TECHNOLOGY TRANSFER AND DIFFUSION:

November 2007

CAPACITY & POTENTIAL IN SOUTH AFRICA'S PUBLIC UNIVERSITIES – SURVEY 2007

Higher Education South Africa–HESA

INSIDE FRONT COVER

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CAPACITY & POTENTIAL IN SOUTH AFRICA'S PUBLIC UNIVERSITIES – SURVEY 2007

Research report
for Higher Education South Africa—HESA

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H E S A

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PREFACE

Events in the past year have underscored the central role that innovation and technology transfer can, and should, play in South Africa's national development. New ideas and knowledge are increasingly becoming key to making the country competitive in the international arena. 2006 saw the review of South Africa's National System of Innovation by the Organisation of Economic Co-operation and Development (OECD). Partly in response to this, the Department of Science and Technology launched its Ten Year Innovation Plan (2007 to 2016) which provides concrete goals and objectives to enable South Africa to strengthen its performance in this area. Once again the role that the higher education sector can play is central to the success of this strategy.

We are living in a time of rapid policy development which seeks to enable a more proactive and effective role played by higher education institutions in addressing national development goals. The challenges facing South Africa are not unique but their complexity demands a co-operative and integrated approached by all those involved in the innovation chain. Higher Education South Africa (HESA), as the representative body for the country's higher education institutions, seeks to contribute to this alignment as well as to provide a platform for a greater contribution by the sector.

Against this backdrop, it is encouraging to see that, from 2007, technology transfer activities are taking root in the higher education sector. While we may be in the early stages of institutionalizing technology transfer and creating the necessary infrastructure, there are significant strides that need to be made particularly in terms of human development, funding strategies and policy alignment. This survey provides an objective view of the contribution by the sector, and as such, provides an invaluable tool for identifying pockets of success and areas for improvement.

HESA looks forward to a strong partnership with key role players for ensuring that the sector achieves great success in this important field.

Prof. ED Malaza
Chief Executive Officer: HESA

ABBREVIATIONS AND ACRONYMS

AUTM	Association of University Technology Managers
CSIR	Council for Scientific and Industrial Research
DoE	Department of Education
DST	Department of Science and Technology
dti	Department of Trade and Industry (South Africa)
DTI	Department of Trade and Industry (United Kingdom)
FTE	Full-time Equivalent
HEFCE	Higher Education Funding Council for England
HEI	Higher Education Institution
HESA	Higher Education South Africa
HSRC	Human Sciences Research Council
IP	Intellectual Property
Mil	Million
MINTEK	Council for Mineral Technology
NRF	National Research Foundation
NSI	National System of Innovation
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisation
R&D	Research and Development
SA	South Africa/n
SME	Small and Medium Enterprise
THRIP	Technology and Human Resources for Industry Programme
TT	Technology Transfer
TTO	Technology Transfer Office
UK	United Kingdom
US	United States
USA	United States of America

EXECUTIVE SUMMARY

Managing the flow of ideas and inventions from the university corridors to the market place aims to benefit society through new products, processes, jobs and ideas. Technology transfer (TT) and diffusion is central to this. Within the South African context, limited evidence previously existed to indicate the extent to which universities are engaging in technology transfer and diffusion. In 2006, HESA commissioned its first study (Survey 2006) to investigate this. Taken together with the findings of Survey 2006, the HESA Survey 2007 findings signal that technology transfer and diffusion activities are taking root in South Africa's public universities.

The population for Survey 2007 consisted of the 23 public universities in South Africa. From among these, the following 17 universities (names in alphabetical order) participated, giving a 74% response rate:

- Cape Peninsula University of Technology
- Durban University of Technology
- Mangosuthu University of Technology[1]
- Nelson Mandela Metropolitan University
- North-West University
- Rhodes University
- Stellenbosch University
- Tshwane University of Technology
- University of Cape Town
- University of Fort Hare
- University of KwaZulu-Natal
- University of Limpopo
- University of Pretoria
- University of South Africa
- University of the Free State
- University of the Witwatersrand
- Vaal University of Technology

This report: i) outlines these respondents' opinions on issues related to technology transfer and diffusion; ii) identifies respondents' institutional strategies and infrastructure; and iii) develops a set of monitoring and benchmarking indicators.

The *opinion survey* aspect of Survey 2007 revealed the following:

- South Africa's public universities believe that they have the technological capabilities to transfer technology to industry and that technology transfer is of high importance to them. However, they indicated that they are only partially persuaded that such activities are financially rewarding to them.

[1] During the course of 2007 Mangosuthu Technikon changed its name.

- Although more universities than was the case in Survey 2006 expressed the belief that they have internally adequate incentives promoting technology transfer, the majority of universities declared technology transfer activities not to influence academic promotions.

- The universities declared that they are aware of industrial needs and that industry requires their services. However, they declared that they do not have adequate human and other resources for technology transfer activities.

- The majority of the universities declared that government does not provide enough resources for collaborative research, development and innovation activities between universities and industry.

- Eighty-eight per cent of the universities stated their belief that government procurement policy is not conducive to the transfer of technology and know-how to government departments and other organs of the state.

The *institutional strategy and infrastructure survey* aspect of Survey 2007 showed that South Africa's higher education sector is in the early stages of institutionalising technology transfer and creating the necessary infrastructure. Approximately 60% of the participating universities indicated that technology transfer is included in their mission statement, with 80% saying that they have an intellectual property (IP) policy. However, only a few universities were found to have regulations requiring their staff to declare different types of intellectual property. Furthermore, only four of the universities indicated that they have comprehensive institutional strategic plans for business support.

The following findings emerged from the *indicators survey* aspect of Survey 2007: the technology transfer offices (TTOs) at South African universities have only fairly recently been established and are understaffed;[2] the median office has been in existence for three years; and the average number of staff is 1.17. In contrast to this, in the USA most of the technology transfer offices in universities have existed for more than 12 years, with the median office employing five staff members.

Invention disclosures and start-up companies were found to be apparently fewer in number in 2006 compared to the previous year. It is speculated that this decline is as a result of the uncertainty created by the introduction by the Department of Science and Technology (DST) of the *Intellectual Property Rights from Publicly Financed Research Framework* (DST, 2006), which led to the introduction of the *Intellectual Property Rights from Publicly Financed Research Bill* (DST, 2007b).

South African universities produce a small number of patents. A large number of individual universities in the USA produce more patents than all of the South African universities together. It is argued that lack of support for technology transfer activities and the character of the country's universities – emphasising undergraduate teaching and social sciences and humanities research – contribute to this phenomenon.

The above findings lead to the following recommendations:

HESA has accepted the responsibility of monitoring technology transfer activities in South Africa's universities and making the relevant findings available to the public. The production of this report testifies to this commitment. The experience in developing this report indicates that university respondents are better prepared and are able to report with greater ease when the effort is undertaken annually. Future research into this area could benefit from including case studies of successful products / processes / businesses that have been created in the process of technology transfer from the universities. An additional front on which HESA should focus its efforts is monitoring of the regulatory environment and the identification of constraints whose alleviation could benefit the National System of

[2] See OECD (2007c:25), which confirms this by stating in connection with the Tshumisano technology stations programme that "...it is already hamstrung by lack of people with skills and experience in both technology and business".

Innovation (NSI). Such actions would be in accordance with HESA's strategic plan 2006-2008 (HESA, 2007). In this context, areas of concern that have been identified are the issues of government procurement and of appropriate incentivisation of international patents. It is suggested that HESA develop position documents in this regard and submit them to the relevant government departments.

Managing the flow of ideas and inventions from the university corridors to the market place aims to benefit society. Tshumisano Trust and the National Research Foundation (NRF) are institutionalised policy instruments aimed at promoting technology transfer and research respectively in the higher education sector. In achieving their objectives, however, both institutions fail to exert their full potential influence. Their current approaches create isolated islands of influence (individual researchers and/or technology stations), operating in environments not always conducive to their objectives. Both institutions – Tshumisano Trust and the NRF – have the right to request of each benefiting university that it harmonise its policies with those advocated by the funding body. For example, Tshumisano Trust could request those universities housing technology stations to develop university-wide relevant strategic plans and to aim to increase the number of governing body members drawn from the industrial and commercial sectors. In Survey 2006 (HESA, 2006), it was recommended that the Tshumisano Trust expand its activities across all universities. Although no new technology stations were developed during 2006, Tshumisano Trust has indicated its intention to expand activities into Limpopo, Mpumalanga and the Eastern Cape provinces.

During the course of 2006, the DST requested comments on the *Intellectual Property Rights from Publicly Financed Research Framework* (DST, 2006), which resulted in the *Intellectual Property Rights from Publicly Financed Research Bill* (DST, 2007b). The process of asking for comments in the development of the Bill appears to have had a dual impact on the higher education sector. On the one hand, a beneficial effect has been the establishment by the majority of the universities of their own intellectual property rights regulations, mainly along the lines advocated by the framework and subsequent Bill. On the other hand, the number of disclosures and start-ups from universities appears to have been affected negatively – probably as a result of the uncertainty introduced by the process. Furthermore, the Bill has been criticised both for being punitive and paying little attention to linking incentives to compliance and performance. At this stage of development of the NSI, any such bill should be enabling in character and should provide support for the introduction of the culture of technology transfer at the country's universities. In this context, among the top priorities should be support for the establishment of technology transfer offices and their appropriate staffing.

Universities are over-dependent on industrial funding for their research and development activities. This dependency creates concerns for the universities. Will they be able to support and maintain their research activities in the event of a downturn in the economy? How will over-reliance on industrial funds affect the university character? What will be the consequences of the replacement of direct incentives (e.g. the Technology and Human Resources for Industry Programme, or THRIP) with indirect ones (e.g. tax incentives for R&D)? HESA, as the voice of South African universities, should make representations to the relevant government departments, such as the Department of Education (DoE) and the Department of Trade and Industry (dti), with the objective of increasing the government component of research support.

1

INTRODUCTION

Technology transfer and diffusion is among the national priorities in South Africa, with the DST spearheading the effort. The DST is establishing the Technology Innovation Agency with the objective of supporting "…the State in stimulating and intensifying technological innovation and invention in order to improve economic growth and the quality of life of all South Africans by developing and exploiting innovations and inventions" (DST, 2007a:4). Similarly, the DST aims to pass regulations related to intellectual property rights accruing from publicly financed research, as per the example of the Bayh-Dole Act and the countries that have followed the US example, i.e. Germany, Korea, Taiwan and others (DST, 2006; 2007b).

Within this context, and arising out of Survey 2006, in June 2006 HESA produced the report *Technology Transfer and Diffusion: Capacity and Potential in South Africa's Public Higher Education Sector*. In the preface to that document, the Chief Executive Officer of HESA, Prof. ED Malaza, stated:

> HESA hopes that the findings and recommendations of the report will place the higher education sector in a position to establish better and appropriate infrastructure and institutional policies to facilitate effective technology transfer and diffusion. We also hope that the recommendations will assist the government and other stakeholders in higher education in formulating policy and making informed choices in their efforts at enhancing innovation within higher education. (HESA, 2006)

The current document reports the related results of Survey 2007. The document has the following structure: the chapter "International Experience" reports on the efforts of the Organisation for Economic Co-operation and Development (OECD) with regard to identifying technology transfer and diffusion trends and international best practice in its member countries; the chapter "Academic Entrepreneurship in South Africa" reports on the findings of the current HESA survey; and the chapter "Discussion and Recommendations" both elaborates on the recommendations of Survey 2006 (HESA, 2006) and develops new recommendations based on the findings of Survey 2007.

2

INTERNATIONAL EXPERIENCE

The OECD is currently considered to be the main multilateral organisation identifying international best practice in a number of fields, including technology transfer. The organisation has been involved in technology transfer from universities for several years. In this document, we review the most recent relevant literature with emphasis on the recommendations being made in each case.

An OECD report (OECD, 2007a) argues that regional engagement by universities is beneficial to both local development and the universities themselves. That report further states that universities could play a stronger role in the economic, cultural and social development of their regions. The report is the outcome of a three-year study by the OECD's Programme on Institutional Management in Higher Education and the Public Governance and Territorial Development Directorate. The report draws on reviews of 12 countries as well as OECD territorial reviews, and offers findings that can be usefully applied by national and regional governments and universities.

