SATN

South African Technology Network

Cape Peninsula University of Technology

Central University of Technology, Free State

DURBAN UNIVERSITY of TECHNOLOGY

A Leading University of Technology in Africa

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We empower people

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POSITION, ROLE AND FUNCTION OF UNIVERSITIES OF TECHNOLOGY IN SOUTH AFRICA

March 2008

UNIVERSITIES OF TECHNOLOGY IN SOUTH AFRICA

POSITION, ROLE AND FUNCTION

CONTENTS

BACKGROUND TO THIS BOOK

At the bi-annual meeting of the now defunct Committee of Technikon Principals (CTP) held in Plettenberg Bay in November 2000, CTP agreed that 'the time was right to continue with discussions started in 1997 and once again consider the issue of "universities of technology' (UoTs)".

The Executive Committee of CTP was requested to appoint a task team to draw up a position paper on 'UoTs' In SA and to 'develop criteria for classification/categories of such universities in the light of the opportunities afforded by the CHE Size & Shape Report (2000) including, inter-alia philosophy, ethos, research focus, the adult market and centres of excellence.'

At a meeting of the Executive Committee of the CTP on 23 November 2000, effect was given to this decision and a task team was appointed, representing as broadly as possible the spectrum and varied interests of the technikon sector. Members of this CTP Task Team were:

Prof DJJ van Rensburg	-	Technikon Pretoria (Chair)
Dr D Moore	-	Technikon Southern Africa
Prof A S Koorts	-	Technikon Free State
Prof Q T Mjoli	-	Eastern Cape Technikon
Prof R H du Pré	-	Executive Director, CTP

The position paper and supporting background documents were developed and completed during January 2001 in preparation for discussion at the CTP Strategic and Information Workshop in February 2001. This document was intended to petition the Department of Education to consider changing the name 'technikon' to that of 'university of technology (UoT)'.

In October 2003, Prof Kader Asmal, Minister of Education announced that technikons would be redesignated 'UoTs'. Other technikons would merge with universities to form comprehensive universities. In February 2004, CTP Exco requested that its academic subcommittee, the Committee for Tutorial Matters (CTM) form a task team to revise the document to clearly spell out the position, role and function of UoTs in the South African context. Members of the CTM Task Team were:

Prof R H du Pre	-	Vaal University of Technology (Chairperson)
Prof A Staak	-	Peninsula Technikon
Prof E Tyobeka	-	Technikon Witwatersrand
Prof P van Eldik	-	Tshwane University of Technology
Prof L Lategan	-	Central University of Technology
Dr T Mpako-Ntusi	-	Border Technikon

This revised document therefore reflects the combined contributions of the members of both task teams, as well as input by members of CTP and CTM. The book sets out broad, general and specific guidelines which technology higher education institutions can use to develop their own planning documents. Regional collaboration is also a prerequisite for the successful transition to, and establishment of UoTs in South Africa.

Committee of Technikon Principal (CTP) at its final general meeting in November 2004 had agreed on the establishment of a "technology network" along the lines of the Australian Technology Network (ATN) to carry on the work of the CTP and Committee for Tutorial Matters (CTM) within the new UoT setup – i.e. to provide for a network to ensure the continuation of the process of co-operation, collaboration, support and joint activities such as joint curriculum development, applied research, quality assurance, cooperative education, etc. At the time CTP considered it first prize to have the technology network established and situated within the new envisaged Higher Education South Africa (HESA) structure. However it was reported to CTP at the time that the joint committee to merge CTP and South African University Vice-Chancellors' Association (SAUVCA) was not eager to accommodate such a request because of their desire to ensure that interest groups were not entrenched within the new body, with the potential of creating fractures before the new body had moulded into a united structure. Because the joint working committee was not willing to accommodate a technology network within HESA, it was decided that the SATN be formed outside of HESA, but not in competition with HESA and that its work and activities will feed into the structures of HESA. The CTM subsequently drafted a proposed framework for such a network.

During the Council for Higher Education (CHE) workshop on UoTs held on Thursday, 22 September 2005 at the Tshwane University of Technology, a resolution was passed to effect the establishment of such a network under the name of the South African Technology Network.

A founding meeting was held on 2 June 2006 at Cape-Peninsula University of Technology (CPUT), Cape Town to formally establish a technology network, and to set up the envisaged structures as outlined in the framework document. Each of the six South African UoTs was represented by either the Vice-Chancellor or Deputy Vice-Chancellor or both.

In November 2006 the five participating institutions agreed to provide seed funding for establishing the South African Technology network

In June 2007 the South African Technology Network (SATN) Secretariat was established. The SATN Trust was registered and the Board of appointed trustees de facto replaced the former Committee of Technikon Principals (CTP).

SATN BOARD OF TRUSTEES

Prof Roy du Pré
Vice-Chancellor and Principal
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Dr David Phaho
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Prof Duma Malaza
Chief Executive Officer
Higher Education South Africa (HESA)

Prof Mbudzeni Sibara
Head of the Merger Unit, Higher Education Branch
National Department of Education

The SATN was established in order to

- promote the development of national education and training policies in accordance with the nature and character of the UoTs
- represent the UoTs at international level
- promote mobility and employability of UoT students
- promote academic quality by building strong UoTs
- promote relevant research and development and to assist with the transfer of appropriate technologies
- promote co-operation between theUoTs and commerce and industry
- promote UoTs as a national asset

Please visit our website at http://www.satn.co.za for more information about the SATN.

A number of project committees have been established to attend to specific issues pertaining toUoTs. The members of the project committee have been appointed by the respective vice-chancellors

1) Curriculum Project Committee
2) Research Output Project Committee
3) Status of University of Technology Concept Project Committee
4) Benchmarking and Criteria for a University of Technology (Typology of UoTs) Project Committee
5) Information Technology Project Committee
6) Work Integrated Learning Project Committee

7) Data Sharing Committee Project Committee
8) Internationalisation Project Committee

The different Project Committees of the SATN commenced their work on different aspects like the identity and characteristics of UoTs. Some of the work completed by these committees has been included in this book.

ABBREVIATIONS

CHE	Council on Higher Education
CPUT	Cape Peninsula University of Technology
CTM	Committee for Tutorial matters
CTP	Committee of Technikon Principals
CUT	Central University of Technology
DoE	Department of Education
DST	Department of Science and Technology
DTI	Department of Trade and Industry
DUT	Durban University of Technology
EU	European Union
FETC	Further Education and Training Certificate
HESA	Higher Education South Africa
HEQC	Higher Education Quality Committee
HEQF	Higher Education Qualifications Framework
JET	Joint Education Trust
MUT	Mangosutho University of Technology
NACI	National Advisory Council on Innovation
NCHE	National Commission on Higher Education
NEPI	National Education Policy Initiative
NPHE	National Plan for Higher Education
NRF	National Research Foundation
NWG	National Working Group
R&D	Research and Development
RPL	Recognition of Prior Learning
SADC	Southern African Development Community
SAQA	South African Qualifications Authority
SATN	South African Technology Network
SMME	Small Medium and Micro Enterprises
SAUVCA	South African Universities Vice-Chancellors Association
THRIP	Technology and Human Resources for Industry Programme
TUT	Tshwane University of Technology
VUT	Vaal University of Technology

SECTION 1

INTRODUCTION

1.1 THE INCREASING DEMAND FOR HIGHER EDUCATION

There are powerful forces driving an increasing societal demand for higher education services in South Africa. The challenge as set out in the 2001 National Plan for Higher Education is to increase the participation rate in higher education from 15% to 20% within ten years. These additional students will have a severe impact on our current system. But beyond the needs of a growing higher education population, there are even more fundamental forces at work that will almost certainly affect the scope and focus of higher education in South Africa.

As we move further into the age of the knowledge economy, the workforce will require more sophisticated education and training to sustain its competitiveness. The need and demand for advanced education and learning opportunities will grow rapidly. Increasingly, the education and skills[1] of individuals are seen as the key to both their personal quality of life and the broader strengths of their society. Furthermore, the need for ongoing education of the existing workforce has created a rapidly growing market for adult education.

People have always looked to education as the key to prosperity and social mobility. But now, more than ever, people see education as their hope for leading meaningful and fulfilling lives. One's level of education has always been a primary determinant of one's economic well-being. Today this may still be the case, but the fact that the market-place is being flooded with people with degrees, many of which are irrelevant to the market-place, will lead employers to set additional criteria for gainful employment. Criteria such as relevance of knowledge and applicability of skills are increasingly becoming important determinants of employability. In fact a certificate of competency is in many cases more sought-after than a degree or other higher education qualification. Employers also want on-going training of staff. Thus, just as a high school certificate became the passport for participation in the industrial age, today, a higher education qualification which is relevant, provides transferable skills and ensures competency, will become the key requirement for economic security in the age of knowledge.

Diversity, quality and relevance of higher education qualifications are fast becoming the deciding factors. Clearly, a different type of institution is needed to take South Africa into the 21st century to meet the challenges outlined above. Such an institution will become an important player as far as the strength of our economy and competitiveness of our country are concerned.

1 The use of 'skills' in this document refers more to competencies, Le. the higher-level intellectual challenges of application and knowledge, in addition to the acquisition of knowledge; and not the lower level skills developed through repetition which do not require high level skills

1.2 VALUE AND UNIQUENESS OF UNIVERSITIES OF TECHNOLOGY

Although a unitary system, the diversity within South Africa's higher education system should form the basis of its strength. This diversity exists not only in the three main categories of higher education institutions in South Africa (viz, UoTs, comprehensive universities and traditional universities), but also within each of these three categories. Institutions such as 'UoTs', which specialise in making knowledge useful, will, alongside the traditional and comprehensive universities, constitute a dynamic and appropriate higher education system for South Africa. The difference in focus and ethos between UoTs and traditional universities will not only bring much wider variety and diversity into the higher education scene but also contribute meaningfully to greater innovation, technology transfer and international competitiveness.

Diversity is similarly fundamental to the ethos of a 'UoT'. Unless we draw upon a greater diversity of people as scholars and students, South Africa cannot hope to generate he intellectual vitality needed to respond to a changing world. The burgeoning complexity and rapidly increasing rate of change will force us to draw upon a broader breadth and depth of human knowledge and understanding. The inclusion of underrepresented groups will allow UoTs to tap reservoirs of human talent and experiences from which they have not yet fully drawn. Indeed, it is clearly apparent that UoTs will not be able to obtain and sustain high levels of growth and distinction in a pluralistic world society without diversity and openness to new perspectives, experiences, and talents. Although UoTs will provide access to higher education in terms of the entry requirements for the Further Education and Training Certificate (FETC), creative ways to identify latent talent should be explored, one being Recognition of Prior Learning (RPL).

1.3 CORE ACADEMIC FUNCTIONS OF UNIVERSITIES OF TECHNOLOGY

1.3.1 Shift in Emphasis

For decades, universities have defined academic quality in terms of inputs - student and faculty quality, resources, and facilities - rather than outputs such as student performance. Rethinking the core academic functions of a university requires a shift in perspective from resources to results. This turns the institutional focus from faculty productivity to student productivity; from faculty disciplinary interests to what students need to learn; from faculty teaching styles to student learning styles. It reconceptualises the university as learner-centred rather than faculty-centred. It grapples with the most fundamental processes, such as the way decisions are made, how information is shared, how students are taught, how students learn, how faculty staff work, how research is conducted, and how auxiliary enterprises are managed. The ethos of a UoT should also be defined along the above lines.

1.3.2 Provide Greater Learning Opportunities

UoTs should provide greater learning opportunities, i.e. what do students need to make them more skilled, more competent, more employable; be more employer-centred: provide constant upgrading through short courses; take the institution into the work-place; liaise regularly with employers to ensure that prospective employees receive a relevant education, etc.

1.3.3 Work-integrated Learning

Experiential Learning (work-integrated learning) was regarded as one of the key strengths of technikons. A UoT should find creative ways of drawing in employers to provide practical problems which students can solve during their training period.

1.3.4 Continuous Upgrading of Knowledge and Skills ('Just-in-Time' Education)

In a world of constant change, career education cannot provide sufficient knowledge to suffice for a substantial portion of a lifelong career. UoTs should become specialists in 'just-in-time' education - experts in providing a continuous upgrading of knowledge and skills:

This practical knowledge will be provided in variety of modules and variations in contact- and distance-learning programmes to graduates when and where they need it. Such 'just-in-time' education will in future become the trade-mark and strength of UoTs. Theoretically, both students and employers will know and be able to judge accurately the value of such programmes. They will be far more willing to pay tuition at levels that reflect the true cost and value and to associate in new and positive ways with the institution.

In a very real sense, learning, working and living will become increasingly interwoven, inseparable in character and content. In this new developing culture of learning, basic degree training as it now exists will be replaced by more instantaneous measures of knowledge and skill acquisition, and UoTs will have to provide leadership in this respect.' Re-skilling', 'up-skilling' and 'multi-skilling' activities will have to be creatively distributed over the careers and lifetimes of students, and in this process new and interactive relationships will have to be forged with local and international employers and knowledge providers. A greater sense of the 'public good' means that UoTs should lead the revolution from the paradigm of producing mechanical professionals who have little sense of the ethos of the 'public good.'

