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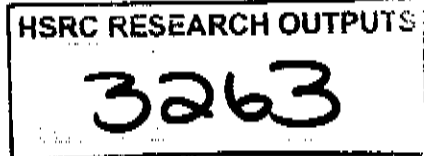
**Tensions in Facilitating Higher Education-Industry Research Partnerships
in High Technology Fields in South Africa**

Glenda Kruss

Research Programme: Human Resources Development

Human Sciences Research Council

gkruss@hsrc.ac.za



Introduction

A key principle of the White Paper on Higher Education (1997) is that conditions must be created to enable the higher education system to contribute to the social good through the production, acquisition and application of knowledge, the building of human capacity and the provision of life-long learning opportunities. A key higher education goal is to 'secure and advance high-level research capacity which can ensure both the continuation of self-initiated, open-ended intellectual inquiry and the sustained application of research activities to technological improvement and social development' (CHE 2004: 32). Thus, research partnerships and collaboration with industry are promoted in new higher education and science and technology policy in South Africa. They are seen as a critical strand in the balance between knowledge production and the application of research, to contribute to the development of a national system of innovation, and a higher education system that is more responsive to economic and social development.

The rapid growth of contract sources of research funding, as opposed to research agency or state higher education subsidy sources, is marked in South Africa over the past few years. Table 1 graphically illustrates the strong imperative experienced by academics to access research funds from industry. The data reflects a growing trend to fund research from 'contracts' with the private and public sector, to almost 60% of research funding in 2000. The growing contribution of THRIP incentivisation to research funding, which has grown rapidly to almost equal the contribution of the higher education subsidy, is further testament to the growth of partnership with industry, and the growing significance of government departments other than Education as a source of funding for research.

Table 1. Research Income by source in the higher education sector 1996-2000

	1996	1997	1998	1999	2000
HE Subsidy	18	16	16	15	14
Agency	23	21	21	19	18
THRIP	5	7	9	10	10
Contracts	54	56	55	56	58
TOTAL	100	100	100	100	100

Source: CENIS 2001

Partnerships with industry are viewed as highly desirable by many in universities and technikons, and in particular, the notion that they can contribute to a 'third stream' of income in a declining and shifting funding context, is gaining precedence in many institutions. This financial imperative is in tension with the traditional intellectual imperatives of higher education promoted by many academics and researchers. There is thus extensive debate around the desirability of research partnerships with industry, and their likely impact on the future of disciplines and knowledge fields. That debate is not the subject of this presentation.

Instead, for the audience at this conference, the presentation draws on the analysis of empirical trends in higher education-industry partnerships in a recent HSRC study, to provide insights for institutions and research managers who wish to pursue partnerships with industry. How can research managers facilitate partnerships with industry in their institutions? What are the most likely constraints on partnership? The HSRC study attempted to map the forms of partnership that exist across the higher education landscape, and to map the institutional policies, structures and conditions that facilitate and constrain. The focus was three cutting edge high technology fields - Biotechnology, New Materials Development and Information and Communication Technology (ICT). Seventeen of 35 universities and technikons were identified as having varying degrees of high technology research capacity, and the discussion in this presentation draws on the trends and patterns evident in their policy and practice only.¹ Partnerships ranged from their simplest form, a one-on-one short term informal problem solving consultancy, to a contract to conduct a piece of applied research to meet the immediate needs of industry, to complex long term networks that include fundamental and strategic research. The variation is determined by the extent to which both industry and higher education partners are involved in a financial and/or a knowledge collaboration relationship.

The paper cannot present a blueprint or set of instructions, for the study shows that apparent 'success' stories in South Africa are shaped by each institution's context, research culture, structures and capacity. A number of higher education institutions have developed policy, strategies, structures and mechanisms to promote strategic research partnerships with industry, often drawing on the experience and practice in countries such as the United States, Britain and the Scandinavian countries as guiding models. However, the South African context is distinctive, with a differentiated higher education system, with uneven levels of Science and Technology capacity, uneven levels of research capacity, uneven levels of research funding and resources, uneven regional distribution of industry and opportunities for economic development, and a massive demand for social development.

