

Harnessing innovation potential?

Institutional approaches to industry–higher education research partnerships in South Africa

Glenda Kruss

Abstract: *This article presents an overview of research partnership activity across the South African higher education system, in three cutting-edge high-technology fields. An analytical matrix of partnership forms is developed, shaped by distinct responses to the tension between the new financial imperatives and the traditional intellectual project of higher education. Using the matrix, four groups of institutional response to partnership are identified. These may be distinguished in terms of their level of research capacity and the sets of strategic policies, institutional structures and interface mechanisms they have in place to promote partnerships with industry. The core argument of the paper is that more institutions need to develop the capacity to harness the potential for innovation, rather than allow the unregulated proliferation of contract and consultancy forms of partnership with industry that can undermine their core long-term knowledge-generation function.*

Keywords: *higher education–industry partnerships; innovation; networks; South Africa*

Glenda Kruss is a Chief Research Specialist, Research Programme: Human Resources Development at the Human Sciences Research Council, Private Bag X9182, Cape Town 8000, South Africa. E-mail: gkruss@hsrc.ac.za.

Universities and technikons in South Africa, like their global counterparts, are being challenged to rethink the nature of and the balance between their core functions of teaching, research and outreach. There is a call for institutions to become more responsive both to pressing social demands and to economic competitiveness in a national and global context shaped by the imperatives of a knowledge economy, held in tension with the call to address poverty and inequality. Since 1994, institutions in South Africa have been faced with

potentially competing sets of demands, from state restructuring of their organizational forms, to curriculum and programme change in line with new institutional missions. The research funding environment has shifted significantly, with a decrease in state subsidy, shifts in priorities of national research-funding agencies towards redress and capacity building and government calls to achieve greater responsiveness and accountability through strategic and applied research and partnerships with industry and community.

With a stronger orientation to global competitiveness, there have also been changes in the way industry funds and conducts research.

It was to begin to understand these complex shifts and challenges for institutions that the Human Sciences Research Council (HSRC) initiated a large-scale, multi-phase exploratory research project that focused on the state of higher education–industry research partnerships in three cutting-edge high-technology fields identified as critical in national foresight studies – information and communications technology (ICT), new materials development (NMD), and biotechnology. This article draws on an empirical study conducted across all 35 South African universities and technikons in 2003¹ to identify the scale and forms of research partnerships with industry, and the mechanisms that facilitate or constrain them, in distinct higher education contexts and knowledge fields (see Kruss, forthcoming).²

Understanding forms of industry partnership in the HE context

In this project, ‘partnership’ was initially defined in its broadest possible sense as any form of linkage of mutual benefit or mutual interest between higher education and industry. A mechanism was then required to discern what was included under the general rubric of partnership in the South African higher education sector. What are the ways in which researchers and academics describe their partnerships? Is there evidence of the new forms of networks and collaborations, or do partnerships take older, more traditional forms? As Smith and Katz (2000) remind us, terms like ‘partnership’, ‘collaboration’ and ‘network’ have multiple meanings, developed in complex environments, at various levels – individual, group, department, institution, sector and country. Which forms of partnership are typically found in which forms of institution, given their historical legacy, uneven research capacity, institutional capacity and financial base?

A strong tension has been identified between the imperatives of the market and the traditional knowledge imperatives of the academy (see, for instance, Slaughter and Leslie, 1997; Jacob and Hellström, 2000; Muller, 2001; Ravjee, 2002). In a context of fiscal austerity and changes in the state funding of universities, there are pressures on South African institutions to become more financially self-sufficient. Again and again, the academic researchers and managers interviewed expressed a tension between an intellectual and a financial imperative shaping their research partnerships. Many academics prioritized research that could be seen to make an intellectual contribution to their field or discipline, to the generation of knowledge for the

future, but felt compelled to pursue partnerships with industry in order to ensure the financial sustainability of their research programmes. There was a wide variety of ways in which academics in different research entities at different institutions responded to this tension. There was a similar tension in industry, whether it prioritized research with a strong knowledge element that could lead to innovation, or research to solve short-term problems and ensure immediate competitiveness.

An analytical matrix was constructed to represent the responses to this tension in the intersecting relationship between higher education and industry, which shaped the forms of partnership that resulted, represented diagrammatically in Figure 1. In effect, the matrix represents two intersecting continua, with the poles defined by either the primarily financial or the primarily intellectual imperatives that shape the form a partnership will take. These are not either–or alternatives, because in reality both operate simultaneously. As Castells (2001) argues about the contradictory functions of higher education, these poles represent resolutions of contradictions more strongly in favour of a particular imperative.

Ideal types of partnership

Ideal types of the partnerships evident in South African institutions were defined systematically and mapped on to this matrix, grounded in the empirical data on all forms of partnership (Kruss, forthcoming). They can be summarized only briefly here. Traditional forms of partnership continue in the present. Donation, one of the oldest forms of partnership, is conceptualized as benefaction or philanthropy on the part of industry, typically in the form of the endowment of a chair or building. Closely related to this is sponsorship, with postgraduate student research funding a core focus, given the imperative for industry to respond to socio-economic development needs in the ‘new South Africa’ and to strengthen its corporate social responsibility portfolios. In these forms of partnership, the relationship between higher education and industry is primarily limited to a financial one, and higher education is left free to continue with its intellectual projects, with few conditions imposed.

