science and technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

COFISA
Cooperation Framework on Innovation Systems betw
Finland & South Africa

COFISA

Mapping triple helix innovation networks in the Western Cape

October 2009

Final report

KAISER ASSOCIATES
ECONOMIC DEVELOPMENT PRACTICE

Leadership House 40 Shortmarket Street
Cape Town 8000 South Africa
tel +27 21 481 6000 fax +27 21 481 6001
www.kaiseredp.com

CAPE TOWN • LONDON
NEW DELHI • SÃO PAULO
DUBAI • WASHINGTON

TABLE OF CONTENTS

LIST OF ACRONYMS

ACT	Auckland Capital Territory
AMTS	Advanced Manufacturing Technology Strategy
ARC	Agricultural Research Council
BBBEE	Broad-Based Black Economic Empowerment
BoP	Base of Pyramid
BPO	Business Process Outsourcing
BWB	Bandwidth Barn
CAPRI	Cape Programme for Rural Innovation
CEO	Chief Executive Officer
CHEC	Cape Higher Education Consortium
CIDA	Canadian International Development Agency
CIMM	Cape Institute for Materials and Manufacturing
CITI	Cape IT Initiative
CoE	Centre of Excellence
COFISA	Cooperation Framework on Innovation Systems between Finland and South Africa
CPUT	Cape Peninsula University of Technology
CRC	Cooperative Research Centres
CSIR	Council for Scientific and Industrial Research
CTRU	Cape Town Routes Unlimited
DEAT	Department of Environmental Affairs and Tourism
DEDAT	The Department of Economic Development and Tourism
DST	Department of Science and Technology
EU	European Union
FET	Further Education Training
FOR	Fields of Research
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
GIAN	Grassroots Innovation Augmentation Network
HBN	Honey Bee Network
HEI	Higher Education Institution
HIV	Human immunodeficiency virus
HSRC	Human Sciences Research Council
ICT	Information and Communication Technology
IDP	Integrated Development Planning
IDRC	International Development Research Centre
INAE	Indian National Academy of Engineering
IP	Intellectual Property
IT	Information Technology
IX	Innovation Exchange
JSE	Johannesburg Stock Exchange
KCA	Knowledge Commercialisation Australasia
KIBS	Knowledge Intensive Business Services
MEDS	Microeconomic Development Strategy
MEM	Micro-Electro-Mechanical
MNC	Multination Corporations
MoU	Memoranda of Understanding
MRC	Medical Research Council of South Africa
NACI	National Advisory Council on Innovation
NGO	Non-Governmental Organisation
NRF	National Research Foundation

NSW	New South Wales
NTBF	New Technology Based Firms
OECD	Organisation for Economic Co-Operation and Development
OSKE	Centre of Expertise Programme (Finland)
PANSA	Performing Arts Network SA
PEP	Positron Emission Tomography
PEPT	Positron emission particle tracking research
PGDS	Provincial Growth and Development Strategy
PGWC	Provincial Government of the Western Cape
PIC	Prior Information Consent
QSE	Qualified Scientists and Engineers
R&D	Research and Development
RALIS	Rapid Appraisal of Local Innovation Systems
RIC	Research Intensive Clusters
RIS	Regional Innovation Strategy
SAAFOST	South African Association of Food Science and Technology
SAMRC	South African Medical Research Council
SARIMA	Southern Africa Research and Innovation Management Association
SAWIS	South African Wine Industry Information and Systems
SEDA	Small Enterprise Development Agency
SEO	Socio Economic Objective
SETA	Sector Education and Training Authority
SMME	Small Medium and Micro Enterprise
SPV	Special Purpose Vehicle
STEP	Science and Technology Entrepreneurs Parks
STIP	Science and Technology Industrial Parks
SU	Stellenbosch University
TAFE	Technical And Further Education
TBI	Technology Business Incubators
TEKEL	Finnish Association of Science Parks
THRIP	Technology and Human Resources for Industry Programme
TIA	Technology Innovation Agency
TTO	Technology Transfer Office
TUT	Tshwane University of Technology
UCT	University of Cape Town
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States
UWC	University of Western Cape
VANSA	Visual Arts Network SA
WHO	World Health Organisation
WRC	Water Research Commission

EXECUTIVE SUMMARY

Introduction

This document is the final output of the COFISA study '*Mapping triple helix innovation networks in the Western Cape'*. The purpose of this project is to understand innovation networks between academia, industry and government in the Western Cape, i.e. triple helix networks. An appropriate definition of innovation in this context is "doing new things or doing things in a new way, drawing on knowledge and creativity to add value in products and processes"[1].

