

University,  
curriculum  
and society  
through a  
scenario  
analysis  
lens

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# University, curriculum and society through a scenario analysis lens

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## **Paradigms Issue 18**

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# Introduction: Futures studies and scenarios of degrees in technology

James Garraway

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In the Higher Education Qualification Framework (HEQF) diplomas, while having some theoretical knowledge, are primarily vocationally focussed towards industrial applications. Graduates are expected to be able to apply what they have learnt in relatively specific fields, and to have engaged in some form of work practice during their studies. In contrast, graduates with a degree are expected to have a stronger theoretical knowledge base which can be applied to a wider variety of contexts. Furthermore, they would be expected on graduation to demonstrate higher levels of initiative and responsibility than diploma graduates, but are not specifically required to gain work practice knowledge during their studies.

Over the last few years in discussions in Faculty Boards and in staffrooms there has been a call to replace many of our diplomas with degrees. The current requirement that all qualifications be resubmitted for review has sharpened interest in this possible change. In fact this has already happened in some instances where the diplomas already have a high level of scientific and theoretical knowledge, even though they still have strong workplace learning components; Radiography, Biomedical Sciences, Emergency Medical Care and Education are current examples of this conversion.

As is discussed in the articles here, there are many pressures from both outside and inside the university to offer degrees, either to replace diplomas or as a parallel offering. Much of the impetus arises from the perceived need to increase the scientific content of diplomas so that students are better able to adapt to increasingly complex workplaces and to respond to issues such as environmental sustainability, a pressure raised by Hugo in her Design scenarios. In fact the issue of sustainability has already been raised in futures studies of universities in general across the world (Blass and Woods, 2012 ). Improved work responsiveness raises an additional important point concerning irreversible future developments: As universities of Technology we are 'locked-in' to acknowledging work in the design of our curricula. All curriculum initiatives must pass through this point of evaluation in some way, as has been suggested by Winberg et al in this volume.

Then there are issues of improved status for staff, students and the university if degrees were more routinely on offer. Difficulties, however, arise when issues of access to higher education and access for success are discussed: Would, for example, offering degrees serve to exclude more students from higher education? Then there is the issue of employability of graduates in the light of the loss of more practice-orientated experiences, and even the suitability of current staff to offer degrees, particularly where they have over the years developed knowledge and skills in more practice-based offerings. Thus any move to offer degrees should not be taken lightly given the potentially contradictory pressures at play which, even if they are not directly resolvable, at least need to be discussed by Faculty. The issue is made even more complex when universities are understood as multi-level organisations, with academic staff having allegiance to both the university and its strategic directions and to their practice fields, including underlying science (Rip, 2011). This tension can be observed in the scenarios developed in this volume.

Thus the purpose of this volume is to provide a discursive space which underlines some of the complexities, advantages and disadvantages of offering degrees. The discussion on degrees and diplomas offered is important in its own right. It requires us to look into possible futures of education and training in relation to the world of work and the role of various qualifications. A useful way to do this is to set out a combination of a diagnosis of the present situation and dynamics, and scenarios

about possible future dynamics. This is what the papers in this issue of paradigms set out to do, and in so doing they showcase an approach to consider future developments.

In the remainder of this introduction I will do two things. First I introduce the notion of future studies and general scenario approaches. Second, I will discuss some foundational issues about the role of future studies in deciding on and shaping of actions.

When we make choices about the design of curriculum we are also imagining what society will look like four years on. We are looking into the future. There are a wide range of tried and tested future-looking methods in science, technical innovation, and general business studies (what will markets be like in future?). These can range from mathematical modelling (for example predicting fish populations in the future given current and future quotas) to expert opinion (Delphi method). These methods have two things in common. Firstly, they assume that futures will unfold in a stepwise and inevitable fashion. However, this is often not the case as complex forces are at play in determining the future (De Laat, 2000). For example, the predicted case of the electric car replacing petrol/diesel cars has not happened at the scale originally predicted in the 70s. Rather, more fuel efficient, environmentally friendly petrol cars and some hybrids have been developed.

A second trend in future studies is that the act of designing is separate from what might occur in the future, and that whatever is designed will be suited to or fit in with what will unfold. A different view is that designs actively change the future (De Laat, 2000). For example, the advent of laptops fundamentally changed how people could work enabling them to work anywhere at anytime and communicate such work to others. What is designed is thus an actor in determining future developments rather than a passive addition.

Scenarios are exploratory, discursive tools aimed at promoting discussion and reflection, rather than projections or extrapolations, in order to ascertain consequences of actions as yet unperformed. In designing scenarios we attempt to take a developing situation (in this case the prospect of offering degrees at universities of technology) and using some information from current discussions to develop a broadly defined, possible and plausible future (Wright et al, 2012). The next stage of analysis is to pose the question 'if these events were to occur then what would the implications be?' (Alcamo and Rothman, 2004). Typically, the scenario sets out an initial position and, in the form of a step-by-step narrative, the main factors which influence developments, but more than one narrative is offered in order to provide for more critical discussion.

Scenario work has generated different methodological foci. Scenarios may be combined with Delphi techniques, for example, or the focus may be on how powerful groups work to preserve their interests as events unfold. Scenarios can also be used as a tool to compare different developmental strategies or, more commonly, to anticipate the future (Wright et al 2013).

The present discussion of degrees and diplomas and related case studies of degree scenarios are anticipatory types of scenarios and have been developed by lecturers in the fields of Health Science, Applied Science, Design and Manufacturing. These scenarios, it is hoped, can be used to stimulate discussion in Faculties, and even serve to improve the qualifications ultimately offered. Issues underpinning the way scenarios may unfold, in particular related to the relationship between university and work, are now discussed.

Universities and workplaces are different institutions in that they have different goals – learning versus production, for example – and have to work together as universities of technology aim to prepare students for work. This initial and visible difference can lead to two lines of thought, both of which relate to the design and showcasing of scenarios concerning the introduction of degrees in the articles in this volume.

One line of thought is that of nurturing new ways of thinking in the curriculum within the protected space of the university. The new ways of thinking may need to be nurtured and protected because

they are as yet not fully accepted by society, even though they may clearly have benefits when seen from the point of view of the creative lecturer. Universities, because of their separateness can provide this protected space. De Waal's example of introducing diagnostics into the undergraduate Emergency Medical curriculum, even though this may not be acceptable under current work conditions, illustrates the need for such protected spaces. It also illustrates the difficulties of 'jumping the gun' by introducing an innovation too soon into an as yet unprepared society; the innovation may be snuffed out at an early stage. Through being developed in the university curriculum it is possible to extend the theory and practice of Emergency Medical Care. In addition, when such diagnostically trained students are given exposure to the field for short periods in weekend experiential work, it may be possible to change society somewhat so that the additional theory training is more acceptable. These sorts of arguments can be related to the strategic niche management concepts of 'fit or stretch' (Hoogma et al, 2002). Here the curriculum innovation could be described as stretch-stretch as there is both a new product (a stretched curriculum) and an attempt to change society to receive it (a stretched society).

In the second line of thought it is not only protected spaces within universities which enable innovation but also new or 'third spaces'. When universities and workplaces come into contact with one another there are both similarities and differences and gaps between them. More specifically, work knowledge is essentially used to enhance the productivity, innovativeness and skills base of the firm whereas in the academy knowledge is concerned with the mastery of disciplines and their (possible) application in the world. Differences between the institutions may serve to challenge and disrupt the previously held knowledge of the other. The processes of disruption are that knowledge and practice may be questioned). A new zone of potential knowledge development, a third space, can be opened up between the two systems such that 'potentially shared or jointly constructed objects' may arise and be identified (Engestrom, 2001: 136).

In creating scenarios concerning a move from more work-oriented diplomas to more academic degrees, writers in this volume are setting up third spaces between the two worlds of academia and work. Perhaps the most obvious example is from Millar and Hovgaard's Clothing Technology article (this volume), an analysis of present and emerging difficulties in work and new developmental spaces opening up. Clothing qualifications have up until now prepared students for a particular vision of work (large scale factories) but the authors anticipate other ways to view workplaces, that may even become new developments in the future which our students could be prepared for; for example, with massive retrenchments in the major factories, worker's groups may buy up redundant equipment and set up small scale manufacturing industries. As before contradictions emerge between old and new ways of doing, and these do not only create tensions but also third or developmental spaces.

Such spaces and the tools of scenarios within them are furthermore seen as developmental in that they provide a reflective space for others – academics and even work representatives - to work across differences in order to come up with hybrid solutions. Both Hugo and Kleyn-Magolie also refer to such developmental spaces in their scenarios.

Such a process is also potentially cyclical, and has much in common with Engestrom's (2001) concept of expansive cycles of organisational learning.

In this model, unlike in typical organisational learning models, the stimulus for learning and development is the recognition of contradictions or difficulties between practices, which may result in successive cycles of learning. For example, in Hugo's case study, the need for graduates with knowledge of environmental issues is one impetus for the addition of more theory leading towards the introduction of degree rather than a diploma. When this is modelled in a scenario, however, further difficulties (secondary contradictions) are seen to arise such as the need for more qualified staff and this difficulty stimulates further reflection and the development of different models. Similarly, Maqutu and Kleyn-Magolie's descriptions of societal pressures to change from Diplomas

to Degrees, for increased status and employability, leads to secondary contradictions such as access issues.

A further observation on third spaces and development, with particular relevance to diploma/degree relationships and developments, concerns the possibility of take up of innovations where previous, functioning methods already exist. There is adherence to the old and thus difficulty in taking up the new. For optimal uptake and development of the new, it firstly needs to be recognisable and communicable to adherents of the old methods. If the innovation is too different from the previous method then there may be such resistance that the new withers. However, if the innovation is too similar to the previous methods then uptake will be easy but there will be little significant change. There is thus a trade-off between degree of difference between old and new practices, and their uptake within institutions (Nootboom, 1999). This sort of tension can be seen in all the cases where staff wish to introduce degrees where diplomas already exist. The case described by Maqutu and Kleyn-Magolie of environmental management introducing a diploma which has an upgraded academic component yet still remains a diploma, is a case in point.

Most of the articles in this issue of Paradigms wrestle with the specific issues involved in choices for diploma or degree, and show that articulating possible futures adds another level to the discussion that will allow more productive discussion. In doing so, they refer to wider issues, about universities of technology in South Africa and about the processes of transformation in South Africa. Winberg et al, and Rip in his brief article at the end, use all this as an occasion to outline desirable futures for CPUT, perhaps setting a model for other universities of technology in South Africa. Thus, this issue of Paradigms can be a stepping stone to further discussions about the future of CPUT, at all levels of the university.

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# Creating futures for the Cape Peninsula University of Technology

Chris Winberg, Penelope Engel-Hills and Arie Rip

## Introduction: a modern university of technology

A powerful set of projections has constructed post-apartheid higher education in South Africa. Among these is the expectation that technikons would become universities of technology, with a mission to drive technology relevant for national reconstruction and development. Like the five other South African universities of technology, the Cape Peninsula University of Technology (CPUT) is still under construction, trying to identify its institutional 'distinctiveness', including the type of undergraduate and postgraduate qualifications it will offer. In this paper, we use CPUT as a case study to explore both the innovative activities, and the challenges, that make universities of technology distinctive. We sketch a broad scenario of a possible future for CPUT, and position this between two other scenarios that we outline only briefly. We draw on future scripting methods developed by De Laat (2000) and Den Boer, Rip and Speller (2009).