The report analyses the barriers to improvement and suggests that universities should adopt a wide agenda of regional development – economic, social and cultural.

It recommends that greater autonomy and better incentives be given to universities and their staff to engage with small and medium enterprises (SMEs). It also argues that countries should provide a more supportive environment for university–enterprise co-operation, including the regulatory and tax environment.

The report suggests that instead of focusing on the supply side of knowledge transfer, countries should develop business demand for university interaction. Finally, the report emphasises the importance of "knowledge transfer on legs", i.e. the students and graduates, who can be among the most effective mechanisms for knowledge transfer.

Similarly, in a recent policy brief, the OECD (2007b) argues that universities are important players in all national and regional innovation systems, yet they are under-exploited. Furthermore, the brief argues that, "the contribution of HEIs to developing their home regions has not previously been a major concern for public policy or the HEIs themselves. But this is changing with the expansion of higher education, particularly in the non-university sector, which in some cases has aimed to address regional disparities" (OECD, 2007b:1).

The policy brief (OECD, 2007b) looks at the policy measures and reforms across OECD countries to mobilise higher education to support regional development. The brief identifies a number of "…traditional obstacles to innovation, such as lack of entrepreneurship, over-regulated markets, insufficient R&D by the private sector, under-investment in basic research, and systemic failures including institutional rigidities in the research system…" (OECD, 2007b:3). The report further argues that market failures justify government's intervention, in order to alleviate these obstacles (OECD, 2007b).

In addition, the policy brief argues that governments should promote the capacity of universities to enhance innovation and wider social, cultural and environmental development in their regions in the following ways:

> First, universities should be encouraged to adopt a strategic stance and promote a better alignment of their activities with regional priorities. Co-operation with regional public agencies in Finland and the USA has shown that universities could bring key contributions to this adjustment. Second, universities should be encouraged to widen their portfolio of services to firms and communities. Many universities are not research-intensive universities, but they can be entrepreneurial and develop an integrated approach to firms emphasizing non-technological aspects such as legal, workforce, infrastructure issues and others. Problem-solving and public-space functions could be further developed. Third, many universities are becoming global actors and are developing a network of national and international affiliates. This connectivity should be mobilized to allow regional and local firms to network outside regional boundaries. Finally, even if measurement is difficult and controversial, engagement policies will not be improved without sound evaluation processes. There is a need to strengthen universities' accountability to society by developing indicators and monitoring outcomes to assess universities' regional performance. (OECD, 2007b:7)

An earlier OECD report (2003) aimed to: i) document and assess the legal and regulatory frameworks for commercialising intellectual property generated with public research funds; ii) measure and analyse the patenting and licensing activities of public research organisations (PROs) in member and selected non-member countries; and iii) identify areas of policy action.

Among the relevant findings for South Africa are the following (OECD, 2003:11-18):

- Much of the focus of the reforms to legal frameworks has been on the issue of transferring ownership of IP to performing institutions. However, in several countries where PROs have owned the IP, patenting activity by institutions has nevertheless been weak. Part of the reason is that PROs have not had sufficient incentives, beyond legal requirements or institutional policies to disclose, protect and actively commercialise IP (OECD, 2003:11).

- In many OECD countries, non-IP related laws and regulations such as public-sector pay scales that make it difficult for PROs to recruit qualified technology transfer personnel, can be a barrier to capacity building in technology transfer offices (TTOs) (OECD, 2003:11).

- …governments in Denmark, Japan and Germany are providing direct and indirect support, on a time limited basis, to help universities and other PROs cover the costs associated with patenting and commercialising inventions (OECD, 2003:13).

- Per institution gross licensing income ranges from the thousands to the low millions: United States (USD 7.7 million)…Japan (EUR 93 000) (OECD, 2003:16).

- Some 80% of Swiss PRO licensees are foreign firms. Similarly, Dutch universities are more likely to license abroad than at home, possibly owing to the international nature of Dutch research as well as the limited national market for IP (OECD, 2003:17).

- Regular surveys of patenting and licensing activities – undertaken by national governments, multilaterally or by PROs themselves – are needed to provide input to policy makers but also to help PROs benchmark performance and learn from one another (OECD, 2003:18).

Within the above context the OECD (2003:19) makes the following recommendations:

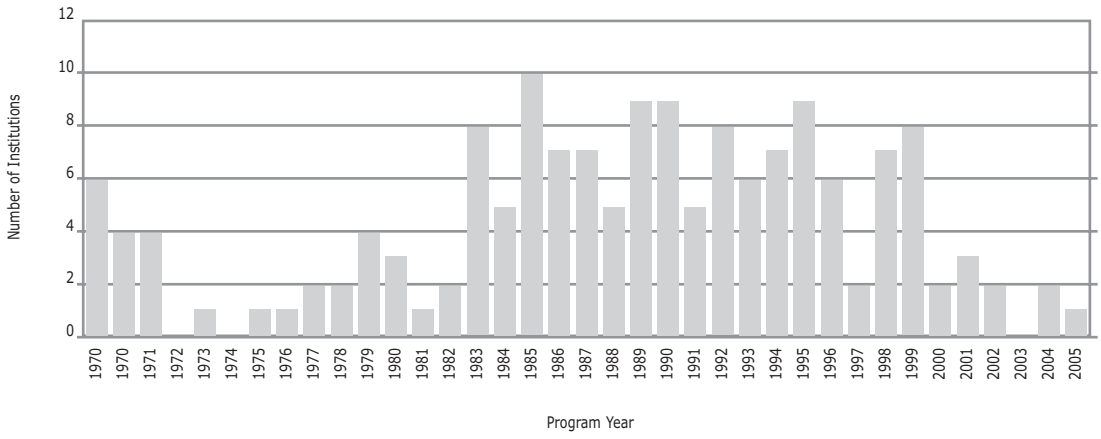
- Make national IP policies more coherent across all PROs and funding agencies.
- Encourage the development and implementation of IP policies at the institutional level through: incentives; design and dissemination of conflict of interest rules; and guidelines balancing negotiating freedom with adequate exploitation.
- Enhance IP management capacity at PROs through government support and diffusion of information related to IP management.
- Improve and facilitate data collection and share good practices.

We complete this brief review by referring to the European Commission study (2002). This study argues that innovation should be fused and become part of all regulatory and institutional reform in a country. The European Commission report argues that current innovation policy – "second generation innovation policy" – emphasises the importance of the systems and infrastructures that support innovation. These, however, are influenced by many policy areas, in particular, research, education, procurement, taxation, intellectual property rights and competition policy. But these policy areas are not developed with innovation issues in mind, and the need to work together is not always recognised. The aim of the "third generation innovation policy" is to maximise the chances that regulatory reform will support innovation objectives, rather than impede or undermine them.

Below we provide a number of indicators (as at 2005) that can assist in contextualising South African technology transfer and diffusion efforts. We have chosen US figures for the indicators because that country's universities provide leadership in the field. However, it should be emphasised that local particularities (e.g. industrial research intensity) may affect the technology transfer activities of universities.

Figure 1 (below) shows the age profiles of US universities' technology transfer programmes, the majority of which are anything between eight and 24 years old. The longevity of the technology transfer offices / programmes is of importance because it is linked to their success – the longer the programme has been in existence the higher the chances of success.

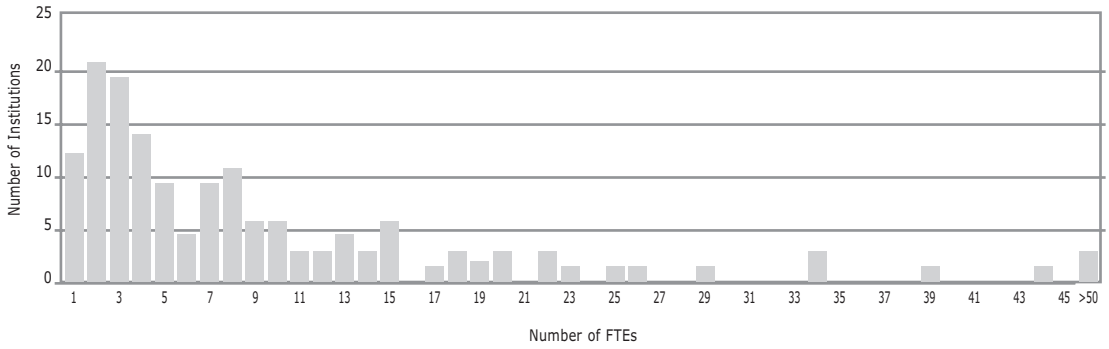
Figure 1: Technology transfer programme start dates of US universities – 2005



Source: Association of University Technology Managers (AUTM, 2005:16)

Figure 2 (below) shows the technology transfer office staffing levels at various US universities. Half of the respondents (76 of 151) reported having five (or fewer) staff members and a third of the respondents (53 of 151) reported having three (or fewer) staff members.

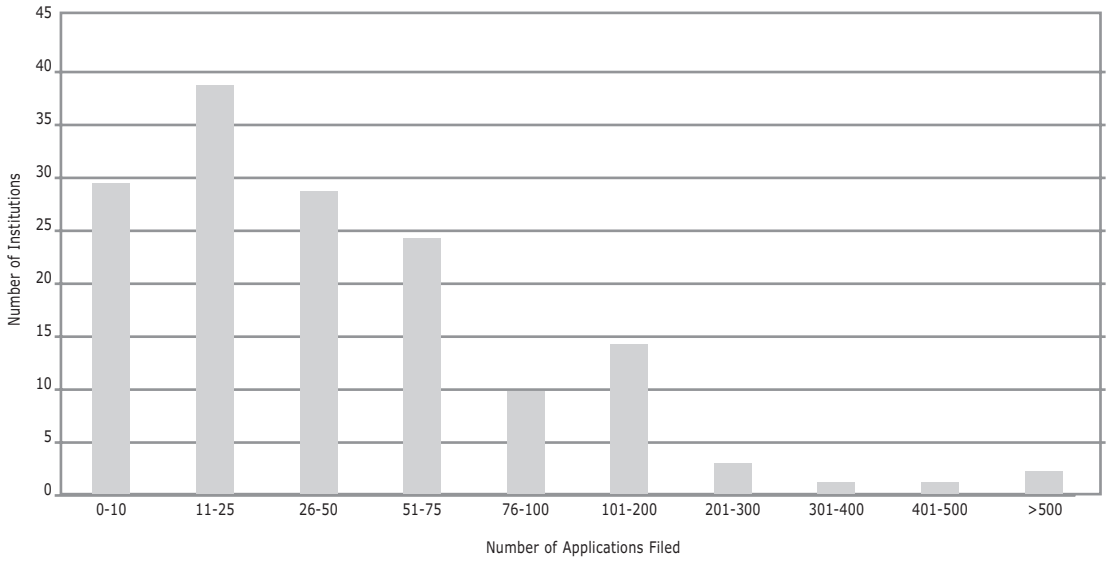
Figure 2: Technology transfer office staffing levels at US universities – 2005



Source: AUTM (2005:18)

Figure 3 (below) shows the number of new US patent applications filed by the US universities during 2005.

Figure 3: New US patent applications filed by US universities – 2005



Source: AUTM (2005:29)

3

ACADEMIC ENTREPRENEURSHIP IN SOUTH AFRICA

This section reports the findings of Survey 2007. This is the first survey that attempts to cover all 23 public universities in South Africa. While Survey 2006 covered only selected South African universities (cf. HESA, 2006:2), Survey 2007 followed international best practice according to examples in the UK and USA. In the UK, the Higher Education Funding Council for England (HEFCE) annually undertakes the *Higher Education–Business and Community Interaction Survey* and informs all relevant institutions accordingly. Similarly, the annual Licensing Survey of the AUTM collects relevant information for the USA and Canada.

