Reimagining futures of universities of technology

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Abstract

Universities of Technology in South Africa emerged relatively recently from technical college-like institutions, known as Technikons. Technikons had a distinct workplace-oriented identity, while Universities of Technology lack such clarity of identity. This paper thus explores the vexing question of what constitutes the identity of Universities of Technology. In conducting the exploration, the researchers drew on Activity Theory to structure the exchange of ideas and narratives about what a future University of Technology might be. In so doing, the researchers discovered fundamental contradictions between current practices and the desirable vision. The most significant contradictions were, firstly, between the rigid, rule-bound culture and the projected need for greater organisational flexibility, and secondly between the current, highly-boundaried university to one that should embrace intra- and inter-organisational collective action. The researchers conclude that the resolution of these contradictions could chart the way forward for reimagining the identity of a University of Technology.

Keywords: Activity Theory, institutional identity, institutional image, University of Technology

Introduction: Where we came from (1960 – 1994)

Our particular focus in this paper is a current vexing issue, that of the identity of Universities of Technology in South Africa, which developed from Technikons. Prior to 1994, the Technikons in South Africa focussed on training skilled workers at the pre-professional level, in particular engineering technicians, and practitioners in a range of fields, including health sciences, biotechnology, nature conservation, auditing, design, film, and video.

Traditionally, the distinction between Technikons and universities comprises the former's strong vocational focus, including their closeness and interaction with workplaces, and the lower entrance requirements for most Technikon programmes, resulting in a more inclusive student body than that of the more elite universities (Kraak, 2009). The Technikon's closeness to industry was maintained through a structured and assessed system of workplace learning in most diplomas and a regular system of industrial advisory bodies

attached to each programme (Du Pre, 2010). As the then Technikon policy on programmes stated:

> The secondary objective of Technikons is to educate students with a view to practice a particular vocation or set of related occupations in industry. In this way Technikons play their specific part in the technology-orientated or vocationally-oriented provision of person power ... this means that Technikons, industry and vocational councils should be closely related to one another ... in regular mutual contact and interaction (Department of Education, 1997a: Section 2.2).

The role of the Technikon system was very clear and somewhat unitary: to produce employees for industry, with industry as the clearly dominant partner. Technikons were similar to the Polytechnics, in terms of their position in the UK higher education system prior to 1992. Most Universities of Technology aspire to the status of the German *Technische Universitäten* or the American Institutes of Technology, but lack the historical progression, research excellence, and prestigious reputation of these institutions. The concept document on the role of Universities of Technology was initially drawn up by a working group of Technikon Vice Chancellors, and it drew heavily on information gathered from the European Technical Universities and Australian Universities of Technology (Du Pre/SATN, 2009). Some of the proposed characteristics were, inter alia: excellence in teaching through flexible, technology-supported approaches, work-integrated learning and industry partnerships, entrepreneurship, centres of excellence in research and innovation, and regional responsiveness (Du Pre/SATN, 2009; Du Pre, 2010).

The South African Universities of Technology are not fully-fledged universities, often because of their histories. They typically developed from technical colleges and later Technikons, employing technically adept staff drawn predominantly from occupational spheres, rather than academically experienced staff with research-based higher degrees. Currently, the research output of a University of Technology academic staff member is approximately one third of that of an academic at a research-intensive university (CHE, 2019). The previous Technikons offered mostly undergraduate certificate and diploma programmes, which tended not to attract the calibre of students willing to do postgraduate studies, nor staff who wished to engage in research (Powell and Mckenna, 2009). Furthermore, University of Technology programmes generally exhibit a knowledge base characterised by principles of practice rather than theoretical principles more typical of a traditional university (Shay et al., 2011; Boughey, 2010). Access to the University of Technology diplomas, which form the bulk of the qualifications offered, has lower entrance level requirements than those required for university degree programmes. Therefore, as Powell and Mckenna (2009) argue, the move from Technikon to University of Technology was more of a reputational marketing ploy than a substantive change in identity, as many of the previous characteristics of the old Technikons still persist. It should be noted that lower reputational status is not always the case; some students, even though they may be

academically gifted, prefer to study in career-orientated rather than academic fields, for example in design and film.

Context: How we lost our way (1995 – present)

The Education White Paper No. 3 (1997b) changed the landscape of South African higher education by, firstly, announcing the future mergers of different historically white and historically black institutions and, secondly, the emergence of new institutional forms, but the detail was not yet provided. This was in an attempt 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' (1997: 1).

The sentiments of the White Paper were further fleshed out in the National Plan (DHET 2001a) through proposing a number of outcomes and goals, for example on increasing participation, graduate outcomes and equity of staff and students. However, the Plan suggested maintaining the binary between traditional Universities and Technikons, despite the call from the Technikons to become Universities of Technology. Part of the rationale for this call was that Technikons were already offering degrees in addition to diplomas. The policy on Restructuring of the Higher Education System (DHET, 2001b; 2002) was the first to announce which institutions would be merged. At that time the predominant concern was the normalisation of South African higher education through the merger of historically black and white Technikons into single institutions, for example the Peninsula and Cape Technikons, and the merger of some universities with Technikons to form 'Comprehensive Universities'. The renaming of Technikons as 'Universities of Technology' was not initially supported by Government (one reason suggested was that the renaming was primarily to source increased subsidy). The shape and size of the comprehensive university was outlined in some detail in the Comprehensive University Concept Document (DOE, 2004).

However, the Technikon Vice Chancellors maintained that, as degree offering institutions, they could rightfully lay claim to the title of 'University'. Furthermore, the Technikons claimed that the knowledge taught and research undertaken was different from, but not inferior to, that of the traditional Universities (Du Pre/SATN, 2009). In 2003, the Minister for Higher Education announced that the merged Technikons would henceforth be known as Universities of Technology (Asmal, 2003), possibly as a result of pressure from the Technikons (Singh, 2008). However, there was no detailed concept document released by the Department of Education, as was the case for Comprehensive Universities (DOE, 2004). Instead, there was a concept document released by the Technikon/University of Technology Vice Chancellors (Du Pre/SATN, 2009). South African Universities of Technology were thus created by decree, 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 other Institutions of Technology were expected to meet certain criteria

before they were acknowledged as fully-fledged universities (e.g., Elwood and Rainnie, 2012). The change to University status impacted the funding of universities:

> The previous funding system, which was in force until 2004, differentiated between Universities and Technikons, whereas the new funding system, fully operational since 2007, treats all Universities in terms of one set of rules (CHE, 2016: 325).