The paper will thus have a very specific focus, and discuss four tensions that emerged in the course of the analysis. Institutions have found different ways to resolve these tensions, in order to facilitate partnership, or have not been able to resolve these tensions, in which case, they act as constraints to the realisation of strategic plans.

¹ The 11 universities are Stellenbosch, UCT, Pretoria, Witwatersrand, Natal, Orange Free State, Rhodes, Western Cape, Potchefstroom, RAU and Port Elizabeth, and the 6 technikons are DIT, Port Elizabeth Technikon, Pretoria Technikon, Technikon Witwatersrand, Cape Technikon and Free State Technikon.

1. Institutional policy coherence and permeation

A continuum of attitudes towards partnerships was evident on the part of research managers and academics in the seventeen institutions, ranging from highly positive to highly negative, as set out in Figure 1.

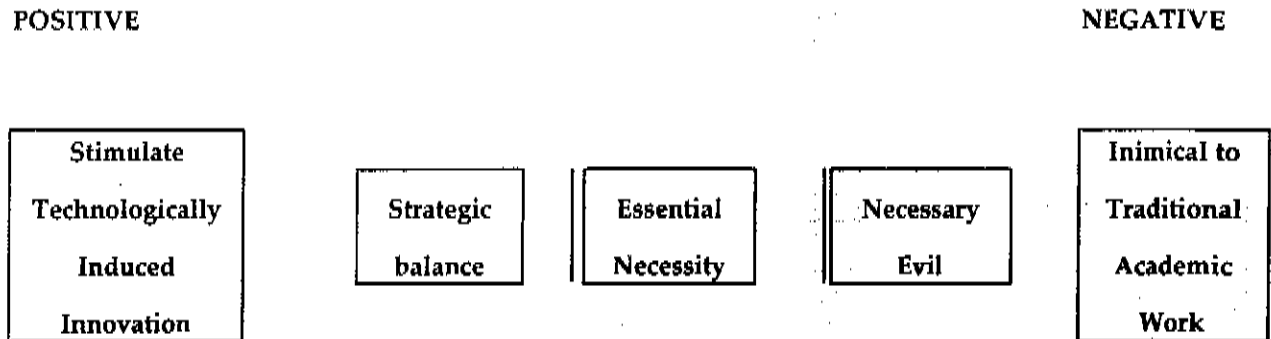


Figure 1. A continuum of attitudes towards 'partnership with industry'

A distinction was evident in the attitudes of those at different organisational levels of higher education institutions, between institutional management, Faculty leadership and research unit or research project leadership. Tensions and potential conflict emerged between these levels in various related ways.

The position formally promoted at the institutional level by senior management – in an institution's formal mission statement, strategic policy and research policy – was often at variance with the position of Deans of key Faculties. It was even more likely to be at variance with the attitude of key project leaders. For instance, an institution might promote a position that they should set in place structures and mechanisms to ensure that they can harness the potential of partnerships, and create a 'strategic balance' between the new financial demands of third stream income, and the traditional academic, intellectual and scientific demands of research. However, the Dean of a key Faculty may have an opposing attitude, that partnerships with industry are 'inimical to traditional academic work', and compromise scientific integrity, and hence are to be avoided. Such a Dean is not likely to promote institutional policy, nor to promote participation in dedicated structures within the departments of that faculty. Likewise, research unit or project leaders may refuse to pursue partnerships, and there was evidence to suggest that those researchers that have the most well established scientific reputations were often those who most vociferously resisted the compromises and constraints partnerships were perceived to place on academic freedom.