In imagining a CPUT-of-the-future, we build on Clark's (1983) analysis of the unavoidable dual structure of universities as well as his (2004) analysis of successful universities, notably that they are flexible and adaptable. Rather than opting for '... the comfort of standing still ...' (2004), they actively transform themselves, and thus are distinguished from mainstream universities (described by Clarke as 'immovable cathedrals') that avoid 'the rapidly flowing streams of societal change'. While we do not adhere entirely to Clark's (1998) five common elements of successful universities: 'a diversified funding base, a strengthened steering core, an expanded outreach periphery, a stimulated academic heartland and an integrated entrepreneurial culture', they are a useful starting point for our scenarios. Rip and Kulati (2013) emphasize that the university has three distinct levels: a level of strategic leadership, a middle level of deans, directors and project leaders, and a base level of expert performance where academics work together productively (See figure 1).

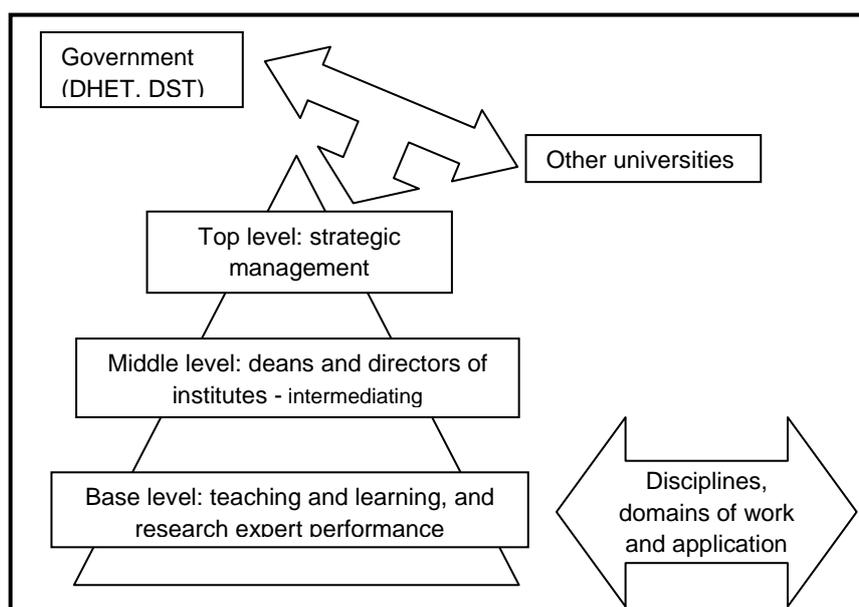


Figure 1: the structure of universities

All organisations are complex, but universities of technology show a particular kind of complexity that is linked to their core competencies being embodied in practitioners who are oriented to their professional domain. A modern university of technology is expected to embody a vision that shows how technology functions, and can function, in our world (Winberg 2004). Universities, as Clark (1983) has pointed out, are 'dual' institutions, accountable 'upwards' to regional and national imperatives, economic conditions, and other forms of contextual enablement and constraint; but they are also accountable 'downwards' to staff embedded in disciplines (and new inter-disciplines and trans-disciplines), research projects, and the development of students. There are the requirements of organisations with a more or less top down thrust; then there are the horizontal dynamics of research and teaching 'performance groups' and to some extent faculties orienting themselves to their disciplines, domains of application, and the future careers of their graduates. In Mintzberg's (1994) typology of organisations, universities are professional 'adhocracies', tempered by some bureaucracy. In recent years, and partly because of the interest in New Public Management, there are attempts to strengthen the role of the top of the university and the concomitant bureaucracy. This creates tensions with the base level where teaching, learning, research and innovation occurs.

### **Two possible scenarios for the Cape Peninsula University of Technology**

Tensions between the 'layers' of the university are structural; and there are various ways of responding to this. The traditional approach has been to limit the role at the top level of management with support staff and advisory groups engaging in 'light' overall management and intermittent strategic decision-making. The base level is responsible for teaching, learning, research and innovation, anchored in its expertise and linkages with the outside world. From the 1960s onwards, there have been increasing attempts to introduce stronger management (Deem 2007). In the modern university, the organisation with its overall strategies and their implementation, its financial models, and its monitoring, becomes more important than the teaching and research performing groups and their specific and diverse expertise (van Vught 2008).

Interestingly, in the modern university, the middle level of Deans (and sometimes also heads of institutes, units and centres) takes up some of the managerial responsibility, and in doing so creates additional dynamics. This middle layer of the university might see their role as derived from delegation from the top, but the Deans are also close to the world of their faculty and its departments, and may identify with that world more than with their remit from the top (Rip & Kulati 2013). Deans, directors and project leaders respond differently to what Rip and Kulati (2013) call 'vertical pressure (and affordances), linked to how the university tries to survive and compete in the larger world'; and 'horizontal pressure (and affordance) deriving from changes in the way science is done (in terms of organisation as well as content)'. (In our case, there are also changes in the world of work that are relevant.) Hence, not only will the structural tension in universities become institutionally localised in the middle level, but this level will show dynamics of its own, adding to the complexity.

We show these tensions by outlining two extreme scenarios for possible future development of the organisation of a university. In scenario 1 (Figure 2), the middle level allies itself with the top level, and tries to implement strategies and measures on a somewhat reluctant base level, leading to the fully modern university. In scenario 2 (Figure 3), the middle level allies itself with the base level, and resists top-down policies. They can do so because they can mobilise external support, ranging from external research funding to involvement in curricula, and moral support for innovative ventures of research and teaching groups. They might even break away from the university. This is a real possibility for 'Centres of Excellence and Relevant Research' (Rip 2002), an increasingly important phenomenon in national research systems, many of them located wholly or partially in a university.

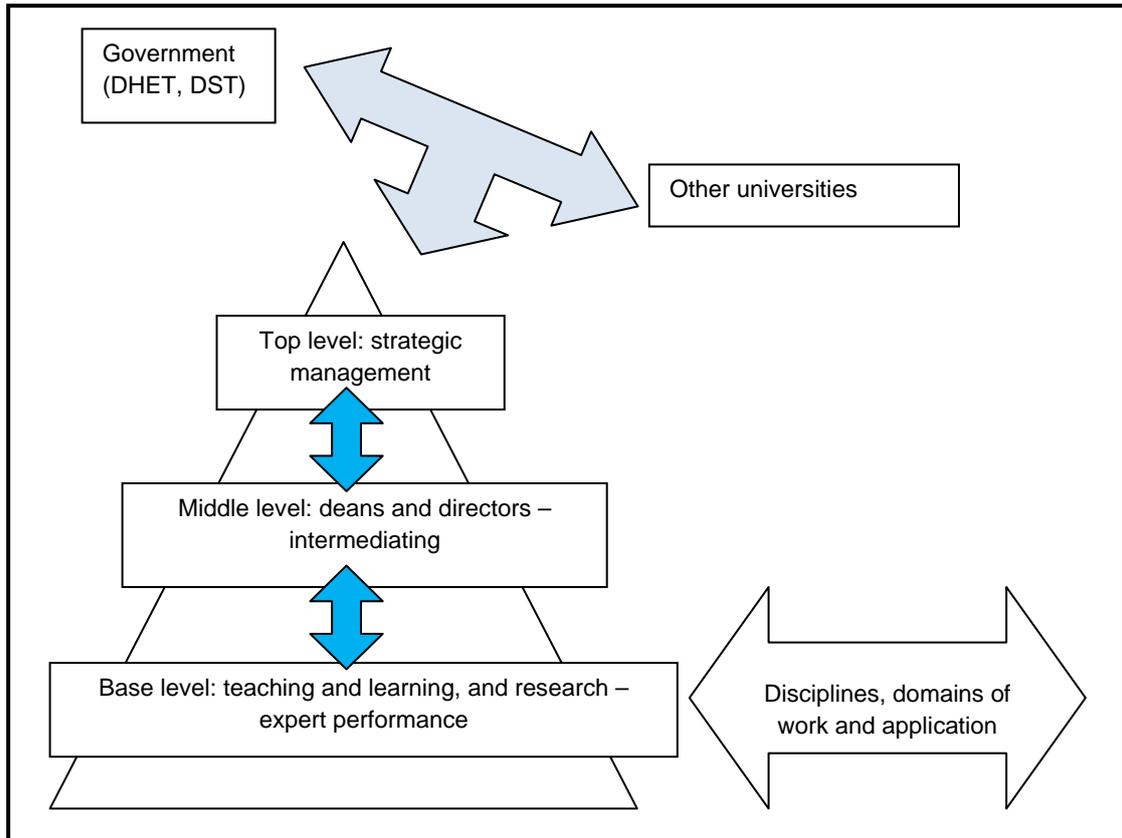


Figure 2: Scenario 1 – an alliance of top and middle level

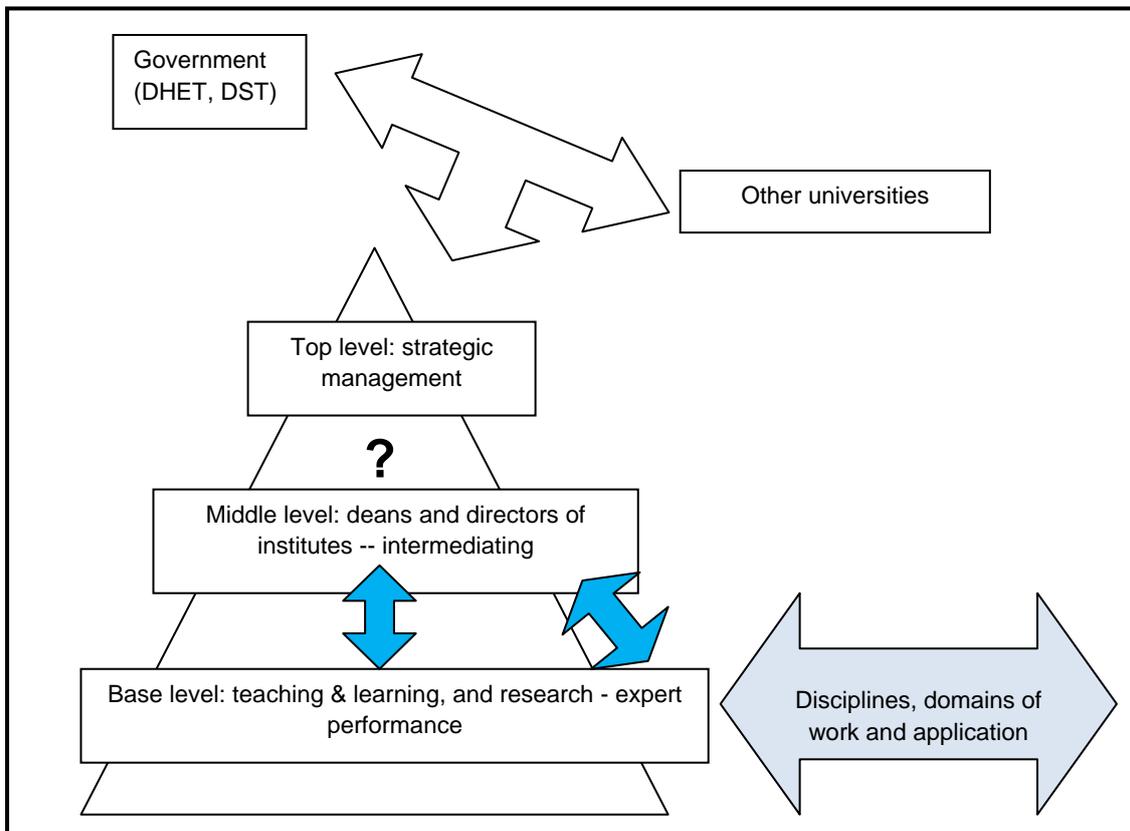


Figure 3: Scenario 2 – alliance between middle and bottom level, and links with external world

These two scenarios exemplify extreme possibilities for the future of CPUT. That is the function of such scenarios: to highlight one or another stream of development. As such, they demonstrate further ways that the structural tension in universities might be handled. The extreme possibilities may not materialise, but their consideration sensitises those in the university, including top management, to the possible latent tensions. This is important because there might be events or concrete developments that exacerbate these tensions, and that need to be understood in these terms. The present move from diplomas to degrees in South African universities of technology is such a development.