1.3.5 Social Engagement

UoTs should be seen as institutions with a greater commitment of service to, and upliftment of the community than has previously been the case with higher education institutions in South Africa. In the teaching, research and development undertaken, the upliftment and transfer of skills to the community are of paramount importance. Due to their focus on relevancy and applicable skills, many students will be able, while still studying, to render a valuable contribution to community training and upliftment. This form of 'service-learning' should be expanded and developed to allow students to play a meaningful role in the community service activities of a UoT. It is important to note that this form of 'service-learning' does not replace the experiential learning components of courses. Experiential Learning is, and should always be an integral part of a UoTs education programmes.

UoTs would not of course ignore issues that beset society such as HIV / AIDS, the chronic lack of basic necessities, wide-spread poverty, etc. Innovation, expertise and the use of technology should be used to find better methods and smarter ways of alleviating and addressing these issues. Higher

education institutions should solve societal problems together with communities, and not for communities. Short courses and learnerships will be key features of UoTs, especially designed to improve the livelihood of communities within and around the radius of a UoT.

Because a UoT is essentially a new institutional concept in the minds of most South Africans, clear definitions and criteria will not only manage the process of redesignation of technikons to UoTs, or the merger of technikons with universities to form comprehensive universities, but also to provide credibility to, and acceptance of the name.

1.4 CRITERIA AND DEFINITIONS OF A UNIVERSITY OF TECHNOLOGY

A UoT as a concept and institutional type is not new. Such institutions exist in many countries, for example, the Technical Universities and the Universities of Applied Sciences (Fachhochschulen) in Germany; Universities of Applied Technology in some countries in Europe; UoTs in Australia and Hungary; Universities of Applied Science and Technology in Iran; and the Institutes of Technology in the USA and Australia. While retaining a particular focus, each institutional type has developed according to its own unique environment and in response to local and international demands.

From an examination of the former technikon sector, it is evident that South Africa will have a wide spectrum of UoTs: some large, some small, some situated in highly industrialized areas, and others more rural. Depending on their size, capacity and location some will be dealing with national and international education and research issues, while others will have a more provincial or even local focus. Some will be doing research and development work with a national and international focus and relevance, while others will be dealing with problems in rural communities and smaller local businesses. The net effect will in all cases still be the same, namely, making knowledge useful, up-skilling, re-skilling, multi-skilling, coupled with responsive ness and relevance.

1.5 REASONS FOR ESTABLISHING UNIVERSITIES OF TECHNOLOGY IN SOUTH AFRICA

The binary divide which has existed for decades in the Higher Education sector is not in line with world trends. Previous White Papers and the 2001 CHE Report came out strongly in favour of a unitary, but differentiated system. So, within such a system, there can be a unitary system of universities, but differentiated in focus.

UoTs are characterised by the following:

- A strong corporate-orientation/focus;
- Service to industry and the community;
- Own characteristic roles and values;
- Relevance of programmes;
- Responsiveness to, and fulfillment of the needs of industry, community and society;
- Appointment of experts acknowledged by industry (not necessarily by academics);
- Strong attention to niche areas;
- Emphasis on scholarship, innovation and R&D to develop new technologies;

- Transfer of technology;
- Preparation of a new generation of knowledge workers. (E.g. work ethics, ability to work in multicultural teams, students-for-life, etc.)

The above makes a UoT a distinct and unique type of institution, markedly different from the traditional universities in South Africa today.

1.5.1 Implications for Technikons becoming 'UoTs'

The name 'technikon', a uniquely South Africa invention, was around for twenty-five years (1979-2004). It took a long time for the South African public to get used to the term, and in many quarters it only became acceptable and recognisable in the late 1990s. Because a technikon did not bear the name 'university', it was considered inferior to universities. Technikon graduates were not recognised by professional associations and the public service, and technikons were usually considered a second or third choice after universities.

With the onset of globalisation and the drive towards internationalisation, the name 'technikon' became a stumbling block - technikons were not known to, and recognised by international associations, professional bodies, government educational institutions and students. Membership of international university associations was denied, as technikons were not known as degree-awarding institutions of higher education.

UoTs can place themselves firmly in the minds of government, industry, parents and students as logical first choice institutions of higher education.

SECTION 2

THE IDEA OF A UNIVERSITY OF TECHNOLOGY

2.1 HISTORY

The history of universities can be divided into four stages. During the 12th - 14th centuries, the late medieval universities at Bologna, Parma, Paris and Oxford specialised in the training of professional clergy, lawyers and clerical and lay administrators, and could be regarded as vocational schools. The 15th - 19th centuries were characterised by education for the elite. Although the curriculum remained the same as that of the original vocational university, the function was not for training but for education. During the 19th century and up to the 1950s, knowledge was fragmented in the Cartesian reductionistic fashion in which one could isolate a very small domain of possible knowledge, and focus one's entire energy on it. The intellectual world became isolated from the world out there. Everything was done for the sake of knowledge. The notion of pure knowledge could of course not accommodate mundane technological enterprises, with the result that engineering, for example, was at first avoided and only included in the late 19th century.

The 1960s introduced a new era in the existence of universities. University life was characterised by economic growth that led to esoteric studies of an unthinkable number of subjects, as well as democratisation that led to open access and the opening-up of the social conscience of universities.

Although a lot could be learnt about universities when their history is studied, it does not give us an insight into the true nature of a university. Policy documents and reports are not helpful either. Reports such as the Van Wyk De Vries Commission (1974), the Committee of University Principal's (CUP) Investigation into Universities (1987), the National Plan for Higher Education (2001) and its forerunner the National Commission on Higher Education (NCHE) (1996a; 1996b), as well as planning documents such as the National Education Policy Investigation (NEPI) (1993), the Shape and Size Report (2000) and the Higher Education Act (Act 101 of 1997) and all its amended forms, do not give direction either. Much is said about what universities should be doing, but the justification why these tasks should be undertaken is virtually non-existent. Here too, the policy reports and their supportive documents fail to provide direction on what a university is.

2.2 WHAT IS A UNIVERSITY?

A university is a social structure that is organised in a logically disclosed reality with a view to that which qualifies it, namely scientifically-oriented research and teaching/learning. The university as a social structure is fused with a multitude of other social structures. In the light of this, the following definition of a university may be rendered: The University is an academic institution at which research is conducted and teaching and learning is offered within the organised cadre of the contact between lecturer and student, and supported by networking, cooperation and collaboration with external academic partners to create, develop and transmit new knowledge.

2.3 DEFINING A UNIVERSITY OF TECHNOLOGY

What makes a UoT different from any other university (compared to the classical concept of a university)? It is not the use of technology within a university, which classifies it as a technological university, but rather the interweaving, focus and interrelation between technology and the nature of a university which constitutes a technological university. At a technological university the focus is therefore on the study of technology from the viewpoint of various fields of study, rather than a particular field of study. With 'technology' is meant the human arrangement of nature with the help of tools for human purposes. TECHNOLOGY refers to the effective and efficient application of the accumulated know-how, knowledge, skills and expertise, that when applied, will result in the output of value-added products, processes and services.

In essence it is the know-how to fabricate things (this includes creating and developing new technologies). This concept finds its origin in the Greek word, techne, that means 'skill' or 'proficiency' and is also related to the words, episteme, meaning 'understanding and skill', and poeisis, that denotes 'working, creating,' and once again, 'skills'. Technology therefore straddles two issues: firstly the skill to fabricate things and, secondly, the skill to manage the fabricated products. The understanding of technology in this document is closer to the definition by UNESCO: ' ... the know-how and creative processes that may assist people to utilise tools, resources and systems to solve problems and enhance control over the natural and made environment in an endeavour to improve the human condition.' (UNESCO, 1985).

The aim of technology then is to improve the lives of human beings. In relation to a UoT it means that all teaching/learning programmes and research projects are related to technology. Technology is thus the qualifying factor inherent to all UoT academic activities. In practice this means that although in principle all academic programmes should be studied at a university, this might not be the case at a technological university due to the nature of the different fields of study. At UoTs then, Science, Engineering and Management should have top priority.

It is obvious that a UoT will differ from a general university. Brook (2000) provides a useful set of characteristics of a UoT:

- Research informed;
- Curriculum developed around the graduate profiles defined by industry and professions;
- Focus on strategic research, applied research into professional practice;
- Multi-level entry and exit points for students;
- Concerned primarily with the development of vocational/professional education;
- Technological capabilities as important as cognitive skills.

It is interesting to note (Klemm: 2004) that some ' classical' universities, such as Oxford and Cambridge, do not offer engineering, for example, as a course, as they don't consider engineering academic enough. To them, the basic subjects are physics, mathematics, chemistry, etc., and engineering is the application of the combined basic sciences, and not a subject for a highly-academic institution. These institutions only award BA degrees (no BSc or BCom degrees) so, graduates get a BA in Chemistry, for instance, showing skill in their chosen 'artform.' In contrast, technical universities around the world have economic advancement as their goal. They want to

make things that work, and produce students who can make it work and make money as well. The Oxbridge approach is to develop learning that makes mankind feel good; making money is not in the equation.

In today's world, it has become important to make technology productive, in other words, how to make money. Technology must make economic sense. Generally, science and engineering students come out of universities with little understanding of the real world or indeed, the world of work. They are skilled in the science but are then faced with doing budgets, drafting strategic plans, writing reports, managing people, developing technology and applying skills. This is where UoTs come into the frame. Clearly, a country needs both types of institutions, and each has its niche in its own spectrum of the country's educational requirements. What UoTs then need to become are centres of technology excellence, and not try to duplicate what traditional universities are so good at, and are geared to do.

Teaching technology at a UoT implies an understanding of the application of the subject in the real world - such as designing and building a jet engine. Thus, there is nothing lower-grade about a UoT. As an example: the PhD candidate from a university will be engaged in advancing mankind's knowledge by thinking about some of the unsolved challenges relating to, for example, space travel - in other words, philosophising until one hits on a new and uncharted piece of knowledge that needs resolution. So, the PhD will investigate the mathematics of how to send a spacecraft to another star, but the PhD does not actually know how to make the spacecraft. This is where the Doctor of Technology candidate at a UoT comes into the picture (the one who will apply the findings of the PhD candidate and design, build and get the spaceship to its destination). There should be equal acceptance of both types of institution, degrees and candidates, because both have an equally important, complementary and symbiotic role to play in the development and advancement of mankind.

UoTs aim at reality, which also happens to have a financial return for society as a goal. They can proudly award masters and doctoral degrees which promote the message: 'here is a person who understands life, and is not a backroom theoretician with little understanding of the real world'. It will therefore be important for UoTs to do this job well and that they reach the goal of becoming world-class: because this is actually the measure that counts

2.4 POSITIONING UNIVERSITIES OF TECHNOLOGY WITHIN A KNOWLEDGE SOCIETY

The emerging knowledge society has profound consequences for the university, regardless of its focus of specialisation. Conceptually three consequences can be identified:

- Firstly, universities have to accept the fact that they have lost their monopoly on knowledge development. The most innovative research and best laboratories are often found outside universities (for example, Silicon Valley). This new development forces universities to reconsider the way in which knowledge is being developed.
- Secondly, universities can sell their knowledge. In doing so, the universities are acting like enterprises competing on the open market. This calls for universities to position themselves with regard to knowledge transfer.

- Thirdly, universities should deliver programmes contributing towards knowledge-based professions.

The way for UoTs to meet these demands, is to direct the teaching and research programmes at meeting the needs of the society, but also to identify new possibilities for the knowledge society's development. The main focus is to create a learning organisation through engagement with business and industry. UoTs serve as a learning laboratory for experimenting with new approaches and practices for the design and delivery of learning and research initiatives. The focus of these institutions would be to deliver on-site education and research enriched by industrial and business experience. The emphasis is to deliver employees ready for the world of work, and the curricula and research programmes are theoretical and application driven. This kind of university brings the academic activities in close contact with the needs of the working place. Academic activities can therefore enrich the world of work. It should be appreciated that UoTs are becoming more effective in their managerial approaches and interaction with business and industry. UoTs should, however, be careful that business principles should not be more important than academic paradigms. To be engaged with your own environment and the environment of the world of work doesn't mean that you have to lose your own unique characteristics and take on features that don't belong to this kind of life form. Engagement, rather, means to take the unique characteristics of an institution and interact through them (the characteristics) with other life forms. In the process the fundamental principles of the life form are not changed but the way in which the foundations of an institution are practiced, is changed.

SECTION 3

PILLARS/COMPONENTS WHICH SHOULD CHARACTERISE UNIVERSITIES OF TECHNOLOGY IN SOUTH AFRICA

3.1 TEACHING AND LEARNING

3.1.1 Relevant Higher Education Programmes

A UoT must deliver appropriately qualified graduates to the labour market and should therefore be closely allied to the business sector to ensure relevant curricula. This must entail a continual revision of educational programmes at under- and post-graduate levels to better address the needs of industry, business and communities. This includes curriculum and course design linked to an outcomes-based type of education as well as to more flexible modes of delivery. The Teaching Factory concept at Nanyang Polytechnic in Singapore and the SUCCEED initiative between eight universities in the USA for first-year engineering studies, are typical examples of such initiatives.

As part of the internationalisation of higher education, institutions abroad are also being redefined. For example, the Hogescholen in The Netherlands are becoming "Universities of (Higher) Professional Education" and the Fachhochschulen in Germany are renamed "Universities of Applied Sciences".