Furthermore, the project aims to understand the potential contribution of science parks, innovation centres, and clusters or incubators within this context.

Data gathering included reviews of institutional websites, reports and available databases, and interviews with 48 innovation stakeholders in the province. Given the time constraint of three months for this project, the findings should be seen as a starting point, with further research required to verify and gain greater depth of understanding on innovation collaborations in the Western Cape.

The deliverables for this project are:
- Mapping Western Cape triple helix innovation networks: final report (this document)
- An initial database of innovation actors in the Western Cape across academia, business, public research institutes, government, and other support structures (see Annexure D as well as the separate Excel file which accompanies this document)

Indicative findings on triple helix networks

Innovation-related assets and strengths

The province has numerous assets that can form the foundation of innovation networks. Overall assets include:
- An existing base of innovative large and small businesses – e.g. a GEM world cities comparison[2] found that Cape Town is the most entrepreneurial city in South Africa (65% higher than the national average) strongly associated with "links to the creative class", although it is less strongly oriented around job growth and use of latest technology than many other cities
- Four universities with research capacity – an estimated 2,200 researchers (including PhD and postdoctoral students), and around 35% of the NRF-rated researchers based at SA universities
- Additional research capacity at public research institutions, hospitals, etc – estimated at an additional 1,800 researchers
- Competent and active public research institutions with significant activity in the province: the Agricultural Research Council (ARC) and the Department of Agriculture research and demonstration farms, the Council for Scientific and Industrial Research (CSIR), Human Sciences Research Council, iThemba Labs (National Research Foundation), the South African Astronomical Observatory, the South African Medical Research Council (SAMRC), and the South African National Bio-informatics Institute
- Various government entities that have stated their intentions to support knowledge intensive activities and innovation in the province

[1] R. Green (2007) , as quoted in Australian Business Foundation speech in 2009
[2] Z. Acs, N. Bosma, R. Sternberg, for GEM (2008) The Entrepreneurial Advantage of World Cities: Evidence from Global Entrepreneurship Monitor Data

- Supportive government programmes, such as THRIP, Innovation Fund, sectoral and other Special Purpose Vehicles, as well as plans for a Provincial Innovation Council and a Regional Innovation Forum

Below are some indications of the strengths in terms of specialisations in the province.

Business strengths (which indicate some form of competitiveness, although not necessarily innovation related) include:

- Large contributors to provincial GDP: wholesale and retail trade, catering and accommodation, transport and communication, financial, insurance and business services
- Additional areas of relative specialisation in the province compared to the national average: agriculture, food and beverages, clothing and textiles, printing and publishing, instruments, and furniture
- Additional sectors where there is an apparent presence of innovative small enterprises: information technologies (in particular software), creative industries and design (media, crafts, fashion, film, advertising, furniture), food and natural beverages, boatbuilding, equipment and tooling, renewable energy, medical devices and pharmaceuticals

Based on a compilation of available information, apparent **university research strengths** include:

- Medical, including genetics, medical microbiology, immunology, physiology, public health, bioinformatics, human movement and sports science
- Engineering, including mechanical, industrial, electrical and electronic engineering
- Environmental sciences and ecology
- Biological studies, including agricultural biotechnology, biochemistry, cell biology and food processing
- Social sciences and related fields, including education, religion, human society, law, cultural studies, language studies
- Business and commerce
- Mathematical sciences

Over half of the spin-off companies from Western Cape universities identified in this report are medical-related (medical devices, drug discovery, treatment management, sport, testing, data analysis). Other spin-offs include metal processing, aquaculture, microsatellites and software.

Provincial **government**'s sectoral priorities include the following (as stated in the Micro Economic Development Strategy):

- "Priority" sectors: oil and gas supply industry, Information and Communication Technology, Business Process Outsourcing (BPO), tourism
- "Significant" sectors: creative industries, film, craft, music, clothing & textiles, metals & engineering, agri-processing & food-processing, boat-building
- "Watch-list" sectors: Fishing & aquaculture, biotechnology, chemicals, printing & packaging, financial services, retail, wholesale & franchising, environmental goods & services, electronics

Existing innovation networks and value chains

The collaborations identified through this project take many forms. Relatively formal collaborations including specialist networks, formal Memoranda of Understanding between organisations, funding, joint centres and facilities/equipment/Technology Stations, joint projects, joint publications and shared patents.