### **The issue of degree programmes**

CPUT is seeking 'distinctiveness' in the post-apartheid higher education landscape, which adds to structural tensions. Focussing on the expectation that the universities of technology will drive the technological aspects of South Africa's National Development Plan, the choice to offer degree programmes, or the choice to continue to offer diploma programmes, as the entry level qualification for employment, is a site where the tensions become articulated, and should be recognised. Since the choice will be programme specific, rather than the same across the whole institution, this tension might work out differently for the various academic departments. This therefore adds a further tension given the preference from the top for unified approaches and standardisation.

The option to shift to a degree programme or to retain the diploma or higher certificate as the first exit point is real; thus CPUT has the option to offer degrees as the entry level qualification for professional practice in the workplace. If we adhere to the vision linked to how technology functions, or can function, in the world of the future, then this choice is not simply about what the academics want or think is optimal for reasons of status. Rather it is a choice made in a complex environment with unwritten rules of engagement that can defend or undermine the concept of a degree based on professional knowledge and scientific content alone. Status, and thus the perpetuation of social stratification, is one such criterion that continues to dominate the social agenda of a society that transfers responsibility for the maintenance of this social structure to the higher education institutions. Engineering work places, for example, are familiar with diplomates trained by ex-Technikons and with the place they occupy in the engineering job market and hierarchy. As universities of technology embrace degree programmes, they leave workplaces in a quandary as to how to absorb the new graduates and who will fill the vacancies that arise when the diplomates disappear. Such a quandary does not belong to engineering alone; it is visible within all professions that are accustomed to tiered entry level qualifications and threatened by radical departures from the known.

Over many years UoTs have developed extensive collaborative partnerships with workplaces (or industry as they are commonly called). This offers a potential competitive advantage in an environment where the focus is on graduate attributes and generic skills. Hence in the choice between a degree or diploma, the continuation of a workplace component in the programme is a non-negotiable; this differentiates UoT programmes from those of traditional universities. But there is a dilemma: if a UoT degree requires the student to spend a lot of hours in the workplace during their studies, this will limit the time spent on theory and generic skills. If this is perceived as problematic, the degree obtained at a UoT will not translate to equal opportunity in the workplace. This dilemma should be faced head on, by showing that working knowledge is just as important for employment qualifications as abstract knowledge beloved by traditional universities.

These brief observations show that there are deep questions involved. One is that functional status differences may not be indicators of relevant competences, but mainly reproduction of existing social stratification. Another deep question is about the nature and relevance of various knowledges and skills. How important is theory, compared with experience-based knowledge, in actual achievements in the world of work? Theory is abstract, and requires translation before it can be relevant (if at all possible). But experience-based knowledge can be conservative, because it is

based on past experience. There may be ways to address this dilemma, but these will be domain specific. This reinforces the point made in the earlier section, that research and teaching groups at the base level address specifics while the top level of the university tends to focus on the general. The latter may have some advantages, but there is a clear case for the top level to entertain, and perhaps stimulate, variety.

Less immediate, but very important, is the question of what a university of technology in South Africa could be. Hence we created a third scenario which sketches a desirable future, taking into account incremental but important improvements, and building on a vision of what a university of technology could be (Winberg 2004).

### A third option for a possible future for the Cape Peninsula University of Technology

In this section we create another possible future for CPUT, acknowledging that there will be different dynamics and different rates of progress towards the CPUT-of-the-future at the three different levels within the university because the different levels have differentiated access to various resources in order to address a variety of needs and interests. Our future conceptualisation accepts that it is not always possible (or desirable) to achieve congruence between the different levels, but it builds on a situation of mutual appreciation, which allows more productive action of the university as a whole than in the two scenarios we sketched briefly above. We do not develop possible routes towards such a future state of the university of technology. Our objective was to show what is possible and desirable. Our vision is applicable to modern universities of technology in South Africa in general, but we focus on the specifics of CPUT, which also allows us to say something about the distinctiveness of CPUT.

In the third scenario, CPUT is able to make a significant contribution to the education of professionals and applied scientists in the region, nationally and internationally. CPUT also undertakes significant activities in fields of applied research and innovation. In conducting its teaching and research it has productive partnerships with local and international business, industry and professions. CPUT also has strong partnerships with communities, with the focus on poverty reduction, education and other millennium goals, and makes a meaningful difference to the quality of life in the Western, Eastern and Northern Cape regions in particular. Using Clark's (2004) notions, as a 'sustainable adaptive' university of technology, CPUT does not depend on 'ephemeral personal leadership', but rather depends on collective responses to build new sets of structures and processes – accompanied by allied beliefs – that steadily express a determined institutional will. The CPUT-of-the-future has 'a stabilizing entrepreneurial constitution woven into the fabric of the university'. In order to realise this vision, CPUT has a new structure, one that is founded on mutual appreciation of the three levels of the university.

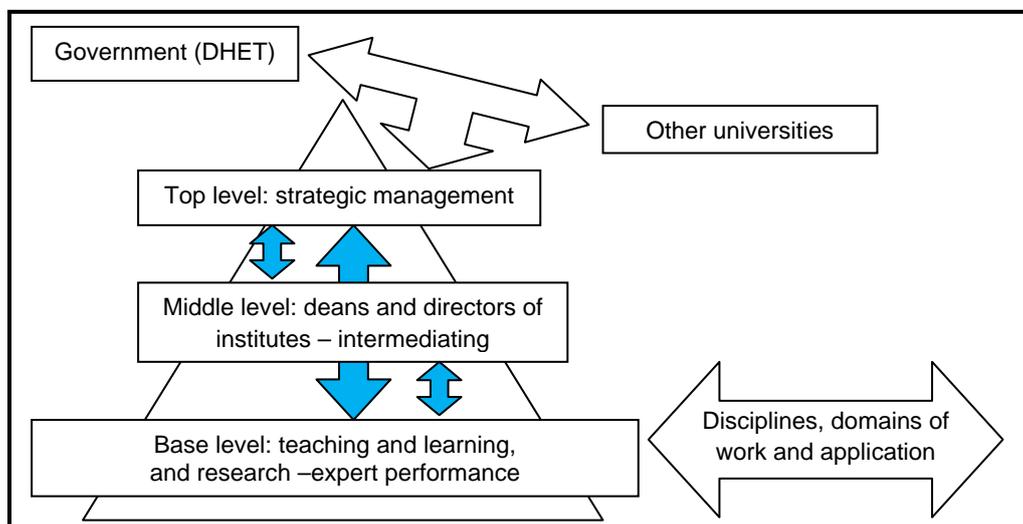


Figure 4: Scenario 3 – mutual appreciation of all levels

### *The level of strategic leadership*

In this scenario, strategic leaders at CPUT are the custodians of the institution's vision and mission, which is to be at the heart of professional education, research and innovation in Africa. This vision provides the guiding principles for students, university teachers and researchers at CPUT. Strategic leaders understand and engage with issues of institutional transformation, to meet national demands for equity and redress and to unshackle the institution from the limitations of its history. CPUT's leaders encourage participation by all levels and all partners in order to enable the institution to implement transformation at an institutional and sector level. Transformation for CPUT is defined in its contribution to development and innovation for the benefit of the communities that CPUT serves. With the support of its leaders, this vision is realized.

### *The level of deans, and directors of institutes*

Between the levels of strategic leadership (top level) and expert performance (base level), there is an active intermediate level comprising deans of faculties, directors of 'Centres of Relevance and Excellence', and leaders of programmes. The intermediate level is still the key, but now because it is a level of 'translation'. Translation is founded on respect for the expertise at the base (because there is an understanding that the university is dependent on that expertise); but also (because of the competence of strategic leaders) there is respect (or at least understanding) of the judgements and decisions of the strategic layer. Practitioners at this intermediary level are responsible for the translation of the needs of the experts to strategic leaders and a commitment to the insightful interpretation of vision, strategy and policy for the purposes of expert implementation (while translation can happen in different ways).

### *The level of teaching, learning, research and innovation performance*

There is pride in the accomplishments and achievements of the performance layer. In particular, CPUT prides itself on its collaboration with business, industry and professional partners. With over 36,000 students, over the years CPUT has graduated 25% of all engineers in the Western, Eastern and Northern Cape regions. CPUT provides education in specialist programmes, has 300 professors and all full-time, tenured academic staff have doctoral level qualifications in their specialist fields. CPUT has an annual operating budget and a spend-per-student that enables it to provide a high standard of educational provision. The ethics of undergraduate and postgraduate education is given particular attention in the context of industry and community collaborations in the broader African socio-technical environment. Students understand their right to a broad education, disciplinary/theoretic knowledge and the discourse of civic engagement (Wheelahlan 2010) in a context of industry-focused collaborations. Sources of curriculum are problems, issues, themes, case studies, concerns and debates of the fields and sectors that students are preparing to enter. Students work on these issues, themes, case studies or concerns in contexts of 'application' and 'implication' (Nowotny 2002).

CPUT has real and virtual classrooms, and it is particularly respected for its care of disabled students. In addition to the physical space, there is space for innovation, experimentation, discussion and debate in the learning and research environments. When you enter buildings or websites, you find posters and models representing the work of students, staff and external partners. Achievements are celebrated and appropriately rewarded. It is a first choice university for academic staff who have specialist knowledge in applied science, engineering and technology, as well as for students who want to learn in an environment where industry partnerships and projects are highly valued. Students 'own' some of the innovation space, they understand and claim their rights (e.g., industry collaboration, or the award of a bursary from a particular industry, does not preclude student recipients of such bursaries from strong debate about the field and the industry). Students are well prepared at CPUT for taking up important positions in the state and corporate sectors related to their educational fields, and for making important contributions to the development of the region.

CPUT has made a positive contribution to regional economic development, promoting 'start-ups' and 'spin-offs' in collaboration with community and business partners. CPUT's location in the midst of a strong economic region makes it a focal point for development. To achieve the applied and collaborative research and innovation outputs, research at CPUT's 'Centres of Relevance and Excellence' is usually conducted in joint projects with industry, business and professional partners. The Centres may be located within faculties and departments, or be interdisciplinary and stretch across faculties, or even transdisciplinary and be housed in commercial, industrial state or private laboratories. These centres have their own boards, with representatives from trade, business and society. This structure makes collaboration and research with industry possible at a range of levels.