The dominant forms of partnership currently in evidence across the system are consultancies and contracts, strongly shaped by higher education’s financial imperatives. In consultancies, typically an individual researcher in higher education acts in an advisory capacity to address the immediate knowledge problems of a firm, usually in exchange for individual financial benefit. Likewise, contracts may be linked to solving potentially interesting scientific problems or,

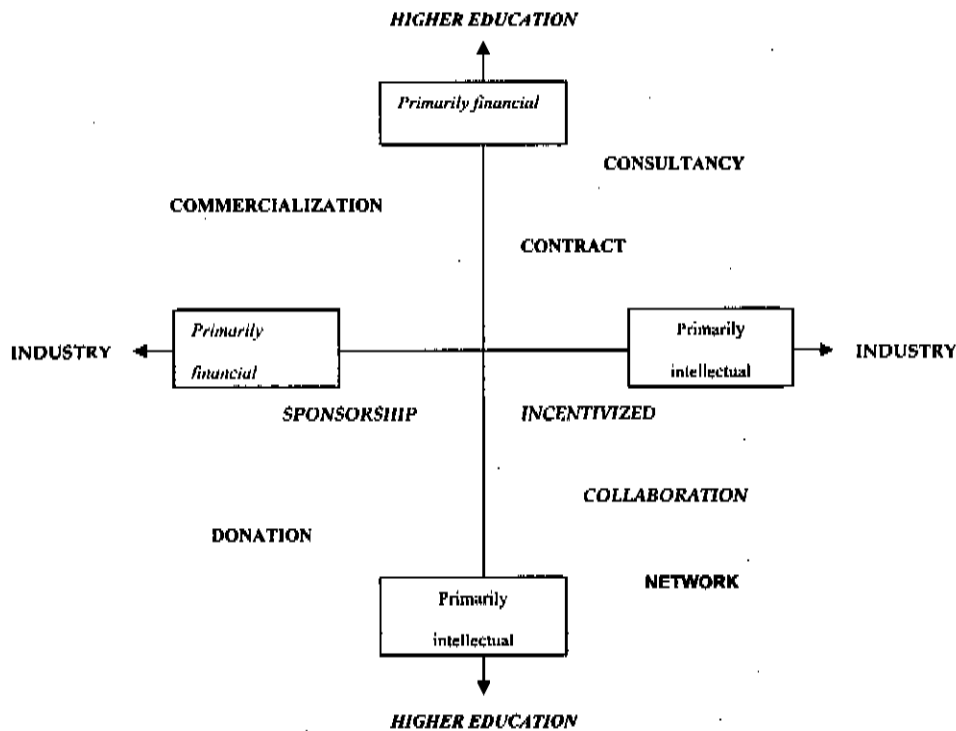


Figure 1. Analytical matrix of forms of partnership.

more likely, to addressing a specific and immediate industrial problem, but are primarily motivated by higher education's need to attract funding for research. Design solution is a related form that has emerged, in which technicians with appropriate technological expertise set up centres for prototyping and testing, offering design solutions to industry. These forms of partnership place potentially severe restrictions on the intellectual project of researchers in order to protect the financial interests of industry.

There is small but growing evidence of new entrepreneurial forms of partnership, such as commercialization, in which higher education researchers take on a strongly entrepreneurial role, attempting to commercialize prior intellectual work in the form of a spin-off company or in collaboration with an existing company willing to exploit intellectual property in the form of royalties, licences and patents, or through venture capital. Here, the relationship is primarily shaped by financial imperatives for both industry and higher education.

New forms of partnership that have emerged include incentivized partnerships, with a weak form of intellectual collaboration, stimulated by government funding aimed at developing research and development (R&D) and innovative capacity in South Africa, by encouraging technology transfer between higher

education and industry. Collaboration partnerships have a knowledge-based linkage in which all partners make an intellectual contribution. Finally, in a minority of institutions, there is evidence of complex network forms of partnership, in the sense of Castells's (1996) definition that they facilitate the acquisition of product design and production technology, enable joint production and process development, and permit generic scientific knowledge and R&D to be shared between a number of industrial organizations and researchers from (several) higher education institutions. These are knowledge-intensive forms of partnership and are shaped primarily by the intellectual imperatives of both industry and higher education partners.