Or, a second example, an institution may aspire to develop research partnerships as a key source of third stream income, but it may lack the research capacity and will on the part of academic staff. Many technikons and historically black universities for instance, reported that the lack of a research culture and tradition amongst staff in their institution was a major constraint, often exacerbated by the demands of heavy teaching loads, that did not allow them to achieve their

research objectives. A disjuncture within an institution would thus occur, where institutional management had articulated a policy in favour of promoting partnerships, but struggled to translate this into workable structures and mechanisms at faculty, department and research unit level. Many strategies and structures were recently established, and had not yet had sufficient time to prove themselves. Fragmentation, in the form of pockets of expertise evident in practice within the institution, despite the aspirations of stated policy, was widely evident.

Thus, while an institution may have articulated policy to promote partnerships, such policy had often not permeated down to faculty or research unit level, or may have been actively resisted, and hence, may remain largely aspirational. The challenge for research managers then, is to attain institutional coherence, to articulate and implement workable strategies and mechanisms to ensure that partnerships are integrated within the institutional strategic policy and structures of power.

2. Financial imperatives vs academic freedom?

The most significant tension inherent in all partnerships relates to the tension between the financial imperatives driving academics to seek partnerships with industry, and the demands of academic freedom, in the selection of the research problem and focus, and in the dissemination of results. This tension it can be seen, often underpinned dissent between managers and researchers at different organisational levels within an institution.

The most widespread motivation for higher education to seek partnerships was to generate funding for the fundamental survival of research capacity in a specific field. Organizational changes in higher education, with a trend towards devolving financial and research responsibility down to faculty level, and changes in the national research funding environment, were perceived to increase the pressure to identify alternative sources of funding, to feed into basic research in the department and the school. Thus, there was a common perception that 'you work with industry who funds research, then you can fund basic research'. For some researchers, this was viewed from the position of being a 'necessary evil', while others viewed it as an 'essential necessity'. These researchers were not interested 'so much in the pursuit of knowledge for knowledge's sake but rather knowledge that is strategically important' (Interview, senior researcher 2003).

Researchers desired to access funding to provide for research facilities and equipment in a number of ways.

- Income generated was used to 'go back into research', to support mainstream academic research activities such as attending international conferences and purchasing computer software. There were also cases where funding was used to 'buy' time for basic research.
- Partnership was pursued in order to fund new research facilities.
- Partnership was pursued to fund expensive equipment that an individual institution could not afford alone.
- A more modest reason was to access funding that could be invested in purchasing or maintaining new equipment.

Attracting quality students, and historically disadvantaged students was a problem for many institutions, even top research universities, because they could not compete with commercial

salaries. The motivation for a large number of contract research partnerships was thus to provide significant funding for post-graduate scholarships, to attract the desired students to remain in academia. Funding could also be for individual benefit, to supplement academic salaries, which was seen by many as a 'welcome addition' that keeps their salaries 'in line with market salaries' (Interview, senior researcher 2003).

The most highly valued motivation for entering partnerships, however, was a research collaboration, where both industry and higher education directly participated in an intellectual knowledge-intensive exchange and had their knowledge needs met. A partnership that facilitated long term fundamental research was seen as first prize for many researchers. Others were more interested in 'strategic research' that could be seen to be relevant, and remove them from the 'ivory tower', and partnerships were important to identify 'relevant' topics for their research, related to the real world. A strong academic motivation was thus to be able to do stimulating work on the 'cutting edge' of a specific field, to facilitate knowledge transfer between academics and those at cutting edge of industry, and provide access to cutting edge technology.

The tension between a financial and intellectual imperative driving partnerships was evident within a single institution, within a research unit and even within a single project. Concern was expressed across the board at the restrictions that can be placed by industry on the publication of data, both in the form of academic publications, and of student theses. The potential restriction on publication of proprietary knowledge was a particular problem for researchers involved in contract research. There were cases that reported that there have been no accredited publications, because intellectual property negotiations were still in process, or because intellectual property agreements embargoed publication for certain periods. Some agreements have confidentiality clauses incorporated that extended to a prescription on discussing findings or problems related to research with peers or anyone outside a project. Many institutions thus grappled to define intellectual property rights in such a way that the academics could derive a publications record, which does not betray or compromise the commercial interests of the company involved.