Entrepreneurial research, especially at the leading edge of science and technology and innovation, is highly prized at CPUT, but there is vigorous debate on the relationship of market-driven, income-generating entrepreneurial research and the realisation of academic freedom, critical reflection, peer-review evaluation, merit, rewards and curiosity-driven research. A key ethical challenge, therefore, is the reconciliation of what has been termed the new 'bilingualism' between market-driven activities and traditional academic values (Rice, 1998), which are increasingly required at CPUT. In a context of socio-technical innovation in Africa, research ethics at CPUT takes into account issues related to field and nature of the innovation (e.g., the ethical management of risk in engineering innovation in vulnerable communities).

Informing and inspiring all these activities is an overarching framework that emphasises 'working knowledge' (Winberg 2004) as the central concern of a university of technology. Working knowledge functions in a complex and evolving society. Inspired by Nowotny et al. (2002), one could speak of transcontextual education which requires a carefully designed curriculum, in terms of scope and sequence, which includes both disciplinary and interdisciplinary learning experiences, generic skills, and 'Mode 2 competencies'. These are the competencies required for individuals to function effectively in a 'Mode 2 society'.

## Concluding remarks

The third scenario, while more detailed than the first two, is still general in the sense that to survive in the 21<sup>st</sup> century, all universities of technology in South Africa must envisage better education and research. New centres and transcontextuality will have to overcome the essential tensions inherent in university structures. CPUT can distinguish itself by adding a 'reflexive hub' on top of, and in service to, the 'spokes' of faculties and centres (see Rip's paper in this issue). This is a real possibility because CPUT has elements of this hub already or can mobilise experiences from elsewhere. These present and possible future activities are all characterised by their close link with practice while being informed by broader insights and experiences. The base level translates now from these broader insights and experiences to ongoing teaching and learning and research in various sectors. At the same time, they are a conduit to contribute to these broader reflexive insights and advance them. Thus, the 'reflexive hub' has a research programme in its own right as well.

In 2004, we envisioned CPUT as a producer of knowledge in the 'real world', of 'creative, intuitive, and analytical knowledge' and of 'working knowledge', but only if certain 'conditionalities' were met (Winberg 2004). Becoming a university of technology was understood to be contingent on becoming a reflexive university and creating space for debate, critique and reflection. As a university of technology, it is our responsibility to analyse, debate and if necessary change what we do. Our mission, as a university of technology, should not only be to make a contribution to technological innovation, but to make a contribution to the ability of our society to control and manage the development of technology, and put it to good ends. In this sense entertaining visions of our future(s) and continually discussing them, so as to include a longer-term future orientation, is part of the thinking and deciding about issues here and now.

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# Creating a curriculum for workplaces under pressure

*There is a crack in everything; that's how the light gets in*  
Leonard Cohen

Bernie Millar and Elspa Hovgaard

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## Introduction

The complex 21<sup>st</sup> century world is one of uncertainty and supercomplexity created by the fast pace of change (Barnett, 2004). This has been experienced intensely by the developed countries, but a globalising South Africa is also feeling the impact of accelerating change and uncertainty. One of the drivers of change has been neoliberalist capitalism which is impacting heavily on the South African workplace with its casualization of labour and emphasis on workers who are both flexible and retrainable. This creates problems for workers, on location and in terms of their training – to be flexible, and having to accept the possibility of becoming superfluous. It also creates problems for higher education: should the curriculum prepare them for survival in the neo-liberal world, or should it also envisage alternatives and how to realize them? Inspired by the above quotation of Leonard Cohen we would say that present pressures lead to cracks in the structure and practice of present workplaces. However, these cracks can also be taken up as openings for change and opportunities for growth and development in the workplace, and in global markets.

The South African Clothing and Textile industry is a good example of a workplace under pressure where cracks are presently appearing, but which might be seen as openings and opportunities for change. For example, a massive 100 000 jobs have been lost in the clothing industry over the past ten years as factories have closed (Phakathi, 2013; IDC, 2012) with great social and economic ramifications for workers and their dependants (Dhliwayo, 2012). This huge loss of jobs could be seen as a crack in the industry. However, some of the retrenched workers have seen this crack as an opening and opportunity for change and bought machinery from factories that were closing down to set up their own small enterprises, often in their garages, where they employed other retrenched workers in their newly established “Cut, Make and Trim” (CMT) enterprise (Nattrass and Seekings, 2013a). Nonxuba (2010) reports that this sector of the clothing and textile industry has shown a steady increase in emerging SMEs.

This paper will consider this particular sector and its work environments, namely that of the Clothing and Textile industry in South Africa and the Western Cape in particular, and how a UoT Department can prepare its students for the rapidly evolving work environment, and the debates and alternatives that occur. A concrete way to address these general questions is the design of a curriculum for a bachelor's degree in Apparel and Textiles that the Department of Clothing and Textile Technology is to develop.

This paper will start by sketching a diagnosis of the South African Clothing and Textile Industry as it stands at present, looking at the different issues, complexities and tensions that exist and at the cracks (problems as well as opportunities) that appear to be there. This will be followed by a discussion of curriculum which needs to respond to the workplace needs as well as the demands of industry, but has, at the same time, to prepare students for this workplace under pressure. When planning a curriculum choices arise – are we preparing students for a neoliberal world, or is there a possible alternative scenario where we could prepare students to operate in a new workplace that functions as a “worker ecosystem”? If this is possible, then the curriculum itself becomes an instrument of change preparing students who will be change agents in the workplace.

## The South African Clothing and Textile industry

The South African Clothing and Textile industry is not monolithic, but consists of a range of enterprises from micro-entrepreneurs, through SMEs to large factories employing large numbers of workers. There is a further differentiation in the industry in that there is top end capital-intensive production in the metro areas where large retailers cater for middle and high-income customers, while at the bottom end in the non-metro areas, production is labour-intensive and produces basic clothing for low to middle income consumers (Nattrass and Seekings, 2013a).

The Southern African Clothing & Textile Workers' Union (SACTWU) (2013) states that it is the largest trade union in the clothing, textile, leather and footwear industry in South Africa and globally, with just more than 85 000 members as at the end of February 2013. Nattrass and Seekings (2013b) indicate that clothing is also the most labour-intensive manufacturing sector in South Africa; however, as stated above, 100 000 jobs have been lost in the clothing industry over the past ten years as factories have closed (Phakathi, 2013; IDC, 2012).

This tremendous loss of jobs is not only a problem in the workplaces and for careers of graduates, but also for higher education, e.g. the Clothing and Textile Department at CPUT has to create a curriculum for the new Bachelor's degree taking an analysis of the current workplace situation in the clothing and textile industry into account. It cannot develop a Bachelor's degree curriculum based on training students for careers in factories (i.e. the factory paradigm), when the possibility exists that there might not be factories in South Africa any longer. It may be noted that students in the Clothing and Textile Technology Department seem to be anticipating this future already by stating that their motivation for studying Clothing & Textiles is to find jobs in retail rather than production. Dhliwayo (2012) expresses a similar observation, "Skills deficiencies have been worsened by perceptions of university graduates that the textile industry is a 'sunset industry' and should be avoided when entering the business world." This is endorsed by Morris and Reed (2008) who point out that there is a shortage of graduates annually into the industry which may be as a result of the industry's poor image. Furthermore, Vlok (2006: 242) makes the crucial point that "investment in the clothing and textile sector has not significantly expanded a pool of highly skilled workers and technicians ... the overall level of skill is inadequate to the task of rapidly raising quality and shifting to value-added production ... the capability of management at all levels is also a weakness". This points to a serious skills shortage in this sector.

The influx of cheap imports, legal and illegal, from the East has been putting great pressure on the South African clothing and textile industry. Manufacturers and retailers struggle to compete with the low-cost imported textiles and garments and many have been forced to close their factories or cut back on the number of their workers (Dhliwayo, 2012). The extent of the problem may be seen in Dhliwayo's (2012) statement that China's share of South Africa's total imports of clothing and textiles increased from 16.1% in 1996 to 60.7% in 2008. South Africa cannot compete with China for several reasons: wages are relatively higher in SA than China, there is a more regulated labour market, and there are strong labour unions (*ibid.*).

South Africa's clothing and textile industry's inability to compete against China and globally may be seen as another crack that has appeared in its workplaces. However, as a crack appears there are those who regard it as an opening and opportunity for change. This also happened in this instance where, in response to this crack, the Cape Clothing and Textile Cluster (CCTC) was launched in 2005. This is a partnership of the Western Cape Provincial Government, 16 regional manufacturers and five major clothing retailers with the aim of improving the competitiveness of the players in the clothing and textile industry. A similar cluster was launched in KwaZulu-Natal, namely the KwaZulu-Natal Clothing and Textile Cluster (KZN CTC). Together they can enable a national development strategy to be carried out to improve the competitiveness of the South African clothing and textile industry (CCTC, 2013). The cluster helps to develop local firms by "accumulating economies of scale through group activities and shared resources, shared learning, rapid diffusion of ideas,

collective action and risk sharing, reduced costs (*ibid.*) – all of which enhance their ability to compete globally.

Furthermore, there are technology-enabled changes as with the introduction of “smart” textiles and garments, based on advances in nanotechnology materials, green technology and, increasingly, ICT. The field of smart textiles may be further categorised into technical textiles and performance materials in the areas of application such as sport, medicine, protection, agriculture, construction, and engineering. This could herald innovative possibilities for SMEs, also in South Africa, to develop and produce for these newly evolving markets where innovation might be seen as the key to survival. The South African Department of Trade and Industry has already ear-marked the development of smart textiles using nanotechnology in its national advanced manufacturing strategy for South Africa (DTI n.d.).

### **Thinking about a curriculum for a three-year Bachelor’s Degree in Apparel and Textiles**

Any thinking about developing a curriculum for the new three-year Bachelor’s degree in Apparel and Textiles has to take this background of the clothing industry in South Africa sketched above into consideration. A further point that also needs to be considered is the opinions and considerations of important stakeholders, such as the industry advisory committee, if this new curriculum is to prepare students for the uncertain, fluid workplace of the 21<sup>st</sup> century which could be a small factory, large retailer or an entrepreneurial enterprise.

The industry advisory committee comprises members of the industry both on the factory/production side and retail side, the trade union SACTWU, the Western Cape Government, the Technology Station, the Department of Trade and Industry, trade consultants as well as the academic staff of the Department of Clothing and Textile Technology at CPUT. As such it is a micro-version of the Cape Clothing and Textile Cluster. It meets on a quarterly basis and has input into the curriculum. This makes this body one of the major stake-holders in the creation of a new curriculum for the Bachelor’s degree in Apparel and Textiles.

In discussions with the academic department, this advisory body has sketched attributes that it considers necessary for graduates to embody. An important attribute would be flexibility and openness to change, that is, the ability to work in an uncertain environment able to think on one’s feet responding to the changing environment by being able to make informed decisions quickly and effectively. Another attribute would be the ability to work in diverse, multi-cultural and multi-lingual teams and being able to negotiate change. The ability to communicate well and effectively would be vital as one cannot pass on decisions or operate well in a team without good communication. Competence in ICT as well as new and green technology skills coupled with disciplinary knowledge is regarded as a *sine qua non*. Any planning for the new curriculum would have to take these attributes into consideration as well as the changing nature of the workplace.

