**Special issue: Higher education–industry research partnerships and innovation in South Africa**

**Introduction**

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**Global and national imperatives**

In the rapidly globalizing world in which innovation and the ubiquity of technological gains have become *sine qua non* for the economic competitiveness of nations, the role and contribution of higher education institutions are constantly under scrutiny. The new global ‘orthodoxy’ about innovation and economic growth is succinctly summed up in one OECD report:

> In the long term, growth depends on building and maintaining an environment that is conducive to innovation and the application of new technologies. This involves ensuring the generation of new knowledge, making public investment in innovation more effective, improving interaction between universities, research institutes and firms, and establishing the right incentives for innovation. (OECD, 2001, p 11).

In South Africa too such a vision, although not uncontested, has informed government policy, shaped by its specific historical, economic, political and social conditions. This is evident in competing national demands for global economic competitiveness, sustainable development and equity. Thus South African economic policy expresses strong aspirations to move up the global value chain, to develop a national system of innovation. However, this goal is held in tension with the demand to develop science and technology that directly addresses poverty reduction. Since 1994 there has been a concerted national push to promote science and technology capacity across the country, with an impressive array of policy frameworks, new institutional structures and funding incentives, which are largely still too new to have borne significant fruit.

The government has prioritized repositioning higher education to contribute to global technological and economic competitiveness, with policy since 1994 strongly framed in terms of developing a knowledge economy in South Africa, but again held in tension with the call to address poverty and inequality. The challenge here for higher education institutions is framed as a dual one – to contribute to economic growth *and* to an improved quality of life for the citizens of South Africa in the face of an extremely unequal past.

Strategic alliances, networks, partnerships and collaborations – as these relationships are variously termed – between higher education institutions and industry have been identified as a primary means of addressing higher education’s role in development in South African policy, as elsewhere. ‘Partnership’ is seen to provide a key means for higher education institutions to achieve greater responsiveness, to ensure
that their research is better utilized, their technology better transferred and their research more strategic or applied. There are attempts on the part of the state to foster partnership between industry, higher education and science, engineering and technology institutions, through funding incentivization schemes such as the Technology and Human Resources for Industry Programme (THRIP) and the Innovation Fund. There is growing pressure on managers and academics in universities and technikons to engage in partnerships as a means of generating income for institutions in the face of shifts in the public funding base for research.

This special issue

It is with such dynamics and the multiple challenges that arise from them that this special issue engages. What are the forms and shapes of partnerships? What are their determinants? What kinds of changes and benefits are they bringing about in higher education and industry? Conversely, what kinds of changes need to be brought about if partnerships are to contribute to innovation and to economic development in South Africa specifically?

The nine articles assembled here are conceptual pieces and reports on case-study research that not only highlight efforts to locate South Africa’s national system of innovation in the highly differentiated global playing field, but offer critical debates on innovation capabilities and what it really means to be competitive in the global arena. In a variety of ways, the papers turn their analytical lenses to the relationship between higher education, industry and innovation in a country described as ‘developing’, ‘newly industrializing’ or a ‘dynamic adaptor’ (UNDP, 2001). The scale, nature and determinants of research and development (R&D) partnerships and networks in key fields of science and technology are the primary focus.

Emerging empirical research

Empirical research on issues related to the nature of higher education research and partnerships with industry has begun to emerge in South Africa over the past few years (Wickham, 2002; Cooper, 2003; SAUVCA, 2004). In the face of the policy analysis of technology achievement problems, a particular focus is the study of ‘technology transfer’ (Van Eldik, 2002; Garduno, 2003) or ‘research utilization’ (Mouton et al., 2003). There are also various studies that attempt to provide indicators of science and technology performance (Kaplan, 2000; Boshoff and Mouton, 2003). The papers in this special issue draw on several large-scale empirical research studies, in particular a study conducted by the Human Sciences Research Council (HSRC) between 2002 and 2004 which explored the extent and ways in which higher education and industry had formed research partnerships in response to global trends and national policy imperatives in three cutting-edge high-technology fields.