A single institution is likely to have a range of partnership forms co-existing in different faculties and departments, or even in a research centre, to meet distinct purposes. For instance, a research unit may have core funding from a science council, supplemented by sponsorship to fund postgraduate students and a range of small consultancies to meet specific financial requirements. However, each form of partnership has specific implications. So, for instance, consultancies are favoured as a means of staff incentive and retention, as well as a means of initially drawing in potential industry partners. On the downside, consultancies have a potentially negative impact on the

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research and teaching functions of academic centres and departments in that they draw away the focus and energies of academic staff into projects for their own private gain. Many institutions endeavour to put mechanisms in place to monitor and check potential excesses. However, to stay with this form of partnership for the moment, if academics are pursuing consultancies, and institutions are focusing energies into managing them, this limits the possibilities for pursuing other forms of partnership and for directing energy towards promoting or managing these. In particular, consultancies may militate against the development of research expertise that can contribute to new scientific knowledge and innovation, or strategic applications in terms of national social or economic developmental goals.

Similar tensions are inherent in the contract forms of partnership which, the data suggest, have become critical to institutional income. The potential restrictions on intellectual property imposed by industry partners, particularly with respect to peer-reviewed journal publication and postgraduate theses, can impact negatively on an institution's research productivity and reputation. Likewise, many institutions have been attracted to commercialization as a source of institutional income, but there were cases in which 'entrepreneurial novices' put in place unsustainable and even unprofitable schemes with potential financial dangers for the institution, as well as implications for the core task of knowledge production.

The network and some incentivized and collaboration forms of partnership seem best placed to make a contribution to enhancing the knowledge field of academics while still meeting the long-term technology needs of industry, and hence contributing to innovation and national economic and social development.

This analytical matrix of forms of partnership can be a useful tool for exploring partnerships across the higher education sector in South Africa – or, indeed, within an institution or research unit – as the following section illustrates.

Institutional responses to partnership with industry

The response of higher education institutions to the contemporary partnership challenge is shaped by their differential historical legacies. As Castells (2001) argues, the core tasks of universities are given different emphases according to countries, historical periods and specific institutions, but they all take place simultaneously within the same structure, which results in a complex and contradictory reality. Thus, as

individual institutions grapple with contemporary challenges and myriad competing demands, they respond in complex, uneven and 'messy' ways. Some universities in South Africa were established in the late nineteenth century to serve colonial elites, and continued to serve a primarily advantaged, racially defined constituency for many years, while others were established in remote rural areas as recently as the late 1970s to serve the *apartheid* 'homelands' policy. The technikons were formally established in the 1970s to serve the demand for career-oriented, technological education and training (Creamer, 2000), were granted degree-awarding status in 1993 and were designated 'universities of technology' in 2004. Consequently, there are considerable differences among institutions in the balance between teaching and research, in science and technology research capacity and productivity, and in the cultures and forms of research management that have evolved – all of which shape their response to the new financial and intellectual imperatives that drive partnership.

Thus, when the matrix of forms of partnership was used to analyse the empirical data on partnerships in the three high-technology fields detailed above, it became clear that only 18 of the 35 institutions had research capacity in the fields of focus. These form the initial focus of discussion in this section. More significantly, clusters of universities and technikons with a similar scale and pattern of old and new forms of partnership could be discerned. The question, then, was what could explain these distinct institutional responses to imperatives to forge research partnerships with industry? One key distinction between the clusters was the extent to which institutions had either a strong or an emergent research capacity in science and technology in general, and in relation to the three high-technology fields in particular. A second key distinction was the extent to which institutions had a highly structured, regulated and proactive organizational response in an attempt to promote partnership with industry, or whether they had a largely unregulated organizational response. These two dimensions were assigned to two axes to create an empirically based classification of four ideal types of institutional response to partnership with industry (see Figure 2):

- harnessing innovation potential;
- emerging entrepreneurialism;
- *laissez-faire* aspirational; and
- *laissez-faire* traditional.

The core distinguishing features of each of these four categories will be outlined in the following sections, but they are summarized in Table 1 to provide an initial comparative overview.

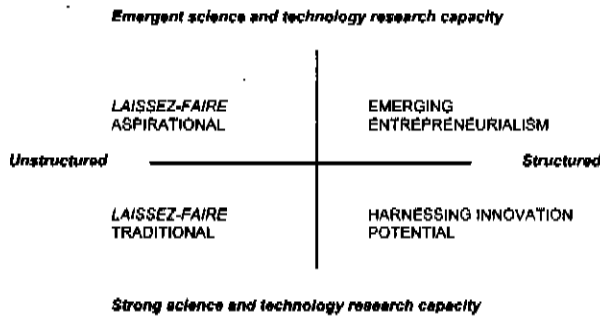


Figure 2. Responses of higher education institutions to partnership with industry.

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The first category of institutions that may be discerned is in many respects an ideal. This group of three universities has a small number of network,

collaboration, incentivized and commercialized forms of partnerships among its total spread, alongside consultancies, contracts and donations, which are significant in scale relative to all the other institutions.

Their sound research capacity and structured institutional response help us to understand why these specific institutions are able to host such new forms of partnership. They are among the oldest and historically most advantaged universities in South Africa, serving a privileged community for many decades. They have extensive fiscal resources and long-standing links with business and industry, some with research roots and expertise strongly shaped by military R&D in the apartheid period. Significantly, they each have a sound science and technology research base³ from which to respond to the challenges of the present, and evidence of considerable capacity in each of the three high-technology fields. Research excellence is prioritized,

Table 1. Characteristics of four institutional responses to partnership with industry.