### **The new workplace**

As seen above the clothing and textile industry in South Africa is, indeed, under pressure; change is imperative if it is to survive. Dhliwayo (2012) calls for a fundamental restructuring and reorientation of the industry as well as “a united front between the Government, industry and organised labour” to create a successful industry. On a small scale, this is what the Cape Clothing and Textile Cluster is attempting. Vlok (2006) states that new export and investment incentive schemes and policies are required and that technology enhancement and innovation must play a crucial role in changing the industry. Furthermore, Nonxuba (2010) reports on worker dissatisfaction within the clothing and textile industry, namely the lack of employee involvement in decision-making as well as miscommunication between management and employees.

From this it seems clear that some fundamental changes have to take place within production in the clothing and textile industry in South Africa. It would appear that there has to be a move away from the old way of thinking and doing to innovative change. It could be suggested that a shift in paradigms has to take place, from the former “factory paradigm” which is not sustainable in the long term to a “new workplace paradigm” in production. But what is this new workplace to be? An alternative scenario to the neoliberalist workplace is possible with a move to a “worker ecosystem” scenario within the new workplace paradigm. By “worker ecosystem” is understood a workplace that is a community of complex relationships between workers and their working environment as well as their broader social and economic environments; it is fluid and dynamic as it adapts to the constant change of the 21<sup>st</sup> century workplace. The ethos of competition is replaced by an ethos of collaboration and co-operation. For example, instead of several SMEs or entrepreneurs within the same geographical location working and producing as silos, each one an island with its own resources and equipment, a scenario of shared resources, shared equipment, shared expertise and even the sharing of expert workers could become feasible. Technological enhancement could be achieved by acquiring the latest technology communally and housing it within a technology hub, where time-share on the equipment becomes commonplace. In this worker ecosystem the management hierarchy would become flatter closing the gulf between worker and manager so that the worker has more voice in decision-making and communication becomes more open. However, this production scenario of the worker ecosystem would require a radical re-visioning of work, work-space, work-place and production. It would also require envisioning a curriculum to prepare graduates for such a worker eco-system.

### **Developing the new curriculum for a three-year Bachelor’s Degree in Apparel and Textiles for the new workplace**

A curriculum aims to prepare students for the future, and must therefore be explicit about the kind of future it wants the students to prepare for (including offering them understanding and skills to work towards such a desirable future) (Rip, 2013). Hence, the new curriculum would have to equip students on two levels: epistemologically as well as ontologically. On the one hand, epistemological preparation refers to the ‘know-why’ and the ‘know-how’. On the other hand ontological preparation would enable students to be prepared on a personal level for the new workplace and their broader social roles in a changing, uncertain world, in other words, as Wheelahan (2010:154) states, education “also needs to prepare us to live in the world of which we are part”.

Knowledge is at the core of a curriculum. In this case it is professionally-oriented knowledge which is explained by Winberg, Engel-Hills, Garraway and Jacobs (2013: 101) as providing students with the disciplinary knowledge informing professional practice as well as enabling them to acquire certain skills and situated knowledge in order to be able to practice competently in the workplace. In order to do this, the content of the curriculum needs to be carefully selected and sequenced from both disciplinary and situated knowledge (Winberg, *et al.*, 2013).

Thus, the Department of Clothing and Textile Technology envisages a curriculum that encompasses three main content areas: apparel, textiles and management with each area incorporating new technologies and innovation pertinent to it. Instead of taking a silo approach to teaching subjects, the approach will be inter-disciplinary with holistic, integrated projects. For example, students will be required to undertake a problem-solving team project whereby they re-engineer technical garments and set up a “tech-pack” for which they have to draw up specifications and a business plan, work out management strategies, include laboratory testing and specifying quality while drawing on fundamental knowledge principles and technology. A project of this sort will require drawing on both disciplinary and situated knowledge, as the exercise is seen as a combination of theory and practice. These kinds of projects will be done over the three years with increasing levels of complexity and decreasing levels of support. While these projects develop students epistemologically, they will also develop them ontologically, i.e. the students will grow and develop themselves through their interaction with the other team members, facing and overcoming

challenges, and learning to deal with change as they develop alongside their project. This type of project will also develop those attributes sought by industry.

For this kind of project to be successful it requires collaboration, co-operation and careful planning both on the side of the academic staff as well as the students. In this way, the project starts to become a microcosmic experience of the new workplace discussed above where co-operation and sharing of resources and expertise is the order of the day, instead of teaching subjects in isolation from each other as normally happens in the department.

## Conclusion

This paper has considered scenarios of the workplace and the curriculum. The South African Clothing and Textile Industry is truly a workplace under pressure with huge job losses as factories have closed over the past decade. What appeared as cracks opening up in the industry and workplace as a result of this pressure, were seen as openings and opportunities for change and development by retrenched workers as well as the industry itself. Indeed, these cracks let the light in. If a curriculum has to prepare students for the workplace, it also has to be responsive to that workplace. So, the Department of Clothing and Textiles has responded by planning a new curriculum for a new workplace. A curriculum can be an instrument of change both of the students and the workplace. For example, the curriculum develops students and empowers them to see with “new eyes” when going into the workplace and will enable them to become change-agents themselves.

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# Degrees and fictive scripts in science

Tholang Maqutu and Bonita Kleyn-Magolie

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The paper aims to firstly examine what forces are at play in pushing for and against degree programmes. This should include the professional environments and the nature of the knowledge taught in the fields. In addition, we will look at why certain actors have so strongly advocated degrees and where they have drawn their support from.

The 'fictive' part will examine the current actors and forces at play in the field of Environmental Management and what effects the introduction of degrees may have on these actors. It may possibly examine what changes are happening or how such changes may interact with the introduction of degree-holding workers and the degree programme itself in the university.

In 2004, all Technikons in the South African higher education system became Universities of Technology (UoT). In 2007, the then South African Department of Education and Training introduced the Higher Qualifications Education Framework (HEQF). According to the HEQF all existing qualifications and programmes offered by higher education institutions had to conform with this policy by 2009. None of the current UoT- type qualifications featured on the HEQF therefore a new suite of "HEQF – compliant" qualifications needed to be designed. UoTs could not comply by the required date and therefore a transitional period was granted to ensure full compliance with the HEQF policy. The main aim of the Higher Education Qualification Council (HEQC) was to transform higher education in South Africa by creating a single qualifications framework for a single coordinated higher education sector (Republic of South Africa, 1997). The implementation of this policy provided UoTs with the opportunity to reflect on their current qualifications offerings and to allow them to engage in a major curriculum reconstruction exercise, referred to as recurriculation in the South African higher education context.

## Should we offer diplomas or degrees?

In the UoT, the Deanery of Faculty of Applied Sciences are keen on the Faculty offering degrees rather than the current system of diplomas. However, different programmes have different structures and purposes which may make them more suitable as degree programmes. All the current programmes are in Muller's (2009) terms 'outward-looking' and involve applied theory and practice-based knowledge as they are aimed at developing students directly for careers. However, some careers involve high levels of scientific theory which would need to be taught in a cumulative fashion over a longer period.

Diplomas prepare graduates with field specific skills and knowledge. According to Winberg (2012), diplomas prepare graduates for more practice-based knowledge that is derived from the field of practice (also see Muller, 2009). On the other hand, degrees contain more pure and applied disciplinary knowledge. Degrees therefore prepare students for a broader field of practice while diplomas prepare graduates for more specialized practice (Muller, 2009; Winberg, 2012). Thus, a graduate may initially be more distant from concrete work practice than a diplomate.

Should UoTs, arguing that they are not Technikons anymore, but are now universities, offer only degrees instead of diplomas, and put more effort into pursuing research. Disciplines, such as Biotechnology, may be well suited to be developed as degree programmes. Modern Biotechnology is relatively new and is a rapidly evolving discipline. Biotechnology by nature uses Mathematics and science as fundamentals resulting in it being highly structured. All its subjects build on one another in the form of prerequisites. The discipline requires knowledge and skills that are mainly theoretical as one progress through the structure (Muller, 2013). In addition the degree will prepare students

more adequately to keep up and contribute to the field than a diploma. Alternatively, careers such as Environmental Management and Consumer Science involve some science but they do so in a relatively loose manner and have a strong focus on the societal aspects of science. Such diplomas may be more difficult to convert to degree programmes.

A situation analysis was undertaken as part of the re-orientation process for the Programme of Environmental Management. Different stakeholders were consulted, namely; students, alumni, industry, academics and environmental organizations. The main findings of the analysis were the following:

Graduates who have degrees are much more respected in the corporate environment than diploma graduates.

Students studying for degrees are exposed to a higher level of learning that enables them to think globally and to implement environmental research at a high level. They also qualify for better positions within industry.

An organisation hiring a diploma graduate, has expectations of someone with basic levels of knowledge in a subject, with little experience or expertise in being able to interpret facts or apply knowledge. Conversely, an organisation hiring a graduate with a degree expects a person with a knowledge base that can withstand robust enquiry and apply academic rigour when required. A degree graduate should be able to conduct any research required, and demonstrate empirical knowledge of the subject/issue researched.

In order for graduates to be effective at work, they are expected to have a complete qualification which can be recognised at a professional level. A degree also enhances the graduate's self-confidence when competing with other practitioners in the corporate world.

It appears from the above that the stakeholders prefer degrees over diplomas. Should that preference be followed? Do the stakeholders understand the implications of all the UoTs only offering degrees? In particular, would there be enough practically skilled employees within industry?

Historically, Technikons were aimed at providing practical skills-based higher education to students who did not meet the entry requirements for degrees at universities but had results that were too good for admission into Further Education and Training Colleges (FET).

Traditionally, degrees are offered at universities, certificates and diplomas at Technikons and higher certificates at FET Colleges. The National Senior Certificate (NSC) indicates whether a student qualifies either for admission to a bachelor's degree, diploma or higher certificate. If UoTs only offered degrees, how will the students who qualify for a diploma be accommodated in the Higher Education (HE) System of South Africa? What will happen to these young adults who have completed their NSC?

FET College is an option for students who would otherwise qualify for admission to a diploma. However, FET Colleges offer qualifications at a National Qualifications Framework (NQF) level four up to level five, which is equivalent to a first year level of a three year diploma. In addition, FET Colleges do not offer all the qualifications that are offered at UoTs, which can restrict students' career choice and upward mobility.

The question that arises from the above situation is whether students who qualify for diplomas will be forced to go to FET Colleges, choose careers that they are not interested in or join the labour force without any qualifications or vocational skills? Anecdotally, South Africa has one of the highest unemployment rates in the world. Many degree-holding graduates are underemployed. Are we setting these young unqualified adults up for failure? The results of not accommodating these

potential diploma students could aggravate unemployment, poverty and crime in South Africa. These are the very problems that the South African government is trying to resolve.

It can be concluded that there is a definite need for UoTs to continue to offer diploma qualifications to accommodate this cohort of NSC holders. Given that recurriculation appears to be inevitable as a mandate of HEQF, the next question is how the objectives and background goals of the diploma and certificate system could still be met under the degree system. It's not clear how that could/should be done. It is therefore useful to explore the possibilities using the scenario approach of the present development of a degree in Environmental Management.

### **Scenario 1:**

Recurriculation for Biotechnology to a degree was successfully completed and was used by the Dean of Applied Science as a model for the other departments. Biotechnology followed the degree route because it is heavily science-orientated by nature.