Data Collection

The population for Survey 2007 consisted of the 23 public universities in South Africa. The surveyed universities were asked to complete a questionnaire that included opinions, issues of institutional strategy and infrastructure, and relevant indicators. The questionnaire was sent to universities (to those individuals responsible for research matters at the level of deputy vice-principal) during August 2007 and the last response was received during November 2007. Seventeen responses received from the 23 universities meant a response rate of 74%, which can be considered good; similar efforts abroad have lower response rates. For example, response rates for the AUTM Licensing Surveys in the USA and Canada tend to be 65% or lower (AUTM, 2005; 2006 and 2007).

Survey Results: Opinions

Figure 4 (below) provides graphic representation of the responses related to the opinion survey aspect of Survey 2007. The opinion survey questionnaire table indicated the statement and the possible range of responses in a five-step scale ranging from "strongly agree" to "strongly disagree".

Statement Q1 said: "Technology transfer is of high importance to our university". While 88% of the universities simply agreed or strongly agreed with the statement, only 6% strongly disagreed with the statement, with the remaining 6% not being sure.

However, only one in three of the universities agreed with statement Q2: "Technology transfer is of equal or higher importance than R&D in our university".

Slightly less than 50% of the universities agreed with statement Q3: "Technology transfer activities are financially rewarding for our university".

Eighty-eight per cent of the universities agreed with statement Q4: "Academic staff at our university is interested in technology transfer activities", and statement Q6: "Knowledge production in our university coincides with know-how required by industry".

However, the universities' opinions were split on statement Q5: "Staff members at our university do not have time to do technology transfer". Forty-one per cent of the universities agreed with the statement, while 41% disagreed.

A mixed picture emerged in response to the statements related to university incentives for technology transfer. Fifty-nine per cent of the universities agreed / strongly agreed with statement Q7: "There are adequate incentives supporting technology transfer in our university". However, only 24% agreed with statement Q8: "Technology transfer activities influence academic promotions in our university" – probably the most important incentive in the university environment.

The majority of the universities (70%) agreed / strongly agreed with statement Q9: "Our university has equipment and facilities that support technology transfer to industry", but two thirds of the universities disagreed with statement Q10: "Our university has adequate resources dedicated to supporting technology transfer activities". Seventy per cent of the universities disagreed with statement Q11: "Our university has adequate human resource capacity to support technology transfer activities".

Two thirds or more of the universities agreed with statement Q12: "Our university has strong links with industry", and with statement Q13: "Our university monitors the needs of industry and government".

Forty-one per cent of the universities agreed with statement Q14: "Industry lacks familiarity with technical work at our university".

The majority of the universities disagreed with statement Q15: "Industry in our region is not interested in R&D and technical know-how", while agreeing with statement Q16: "There is a critical mass of demands for technologies and technical competencies by industry in South Africa".

Concerning government support for co-operative R&D and innovation activities between industry and universities (statements Q17 and Q18), approximately two thirds of the universities identified that such support was inadequate and, from among them, 82% agreed with statement Q19: "Government incentives for academic research outweigh incentives for industrial research".

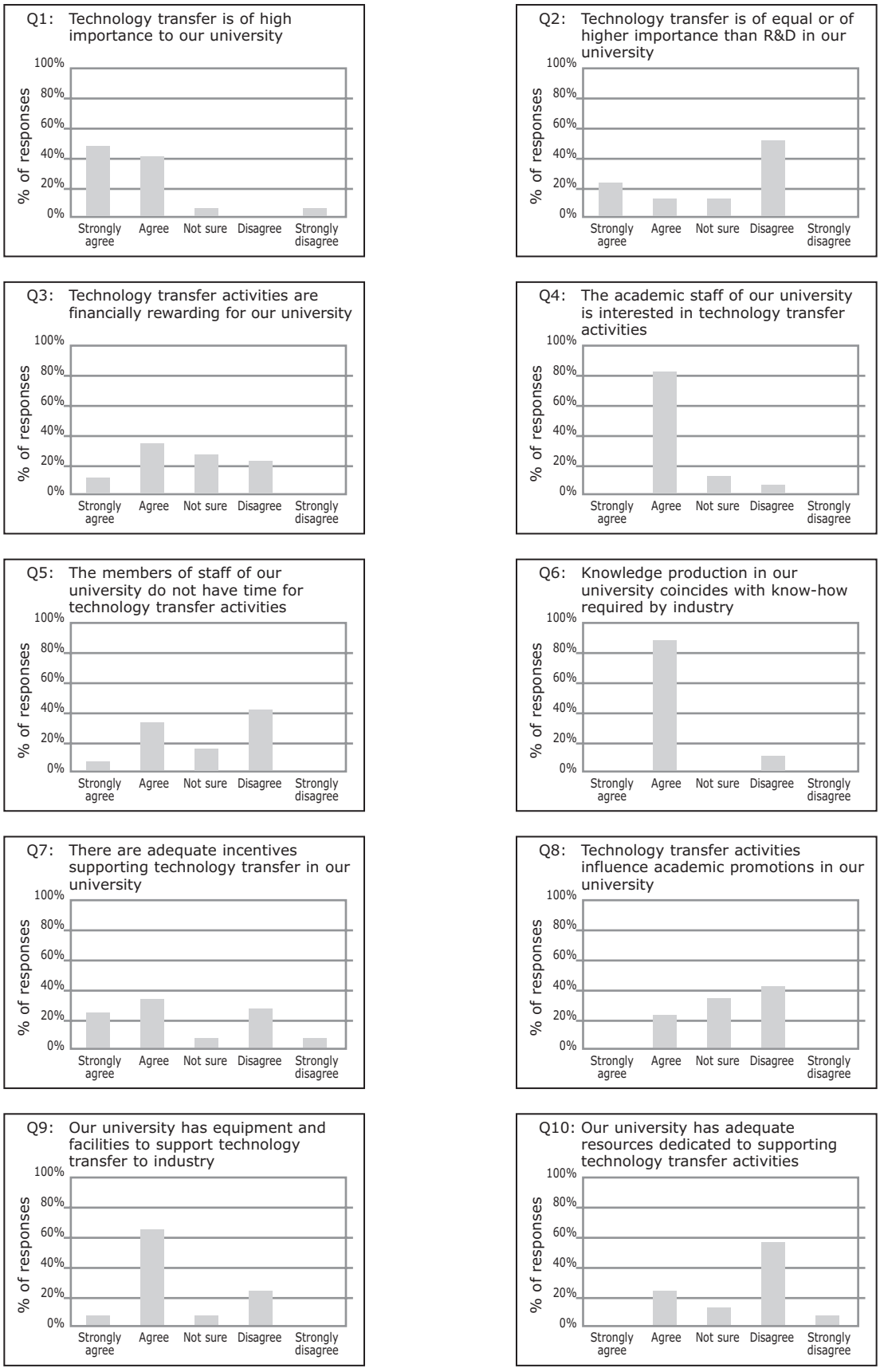
Only 12% of the universities agreed with statement Q20: "Government procurement policy is assisting universities to transfer technology and know-how to government departments and other organs of the state".

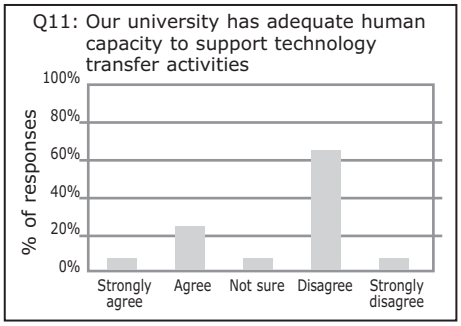
On statement Q21: "Government procurement in the country shapes demand for technological innovation", the responses indicated uncertainty. Five of the universities declared that they were not sure, while six agreed and six disagreed with the statement.

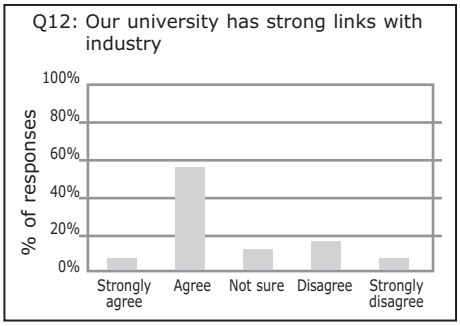
Forty per cent of the universities were not sure about statement Q22: "National intellectual property policies assist technology transfer from our university to industry".

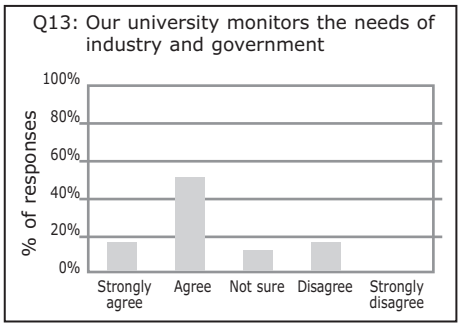
Only 24% of the universities agreed with statement Q23: "Competition by scientific councils (e.g. CSIR, MINTEK, HSRC) adversely affects university efforts to transfer technology and know-how to industry".

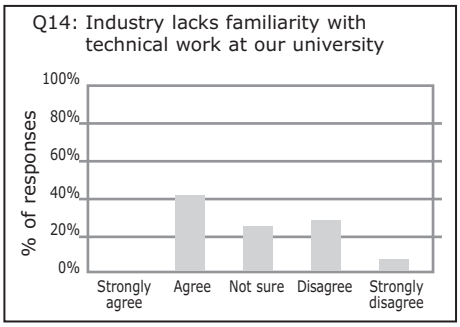
Figure 4: University opinions on technology transfer issues

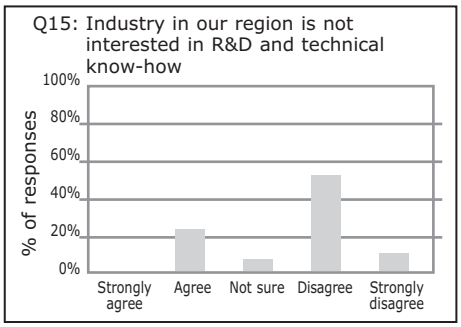


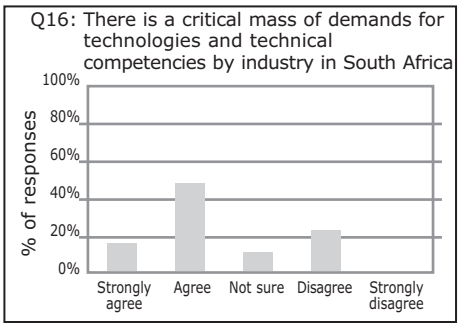

Q11: Our university has adequate human capacity to support technology transfer activities
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree

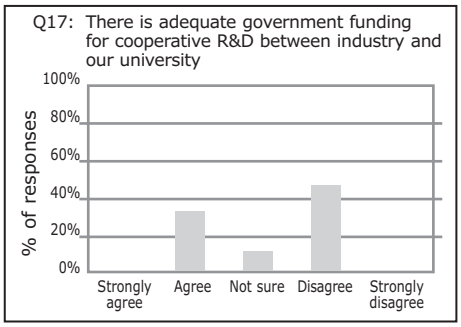

Q12: Our university has strong links with industry
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree

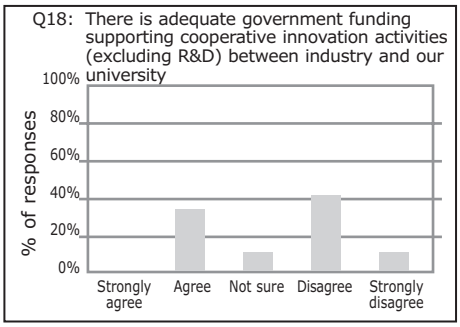

Q13: Our university monitors the needs of industry and government
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree

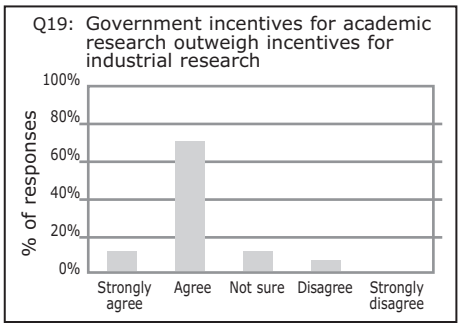

Q14: Industry lacks familiarity with technical work at our university
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree