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Partnerships happen because of two things: significant institutional steering and support, and through individual champions based in faculties, academic departments or research units.

Partnerships are premised on a sound science and technology research base.

Regulation of research is a key feature.

Underpinned by a coherent institutional strategy for research.

Led from the centre and at faculty level by institutional leadership.

Internal and external interface structures and mechanisms planned to support partnership.

Institutional examples: Historically advantaged, well-established universities located near major economic centres.

Laissez-faire traditional

Partnerships happen in a decentralized manner because of individual champions, research professors who are based in academic departments or research units.

Partnerships are premised on a sound science and technology research base.

Research environment not regulated.

No overall coherent institutional strategy.

Central institutional leadership not proactive and little central steering.

Internal and external interface structures develop on an *ad hoc* basis.

Institutional examples: Historically advantaged, well-established universities located near major economic centres.

Emerging entrepreneurialism

Partnerships happen because of two things: significant institutional steering and support, and through individual champions who are based in faculties, academic departments or research units.

Partnerships are premised on an emergent Science and Technology research base.

Regulation of research is an emergent feature.

Underpinned by a coherent institutional strategy for research as 'third-stream' income.

Led from the centre by institutional leadership.

Internal and particularly external commercialization interface structures and mechanisms planned to support partnership.

Institutional examples: Historically advantaged Afrikaans universities and historically advantaged technikons located in urban areas, one near a major economic centre, the others near regional economic centres.

Laissez-faire aspirational

Partnerships happen in a decentralized manner, because of individual champions based in academic departments and through research managers acting in an individual capacity.

Partnerships are premised on an emergent science and technology research base.

Research environment not regulated.

No overall coherent institutional strategy.

Individuals in central leadership proactive but minimal central steering by key individuals.

Internal and external interface structures develop on an *ad hoc* basis.

Institutional examples: A historically disadvantaged university, a historically advantaged university and technikons, mostly located near major economic centres but also near regional centres.

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and hence there is an attempt to create a balance in favour of fundamental research, while strategically exploiting opportunities for applied and strategic research that can contribute to greater economic responsiveness.

These universities have well-articulated and well-integrated formal institutional strategic and research policies, accompanied by long-established structures and mechanisms to coordinate and support research activity in general, at both central and faculty levels. Formal strategic policy explicitly supports innovation, encompassing a conception of partnership framed in terms of developing a 'strategic balance'. Policies encompass the aspiration to relate to industry in academically beneficial terms and are not explicitly driven solely by financial imperatives; they seek to develop forms of partnership that can contribute to innovation. Intellectual property rights policy typically reflects a concern that potential tensions be resolved, that partnerships should be structured and designed such that they are able to generate research from which the academic can derive a publications record which does not compromise the commercial interests of the industry partner.

Drawing on a study by Martin (2000) of the institutional practices typically established to manage university-industry relations in twelve developing countries, a distinction was drawn between internal and external interface structures. Internal interface structures refers to those dedicated forms of organizational development created within an institution to support relations with industry, such as specialized internal structures for technology transfer, dedicated managerial posts, offices for continuing education or technology innovation centres. External interface structures play a similar role but they typically have a separate legal status from the institution, to enhance flexibility and responsiveness, and to create a professional, higher-status, market-related interface, such as university-owned companies, incubators, science parks and consultancy centres. These differ in the degree of decentralization involved, in that they may be attached to central research management or to faculties or departments, or even to research centres.

What stands out in the institutions in this category is the extent of centralized steering and supportive structures created by management to promote partnerships. Various high-level internal interface structures have been established by central research management, such as dedicated structures to manage and process all external contracts, and to provide expertise to support the process of patent applications, royalties and protecting intellectual property. They have also created external interface structures to facilitate

and manage the relationship with industry, such as university-owned companies, and involvement in incubators established in response to national incentivization schemes in specific technology fields.

It must be borne in mind that, while an institution may formally have adopted policies and established institutional structures and mechanisms, the extent to which these had permeated through faculty and departmental structures and were reflected in the experience of individual academics varied considerably within and between institutions. The average researcher experiences pressures from all directions – from government, peers, institutional management and the new nature of important problems – which makes implementation of institutional plans extremely complex. Institutional research managers reported the strategies and structures described as if they were successful, whereas interviews with academic research staff at project level often revealed starkly contrasting perspectives. Nevertheless, these universities stand out in their attempt to harness the innovation potential of their research, in partnership with industry, in ways that can contribute to innovation and provide an indication of what is possible in the South African context.

Emerging entrepreneurialism

Closely related to the above is a second set of institutions that display an emerging entrepreneurialism, including a number of younger Afrikaans-language universities with a specific ideological orientation that was shaped by and favoured under the *apartheid* system, as well as a number of historically advantaged technikons. The technikons have a specific mandate to concentrate on vocational and career-oriented education geared towards the promotion and transfer of technology in support of the developmental needs of the country, and this shapes their response. Over the next year these institutions will all be subject to a process of institutional merger that will impact directly on the restructuring and research strategies they are attempting to put in place, in both the short and medium terms.