The 'rules' include higher levels of funding for postgraduate qualifications, as well as for students who complete programmes in the minimum time. The funding mechanism for the South African higher education system post-1994 was not intended to be hierarchical or to favour particular institutional types. Rather, the intention was to enable equity of access to higher education generally, as well as support and develop institutional autonomy, effectiveness and efficiency, as set out in the White Paper (1997). However, contextual issues within the South African higher education sector, and the intended consequences of policies, thwarted this intent (Cooper, 2015). Firstly, the undifferentiated nature of funding across the sector meant that Universities of Technology aspired to offer postgraduate and research-based degrees as these generated considerably more income than undergraduate qualifications. Secondly, key policy directives allowed for a non-rigid demarcation of existing institutions according to their existing niches and strengths. Thus, Universities of Technology could now include research in their missions, even without the background, skills and resources to do so. Historical differences amongst institutions, often with their origins in earlier 'race' and class divisions from the apartheid era, have had the unintended consequence of, ironically, cementing institutional hierarchies (Singh, 2008; Kraak, 2009). The hierarchy comprises research-intensive Universities at the apex, followed by traditional Universities with a stronger teaching focus, Comprehensive Universities, offering a mix of more academic and career-focussed programmes, and greater possibilities of articulation between programmes, sit somewhere in the middle range, while Universities of Technology occupy the bottom rungs. Universities of Technology are characterised by a focus on career-based education, the offering of diplomas, and a strong undergraduate focus (DHET, 2014).

As Singh points out, the key policy documents 'indicate a preference for an approach that did not create rigid and demarcated sectors' (2008: 16) in order to contribute to South Africa's ambitious reconstruction and development plan. Hence in 1995, immediately following the first democratic elections in South Africa, the 'Technikon Act' was repealed, and Techikons were permitted to offer degrees – which they did, often without clear criteria for the award of undergraduate or postgraduate degrees (Cloete, 2010). The role and position of South African Universities of Technology within the National Plan for South African higher education is a topic of debate (Coleman, 2016). The six South African Universities of Technology are still under construction, trying to identify their institutional 'distinctiveness', including the kinds of teaching and research they will offer. It is a sector in which there is considerable internal diversity, as is common in higher education systems under development (Clarke, 2005; Morphew and Huisman, 2002), with some Universities of Technology showing signs of emerging, distinctive identities.

What has become apparent is, firstly, the lack of clear guidance from Government with regard to the identity of the University of Technology, as there was in the past for Technikons (for example, as outlined in Report 150). Secondly, there are a number of aspirational pressures (for example from SATN documents) to take on a more expansive identity, well beyond serving industry.

Institutional culture, identity and image

Institutional cultures, identities and images are inextricably linked. Institutional culture represents the 'personality' of an institution. There is no simple definition of 'institutional culture' because there is no single characteristic that can be cited to define its culture. Institutional culture evolves over time. Culture is ubiquitous: every organisation, every department, every informal work team has a culture. People create culture, but are also shaped by it (Chidester, Dexter and James, 2003). In the context of higher education, institutional culture is usually understood as 'the prevailing ethos – the deep-seated set of norms, assumptions and values that predominate and pervade most of the environment' (Steyn and van Zyl, 2001); it is the sum total of the values, attitudes, styles of interaction, collective memories – the 'way of life' of the university, which is known by those who work and study in the environment, through their lived experience. Institutional culture has the capacity to influence every aspect of a university – both academic and non-academic functions (Steyn and van Zyl, 2001). While culture might be considered invisible in some sense, it tends to make its presence known whenever attempts are made to introduce changes into an institution (Jansen, 2005). Although institutional culture is difficult to pin down, and is a collective of many diverse factors, key indicators of the state of the university's institutional culture relate to its organisational integrity, affirmation of diversity, respect for scholarship (in teaching and learning, research and social engagement), quality of leadership and shared governance, physical environment (in particular the quality of the teaching and learning environments and research facilities), and the adequacy of its funding (Kezar and Eckle, 2002).

Cultures can be changed, as can the people who create them. Universities of Technology may attempt to change their cultures by emulating more traditional universities, but in so doing will encounter resistance – and may lose their advantageous distinctiveness, such as their closeness to work and society. This is likely to be the case if change is driven without consultation or concern for possible unintended consequence. In fact much of difficulty with the identity of the current University of Technology sector may stem from this emulation and concomitant 'academic drift'. The prior Technikon sector attempted to both maintain its vocational training niche while exploring the offering of post-graduate degrees and an enlarged research agenda. However, owing to the practice focus, the culture of the Technikons had not supported and developed disciplinary knowledge development nor research capacity; thus, mitigating against this move (Kraak, 2009).

An institution's identity flows from its culture, and can be thought of as a form of collective sense-making that develops through the conversational exchange of ideas (Hardy,

Lawrence and Grant, 2005.). Institutional identity is understood to be open, fluid (rather than fixed), relational and evolving over time (Hardy, Lawrence and Grant, 2005). A university's identity develops over time and will tend to resist conscious efforts to introduce new philosophical or cultural attributes, or values that are given priority over long-established sources of meaning. For a university there is usually a plurality of identities, some of which the institution may not be consciously aware (Castells, 1998). Probing the university's identity requires paying attention to the narratives that individuals develop around themselves and their institution. Accordingly, exploring these constructions implies analysing the meanings that emerge whenever the members of an organisation interrogate themselves about who they are, what they do, and what they want to be (Hatch and Shultz, 2004). In this research the researchers interrogated academic staff members of senior committees at one institution as to what should constitute a University of Technology. In order to do this the researchers employed an organisational change framework drawn from Activity Theory.

Theoretical framework: Understanding identity-building as activity

The concept of expertise, and so organisational change, as residing within the minds of individual thought leaders is persuasive in modern society (Engeström, 2018). However, there have been approaches in the last 30 years or so that open up the nature and identity of organisation as constituted by its practices, for example Lave and Wenger's (1991) depiction of organisation as a 'community of practice'. Activity builds on this depiction through understanding expertise as embedded within the totality of the system, including how it operates with what cultural resources and constraints to what end, or what Engeström refers to as the 'collective, culturally situated nature of expertise' (2018: 12). Furthermore, the 'collective experts' typically experience difficulties and disturbances in their daily activities, which may not emerge in external experts narratives. In Activity terms these disturbances hold within them the possibility of the collective propelling themselves forward to search for new ways of doing, about 'what is not yet there' (Engeström, 2018: 14). We now go into more detail of our theoretical framework, Activity Theory.

Activity Theory understands that human activity is always undertaken by subjects, mediated by cultural tools and embedded within a social context. These interactions are known as the activity system (Engeström, 1999). The activity system has zones of production, exchange, consumption and distribution. The zone of production comprises subjects, their tools, and the object of their activity. In this study academic staff and university managers are the multiple subjects involved in the achievement of the object. The tools in an activity system can be physical, cultural or conceptual. The first principle of activity is that the object drives the activity (Engeström, 1999). Activity Theory distinguishes between the object and the outcome of a system. The object is what is being worked on, the raw material or even what actors are working against, which propels them forward to take action (Engeström, 2018). The outcome is then what actually emerges as the various elements of the whole system come to influence the subjects' work on this 'raw material'.