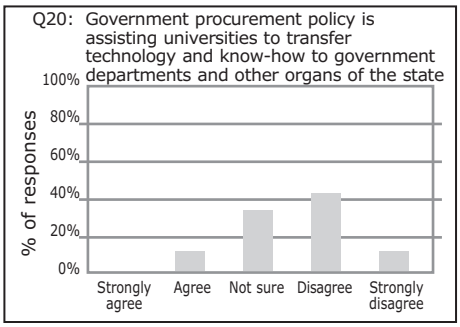

Q15: Industry in our region is not interested in R&D and technical know-how
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree

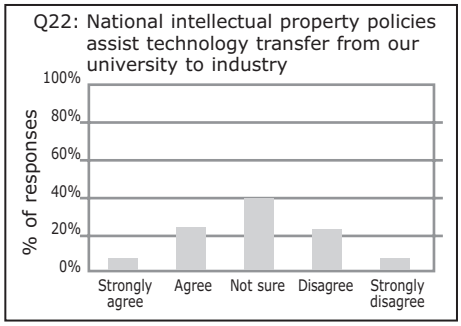

Q16: There is a critical mass of demands for technologies and technical competencies by industry in South Africa
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree

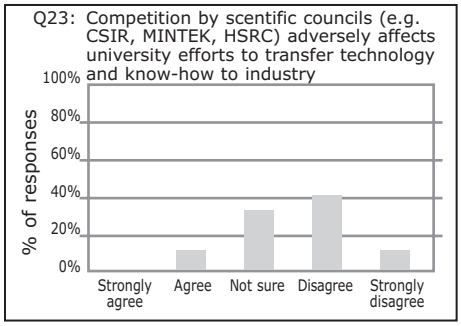

Q17: There is adequate government funding for cooperative R&D between industry and our university
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree


Q18: There is adequate government funding supporting cooperative innovation activities (excluding R&D) between industry and our university
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree


Q19: Government incentives for academic research outweigh incentives for industrial research
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree


Q20: Government procurement policy is assisting universities to transfer technology and know-how to government departments and other organs of the state
% of responses
100%
80%
60%
40%
20%
0%
Strongly agree
Agree
Not sure
Disagree
Strongly disagree





To summarise the responses:

- South Africa's public universities believe that they have the technological capabilities to transfer technology to industry and that technology transfer is of high importance to them. However, they are only partially persuaded that such activities are financially rewarding to them.

- Although more universities than was the case in Survey 2006 believe that they have internally adequate incentives promoting technology transfer, the majority of universities declared that technology transfer activities do not influence academic promotions.

- The universities declared that they are aware of industrial needs and that industry requires their services. However, they indicated that they do not have adequate human and other resources for technology transfer activities.

- The majority of universities declared that government does not provide enough resources for collaborative R&D and innovation activities between universities and industry.

- Eighty-eight per cent of the universities declared their belief that government procurement policy is not conducive to the transfer of technology and know-how to government departments and other organs of the state.

Survey Results: Institutional Strategy and Infrastructure

The second set of Survey 2007 questions aimed at identifying issues of institutional strategy and infrastructure related to universities' involvement in technology transfer.

Figure 5 (below) shows that 59% of the universities declared that technology transfer is part of the university's mission statement, while 41% stated that it is not.

Figure 5: Technology transfer as part of university's mission

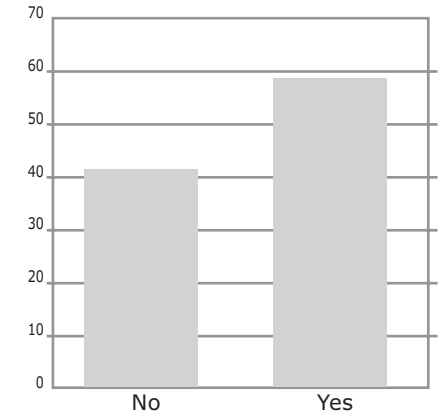


Figure 6 (below) shows the responses of universities concerning the availability of strategic plans related to business support. Only four of the 17 universities declared that they have relevant strategic plans that have been developed through an inclusive process across the whole university. It should be emphasised that a number of the universities hosting Tshumisano technology stations indicated that they do not have a relevant strategic plan in place or that a plan is in existence but is only partially functional.

Figure 6: Types of strategic plans for business support

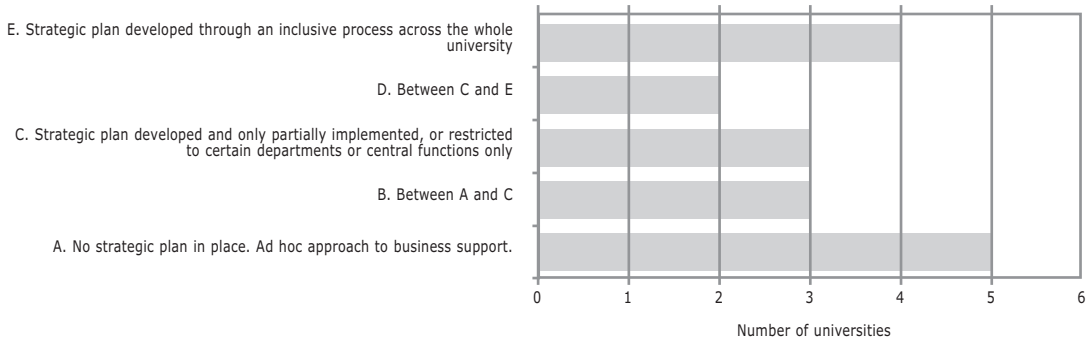


Figure 7 (below) shows that 14 of the 17 universities participating have an intellectual property policy.

Figure 7: Existence of intellectual property policy at the universities

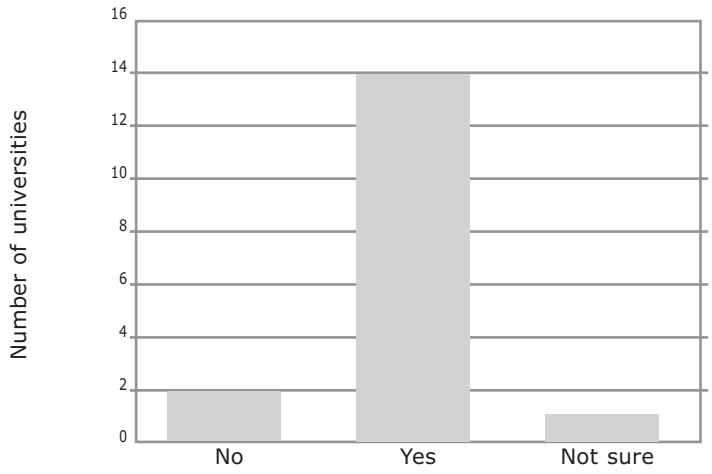


Table 1 (below) shows the distribution of royalties from intellectual property to university, faculty / department and inventor respectively. The last row shows the percentage allocated to a particular stakeholder in the median university. In the median university, 50% of the royalties are allocated to the inventor.

Table 1: Distribution of royalties within the universities

Royalties intellectual property %			
University	Faculty/Department	Inventor	Total
0.10	0.10	0.80	2
0.20	0.50	0.30	1
	0.20	0.40	1
0.25	0.15	0.60	1
	0.25	0.50	2
0.30		0.70	1
	0.30	0.30	2
0.33	0.33	0.33	3
0.50		0.50	1
Median 0.275	0.250	0.50	14

Only seven of the universities declared that they provide incentives to encourage their academics to participate in the NRF evaluation and rating programme. Certain universities link salaries and promotions to NRF rating while others provide a salary supplement or a one-off amount for the account of the individual researcher.

Sixteen of the 17 universities declared that they provide incentives for their academics to produce research publications. Table 2 (below) shows how the universities distribute incentives to authors and faculties respectively as a percentage of the total subsidy that they receive for each publication from the DoE. Survey 2007 found that the median university offers 25% of the received incentive to the authors (either in their research account or as part of their salary), while 30% of the received incentive goes to faculties / departments for research promotion.

Table 2: Distribution of publication incentives within the universities

Incentives publications %		
University	Faculty/Department	Author
0.00	0.30	0.70
0.00	0.75	0.25
0.10	0.90	
0.20	0.40	0.40
0.50		0.50
0.55	0.20	0.25
0.60	0.10	0.30
0.70		0.20
0.86		0.14
0.88	0.06	0.06
0.90		0.10
Median 0.60	0.30	0.25

Ten of the universities declared that they provide incentives for patents and technology transfer activities, while seven indicated that they do not.

Figure 8 (below) depicts the total number of staff at those universities that declared that they have dedicated staff for a business and community function. It should be emphasised that only six of the universities declared that they have staff dedicated accordingly.[3]

Figure 8: Number of staff in a dedicated business and community function

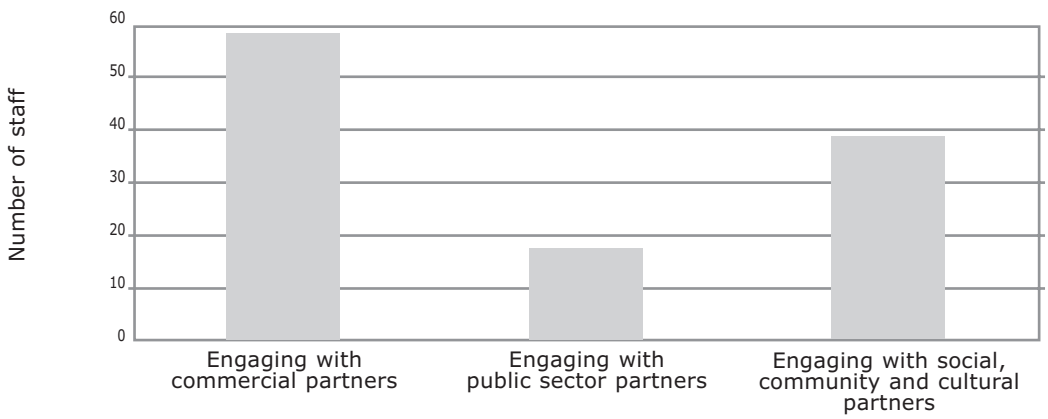


Figure 9 (below) shows the responses received to the question of whether the university has in-house capability to seek out licensing opportunities for its intellectual property or whether it uses an external agency. Nine of the universities declared that they have internal capability, while five stated that they use external agencies.

Figure 9: University capability to seek out licensing opportunities

University capacity to seek out licensing opportunities

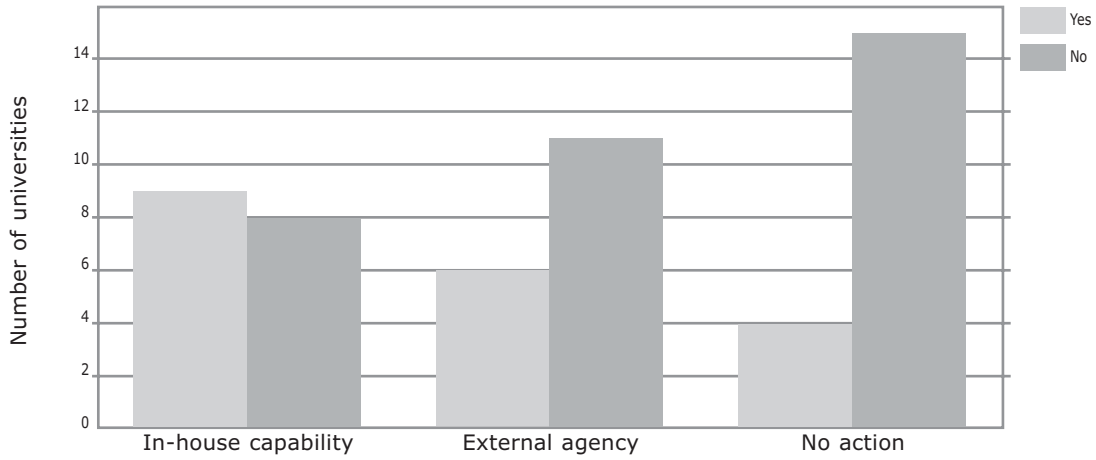


Figure 10 (below) shows the support services available in South African universities. Six of the universities declared that they have an inquiry point for SMEs, and eight declared that they have units assisting SMEs in specifying their needs. Eleven of the universities declared that they have a contracting system for staff interaction activities with business and community, while 11 declared that they have indemnity insurance for their staff.