It was not by design, but it is striking that the research on which many of the articles are based relies on a case-study methodology. Most likely, this is a reflection of the embryonic state of research, with attempts to open up issues by understanding distinct national, regional and even institutional conditions. It is also the case that this focus is framed by an approach to social research that is premised on understanding complex dynamics and interrelationships that require such a methodology. Suffice to note the methodological trend, and to point to the richness and detail possible in each of the articles as a result. They provide insight into different facets of the South African case, and so enhance comparability with other national contexts.

South Africa in comparative context

The opening article by Jo Lorentzen sets the tone. Lorentzen cautions that the conditions under which innovation does or does not take place are context-specific, and as such differ across and even within countries. He argues that the successes and shortcomings of innovation performance are relative measures that make little sense when looked at in isolation. As a case in point, in 2000 Taiwanese engineers ranked tenth in terms of the number of papers published in the Engineering Index, while Taiwanese inventors registered more patents in the USA than any other country except the USA itself, Japan and Germany. Yet Taiwan continues to import the majority of the critical components and manufacturing technologies it uses. The article makes a strong case that the study of relationships between industry and higher education – and innovation – should be embedded in an understanding of patterns of knowledge creation and use in a specific society. Lorentzen argues that ‘benchmarking’ using internationally accepted indicators should not be a substitute for such a thoroughgoing policy analysis or, in effect, we may be comparing the proverbial oranges and apples.

Michael Kahn and William Blankley provide a useful contextualizing paper, which can facilitate and deepen comparability with the South African case. The article plots major changes in the South African national system of innovation since the transition from
apartheid to democracy in 1994, drawing primarily on the recently completed 2001/02 national Survey of Research and Experimental Development. They note that South Africa is rich in natural resources and should maintain adequate levels of basic research to support its R&D programmes. The point Kahn and Blankley make is that investment in R&D is in part an expression of belief in future benefits. In the case of South Africa, the state absorbs a great deal of risk, mainly through part-funding of the science councils and of higher education. It acts as an incubator and promotes research for the public good. However, the same cannot be said of industry. Hence the authors find no strong evidence of collaboration between industry and higher education or science councils.

There is a sense in which a number of the papers in the collection begin to contribute to the research task that Lorentzen proposes. They explore how and why industry and higher education interact, the structure and dynamics of their interaction and to whose primary benefit that interaction is effected – and hence they aim to enhance our understanding of the determinants of innovation in a specific context. They are organized into two sets – one reflecting on the dynamics and challenges from the perspective of higher education, and the other focusing on the perspective of specific industrial sectors.

**Partnership, innovation and knowledge generation**

Glenda Kruss provides an overview of research partnership activity across the South African higher education system in three cutting-edge high-technology fields. She shows the ways in which South Africa’s 35 higher education institutions respond to a tension between new financial imperatives and their traditional academic core function as they engage in distinct forms of partnership with industry. The article identifies four groups of institutions, distinguished in terms of their level of research capacity and the sets of strategic policies, institutional structures and interface mechanisms they have (or have not) set in place to promote partnerships with industry. Kruss argues that more universities need to develop the capacity to harness the potential for innovation, rather than allowing the unregulated proliferation of contract and consultancy forms of partnership with industry that can undermine their core long-term knowledge-generation function.

David Cooper provides a synergistic argument through his analysis of the organizational forms of research groups at higher education institutions in one specific region. His main concern is that there is poor vision and strategy among university centres. This is further exacerbated by grossly inadequate levels of funding, which not only militate against these centres achieving some semblance of stability but also have the unintended consequence of senior researchers being lured to industry and government to the detriment of higher education. Implicit in Cooper’s account is a sense that the responses to the tension between financial and intellectual imperatives highlighted by Kruss shape the new organizational structures he describes. Cooper argues that, in a country like South Africa, the base on which research centres and units have been constructed at universities and technikons is much more fragile than in Europe. Thus if networks and strategic applied research are to be promoted, an essential task is to consider ways in which the internal structures of research centres and units can be strengthened.