There are three additional zones in the activity system: exchange, consumption, and distribution. The exchange zone is governed by tacit and explicit rules that determine how the subjects (academics and managers) may act, and are a result of socio-historical processes. Conventions and guidelines in higher education have their roots in academic traditions, and are slow to change to accommodate new objects. The zone of consumption is determined by the community; that is, the broader social context in which the system operates. In this regard, the inequality that persists in South African higher education would have considerable impact on how the system can operate, and can advance or block the achievement of the object – for example, in terms of persistent inequality, black working class students continue to make up the bulk of failures in first year and beyond (Cooper, 2015). The zone of distribution is the arrangements made for the division of labour, i.e., the hierarchical structures and task distribution within the larger university activity system.

The four zones anchor the subjects, tools, objects, rules, communities, and control how work is done. In order to understand identity development and its potential outcomes, the whole activity system, both process and outcome, has to be studied (Engeström, 1999). By studying the whole system, researchers can identify the interactions that subjects have to negotiate, as well as the tensions and contradictions. Finding these 'sticking points' indicates ways of improving practices within the activity system.
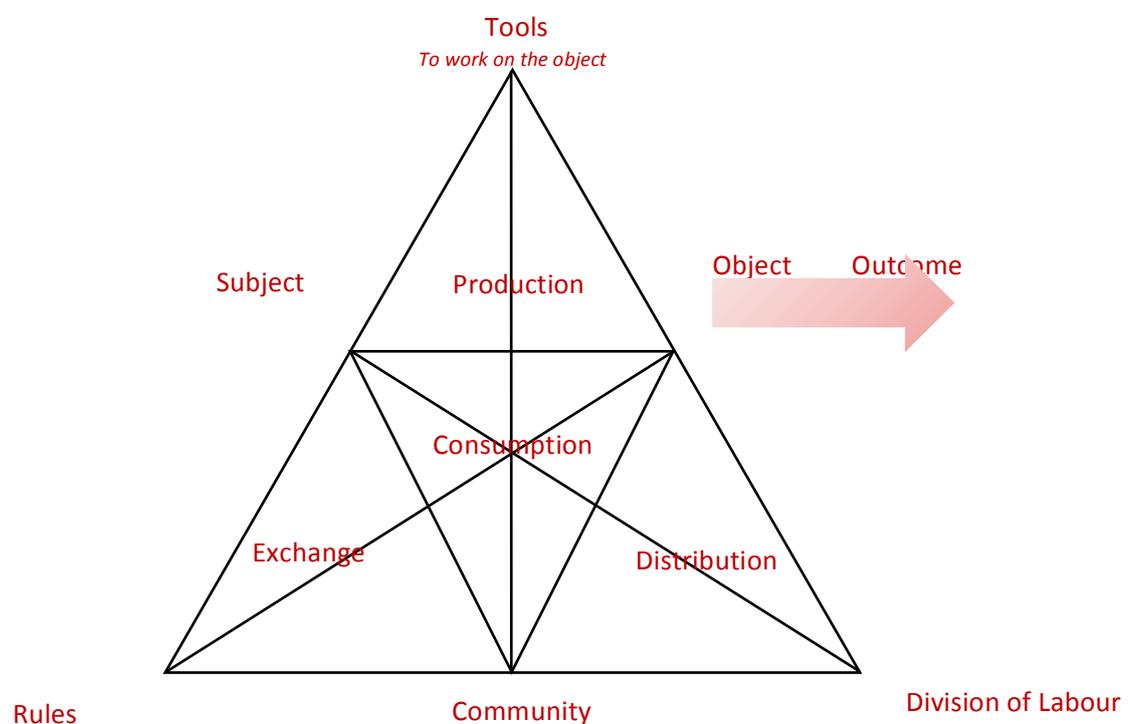

Figure 1: An activity system (adapted from Engeström 1999)

Activity Theory is particularly apposite for our research as it focuses on development and change in activity systems, often arising from historically derived tensions in organisational systems (Sannino and Engeström, 2017). In short, we identify who are the people of interest in the system, which in our case are the academic staff in the university, who constitute the subjects. We then look at what our focus is, what it is we wish to work on. In our system, it is the object of a reimagined University of Technology. In order to work successfully on this object the staff need to mobilise certain resources, which may, or may not, be sufficient. The staff, however, work as part of a much broader system of the university culture, rules and who takes decisions and provides guidance (rules and divisions of labour respectfully). Both these systems of rules and divisions of labour may enhance or inhibit staff's ability to work on the object, the initial, as yet not concretised idea of a new University of Technology.

Returning to the earlier discussion on the identity of the University of Technology, in Activity Theory terms the 'object' of the Technikons was to work on creating employees for industry (Figure 2). The Technikon's object was thus strongly determined by the requirements of industry. To some extent, both the then Technikons and industry could be said to share a common object, as indicated in Figure 2. However, this previously clearly delineated object has become less clear, even confused, within the new, emerging and aspirational University of Technology (Figure 3).
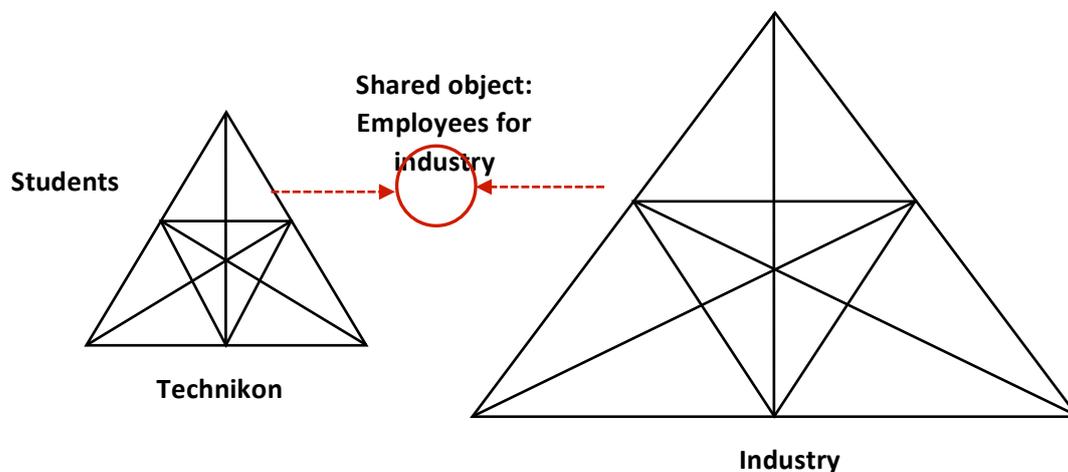