Figure 10: Dedicated units to provide support services for SMEs

University capacity to seek out licensing opportunities

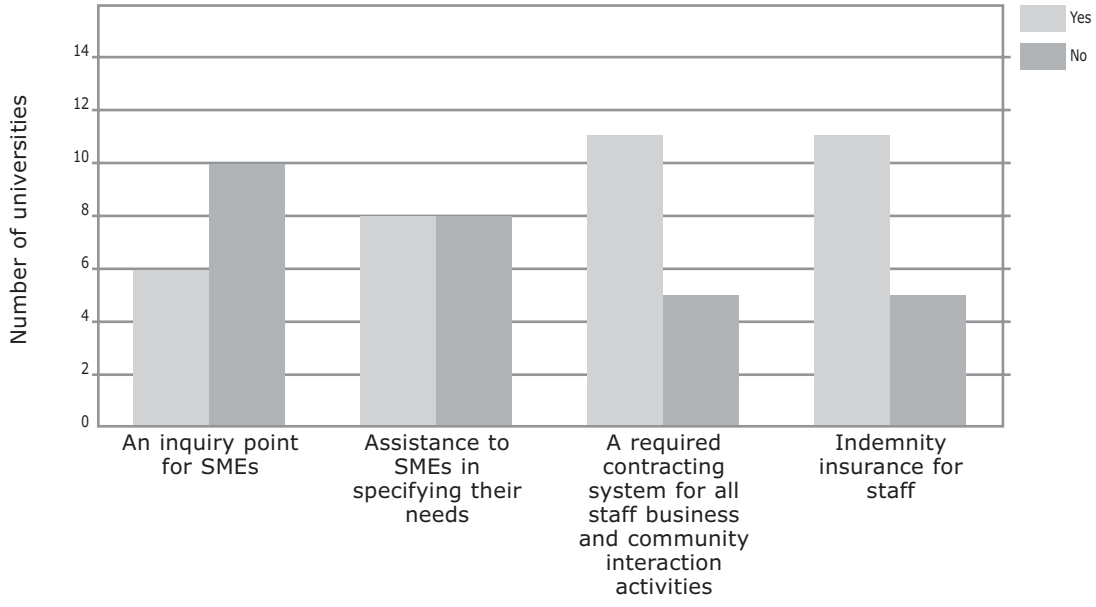
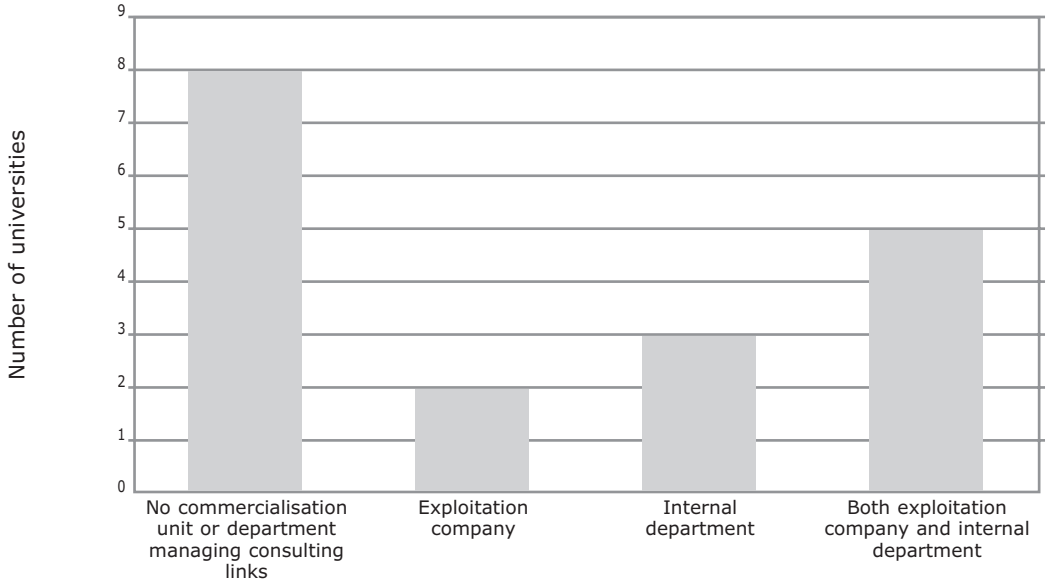


Figure 11 (below) shows that eight of the 17 universities participating in the survey do not have a commercialisation unit or department managing consulting links.

Figure 11: Availability of structures for the management of external interactions



Analysis of the age profiles of the structures established to manage consulting links and other external relations identified that 50% of the structures were established after 2003, with the oldest having been established in 1996.

Table 3 (below) shows business and community representation on the governing bodies of the universities. Survey 2007 found that the responding universities collectively have 345 board members, with only 84 (24%) of these being drawn from commercial business.

Table 3: Membership of universities' governing bodies

	No. of members	% members
Members from commercial business	84	24%
Members from social and community groups	33	10%
Members from public sector organisations	60	17%
Others	168	49%
Total members in governing body	345	

Figure 12 (below) shows the reporting requirements with regard to the creation of different types of intellectual property in the various universities. Only a small number of the universities require of their staff that they report the creation of intellectual property.

A similar picture appears in figure 13 (below), which shows the support provided for spin-offs by the universities.

Figure 12: Frequency of reporting of the creation of different types of intellectual property

Reporting of the creation of different types of intellectual property

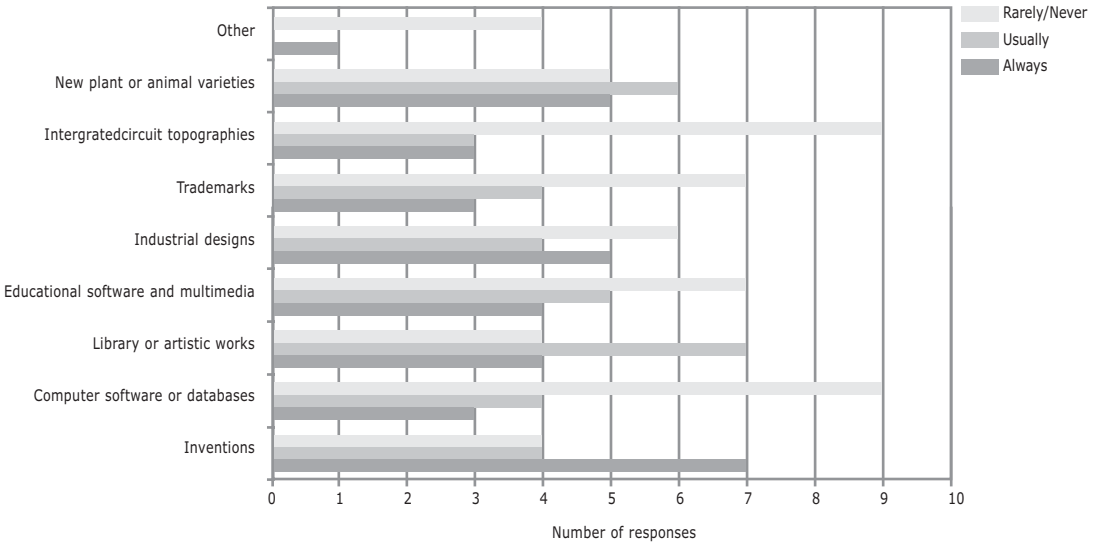
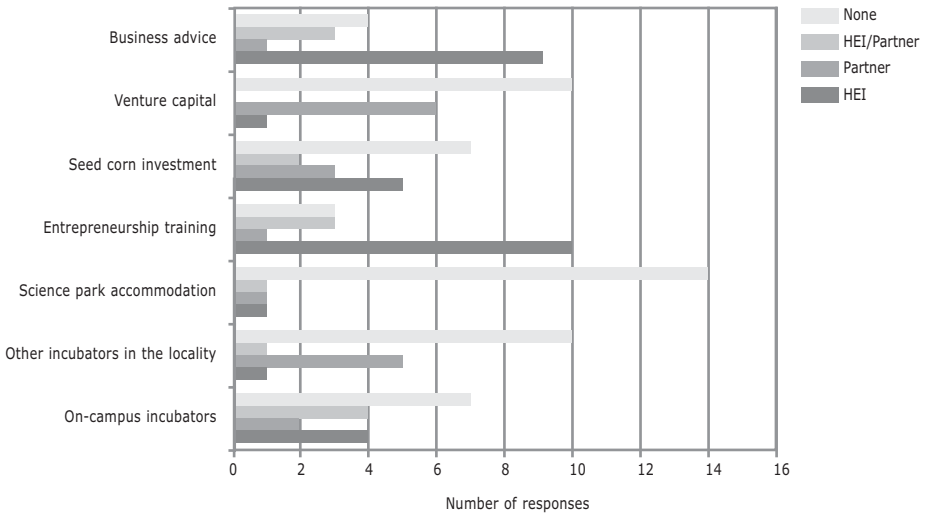


Figure 13: Availability of mechanisms supporting spin-offs

Support for spin-offs through a variety of mechanisms provided by the university or in collaboration with a partner organisation



Survey Results: Indicators

Figure 14 (below) shows the age profile of technology transfer offices in South African universities. The statement was (Q1): "In which year did your university dedicate at least 0.5 Professional FTE toward technology transfer activities?". Technology transfer offices that at that point existed only on paper were therefore excluded. The figure shows that 50% of the offices were created after 2003, with the oldest having been created in 1996.

Figure 14: Age profile of technology transfer support at universities

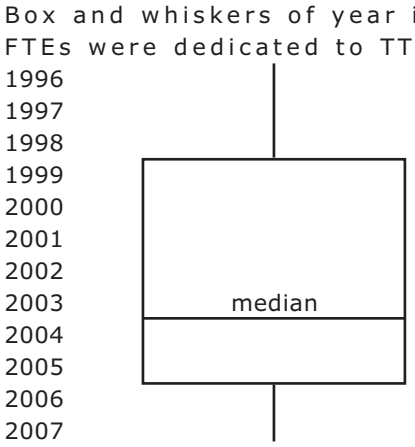


Table 4 (below) shows the total Full-time Equivalent (FTE) number of licensing officials and total number of staff employed in the technology transfer offices of the universities. The table also shows the average and median numbers. While the figures appear to be on the increase (from 2005 to 2006) they are still very low. In addition (not evident from the table below), the increase in numbers appears to have taken place only in some universities and not in others.

Table 4: Staff employed in technology transfer offices – 2005 and 2006

	Licensing FTEs in technology transfer offices		Total FTEs in technology transfer offices	
	2005	2006	2005	2006
Total	5.25	9.25	5.25	11.75
Average	0.525	0.841	0.455	1.175
Median	0	0.25	0	0

The universities were asked to indicate the total amount that they spend on research per annum. Further, they were requested to indicate how much research expenditure is obtained from government funds versus industrial sources. Fourteen of the universities provided the requested figures. They reported research expenditure of R165 billion, of which R573 million (34%) comes from government and R442 million (27%) from industrial sources. These figures reflect an unusually high contribution from industrial sources.

According to the OECD, "this degree of connection between industry and the university sector is very high in international terms and constitutes an unusual asset" (OECD, 2007c:191). Indeed, in the USA the total research support from industry towards R&D varies between 7% and 10%, with federal government's contribution varying between 62% and 68% (AUTM, 2007:20). It is fair to assume that the US federal government's contribution to university research in the USA is much higher than the contribution by the South African government (34%) to South African university research expenditure. Could it be that the South African universities' unusually high level of reliance on business funding arises from government's failure to provide sufficient research support?