Environmental Management, Consumer Science and some other departments protest as they feel that the nature of their programmes are more geared towards Diplomas but to no avail. The proponents of the degree route argue that our university status would require that we offer degrees grounded in the fundamental sciences. The challenge for Environmental Management is that it is a multidisciplinary-based programme. The field is broad and combines aspects of natural sciences, social sciences and legislation. There had been wide consultation with various stakeholders but because of the multidisciplinary aspect of the field it is unclear which segment and concurrent employment opportunities are to be given priority. Should UoTs produce graduates that would occupy middle-level jobs in companies, consultancies or policy staff in government? Presently the programme is segmented and includes a little of everything.

Furthermore, the curriculum is devoted to projects with more problem- and practice-based orientation, including a project on the interdisciplinary challenge of environmental issues. Consequently, because of the nature of the discipline students do not follow a specific discipline but are generalist.

Environmental Management degree holders enter the job market; their qualifications are interesting and attractive for government agencies. But there, they compete with graduates from many other disciplines such as Geology, Economics, Chemistry and Law. The Environmental Management graduates realise that although their degrees appear to be more attractive they are not specialists in any discipline but are generalist.

The Environmental Management graduates feel at a disadvantage as the graduates that have specialised in specific disciplines have more in-depth knowledge of their particular fields. This makes the Environmental Management graduates feel inferior and inadequate. When the current Environmental Management students at CPUT hear about the problems the graduates are facing, they raise the issue with the institution and insist on the curriculum being reviewed.

After consultation with staff and other relevant stakeholders it is decided to stream the programme, allowing students some specialisation. After many discussions it was decided to divide the programme into three streams, namely; Environmental Resource Management, Water Quality Management and Air Quality Management. In the first year all the Environmental Management students will enrol for all the subjects and from the second year the programme will be divided into the three streams. This would allow students to become specialist in any one of the three streams.

## Scenario 2:

The Deanery of the Faculty of Applied Sciences wants the Environmental Management Programme to become more scientific (as it is in the Faculty of Applied Sciences), but the Department resists, some voices arguing that there is the challenge of interdisciplinarity, and others emphasizing that the responsibility of a UoT is to offer training for potential young people that do not meet the admission requirement into degree qualifications. This resonates with the new Vice-Chancellor who wants to be serious about the contribution of Higher Education (HE) to transformation. A compromise is made allowing Environmental Management to continue as a diploma qualification provided that there is some improvement in the quality of the diploma qualification. This would be achieved by developing relevant and responsive curricula which integrates the needs of various stakeholders and takes into consideration employment trends of the country; industry needs; and, new developments in the field. The improved curricula will provide the Environmental Management graduates with a competitive edge and enhance the viability and sustainability of the programme. A further part of the compromise is to create an integrated degree in Environmental Management, which would be interfaculty – while led by the programme of Environmental Management.

The combination of present and new tasks puts pressure on the staff. Some of the staff are relieved when the Vice-Chancellor is able to obtain funding from the Department of Higher Education and Training (DHET) for the development of the interfaculty degree in Environmental Management, and a project leader is seconded to manage the project. The University, that is, Vice-Chancellor and Public Relations and Communications Office present the project to the DHET showcasing the innovativeness of this UoT, and high expectations are created. As with other attempts at interfaculty teaching and training programmes worldwide, it turns out to be difficult to get everybody across faculties and departments working together. The project leader proposes to work in two steps: first, to use what has been achieved already to create a high-level post-graduate training programme for capacity building and staff development, which also builds on specificities of Southern-African countries. And second, if successful, attempt to have a degree curriculum as well. By that time, the University and its faculties have evolved further, and interdisciplinary approaches in teaching and research have become growing concerns, including appropriate organisational and administrative forms.

In the meantime, the diploma, while appreciated, had come under criticism that its contribution to emancipation of the previously disadvantaged and social transformation would require a more varied supply of learning, including dedicated certificates. Such a move towards what others might regard as downward was seriously considered. While a few experimental set-ups were agreed, it also led to further discussion about the nature of a UoT in the South African HE system: would it be about Technology, or about work-related learning for all levels of the knowledge society?

### In conclusion

This study shows that the main finding of the situation analysis conducted by the Programme of Environmental Management was that stakeholders would prefer graduates with degrees. However, the study has explored two scenarios, in order to explore the best option for their Programme of Environmental Management.

In scenario 1: A degree is implemented and industry responds positively to the students multidisciplinary skills. The advantage to industry and the world of work is that the multidisciplinary nature of the Environmental Management enables graduates to work across different fields. These graduates would have already been exposed to integrated projects at university that relates directly to the workplace. This experience will make these graduates more employable as technicians or technologists. The benefit for industry would be a graduate that has a holistic view of the world of work.

However, these graduates themselves feel inadequate compared to graduates that have specialised. These graduates are at a disadvantage when competing for promotion into senior positions as they will have the technical knowledge but not the strategic and vocational research skills.

In scenario 2: The advantage in this scenario is that the institution will produce graduates who will work at all levels within industry from occupying white collar jobs to technicians. In addition, as we are offering degree programme this will enable the institution to pursue research in related fields. The biggest challenge for this scenario however is whether UoTs will have enough resources to offer both qualifications and pursue research in the related fields.

The question that remains is, should UoTs only offer degrees and discontinue diplomas? The challenge is how the HE system will provide for a cohort of school leavers who do not qualify for degree qualifications. In addition, we have argued that if the preference of industry is implemented would there be enough practically skilled employees within industry?

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# Design degrees for the future

Cheri Hugo

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## Introduction

In 2010 the opportunity arose to recirculate the offering of Degree course for the faculty of Informatics and design, at the Cape Peninsula University of Technology. This opportunity was pushed and pulled by role players with different interests. This article aims to forecast a possible scenario if degrees were to be offered in our particular context.

The issue of offering degrees has long been the subject of curriculum meetings and workshops in the Design Faculty, and was initially suggested and promoted by Faculty Management. In the initial presentation of offering the degree all staff seemed to be for it and were excited about these changes. At first glance it seemed as if it was just about how to restructure the course curriculum to adequately address this new offering; some staff even assumed it would just be the same offering under a different name. Staff appeared to be supportive and even proud of the idea of offering degrees – students also seemed to support and feel a sense of pride around a future degree offering. It was these observations which originally sparked my interest in examining the introduction of degrees further.

However, when changes were needed to make this possible staff members – i.e. those who would have to actually design the new qualifications - seemed to be uneasy. What, for example, were the implications for new or changed content and practices? Questions arose around current staff qualifications to offer the degree and access to the degree course for students given the education system of public schools. Some questions were also raised around what such a qualification would be able to bring to the industry, society and university, and how industry would view such graduates. A basic issue is that the upward pressure to have degrees rather than diplomas and other, lower-level certificates can improve qualifications but also creates distance to what is actually required in professional and proto-professional practices of the graduates.

It was clear that change in any situation and particularly here were going to be troublesome. Investigations would take time and changes were quite possibly going to be slow. However, scenario approaches may help staff understand better what is involved in changing to a degree even before they have embarked on this course.

The scenario approach first identifies important trends and issues, and then selects, or in a sense constructs, situations in which these play out in a particular way, which is then explored as to repercussions and eventual outcomes. One scenario approach is to develop a plausible description of how the future may unfold based on 'if-then' propositions. Thus a typical scenario includes a representation of the initial situation and a sequence of events that describe the key driving forces and the changes that lead to an image of the future (Alcamo, 2008).

This scenario focuses on the status of degrees in a South African context. It explores the status of offering and having a degree by the different role players. This is the departure point that sets a series of events in motion some intentionally and others unintentionally. The events are unpacked as consequences or repercussions of the events that spark off other repercussions and consequences.

For the case discussed in this paper, faculty and Deans in a University of Technology, and some higher-level actors are the managers and planners who could avail themselves to construct scenarios. Scenario approaches also often have stakeholders contributing to the creating of the

scenarios. This would be something like the 'expert panels' used in forecasting in the Delphi Technique (see, for example Green et al, 2007). In this paper however, it is not these actors who take the initiative, but an author (from the faculty) who takes a step back and develops scenarios based on a diagnosis of the situation and the drivers and dynamics in it. These scenarios are then offered for discussion to the actors, to broaden their views and make them more reflective.

We speak of 'actors' here, because we do not want to limit ourselves to managers and planners, even while they are important as a target group. Thus other actors here are:

- Faculty
- Students
- Staff
- University (institution of higher learning) as a whole
- Government
- Industry
- Other clients

These actors all have an interest in the issue of degrees as it develops, and could be called stakeholders. They are not only recipients of the scenarios, but also part of them, as characters in the story, and their interests and opinions driving the developments.

This paper is simply to raise the awareness of managers and decision makers about the uncertainty of the future and to alert them to emerging problems and possible surprises in the business environment that may influence how we prepare students today; to help managers and decision makers to "think big" about a problem – or a change and its impacts or domino effect that one change can have, that by offering new qualifications one must also consider the environment in which those will be offered and will practiced in.

### **Scenario 1: Degrees for Status**

In this scenario the focus is the benefits that staff enthusiastically takes on, even though curriculum is not at first the primary issue. Many staff perceive themselves as 'not quite as good as university staff'. But now the dean provides opportunity for advancement through generous sabbaticals and replacement staffing so that staff can improve their qualifications, with many staff now able to pursue doctoral studies both at home and abroad. This enables them to also engage in research and publish, which also pleases the dean and the university research office which is attempting to improve both numbers of staff with doctorates and the overall research output of the university. This is in itself important for raising the status of the university in national and international rankings. But the benefits are not only for staff. Students perceive the degrees offered as having high status as the department now develops a high profile in the country. Students who would previously have studied at other universities or private colleges choose to study at CPUT in the knowledge that their employability options are improved with a CPUT degree. As the department becomes well known and respected students can more easily sell themselves overseas as well.

On the downside this is a long process and not all staff are initially fully on board. Many find it difficult to advance academically and much effort needs to be put into their masters and doctoral supervision. The dean also realises that he has to attract more academically orientated staff as well, and this is initially perceived as a threat to the existing staff. Some staff who cannot 'make the cut' have to be retrenched within the new regime. An unforeseen difficulty with students also arises. In diploma studies a lower level NSC qualification only is required, but now students can only apply with a higher NSC standard, and at first the pool of potential applicants is reduced and this is only turned around years later as the status of the university becomes well known; so there is an extended turn-around period which has implications for enrolments and hence funding. A further difficulty which needs to be addressed is the increased period of study which means that students have to study for longer before they can earn. But this is eventually counterbalanced by the higher wages students earn and what they can contribute to the company or their own business.

## Scenario 2: Collapse of Degrees/qualified unemployed

While status remains important, many actors think the curriculum should reflect the higher level of qualifications that goes with a university degree, and start working towards it. But, would industry 'miss' the more intermediate, ready to produce work, diplomates? And, how would industry cope with higher wages commensurate with higher qualifications?

The discussions and negotiations in the Faculty referred to these broader considerations, but also focused on a curriculum that deserved to be called a university degree curriculum. In such a new curriculum there should, for example, be more theory. Furthermore there is opportunity to pay more attention to the creative aspects of graphic design. Then there is also the potential to respond to the national and international growing impetus for students who can work sustainably, both in terms of the types of projects they take on and the materials they use.