Figure 2: Training for industry

Furthermore, the influence of industry on the institution is no longer totally dominant; industry is one of a number of role players informing the identity of the university. Industry is also only one of many members of the community, and has some, but not total, influence on the rules which govern the University of Technology (for example, through professional bodies). This is shown graphically in Figure 3 below.
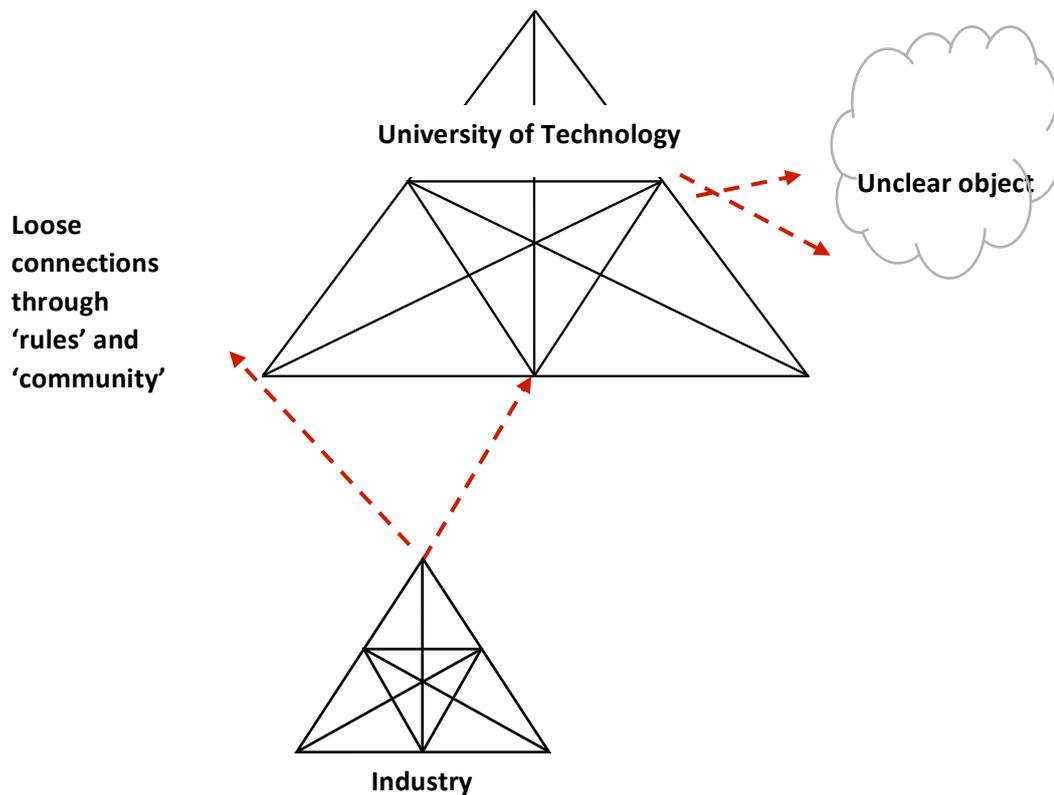
Figure 3: The aspirational University of Technology

In this paper, the issues addressed are the potential responses that a University of Technology might have to its often-conflicting agendas of social responsibility, graduate employability, and research output, and how these conflicts may influence perceptions of identity. There are additional pressures on all universities where newly emerging student bodies (for example the #FeesMustFall movement) have called for social transformation of the curriculum, one that is more 'decolonised' and Africanised (though such calls are currently somewhat muted).

Academic staff are under considerable pressure to change. For example, at the University of Technology in this case study, there is currently a strong push to improve its research rankings as measured through increased publications outputs. There is also pressure, both in research and teaching, to take on and respond to the 4th industrial revolution, and so become a different, more advanced university (CPUT, 2019). The first Vice Chancellor's vision was for the institution to become the 'MIT of Africa'. But all these 'becomings' are desired outcomes, mostly very much from the University's top management. What has not necessarily been done is the more granular examination of what we are now, what we want to be as a University of Technology of the future from a wider segment of staff and what would happen if certain outcomes are actioned now on the future of the university.

Researching participatory identity formation

We conducted our research on what the future of a University of Technology could be by collecting information from two influential bodies, the Senate Teaching and Learning Committee and the Senate Research Committee, in one University of Technology. These committees consist of the Faculty Coordinators for teaching and for research, members of the University support units, Deputy Deans, and Directors of key units (for example e-learning, the teaching and learning centre, and heads of research centres).

Committee staff were invited to two focus group interviews in order to discuss research or teaching in the future University. Each focus-group interview lasted between two to three hours, and was held immediately after the formal Senate Committee meeting. The teaching and research meetings attracted 15 and 10 staff, respectively. The meetings were structured using the activity system in Figure 1. As is typical in Activity Theory analyses, the researchers began the discussion with a stimulus or 'provocation' (Virkunnen and Newnham, 2013). This took the form of a shortened transcript from the Chair of the South African Technology Network (SATN) depicting a loss of identity and future direction in the sector (Van Staden in Dell, 2016). The researchers then posed activity-system inspired questions beginning with a future potential 'object' in the form of 'What should we be focusing on in the future?' This was followed by additional activity system inspired questions which probed what sorts of staffing (subjects), what sorts of resources (tools) and so on would be necessary to work on this identified focus or object. Key points made by participants were scribed on newsprint during the meeting so that participants could maintain a sense of the whole system. The meetings were audio-recorded, transcribed and analysed, using the activity system framework. The Research Committee focused on what would constitute new forms of research for the University, and the Senate Teaching Committee on new forms of teaching.

Re-imagining research in times of change

The researchers presented the staff with a quote that the University of Technology sector had 'lost our way' and that we were no longer 'attracting third stream income' (Van Staden in Dell, 2016) as a provocation. Interestingly, the quote set the scene for the discussion as the staff rebuked the notion of research in order to accrue income for the university, but rather argued that research should serve to help the broader community:

> The research we do should ... have an impact on communities ... at an entrepreneurship level ... you would create jobs (Research Participant 7).

The issue of research being about the community emerged continuously throughout the focus group discussion. 'Community' as a target of research was in stark contrast to the Universities' research vision of high-end, high-tech research within the ambit of Industry 4.0; in fact Industry 4.0 was not mentioned at all in the research discussion. The traditional focus on practice and closeness to those outside the University was highlighted during the

discussion, and gave participants direction in working with the community. They did not want to do research for research's sake, but research that could transform and improve society through solving societal problems. Such research is perhaps in line with the previous Technikon's historical mission of having a predominantly practical, rather than a disciplinary, focus (see, for example, Kraak, 2009).