Figure 15 (below) shows the information obtained with regard to licences executed and active during 2005 and 2006 for the whole of the South African university system. The trend appears to be one of increase, albeit from a low base.

Figure 15: Active and executed licences – 2005 and 2006

Licences / options executed and active (2005 and 2006)

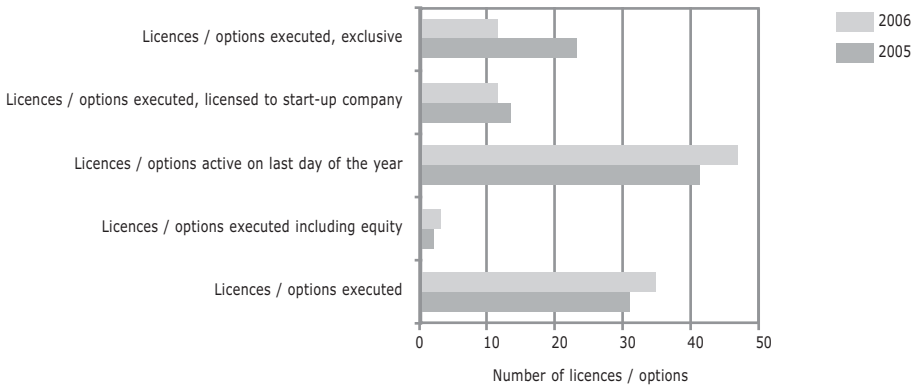


Figure 16 (below) shows the number of licences yielding income, and figure 17 (below) shows the amounts received from licence income, education activities, and consultancy.

Figure 16: Number of licences yielding income – 2005 and 2006

Licences / options executed and active (2005 and 2006)

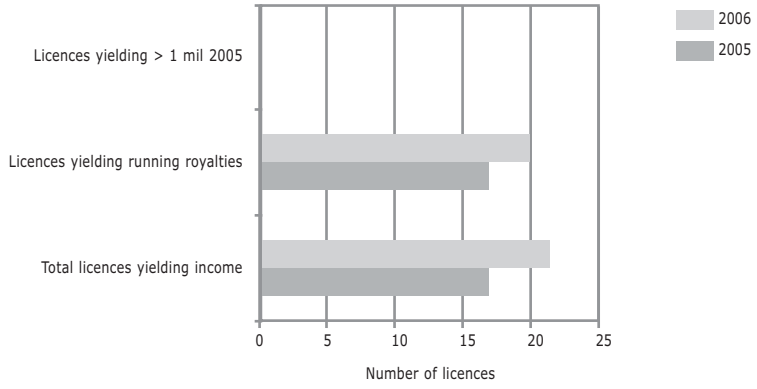


Figure 17: Licensing income from technology transfer activities – 2005 and 2006

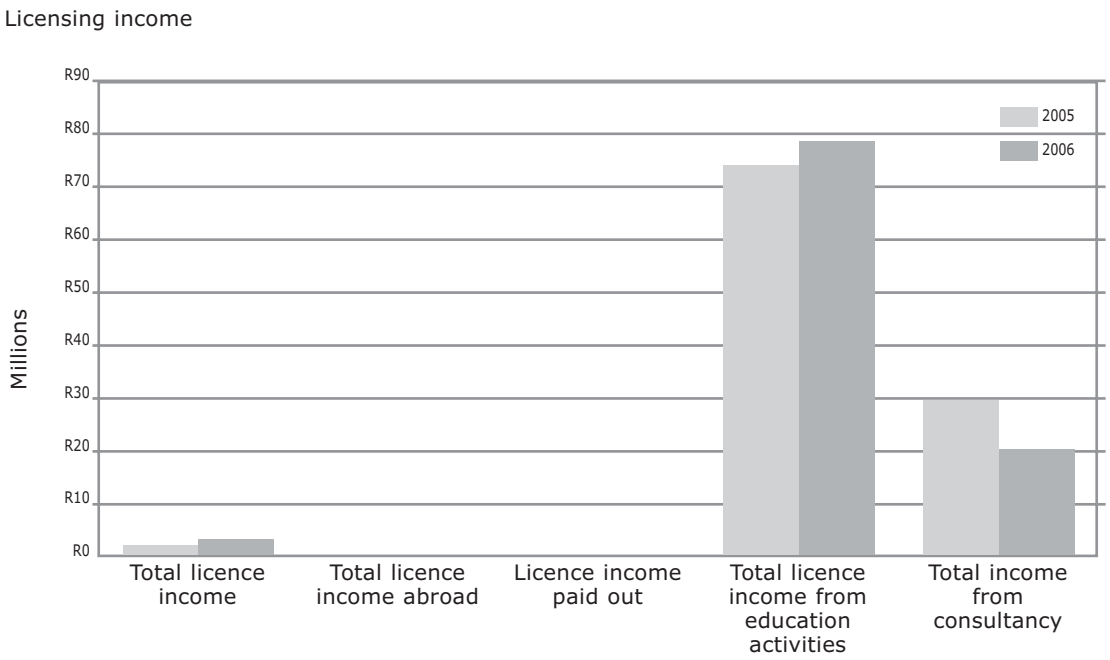


Figure 18 (below) shows the number of invention disclosures of different types received by the universities during 2005 and 2006. Patentable invention disclosures were the most prevalent category. The universities declared that they received fewer disclosures during 2006 than 2005.

Figure 18: Invention disclosures – 2005 and 2006

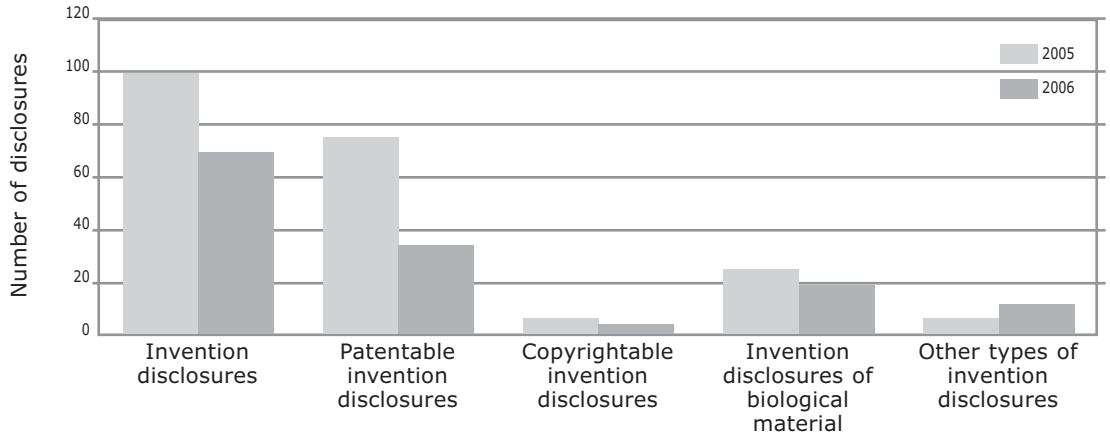


Figure 19 (below) shows levels of activity with regard to patents at the South African universities, for the two years 2005 and 2006. Noticeable is the increase, from 2005 to 2006, in the number of patents filed abroad. Table 5 (below) shows the average and median number of patents in South African universities for the years 2005 and 2006.

Figure 19: Patent activity – 2005 and 2006

Patents at SA and foreign patent offices

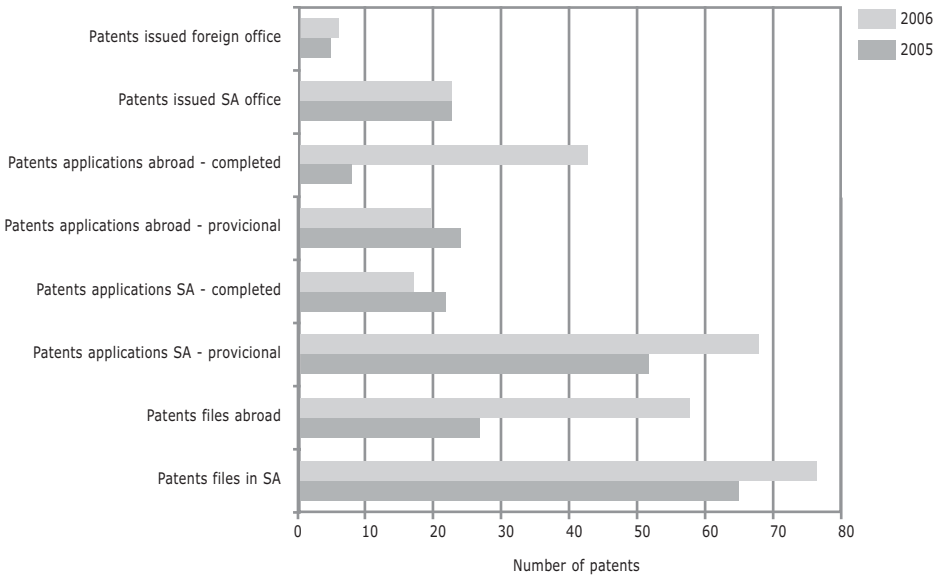


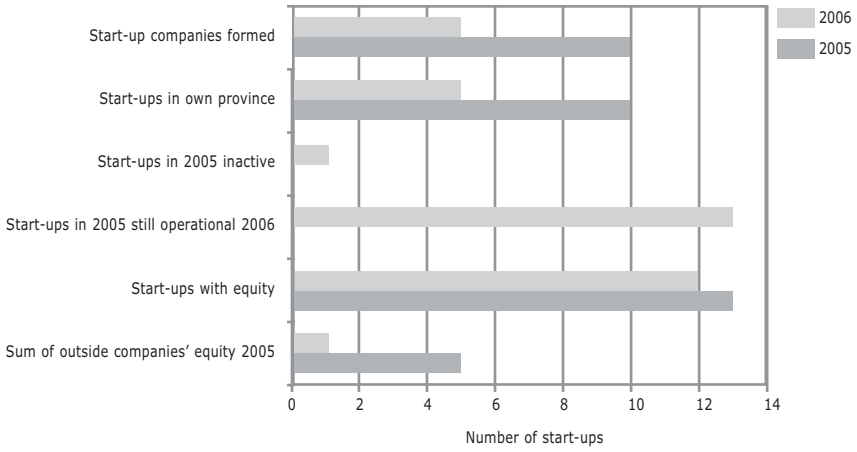
Table 5: Average and median number of patents in South African universities – 2005 and 2006

	Average	Median
Patents filed SA 2005	4.92	3.00
Patents filed SA 2006	5.43	3.00
Patents filed abroad 2005	2.33	1.00
Patents filed abroad 2006	4.46	1.00
Patent applications SA provisional 2005	4.25	2.50
Patent applications SA provisional 2006	4.53	2.00
Patent applications SA complete 2005	1.91	1.00
Patent applications SA complete 2006	1.50	1.00
Patent applications abroad provisional 2005	2.40	1.50
Patent applications abroad provisional 2006	2.00	1.00
Patent applications abroad complete 2005	0.88	0.00
Patent applications abroad complete 2006	4.20	1.00
Patents issued SA office 2005	2.09	1.00
Patents issued SA office 2006	1.77	1.00
Patents issued foreign office 2005	0.56	0.00
Patents issued foreign office 2006	0.67	0.00

Figure 20 (below) shows levels of start-up activity at South African universities. The universities appear to have had fewer related activities in 2006 than in 2005. It can be speculated that this is the result of the request for comments on the IP framework document (DST, 2006), which could have created uncertainty. However, there is no way of ascertaining proof for this speculation.

Figure 20: Start-up activity – 2005 and 2006

Start-up companies by universities



4

DISCUSSION AND RECOMMENDATIONS

Technology transfer and diffusion from universities has become a preoccupation of policy authorities internationally. The possibility of additional beneficial resources for the universities, and technology transfer as a means to improve the public good – that is, to create the greatest possible economic and social benefits from research, whether or not such benefits accrue to the university – are the underlying factors fuelling this interest.

The characterisation of technology transfer as public good has policy implications. While individual universities may or may not be interested in maximising public good, policy authorities have the responsibility and duty to do so.

