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ORIGINAL PAPER

Ethics "Upfront": Generating an Organizational Framework for a New University of Technology

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Abstract

A powerful set of projections has constructed post-apartheid higher education in South Africa. Among these is the expectation that technikons (institutions similar to the British polytechnics) would become universities of technology, with a mission to drive the technology of national reconstruction and development. In this paper, one of the new universities of technology serves as a case study to explore organizational structure and to highlight the ethics of university management and leadership. Building a new university provides the opportunity to place ethics "upfront", rather than as an afterthought, by constructing an organizational framework that makes ethical issues integral to management and decision-making processes. In imagining the structure of a university of technology, the authors were inspired by future scripting methods developed by Bastiaan De Laat, and by Duncan Den Boer, Arie Rip and Sandra Speller. The research process firstly involved the identification of themes related to values and ethics through an analysis of the environment. These themes were incorporated into three scenarios of possible futures for this new university type. Using these scenarios, the ethical issues that emerged (according to how the university of technology might choose to organise itself), are compared with the original themes. Conclusions are then drawn with regard to management structures that are hierarchical and entrench compliance, or that are traditionally collegiate and expertise-based, or that might enable mutual appreciation and allow for leaders to emerge within any functional space at a university of technology.

Keywords Higher education management · New Public Management · Management ethics · Scenario building · Compliance · Disaffiliation · Mutual appreciation

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Introduction: The Post-apartheid South African Higher Education Landscape

The way in which a university organizes itself is more than a matter of higher education policy and university management. Ethical aspects and values are involved as well, but these are generally not overtly recognized and addressed. In post-apartheid South Africa, the redress and transformation agendas emphasize ethical and political issues of the university, even if they may recede again when focusing on day-to-day management issues. There is a further feature of the South African higher education landscape which creates occasions to consider the values guiding universities of technology, and broader concerns of these institutions: the relabeling of the technikons (similar to polytechnics in the United Kingdom before the system was unified) as universities of technology without much indication of what kind of university they should be (Winberg 2005).

Under apartheid, the South African higher education system was comprised of two basic types of higher education institutions: universities and 'technikons'; the latter provided diploma-level higher education, usually although not always, in technical fields. In 1995, following the first democratic elections in South Africa, the Technikon Act was repealed, and technikons were permitted to offer degrees—which they did, often without clear criteria for the award of undergraduate or post-graduate degrees (Cloete 2010). The Higher Education Act (Republic of South Africa 1997a) changed the landscape of South African higher education, attempting to address the "fragmentation, inequality and inefficiency that are the legacy of the past" and "create a learning society which releases the creative and intellectual energies of all our people towards meeting the goals of reconstruction and development" (Republic of South Africa 1997b, p. 3). The Higher Education Act (Republic of South Africa 1997a) changed the nomenclature of institutions of higher education to 'universities', 'comprehensive universities', and 'universities of technology' with the intention to encourage diversity in the higher education system (Cloete 2010). South African universities of technology were thus created by decree, in a way that was similar to the creation of the post-1992 universities in the UK. That is, they were not expected to meet any particular criteria to be awarded the title 'university of technology'—unlike, for example, in Ireland where the polytechnics and institutions of technology werer expected to meet certain criteria before being acknowledged as fully-fledged universities (e.g., Elwood and Rainnie 2012).

The South African higher education system is intended to be hierarchical, with research-intensive universities occupying the highest level, the comprehensive universities focussing on mass higher education, and the universities of technology focusing on technology-based qualifications. The specific mission of the universities of technology was to drive the technological aspects of South Africa's ambitious reconstruction and development plan.

These arrangements were rejected by universities of technology who felt that they had made considerable progress since 1995, and had in fact overtaken some traditional universities in terms of research output (notably the historically

disadvantaged universities that were under-developed during apartheid). The role and position of South African universities of technology within the National Plan for South African higher education is a topic of debate (e.g., Cloete 2010). The five South African universities of technology are still under construction, trying to identify their institutional distinctiveness, including the types of undergraduate and postgraduate qualifications they will offer and the research centres they will support. It is a sector in which there is considerable internal diversity, as is common in higher education systems under development (Clark 2004), with some universities of technology showing progress in the establishment of research centres, industry and science-council partnerships, and the successful graduation of Masters and doctoral students. In other words, the universities of technology are still learning about what they can be and should be, and are thus a good site to consider organisational frameworks with ethics upfront.