> We should be seen to be using our new University status to do research that actually tends to address social issues in society, whether it is a problem that can be addressed by an engineer or one that can be addressed by Health Sciences. It should ... the practice orientation should be there ... practical solutions to problems (Research Participant 3).

Problems were furthermore understood, not as one thing, but as evolving as solutions to complex problems. Thus there was nothing pedestrian or deficit about this sort of practical research, even if it had a more local flavour. Researchers would need to be able to deal with complexity, and in the words of the participants, be 'nimble and clever' as initial problems multiplied:

> In terms of our impact on the community ... if you look at the human dynamics that are there, that just keep on changing into different problems. You solve one problem, another comes up again. Then you have to solve that. So, if you can have a research that focuses on immediate impact on the community, then it's going to be complicated (Research Participant 5.

Participants began to describe what sorts of researchers would be needed for this 'nimble' research agenda. As well as having expertise in their fields, they would need to have a number of additional attributes. For example, they would need to be able to work across disciplines in attempting to solve real world social problems. They would need to become 'transdisciplinarians'. But such expertise would need to be reciprocated by either being, or at least working with, experts in communities. Such experts would thus also have an ability to work across the boundaries between University and community fields. As the participants considered the idea of new expertise, additional ideas emerged about the nature of transdisciplinary research work, in particular the idea of drawing on philosophical expertise as a basis for developing our own transdisciplinary expertise. As an emerging research institution, effort would have to be put into collaboration across local and overseas institutions, even though there was a more local research focus advocated. As Winberg (2005), points out, transdisciplinarity may underpin technological work. However, how transdisciplinary research and teaching is to be performed within a University of Technology has not currently been adequately explored, and there is thus a need for reflective and developmental spaces here.

As is typical in such problem-solving group activities, participants move back and forward, testing the ideas they are proposing in the imagination (Virkunnen and Newnham, 2013), and examining constraints and enablements. The first constraint was the relatively recent move from the Technikon, where research was minimal, to the new concept of a University that engages in research:

> We moved from zero research, or it happened in an ad hoc way, to research as one of our main thrusts, in a relatively short time (Research Participant 2).

This rapid progression was not, however, matched by an equally rapid change in the systems needed to support research. There was a sense that the human resources and finance systems were not geared to support research and were falling back on prior ways of more generally managing finances. They often could not understand researchers' needs, particularly for innovative transdisciplinary research. Lack of understanding often resulted in financial loss for researchers as prices spiralled, for example owing to a lack of urgency and questioning of the need for flights and accommodation and employment of research assistance. Systems needed to change to better reflect the needs of researchers, and to help preserve their already limited funding. Furthermore, administrative staff did not always know how to apply general finance management systems to research grants awarded to the University, which have to be spent following the funders' stipulations, not those of the University finance department. There was a need for a different approach:

> We need one system of procurement for the University and another one for research (Research Participant 2).

White, Carvalho and Riordan (2011) point out that even though Universities of Technology have an aspirational research development agenda, they remain strongly managerial with authority vested in the Vice Chancellor and other senior managers. It might be suggested, therefore, that there is a lack of flexibility when dealing with the comparatively new challenges of managing research funds.

It was not just the finance systems that needed to be more flexible, there was also a need for more flexible approaches generally, to allow and promote transdisciplinary, industry and community research

> We need to be more flexible because if we are saying that we are experts at different industries, and we have engagement with different industries. We can't clearly now say that the shoe must fit everybody. We need to be much more flexible in our approach (Research Participant 6).

Participants felt strongly that the role of researchers needed to change if they were to support and change communities. This must necessarily involve those within the community

either as sources of knowledge or as field researchers, strongly suggesting an approach in which researchers, rather than leading and showing the community what was important, would need to adopt a humbler attitude to local people and conditions. Local expertise from both industry and the community would need to be granted an equivalent status to the University researchers. Such humility, it was felt, should not only reside in the researchers but in the top management of the University as well, in order to reflect and support the values involved with more community-based research.

In general, researchers' needs, difficulties and the nature of their work needed to be recognised and supported by the University as a whole, and this would include more research-oriented workload models. The importance and specialised knowledge of researchers should also be recognised.   But even with better workload models, the University was seen as currently too inflexible.

Although research with the local community was, the main thrust of the discussion, there was also reference to industry. A new relationship to industry was proposed, perhaps in line with the new descriptor as a University. Rather than working under industries' direction, which was how things were done in the past, participants saw the opportunity for directing research that could also be locally focussed:

> We must apply knowledge to those industries ... we have the chance to transform knowledge and not to just apply what is philosophically acceptable across the globe ... but really look at what is applicable to our context (Research Participant 1).

If the University was to further its work with industry, and even with the community, perhaps a new research position should be considered, that of a 'dual-role' researcher. Such a researcher would be part time in the University but also involved with developments outside of the University. The dual role researcher would also support and develop what the prior Technikons were good at - links to industry - but now in a different more expert fashion.

The activity analysis, outlined graphically in Figure 4, indicates a powerful vision of what a University of Technology could become. It celebrates the concept of a University of practice but does not resort to previous more industrial models of the Technical University. Rather, it sees the University, through its research activities, having an impact on and the potential for improving society. In order to do this a different form of research and expertise, that of lay knowledge and boundary crossing, is proposed.