Less visible, but nevertheless important linkages identified through stakeholder interviews include regular forums, information sharing and assistance with problem-solving or unblocking hurdles to commercialisation, movement of people between helices over their careers, and movement of students between institutions (either simultaneously or over time).

In addition to collaborations within the province, there are also various national and international collaborations with universities, corporates, grant funders/donors and multilateral institutions. These may be to access funding, appropriate expertise, markets, or to form part of multinational teams for long-term and extensive projects that are beyond local scope.

Unfortunately, there seem to be many cases where research never reaches the point of commercialisation, is commercialised too slowly and therefore misses the window of opportunity (which is taken up by more rapid innovators in other countries). In other cases, the commercialisation may be "off-shored" with the aim of overcoming funding or human resource constraints and or accessing larger markets.

Value chains where examples were found of Western Cape collaborations resulting in commercialisation include:

- Agriculture, food and beverages, e.g. post harvest technologies, indigenous teas (honeybush, rooibos), plant cultivars and wine
- Creative industries: with some links with CPUT, the FabLab and UCT
- Consumer goods serving low income/base of the pyramid markets (through the BoP learning lab)
- Aspects of engineering (within electronic and medical equipment)

Success factors for collaborations identified include:

- Relationships between people are far more important than formal institutional relationships: personal and professional relationships between collaborators where trust has been established (and tested) are critical
- The nature of the collaboration is clearly defined and expectations are unambiguous
- Presence of champions who are committed to implementation and possess characteristics such as good networking abilities and contacts, being visionaries who are able to see the big picture and understand how different role players fit together
- Understanding of when (and if) to progress from informal to formal relations
- A well-resourced platform to facilitate or broker the relationships
- Good team dynamics and the ability to work together
- Direct participation of people with the authority to make decisions
- Partner organisations are evenly matched in terms of their relative commitment to and prioritisation of the collaboration project
- Similar levels of familiarity with the Western Cape context in the field in which the collaboration is taking place

Areas of potential

Some potential areas of greater collaboration that would require further exploration include:

- Biomedical, drug discovery and pharmaceuticals: the province has very strong research capabilities, strong international collaborations, and anecdotally there are various small businesses being set up in the Western Cape
- ICT: software, information management, media, etc applied to address the needs of various service sectors e.g. financial services, marketing, catering and tourism (there is strong business activity in the province and support from government through the Cape IT Initiative and Bandwidth Barn, but activity does not seem to have strong linkages to HEIs)

Assessment of constraints

A range of constraints to innovation collaboration were identified. Distrust between parties was one key issue. The identified lack of trust relates to a range of issues, including the following:

- Distrust in the abilities and competence of potential partners
- Distrust of intentions (in particular, fear of abuse of intellectual property)

- Distrust of predictability, consistency and delivery on promises (in particular in relation to government)
- Distrust of other actors' principles and ethics

Other issues included the following:

- In many cases, specialisations and focus areas do not match across players within the various organisations
- Divergent objectives and ways of operating across the helices
- Inadequate presence of knowledge brokers and intermediaries to ease communication and understanding between people
- Increased bureaucracy and administration in collaborations with universities and government

Constraints in the wider enabling environment

Intellectual property regulation was a major constraint raised in interviews. Local patents were not considered transparent or meaningful, and international patents are very expensive (despite availability of some support mechanisms). The new Intellectual Property Rights from Publicly Financed Research and Development Act of 2009 and its regulations do not appear to set clear guidelines on proportionality in determining universities' share of IP, or set conditions for minimum financial investment required before universities can claim rights to IP.

Other constraints raised included the availability of skills (including mid-level management and skills required for rapid expansions), inadequate pre start-up and start-up funding, and government funding not being oriented towards supporting businesses that want to reach global markets.

Views on support recommendations

Science parks have been shown to have the potential in some cases to support innovation and help to attract and retain knowledge workers. However, internationally the future of science parks in relation to innovation and triple helix networks is being debated. For example, possible scenarios have been developed[3], ranging from incremental evolution of science parks to increase their effectiveness and develop more creative collaboration networks, to looser "research clouds" and clustering with greater mobility and reliance on social networks and reduced centrality of universities, to obsolescence of science parks as collaborations become more virtual. Given these uncertainties the possible development of science parks in the Western Cape context should be approached with care and due attention to international and local lessons and trends.