More generally, South African higher education has been shaped by political, social and cultural contexts and concerns. Teaching, learning and research continue to be conducted in contexts of widespread inequality. These realities warrant analysis and discussion. Universities also need to account for how they organize and manage themselves. Like many universities in other parts of the world (Deem et al. 2007), South African universities have been subjected to New Public Management,[1] in particular in an attempt to steer the higher education system toward greater contextual relevance. A number of research studies of the institutional audits and the programme accreditation process of South African higher education have appeared in regional and international journals, for example work by Sioux McKenna and Lynn Quinn (2012) and Vivienne Bozalek and Chrissie Boughey (2012), respectively. A number of such articles claim that the South African universities of technology take a 'technical compliance' approach (McKenna and Quinn 2012) towards audits, accreditation processes, and management arrangements. Operation by compliance is a response to an expanding regulatory context in which there is lack of understanding about what exactly is required, and a resultant administrative simplification through a mechanistic and procedural approach. This has now led to a debate currently engaging the sector: namely how a new university of technology, in a context of development and of increasing managerialism, could replace compliance and superficial imaginings of quality, excellence and technology with practices that promote critical reflection and engagement (cf. Barnett 2013).

This paper considers ways in which a new university of technology might decide to organize itself. Such decisions would raise a range of ethical issues that are integral to university organization and management, and are also important for internal and external relationships. It is important to consider the space for the discussions and actions connected with these ethical issues in different constellations of university organizational structure. The scenario approach used here can be understood in commonsensical terms, but it is actually inspired by 'fictive scripting' methods (De

[1] New Public Management is a term first introduced by scholars in the field of public administration in the United Kingdom and Australia. It describes the approach that is an attempt to apply private sector business management principles to public service organisations in order to increase efficiency.

Laat 2000; Den Boer et al. 2009). The first phase of the research process identified themes related to values and ethics through an in-depth analysis of the selected university of technology. In a two-step, reflective process these themes are incorporated into a futuristic look at the institutional structure.

In the first step (after outlining the values that were identified), the basic tension in the organizational structure of any university, between the orientation of governance and management at the top, and the research and teaching performance of the bottom was discussed. This tension was exemplified in two simple scenarios: one where the top is dominant, the other where the bottom is dominant. Although we could have explored the implications in-depth, in terms of the values embedded in each of these organizational structures (e.g., the value of command and control from the centre), we chose to offer only a few indications, sufficient to make the point that a structure that embodies mutual appreciation will be a better starting point for an "ethics upfront" framework. We then created a third scenario, where we articulate how values are positioned upfront in a framework for ethical management in a new university of technology. The conclusion, briefly considers how the new university of technology might create arrangements to address ethical aspects.

The Ethics of Internal Relationships in a University of Technology

The values that emerge from the analysis are fairly general and include trust, integrity, honesty, equality, justice, respect, fairness, transparency and equity. The translation of these values into the operations of a university is evident through statements that include a student-centred approach, reference to relevant curricula, sustainability and environmental awareness. Many of the core values expressed are aligned to the mission of the university operating in a transformational and developmental agenda. In a context where the majority of those completing school and entering higher education are found to be underprepared for study at university level, issues of access are high on the agenda. Social justice through fairness and equity of opportunity to enter engineering is a focus, as is the enhancement of student success. Yet the analysis phase of the case study also highlighted gaps with regard to honouring the proposed values in practice. This appears to be related to the importance of reflection (in action) and the present lack of it. This critical observation is similar to Ronald Barnett's (2013) general idea of 'imagining the university', with the suggestion of the need for interrogation and deep reflection to critique the university and uncover good ideas for transforming it into an organization fit for the purpose of higher education today.

The starting point is Burton Clark's (1983) well-known but often neglected diagnosis of the structural difference in universities between an orientation towards the institution and that towards various fields of science and scholarship (and by now, also domains of application). The former is dominant at the top of the organization, the latter at the bottom. Thus, universities are dual organizations, and there will be tensions between the top and the bottom. In business organizations and government departments, the top can dictate what the bottom should do and can demand loyalty to the organization. In a university, the top has to defer to the performance and

reputation of its academic employees in their respective fields of science and scholarship. Thus, academics feel justified in having their primary loyalty to the fields they move in. Recently, there are some shifts, in that domains of application have become important, as have regional and community orientations where the university as an institution also plays a role. The basic point remains that there is a gap between policy development and preferred organizational forms at the top management level, and academic life and the exigencies of doing excellent and relevant research. In the university structure there is also a mid-level of deans and directors of centres and institutes which can act as the "go-between" to ensure policy and procedures are applied and the academic programmes are aligned to the vision, mission, values and needs of the institution and region.