The argument for stable internal structures is reinforced by Mlungisi Cele’s detailed case study of the evolution of a successful partnership in a single university department. Cele focuses on changes in the knowledge-generation role emerging out of a relationship with a large former parastatal company over a twenty-year period. A key observation is that the partnership resulted in a strong link between the university’s basic disciplinary Mode 1 teaching and research on the one hand, and the multidisciplinary Mode 2 applied and strategic research and training stimulated by industry partnership on the other. Even more striking is the fact that at the outset the university’s Department of Chemical Engineering lacked the research culture, infrastructure and expertise that subsequently evolved. Cooper developed a new South African nomenclature and Cele adopts the conceptual frames developed in other contexts, but they come to similar conclusions about the growth and facilitation of what Cooper has called ‘applied fundamental research’ in the South African higher education context.

Moeketsi Letseka investigates the South African government’s incentivization of higher education–industry partnerships, which has facilitated the growth of applied and applied fundamental research in three priority innovation areas – information and communication technology (ICT), biotechnology and new materials development. He confines his focus to the contribution of THRIP and the Innovation Fund, two key government funding programmes aimed at supporting collaboration between industry and higher education and facilitating R&D in science, engineering and technology that can lead to innovation. Letseka seeks to ascertain the impact of the two programmes on capacity building in science and technology, technology
diffusion and stimulation of innovation. He reviews the considerable outcomes and products of the programmes, but highlights important political and social dimensions of innovation. The allocation of THRIP and Innovation Fund research monies continues to be dominated by historically white, advantaged, urban-based universities that have long traditions of research and accompanying investment. This has implications for long-term and sustainable development in South Africa.

**Networks, innovation and competitiveness**

The final three articles change tack, interrogating the nature of the small number of networks that have emerged in South Africa and examining how they take shape in specific technology fields and their related industrial sectors.

Gilton Klerck echoes Lorentzen’s caution against inappropriate international comparisons. He draws on three case studies of networks in South Africa’s biotechnology sector to interrogate the notion of a simple convergence within and between national innovation systems and the idea of an unproblematic adoption of ‘best practice’ at the organizational level. Klerck is unequivocal in his contention that industrial networks are not a panacea for the economic ills of a developing country, and that the search for ‘one best way’ of organizing and embedding such partnerships is therefore misguided. He illustrates how, in the industrial sectors in which cutting-edge biotechnology research is inserted, rising levels of competition and new state policy initiatives provide an impetus for collaboration, which in turn shapes patterns of strategic alliances within the networks.

Andrew Paterson contributes to our understanding of the embeddedness of partnerships by exploring the dynamics in a specific ICT industrial sector. The article employs Porter’s ‘value chain’ framework – conceived to show how a particular business process can be identified as a linked part of a larger ‘system’ of activities in which many enterprises interact to produce a particular good or service – to demonstrate how and why particular higher education–industry R&D networks articulate with the South African telecommunications sector. Paterson identifies how the R&D work leverages improvements in processes leading to the provision of telecommunications services in South Africa, and illustrates why and how the enterprises involved approached particular higher education institutions with their R&D needs.

In the last article, Shane Godfrey provides a detailed descriptive account of the power dynamics within networks in the field of new materials development. Given the history and nature of the industries concerned, these are characterized by secrecy and extreme competitiveness. Godfrey illustrates how the industry partners thus play the dominant role – indeed, he suggests they have a disproportionate influence – in determining the initiation, structure and functioning of networks. In this regard, the old adage that ‘knowledge is power’ is a moot point.

**The path to innovation?**

Read together, the nine papers illustrate the contested and complex nature of the relationship between higher education and industry, and of higher education’s potential contribution to economic and social development in a country like South Africa. They suggest a significant distance between industry and higher education. Kahn and Blankley show how little industry contributes to funding significant levels of research and development; Kruss illustrates how few higher education institutions are able to adopt a strategic stance towards industry partnership; Cooper illustrates the fragile nature of higher education organizational forms in relation to strategic research; and Letsuka illustrates the dangers of reproducing old institutional inequalities in new forms. Nevertheless, the papers by Paterson, Klerck and Godfrey open up fresh perspectives on the embeddedness of the structure and dynamics of networks in high-technology fields and industrial sectors, and illustrate the cutting-edge research and relationships that are possible.

Such research begins to reveal the ways in which networks and partnerships can contribute to innovation in South Africa, in an empirically and contextually grounded manner.

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