In terms of Western Cape experience, further investigations are required and lessons learned from the examples of both Capricorn Industrial and Business Park (now a commercial property development), and Stellenbosch Technopark (now a commercial park), which at inception were intended to be collaborative science parks. Based on stakeholder interviews, it seems that some of the challenges included a lack of funding and critical mass of innovative businesses, mismatch and inability to tailor services and incentives to meet the needs of the Western Cape market (e.g. affordability to SMMEs, centrality and accessibility of location).

Based on the available information and stakeholder input, our assessment is that there are some suitable conditions for the sustainable development of science parks in the Western Cape, but also a range of challenges. These are summarised in the table below.

[3] A Townsend, A S-K Pang, R Weddle (2009) Future Knowledge Ecosystems: The next twenty years of technology-led economic development

Assessment of feasibility of establishing science parks in the Western Cape

Positive factors	Challenges
▸ Some common areas of strength between research and industry ▸ Relative to the rest of South Africa, the Western Cape has greater availability of university graduates ▸ Pockets of existing collaborations, networks and trust ▸ Established international linkages ▸ Base infrastructure in place: roads, rails, port, international airport to provide an accessible location ▸ Quality of life factors in place: natural beauty, recreation options, food, lifestyle etc. ▸ Infrastructure improvements planned: fibre optic network and rapid bus transit public transport	▸ The majority of business and academia is not innovation oriented ▸ Uncertainty of capital and operational funding ▸ Widespread presence of distrust and lack of mutual belief in capability of other triple helix players ▸ Relatively dispersed innovation activity across numerous small businesses – economies of scale may not be present ▸ Bureaucracy in universities and government, short-term orientation of much of industry ▸ Of those interviewed, none expressed willingness to relocate their unit or organisation to a science park – scale of demand is therefore not clear and may be difficult to determine accurately ▸ Other requirements to support the growth of innovation businesses in the province are not yet in place e.g. sufficient venture capital for technology start-ups; this could potentially be partially addressed in future through the Technology Innovation Agency's activities

Given these challenges, it is recommended that any science park developments be viewed from a medium to long term perspective and approached cautiously and with a clear strategy to address these challenges. In the shorter-term, it may be more realistic to focus on more organic developments where there is an existing base of activity and infrastructure, as could be done with the proposed East City Design Precinct.

There are also potentially more adaptable and less costly ways to support innovation networks in the province. Some initial thoughts on other areas of support include the following.

- Information and knowledge generation and sharing: e.g. snowball identification of innovative businesses and research networks, participatory innovation appraisals, further development of innovation database
- Raising awareness and shifting mindsets across triple helix players: marketing of success stories, innovation awards, providing exposure to international innovation outcomes (in particular competitor countries)
- Networking and relationship building: opportunity or problem-solving forums, support for additional events and community building, "diaspora" innovation network, supporting grassroots innovation networks, and matchmaking between research and business interests
- Institutional reforms: including greater accommodation of parallel appointments or exchanges between helices, greater integration of innovation into performance measurement
- Strengthened support services: including support for knowledge brokers/ knowledge intensive business development services, intellectual property and commercial management, cooperative research facilities, and international exposure for innovators
- Enabling infrastructure: fast-tracking of affordable broadband access to key innovation locations, and increased shared technology infrastructure e.g. rapid prototyping, FabLab type design facilities, creative
- Pre-start-up and start-up funding: further government support
- Tapping into and expanding existing initiatives, including supporting:
  - International exchanges with successful innovators internationally (academic, business or government) on an annual basis

  - The implementation of the Regional Innovation Systems Strategy in the Western Cape (establishment of a Regional Innovation Forum and a Provincial Innovation Forum)
  - Initiatives to brand the Western Cape as an innovation hub, which also include facilitating networking between innovation role players (e.g. the Silicon Cape Initiative, Cape Town Activa, and the Wesgro/Accelerate Cape Town initiative)
  - Tektique, an inter-university technology transfer initiative
  - Existing clusters and Special Purpose Vehicles
  - Private sector initiatives to cluster and foster collaborative networks e.g. some stakeholders in the arts and entertainment sector in Cape Town have purchased their own buildings and sub-let space to product and service providers in their sub-sector's value chain
- Improving the support infrastructure for SMMEs through greater coordination and alignment between different role players such as the Innovation Fund, THRIP, SPVs, SEDA, and local and provincial government (which manage SMME support programmes such as RED Door)