This structure of policymaking and organizational arrangements can work out in different ways; that is the reason for exploring scenarios. For instance, while the structural difference between top and bottom remains, there can be open communication and transparent debate across the levels. But there can also be a dominance of top-down decision-making that is sometimes rational but often incomplete, rushed and superficial because it is driven by the preferences and biases of managers at the top. Communication and debate across levels does not ensure good outcomes, but when the top seeks only to enforce policy and regulation rather than to promote quality academic programmes and innovation, this will actually undermine the productivity of the university in its main missions of education and research, which have to be achieved by its academic employees and the support staff. If the top tries to continue this approach, using its power differential, tensions are created and the resultant focus in the organisation is on the task rather than the process. This does not allow for a contribution to high level decisions by academics (professional educators, research engineers and scientists), nor for reflection on and interrogation of policy. This applies to situations where the top enforces rules rather than the quality of the work of a university. The top may also play an enlightened role, and break through conservatism at the bottom, and struggles about turf (Becher and Trowler 2001). There are interesting examples, and such a role is particularly important in present day, South African universities of technology.

It is in this constellation of universities as dual organizations having to respond to changing contexts, both in general and in South Africa in particular, that values and ethics have to be addressed. This leads to consideration of themes related to ethics that were identified and are integrated into the third scenario.

The Institution

As noted, in the multi-level, complex organizational structure of a university of technology the academics have primary allegiance to their profession and field of practice and a secondary allegiance to the university with its attempts at strategic direction. There is an ethic (of practice) dealing with how best to balance these two allegiances. There are also ethics related to university top management that might be called an ethics of institutional operations. This is a de facto ethics rather than a matter of paying explicit attention to ethics. For historical reasons, South African

universities of technology have emphasized a top-down structure, with bureaucratic territories and procedures. The process of determining the "most right" decision is shaped by mandates and procedures rather than consideration of relevant values. In this structure there is an ethics of operating, however: overt attention to value and ethical dimensions is generally an after-thought rather than there being an upfront activity.

Universities of technology generally subscribe to higher order values such as trust, respect, integrity and honesty. However, while such overarching values of the institution are formulated when a vision and mission are articulated, they are not routinely applied to the day-to-day functioning of the institution. This translates into there being limited guidance or support for thinking about problems in new ways, or debating on, or processing decisions. This can expose the university to unethical behaviour by the actors in control, or those making decisions at any level, due to a lack of awareness, and thus operating in a value-deficient environment. In general, these actors operate in a space of ethical neglect rather than with unethical intent.

Innovation

Innovation is always ambivalent, in the sense that it proposes to undermine an existing order (in the sense of replacing already existing products or services) whether or not it is clear that the proposed new order is actually better. In engineering, with the rapid advances in science and technology, novel thinking and breaking the rules of doing things as they have been and are being done, is seen as important in its own right.

Behind innovations, as outcomes, there is what, in her inaugural lecture as a Professor at the Cape Peninsula University of Technology, Christine Winberg termed, the "working knowledge" of scientists and engineers, which is at the heart of a university of technology, and should be reflected upon as it functions in a complex and evolving society. This has implications for teaching and learning. Inspired by Helga Nowotny and colleagues (2001), 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' to allow individuals to function effectively in a 'Mode 2 society'.

Any response to this call for innovation and working knowledge must bridge the gap between innovative and socially appropriate change in order to ensure the protection of individuals, society and the environment. Thus, there is a fine line between the unethical act of breaking rules and the ethical practice of knowing which rules to challenge and under what circumstances (Baucus et al. 2008).

Work Placement

The unique identity of engineering programmes at South African universities of technology is that all students gain workplace experience as an integral learning component of the curriculum. This requires good working relationships with

industry partners and can mean that students have varied learning opportunities that cannot be micro-managed by the university. In this environment, decisions by university administrators or academic staff members that result in the loss of more practice-oriented graduates may affect the employability of graduates. This can make such curricular choices ethical dilemmas in a country that needs technically competent engineers (Garraway 2013).

Access to Higher Education

In South Africa, the majority of those finishing school are underprepared for higher education, particularly science, engineering and technology. With this as a reality, universities of technology need to address equitable access and enhance success through the provision of academic and psycho-social support for underprepared students with socio-economic disadvantage. Social justice in the sense of fairness and equity of opportunity to enter engineering is essential, but to meet the published values of the universities of technology they must find innovative ways to provide academic and psycho-social support for under-prepared students who are granted access.