Some of these curriculum elements could be put in place quickly, because faculty members had been interested in them and could now put them into place, not constrained by the practice-orientation of the previous diploma curriculum. Some of these new elements were even tried out in part with existing diploma students and further developed into learning and assessment activities. Thus the new degree curriculum could start almost immediately.

Four years later the degree graduates started to enter the workplaces. This led to disappointments from both sides. The graduates found there was insufficient space for their creativity in the workplaces they entered. Some of the employers found that the practical skills necessary in the workplace were missing. At first, further training was done by the university so that the degree now had more practice-based components, but at some moment, employers found it easier to attract graphic designers with the adequate skills from other universities or even from abroad. That quickly became the rule rather than the exception. CPUT graphic design graduates moved to other kinds of jobs (based on the fact that they had a degree) if they could find them.

Two years into the new situation, the Daily Mail & Guardian devoted a background article to this situation, where some South-African higher education institutions had moved to what was effectively education for un-employability. This caused an outcry, with critical questions in Parliament, and a movement among students to reconsider the curriculum. For the university, the immediate problem was the reduction in student numbers. They had to respond, and respond quickly. They chose to reinstate the diploma curriculum, taking the risk that there would be no return to a degree.

## Scenario 3: Degrees for an uncertain future

With rapidly changing work practices, for graphic design as well as generally, there is a structural problem: the curriculum that appeared adequate for work practices at time  $t$  may not be adequate anymore at time  $t+4$ , when the student gets his degree (or diploma). In other words, old degrees had left students qualified but unemployed as they don't know what kind of work to find with those degrees as the job markets has changed in the meantime. The old diplomas were much more adaptable to changing work needs than the more heavily theorised degrees. But degrees may have a more general description of content; more outcomes based which allows for change – the old diplomas tended to a blow-by-blow account of what was to be taught.

Graphic Designers live in a rapidly evolving world where print is just one option among many. So posters, billboards, magazines, pamphlets and booklets will all be online or projected from devices. Specialized graphic design skills will be easy to access online and even prepare templates will enable anyone to design for his own needs. Software that is special for graphic design work will be as common as Microsoft word today. Specialized information such as file formats and saving options for art work will be irrelevant as access to software and technology that will do these things automatically will be freely available.

Education would be online, universities would have difficulty in creating flexible curriculums as the 3 or 4 year degree planned in advance may be completely out-dated by the time students graduate due to the turn-around of technology developments even for a third world country like South Africa. Lecturers will have difficulty in staying abreast of new developments in industry. The slow turn-around of universities for change and the red tape to get the smallest thing changed will leave universities in the dark soon. At the rate that technology and the needs of people are changing designing degrees that would be able to deal with these will be a tall order.

Faculty recognizes the challenge, but in the present curriculum structures cannot do much else than invite guest lecturers to talk about new developments and challenges. Students can then recognize the challenge, but that is not the same as actually acquiring competencies and skills to function in the brave new world. Experiments in project-based learning are started. This then reveals a basic problem for a future oriented curriculum: the learning outcomes have to be assessed, but there is no simply given standard against which they can be assessed. The targets are moving targets.

Universities of technology, following the tradition of the Technikons, rely on their close links with the worlds of work, but that may imply being conservative, accommodating to the present situation rather than what the world will be like in another 5 to 10 years. These are larger issues than what diploma or bachelor degree students can be asked to understand and contribute to. Some visionaries propose to restructure the curriculum and include an open-ended part. CPUT has recognized the structural problem, and supports a few faculties to experiment with new curriculum structures. Graphic design is one of the pilot degree courses in this scheme. It turns out to work well within the university. Some examples of these pilot schemes are: the Graphic Design Department holds supplier and company meetings (professional body) on campus so that students and staff become aware of new developments; students do projects via the internet on new initiatives in the field; and curriculum is broken down and redone every year in December in order to include new ideas.

These all help staff and students to keep up but the problem of the fixed curriculum still persists. There is only so much more which can be added to an already full programme and then there is the difficulty of which elements to remove to open up space for the new developments.

## **Conclusion**

From these brief indications it is clear that the scenarios play out in a world full of tensions. Some of the tensions are resolved to some extent, and of necessity, other tensions will then remain unresolved. There is no one best way. But the way (ways?) that will eventually be followed will be better because they take the insights from the scenarios into consideration.

Any changes need to be aware of the often different needs and competencies of students, staff and industry. But this is not a reason to stop any forward looking development of the qualifications, it is just that all the complexities need to be examined and the best possible new developments supported. Staff can also look at these different and often competing advantages and difficulties and develop some sort of in-between vision for the future. Imagination of the future occurs all the time, and in informal ways. Managers and planners may want to be more systematic, and this can lead them to the use of scenarios.

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# Scenario scripting of future intersections between degrees, curriculums and professionalization in prehospital emergency care

Ben de Waal

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Prehospital emergency care in South Africa has advanced rapidly in the last 20 years (MacFarlane, van Loggerenberg & Kloeck 2004:145). From humble beginnings with various short courses this vocation has turned its focus to professionalization with the development of undergraduate qualifications (Castle & Owen 2003:29) such as the National Diploma in Emergency Medical Care and the National Certificate in Emergency Care. Degree programs, such as the Bachelor of Technology (B.Tech.) and Master's Degree in Technology (M.Tech.) Emergency Medical Care followed and have subsequently culminated in the four year professional degree, Bachelor (BEMC) in Emergency Medical Care. Currently the national certificate program is also being restructured to a two year National Diploma to align to the new South African National Qualifications Framework (NQF).

These changes have had drastic effects on the prehospital emergency care environment, with significant changes to scopes of practice, career progression and human resources management. Most notably, South African paramedics have become more employable in the international market, which offers the promise of improved wages and working conditions, and subsequently a similar trend in skills migration has been seen as compared to other allied health professions (Binks, 2011). Currently there are three classifications for paramedics, represented by three professional qualification registers (registration with the PBEC, HPCSA), each with different scopes of practice. This has created much confusion and angst in EMS as to the direction of the profession and the future of practitioners (especially those remaining in South Africa), most notably those with the older, short course qualifications.

Scenario scripting provides a potentially useful method to evaluate the path, or paths, which Emergency Care may take in its quest to become a profession with an appropriately qualified workforce. It also presents a useful way to consider the possible tensions between industry, educators, curriculum and the needs of patients. The scenario approach first identifies important trends and issues, and then selects, or in a sense constructs, situations in which these play out in a particular way, and can be explored as to repercussions and eventual outcomes.

A basic issue is that the upward pressure to have degrees rather than diplomas and other, lower-level certificates can improve qualifications but also create distance to what is actually required in the proto-professional practices of EMS. The upgrading of proto-professionals, so that their own knowledge becomes more imperative and medical oversight is not always necessary (even if there will be a tension with the authority ascribed to emergency medicine), is a situation that can be further explored by creating scenarios. Taking this situation as the starting point is important because EMS practitioners, at all levels of qualification, will have to exercise judgment to respond adequately to an urgent concrete situation. How can the quality of that judgment be assured, and what accountability or liability aspects play a role?

One scenario explores how this situation can be addressed in degree curricula, where one can be intellectually ambitious. The entrance point is the BEMC EMC program in the context of the introduction of a subject for diagnostics. In past qualifications the underlying concepts of diagnostic reasoning and philosophy did not form a formal part of the curriculum. Diagnostic reasoning supersedes the more routine activities that come automatically to the practitioner as they draw on

their tacit know-how to solve problems. Now the situation changes as what is observed does not necessarily fit into existing well known patterns and the practitioner experiences 'surprise' (Schon, 1995). The problem itself has to be reframed and new approaches designed on the spot which requires some knowledge of diagnostics. This difficulty of problems requiring more than routine and/or tacit responses left especially novice practitioners underequipped to manage complicated patients. Although not well documented (except for quality assurance audits at service provider level) this may have in turn led to poor patient management.

In response to this, the new curriculum (BEMC) has made provision for a formal course in diagnostics, for which outcomes align to similar courses in medicine and other allied health professions. With improved diagnostic reasoning skills novice paramedics may be better equipped and may also have a shorter and less steep learning curve when entering independent practice. This is a laudable aim, but students who are currently undergoing this training are reporting that they are frustrated; as many of the mentors they are working with do not share the reasoning philosophy which they are being taught. Thus, newly qualified paramedics with improved diagnostic training may face challenges, as they may find themselves in the right, but in disagreement with a more senior colleague, who does not share a similar level of insight. This may hamper workplace learning and relationships, as the novice paramedic may not have the skills to articulate a diplomatic argument to convince a more senior colleague, due to a lack of conflict resolution experience, for example.

A second scenario starts with the lower-level practitioners who often are the first to encounter the emergency situation, and suggests the need for such practitioners to undergo more theoretical training, perhaps in the form of a bachelor's degree, in order to avoid possible disaster. All sorts of rules and protocols have been articulated already, so that their task could be formulated as applying the rules to the concrete situation. But rules are never fully adequate, and concrete situations have lots of complications. So ad-hoc, and sometimes split-second decisions are in order. The skills to do so can be acquired, but most often in practice through experience (tacit knowledge as described by Wyatt (2003)) and exchange of experiences between practitioners, related to practice culture within geographical areas or services. In concrete situations, EMS practitioners must address novel situations, and may have to deviate from what the rules prescribe. They should have a certain amount of discretion to do this, but one could ask what sort of competence is necessary to justify such discretion. And there is a question of accountability, and even liability, if the practitioner deviates from the rules and things go wrong.

This extends to many informal practices situated in the "grey areas" of the rules. An example of this is the culturally embedded practice of drug facilitated intubation. It has been a common practice in the South African prehospital setting to use a combination of sedative and analgesic medications (similar to conscious sedation regimes) to facilitate endotracheal intubation. This despite the fact that this practice has no scientifically established credibility or regime, is not explicitly described in the protocols or used for this purpose in other health care setting such as the emergency department. This practice in part extends to the need of patients to have this procedure performed, and may also extend to the perceived duty of practitioners to provide this treatment, as these patients would be routinely intubated at the emergency department. But this practice is ethically questionable. Practitioners would often cite the argument of need, stating that they are not comfortable managing the patient without this therapy, or that they have successfully performed the procedure in the past. Both these arguments are potentially fallacious, as scientific evidence has demonstrated the intubation in certain circumstances provides no particular benefit of advanced airways (intubation) and may be harmful. The second argument extends to epidemiological fallacy, as success with limited selection does not imply the therapy is appropriate. Both these arguments are weak, and stem from the lack of contextual understanding and knowledge as related to level of training these lower level providers receive, particularly in relation to critical appraisal, diagnostic and creative problem solving skills. Practices such as these are products of high levels of discretion, in combination with limited understanding of theoretical or scientific principles and low levels of accountability. In addition they are often self-perpetuating, becoming culturally embedded and

perceptually obligatory in the minds of practitioners as the practice norm. Practices such as the one discussed above are potentially harmful, not only to patients but to the practitioner agency and the goal of professionalization.

As mentioned above, the driving forces for emergency care practices and decision making by trends which do not align with current scientific evidence or practice in other disciplines of medicine are multifaceted. What would happen if this remained uncorrected? One could consider the legal liability of emergency service organizations and practitioners, and the cost of healthcare in relation to the management incurred morbidity, as well as the cost of poor health outcomes to the economy. As a large part of the South African population is dependent on the emergency medical services for the provision of emergency services, this becomes a significant consideration. It is also not inconceivable that the profession may lose its current independent status from the perspective of health care regulators (HPCSA), opting rather for a system with higher degrees of medical oversight and limited scopes of practice to improve practitioner accountability and reduce the liability of the profession.