3.1.2 Flexible Learning Models

The untilization of ICT (Information and Communication Technology) for a variety of flexible learning modes and online learning has broadened access to programmes of higher education institutions as part of a worldwide life-long learning philosophy. This covers the total spectrum of distance learning (e.g. technology-enhanced) as well as a variety of modes used on campus as part of a course. For example, Virginia Polytechnic Institute and State University utilizes the Virginia State network (Net.Work.Virginia) to offer courses at graduate level in Engineering and Business Administration.

Flexible learning makes individualization of learning and courses for a variety of prospective learners (such as mature, working persons) possible by means of wider access, recognition of prior learning and telematic learning methods.

3.1.3 Entrepreneurial Institutional Culture

A new generation of innovative and entrepreneurial institutions were recently established.

In Creating Entrepreneurial Universities: Organisational Pathways of Transformation (1998) five institutions in Europe identified and analysed as being very successful innovative and entrepreneurial institutions: University of Warwick in England, University of Twente in The Netherlands, University of Strathclyde in Scotland, Chalmers UoT in Sweden and the University of

Joensuu in Finland. Common characteristics include:

- A strengthened steering core with central faculty involvement and an administrative backbone that fuses new managerial values with traditional academic ones;
- A strengthened managerial core of agents who work to find resources for the institution as a whole;
- A lesser dependency on and greater autonomy from government;
- An enhanced development periphery where outreach units promote contract research, contract education and consultancy. These include new units and centers that are generally multi- or trans-disciplinary in nature. The institution moves into a matrix - type structure of basic units In which traditional departments are supplemented by centers linked to the outside world;
- A revised diversified funding base by constructing a portfolio of patrons to share rising costs. As new patrons contribute, their expectations of what they should get in return readily intrude to become new constraints;
- Academic departments had bought into entrepreneurial change, even if the shift for social science departments (excluding economics and business) was more difficult;
- Successful entrepreneurial beliefs, stressing a will to change, can, in time, spread to become a new culture;
- An organisational identity and focus to solve the problem of severe imbalances and to define anew their societal usefulness.

One must also take note of the entrepreneurial approach of the 'land grant' universities in the USA and their commitment to their region/ Local municipalities.

3.1.4 Emergence of Centres for Research and Development

There is a move towards the development of R&D centres of specialisation with common features such as being multidisciplinary in nature linked to a thematic approach in general, with the areas of specialisation directly linked to the needs of industry and business, and the participation of staff and students from various departments and faculties in the activities of the centre. These include educational programmes, R&D projects, industrial consultancy, innovation, incubation, technology transfer and product development.

Research and development centres are characterised by frequent interactions with business people, manufacturers, venture capitalists, patent lawyers, production engineers and researchers located outside the institution. R&D outputs may not always be reported in the traditional way through scientific conferences and journals, and are sometimes confined to confidential reports of commercial sponsors, and patents and licensing agreements.

3.1.5 Strengthening Industry Partnerships

A new dimension in higher education, namely, industry linking and partnerships has emerged. Institutions have realised both the potential and need for cooperation, partnerships and joint ventures with industry and business linked to an entrepreneurial approach. This development ranges from formal education and training programmes and short courses to research and development (R&D) projects and programmes. For example:

The success of Silicon Valley is directly attributed to the extensive linkages with four major universities; The Warwick Manufacturing Group of the University of Warwick plays a key role in the development of Warwick Science Park, a hothouse environment which nurture's high tech companies; and The University of Twente, utilises the Twente Business and Science Park to ensure a vibrant economic development of the region.

3.1.6 Practical Contributions towards Regional and Economic Progress

An extended and revised role for higher education institutions in contributing towards regional and economic development of the community they serve has emerged. The UK Dearing Report (1997) strongly promotes the establishment of more technology incubator units within or close to an institution for the fostering of start-up companies and to support staff and students in taking forward business ideas developed in the institution. In the case of Silicon Valley in California it has been calculated that more than 1500 companies have emerged as spin-offs from the work of staff and students from the engineering schools of Stanford University. The current value of the IT companies within this group exceeds $90 billion. In 1996 the sales from technologies licensed by academic institutions in the USA were estimated at $20.6 billion for that year.

3.1.7 Establishment of Institutional Support Structures

Effective institutional support structures for their revised role and linking with industry and business are being established. These groups assist in the promotion and facilitation of projects and business development. The structures differ in order to accommodate specific needs of institutions. Examples are:

International Relations and Business Development at Temasek Polytechnic;
Innovation Centre at Nanyang Technological University;
New Technology Development at Massey University in New Zealand;
The Office of Technology Licensing at Stanford University.

3.1.8 Work-Integrated Learning (Experiential Learning)

Experiential Learning (or work-integrated learning) is a strategy of applied learning (learning integrated with work) which involves a structured educational programme that combines productive relevant work experience with academic study and 'professional reflection'.

Embedded in the nature of technology higher education is compulsory experiential learning which provides students with relevant work experience. Students are required to undergo a period of on-the-job training as part of their degree studies. This period of work placement varies from a few weeks undertaken throughout the period of study, to six months and a year in some programmes, in the final year of study. The principal advantage is that students gain experience in a professional field during their formal studies and begin working life with knowledge of the marketplace, organisational structures and employer's expectations. Students are provided with practical and creative scope, and potential for advancement and personal growth in their chosen field. The private and public sectors have consistently singled out the former technikons for their career-focused, hands-on approach to education and training and the delivery of graduates with knowledge that is immediately relevant in the workplace. The added advantage of Experiential Learning for both

students and employers is that students 'hit the ground running' when they enter the workplace. Employers do not have to waste time and resources training employees who only have theoretical background knowledge. Work-integrated Learning will become even more important in UoT programmes because of the growing trend in industry and commerce for graduates who are already familiar with the world of work before they are offered employment. Furthermore, it should be highlighted that graduates who are job-ready are in high demand with small and medium enterprises, since they do not have the capacity, nor the money to invest in experiential training or on-the-job training of graduates.

3.1.9 Career-Oriented Programmes

Degrees at a traditional university are expected to give students a grounding in, and understanding of, the basic scientific principles underpinning their field of study. UoT programmes however focus on application of scientific principles in practice and only use basic scientific principles in those cases where such knowledge is deemed to be essential to the successful application of the scientific principle concerned.

Important is that knowledge with a practical work-related orientation which draws from multiple disciplines can be segmented into subjects that have an internal coherence, the mastery of which equips the student with real skills. Additional subjects (many of which are multi-disciplinary) may be added, which can enhance the array of skills in the student's portfolio or increase the depth of understanding of scientific principles that form the basis of that specific career.

In vocational programmes, students must have some mastery of the fundamental concepts and theories of the cognate disciplines upon which their knowledge field draws, while directing theoretical understanding to its application in practical contexts. Hence, both vertical expansion of complexity and horizontal expansion of skills are possible. The vertical expansion will however be specific and may be spread over several disciplines. The level of vertical expansion may in certain cases be higher than for traditional academic programmes. It is accepted that for each traditional academic discipline a so-called "body of knowledge" exists which needs to be mastered to a certain extent by the student.

In the same way, a 'body of knowledge' can be associated with a specific occupation or career. This “body of knowledge” also contains a combination of applicable elements of academic disciplines. Because the 'body of knowledge' required for successful career practice can fairly accurately be defined/determined and evaluated through inputs and interaction from that specific sector, the number of choice subjects will be severely restricted in career-oriented programmes. The opposite is true for traditional university courses where the variety of choice is fundamental to the development of intellectual curiosity and a sense of enquiry.

To summarise - a specific career-focused qualification will have its own distinctive 'body of knowledge'. This 'body of knowledge' is fairly well defined and is growing at a rate much faster than that of a pure discipline. Quality can be evaluated much easier and more accurately than is the case for 'basic scientific' subject disciplines. The 'width' and 'depth' of this 'body of knowledge' are determined by factors such as the rate and level of technological development, level of competitiveness of the specific vocational sector, skills and competencies needed for economic growth of the sector, national identity and pride, etc. Likewise the 'level of complexity' of this body

of knowledge can be defined by various dynamic, external factors.

An interesting aspect of this 'body of knowledge' is that it has the fundamental benchmarks of relevancy of knowledge and applicability of skills. These benchmarks in themselves lead to an 'unwritten' but generally accepted requirement for 'work experience' where the students must be afforded the opportunity to test, apply and refine aspects of their acquired knowledge and skills within the actual workplace (vocational environment).

One of the more pronounced differences between the vocational body of knowledge and the traditional subject-type academic body of knowledge lies in the evaluation of its mastery. Mastery of the traditional academic knowledge body is mainly evaluated through 'traditional' forms of examination. Mastery of the vocational body of knowledge will be through a wide array of methods that vary from different forms of assessment, evaluation in the work situation, practical skills assessment, evaluation by experts from the world of work, etc. In this case, the ability to apply knowledge is seen as fundamental, and evaluation of this mastery should, in principle, be easier than evaluation of academic insight and ability.

3.2 RESEARCH AND DEVELOPMENT IN UNIVERSITIES OF TECHNOLOGY

3.2.1 The 'Research' University

UoTs acknowledge the world-wide negative impact on the higher education system caused by more and more institutions trying to adopt the culture and value system of 'research' universities. In fact, many institutions claim a 'Research' mission, declare themselves 'research universities' and 'first team' players, but are nowhere near the basic norms set for such institutions. With many institutions seeking or claiming this distinction, the public is understandably confused. The long-term result may lead to an erosion of the willingness to support or tolerate the research role of our most distinguished universities. UoTs are wary of falling into this trap by clearly defining what a UoT should be, and what it should not be. At their present stage of development they make no claim to be 'research universities'.

There is a perceptible swing in public attitudes toward higher education that will place less stress on values such as 'research excellence' and 'elitism' and more emphasis on the provision of cost-competitive, high-quality services - i.e. from 'prestige-driven' to 'market-driven' philosophies. While quality is important, relevance and cost is even more important. The marketplace seeks low-cost, tailor-made, quality services rather than 'prestige'. The public is increasingly asking, 'If a Volkswagen will do, then why buy a Mercedes?' It could well be that the culture of 'excellence', which has driven both the evolution of, and competition among research universities for over half a century, will no longer be accepted and sustained by the general public, and that 'new era' universities could well become the mode. It is however imperative that UoTs clearly know where they are going, what the prerequisites are, and most of all, what the expectations and outputs of such an institution are and should be.

As South Africa's higher education system evolved and changed over the past years, specialisation within the academic disciplines, driven by the explosion in knowledge that occurred in the past 20 years, was one of the most important trends in higher education. Today, as the speed of change

increases, it is evident that some changes need to be made to the discipline-focused nature (culture) and structures of traditional universities. New funding policies within commerce and industry have started to support, to an increasing degree, multi-disciplinary teams and scholars. In a period of rapid intellectual change in higher education the need for a different type of institution, specialising in multidisciplinary teaching and research as well as the application of knowledge has become evident. UoTs are well positioned to address this need. Not only are they strong in multi-disciplinary teaching but their ethos and origin come from the multi-disciplinary world existing in commerce and industry.

While the unwritten social contract underlying the traditional government-university research partnership has always been based on the premise of practical benefits to society, it was also based on a linear model in which basic research successively led to innovation, development, production and societal benefit. In may cases this 'linear' process was not so straightforward, and societal benefits were not so self-evident. There is no clear-cut distinction between basic and applied research, and in many cases commercial applications actually enable basic research. Institutions with a clearer ethos and mission towards innovation and development will form an invaluable ally and partner alongside the traditional basic research institutions. In the variety and scope of research approaches lies our country's future strength.

The focus of a UoT will be mainly applied research and innovation, as well as on ways and means of solving specific problems that exist within commerce and industry. It is important to underline however that UoTs do not aspire to be 'research' universities in the form as discussed above. The emphasis should be on teaching and learning, responsiveness and innovation.

3.2.2 Globalisation and Democratisation

The changes taking place globally as well as within our own national context have a profound impact on the higher education sector and therefore have a great influence on how the sector responds to the changing environment. Globalisation as reflected by the interdependent world economy, together with rapid developments in information and communication technologies, has put knowledge at the centre of the new economy. The demands made by globalisation on higher education institutions is that they should go beyond providing learners with necessary cognitive skills and competencies, but more importantly, prepare them for working in a knowledge society.

In the South African context over the past 30 years, there has been a dramatic shift in the economy, and consequently also changes in labour market trends. The primary sector of the economy has consistently declined, whereas the service sector has grown rapidly. It should be noted that with the establishment of a new democratic government in 1994, many of the technology missions of the apartheid era were downscaled, which partly resulted in a reduction of national research and development expenditure. These circumstances have required specific responses from the higher education sector.

A plethora of policy and legislative frameworks have been developed by the democratic government to ensure that the higher education sector, like all other public institutions, function in line with the norms and values of the new dispensation and, more importantly, meet the pressing needs of our society. Amongst these regulatory frameworks, the Education White Paper 3 - A Programme for Transformation of Higher Education, provides the foundation for strategic direction

and interventions in transforming higher education.