The institutions in this category are more explicitly driven by the financial imperatives facing higher education, and at the same time are trying to consolidate and develop their scientific research capacity. The growth of partnership is underpinned by a coherent institutional attempt to develop research expertise in potentially lucrative directions, and to generate 'third-stream income' for the institution. They explicitly articulate the discourse of an entrepreneurial university or university of technology, and foreground the concerted attempt to respond in a strategic manner to position the institution favourably in a new policy

context. There is a conception that the institutions should allow for different modes of research, from basic research to research in application, addressing problems experienced by the public sector, the private sector and the community. However, priority tends to be given to applied and strategic research. The technikons specifically aim to become key players in the development and transfer of technology, to contribute to the process of technological innovation.

The scale of partnership with industry tends to be small. What stands out among the forms of partnership is the promotion of commercialization and forms of partnership that offer design solutions at technikons, as well as an extremely small number of fledgling incentivized networks. These exist alongside predominantly contract and consultancy forms of partnership.

These institutions are distinct from the previous category in that the imperatives of a new policy and funding emphasis stimulated these heretofore primarily teaching institutions to adopt a stronger focus on research than in the past. They currently have limited research expertise and capacity in science and technology, and hence a more limited base for partnership in high-technology areas. Most have only very recently articulated a formal institutional research policy and development plan, which typically aims to develop and improve research capacity. The regulation of research is largely emergent or very new. They too have a highly regulated, structured, proactive institutional response, led strongly from the centre by institutional leadership. In the strategies and structures they are developing to realize their aspirations, these universities and technikons have adopted the 'textbook' features they have come to believe promote partnerships, drawn from international 'best practice' – particularly investment in external interface structures. Through the establishment of technology stations, a science and technology park, technology incubators that focus on small, medium-sized and micro-enterprises (SMMEs), or 'design solutions' centres such as prototype product development, they reveal ambitious plans, but the scale of operations is generally modest. Notably, they are driven by central management and are based largely in dedicated structures outside the mainstream structures of institutional power. In some cases, they were driven by an enterprising academic or research unit, separate from official initiatives, but subsequently formalized.

Thus the extent to which these forms of partnership have taken root in institutions and permeated down to all levels of practice varies, but there is evidence to suggest that at this point new practices are still emergent or embryonic, outside of small pockets of

expertise. It was evident that a research culture was still budding, with research capacity unevenly distributed. High teaching demands in the technikon sector in particular were frequently cited as a constraint. Typically, only a few active individual researchers manage to enter into and sustain industry partnerships. Again and again, researchers in these institutions bemoaned the fact that new systems did not always work effectively, or were often too bureaucratic, and that there was insufficient understanding of the implications of applied research and interaction with industry. Research leaders indicated that changing institutional culture was a slow process, with one professor wryly remarking that 'getting things done in the university environment is like mating elephants. It takes place at a very high level, with a lot of noise and takes two years to produce results.'

Their location in relation to major economic centres or 'hubs' is also significant in explaining the scale and pattern of partnerships in these institutions. A lack of industry interest is directly ascribed to the relatively isolated location of the institutions in some provinces, or to the relatively poor state of the economy in a city or region, particularly those that rely primarily on agriculture and the services industry. No matter how good the policies, structures and mechanisms an institution puts in place, it may struggle to realize its potential if it is not situated in an economic environment in which industry is willing and able to enter into partnerships. External structural constraints often mean that their institutional plans are still largely aspirational.

Laissez-faire aspirational

A third group of younger, primarily historically advantaged, universities and technikons contains the largest number of institutions. These institutions are distinguished by a generally positive attitude towards partnerships. Institutional policy tends to enshrine a view of partnership as an 'essential necessity' that can contribute to the funding base of the institution's research, and to its commitment to responsiveness and community relevance. They do not have a significant scale of partnerships in the three fields, and it is notable that the universities do not have engineering faculties, with most partnerships concentrated in departments in a science faculty. The forms of partnership are primarily driven by the financial imperatives impacting on higher education – typically in the form of contracts or consultancies. These problem-related partnerships use applied-research techniques in which there is usually little space for graduate students to do original research towards a higher degree. Given the historical legacy of some institutions as historically black and hence

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disadvantaged, there are a few sponsorships that aim to build capacity, a very few incentivized partnerships at each institution, as well as a tiny number of commercialization partnerships, in the form of spin-off companies, at some of the universities. Collaborative partnerships with other universities are a significant feature of the technikon, at which the challenge of developing a research ethos was particularly evident. It was noted typically that some industry relationships were built through the cooperative learning system that could form the basis of research partnerships in future.