Partnerships were reported to have provided post-graduate students with the opportunity to develop the skills to work with industry and to present their work to both industry and scientists. Again, there is a tension inherent, where a confidentiality or 'secrecy' clause is signed, which is believed to limit students' work. Most institutions were concerned to minimize industry demands by protecting the rights of post-graduates to complete dissertations or publish research findings. Industry demands for limitations on access to research findings was usually for a maximum of two years, but some partners required tighter restrictions, which it was reported, was difficult to challenge, for fear of ruining more long term relationships. The possible detrimental effect on the publications output of young scholars was a major concern.

The concern that academic freedom would be compromised was thus a major constraint on the willingness of individual academics to participate in partnerships. It was notable that the majority of institutions, at the institutional level, viewed partnerships as an 'essential necessity' with benefits ranging from the financial through the intellectual, or as a 'necessary evil', with financial benefits but requiring controls to prevent a negative impact on the institution's traditional role of knowledge production. The challenge for research managers is thus to find a creative balance between the financial and intellectual imperatives, particularly in the intellectual property policy of their institution, if they wish to facilitate partnerships with industry.

3. Centralised or decentralised strategies?

There was evidence of a tension in the conception of how partnerships were best promoted and initiated within an institution. Should it be a centralised function of the institution, or decentralised to faculty, research unit or even individual level?

Institutions developed a range of centralised internal interface structures in an effort to promote, or at least, create the conditions that can support, partnerships with industry. Many institutions had linked their strategic policy to (a recently developed) institutional research policy. They had identified niche areas as a focus for expertise and funding, to consolidate existing capacity, particularly supported at technikons by the NRF. They had established a research office, or extended its mandate beyond research administration to research management, facilitation and co-ordination. They had developed the functions of Faculty Deans and Research Committees, to play a more proactive, facilitating role in relation to research in general and partnerships specifically. They had devised staff incentive schemes, such as performance appraisal, allowing a given percentage of time to be spent on contract research, or allowing a given percentage of externally generated income to be allocated to individuals, as incentives to retain them in academia. They had developed Intellectual Property Policy that operated in favour of the institution rather than the individual as in the past. A few institutions had established dedicated structures to protect IP, in the form of legal assistance in pursuing patents, royalties and licencing agreements. Such are the structures and mechanisms that were developed to meet the challenge of balancing financial and intellectual imperatives.

Institutions had developed centralised external interface structures to manage their relationships with industry. These took a range of forms, from university owned holding companies as an umbrella for small spin-off enterprises, to science parks, to technology stations and centres of expertise, to incubators. Such dedicated structures tended to operate outside of the mainstream structures of institutional power, and play an advocacy role within the institution, with mixed results.

A decentralised approach was most commonly evident at institutions that had a *laissez faire* approach to partnership. In some cases, this was because the institution and its academics generally tended towards a negative attitude towards partnerships, and so tolerated them as a 'necessary evil'. Special structures or mechanisms were not created, but individual researchers who so desired were allowed to pursue industry partnerships. In other cases, individual initiative was strong because institutions lacked sufficient management capacity, and research capacity in general and in science and technology, to develop a co-ordinated response to partnerships, although the general attitude may have been positive.

However, when one moved beyond the level of the institutional management that promoted a specific structure or programme, there was a great deal of scepticism about the efficacy of such centralised efforts to promote partnership. There was widespread consensus from those academics engaged in research that individual initiative and creativity were the key to initiating and sustaining partnerships with industry. It was widely believed that there was nothing more important than the individual researcher, the 'academic champion' or the 'academic entrepreneur', an individual with academic and industry credentials building on his or her informal networks, in order to pursue partnerships. The majority of partnerships initiated by

higher education were reported to be where an individual researcher acted as the catalyst, particularly based on personal relationships of trust and a common understanding that had been built up, often over long periods of time. At a few institutions the necessity of a 'bottom-up and top-down' approach was favoured, that was flexible enough to allow for individual creativity but at the same time created conditions that supported partnerships.