The National Plan for Higher Education, on the other hand, outlines the key goals and objectives necessary for achieving transformation within the sector. These documents together with other policy documents such as the White Paper on Science and Technology, the National Research and Development Strategy, the Human Resource Development Strategy and the DTI's Driving Competitiveness Framework Document form an essential guide for the UoTs to determine their role and scope in and contribution to national research and development.

3.2.3 The Nature of Research and Development

Prior to the restructuring process in higher education, which led to the reclassification of some technikons as UoTs, the existing legislation categorised technikons as institutions concentrating 'on the application of scientific principles to practical problems and to technology and thus preparing learners for the practice, promotion and transfer of technology within a particular vocation or industry.' The National System of Innovation proposed in the Science and Technology Policy requires that a set of functioning institutions, organisations and policies interact in pursuit of common social and economic goals. Given that some of the key objectives of this policy are to promote competitiveness and employment, improve the quality of life and work towards environmental sustainability, it is therefore understandable that UoTs, by virtue of offering training often linked to industry, are strategically placed to contribute significantly to innovation. This will remain a characteristic of significance to UoTs, as their core function will still be education and training in the career-and professional stream. These institutions, apart from having close links with industry will also need to be responsive to other societal needs. While recognising the importance of the complete continuum from basic research to commercialisation of research outputs, UoTs will focus on research that is of a more applied nature (strategic and applied research), solving problems of society and the practical implementation thereof. This does not necessarily preclude involvement in basic research, as basic research provides the impetus for applied research.

The National Research and Development Strategy ill addressing weaknesses in the research and development strategy, recognises the problem of the innovation 'chasm', which is a gap between human capital and technological innovation activities. Through applied research and working directly with industry on incremental problem-solving and consulting, the UoTs will make a significant contribution to the innovation chain. Furthermore, in the National Research and Development Strategy, a number of new technology goals
are proposed to be pursued and these include poverty reduction, the knowledge intensive new industries (ICT and National Biotechnology Strategy), advanced manufacturing and leveraging resourced based industries and developing new knowledge-based industries from them. These platforms provide an opportunity for UoTs to function within and be part of the National System of Innovation (NSI).

In the experience of the National Research Foundation, whose mandate is to promote and support research and research capacity-building, the following issues are critical to creating a sustainable research effort:

- A long term perspective is required in building sustainable research capacity;
- Each institution needs to take responsibility and ownership of its research endeavour;

- A critical mass of no less than four active researchers working on a common theme is necessary to create a sustainable research programme;
- Staff development is an essential and necessary prerequisite for a research capacity development and therefore research should not be an end by itself, but translate to further involvement in research at levels beyond doctoral studies;
- There needs to be sustained pressure to produce appropriate quality research outputs.

The above areas will require serious attention from UoTs, in order for them to make a meaningful contribution to the national research effort.

Firstly, institutions need to prepare a well-thought strategic plan of research so that the question of what areas/ fields of research the institution would like to be involved in, is resolved, given their geographical environment, capacity, capabilities and resources. Institutions need to establish their niche research areas. This is in line with the approach of the National Research Foundation which has identified a number of key focus areas as opportunity and problem areas for research - so too, the National Research and Development Strategy on the new technology missions. Institutions need to identify their research and development niche areas in order to concentrate their capacity development and enhance their research effort. In fact both the key focus areas and the new technology missions provide platforms that should be considered for possible niche areas because this would bring with it possible research funding for their research activities and more importantly, also an opportunity to become significant players in the national system of innovation. In this processing of strategic planning of research the institution would have already integrated the research function into the mission of the institution and an appropriate institutional research policy framework will also have been developed.

Secondly, it is accepted that national growth and competitiveness are dependent on continuous improvement and innovation and also that a competitive edge can be built on efficient and innovative application of existing technologies. This requires well-trained research and development human capital. While the importance of having staff development as an integral part of the research agenda cannot be understated, another area of great concern, as reflected in the National Plan for Higher Education, is that of low enrolment in postgraduate programmes. UoTs would need to pay particular attention to using research as an enabler for increased participation of students at masters and doctoral levels, and, in this regard the emphasis should be on previously disadvantaged groups. Once the institutions have developed adequate research expertise in specific areas, consideration would then be given to establishing centres of excellence, which in turn would serve as magnets to draw in more students into research.

As a mechanism of accelerating research development, UoTs would be engaged in collaborative research. Because of the emphasis in the area of strategic and applied research it is expected that UoTs will develop strong cooperative and collaborative networks with industry. Since the focus of UoTs is only on one area in the research and development continuum, it becomes imperative that they collaborate with other institutions of higher education, especially the traditional universities whose emphasis tend to be fundamental research. These research partnerships should produce the synergies derived from operationalising the National System of Innovation. Co-operation and networking should of course not be confined to the institutions in the innovation system, but should be fostered across disciplinary boundaries. The multidisciplinary approach, particularly in strategic and applied research and problem-solving, makes it possible for the growth of an innovation

culture, which then leads to enhancing our industrial competitiveness as well as our ability to solve societal problems.

UoTs will benefit from the policy change in the funding research from the 'blind finding' approach to allocation of resources to a new funding formula, which will be based on research and graduate outputs. This puts enormous responsibility on institutions to ensure that the investment in the research endeavour is used effectively and efficiently and that set objectives and outcomes are achieved.

The ability of institutions to assure the quality of research as well as the ability to deliver research outputs will determine whether institutions will receive adequate financial support for this function. Previously, technikons did not benefit from the 15% 'blind' subsidy given to universities for research and they had to access funds through the submission of project proposals. UoTs therefore have the experience of accessing funding through project proposals, which can be used to ensure sustainable inflows of research funds.

However, the exclusion of the UoTs from ‘blind subsidy” and the late entrance in the research realm resulted in enormous backlogs in research infrastructure and research culture for wich the UoTs received any compensation.

3.3 DEVELOPING LEADERSHIP IN TECHNOLOGY

An important characteristic of a UoT is the relevance of its curricula and research programmes, which are related to the problems and concerns of industry, the community and society at large. These real world problems are seldom neatly contained within the confines of any specific discipline. They are inherently complex in nature, cutting across a range of disciplines and requiring multidisciplinary teams to develop solutions. Usually there are many possible solutions to this type of problem, some more appropriate than others. Invariably technological choices have to be made.

If it is the objective of UoTs to educate and develop students who can engage effectively with real world issues to the benefit of society at large, then these institutions cannot adopt a narrow focus and equip students only with technological competencies and practical skills to deal with these issues. It will be necessary to broaden the educational approach, to expose students to a range of disciplines, including those from the humanities and social sciences, to enable them to make intelligent decisions and choices about a range of issues involving technology. For example, the exploration of Indigenous Knowledge Systems, and its incorporation into the curriculum, should be a core activity of UoTs in South Africa.

Unprecedented changes, accompanied by unexpected opportunities and consequences, have been distinctive features of modern technology. While technology has brought with it unparalleled benefits, it has also had far-reaching implications, many of these undesirable. Students of UoTs must be in a position to appreciate the impact of technology on society, and understand the broader social, political and economic consequences of a particular technological solution.

Technology is perhaps the most powerful agent affecting the environment. Technological development, particularly in the realm of biotechnology and genetics has raised a number of ethical

questions as well. It is necessary for students of a UoT to be aware of the ethical and environmental implications of their technological choices, and to be able to determine the most appropriate solutions given the societal context. Students should be encouraged to think about the broader issues relating to technology. In this way they will not only be prepared for a more meaningful role in technology development and innovation, but for a far more responsible role in society as well.

With its strong focus on technology development, innovation and technology transfer, UoTs will have to give attention to promoting a better understanding of these phenomena among their students. Topics relating to the management of technology, how it can be effectively used to create competitive advantage for the industry, and how technology interacts with other key business areas will also have to receive attention. While UoTs will be actively engaged in technology development, technology transfer and innovation, it is also important that these institutions, the staff and students develop a deeper understanding of these processes, and how best to promote these in a variety of different contexts.

UoTs must therefore create opportunities in the curriculum for students

- To reflect on the broader issues relating to technology, thereby generally raising their technological consciousness, and promoting a culture of technology at the institution;
- To be encouraged to think about the impact of technology on society, in particular the unintended consequences of particular technological solutions, thereby enabling them to select the most appropriate solutions in a given situation;
- To be exposed to a wide range of disciplines, including the human and social sciences, to provide them with a richer understanding of the world within which they operate;
- To deal with issues relating to the management of technology, both within the industrial context as well as the broader societal context;
- To gain a deeper understanding of the innovation and technology transfer processes, as well as the product development chain;
- To work in teams, preferably multidisciplinary teams, around the solution of problems related to real world situations;
- To discuss and debate technology policy and the implications this will have on the different sectors in society.

In this manner UoTs will not only equip students with the high-level technical skills to effectively engage with real world issues, but will also educate students for leadership on the important technological issues facing society.

3.4 TECHNOLOGICAL INNOVATION AND TECHNOLOGY TRANSFER

3.4.1 An International Perspective

Higher education institutions worldwide have realized the importance not only of generating new knowledge through research and development (R&D) programmes, but also actively participating in applying and utilizing the knowledge and technology for new products, processes and services.

Entrepreneurial institutions have formulated and implemented strategies to ensure that 'flow through' of new technology into the market place actually take place. The emergence of new modes of knowledge production, more geared towards addressing the needs of government, industry and communities, as well as the need for higher education to stimulate economic growth, has led to revised strategies. In particular a number of universities have opted for:

- Developing a community of skilled graduates with relevant and specialized knowledge and skills;
- Contributing to a modernizing economy through technological innovation and technology transfer, entrepreneurial development and the application of knowledge and technology;
- Stimulating economic growth and prosperity.

In the 2003 report of the International Intellectual Property Institute in Washington, USA, on technology transfer systems in the US and other countries, the key role that universities play in national innovation systems is stressed. This role has traditionally been confined to training the human capital involved in R&D. However, universities are increasingly making a direct and substantial contribution to innovation, and thereby to regional economic growth through the development of new technologies.

Both developed and developing countries are seeking to increase the contribution university R&D makes to national economic growth. This has led governments to restructure the institutional environment, usually through establishing clear intellectual property ownership policy in favour of universities, and by providing support programmes for the commercialisation of technology. In countries where this approach has been followed, universities take technology transfer seriously and have clear policies in place governing the rights to intellectual property of inventions developed by them. Furthermore, the necessary support structures have been created to facilitate the commercialisation of university R&D, usually in the form of technology transfer offices.

3.4.2 National Policies and Initiatives

The National System of Innovation (NSI), as outlined in the White Paper on Science and Technology (1997), emphasized the importance of innovation as the underlying engine for modern economic development, and challenges the higher education system to take the lead in human capital development by equipping them with appropriate skills and competencies.

Different government departments, in support of the NSI, established various mechanisms. These included:

- The establishment of NACI, the National Advisory Council on Innovation;
- The THRIP (Technology and Human Resources for Industry Programme) initiative of the DTI administered by the NRF;
- The Innovation Fund of the DTI, administered by the NRF;
- The SEDA technology programme (previously the GODISA trust), a special initiative of the national Department of Trade and Industry (DTI), responsible for the technology transfer and business incubation;
- The Tshumisano Technology Stations Programme of DST in support of technology-based SMMEs;

- Provincial initiatives such as the Innovation Hub, a Blue IQ project of the Gauteng Province, hosting a science and technology park and incubator facilities.

The Research and Development Strategy (2002) of the Department of Science and Technology is geared to ensure a major increase in support for R&D programmes, of which the various outputs have to lead to an improvement of South Africa's world competitiveness.

The current development of a Technology Transfer Strategy for South Africa builds onto the Research and Development Strategy, enabling the higher education system to fully participate through revised legislation, financial incentives and support schemes. This includes the transfer of knowledge and technology between higher education, industry and society, the development of innovation hubs and incubators, and support for the development of knowledge and technology intensive enterprises.

3.4.3 The Spectrum of Technological Innovation and Technology Transfer

Technological innovation is the process that transforms new knowledge into wealth. It covers the different steps of the innovation chain, from the creation of new ideas, the development of technology in the form of products, processes and services, up to the ultimate successful commercialisation and/or implementation. Technology transfer is the formal transfer of new discoveries, innovations and technology, usually resulting from R&D activities at universities, to the commercial and industrial sectors in the economy. Implicit in the term is the understanding that a tangible "intellectual asset" has been identified for transfer. The literature also refers to technology interchange, emphasizing the two streams for technology transfer - one from within the university and the other an external stream of opportunities being brought into the university for joint development and exploitation.

Within a UoT environment, these concepts incorporate the following:

- Enhancing R&D 'downstream' related activities such as patenting, licensing, commercialisation and marketing of intellectual property (IP) and R&D results in the form of products, processes or services;
- Promoting and marketing a corporate culture for technological innovation, entrepreneurship and technology transfer;
- Developing appropriate policies, strategies and models for technological innovation and technology transfer;
- Promoting and developing knowledge and technology intensive enterprises;
- Participation in the establishment of technology and business incubators and related support structures.

Research in Germany and the USA show that many institutions are quick to react to politically-motivated programmes, and create transfer units or technology licensing offices. However, successful transfer depends on the personal relationships among the participants and the entrepreneurial spirit of the lecturer or professor. The institutional culture of academic institutions does not easily relate to the institutional culture of private enterprise. UoTs must develop policies to provide for a sufficiently enabling environment.