The Needs of the Country

The tendency, within the engineering profession, for curriculum decisions to be benchmarked against those of other countries can work against the national expectation that higher education should be responsive to the needs of the South African society. The question of what is right for the country must be asked. Hence, while alignment with international trends should be maintained, highly trained engineers in South Africa must also be equipped for professional practice and relevant research in a developing country with its own unique circumstances. In this country of extremes, engineers must be equipped to address issues such as energy supply from the diverse perspectives of the latest technology in sustainable energy sources, and the realities of energy needs in conditions of poverty and underdevelopment. It is, however, suggested that policy declarations will have little effect on entrenched practice without the presence of a reflective decision-making process to determine what is best in the particular circumstances. The ethical argument is that there should be more insightful deliberations that take heed of contextual needs so as to make decisions for engineering education that are in line with South African policy and national societal needs.

Students

In the university environment, values and ethical decision making do not belong to the staff alone. Students must be empowered to think beyond the obvious confines of the content and practice knowledge that they need in order to enter the profession. They must be enabled to engage with alternative perspectives and familiarise themselves with varied situations as they develop into conscientious thinking agents. South Africa has diversity of languages and cultures and extremes in socio-economic

conditions. To function in this environment, students must be empowered to be open minded and engage in a wide range of intellectual discourses while also being willing to gain deeper understanding through hearing the different opinions and perspectives of other students. Through such engagement students will become enhanced critical thinkers who are more able to solve problems in society and work in teams where the differing opinions become a strength and not a stumbling block to success.

Moving from Themes to Possible Scenarios for a New University of Technology

In Clark's (2004) analysis of successful universities, they are flexible and adaptable. Rather than opting for the comfort of not changing, they actively transform themselves, and thus are distinguished from mainstream universities that distance themselves from the ever changing world change (Clark 2004).[2]

All organizations are complex, but universities of technology show a particular kind of complexity that is linked to the core competencies that are embodied in practitioners who are oriented to their professional domain. The diagrammatic presentation in Fig. 1 indicates where the ethical dimensions of a modern university of technology come in, given the idea of the university as a 'dual' institution (Clark 1983), accountable 'upwards' to regional and national imperatives, economic conditions, and other forms of contextual enablement and constraint; but also accountable 'downwards' and horizontally to disciplines (and new inter-disciplines and trans-disciplines), application domains, and the development of students. There are the requirements of organizations with a more or less top-down thrust; then there are the horizontal dynamics of research and teaching research groups and centres, and to some extent faculties, orienting themselves to their disciplines, domains of application, and the future careers of their graduates. In Henry Mintzberg's (1994) typology of organizations, 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. As previously noted, this creates tensions with the base level where teaching, learning, research and innovation occur.

The traditional approach to higher education management was self-governance through structures such as university committees and Senate (or equivalents). It created stability within the organization by limiting the role at the top level of management with support staff and advisory groups engaging in 'light' overall management and intermittent strategic decision making. In this arrangement the organization acknowledges the expertise of the base level, or at least of the professoriate. Those in management support those responsible for teaching, learning, research and innovation.

[2] In his earlier work on innovative universities (Clark 1998), Clark formulated five common elements of successful innovative universities: a diversified funding base, a strengthened steering core, an expanded outreach periphery, a stimulated academic heartland and an integrated entrepreneurial culture. These have been criticized as underestimating the importance of the level of deans, research institutes, and research performers (Rip and Kulati 2015). Elements could still be used selectively to further articulate scenarios presented here.

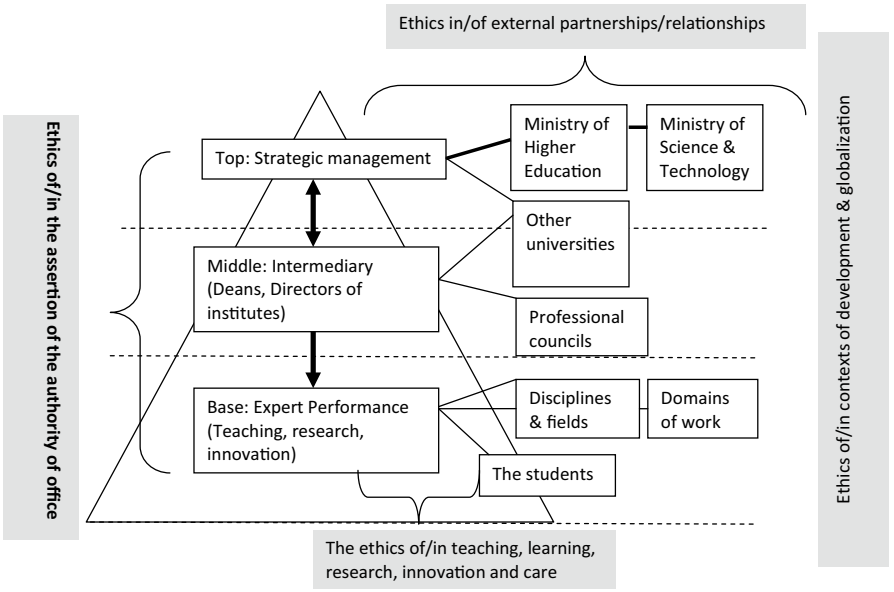

Fig. 1 Ethical considerations for Scenario 1 (dominance of 'office')