We can explain why this group of institutions reflects such a pattern by examining a number of intersecting features. Like the institutions with an 'emerging entrepreneurial' approach, they are still developing research capacity, with a small emergent research base in niche areas. Unlike those institutions, however, they have a largely unregulated and unstructured approach to partnership. These institutions do not have clearly formulated and well-structured explicit institutional policies, structures or mechanisms to support partnerships specifically. The policy and vision is of course shaped by each institution's unique history, culture and traditions, but in general there tends to be a stronger commitment to economic and social development, and partnerships are envisioned in this light. In contrast to the institutions in the previous two categories, they do not have a substantive, detailed set of policy articulations to strategically drive partnership or the allocation of intellectual property rights. They tend to have policy documents that are largely symbolic and aspirational, providing frameworks for future institutional development. Similarly, these institutions tend to have or are developing internal interface structures that support and facilitate research, rather than promoting partnerships specifically. There are few formally structured entities that are less inserted into institutional structures of power, to provide an easier external interface with industry in the three high-technology fields of focus (although there are instances in other fields of expertise).

Thus they may be said to have a *laissez-faire* approach to partnership, leaving much of the initiative to be driven by individual academic 'champions' on an *ad hoc* basis, or facilitation in terms of the tacit knowledge and expertise lodged in an individual manager at central level. The *laissez-faire* approach is believed to allow academics the freedom to exploit their intellectual property on their own initiative. The typically small size of these institutions means that it is possible for managers to respond as the need arises. A key question is whether research partnerships have flourished in these institutions despite the *laissez-faire* approach or precisely because of the lack of centralized

control mechanisms, which gives individual researchers leeway to pursue their interests with a degree of individualized support.

Given this *laissez-faire* management approach to partnership, in practice the financial imperatives driving partnerships tend to prevail in shaping the predominant forms of contract and consultancy, which do not contribute to innovation or long-term knowledge generation in a field and hence potentially undermine an institution's vision.

There are different reasons behind these patterns. For instance, one technikon has a *laissez-faire* approach because institutional energies are concentrated on merger processes. Once the merger has been more fully consolidated, the institution and its partnerships may develop in a different direction. Another technikon prioritizes the development of a research culture and research management structures, and yet another has the added focus of devolving research leadership and structures to faculty level. This is very different from a relatively young university, which has a more stable history and research tradition, but which tends to leave academics to follow their own interests – and will now have new directions arising from the merger process. A historically disadvantaged university has a *laissez-faire* approach in response to its attempt to enhance its legacy in changed conditions to contribute to social and economic responsiveness. And a historically advantaged university in an isolated location has the strongest research base, and the most clearly articulated policies and embryonic support structures, but its smallness means that those with initiative can take innovative ideas to top management and receive institutional support on an *ad hoc, laissez-faire* basis.

It is conceivable that over the next few years some of these institutions may develop in the direction of those institutions that 'harness innovation potential', but on a smaller scale. This is a key reminder that such categories are not fixed and that individual institutions are dynamic and changing, and may develop significant new features in a short time.

Laissez-faire traditional

The fourth category also evinces a *laissez-faire* approach to partnership in terms of institutional strategy, in that there are few dedicated strategies, structures or mechanisms to facilitate partnership. However, there is an ambivalent-to-negative attitude to partnerships. While individuals may engage in industry partnerships, the institutional policy and leadership in general tends to tolerate them as a 'necessary evil' that has to be controlled. Even more significantly, there is a concerted institutional lobby opposed to partnership as 'inimical to traditional academic practice'. This is in

the context of historically advantaged universities which for the most part have strong, well-established research capacity in science and technology, like those universities in the 'harnessing innovation potential' category. Most partnerships take the form of contracts and consultancies that involve straight commercial relationships, with the presence of some incentivized and historical sponsorship forms of partnership, such as from the mining industry and in relation to student funding. There are very few commercialization or network forms of partnership at these institutions, particularly when considered relative to their counterparts with sound research capacity.

Unlike the other strong research universities, these institutions tend not to have a centralized formal research policy or strategy, nor do they have a coherent policy or strategy relating to partnerships. Central institutional leadership is not proactive, and there has been little central steering of partnership activity. These universities have begun, in a rather *ad hoc* and inexplicit way, to implement policies and practices in relation to partnership, specifically those related to intellectual property and third-stream income. However, given the conception of partnerships as a 'necessary evil', there is an attempt to control the potential 'excesses' in the interests of protecting the traditional academic project of the institution. As a senior research manager stated, the policy is 'to stop us from being taken for a ride by industry'. For instance, at one university consultancy-type partnerships were defined as 'contract work that is done under the table for private gain', and there were considerable efforts to limit these endeavours. Moreover, there was evidence of strong contestation in these institutions around the acceptance of proposed new policies – for instance, in relation to intellectual property rights and private remunerative work. This was seen by some as a setback for the development of partnerships with industry, leaving critical areas governed by older policies and a degree of ambivalence. Likewise, new internal interface structures primarily aimed at consolidating and enhancing the institution's traditional research base were being proposed at the time of the empirical research in 2003 but were in the early stages of implementation, and appeared to be subject to a great deal of contestation. Thus a *laissez-faire* approach prevails in practice.