The scenarios as presented here allow situations and possible future developments to be evaluated. The small, pre-emptive solutions to problems signalled in one or another scenario may be embedded in the curriculum in anticipation, for example, by having modules in conflict resolution, critical argumentation, evidence based medicine and health care ethics.

Moving forward, BEMC students once qualified, with improved diagnostic skills and clinical reasoning, may have the potential to improve clinical decision making (Crosskerry, 2009) in the field. This may reduce the risk of harm, which novice practitioners pose inherently (Singh *et al.* 2007). It also has the potential to improve the capacity of mentorship in the clinical setting in addition to more direct improvements in prehospital care, triage and patient routing. This may further build practitioner agency and add to the quality of workplace learning experiences, such as quality assurance programs and patient care reviews.

In the large, future challenges of Emergency Care must be considered, at least to avoid the risk of a misaligned curriculum. This is linked to broader issues of proto-professionalization as well as adequate provision of emergency care as related to its aim to reduce the mortality and morbidity associated with victims of emergencies, without compromising the fundamental principles of medicine: *Primum non nocere*, and beneficence.

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# Comparative advantages of a university of technology: fictive scripting in training and in research

Arie Rip

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An important asset of universities of technology is their close links with practices. In the move towards degrees rather than diplomas, those links are under pressure. The scenarios developed in the preceding articles show this tension, and explore different ways of addressing it. I want to step back and ask whether the link with practices can be supported and further developed, in addition (or perhaps instead of) students going out to acquire work practice knowledge. This may actually introduce transformations of the university of technology as a whole, and create a competitive advantage for CPUT when pioneering such an approach. As such, it will add to the ideal future of CPUT as sketched in the first article in this issue.

I will start by presenting a possible curriculum element, which I will call 'fictive scripting', after Den Boer et al. (2009) that will help bridge the distance between degree curricula and the world of work and other practices. The approach of fictive scripting is an important way to anticipate on the eventual embedding of UoT research results (and more generally, knowledge produced) in society. Enhancing uptake of such results is a challenge for universities worldwide (cf. tech transfer offices and other attempts to do better). Universities of technology had an advantage there because of their closeness to practices in the wider world, at least in terms of training. With the move towards degrees rather than diplomas, and the increasing orientation on research, they will become more like regular universities. They should exploit their competitive advantage, however, and support it by making anticipation on embedding in society a regular part of their "business".

Fictive scripting is a particular way of exploring possible uptake of new knowledge and the innovations building on it, by making the visions concrete and checking them against what is happening out there so as to make the visions about the promise more realistic. The approach was first applied by De Laat to improve the strategic research agenda of a French public research organisation, and subsequently taken up by Den Boer et al. as a way to enhance reflexivity of PhD students about possible uses of their work, or of the program of work they are part of. There are related approaches as explored in the SocRobust project (Larédo et al. 2002), as well as other useful ways to anticipate on future embedding in society through sociotechnical scenarios, in particular Constructive Technology Assessment as developed for new nanotechnology (Rip and Te Kulve 2008).

For first degree students, fictive scripting can be taught in the form of exercises about specific cases, supported by lectures about the steps toward uptake (including the importance of translational research, see below) and insights into eventual embedding in society. Elements of this have been successfully introduced in a first-year course 'Analysis of Technology in Society' for the new Bachelor degree Advanced Technology in the University of Twente. Depending on the structure of the degree curricula to be developed, training in fictive scripting could be part of some of the regular courses, or a course in its own right.

The 'script' is about the shape of the world in which the promises of the research results or idea and proof of principle of a new technological option could be realized and become successful. This is a fictive script, because it is projected, often implicitly as part of the vision. This is made explicit, and then compared with the present shape of the world and possible developments. Some analysis is necessary, and interviews with actors important for the script are particularly important. A further step is to explore possibilities to change the world and/or change the vision, up to concrete research

and explorations of possibilities. Important also is what is called 'translation research' in the pharmaceutical industry, but is done without such a label in engineering practices as well. Translation research refers to the research necessary to turn a proof of principle into a working product. For example, the effective chemical constituting a new drug has to become part of a pill (or other form of introduction in the body) that is effective and that patients can use in their situation. Such additional elements are just as important for eventual success of the drug as the efficacy of the chemical entity in clinical tests.

Fictive scripting can also be used to explore which actors and their views about the innovation have to be taken into account when considering acceptability (and thus, a social licence to continue with the innovation). By now, social and ethical aspects of innovation are getting more attention, and separate, so-called ELSA (ethical, legal and social aspects) studies are being done to anticipate. This is where Constructive TA can contribute with extended sociotechnical scenarios.

While I started talking about fictive scripting as a curriculum element, it is actually just as important for research that is done in a university of technology (and for that matter, in universities generally). There is still a training element involved, for PhD students, and in a transitional phase, also for academic staff. (who might have naive ideas about uptake of research results in society.) For some academic staff, anticipating on embedding in society comes naturally, but even then, they may profit from the more systematic approach and the insights from innovation studies and studies of knowledge utilisation that are mobilized in fictive scripting exercises.

Actually, such anticipation on embedding in society involves research and studies in its own right, and this should be supported and stimulated by having a Centre for Societal Uptake Research. An important further challenge that such a Centre could address is to translate and further develop the insights from studies of innovation and knowledge utilization to the situation of developing countries and the role of a SA-style university of technology.

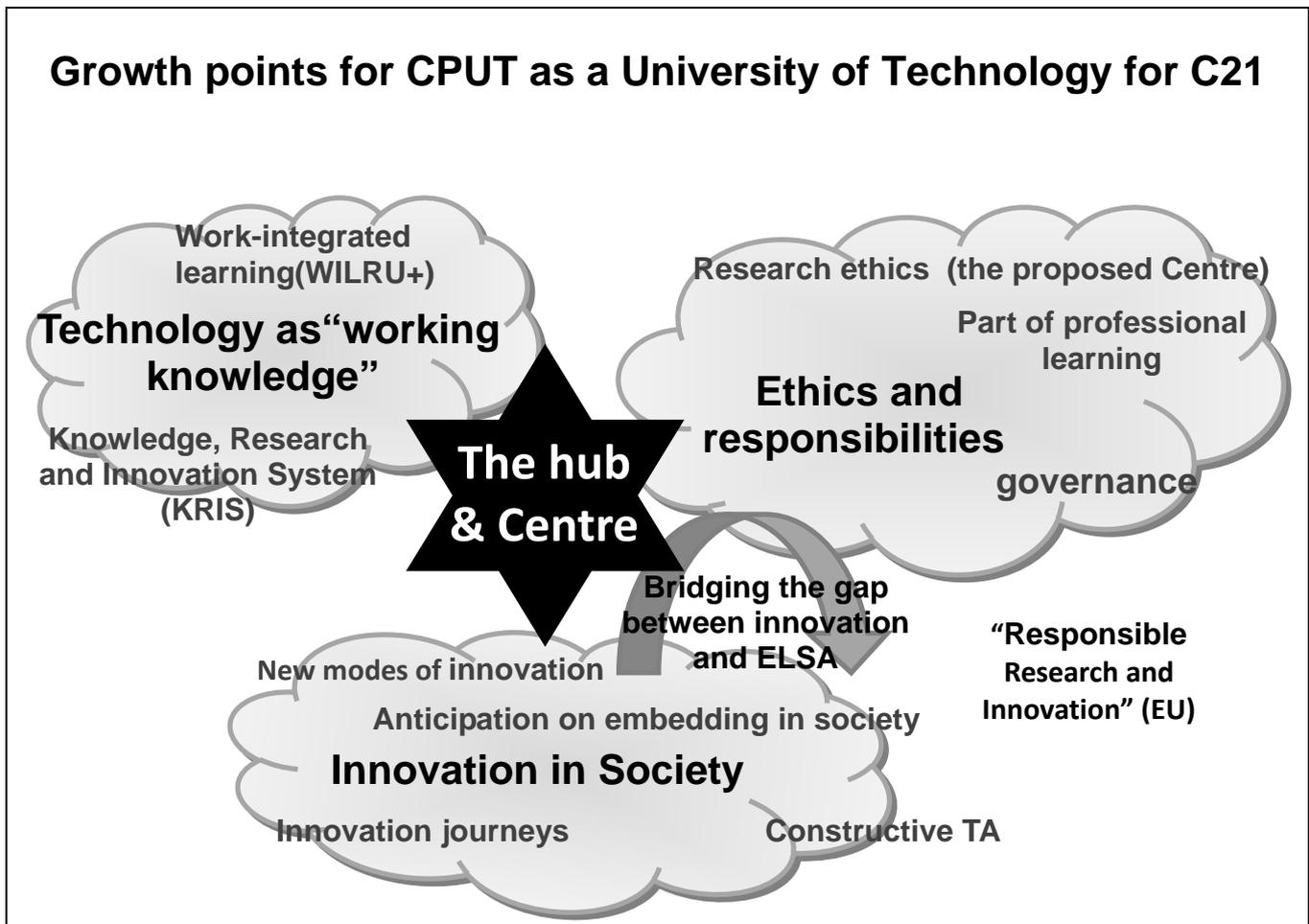
Why have such a Centre? Firstly, it will be a hub to which teaching and research in the Faculties could refer, and thus be of service to them. The link with practices (industry, professions, communities) is an asset of CPUT (and universities of technology generally), but there must be a future-orientation, and this must be articulated in its own right as well. Secondly, such a hub can accommodate other important activities and studies than what one could call 'Innovation in Society', which I have focused on until now.

There are the ins and outs of 'Technology as Working Knowledge' (Winberg 2004) that deserve to be articulated further. CPUT is addressing this already through studies and activities on work-integrated learning. Again, anticipation is involved. Work-integrated learning could be reduced to accommodating to present requirements from the world of work. But present requirements may be conservative, and a university (of technology) should build on its distance to the world of work to look ahead and consider the future world of work and how to prepare its students for it (cf. Millar and Hovgaard's article in this issue, and Garraway's discussion of fit and stretch in the introduction). This is a challenge, and fictive scripting cannot address it. But what it can do, when integrated in teaching and research, is help creating a culture of which forward looking is an integral part.

And there is the envisaged Centre for Research Ethics. The issues are much broader than medical research ethics. It is part of professional learning in all Faculties, implicitly and sometimes explicitly. Ethics is related to actual and possible responsibilities, and as such an integral part of professional learning. It is now also considered explicitly in Europe and the USA under the label 'Responsible Research and Innovation', up to being integrated in the new EU Framework Program Horizon 2020 (Owen et al. 2013).

Such a Centre, whether it is called a Centre for Societal Uptake Research or any other name, as long as it is clear that it is both a hub and a centre for research and studies in its own right, is

visualized in the Figure below. Some keywords are added to indicate further topics and issues, but these will not be discussed here.



With such a hub & Centre, CPUT can be more effective in fulfilling its missions, and be reflective about them. In doing so, it can also be a model for other universities of technology in South Africa. Given the worldwide interest in these issues, CPUT could offer contributions internationally, at the level of teaching and research in Faculties, as well as at the level of studies and research in its own right. A number of the building blocks for such a hub & Centre are already in place. It would be relatively easy to take the next step.

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