As is typical in Activity Theory analyses, the complexity of developing new visions for research was uncovered and we were able to see many of the forces at play 'all at once'. Historically developed practices which may serve to constrain new initiatives were also exposed (for example financial processes).
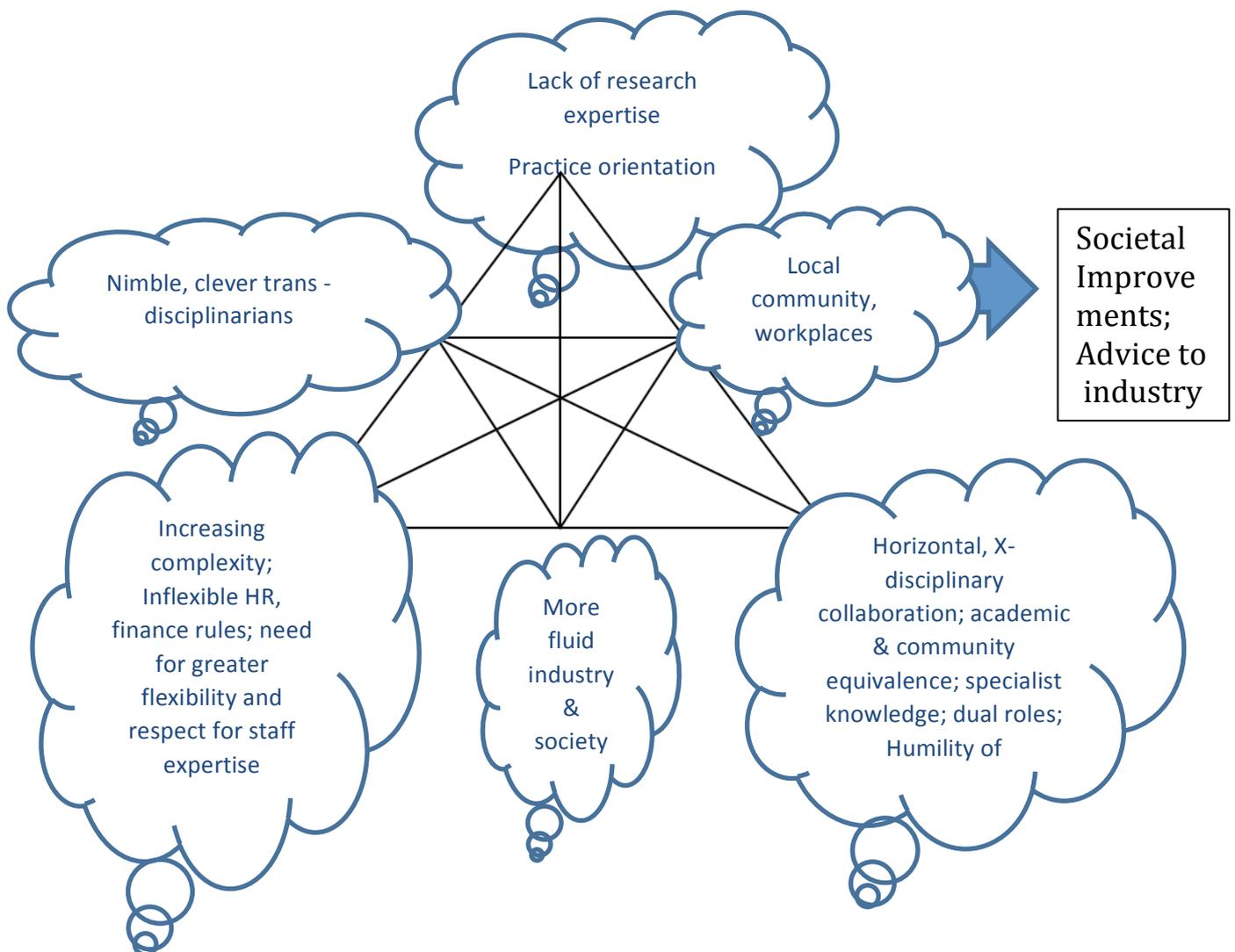
Figure 4: A community vision towards more flexible research

'The University is where the student is': Teaching for the future

The second set of findings was derived from a focus group discussion with members of the Senate Teaching and Learning Committee who articulated a vision for future teaching and learning. The group agreed that the purpose of teaching was to facilitate students' learning and development towards becoming competent practitioners, but because industries and workplaces were rapidly changing, it was less clear what teaching activities would be productive and what outcomes these would be expected to achieve. In the past, the focus of Technikon education had been 'training for industry', but it had become increasingly difficult to understand what 'training for Industry 4.0' (as a new institutional vision) might involve.

Added to confusion around the new purposes of University of Technology education was the increasing complex nature of the student body. A participant pointed out that 'of the

7,100 [first year] students, approximately 2,000 wrote Matric more than 5 years ago'. The group agreed that this considerable gap between school and University had not been taken into account, for example, when planning the institution's 'first year experience' because 'your first year is not a first year anymore'. There was general concern that the implied 'homogeneity of the students' was fallacious, but that teachers were 'still using the same old, same old method for students with a wealth of experience coming in':

> ... what we also must realise is, your student who wrote Matric five years ago who comes here, the last knowledge they had of pedagogy was five years ago and how people used to teach then and now all of a sudden ... so that the bridging is not just about school to University ... there's another bridging that we haven't actually really addressed and that's the time that has elapsed (Teaching Participant 1).

There was agreement that the answer was not about offering more online or multimodal teaching approaches as that would entail the institution 'just becom[ing] a more efficient sausage machine'. A more fundamental change was needed, expressed by one participant as 'the University is where the student is':

> Teaching Participant 1: Pop up spaces where there's a need. For instance, if there is a need for students to do something in Khayelitsha, pop up, it should be a space there for that particular, whatever activity. But then another one in Camps Bay for six months.

> Teaching Participant 2: Now for example, talking about pop up spaces. How many church halls are there in Khayelitsha that aren't used in the week? How many school halls are there that aren't used over a weekend?

But while the University and University teachers needed to be where the students were, both physically and in terms of students' needs, a reciprocal commitment was required of students:

> The first thing we need to instil in the student is you're responsible for becoming educated (Teaching Participant 1).

While the re-imagined University needed to be where the students were, and students needed to take responsibility for their own learning, the issue of what they needed to learn and what their education was for, was less clear:

> So, they will therefore do ... hub and spoke sets ... that there'll be certain things that are in the hub and the University will do those. It's very much like we are trying to now

... with CPUT101. That's the hub ... and then the spokes will be on the sides and will be things that people do ... (Teaching Participant 1).

In the light of these confusions and concerns, participants felt that an appropriate response would be to offer a more holistic education, but with specialisation, training 'our students ... to be responsible members of communities' (even while acknowledging that even this was fraught with complexities because 'some students coming from the rural areas after graduating they don't want to go back ...').

Complex times and complex issues called for flexibility in teaching, but such flexibility placed heavy demands on University teachers, thus much of the discussion centred on the identities and capacities of the University teachers – and how they might (or might not) cope with changing demands:

... we come from a specific dispensation and a specific history from colonised Eurocentric Universities ... so for this futuristic [vision] we need, I think, different cohorts of staff. The millennials will be the staff and not necessarily in offices (Teaching Participant 2).

Participants grappled with ideas of who might be able to teach 'different types of knowledges and knowledge systems':

So, there is going to be a space where someone who dropped out in Grade 8, coming to do a lecture on how we make R50 million (Teaching Participant 3).

It was not clear what forms of knowledge and technical skills the new academics might require, so there was a need to re-define what academic staff might look like:

So, there's this rise of this new thing called the Professor of Practice ... and the Professor of Practice is somebody who is both a professional practitioner and an academic. So, it would be somebody who's either spent some time at University and then went back to practice and picked up a whole lot of work or the other way around (Teaching Participant 1).

If industry was changing as rapidly as the proponents of Industry 4.0 claim, the University would require a similar rapid staff turnover:

... pulling in people from industry, today, tomorrow somebody else will come in. The next day someone else will come in. So, when you start talking about staff, a permanent staff is Victorian concept and we need to move away from that (Teaching Participant 3).