In South Africa, technology transfer and diffusion appears to have started to take root. Most of the country's universities include technology transfer in their mission statement and have established relevant supporting structures. Two of the universities declared that they had established technology transfer offices during the course of 2006. The national effort, however, appears to be in the embryonic stages of development. After all, this report on technology transfer and diffusion is the first covering *all* of the public universities in South Africa.

The *opinion survey* aspect of Survey 2007 identified a number of deficiencies at the policy level. Probably the most important deficiencies are related firstly to lack of adequate human and other resources for technology transfer activities; secondly to the lack of resources for collaborative research and innovation activities between universities and industry; and thirdly to the obstacles that government procurement policy presents to universities in their efforts to offer their services to government departments and other organs of the state.

These findings are in accordance with those of Survey 2006:

> South Africa still operates its national system of innovation on the basis of a second generation innovation policy paradigm, which emphasises the importance of systems and infrastructures that support innovation. The third generation innovation policy paradigm makes innovation a government-wide policy and aims to maximise the chances that regulatory reform in other domains (e.g. government procurement, competition etc.) will support innovation objectives, rather than impede or undermine them. The example of procurement in South Africa is indicative of the failure to monitor the effect of regulatory reform on innovation. (HESA, 2006:29)

More specifically, the argument is that by being a more intelligent customer and by being more open to new approaches from the outset, government is able to stimulate the market for innovative products and encourage the growth of innovative and dynamic industries. Government can also provide a means of demonstrating new products, processes and services, and help to justify investment in new skills, equipment and R&D (DTI, 2005).

An example of the South African government falling short in this regard has been captured in the report of Survey 2006:

> In South Africa, not only is procurement policy not utilised for the benefit of local scientific and technological growth but, in contrast with other countries, procurement is isolating government from the beneficial effects of its interaction with the higher education sector (and vice versa).
>
> *Preferential Procurement Policy Framework Act No. 5, 2000* presents an obstacle in the efforts of universities to offer their services to government and other organs of the state and of government to promote innovation through procurement. More specifically, paragraph 13 (5) (a) of the Act states that "Preference points may not be awarded to public companies and tertiary institutions". As a consequence, universities tendering for government tenders are at a disadvantage compared to other competing institutions. In effect, this regulation advocates that government departments and state organs under *ceteris paribus* conditions should prefer to award tenders to and accept advice from private sector consultants rather than academics. (HESA, 2006:19)

The above regulation, furthermore, undermines the DST's efforts to manage the intellectual property produced with public resources and presents an obstacle to universities in co-ordinating their efforts in their interactions with their potential clients.

In Survey 2007, the section related to issues of *institutional strategy and infrastructure* showed that the higher education sector in South Africa is in the early stages of institutionalising technology transfer and creating the necessary infrastructure. Approximately 60% of the universities include technology transfer in their mission statement and 80% have an intellectual property policy. However, only a few of the universities have regulations requiring their staff to declare different types of intellectual property that they produce and only four of the universities declared that they have comprehensive strategic plans for business support. In this context it is interesting to note that some of the universities in which the Tshumisano Trust invests resources and establishes technology stations are not committed and well organised in the sense of having institution-wide strategic plans for business support. It can be argued that the technology stations will not be able to reach their full potential in universities that have not officially adopted technology transfer and lack relevant strategic plans.

The issue of unbalanced incentives was identified as being of importance both in the *opinion survey and institutional strategy and infrastructure survey* sections of Survey 2007. Sixteen of the 17 universities offer incentives to their staff for research publications but only ten of the universities offer incentives for patents. Furthermore, research publications offer guaranteed returns for the researcher (e.g. 30% of the approximately R85 000 that the universities receive from the DoE per publication), while inventors, by contrast, receive a return on their effort not when their patent is granted but when their invention starts delivering financial returns.

The university responses indicated that only 24% of governing body members are drawn from commercial business. While low, this figure is higher than the 17% declared by participating universities in Survey 2006 (HESA, 2006:25), which were mostly universities of technology. The lower figure for Survey 2006 could be interpreted to mean that universities of technology are less influenced by commercial concerns than other universities. It should be emphasised that the relevant figure in the UK universities is 34% (HESA, 2006:29).

The section of Survey 2007 on *indicators* has provided a set of statistics that can be utilised for benchmarking purposes in monitoring the progress of the universities, over time, in the field of technology transfer and diffusion. The same figures can be employed to compare the local universities with universities abroad.

The first set of indicators relates to the number of staff and age of the office of technology transfer. Both factors affect the performance of a university in implementing its mission in the field of technology transfer. It takes time for a successful academic technology transfer programme to provide staffing, develop key campus relationships and foster an appropriate culture.

The technology transfer offices of South African universities are relatively young and under-staffed. The age of the median office is three years and the median university has 0.25 FTE licensing officials, while the average number of staff is 1.17. In contrast, most of the technology offices in the US universities were created during the period 1983 to 1999 and are therefore anything between eight and 24 years old. Similarly, half of the respondents (76 of 151) in the USA reported having five (or fewer) staff members and a third of the respondents (53 of 151) reported having three (or fewer) staff members.

Invention disclosures (figure 18) and start-up companies (figure 20) appear to have been reduced in number in 2006 compared to the previous year. It can be speculated that this decline is the result of uncertainty created by the introduction of the draft *Intellectual Property Rights from Publicly Financed Research Framework* (DST, 2006). Individual researchers and university authorities may be adopting a conservative approach to decision-making, preferring to see the results of the new legislation before committing to new ventures.

Finally, the relatively small number of patent applications from South African universities should be noted. A large number of individual universities in the USA produce more patents than all of the South African universities together (see figure 3, above, for the US figures for 2005). Lack of support for technology transfer activities and the character of South Africa's universities – emphasising undergraduate teaching and social sciences and humanities research – contribute to this phenomenon.

The above findings lead to the following recommendations:

1. HESA has accepted the responsibility of monitoring technology transfer activities in South Africa's universities and making the relevant findings public knowledge. This report testifies to the above. The experience in developing this report indicates that university respondents are better prepared and are able to report with greater ease when the effort is undertaken annually. Future research efforts in this area could benefit from the inclusion of case studies of successful industries that have been created in the process of technology transfer from the universities. An additional front on which HESA should focus its efforts is monitoring of the regulatory environment and the identification of constraints whose alleviation could benefit the NSI. Such actions would be in accordance with HESA's strategic plan for 2006-2008. According to the strategic plan, one of the four key roles that the HESA executive office has to fulfil is that of Strategic Research and Policy Analysis. The focus of this role has been conceived as follows:

    - To strengthen the existing Higher Education knowledge base.
    - To actively participate in, and influence the direction of, policy development.
    - To monitor and evaluate the current policy and regulatory environment, particularly in terms of alignment.
    - To generate position papers that are useful and accessible to Higher Education leaders and decision-makers.
    - To develop policy analyses that are relevant and authoritative on key Higher Education issues.
    - To facilitate sector discussion and expert input to these issues by relevant networks.
    - To provide up-to-date and factual information for and about South African Higher Education institutions. (HESA, 2007:12)

In this context, areas of concern that have been identified in this document are the issues of government procurement and incentivisation of international patents. Both issues have also been referred to in HESA (2006:19 & 30). HESA should develop position documents accordingly and submit them to the relevant government departments (e.g. Treasury, DoE etc.).

2. Tshumisano Trust and the NRF are institutionalised policy instruments aimed at promoting technology transfer and research respectively in the higher education sector. In achieving their objectives, however, both institutions fail to exert their full potential influence. Their current approaches create isolated islands of influence (individual researchers and/or technology stations), operating in environments not always conducive to their objectives. Both institutions – Tshumisano Trust and the NRF – could request that each benefiting university harmonise its policies with those advocated by the funding body. For example, Tshumisano Trust could request that the universities hosting technology stations develop university-wide relevant strategic plans and that they aim to increase the number of governing body members drawn from the industrial and commercial sectors. In Survey 2006 (HESA, 2006), it was recommended that the Tshumisano Trust expand its activities across all universities. Although new stations were not developed during 2006, it would appear that the board of Tshumisano Trust has accepted this recommendation.

3. During the course of 2006, the DST requested comments on its draft IP framework (DST, 2006), which resulted in the *Intellectual Property Rights from Publicly Financed Research Bill* (DST, 2007b). The process of developing the Bill appears to had have a dual impact on the higher education sector. On the one hand a beneficial effect has been the establishment by the majority of the universities of their own intellectual property rights regulations, mainly along the lines advocated by the framework and subsequent Bill. On the other hand the number of disclosures and start-ups from universities appears to have been affected negatively. This could have been as a result of the uncertainty introduced by the process. The Bill has also been criticised both for being punitive and paying little attention to linking incentives to compliance and performance. At this stage of development of the NSI any such bill should be enabling in character and should provide support for the introduction of the culture of technology transfer at the universities in South Africa. In this context, among the top priorities should be support for the establishment of technology transfer offices and their appropriate staffing.

4. Universities are over-dependent on industrial funding for their research and development activities. This dependency creates concerns for the universities. Will they be able to support and maintain their research activities in the event of a downturn in the economy? How will industrial funds affect the university character in the long run? What will be the consequences of the replacement of direct incentives (e.g. THRIP) with indirect ones (e.g. tax incentives for R&D)? HESA, as the voice of South Africa's universities, should make representations to the relevant government departments, such as the DoE and the dti, with the objective of increasing the government component of research support.

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APPENDIX 1:
Technology Transfer & Diffusion: Capacity & Potential in South Africa's Public Universities

HESA Questionnaire

This survey is undertaken on behalf of Higher Education South Africa (HESA) and it aims to identify obstacles to technology transfer and the state of technology transfer from universities to industry and government in South Africa.

For the purposes of this effort, technology transfer is defined as the movement of know-how, technical knowledge or technology from one organisational setting to another.

Please complete this questionnaire by typing over the grey areas, and return it by *25 September 2007* to Wilna Venter at wilna@hesa.org.za. If you have any queries, please contact Wilna Venter at (012) 481-2935.

OPINION SURVEY

Name of institution: Name of person completing this section: Telephone: email:

1. Technology transfer is of high importance to our university ■ strongly agree ■ agree ■ not sure ■ disagree ■ strongly disagree
2. Technology transfer is of equal or of higher importance than R&D in our university ■ strongly agree ■ agree ■ not sure ■ disagree ■ strongly disagree
3. Technology transfer activities are financially rewarding for our university ■ strongly agree ■ agree ■ not sure ■ disagree ■ strongly disagree
4. The academic staff of our university is interested in technology transfer activities ■ strongly agree ■ agree ■ not sure ■ disagree ■ strongly disagree
5. Staff members at our university do not have time to do technology transfer ■ strongly agree ■ agree ■ not sure ■ disagree ■ strongly disagree
6. Knowledge production in our university coincides with know-how required by industry ■ strongly agree ■ agree ■ not sure ■ disagree ■ strongly disagree

7. There are adequate incentives supporting technology transfer in our university ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
8. Technology transfer activities influence academic promotions in our university ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
9. Our university has equipment and facilities to support technology transfer to industry ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
10. Our university has adequate resources dedicated to supporting technology transfer activities ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
11. Our university has adequate human resource capacity to support technology transfer activities ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
12. Our university has strong links with industry ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
13. Our university monitors the needs of industry and government ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
14. Industry lacks familiarity with technical work at our university ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
15. Industry in our region is not interested in R&D and technical know-how ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
16. There is a critical mass of demands for technologies and technical competencies by industry in South Africa ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
17. There is adequate government funding for co-operative R&D between industry and our university ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
18. There is adequate government funding supporting co-operative innovation activities (excluding R&D) between industry and our university ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
19. Government incentives for academic research outweigh incentives for industrial research ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
20. Government procurement policy is assisting universities to transfer technology and know-how to government departments and other organs of the state ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
21. Government procurement in the country shapes demand for technological innovation ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
22. National intellectual property policies assist technology transfer from our university to industry ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree
23. Competition by scientific councils (e.g. CSIR, MINTEK, HSRC) adversely affects university efforts to transfer technology and know-how to industry ☐ strongly agree ☐ agree ☐ not sure ☐ disagree ☐ strongly disagree

INSTITUTIONAL STRATEGY AND INFRASTRUCTURE

Name of institution:
Name of person completing this section:
Telephone: email:

1. Is technology transfer part of your university's mission statement? YES ■ NO ■

2. Does your university have a strategic plan for business support (Please tick one):
   a. No strategic plan in place. Ad hoc approach to business support ■
   b. Between a & c ■
   c. Strategic plan developed and only partially implemented, or restricted to certain departments or central functions only ■
   d. Between c & e ■
   e. Strategic plan developed as a result of an inclusive process across the whole university. Accepted across almost all units and recommendations implemented. Use of plan to set targets and monitor achievement. ■

3. Does your university have an intellectual property (IP) policy? YES ■ NO ■

4. How are royalties from IP divided among the inventor, department / college of inventor and the university?
   % University
   % Faculty / department
   % Inventor

5. Does your university provide incentives to academics for evaluation by NRF? YES ■ NO ■
   If yes, please describe:
   .....
   .....
   .....
   .....
   .....