3.4.4 Opportunities and Strategies

UoTs have to become leading higher education institutions in technological innovation and technology transfer, and the various opportunities mentioned earlier have to be incorporated into the teaching and learning and R&D programmes of the university. It is also essential to have the buy-in of staff and students, and in particular the full support of top management. The following strategies will play an important role in achieving the stated objectives:

- The promotion and establishment of a culture of technological innovation and technology transfer amongst staff and students to be measured by its incorporation into education and R&D programmes, number of patents, licenses, spinout companies and financial benefits;
- The establishment of appropriate technological innovation and technology transfer strategies, systems, incentive schemes, support services and infrastructure, to be measured by the optimal utilisation of tangible intellectual assets and client satisfaction;
- The development and implementation of specific models for establishing knowledge and technology intensive enterprises, incubators and SME technology centers, to be measured by the outputs and the financial sustainability of these entities.

SECTION 4

THE CURRENT STATUS OF UNIVERSITIES OF TECHNOLOGY

4.1 INTRODUCTION

"*The universities of technology are excited at the prospects in redefining the sector's focus in line with the challenges and demands of a dynamic and developing South Africa positioned within the global market economy. These institutions are determined to continue making significant and infallible contributions towards the sustainable development of our ten-year-old democracy."* (CTP Press release, 1 March 2004).

This statement spawned the debate on challenges for the South African restructured Higher Education System within a single unitary but differentiated system. Within a unitary system, three University types emerged where "University" is the common denominator and the core functions namely, teaching/learning, research and community engagement are similar. However, differentiation is imbedded through the purpose and focus of each University type.

It became clear that the continuous recognition of UoTs, as technikons or statements referring to UoTs as "glorified high schools" initiated a debate on the Status of UoTs within the new South African Higher Education system. As UoTs are still in an infancy phase, the development towards recognition as a UoT is an evolutionary process.

It is also clear that new policy directives are not only used as steering mechanism for planning, quality and funding, but also to instill differentiation. The UoT sector does not necessary agree with the direction of the steering. In the absence of a policy directive and criteria defining UoTs, the debate on differentiation is premature.

There are fundamental forces at work that will certainly affect the sector's scope and focus. Therefore it would be difficult to define what the appropriate UoT for South Africa should be at this stage. It would come about through a process of evolution tempered by demographic characteristics, sosio-economic imperatives and impact of the mergers. The full impact of the mergers and incorporations are only now being realized. The reality of the mergers was fraught with challenges as the emergence of distinct differences between the merging partners influenced the educational services and impacted on organizational and financial resources.

Even though the funding framework is meant for equal funding, eradication of the backlogs has never taken place and the current application of the funding framework augments the backlogs. This is evident in the progression of UoTs from Colleges, to Technikons offering degree and post graduate programmes, to its current institutional type that has never received the same financial footing as the Historical Advantaged Institutions (HAI's).

It is therefore the opinion of the SATN Board that UoTs are on a developmental trajectory and should be given a time period with the necessary facilitation and funding to develop into fully fledged UoTs.

4.2 THE UNIVERSITY OF TECHNOLOGY (A PERSPECTIVE)

The strategic focus of the UoTs is manifested through its curriculum alignment with the labour market needs and human resource development challenges as indicated in initiatives such as Accelerated and Shared Growth-South Africa (ASGISA) and Joint Initiative on Priority Skills Acquisition (JIPSA). Therefore the curriculum is developed around the graduate profile defined collaboratively with industry and the professions and reacts to the responsiveness as a policy directive.

However, historical socio-political distortions in the labour market have resulted in demands for access to higher education beyond that which was planned by government. Furthermore, enhanced economic development in South Africa has contributed to the skills shortage in the country thus highlighting the gap between economic planning and Human Resource development.

The UoTs are strategically positioned to narrow this gap by addressing these skills shortages through the widening of access to higher education. Indeed it may be argued that they have been doing this since their inception as Colleges of Advanced Technical Education! Certainly there can be no doubt as to the responsiveness of the UoTs to the needs of the country in general and industry and the professions in particular.

The approach of a UoT is focused on increasing technological capabilities and is primarily concerned with professional and career focused education. The contribution of UoTs to research, which is generally understood as the development of new knowledge, is the development of a new understanding of a problem through the application of new and/or existing knowledge to a problem. The application of research is thus technology-informed and directs calls for the management thereof. The management of technology as research focus is as important as research directed at applied problem solving. Given this position of UoT research it can be stated that research in this sub-sector of higher education straddles three issues:

(i) The application of knowledge to address business and industry (in the broadest sense meaning all sectors in society) related problems.
(ii) The training of high-level technologist.
(iii) The inclusion of a multidisciplinary focus in research.

The paramount characteristic of the nature of UoTs is technology – and technology should be conceptualize in its broadest sense as referring to the effective and efficient application of the accumulated know-how, knowledge, skills and expertise, that when applied will result in the output of value added products, processes and services. This wide interpretation of technology implies that the results of technology activities will be diverse. This also means that UoT graduates should be able to do/make things on the basis of their newly gained knowledge.

UoTs contribution to new knowledge and technology transfer is evident in the recent published annual report of the Tshumisano Trust where it has contributed extensively to the National System of Innovation. Undergraduate and post-graduate students and technology staff members participated in SME's projects that require both basic and applied R&I. Fifteen major projects were registered. Seventy Three (73) researchers were involved in R&I projects that were undertaken in the Technology Stations. These Technology Stations have designed and developed over one hundred (100) processes, registered eight (8) patents, developed or enhanced over eight hundred (800) products and ninety eight (98) prototypes. These types of research output are currently not recognized as part of the research funding. Acknowledged outputs can therefore not be limited to the current DoE list only. Patents, prototypes, artistic works, etc are evident of basic and/or applied knowledge.

The orientation to the labour market is extended to communities where community engagement goes beyond simply the disadvantaged 'societal' community as it also embraces the labour market and the professions. This is evidenced by the fields of study offered by UoTs, inter alia education, government sciences, art, fashion, and hospitality management. Thus, the community that UoTs engage with comprises Government, Industry, Business and the Social community. UoTs are thus known for their close relationship with commerce and industry. The scope of collaboration, as stated in the recent published annual report of the Tshumisano Trust, is also a focused approach addressing problems within the world of work and society. The work integrated learning (WIL) model of the UoTs makes this relationship almost compulsory. To secure WIL places UoTs are in close contact with the employers to ensure that students would be able to cover the curriculum in order to graduate. This unique relationship ensures that UoTs are responsive to the communities it serves.

As identified by the then Technikon sector, during consultation for the development of the White Paper on Higher Education Transformation and subsequently consolidated in the CTP publication[2], the UoTs have identified a trajectory for their development. However, the current HE environment serves to constrain and re-direct the efforts of this sector thus constraining progression on this developmental trajectory.

Quality, planning and funding are the three main steering mechanisms for higher education. However, the selective application of 'instruments'[3] to effect such steering are constraints for the UoTs as they are perceived as the means to an end – differentiation within a unitary system. Whilst it may be argued that the quality of provision is the greatest differentiator of higher education institutions, the selective allocation of funds and approval of new programmes for example, impact on the quality of provision by design at a national level. It is a moot point that if UoTs were supported and empowered by government, initiatives such as ASGISA and Jipsa (which are indicative of the distortions in the labour market) might not have been necessary.

2 Du Pré, R. 2004. Universities of Technology in South Africa: Position, role and function. Committee of Technikon Principals (CTP).

3 National policies, frameworks and structures are included in this term

4.3 POLICY DIRECTIVES

4.3.1 Legislation within the Higher Education Act

The Higher Education Act 101 of 1997 (as amended by the HE Amendment Acts 55 of 1999, 54 of 2000, 63 of 2002 and 38 of 2003) defines a Technikon as any Technikon established, deemed to be established or declared as a Technikon under this Act. The commencement of this Act was 2 November 2001

In this same Act the following acts were repealed:

Technikons (Education and Training) Amendment Act, 1983 (Act 48 of 1983);
Universities, National Education Policy and Technikons Amendment Act, 1984 (Act 75 of 1984);
Technikons (Education and Training) Amendment Act, 1984 (Act 77 of 1984);
Universities and Technikons for Blacks, Tertiary Education (Education and Training) and Education and
Training Amendment Act, 1986 (Act 3 of 1986);
Certification Council for Technikon Education Act, 1986 (Act 88 of 1986);
Technikons (National Education) Amendment Act, 1986 (Act 89 of 1986);
Technikons (National Education) Amendment Act (House of Assembly) Act, 1988 (Act 33 of 1988);
Universities and Technikons (Education and Training) Amendment Act, 1990 (Act 41 of 1990);
Universities and Technikons Advisory Council Amendment Act, 1991 (Act 24 of 1991);
Certification Council for Technikon Education Amendment Act, 1993 (Act 185 of 1993);

The abolition of these acts eradicated the notion of a Technikon. However, the presence of a definition for a Technikon in this Act seems to be an inconsistency. In terms of legislation technikons became universities when these acts were abolished. However the “non-existing technikons” were officially declared UoTs in 2003.

In the preamble to the act it is stated (amongst others) that the act was drafted to:

- ESTABLISH a single co-ordinated higher education system which promotes co-operative governance and provides for programme-based higher education; and to

- RESTRUCTURE AND TRANSFORM programmes and institutions to respond better to the human resource, economic and development needs of the Republic.

The Act defines a university as “'university' means any university established, deemed to be established or declared as a university under this Act”. It is evident that the Act recognized only universities and did not differentiate between traditional universities, comprehensive universities and UoTs. The Act and specifically the preamble creates the opportunity for UoTs to respond to the human resource, economic and development needs of the Republic in a specialized particular way.

4.3.2 HEQC, SAQA and DOE approval process impact on the responsiveness

One of the key characteristics of UoTs is their responsiveness to changes within the world of work. In the preamble to the Higher Education Act it is stated that universities should respond to the needs of the Republic and of the communities served by the institutions.

The education and training offered by UoTs must be relevant for commerce, industry, government and the community at large. Students qualifying at UoTs must be employable and immediately productive. To ensure this the UoTs must be in constant contact with employers (eg. through advisory committees) and the curricula of UoT programmes must prepare the students for the world of work (eg. Work integrated learning). To deliver adequately educated workers, UoTs must be pro-active to the changes in the workplace.

It is evident that UoTs must continuously adapt their educational programmes to the ever changing requirements of the labour market. However, the process from curriculum design through approval, registration and Quality Assurance takes 18 to 24 months.

Currently a new programme must be:

- approved by the DoE for funding purposes and inclusion on the institutional PQM
- Registered by SAQA
- Quality Assured by the HEQC

In a world where technology changes almost weekly an 18 month response time is not acceptable. The well intended DoE bureaucracy has created a good but impractical system that hamstrings the responsiveness of UoTs.

To enable UoTs to deliver appropriately trained workers in time to satisfy employer requirements; UoTs must develop a shorter process for the redesign and acceptance of programmes. This would also demand super fast consultation and curriculum design by academics.

4.4 SYSTEMIC DRIVERS - PLANNING, FUNDING AND QUALITY

Following the release of the CHE “size and shape proposals” June 2000 the Minister of Education committed the system to on-going investigations and discussions to formulate the differentiation methodology proposals to realize the differentiation recommended by the CHE. At that stage the general dimensions for a possible differentiation was already announced in the White Paper, namely planning, funding and quality. It was therefore evident that the sector’s responses and submissions on the different stages of consultations around these issues would be important to differentiation determinations in the future. However, the paucity in the then leadership was apparent as UoTs have individually and/or collectively not been adequately aware or failed to give more detailed attention to the policy-framing stages the higher education system has been going through.

It is important for the sector to contextualize the wider issues impacting on the differentiation debate and to advance their concerns within this context. The following are some contextual matters requiring researched positions. If planning and funding is to ensure greater public accountability,

then what are the public accountability issues relevant to the Minister not be informed by the "fruitful expenditure" criteria of the Public Finance Management Act?

In particular,

- Should the employability of graduates and improving economic competitiveness of individual businesses through innovation not considerably outweigh other considerations in view of poverty and sustained employment opportunities?

- Should considerable portions of public money be invested in research with doubtful public benefit?

- Are research citation indices a good social measure, especially when research that improves economic competitiveness and research used for enterprise incubation are not reported in most scientific publications?

It appears that research is being drawn into this debate on differentiation, without clearly defining the differentiated functions of purposes. For example, UoTs should possibly play a bigger role in technological innovation, which is part of the R& I chain whilst the research universities concentrate on basic research. HESA welcomes the establishment of the Innovation Agency to balance the FRC emphasis on excellence in basic research and to promote the commercialising of research, but the potential role of the UoTs in the knowledge exchange and commercialisation challenge cannot be downplayed. This indicates that the differentiation debate is not just a straightforward exercise of re-allocation money to those institution that are currently seen as producing "quality research".

