

Relevant variables

- Access to On-line public access catalogue (OPAC)
- Provision of services in academic information management
- Provision of training in academic information management

Suggested Matrix for application of ICT in academic information services (library) using the characteristics of each stage

Application of ICT in academic information services (library)	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Provision of on-line public access catalogue (OPAC)	Available in the library. Access for library staff only.	Available in the library and available on campus (through campus network). Access for library staff plus access for academic staff.	Available in the library, available on campus and available on the Internet. access for library staff plus access for academic staff plus access for students		
Provision of services in academic information management	Through CD-ROMS only	Through CD-ROMS, plus through the Intranet, plus -assist staff in collecting information on the web plus -assist staff in using subject matter information gateways	Through CD-ROMS, plus through the Intranet plus through the Internet -assist staff and students in collecting information on the web plus -assist staff and students in using subject matter information gateways	Electronic publishing of research outcomes, theses, etc on the Intranet	Electronic publishing of research outcomes, theses, etc on the Internet
Provision of training in academic information management	Library staff only	Library staff and Academic staff	Library staff Academic staff Some Students	Library staff Academic staff All Students	Library staff Academic staff Students Public

Set 5: Application of ICT in Administration and Management

Relevant variable

- Extent of ICT applications in administration and management functions

Suggested Matrix for the Application of ICT in administration and management using the characteristics of each stage

Application of ICT in administration and management	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Extent of ICT isolation	Stand-alone, isolated systems, automation of tasks Internal communication (e.g. e-mail)	Isolated systems, automation of procedures -Assets and maintenance	Automation of processes/functions (e.g. administration)	Integrated automation of functions	ICT to do things that before were not possible, e.g. financial decentralization and keeping central control; merger of multi-site institutions; manage global distance education programs, etc.

Set 6: ICT Infrastructure

Relevant variables

- Type of infrastructure
- Type of carrier technology
- Type of functionality provided
 - e-mail
 - internet/web access
 - conferencing/group work tools
 - video
 - full multi-media
 - on-line teaching, learning, research

- Type of Internet connectivity
 - Dial-up to local ISP
 - Dedicated PSTN line
 - Wireless connection to PoP
 - Low bandwidth connection $\leq 64\text{kbits/s}$
 - Medium bandwidth between 64kbits/s and 128kbits/s
 - High bandwidth $> 128\text{kbits/s}$

- Accessibility:
 - Computer-student ratio
 - Computer-staff ratio

- Actual use (as compared to accessibility):
 - Staff use (average hours per week)
 - Student use (average hours per week)
 - Number of staff accounts
 - Number of student accounts

- Operating system:
 - Freeware
 - Proprietary

Suggested matrix for assessing ICT infrastructure using the characteristics of each stage

ICT infrastructure	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Type of infrastructure	-Stand alone computers	-(Various) Local Area Networks	-Campus-wide backbone connecting LAN's	-Multi-campus backbone connecting LAN's	
Type of carrier technology:	Reliance on PSTN lines alone	Wireless radio UTP Coaxial	VSAT	Fibre optical cables	Combination of various technologies, including emerging technologies
Type of functionality being provided	-e-mail only	-e-mail -plus internet/web access	-e-mail -internet/ web access -plus	-e-mail -internet/web access -conferencing/	-e-mail -internet/ web access conferencing

			conferencing/group work tools	group work tools -plus video	/group work tools -video
Accessibility	-Computer-student ratio (low or specify numbers) -computer-staff ratio	-Computer-student ratio -computer-staff ratio	-Computer-student ratio (medium) -computer-staff ratio	-Computer-student ratio -computer-staff ratio	-Computer-student ratio (high or specify optimal student ratio) -computer-staff ratio
Actual use (as compared to accessibility): -Staff use average hours per week -Student use average hours per week	-Low for staff -almost unavailable to students	-Low for staff -low for students	-Medium for staff -low for students	-Medium for staff -medium for students	-High for staff -high for students
Operating system	-Windows OS	-Windows NT for networks	-Linux OS including its use for networking	-Web design languages, e.g. html, JavaScript, Java and other object oriented languages	

Set 7: ICT Organizational (support) Infrastructure

Relevant variables

In general, the more explicit tasks and responsibilities are, the more mature the support infrastructure. Thus, a small but mature institution may do all the things under appropriation, but with only a limited number of staff.

- Presence of committees/units
- Support responsibilities
- Staff in the following ICT technical areas:
 - network management
 - administrative system analysis and design
 - Intranet and Internet application development
 - Database management

- hardware maintenance and repair
 - help desk
- Staff in the following ICT functional areas (within the user organizations):
- Systems administration (e.g. library and archives system, finance, student registration system, human resources, etc)
 - Systems maintenance and control (e.g. library and archives system, finance, student registration system, human resources, etc)
 - Primary system of user support
- Staff for online teaching and learning
- System administrator for online courses
 - Instructional technology (to combine pedagogy with technology)
 - Primary system of user support

Suggested matrix for assessing ICT organizational (support) infrastructure using the characteristics of each stage