The Tension Between the Level of Management and the Level of Performance

Tensions between the levels of the university are structural; these tensions are increasingly recognized and concerted attempts are being made to respond and resolve them, particularly at the middle level of the organization (deans and directors). From the 1960s onwards, there have been increasing attempts to introduce stronger management (see Deem et al. 2007). In the modern university, the organization with its overall strategies and their implementation, its financial models, and its monitoring, is seen as more important than the teaching and research performing groups and their specific and diverse expertise (van Vught 2008). Max Weber's (1947/2012) notion of 'authority of office' and 'authority of expertise' can be adapted to the university context, where the organizational structure reduces the base level to obedient submission to authority.

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 of changed function that raises new dimensions of what might be described as 'operational ethics' (Meek et al. 2010) that is at a level different from the top-down ethics of institutional operations (see "The Institution" section above).

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. Deans, directors and project leaders respond differently to what Arie Rip and

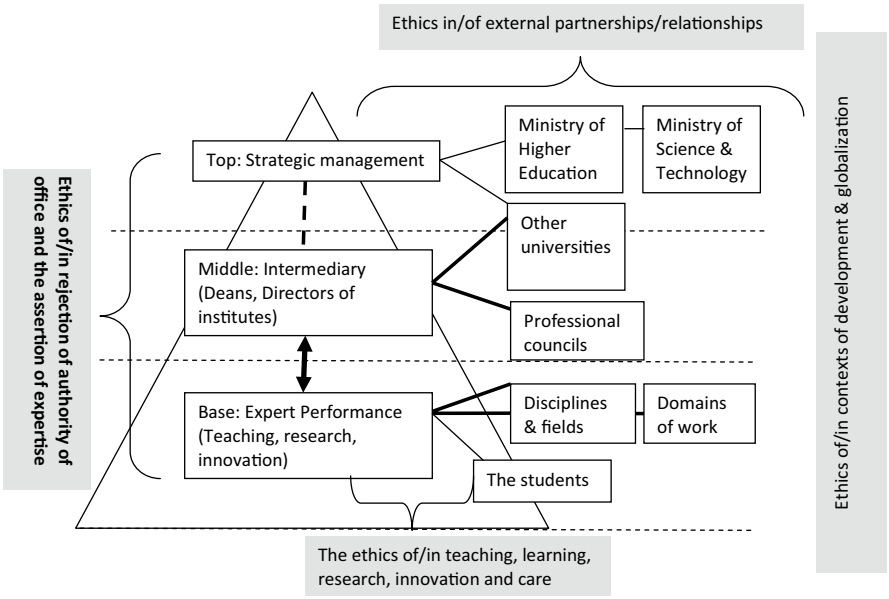

Fig. 2 Ethical considerations for Scenario 2 (dominance of performance)

Tembile Kulati call vertical pressure (and affordances), that is linked to how the university attempts to survive and remain competitive in the global context; and horizontal pressure (and affordance) that derives from changes in the field of science, in terms of organization as well as content (Rip and Kulati 2015). 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.

In Scenario 1 (Fig. 1), the middle level allies itself with the top level, and tries to impose strategies and measures on a somewhat reluctant base level. In Scenario 2 (Fig. 2), the middle level allies itself with the base level, and resists top-down policies. They can do this because they can mobilise external support, ranging from external research funding to involvement in curricula, as well as 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 2008), an increasingly important phenomenon in national research systems, many of them located wholly or partially in a university.