How such activities of the future might be supported administratively and financially was a concern, although it was pointed out that administration would need to become more specialised:

> Take a look at [Department A] in their own building ... they're only doing [Discipline A] and they can cope with any kind of flexibility because they are part of us but they're smaller. We sit with the problem that ... we are not homogenous students. We are not homogenous offering types either. We've got some courses that are chunks of students, literally, 200 in a course and we've got other courses that are far fewer, far more focused, far more flexible (Teaching Participant 4).

It was also pointed out that the divisions of labour and internal communities would need to be expanded because 'in order to go whichever different route there are also other role players who must come to the table' and that the expanded community, including the students would have to have 'a certain say on what sorts of graduates they want'. National role players like the Council on Higher Education, the Department of Education and professional bodies would also need to reconfigure their role and rules:

> Let me just summarise it like that because if you are going to be visualising the future UOT as we are, they cannot expect that we will fit into their concept of streamlined traditional Universities, which is exactly what they are asking us to do (Teaching Participant 5).

What emerged from the Teaching and Learning focus group was the need for change and for flexibility: 'we need flexible learning, flexible staff, flexible students, flexible space and flexible rules'. But what comprised this flexibility and how the purpose of these new educational practices was to be concretised, became increasingly difficult to pin down within the discussions. Figure 5 thus represents the emerging teaching and learning activity system as one as undefined and confusing.
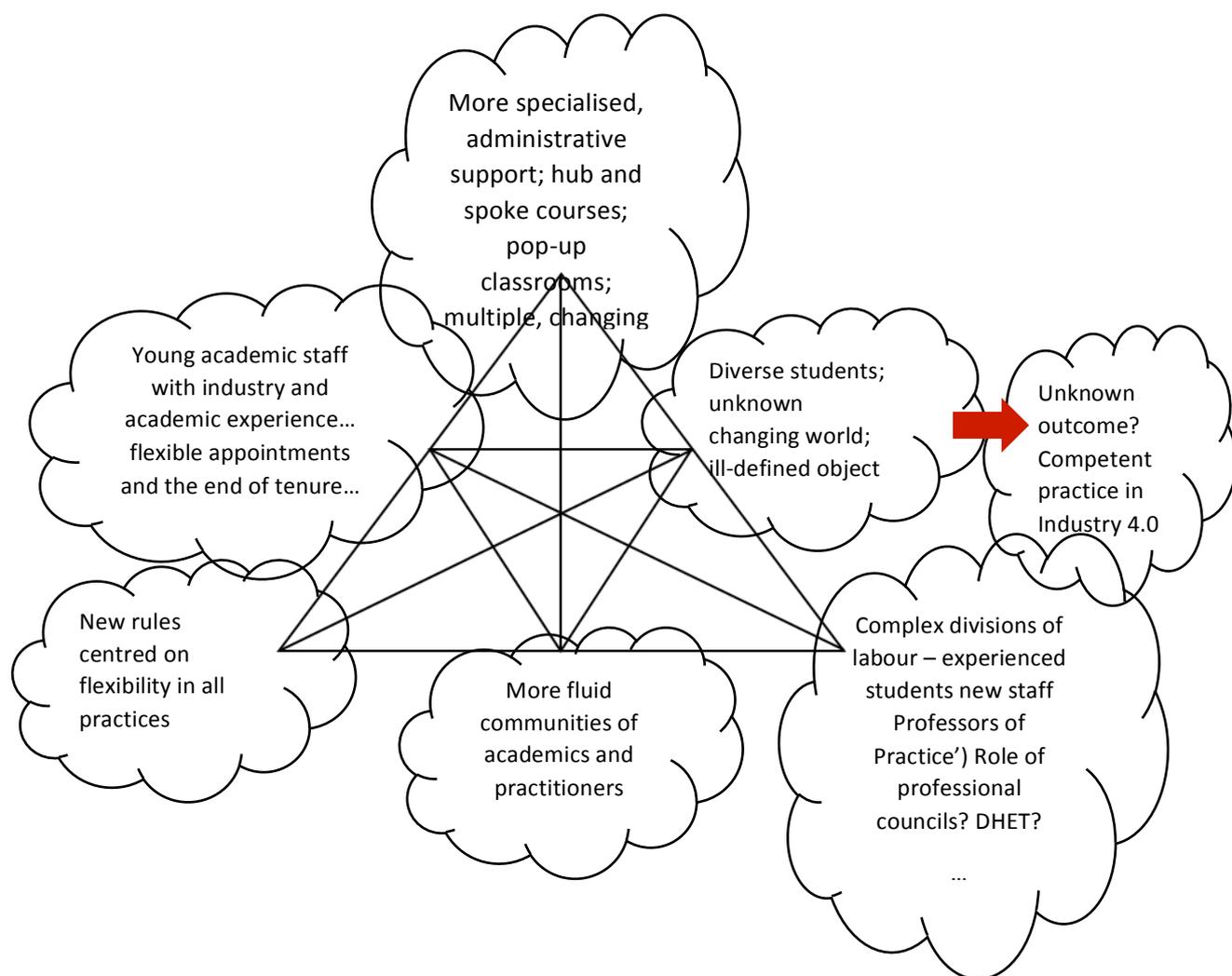
More specialised, administrative support; hub and spoke courses; pop-up classrooms; multiple, changing

Young academic staff with industry and academic experience... flexible appointments and the end of tenure...

Diverse students; unknown changing world; ill-defined object

Unknown outcome? Competent practice in Industry 4.0

New rules centred on flexibility in all practices

More fluid communities of academics and practitioners

Complex divisions of labour – experienced students new staff Professors of Practice') Role of professional councils? DHET? ...

Figure 5: Confusion and a lack of clarity in changing the teaching and learning activity system

What the university could become

In analysing the future data we gathered information about what the University was in the past and what it is today. This historical data proved useful, as it indicated to the researchers which elements of the system had changed the most and which, in comparison, had stayed more or less the same. These differences in development and change can reveal major historically-developed tensions (Virkunnen and Newnham, 2013). Table 1 shows the main changes in the University of Technology activity system over time. What became apparent is that what we were working on, the object, was in a process of major change. There were also major changes from a prior well-defined, more industrially-focussed object to a more research-laden, but at the same time, responsive object towards issues outside of the university. These are not well-defined issues, whether they be societal and skills changes with the onset of Industry 4.0, or responding to emerging community needs. The object gives meaning and intention to the activity participants, but at the same time is something of a

'vanishing' object (Sannino and Engeström, 2017: 86), thus reducing certainty and the will to engage. Staff used to know what it was they were working on, but now are less sure. In addition, object shifts may not necessarily be met with equivalent changes in the rest of the system, particularly as regards relatively hierarchical and siloed academic and administrative divisions of labour and inflexible ways of operating.