These institutions had attempted to set up centralized external interface structures in the past, but decentralized structures appear to have had more success. The negative experience and poor returns of a science park at one university may have contributed to the current negative *laissez-faire* institutional thrust. Greater success was achieved from spin-off companies

on a much smaller scale and founded on the basis of existing research and established technologies at the initiative of individual researchers. These provide a more organically rooted base of experience for the institution, which may be at the cutting edge of new developments from the bottom up. At another university, the institution's bureaucracy was seen to hamper rather than enable partnerships. The *laissez-faire* institutional approach was seen as a significant constraint by those researchers who desired to or did pursue partnerships with industry. Together, these dynamics resulted in academics or faculties establishing their own spin-off companies, which provided the financial and governance freedom required to work with industry, enabling them to retain all intellectual property rights. Such interface structures act in an *ad hoc* manner to fulfil the interests of specific departments or individual researchers. They tend to be more firmly driven by the short-term needs of industry, and may be at odds with the central institutional strategic thrust. This represents a potential danger for the institution, and for the long-term development of knowledge in a field. It helps to explain why the scale of partnership in the three fields of focus is smaller, and why there are fewer 'network' forms of partnership that can contribute to innovation. Nevertheless, it is possible that these interface structures, based in the considerable research strengths of individual faculties and departments, can provide a future base to shift the institutional approach in the direction of harnessing the potential for innovation in a more rooted manner.

Emergent alternatives?

At the time of the study, seventeen institutions did not display research capacity in the three high-technology fields of focus. They are primarily, but not entirely, historically black universities and technikons in isolated rural locations, with a focus on teaching, and for whom research was not part of the core mission. The focus at all of these institutions was on building research capacity – in science and technology, and in general – and an institutional research culture. Thus these institutions are under a financial imperative to pursue partnership with industry in order to fund research activities differently. In relation to research capacity building, there is public-sector support and a small degree of private-sector support in sponsorships initiated by large corporations, as well as a degree of donor support. Ironically, despite their historically unequal funding, the non-materialization of expected redress funding and their general financial pressures, many of these institutions are not driven to pursue contract and consultancy forms of partnership to

support research *specifically*, to the same degree as those institutions with high-technology capacity.

There is evidence of recent concerted efforts to build research capacity, but the research in science and technology currently being carried out is still in a nascent stage at most of these universities and technikons. The dimensions of a research culture and structure are still at the developmental or 'infancy' stage, as one research manager phrased it.

Should these institutions succeed in developing greater research capacity over the next few years, they are likely to become similar to the institutions grouped in the four ideal typical categories. However, they vary in the way they would approach partnerships with industry, were they to have a more developed research base. One group of technikons focusing on developing capacity in high-technology areas displays features that make it logically akin to technikons in either the *laissez-faire* aspirational or the emerging entrepreneurialism categories.

A second group of universities that historically have focused their resources on the development and consolidation of their primary teaching effort (particularly distance institutions) constitutes in effect a set of extreme cases logically akin to those in the *laissez-faire* traditional category.

A third sizeable group of historically black universities and technikons has a distinct legacy. This arises from the fact that the institutions were established as part of the *apartheid* political strategy. Their founding mission was to train a bureaucracy to support the 'homelands' or separate states created by *apartheid* policy, which largely precluded the development of a strong academic research orientation, with little emphasis on the production of new knowledge in the form of research or postgraduate programmes (Nkomo and Sehoole, 2004). This was exacerbated by unequal funding to black universities, inadequate to sustain a vibrant intellectual culture, and by their isolated rural location. However, as Reddy (2004) reminds us, some of these institutions became important sites of political resistance, among both academics and students, developing a basis for the production and dissemination of democratic values, policy and practices. Thus there evolved a 'community development' model of outreach activities that involved academics in participatory processes drawing on their teaching and research to varying degrees.

In the current context, these institutions are logically most akin to the institutions that are harnessing the potential for innovation, albeit with an alternative development vision that is potentially significant in the South African context. They articulate a strong aspiration towards the use of technology in poverty

reduction and sustainable development and focus on partnerships that facilitate community development and impact positively on the quality of life. Some of these universities have articulated a strategic research vision and identity that emphasize a commitment to regional and local socio-economic development more than to the development of high-technology capacity to enhance global competitiveness. There is an attempt to turn the disadvantage of their isolated rural location, far from economic activity, into a comparative advantage. In some cases the specific features of the institution's location act as an incentive for research collaboration and the development of expertise. For instance, it was proposed that the biophysical characteristics of one region lent themselves ideally to research opportunities in natural resource management and the ecology of terrestrial and marine habitats with high levels of biodiversity.