The new universities in South Africa must develop and form an identity. The first two scenarios for the possible future of the South African university of technology highlight the operational ethics embedded in the different structural dynamics. In Scenario 1, the old 'technikon' culture of the historic institutions and their tendency towards top-down management, and the response of "compliance" at the base level is dominant; Scenario 2 presents the possibilities of resistance to the top, and breakaway, and the concomitant dilemma of identity and change. In a traditional university, Scenario 2 represents the traditional, collegiate arrangements and the values of academic freedom and autonomy. For a new university, Scenario 2 might

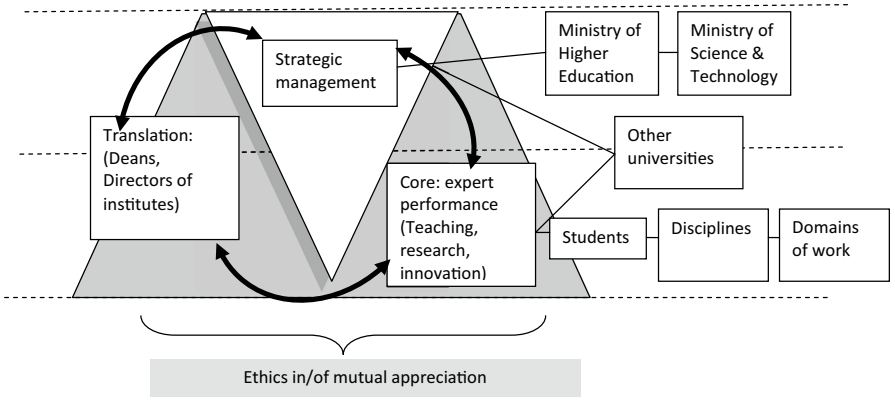

Fig. 3 An organizational framework to guide mutual appreciation

represent an important part of its development: immersion in disciplinary research cultures and capacity building. But Scenario 2 could also represent the subversion of attempts to give strategic direction, in the interests of development and social cohesion in the South African context.

These two scenarios exemplify extreme possibilities for the future of universities of technology in South Africa. 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. In much of the literature on higher education management, such as the 'assault on the professions' inherent in the managerial practices described by John Beck and Michael Young (2005), the reference is to situations captured in Scenario 1. In considering the future of the research university, Rip (2011) finds it unlikely that high performing centres of excellence and relevance could maintain adherence to a business model in which strategy is determined and directed from the top, and so refers to a situation that is possible in Scenario 2. The extreme possibilities may not materialise, but their consideration sensitises those in the university, including top management, to latent tensions and their ethical aspects. This is important because there might be events or concrete developments that exacerbate these tensions, which must thus be understood for what they are.

In Scenario 3 the organizational structure of the university of technology is reorganized. Others have also imagined such possibilities [see the work of Barnett (2013) on the ecological university]. The top level of strategic management, at the apex of the triangle, becomes more flexible and managers locate themselves within the translation zone (of deans and directors) and the core functions (teaching, research and innovation). This organizational structure is represented by three triangles forming a trapezoid (Fig. 3). It diagrammatically represents the continuance of strategic management but now the incumbent managers encourage leadership within all functional domains of the institution. In this 'flat' university of the future the management shifts from the need to control to an emphasis on flexibility (Weisz and Kimber 2001). Management is not perceived as hierarchical but as a

necessary function and leadership is diffused throughout the university of technology. This is not presented as a general preference for the organizational framework of a university, but rather as an effort to address the need for a university of technology in South Africa to find out what kind of organization it can and should be. In this engaged management style, teaching, learning, research and innovation are valued as the core functions, and supported by appropriate governance and infrastructure. Thus we create another possible future for a new South African university of technology. It is not always possible (or desirable) to achieve congruence between the different levels, but it promotes a structure that is oriented towards mutual appreciation. The more forward-looking, flexible management is underpinned by guiding values and the development of practices that open the way for a process of reflection and learning within a robust yet flexible ethical framework. This can translate into an environment that enables responsibility at all levels of staff and student, promotes equity and fairness in work practices, and enhances professional development throughout the university (Weisz and Kimber 2001). In Scenario 3 the objective is to show what is possible for the future state of a university of technology when there is the motivation and willingness to operate in a flexible and open system. These scenarios are applicable to universities of technology in South Africa in general, although they were developed for the case of a single university of technology (and some of the distinctiveness of this particular university is captured in the scenarios).

It is proposed that the universities of technology need to shift away from the dominance of office (Scenario 1, Fig. 1), and simultaneously consider the benefits and risks of moving towards an environment of mutual appreciation (Scenario 3, Fig. 3). We think it is likely that establishing a dominance of performance (Scenario 2, Fig. 2) is the first step towards enabling the university of technology to make a significant contribution to the education of professionals and applied scientists. As a 'sustainable adaptive' (Clark 2004) university of technology, it does not depend on 'ephemeral personal leadership' (Clark 2004), but rather depends on collective responses to build new sets of structures and processes, accompanied by allied beliefs, that steadily express a determined and positive institutional will. Building on the dominance of performance, the university-of-the-future may develop 'a stabilizing entrepreneurial constitution woven into the fabric of the university' (Clark 2004, p. 5) through the realization of the vision of the university of technology to transition to a structure that is founded on mutual appreciation between the levels.