4.4.1 Differentiation impact of the funding framework

The new funding framework is to facilitate the transformation of the higher education system as recorded in The Education White Paper 3: A Programme for Transformation of Higher Education (July 1997). In agreeing that the funding framework "must be goal oriented and performance-related" to achieve this transformation, the application of the new funding framework has disadvantaged UoTs. The funding framework, as well as its current application, assumes that all higher education institutions are on par with each other. UoTs are expected to achieve benchmarks that have not even been achieved by traditional universities that have been in existence for over 25 years. Whilst it is agreed that a reasonable international benchmark must be achieved, it is necessary to ensure that the capacities within UoTs are brought to an even footing with institutions that would be drawing from the same relatively decreasing pool of higher education funding.

The current funding framework makes provision for the following three funding categories (It also makes provision for an "institutional factor" which takes into consideration the institutional size):

- Funded student places.
- Institutional outputs, including student and research output.
- Development grants as per agreement with the DoE.

It is needed to illustrate the inter-relatedness between student enrolment planning and input and output funding:

4.4.1.1 Proportion of Diploma, Degree and Postgraduate Enrolments: The higher order weighting assigned to postgraduate studies implies that more undergraduate student numbers are required to receive the same consideration as for one postgraduate student. By implication, the resources and the maintenance of these resources of an institution with low prescribed postgraduate students are under considerable more pressure than one with a high postgraduate student cohort. It is therefore also important that the institutional factor takes into account the prescribed enrolment shape of an institution so as to restructure this resources strain to maintain and improve output levels.

The impact on UoTs is as illustrated:

- As indicated by the enrolment targets UoTs will have a range of "at least 74% - 87% of head count enrolments in undergraduate diplomas, and 10% - 19%" in undergraduate degrees. The proportion of enrolments in postgraduate qualifications must not exceed 7%. What is clear here is that there is a strict upper limit to postgraduate enrolments and a flexible upper limit for undergraduate diplomas. This suggests that DoE prefers that UoTs concentrate on diplomas and forget about postgraduate students. If the argument above is followed, then it indicates that funding of UoTs will never reach adequate levels.

If UoTs have to be essentially diploma awarding institutions, let the DoE put that on the table for debate first.

However, the contribution of UoTs towards the need of an increased delivery of post graduate students has to be acknowledged and funded. Additional research and innovation funding for UoTs should be seen as a strategic investment towards capacity development, upgrading of current staff's qualification, eradicating the backlogs created by differentiated funding towards the research universities, and addressing the equipment backlogs.

4.4.1.2 Shift to SET programmes: Funding is also awarded according to enrolment shape in particular the approved shift to SET programmes. At the time of drafting the new funding framework, UoTs did not exist. In making the decision to transform former technikons to UoTs, the understanding was that the Minister of Education aimed to create Technological Universities in line with other international technological universities. In approving enrolment plans for VUT, CPUT, DUT, CUT and TUT the minister expects that Science Engineering and Technology enrolment must shift to 50%, 50%, 50%, 45% and 40% respectively. These would be acceptable ratios in UoTs but given the huge cost of SET offerings this further disadvantages UoTs in that additional funding will be needed to provide a platform from which they will compete with traditional Universities that already have these in place.

It is recommended that a Task Team be established by the Minister, which must also include persons from former technikons or current UoTs to report on the backlog (infrastructure and staffing) at UoTs especially in light of the SET enrolment targets set by the Minister, and what interventions the Ministry can undertake to ensure that all institutions are on the same footing to compete for HE funding allocations.

4.4.1.3 Institutional outputs: There is another consideration relevant to the funding awarded for institutional outputs. There is nothing principally flawed in awarding the same consideration for the same outputs. Flaws however emerge in two areas for UoTs.

a) The first flaw emerges in connection with what constitutes the same outputs, especially the historical context thereof. As already mentioned, traditional outputs for these institutions are now disregarded.

- Research and Innovation Output Modalities for UoTs - In a period of rapid intellectual change, the need for UoTs which specialize in multi-disciplinary teaching and research as well as the application of knowledge has become evident. It is important to underline that UoTs will not aspire to be "research universities" and has a different focus through the application of technological knowledge to a given problem. However, the research enterprise in our country needs to raise its outputs. It needs to be recognized that there will be no shift in the research climate and output unless there is a sustained and dramatic increase in research funding and acknowledgement of other existing modalities of outputs, especially technology – orientated outputs. It therefore needs a broadening of the traditional understanding of research output as UoTs focus is towards the invention of new technologies and transfers of technologies towards commercialization.

b) The second flaw emerges in connection with the historical unevenness in the distribution of capacities to achieve the "same" outputs. In particular, the historical context of UoTs recruited staff more for their industrial demand and their technological prowess than their ability to facilitate learning, or to produce accredited research publications, or develop postgraduate programmes, or supervise postgraduate students.

- It is understood that right now UoTs may not have the capacity to increase postgraduate enrolments, but UoTs should not feel constrained in the future. UoTs cannot be given University status and at the same time be encouraged to only concentrate on diplomas and not research and postgraduate education. These apparent restrictions will not help to improve the research profile or the access to funding. The development of capacities within UoTs should be acknowledged as a strategic investment.

In short, the transformation of higher education, especially the definition of what should be the system outputs as well as the benchmarks thereof, places the UoTs at a considerable disadvantage in achieving these outputs and therefore in competing for funding consideration in this category.

4.4.1.4 Research Funding: The provision of "blind" research funding to traditional universities in the old formulae enabled them to not only attract quality researchers that built up a sustainable research legacy for traditional universities but also to establish post-graduate articulation routes in all their qualifications. The current funding framework forces UoTs to compete for the same funds without a solid foundation, although lower benchmarks are used for UoTs (0.5). There are also issues of recognition of the type of research work that disadvantages UoTs. Some work on this was done by the higher education sector in the past, but no movement has taken place ever since. SATN has established a working group to revisit this project.

The DoE's recent pronouncements – formal and informal – on various issues of research and enrolment appear to differentiate the higher education system in a piece-meal and opaque fashion. The concept of participatory democracy, the hallmark of the White Paper on Higher Education, seeks to ensure that those affected by decisions are engaged adequately before implementation. However, before UoTs have had that opportunity, they seem to be relegated to non-research and diploma institutions.

Development grants in terms of the funding framework is perhaps more ominous for institutional autonomy and academic freedom at UoTs. In particular, the state may award development grants if the intended development is consistent with its aims and desires for an institution. Thus the non-awarding of a development grant constitutes a state decision about the scope of academic engagement for a particular institution. It is important for UoTs that the conclusion of the differentiation debate will also conclude the avenues for development grants. In this respect, it is important for these institutions to develop alternative system development demands as well as the accompanying performance metrics and measures to be funded under this category.

4.4.2 Higher Education Qualification Framework (HEQF)

In the more recent consultation on the higher education qualifications framework there is no evidence that individual submissions from the UoTs was considered before the Minister finalized her decision on the matter.

The newly released HEQF will impact far more on UoTs than on traditional Universities. Diplomas, traditionally associated with Technikons are now on a lower NQF level than a Bachelor's degree. Although having the option to re-curriculate current diplomas, the following are only a few possible implications for UoTs:

- To move from a Diploma (NQF level 6) to a Masters level (NQF level 9) will require an additional year, unlike the current one year BTech. This will impact on the resources of UoTs, and diminish the opportunities to offer masters and doctorate degrees.

- To design Diplomas as Degrees will result in a change in admission requirements, which will negatively impact on student numbers. The implications of qualification admission requirements on first year student intake should be considered as the Minister had already gazetted the minimum entrance requirements.

- It appears that whilst the policy imperative is to make higher education accessible to more South African students especially from previously disadvantaged backgrounds, the HEQF is putting a ceiling on how far these students could aspire. The current provisions – where the Diploma is at level 6 – would hamper progression from certificates to higher degrees for many of the students. In addition, they would have to meet some minimum admission requirements for the qualification that most Diploma students may not have, but could be assumed to have through RPL. So, somehow, access to higher education is being curtailed and official pronouncements on it are being unmasked as mere rhetoric.

- Institutions (UoTs) will have to decide on a suite of programmes that would be most appropriate for UoTs. The costing implications of this curriculation process are still unknown, but will definitely have a financial impact.

- The offering of these programmes will be affected by the funding or non-funding of the Work Integrated Learning (WIL) component. The funding of WIL is not addressed in the HEQF or in the latest ministerial statement on HE funding. Although WIL has always been associated with UoTs and recognized as one of its distinguishing factors of our qualifications, it is excluded from subsidy, yet the proper monitoring and assessment of WIL is costly.

On Page 7 of the Government Notice of 5 October 2007 on the HEQF it is being claimed that "The framework incorporates a nested approach to qualifications design". This nested approach appears to be limited only to the technical aspects within a qualification – from generic to specific outcomes. Therefore, this nested approach could be interpreted as an intra-qualification nested approach. An inter-qualification nested approach should be considered where articulation from a diploma to bachelors and to masters could be less limiting. Articulation mechanisms should be both intra-sectorial (within higher education, for example between UoTs and traditional universities) and inter-sectorial (between FET and HEI).

On Page 13, there is paragraph on "Award of qualifications". Whilst it is agreed that a qualification should not be awarded for failure at a higher level, this statement needs to be qualified. Whilst this view is shared, a more progressive and positivist view about this situation should also be allowed. In an inter-qualification nested approach to qualifications, there should always be a scaffolding of qualifications from certificate right up to PhD. The Master qualification in the U.S. system is an integral and developmental part of the PhD where some of the students with Bachelors degrees register for a PhD. For the first two years they would be in virtually the same classes as the rest of the PhD students, except for individual choice. Those who are continuing towards PhD write their qualifying exams and then the full theses. Those who do not get past the qualifying examination stage would have achieved all the requirements for a Masters and could graduate with it. A good example is also Ireland, were a progressive inter-qualification nested system from certificates right up to PhD is being followed.

On Page 9 there is reference to "In the interim, a maximum of 50% credits of a completed qualification may be transferred…" How can UoTs design curricula by 1 January 2009 on the basis of an interim measure that could change just as the process is completed? This should not be made a general rule as this measure is restrictive and some diplomas could carry a substantial number of credits at the next NQF level -it should only refer to those diplomas carrying less than 50% of the credits at higher levels.

A concern is raised regarding the process leading to the final HEQF. Although a consultative process was envisaged and initially implemented, no progress reports were published and no discussions were held to address and interrogate suggestions and feedback from various constituencies.

4.5 EVENT OF THE MERGER

It is clear that the transition of technikons to UoTs presents many challenges of which the far reaching results of the mergers have not yet been realized. The development trajectory of the UoT sector was severely hampered by the advent of mergers in higher education. While still in their infancy many of these UoTs had new issues thrust upon them by these mergers. Even the Traditional Universities that were involved in mergers struggled to come to terms with the consequences of mergers.

The evolution of UoTs was rooted in mergers of two or more technikons; one always being historical advantaged and the other(s) historically disadvantaged. This in itself created a disparity amongst the newly established multi campus institutions. Although funding allocations of R3 578 million for infrastructure and efficiency have been provided in the MTEF, UoTs have only received a small percentage (20,8%) - funding for the multi-campus factor is yet forth coming. As stated in the Ministerial Statement on HE funding, the individual institutional allocations were based on a range of factors namely institutions needs, enrolment plans and performance targets relating graduate outputs. The basis for these allocations is questioned as the allocations have not kept trace with the impact of the merger process.

Although all merger partners of the UoTs were regulated through common structures such as the Committee of Technikon Principles (CTP), Committee for Tutorial Matters (CTM), accreditation body of the then Certification Council of South Africa (SERTEC), convenorship process which ensured commonality in similar academic programmes and credits, some key distinct differences influenced the quality of educational provision. Some key differences were the approaches and practices to budgeting, resource allocation, academic structures, and development of staff, students and curriculum. The impact of the mergers can only now be seen in the low success rates, staff turnover, decrease in student enrolments and leadership change and void that are being created.

Among the more serious consequences that newly merged Universities faced was the quest for a new institutional culture. The extent to which many of these institutions were successful in grappling with this unanticipated consequence was widely reported in the press. The Transformation goals of the National Working Group became engulfed in reports of racism, corruption and mismanagement. With communication through the press becoming the order of the day, public and corporate interest in many of these merged universities waned. Differential institutional cultures impacted on policy implementations whereby procedures are still not uniform. The “interim” capacity of staff influenced accountability and policy implementation within the multi-campus institutions. This includes the teaching and learning practices and procedures.

The brand of many (if not all) merged universities became more endangered as questions of academic credibility surfaced. The “brand” has had the advantages of attracting better third stream income to maintain the status quo of staff/FTE ratios, attracting better students from schools, attracting students from more affluent backgrounds who could settle their debts and contribute significantly to the sustainability of these universities.

The process of harmonization of conditions of service and of the tuition fees of two or more merging partners further exacerbated the process of forging branded organizations with common institutional cultures.

Early years of the Post-merger phase were dominated by concerns with establishing systems to enable the new institution to function as normal as possible – as a single entity. This created a platform for quick decision making processes which have new long term consequences and is now difficult to unravel.

One final unintended consequence of the merger process has been the 'mass' exit of senior management of UoTs during the process. Apart from the unstable environment this high management turnover created on individual universities, it has had a detrimental impact on the collective political clout that UoT Vice-Chancellor's have on HESA.

Although it may be argued that the negative impact of mergers affected traditional universities as well, the fact remains that the timing of the implementation of mergers (including the one that created HESA) has had a detrimental impact on the developmental trajectory of UoTs: fewer UoTs exist in the Higher Education Landscape today, with a concomitant diminished influence on HESA and the high management turnover appears to be confined to the UoT sector.