Way forward

As COFISA is closing out its activities, it is recommended that provincial role players should lead the support for innovation collaboration in the province, in partnership with DST and the Technology Innovation Agency as it becomes fully operational. Next steps might include:

- Funding more comprehensive and long-term research on innovation collaboration
- Reaching agreement on priority support initiatives (short, medium and long-term)
- Committing to lead, fund and support the prioritised initiatives

1 Introduction

This document is the final output of the COFISA project to assess triple helix innovation networks in the Western Cape, with a particular focus on Cape Town and Stellenbosch.

1.1 Purpose

The purpose of this study, as stated in the Terms of Reference, is to provide provincial baseline information on the following:

a. The 'technology co-operation networks' in place in the region and the functional sectors and role-players engaged. In other words, what productive linkages currently exist between players in related technology fields?

b. The extent of technology transfer, commercialisation of R&D, or industrial application derived from the local HEI and R&D institutions. How much of this is happening in the province and how much is happening elsewhere in South Africa or beyond South Africa?

c. Specific sectors where "regional innovation value chains" exist or have good potential to develop competitive businesses.

d. The extent of inter-institutional research collaboration, going beyond sub-contracting to the establishment of longer-term strategic relationships. In each case, what sustainable business-exploited outcomes has this collaboration produced?

e. The estimated trust and relationship levels in the 'triple-helix' in the region. Identification of barriers to creation of such collaborative relationships would be of value.

f. The current contribution of any present institutions or organisations in the region which promote and facilitate knowledge economy or triple-helix development.

g. Which government incentives, policies and funding promise or have proved to be effective in promoting innovation, and what impediments do state initiatives represent?

h. The depth of understanding in the triple-helix community that science parks and or innovation centres can provide environments to better support the development of 'network enterprises' (businesses growing out of the combined strength of multiple institutions) and whether the level (or realistically anticipatable level) of output in the form of innovative companies, spin-outs, etc, can justify investment in a science park or science parks.

In summary, this project aims to profile existing innovation networks and value chains, understand their strengths and weaknesses, and identify the characteristics of successful networks. Based on these findings, the project also makes initial recommendations about future support to these innovation networks, including assessing the appropriateness of science parks, incubators, clusters and other forms of support.

1.2 Definitional issues

The National Advisory Council on Innovation (NACI) has defined **innovation** as[4]:

> *"…the process of transforming an idea, generally generated through R&D, into a new or improved service, product, process or approach that relates to the real needs of society and involves scientific, technological, organisational or commercial activities. The key to this definition is the fact that the innovation process is only complete once a defined product, process or system with some tangible benefit has been implemented."*

In simpler language, innovation can be described as:[5]

> *"…doing new things or doing things in a new way, drawing on knowledge and creativity to add value in products and processes"*

Whilst many people associate innovation primarily with "high technology", innovation can involve a problem solving and creative activity across almost any field.

According to the Institute for Triple Helix Innovation[6], **triple helix innovation** is:

> *".. a process by which academia, government, and industry collaborate (i.e., engage in a process of mutually beneficial leveraging of resources) to create or discover new knowledge, technology, or products and services that are transmitted to intended final users in fulfilment of a social need. Final users then consume the knowledge, technology, or products and services or they use them to produce new goods and services that are ultimately sold or consumed."*

In the South African and Western Cape context, **triple helix innovation networks**[7] can therefore be seen as networks of interactions and relationships relating to knowledge exchange and innovation between the following:

- *Academia:* Universities and associated research institutions
- *Business*: any business, whether large or small, individual or cooperative
- *Government*: all three spheres of government (national, provincial, and local), public research institutions and other public entities

In some cases, advanced business services, **or Knowledge Intensive Business Services** (KIBS) whether private, donor, non-profit, or government, are also included in these networks as **links or brokers** between the helices. These service providers may include venture capitalists, consultancies, intermediaries, agents, and legal firms with IP or technology business start-up expertise.

Note: Suppliers, consumers and communities are not included within the triple helix model, although these groups are considered to be important within some innovation approaches e.g. co-creation and Base of the Pyramid related innovation[8].