Much of the small scale of partnership activity is related to the dissemination of knowledge in new contexts and to critical social applications of knowledge. There is also a small scale of knowledge generation in relation to harnessing indigenous knowledge structures in innovative ways, such as the biotechnological investigation of the potential of medicinal plants. At this stage, many strategic plans function primarily as statements of symbolic intent which capture the future vision and aspirations of the institution. They will need a great deal of support to be translated into substantive policy and concrete transformation at the institutional, faculty and sub-faculty levels, particularly given the constraints of the institutions' legacies. However, these forms of partnership represent an emergent alternative position, with potential opportunities to contribute to innovation in a social developmental manner, appropriate to and shaped specifically by the South African context.

A stronger strategic approach

This article and the research on which it is based are an attempt to place conceptual order on the forms of partnerships with industry evident across an entire national higher education system, at a particular point in time, in cutting-edge high-technology fields only.

In the context of transition, and the imperatives of transformation of the higher education system in South Africa, there has been an increasingly negative public perception of the higher education system (Cloete, 2002), and a perceived weakening and vulnerability of the sector that precludes it from determining its future trajectory (Ndebele, 2004). In contrast, the empirical evidence of the study is cause for optimism in the sector, as it reveals the wide range of ways in which

institutions can and do contribute to social and economic development through their research (see also *Mail & Guardian*, 2004, and NSTF, 2003). Significant scientific advances have been made in partnership with industry which contribute both to global competitiveness and to the quality of life.

The research highlighted the significance of the external conditions that support or constrain partnerships, such as government incentivization funding, regional location and proximity to economic centres – conditions over which institutions have little control. Above all, the article illustrates the complex and diverse ways in which individual institutions respond to global and national imperatives to develop research partnership with industry.

Innovative capacity in high-technology cutting-edge fields currently exists in five or six universities, with pockets of innovative capacity in universities and technikons that have emergent science and technology capacity. The ideal forms of the knowledge economy – knowledge-intensive collaboration and networks between higher education researchers and industry – are typically found in a small minority of partnerships in a small number of universities. Indeed, collaboration between institutions on a regional basis, or even between cognate departments in the same institution, does not seem to occur on a wide scale. In the industry–research partnerships that take the form of networks, collaboration and, to a lesser extent, incentivization, higher education's role is most likely to include open-ended intellectual inquiry in the form of fundamental or strategic research, motivated by the intrinsic demands of a discipline or field of knowledge. It will probably include multiple disciplinary partners within higher education and science councils, as well as multiple industry partners.

This concurs with Castells's (2001) claim that critical to developing institutions as centres of innovation is cross-fertilization between different disciplines, together with detachment from the immediate needs of the economy. Academics can and do derive significant traditional benefits from such industry partnerships, from yielding a high number of publications to successful postgraduate students to enriched undergraduate teaching to enhancing the reputation of a department or institution. In these network forms of partnership, higher education is most able to balance its intellectual imperatives with new financial imperatives in the long-term interest of higher education, of an industrial sector and of economic and social development needs for innovation that enhances the quality of life. Biotechnology research that develops drought-resistant seeds suited to the Southern African climate is but one example of many described in the study.

However, such forms of partnership are not well-entrenched. In most institutions partnerships take the form of consultancies and contracts, particularly in those institutions with a *laissez-faire* approach, whether aspirational or traditional. The reaction to an increase in consultancies and contracts reflects the desire to protect fundamental research activity from a utilitarian, immediatist and economic approach. The irony and danger are that a *laissez-faire* institutional approach may allow large numbers of consultancies and contracts to develop in practice in individual research units, departments and faculties. This creates negative precedents and may create future problems for sustaining an institution, its academic project and the research base in a knowledge field.

Thus the study suggests that a far stronger and more systematic strategic mindset is required on the part of higher education institutions in order to 'harness potential' more widely across the system in South Africa. This would allow higher education institutions to contribute to innovation, facing both the global economy and pressing demands for national development that will enhance the quality of life of all South Africans.

Notes

¹A process of mergers between higher education institutions has already begun, and will significantly alter the institutional landscape by 2005.

²A database of active researchers in the three fields and a profile of the research capacity and productivity of each institution were compiled prior to site visits. During the visits, interviews were conducted with senior research managers, faculty deans and senior academic research project leaders.

³This is in terms of the qualifications of academic research staff, their ratings as scientists on national measures, their research publications output, research funding and levels of postgraduate supervision.

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Author: Kruss, Glenda

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Abstract:

This article presents an overview of research partnership activity across the South African higher education system, in three cutting-edge high-technology fields. An analytical matrix of partnership forms is developed, shaped by distinct responses to the tension between the new financial imperatives and the traditional intellectual project of higher education. Using the matrix, four groups of institutional response to partnership are identified. These may be distinguished in terms of their level of research capacity and the sets of strategic policies, institutional structures and interface mechanisms they have in place to promote partnerships with industry. The core argument of the paper is that more institutions need to develop the capacity to harness the potential for innovation, rather than allow the unregulated proliferation of contract and consultancy forms of partnership with industry that can undermine their core long-term knowledge-generation function.

Keywords: HIGHER EDUCATION-INDUSTRY PARTNERSHIPS; INNOVATION; NETWORKS; SOUTH AFRICA

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