6. Does your university provide incentives to academics for publications? YES ■ NO ■
   If yes, please describe:
   .....
   .....
   .....
   .....
   .....
   % University
   % Faculty / department
   % Author

7. Does your university provide incentives to academics for patents and/or technology transfer activities? YES ■ NO ■
   If yes, please describe:
   .....
   .....
   .....
   .....
   .....
   .....

8. How many of your university's staff are employed in a dedicated business and community function (Full-time Equivalent)?
   - Engaging with commercial partners
   - Engaging with public sector partners
   - Engaging with social, community and cultural partners
   - TOTAL

9. Does your university have an in-house capability to seek out licensing opportunities for its intellectual property, or does it use an external agency? (Please indicate the principal method only.)
   - Yes, in-house capability
   - Yes, external agency
   - No action taken

10. Does your university have a central dedicated unit, which provides any of the following? (Tick all boxes that apply.)
    - An enquiry point for SMEs
    - Assistance to SMEs in specifying their needs
    - A required contracting system for all staff businesses and community interaction activities
    - Indemnity insurance for staff

11. Does your university have a commercialisation company or department to manage consulting links and other external interactions?
    - No
    - Yes, exploitation company
    - Yes, internal department
    - Yes, both

12. When was the internal department established (year) for question 9 in this section?

13. Business and community representation on your university's governing body:
    - Total number of members on governing body
    - Number that are from commercial business
    - Number that are from social, community and cultural groups
    - Number that are from public sector organisations

14. Is there a requirement within the university to report the creation of the following types of intellectual property? (Tick one box for each type.)

	Always	Usually	Rarely / Never
Inventions			
Computer software or databases			
Library or artistic works			
Educational software & multimedia			
Industrial designs			
Trademarks			
Integrated circuit topographies			
New plant or animal varieties			
Other			

15. Does the university offer support for spin-offs through the following mechanisms, either provided by the university or in collaboration with a partner organisation?

	University	Partner	Both	None
On-campus incubators				
Other incubators in the locality				

	University	Partner	Both	None
Science park accommodation				
Entrepreneurship training				
Seed corn investment				
Venture capital				
Business advice				

INDICATORS SURVEY

1. In which year did your university dedicate at least 0.5 Professional FTEs toward technology transfer activities?

2. How many licensing FTEs were employed in your technology transfer office in
   2004? 2005?

3. What is the highest qualification of each person in (2) above?
   Please enter as necessary

4. How many other FTEs were employed in your technology transfer office in
   2004? 2005?

5. What is the annual amount of research expenditures (include direct and indirect costs) for your university?

	2004	2005
Total research expenditures		
Research expenditure from government funds		
Research expenditure from industrial sources		

6. Licenses / options

	2004	2005
How many licences / options did your university execute in the years shown?		
How many licences / options, executed in 2006, included equity?		
How many licences / options were active as of the last day of the years shown?		
How many of the licences / options executed in the years shown were licensed to start-up companies?		
How many of these licences / options executed in the years shown were exclusive?		

7. How much research funding was committed to your university in 2006 (includes multi-year commitments) that was related to licence or option agreements executed in 2006 or that was related to licence or option agreements executed in a prior year (e.g. as a result of a research agreement renewal)?

8. Licensing income

	2004	2005
What is the total number of licences / options yielding licence income in		
How many licences / options yielded running royalties in		
How many licences / options yielded more than R1 million in licence income received?		
What was the total amount of licence income received at your university?		
How much of the licensed income was paid to other university?		

9. What was the total income received from:	2005	2006
Further educational courses?		
Consultancy?		
10. Invention disclosures	2005	2006
How many invention disclosures were received in		
How many of the above were disclosures of potentially patentable matter?		
How many of the above were disclosures of potentially copyrightable matter?		
How many of the above were disclosures of biological materials?		
How many of the above were disclosures of other types of intellectual property?		
11. Patents by your university	2005	2006
How many total patent applications were filed in SA?		
Foreign Patent Office?		
Report the number of new patent applications filed in SA (Provisional)?		
SA (Complete)?		
Foreign Patent Office (Provisional)?		
Foreign Patent Office (Complete)?		
How many patents were issued to your university by SA?		
Foreign Patent Office?		
How many of the start-up companies formed during that year were dependent upon the licensing of your university's technology for initiation?		
12. Start-up companies by your university per year shown	2005	2006
How many of these start-up companies have their primary place of business operating in your province?		
How many of these start-up companies have their primary place of business operating in your province?		
How many start-up companies that were dependent upon the licensing of your university's technology for initiation that were reported in 2005 became non-operational in 2006?		
How many start-up companies that were dependent upon the licensing of your university's technology for initiation that were reported in 2005 were still operational in 2006?		
In how many of the start-up companies formed (as reported above) does your university hold equity?		
In how many outside companies (excluding start-up) does your university hold equity?		
13. Were there any institutional changes in your technology transfer activities since the beginning of 2006? Please describe: *Please enter text as necessary*		

14. Are you aware of any technologies developed originally by your university that subsequently were lost to companies abroad because of lack of support locally? Please describe technology, missing support and so on: *Please enter text as necessary*		
Do you wish to keep your university's statistics confidential?	YES	NO
If not, would you consider making them available to those who will make their statistics available to you?	YES	NO

DEFINITIONS

ACTIVE LICENCES / OPTIONS: The cumulative number of LICENCES / OPTIONS over all years that had not terminated by the end of the Survey's fiscal year requested.

0.5 PROFESSIONAL FTE means a professional position whose duties included support of TECHNOLOGY TRANSFER ACTIVITIES at least 50% of the time. This person may or may not have been located in a formally established TECHNOLOGY TRANSFER OFFICE at that time.

EQUITY, for the purposes of this Survey, is defined as a university acquiring an ownership interest in a company (e.g. stock or the right to receive stock).

EXCLUSIVE LICENCE: The reporting of a licence as exclusive or non-exclusive should follow the terms of the licence agreement. If a licence is designated as exclusive in the licence agreement, it should be reported as an exclusive licence to this Survey. Exclusive licences include licences that are designated as exclusive by field of use, territory, or otherwise but exclude co-exclusive licences, which are reported as NON-EXCLUSIVE LICENCES.

INVENTION DISCLOSURES include the number of disclosures, no matter how comprehensive or how incomplete, that are made in the year requested and are counted by the university.

LARGE COMPANIES: Companies that had more than 500 employees at the time the licence / option was signed.

LICENCES / OPTIONS EXECUTED WITH EQUITY: The number of LICENCES / OPTIONS that were executed in the year surveyed that included EQUITY, where EQUITY is defined as a university acquiring an ownership interest in a company.

LICENCE INCOME RECEIVED includes: licence issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed in, and software and biological material end-user licence fees equal to R10,000 or more, but not research funding, patent expense reimbursement, a valuation of equity not cashed in, software and biological material end-user licence fees less than R10,000, or trademark licensing royalties from university insignia. Licence income also does not include income received in support of the cost to make and transfer materials under Material Transfer Agreements.

LICENCES / OPTIONS: Count the number of LICENCE or OPTION AGREEMENTS that were executed in the year indicated for all technologies. Each agreement, exclusive or non-exclusive, should be counted separately. Licences to software or biological material

end-users of R10,000 or more may be counted per licence, or as 1 licence, or 1 / each for each major software or biological material product (at manager's discretion) if the total number of end-user licences would unreasonably skew the university's data. Licences for technology protected under SA plant patents or plant variety protection certificates may be counted in a similar manner to software or biological material products as described above, at manager's discretion. Material Transfer Agreements are not to be counted as Licences / Options in this Survey.

NEW PATENT APPLICATIONS FILED are the first filing of the patentable subject matter. NEW PATENT APPLICATIONS FILED do not include continuations, divisionals, or reissues. A SA PROVISIONAL APPLICATION filed in fiscal year 2005 will be counted as new unless it is a refilling of an expiring SA PROVISIONAL APPLICATION. If a SA PROVISIONAL APPLICATION is converted in fiscal year 2005 to a SA UTILITY APPLICATION, then that corresponding SA UTILITY APPLICATION filed in fiscal year 2005 should not be counted as new.

NON - OPERATIONAL: A company that no longer possesses sufficient financial resources and expends these resources to make progress toward stated business goals. The licence to a company that is NON-OPERATIONAL will most likely have been terminated. A company may have terminated its licence and still be OPERATIONAL because it has changed its business focus; however, it may be difficult to determine if such a company is still OPERATIONAL. A company that has been acquired and no longer operates independently should be counted as NON-OPERATIONAL if the licence has been terminated.

OPERATIONAL: A company that possesses sufficient financial resources and expends these resources to make progress toward stated business goals. The company must also be diligent in its efforts to achieve these goals. A company that has been acquired and no longer operates independently should still be counted as OPERATIONAL if the licence is still active and in compliance.

RESEARCH EXPENDITURES: INDUSTRIAL SOURCES include expenditures made in fiscal year 2005 by the university in support of its research activities that are funded by for-profit corporations, but not expenditures supported by other sources such as foundations and other non-profit organisations.

RESEARCH FUNDING includes the total amount of research support committed (i.e. awarded) to your university in year 2005 (even if the funds are to be spent over several years) that was related to LICENCE / OPTION AGREEMENTS executed in the Survey period. RESEARCH FUNDING also includes the total amount of research support committed to your university in the surveyed year (even if the funds are to be spent over several years) that was related to LICENCE / OPTION AGREEMENTS signed in a prior year.

RUNNING ROYALTIES: For the purposes of this Survey, RUNNING ROYALTIES are defined as royalties earned on and tied to the sale of products. Excluded from this number are licence issue fees, payments under options, termination payments, and the amount of annual minimums not supported by sales. Also excluded from this amount is CASHED-IN EQUITY, which should be reported separately.

SMALL COMPANIES: Companies that had 500 or fewer employees at the time the licence / option was signed, but, for the purposes of this Survey, not including START-UP COMPANIES initiated by your university.

START - UP COMPANIES are new companies that were dependent on licensing your university's technology for their formation. If a technology was licensed to an existing start-up company, this company should not be counted as a START-UP COMPANY. START-UP COMPANIES, as used in this Survey, refers only to those companies that were dependent upon your university's technology for their formation.

TECHNOLOGY TRANSFER ACTIVITIES include those activities associated with the identification, documentation, evaluation, protection, marketing, and licensing of technology (including trademarks but not university's insignia) and intellectual property management, in general. It encompasses all other activities also associated with the day-to-day operations of a TECHNOLOGY TRANSFER OFFICE, including assisting with the negotiation of research agreements, reporting of inventions to sponsors, and all other duties performed by the office.

TOTAL RESEARCH EXPENDITURES include expenditures (not new awards) made by the university in year 2005 in support of its research activities that are funded by all sources including the central government, local government, industry, foundations, voluntary health organisations and other non-profit organisations.

VENTURE CAPITAL means the START-UP COMPANY received funds from a loan or purchase of equity by a corporation or partnership organised for the specific purpose of making long-term, high risk in early stage ventures in the expectation of substantial long-term capital gains.

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