Table 1: Summary of findings: changes and stasis in the elements of the University of Technology activity system over time

	Object	Subjects	Tools/ resources	Roles and divisions of labour	Rules and culture	Commu-nity
The 'old', previous Technikon	Specific workplace preparation; No/ very little research	Low level qualifications, work linked	Rigid administrative systems; tenured staff;	Hierarchical decision making, industry dictates	Strong controlling rules in finance, HR and practices inflexible	Large industry
The current University of Techno-logy	General workplace preparation; strong community engagement high value on research; Vision 2030	More academically qualified	Rigid admin; tenured staff	Hierarchical decision making; university exerts some but limited agency	Strong controlling rules in finance, HR and practices inflexible rules of vision 2030	Large industry and community
Reimagined University	General responsive-ness and runaway object of open-ended society	Dual appointments, varied staffing	Flexible research agenda, curriculum and teaching spaces	Flexible, multiple, dual and changing roles, with buy-in from leaders; University directs	Flexible rules of research and teaching	Multiple industrial and community partners

The highlighting of major historically developed tensions, or contradictions, between the old system of the University of Technology and the vision emerging through the discussions of

possible futures in Table 1 can be transferred to a four-field diagram (Figure 6). The diagram sets up the tensions against one another and suggests a direction forward from where the University was in the past to a possible, even better future identity. This direction can be described as a zone of proximal development (ZPD) for learning and change for the university.
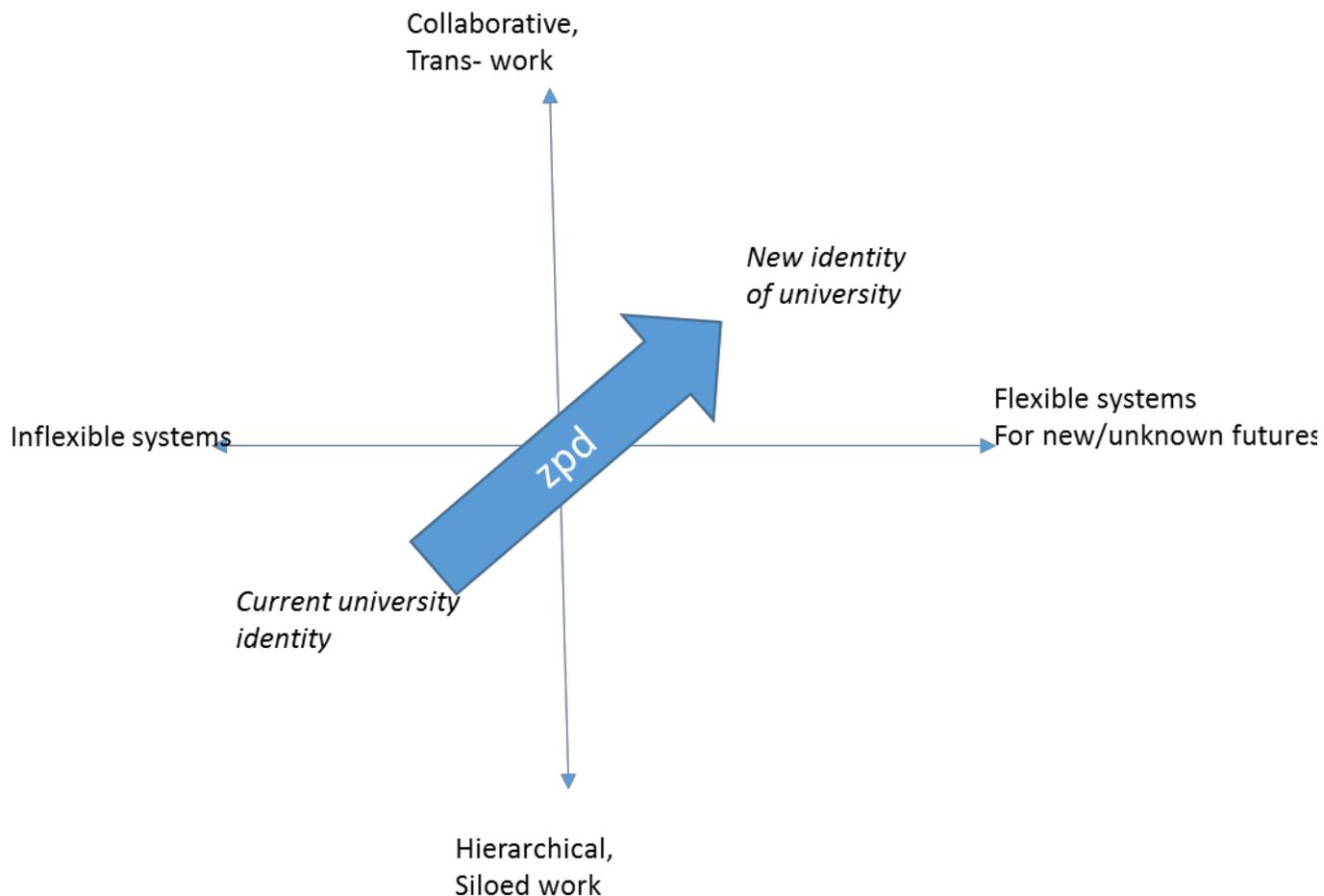

Figure 6: ZPD for a new vision for the identity of a University of Technology

The ZPD exists between an older system and a newer improved one (Sannino and Engeström, 2017), and can focus attention on what changes need to be implemented if a desired vision of a new identity is to be achieved. In this research, as shown in Figure 6, the ZPD is between a current hierarchical, directed and inflexible activity system of a University of Technology, towards a more collaborative, directing and flexible vision. This sort of ZPD (towards collective flexibility) is also typical of changes emerging in current Activity studies of working life, as new work orders demand responsiveness to increasingly complex demands from society (Engeström, 2018: 256; Virkunnen and Newnham, 2013: 237). In these cases, the depiction of possible changes (Figure 6) provides for both a stimulus and a focus for future developments.

Finally, if the vision proposed by the two Senate Committees is to be achieved, there needs to be a motivation for change from the university more generally, including its management, and tools to work on the vision. The first 'needs state' (Virkunnen and Newnham, 2013: 53) is the recognition by management (for example, the Vice Chancellor, Deputy Vice Chancellors and Deans) that there is a problem to be addressed, and understanding this as fully as possible. As regards tools to navigate the ZPD, following Engeström's (2018) argument that expertise resides in systems not individuals, there would need to be Faculty-based change research groupings, who could work on attempting to resolve the contradictions set up in Figure 6. In keeping with Activity's dialectical ontology, it is these contradictions which highlight spaces for new learning and development (Virkunnen and Newnham, 2013).

Acknowledgements

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