Researchers at project level commonly complained that institutional bureaucracy did not provide appropriate conditions to support partnerships, and often acted as a constraint. This was particularly evident in relation to centralised financial procedures, where there were extensive delays in processing payments that could jeopardise research, and was perceived to provide a negative impression to industry. Some researchers reported that as a result, they had formed their own company, to channel research funding in a way that it could be rapidly accessed as and when required. Another instance was lengthy Faculty and university-wide processes for approval of research proposals in terms of quality assurance, which was perceived to cause unnecessary delays. A third instance was in relation to intellectual property rights. Researchers drew a distinction between protecting intellectual property, and exploiting intellectual property in an innovative manner at the institutional level.

The challenge for research managers then, is to resolve the tension between centralised and decentralised incentivisation and support of partnerships, that does not stifle individual initiative and at the same time provides simple and effective support mechanisms, particularly in administrative processes.

4. Regional location and industrial sector

Some institutions strongly articulated that while they viewed partnerships as an 'essential necessity', and had attempted to put in place strategy, structures and mechanisms, often very creative and unusual schemes, they faced external constraints over which they had very little control.

A strong external facilitator or constraint was regional location. It was a constraint in provinces such as the Free State and Eastern Cape, which are far from the industrial heartland and have institutions in areas that are geographically isolated. Conversely, some institutions were able to draw on their favourable regional location to develop research links with industry, in some cases, even with large-scale agricultural companies, and in some cases with regional economic development initiatives or 'innovation hubs'.

Linked to this is the difference between knowledge fields and industrial sectors. The way in which some knowledge fields and industrial sectors have developed in South Africa creates conditions more or less conducive to partnerships. For instance, researchers typically identified the lack of involvement of South African industry in fundamental, strategic or even applied research with a longer time frame, as a major constraint on research in the field of ICT. The point was made repeatedly that the IT industry in SA suffered from 'colonialism', in that large multinational corporations such as Microsoft conduct their software research in the country of origin. They only operate sales divisions in South Africa, with perhaps a limited degree of development work in the sense of adapting products or processes to the South African context, rather than research. Local companies reportedly do not see the benefit of research unless it is of

immediate application, to solve a specific industry problem. Indeed, the claim was made that in the 1990s, many local companies (such as insurance companies) have closed down their R&D activities and outsourced the research function to universities in this way, or to small, specialised IT companies. These small companies were believed to be more open to research, but to lack the financial means to fund research in any significant manner.

Thus, researchers may be keen to pursue partnerships with industry, but may not find a willing partner, or one prepared to commit time, money and expertise to conduct the kind of research that can be valuable in academic terms as well as financial terms. The immediatism of industry, and the lack of interest in supporting innovative research with long time lines and long term application, was identified as a major external constraint.

The challenge for research managers is to develop ways to harness the potential of their regional location and to build relationships with industrial sectors related to their niche areas of strength.

Conclusion

The HSRC study of partnerships in all 35 higher education institutions has resulted in a mass of data, revealed many patterns and trends and raised many issues for debate. It was only possible in this presentation to highlight a few key tensions, which illuminate the difficulties of managing partnerships with industry, in 17 institutions with a degree of high technology capacity. It is evident that facilitating partnerships within institutions in their specific regional and industrial contexts, and given their historical legacies, is a challenging task, and an issue that requires greater attention in higher education circles.

The tensions highlighted here point to the significance of policy coherence between organisational levels within an institution, to the importance of seeking a balance between financial and intellectual research imperatives, and to the need for flexible regulation within institutions to provide levers and incentives without being heavy handed or constricting. It is evident that institutions alone cannot facilitate partnerships and innovation, unless there is greater state incentivisation, and greater commitment on the part of industry to contribute to long term research collaboration in the interests of innovation and national development.

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