Strategic Management

In Scenario 2, leadership is more distributed and all are the custodians of the institution's values and ethical framework that allows for the vision and mission, which is to achieve excellence in the business of professional education, research and innovation in Africa. This framework and vision provide guiding principles for students, university teachers and researchers at the institution. Strategic managers 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. The leadership is therefore from within all organizational components and

this enables the institution to implement transformation at an institutional and sector level. The more flexible stance by strategic managers encourages distributed leadership and participation.

Level of Translation: Deans of Faculties and Directors of Institutes

Scenario 3 enables deans of faculties, directors of 'Centres of Relevance and Excellence', and leaders of programmes to 'translate' more effectively between strategic managers and educational and research performance. There is respect for performance (because there is an understanding that the university is dependent on the performance level), but also there is respect (or at least understanding) of the judgements and decisions of strategic managers. Deans and directors, and other leaders, would build towards an environment of mutual appreciation as they translate between management and performance functions.

Teaching, Learning, Research and Innovation Performance

In Scenario 3, there is satisfaction in the accomplishments and achievements of the performance level. In particular, the institution prides itself on its collaboration with business, industry and professional partners. It graduates engineers for the region and for the rapidly developing African continent. It provides sought after engineering programmes, has a growing number of professors, and all full-time, tenured academic staff have doctoral-level qualifications and research experience in their specialist fields. The annual operating budget and amount spent per student enables a high standard of educational provision. Ethics that spans the academic and workplace contexts is given continuous integrated attention in undergraduate and postgraduate programmes. Students understand their right to a broad education, disciplinary/theoretic knowledge, and the discourse of civic engagement (Wheelahan 2010). They furthermore understand the responsibilities to the profession and society that accompany the rights they invoke, in a context of engineering-focused collaborations. Students work on real world problems and concerns in contexts of 'application' and 'implication' (Nowotny et al. 2001).

Students are well prepared 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. The university of technology will make a positive contribution to regional economic development, promoting start-ups and spin-offs in collaboration with community and business partners.

A key ethical challenge is the reconciliation of what has been termed the new 'bilingualism' between market-driven activities and traditional academic values (Price 1998), both of which are increasingly required within universities of technology. In a context of socio-technical innovation in Africa, research ethics takes into account issues related to the field, and the nature of the innovation (e.g., the ethical management of risk in engineering innovation in vulnerable communities).

Concluding Reflections

To survive in the twenty-first century, all universities of technology in South Africa must envisage better education provision and better research and innovation practices, and will therefore have to find a way to manage the tensions inherent in university structures.

The new South African university of technology can distinguish itself by operating within an organizational framework that positions ethics 'upfront'. This starts with the university having a process in place that continuously seeks clarity of principles and values. One necessary but not sufficient element is that the university would have an autonomous, discipline specific ethics committee in all its faculties to promote systematic, methodical and critical reflection on the values, principles and procedures that represent acceptable behaviour and practice. The engineering research ethics committee would contribute to the growing development of engineering ethics as a specific area within the broader discipline of professional and research ethics.

The university would promote debate and deepen the awareness and understanding of societal issues. This would also provide a platform for reflection such that decisions are made that are representative of the cultural diversity within the South African society.

Practically, it will be important to add a 'reflexive hub' on top of, and in service to, the 'spokes' of faculties and centres. This is a real possibility if there is a transition to the dominance of performance and cognisance of the strength of a framework that promotes mutual appreciation. Present and possible future activities will be characterised by their close link with practice (cf. working knowledge), while being informed by broader insights and experiences. Those committed to performance provide ongoing teaching and learning, research and innovation, and have broad insights and experiences about these matters. Deans and directors are a conduit to such broader reflexive insights, and they advance them.

Becoming a new university of technology is contingent on the processes that emerge to enable a reflexive university through creating space for debate, critique and reflection. A university of technology has a responsibility to analyse, and if necessary change, what it does. Its mission should not only be to make a contribution to technological innovation, but to make a contribution to the ability of South African society to manage the development of technology, and put it to good ends. Entertaining visions of the future of the university, 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.

References

Barnett, R. (2013). *Imagining the university*. New York: Routledge.

Baucus, M. S., Norton, W. I., Baucus, D., & Human, S. E. (2008). Fostering creativity and innovation without encouraging unethical behavior. *Journal of Business Ethics, 81*(1), 97–115.

Becher, T., & Trowler, P. R. (2001). *Academic tribes and territories. Intellectual enquiry and the culture of disciplines*. Buckingham: Open University Press.