4.6 CONCLUSION

During 2001, in a position Paper, the then CTP argued the establishment of UoTs and stated as an opinion that "diversity, quality and relevance of higher education qualifications are fast becoming the deciding factors". It further argued for a "different type" of institution that will contribute to the diversity within South Africa's higher education system which should form the basis of its strength. Although a single, unitary system, the difference in focus and ethos between UoTs and traditional universities will not only bring much wider variety and diversity into the Higher Education scene but also contribute meaningful to greater technology transfer and international competitiveness (Report of the CTP Task Team on "University of Technology).

It is now clear that the differentiation of the Higher Education Institutions in South Africa is convoluted by the introduction of compulsory policy directives and mechanisms such as the HEQF, funding framework and other DoE policies. There is a perceived differentiation by stealth and therefore the differentiation debate can not continue in the current manner.

There is also clearly a lack of understanding of UoTs and the representation of members on many statutory bodies. There is a notion that HESA does not represent higher education but perpetuates the old SAUVCA bias.

For UoTs to contribute to a new intellect for Africa, its role as a newly established institutional type needs to be recognized and its status be seen on the same level as other institutional types that have been in existence for a very long time. All higher education institutions are of equal importance but with a different purpose.

It is an obligation of Government to provide funding as it cannot only announce technikons as UoTs and not support the development trajectory through additional funding and strategic investments. UoTs should also be given a fixed period with the necessary facilitation to develop into fully-fledged UoTs.

SECTION 5

CHALLENGES FOR UNIVERSITIES OF TECHNOLOGY

5.1 STRATEGIES TO FOLLOW

A UoT participating in the knowledge society needs to have an innovative approach towards knowledge. The following principles should be taken as a point of departure:

- Increase the percentage of postgraduate students to contribute through their research and innovation to the generation of new knowledge;
- Identify new technology-based fields of study;
- Redesign existing curricula;
- Increase the focus on applied research innovation and technology transfer within programmes;
- Introduce new delivery modes to support the notion of technology-based education and entrepreneurial skills.

5.2 ETHOS OF A UNIVERSITY OF TECHNOLOGY

The ethos supported by the university should be:

- Students should acquire the ability of life-long learning.
- Transferable skills are more important than subject knowledge;
- Students should be in a position to transfer from one level of education (B-Degree) to another level (M-Degree, PhD) at any other higher education institution;
- Students should be computer-literate with a sound understanding of entrepreneurial skills and sensitive towards work ethics;
- Next to computer literacy, students should have basic knowledge of information-literacy and business practices;
- Students should have a language proficiency in at least one international language;
- A qualification should lead to employability in more careers than simply' obvious' ones.

A new ethos calls for new strategies to be part of the knowledge society and its knowledge economy.

The following principles will be followed:

Principle 1: A UoT should identify strategic programmes with niche markets in the region and the national context.

- A university does not need more than 2 or 3 strategic programmes within each of its departments/schools;
- Programmes limited to the 13 fields of study identified in the NQF;
- Programme design is trans-disciplinary (between, for example, graphic design and

information technology) and inter-disciplinary (between various subjects for example, Management Sciences);
- Programmes should consist of core modules, experiential learning and an applied research component;
- All programmes should have an entrepreneurial and technological focus and based on technological education delivery;
- Students should have real work experience as part of work-integrated learning (experiential learning) within the curriculum.
- Business and industry should play a leading role in the development of the curriculum and outlining criteria for assessment.

Principle 2: The model of instruction should change

- Programmes should be a combination between a teaching/learning curriculum and a research component
- It should be accepted that postgraduate studies are not viable in all fields of study. A programme, however, should acquaint students with research methodologies such a qualitative, quantitative, triangulation, etc. and research philosophies such as structuralism, postmodernism, Mode 2 Knowledge Production, etc.
- Programmes should reflect the paradigm shift from teaching to learning.
- Contact sessions should be limited to the minimum with maximum opportunities to have focus-group discussions guided by a tutor/ facilitator.
- More practice/applied activities should be built into the curriculum.
- Programmes should be offered on an open and flexible system based on the concept of resource-based Learning.
- Assessment should be on transferable skills and the implementation of knowledge. The question no longer is what do you know? but rather what can you do?

Principle 3: Inter-institutional arrangements and co-operation with business and industry

The university should deliver (new and existing) programmes in co-operation with other (national and international) businesses and industries to avoid duplication and support the idea of accreditation, articulation, joint educational ventures, co-operative education, etc.

5.3 ADMISSION REQUIREMENTS (thresholds to entry)

5.3.1 Minimum thresholds for entry into Public Higher Education

The amended policy on *Minimum Admission Requirements for Higher Certificate, Diploma and Bachelor's Degree programmes requiring a National Senior Certificate* was published in the Government Gazette 31231 on 11 July 2008, and it amends the policy document by the same name gazetted on 5 August 2005.

The common basis of admission to a Higher Certificate, Diploma or Bachelor's Degree is the achievement of a *National Senior Certificate* (NSC) according to the rules of subject combination prescribed in the policy for the *National Senior Certificate – A Quilification at*

level 4 on the National Qualifications Framework, Government Gazette, Vol. 481, No. 27819, July 2005.

Higher certificate
The minimum admission requirement is a National Senior certificate (NSC) with a minimum of 30% in the language of learning and teaching of the higher education institution as certified by the Council for General and Further Education and Training (Umalusi). Institutional and programme needs may require appropriate combinations of recognized NSC subjects and levels of achievement.

Diploma
The minimum admission requirement is aNational Senior Certificate (NSC) with a minimum of 30% in the language of learning and teaching of the higher education institution as certified by Umalusi, coupled with an achievement rating of 3(Moderate achievement, 40-49%) or better in four recognized NSC 20-credit subjects. Institutional and programme needs may require appropriate combinations of recognized NSC subjects and levels of achievement.

Bachelor's Degree
The minimum admission requirement is a National Senior Certificate with a minimum of 30% in the language of learning and teaching of the higher education institution as certified by Umalusi, coupled with an achievement rating of 4 (Adequate Achievement, 50-59%) or better in four 20-credit NSC subjects chosen from the designated subject list. Adequate Achievement in four designated NSC subjects provides the primary basis for admission into a Bachelor's Degree programme. An institution is entitled to specify and appropriate level of subject achievement for a particular programme.

Summary: Minimum admission requirements to higher education

Higher Certificate	**Diploma**	**Bachelor's degree**
NSC Min of 30% in language of learning and teaching	**NSC** Min of 30% in language of learning and teaching Achievement rating of 3 in four recognized 20-credit NSC subjects	**NSC** Min of 30% in language of learning and teaching Achievement rating of 4 in four 20-credit NSC subjects from the designated list

5.4 THE HIGHER EDUCATION ENVIRONMENT

5.4.1 Relationship with Comprehensive Universities

In order to determine the nature of the relationship, the National Working Group's proposal to establish a comprehensive institution through the merger of a university and technikon was noted. Initially this proposal raised concerns regarding the implications thereof for the continued maintenance of the binary divide, in particular, that the role of technikon programmes would be eroded in a comprehensive institution because of the tendency to academic drift. The Ministry felt however that the proposals were intended to strengthen the provision of technikon programmes through ensuring that technikon programmes are available throughout the country, in particular, in rural areas, which are inadequately served in terms of technikon-type programmes. The proposed institutional landscape would, in fact, result in an increase in the existing stock of UoT programmes, which would be offered both in the proposed comprehensive institutions, and also in a number of universities in regions where there were no UoTs, such as in Limpopo, and the North-West, as well as in the National Institutes for Higher Education in Mpumalanga and the Northern Cape.

The Ministry's view was that the notion of a comprehensive institution was an important innovation, which would contribute to promoting a range of goals identified in the National Plan and which were central to Government's Human Resource Development Strategy, including:

- Increased access, in particular, in career-focused programmes with prospective students able to choose from a wider range of programmes with different entry requirements;
- Improved articulation between career-focused and general academic programmes, thus facilitating student mobility between different programmes;
- Expanded opportunities for research and the strengthening and development of applied research through linking emerging foci of the technikons to the current research strengths of the universities;
- Enhanced capacity (because of the broader range of expertise and foci) to respond to the social and economic needs of the region in general and of industry and civil society in particular.

The Ministry acknowledged the concerns regarding' academic drift' raised by the UoTs sector and agreed with the suggestion made by the NWG that' great care should be taken to prevent "academic drift" towards university programmes at the expense of technikon programmes' in comprehensive institutions (NWG: 18). The appropriate balance between enrolments in UoT and university programmes within comprehensive institutions would be determined by the Ministry as part of its programme and qualification mix approval process, and would thus be linked to the funding of student places.

From the above, it becomes clear that the Ministry envisaged a strong leaning in the comprehensive universities, and the 'refocused' universities, towards UoT-type programmes. Thus UoTs, the comprehensive universities and the 'refocused' universities will share many similarities and goals. Much of what appears then in this document in defining and delineating the broad terrain of UoTs, would apply also to, and can be taken on by, comprehensive universities and the 'refocused' universities.

5.4.2 FET Colleges

There has always been a natural alliance between Further Education and Training Colleges (FET) and technikons because of their common focus on vocational/applied training and education. As in the past UoTs will work in close cooperation with FET colleges to ensure a seamless transition for FET students into the UoTs. UoTs are assisting FET colleges in their recurriculation to ensure that N3-N6 students articulate smoothly into UoT programmes.

5.4.3 International Trends

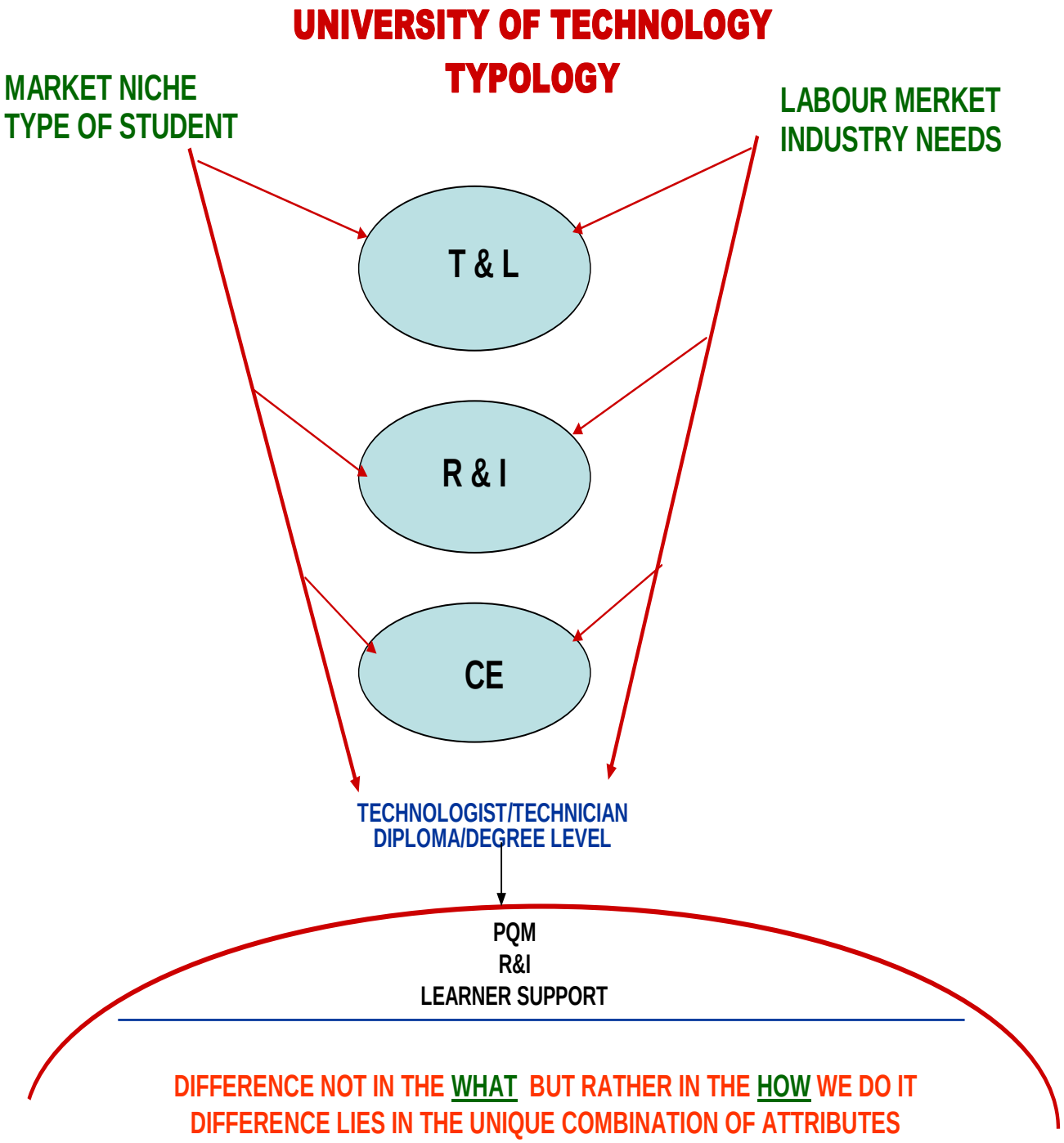
UoTs have concluded agreements with various international institutions to facilitate benchmarking and best practice. Membership of international associations such as the International Association of Universities(IAU) and Association of African Universities (AAU), and interaction with associations such as the HRK (Hochschulrektorenkonferenz) Germany, A VCC (Australian Vice Chancellors' Association), ATN (Australian Technology Network), IIE (International Institute for Education) in the USA, and VLHORA (Vlaamse Hogeschole Raad) in Belgium, allows UoTs the opportunity to keep up with the latest trends in technology education around the world.