ICT organizational (support) infrastructure	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Committees/units available with some or all of the following mandates (read across):	None	-Carry responsibility for management and maintenance of the shared ICT infrastructure	-Support administrative units in use of administrative systems -Consider ICT users' needs	-Support academics in the development and application of ICT-based teaching and learning materials -Support academics in the use of ICT tools in research	-Support students in the use of ICT tools in learning and research
Support responsibilities:	Individual 'ICT champions' only	Centrally available	-1st and 2nd line support structure	-Define support services in the form of Service Level Agreements	
Staff in the following technical ICT	-Network management only	-Network management plus	-Network management -administrative	-Network management -administrative	

areas:		-administrative system analysis and design	tive system analysis and design -plus Hardware maintenance and repair and -Database management	system analysis and design -hardware maintenance and repair -database management -plus Intranet and Internet application development and -help desk	
Staff in the following ICT functional areas (within the user organizations) :	-Systems administration only (e.g. library and archives system, finance, student registration system, human resources, etc)	-Systems maintenance and control (e.g. library and archives system, finance, student registration system, human resources, etc)	-1 st -line user support	-System administrator for online courses instructional technology (to combine pedagogy with technology) 1 st -line user support	

Set 8: ICT Financing

Relevant variables

- Funding for technology internally and via fundraising
- Extent to which ICT budget votes are distinguished

Suggested matrix for assessing ICT financing using the characteristics of each stage

ICT Financing	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Funding for technology internally and via fundraising	-No budget line item -limited investment -limited grants and fundraising	-Budget below most campus programs	-Modest budget line item -growing investment -priority given to ICT	-Equals most campus programs -targeted fundraising	-Continuous investments -aggressive fundraising
Extent to which ICT	-No distinctions	-Budget distinctions	Budget distinctions	Budget distinctions	Budget distinctions

budget votes are distinguished	made	only for -hardware acquisition -software acquisition -software license fees -communication fees (ISP, bandwidth)	include: -hardware acquisition -software acquisition -software license fees -communication fees (ISP, bandwidth) PLUS -hardware maintenance -system development -ICT staff salaries PLUS -ICT technical staff salaries	include: -hardware acquisition -software acquisition -software license fees -communication fees (ISP, bandwidth) PLUS -hardware maintenance -system development -ICT staff salaries PLUS -ICT technical staff training	include: -hardware acquisition -software acquisition -software license fees -communication fees (ISP, bandwidth) PLUS -hardware maintenance -system development -ICT staff salaries PLUS -ICT technical staff training -ICT user training
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Set 9: Training, Research and Development in ICT

Relevant Variables

- Training for ICT human resources development
- Research on ICT
- ICT design and development

Suggested matrix for assessing Training, Research and Development using the characteristics of each stage

Training, R&D in ICT	Entry Stage	Adoption Stage	Adaptation Stage	Appropriation Stage	Invention Stage
Training for ICT human resources development	-Short courses (sporadic)	-Short courses -plus certificate courses	-Short courses -certificate courses -plus diploma courses	-Short courses -certificate courses -diploma course -plus undergraduate degrees	-Short courses -certificate courses -diploma course - undergraduate degrees -plus graduate degrees
Research on ICT	-Training provided on research on ICT	-Basic research	-Basic research -plus applied research	-Basic research -applied research -plus ICT policy development	-Basic research -plus applied research -ICT policy

					development -plus collaborative research (e.g. networking, virtual laboratory, etc.)
ICT design & development			-Software developmen t	-Software development -plus hardware development	-Software development -hardware development -plus network development

CHAPTER 5 - CONCLUDING REMARKS

This study has tried to provide a guide for African universities to individually conduct a self assessment of their general capacity to use ICT's effectively to enhance teaching, promote learning, conduct research, and manage their institutions. The result of the assessment should feed directly back into the university's strategic planning process, which in itself is key to realizing the university's vision for development and revitalization. The summary of the discussions held by African scholar's via an electronic forum in April 2000 on key issues is available through the Association of African Universities. Those discussions identified the critical components that would need to be in place in an African university for it to achieve effective capacity for the utilization of ICT's.

The study suggests that a university's technological maturity and level of infrastructural development to utilize ICT's effectively should be determined by examining the institution's competence in nine key areas which together characterize the application of ICT's for academic and institutional management purposes. Five stages of development have been identified and described to capture the natural growth pattern of technological capacity and expertise. For each of the nine assessment areas key variables have been suggested. These are to be individually matched against the characteristics of the corresponding five stages of development. The result would locate the technological stage that best represents the university's capacity in that area.

The set of nine matrices presented in this report offers a practical and reliable means of assessing the parameters that will help a user institution determine it's level of development in this field. It is quite possible that an institution would find itself at different stages of development in the nine assessment areas. Such a finding will help the institution to recognize a potential skewness in its efforts and strategies, and to respond accordingly in order to optimize its opportunities. The finding will also help the institution to continuously review its priorities in ICT development and funding.

In presenting these matrices to guide self assessment of an institution's ICT maturity no global rating system has been proposed, as no universally

applicable point-scoring comparison is possible. An institution using this tool kit as a guide will therefore rely on its own perception of what stage of development it has achieved in any of the assessment areas. This ranking is best arrived at by consensus of appropriate evaluators who will examine the availability, quality, extent of use etc. of the applicable variables in order to determine how well (or otherwise) the institution's overall performance in that area meets expectation or fulfills the institution's needs.

The report has suggested that an appropriate process for the self assessment requires that the exercise be conducted first within each faculty, school, or department of the institution (especially if there is a wide capacity variation among them), and the profile for each area of assessment be aggregated to characterize the institution. As noted earlier in the report, the main purpose of the study is to guide, encourage, and facilitate the establishment of institutional arrangements that can help African universities and their stakeholders understand the challenges and opportunities of ICT applications in academic settings, and thus make prudent investments in this field to maximize the benefits of technology.

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