Beck, J., & Young, M. F. D. (2005). The assault on the professions and the restructuring of academic and professional identities: A Bernsteinian analysis. *British Journal of Sociology of Education, 26,* 183–197.

Bozalek, V., & Boughey, C. (2012). (Mis)framing higher education in South Africa. *Social Policy and Administration, 47*(6), 688–703.
Clark, B. R. (1983). *The higher education system: Academic organization in cross-national perspective*. Berkeley, CA: University of California Press.
Clark, B. R. (1998). *Creating entrepreneurial universities: Organizational pathways of transformation*. Oxford: Pergamon.
Clark, B. R. (2004). *Sustaining change in universities: Continuities in case studies and concepts*. Maidenhead: Open University Press.
Cloete, N. (2010). Higher education differentiation: The good, the bad and the incomprehensible. *Paper presented at the stakeholder summit on higher education transformation, Cape Peninsula University of Technology*, 22–23 April 2010. http://www.cepd.org.za/files/Commission%204.pdf. Accessed 10 Feb 2013.
De Laat, B. (2000). Scripts for the future: Using innovation studies to design foresight tools. In N. Brown, B. Rappert, & A. Webster (Eds.), *Contested futures: A sociology of preposective technoscience* (pp. 175–208). Aldershot: Ashgate.
Deem, R., Hillyard, S., & Reed, M. (2007). *Knowledge, higher education, and the new managerialism: The changing management of UK universities*. Oxford: Oxford University Press.
Den Boer, D., Rip, A., & Speller, S. (2009). Scripting possible futures of nanotechnologies: A methodology that enhances reflexivity. *Technology in Society, 31,* 295–304.
Elwood, E., & Rainnie, A. (2012). Strategic planning in Ireland's Institutes of Technology. *Higher Education Policy, 25,* 107–129.
Garraway, J. (2013). Introduction: Future studies and scenarios of degrees in technology. In A. Rip & J. Garraway (Eds.), *University, curriculum and society through a scenario analysis lens*. Paradigms Special Issue, 18, Cape Peninsula University of Technology.
McKenna, S., & Quinn, L. (2012). Lost in translation: Transformation in the first round of institutional audits. *South African Journal of Higher Education, 26*(5), 1033–1044.
Meek, V. L., de Boer, H., & Goedegebuure, L. (2010). The changing role of academic leadership in Australia and the Netherlands: Who is the modern dean? In V. L. Meek, L. Goedegebuure, T. Carvalho, & R. Santiago (Eds.), *The changing dynamics of higher education middle management*. Dordrecht: Springer.
Mintzberg, H. (1994). *The rise and fall of strategic planning: Re-conceiving roles for planning, plans, planners*. Toronto: Free Press.
Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty*. Cambridge, MA: Polity Press.
Price, C. A. (1998). Post-war Immigration: 1945–1998. *Journal of the Australian Population Association*, *15*(2), 115–129.
Republic of South Africa. (1997a). *Higher Education Act No. 101*, Government Gazette 19 December 1997. Retrieved September 10, 2019 from https://www.gov.za/sites/default/files/gcis_document/201409/a101-97.pdf.
Republic of South Africa. (1997b). *Higher Education Act No. 18207*, Government Gazette 15 August 1997. Retrieved September 10, 2019 from http://www.justice.gov.za/commissions/FeesHET/docs/1997-WhitePaper-HE-Tranformation.pdf.
Rip, A. (2008). Towards post-modern universities. *Paper presented in the Prime-Latin America Conference at Mexico City*, September 24–26 2008.
Rip, A. (2011). The future of research universities. *Prometheus, 29*(4), 443–453.
Rip, A., & Kulati, T. (2015). Multilevel dynamics in universities in changing research landscapes. In D. Jansen & I. Pruisken (Eds.), *The changing governance of higher education and research. Multilevel perspectives. Higher education dynamics* (Vol. 43, pp. 105–115). Cham: Springer.
Van Vught, F. (2008). Mission diversity and reputation in higher education. *Higher Education Policy, 21,* 151–174.
Weber, M. (1947/2012). *The theory of social and economic organization* (A. M. Henderson & T. Parsons (Ed.), Trans.). New York: The Free Press.
Weisz, M., & Kimber, D. (2001). Ethics, education, and work: Reflections on cooperative education in the new university system. *Journal of Cooperative Education, 36*(2), 43–50.
Wheelahan, L. (2010). *Why knowledge matters in education: A social realist argument*. Oxford: Routledge.
Winberg, C. (2005). Continuities and discontinuities in the journey from Technikon to University of Technology. *South African Journal of Higher Education, 19*(2), 189–200.

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