5.4.4 HESA

As part of the new single higher education association, Higher Education South Africa (HESA), UoTs will be working in close cooperation with the rest of the public higher education sector, to provide the wide range, and diverse human resources needed for South Africa's growing economy. However, it is mindful of the Ministry's view that this sector must not succumb to academic drift and that a clearly technology focus is maintained to ensure differentiation and diversity, yet equality and quality, in the provision of academic programmes.

5.4.5 Benchmarks for a University of Technology

The operational implications for managers in a UoT entail that the characteristics of a UoT be elaborated into measurable criteria. These criteria are mentioned to serve as barometers against which management of the process may be effected and progress measured. Norms to classify institutions as UoTs will still be further refined in the future. The essence for managers is to create innovative, forward-thinking higher education institutions with strong "traditional" academic values, entrepreneurial business management practices and an essential customer focus. The criteria in the following tables should characterise a UoT:


UNIVERSITY OF TECHNOLOGY
TYPOLOGY
MARKET NICHE
TYPE OF STUDENT
LABOUR MERKET
INDUSTRY NEEDS
T & L
R & I
CE
TECHNOLOGIST/TECHNICIAN
DIPLOMA/DEGREE LEVEL
PQM
R&I
LEARNER SUPPORT
DIFFERENCE NOT IN THE WHAT BUT RATHER IN THE HOW WE DO IT
DIFFERENCE LIES IN THE UNIQUE COMBINATION OF ATTRIBUTES

Characteristics	Attributes	Criteria	Enablers	Benchmarks
Technology programmes that lead to innovation	Present relevant professional career programmes	• Advisory Committees • DoE/CHE/SAQA approval accreditation and registration • Professional bodies • Relevancy	• Labour market analysis • Stakeholder analysis • HEQF	Responsiveness of programme Employability
	Incorporate technological competence in learning programmes	• IT-related projects • E-learning components • E-assessments • Compulsory computer literacy modules • Utilizing technology within the teaching methodology • Electronic data/information resources	State of the art technology	All learning programmes have a technological competency
	Forster a qualified andcompetent lecturing corps	• Minimum of M + D qualification • Staff with industry experience • Staff competent with OBE • Staff competent with latest technology/technological advances	• Capacity building programmes • Sabbatical leave	All lecturing staff with a Masters as minimum.
	Operate within an advanced	• State of the Art labs, workshops • "Smart" classrooms • (Online applications) • Technological support	Funding	• 50% of classrooms "Smart" • 100% of labs state of the art.
Promote R&I to ensure leadership in and through technology and technique	Get R&I leaders acknowledged	• R& I staff with doctorates • Nationally rated researchers • Internationally recognised R&I leaders • Recent regular R&I outputs • International exchange • Research chairs • Critical mass		100% doctorates Annual output 1 Research chair per focus area • 15 persons per R& I activity
	Increase M & D students	• Steady increase in M&D FTE students • International acknowledgement and exchanges • Acceptable% of post-graduate students		1% per annum for 10year • 1 international examiner/ doctorate • 10% -15% M&D students • 0,5 publication units) (? M&D's, patents, artifacts, etc). No. of units, funds.
	Increase R&I outputs	• Steady increase in the research value chain outputs	Funding for R&I endeavours	1% of total income in funding for R &I activities
	Implementation of new modes of R&I	• R&I themes and projects created for M&D students • Partnerships entered into with aim to further R&I activities • Trans-disciplinary projects entered into • Applied R&I projects and problem-solving projects • New inventions		• R&I projects of a problem solving nature completed • R&I projects that lead to some improvement Projects completed on request from • commerce & industry

	Specialization in application (general statement)	• Problem solving R&I projects • Projects that lead to sustainable development • Technology transfer	• Venture capital • Seed funding	• Satisfaction of commerce/industry with graduates • 100% Employability of graduates • % of lecturers registered in professional books • % of lecturers with industry experience
Promote and develop an institutional entrepreneurial and innovative culture	Establish an enabling environment	• Diversified funding base • Resource generating ventures • Strengthened steering management	• Business plans for functioning and proposed ventures	External funding
	Commercialise ventures	• Patents and artefacts registered • Business ventures established • Partnerships and contracts entered into with business ventures • Third stream income	• Sound financial operation and functioning • Strategic plans • Venture capital • Industry participation	Annual increase in external funding for start-up of commercial ventures Sound financial operation and funding
	Advance entrepreneurship in students	• Programmes with entrepreneurship content and projects • Student projects commercialized through incubators/technology stations/Science Parks/etc.		Number of students involved
Increase national and international impact	Promote Academic Partnerships	• Programmes with international collaboration on curriculum compilation • Lecturer exchange/visiting professors • International students registered	• Project proposals • Conducive/ enabling environment • Availability/access of funding • Networking and serviced networks • Developed partnerships	• International partnerships entered into • Programmes recognised by institutions abroad • A visiting expert per programme/project p.a. • 2% of international students of students registered p.a.
	Increase national and International exposure	• Presentations/workshops/ conferences given/attended abroad • Visitors officially from abroad • Staff exchanges • Student exchanges	Affiliation to international bodies	1 paper per year in conference proceedings in field of study
	Otain International acknowledgement	• Formal invitations to specialised activities from abroad • Joint research/collaboration • Joint ventures • Consulting appointments	International Networking	Articles published in international journals

Obtain sustainable government/business/industry engagement with communities as end-users	Engage in government, business & industry participation	• Industry : WIL, joint/contract research, CPD, consultations • Government (Local, Provincial, National) : Short courses, CPD, consultancies • Society: mutual partnerships for sustainable development, research projects/curriculum input, develop/support/SMEs/ entrepreneurial activities, vacation weekend schools • Instilling civic responsibility in student	• Conducive/ enabling environment • Availability/access of funding • Networking and serviced networks • provision of expertise • multidisciplinary approach • RPL access • Favourable academic workloads	• Engaged Institution • (n) of project proposals • (n) of developed partnerships • Student community service projects completed • Cooperation agreements/ partnerships/contracts locally • Short courses offered for adult learners • (n) of Credit-bearing CPD courses
	Obtain community involvement	• Approaches by community • Needs focused projects	• Community-directed projects and programmes	Repeated Requests/ Continuity of interactions

SECTION 6

CONCLUSION

The growing importance of knowledge and applicable skills in the world of today, and the ever-increasing numbers of people being educated and trained at a higher level has increased higher education's responsibility to and its influence within society. In order to fully assure its responsibility and its role, higher education needs to change, and UoTs need to identify and actively fulfill their new and growing role and responsibility in this respect.

The labour market has in effect now become the skills market, and, if education led only to knowledge, it would support an outdated system. Only when learning leads to the acquisition of new skills, and the active application of such skills, will the economy benefit and can the challenges of change be managed more effectively. Relevance in higher education should be assessed in terms of the fit between what society and the modem world of work expect of institutions and what they actually do.

Cognisance must be taken of the full consequences for higher education of a modem economy and sustained development. A modern economy with its high 'technicity' and sophisticated technology has an insatiable need for innovation, in turn requiring continual progress in applied research and development, as well as highly-skilled and qualified staff in various fields, especially new fields, who not only need to keep their knowledge up to date, but also have to progress, improve, and innovate at a personal level4.[4] Developing entrepreneurial skills and initiative should become major concerns of UoTs in order to facilitate the employability of graduates who will increasingly be called upon to be not only job seekers but also job creators.

In this new millennium, the dominating philosophy is that of sustainable development, with the major aim of eradicating poverty. As 83% of the world's population lives in developing countries, the role of technology and technology education is crucial for development. Since technology contributes to a country's ability to create wealth, it stands to reason why nations, especially in developing countries, should focus their education on technology. Because UoTs are so closely aligned to industry and the needs of society, they should fulfill a leadership role in contributing to the development and sustainability of the built, economic, institutional, natural and social environments.

South Africa is currently experiencing only the initial growing pains of a modern economy. The question is whether our current higher education system will be able to plan and proactively meet the highly complex educational needs it is going to be confronted with. This is the challenge UoTs intend to meet.

4 The goal of technology education is to develop well-balanced intellectuals who could take the lead in society, and not unbalanced technocrats by way of narrow 'job training.'

SECTION 7

DEFINITIONS

Academic development
Also known as Educational Development. A field of research and practice that aims to enhance the quality and effectiveness of teaching and learning in higher education, and to enable institutions and the higher education system to meet key educational goals, particularly in relation to equity of access and outcomes. Academic development encompasses four interlinked areas of work: student development (particularly foundational and skills-oriented provision), staff development, curriculum development and institutional development.

Accreditation
Recognition status granted to a programme for a stipulated period of time after an HEQC evaluation indicates that it meets minimum standards of quality.

Benchmarking
A process by which an institution, programme, faculty, school, or any other relevant unit evaluates and compares itself in chosen areas against internal and external, national and international reference points, for the purposes of monitoring and improvement.

Community engagement (service)
Initiatives and processes through which the expertise of the institution in the areas of teaching and research are applied to address issues relevant to its community. Community engagement typically finds expression in a variety of forms, ranging from informal and relatively unstructured activities to formal and structured academic programmes addressed at particular community needs (service learning programmes).

Cooperative education
A philosophy of learning that promotes the concept of enhanced learning based on cooperation between education institutions and industry, commerce and the public sector.

Education and Training Quality Assuror (ETQA)
Body responsible for monitoring and auditing the level of achievement of national standards or qualifications offered by providers and to which specific functions have been assigned by the South African Qualifications Authority (SAQA).

Existing programmes
Programmes that are registered on the NQF and have been accredited by the Universities and Technikons Advisory Council (AUT), SAQA or the HEQC.

Experiential learning
A term traditionally used within the former technikon sector for “work-based learning” (see Work-based learning).

Innovation
Refers to the application in practice of creative new ideas, which in many cases involves introduction of inventions into the market place Technological innovation is the process that

transforms new knowledge into wealth. It covers the different steps of the innovation chain, from the creation of new ideas, the development of technology in the form of products, processes and services, up to the ultimate successful commercialisation and/or implementation.

Institutionally managed evaluation
Evaluation activities that are initiated, managed and financed by the institution itself.

Institutional quality management system
Institutional policies, systems, strategies and resources for assuring, developing and monitoring the quality of teaching and learning, research and community engagement.

Minimum standards
Requirements for a specific level of provision that a programme has to meet in order to be accredited by the HEQC. In order to make an independent assessment of a programmes development, management and outcomes through the validation of the findings of an internal programme self-evaluation.

New programme
A programme which has not been offered before, or a programme whose purpose, outcomes, field of study, mode or site of delivery has been considerably changed.

Professional programme
A programme that has to meet the licensure and other professional and work-based requirements of statutory councils.

Programme
A purposeful and structured set of learning experiences that leads to a qualification.

Programme evaluation
The external quality assurance processes which are undertaken

Programme review
An institutional quality assurance process undertaken to make an evaluation of a programme's development, management and outcomes and, where external, to validate the findings of an internal programme review.

Qualification
Formal recognition and certification of learning achievement awarded by an accredited institution.

Quality assurance
Processes of ensuring that specified standards or requirements have been achieved.

Quality management
Institutional arrangements for assuring, supporting, developing and enhancing, and monitoring the quality of teaching and learning, research and community engagement.

Recognition of prior learning
Formal identification, assessment and acknowledgement of the full range of a person's knowledge, skills and capabilities acquired through formal, informal or non-formal training, on the job or life experience.

Re-accreditation
Accreditation of an existing programme after its previous accreditation by the AUT or SAQA or the HEQC.

Service learning
Applied learning, which is directed at specific community needs and is integrated into an academic programme and curriculum. It could be credit-bearing and assessed, and may or may not take place in a work environment.

Technology
Refers to the effective and efficient application of the accumulated know-how, knowledge, skills and expertise, that when applied, will result in the output of value-added products, processes and services.

Technology transfer
Is the formal transfer of new discoveries, innovations and technology, usually resulting from R&D activities at universities, to the commercial and industrial sectors in the economy. Implicit in the term is the understanding that a tangible "intellectual asset" has been identified for transfer.

The literature also refers to technology interchange, emphasizing the two streams for technology transfer - one from within the university and the other an external stream of opportunities being brought into the university for joint development and exploitation.

Universities and Technikons Advisory Council (AUT)
This was the Minister of Education's advisory body before 1994.

Work-based learning
A component of a learning programme that focuses on the application of theory in an authentic, work-based context. It addresses specific competences identified for the acquisition of a qualification, which relate to the development of skills that will make the learner employable and will assist in developing his/her personal skills. Employer and professional bodies are involved in the assessment of experiential learning, together with academic staff. (Also see Experiential learning.)

SECTION 8

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