[4] NACI (2006) The South African National System Of Innovation: Structures, Policies and Performance; Background Report To The OECD Country Review Of South Africa's National System Of Innovation
[5] R. Green (2007) , as quoted in Australian Business Foundation speech in 2009
[6] Triple Helix Institute for Innovation, Taxonomy of Triple Helix Innovation
[7] This description draws on the definition used by the Triple Helix Institute, http: or or www.triplehelixinstitute.org or
[8] For example, see E. Simanis & S. Hart (2008) The Base of the Pyramid Protocol: Towards Next Generation BoP Strategy, 2nd edition.

1.3 Why innovation networks?

Networks are the oxygen of innovation[9]

Recent thinking points to the importance of knowledge networks in generating innovation. Innovation is now understood to come from "flows of knowledge", rather than "stocks of knowledge"[10]. People and the networks between them are considered the carriers of innovation.

Within this thinking, innovation is seen as "connecting for value" [11].

> *"Newer models of the innovation process make no assumptions about value being inherent in any particular process, idea or technology. Value is created through rearranging and recombining knowledge, people, processes and technologies."*

The collective ability within networks can also reduce risks and improve success rates in difficult times in the innovation cycle. It can also potentially speed up the pace and effectiveness of commercialisation by

- Ensuring that researchers are well-informed about developments in their field and the focus of their competitors
- Enabling them to rapidly access the competencies and partnerships they need to move forward

In recognition of these benefits, various countries have begun to focus at a policy and strategy level on supporting regional innovation networks and clusters.

[9] A.Nolan of the OECD, as quoted in Australian Business Foundation (2008), Inside the Innovation Matrix, p.xiv
[10] N. Kennedy, CEO of Australian Business Foundation (2009) Speech to Innovation March 2009 Conference, Sydney
[11] J. Steen, S. Macaulay, T. Kastelle, University of Queensland Business School, 2008.Mapping and Managing Networks for Innovation Performance: New Perspectives and New Tools, in The Human Dimension of Innovation, Australian Business Foundation

2 Methodology

2.1 Principles applied to the project methodology

The limited timeframe available for this project means that it should be seen as a starting point in understanding the triple helix innovation networks in the Western Cape, rather than as a comprehensive exercise in its own right. Further research will be needed to develop a more in-depth understanding of triple helix innovation and the most effective support to these networks.

In order to provide a solid basis for more in-depth work in future, the project team decided to incorporate the principles of social network analysis, which we feel has the potential to provide useful insights into the network over time. Whilst suitable for use in various fields of study, social network analysis is increasingly viewed as a useful way of mapping innovation networks and regional innovation systems[12].

Social network analysis is based on a definition of networks as being made up of "a set of nodes connected by a set of ties"[13], defined as follows:

a. **Nodes or actors**, which can be either institutions or people, and who have characteristics in their own right
   - In the case of institutions, characteristics can include location, mandate and focus areas
   - In the case of people, characteristics can include location, specialisations, prior roles and personal history
b. **Relations or ties**, which are the links between actors, can be continuous or once-off. In the case of innovation networks, these can include but are not limited to:
   - Information sharing
   - Funding
   - Exchange of people
   - Shared infrastructure or equipment
   - Spatial proximity
   - Joint projects
   - Contractual relationships
   - Reporting relationships
   - Joint participation in knowledge and innovation outputs, such as publications, patents and new products or processes
   - Co-membership of clubs, associations or other groupings
   - Personal ties through individuals (rather than at an institutional level) e.g. friendships

Unfortunately, reliable indicators of the ultimate outputs of innovation collaborations are difficult to access (e.g. new products and processes, improved efficiency, productivity and competitiveness, increased revenue and business sustainability, growth, and new employment). Most research efforts instead use intermediate indicators such as patents, publications, or spin-off companies which give a rather incomplete picture of the concrete benefits of innovation.

Once base data on a network has been gathered, various analytical and visualisation tools can then be used to describe the qualities and structure of networks and their sub-components (such as pairs of actors, sub-groups and groups). Some of these description categories are set out in Appendix C. However, structural measures do not necessarily capture the causal contribution of these networks to tangible innovation outputs, such as improved knowledge and technology diffusion, better or faster innovation performance. Social network analysis is a descriptive tool, and potentially can support diagnosis of potential structural issues, but cannot be used to attribute

[12] F. Coulon (2005) The use of social network analysis in innovation research: A literature review
[13] Ibid

causality. There are also challenges within this approach relating to properly understanding the dynamism or fluidity of these networks over time.

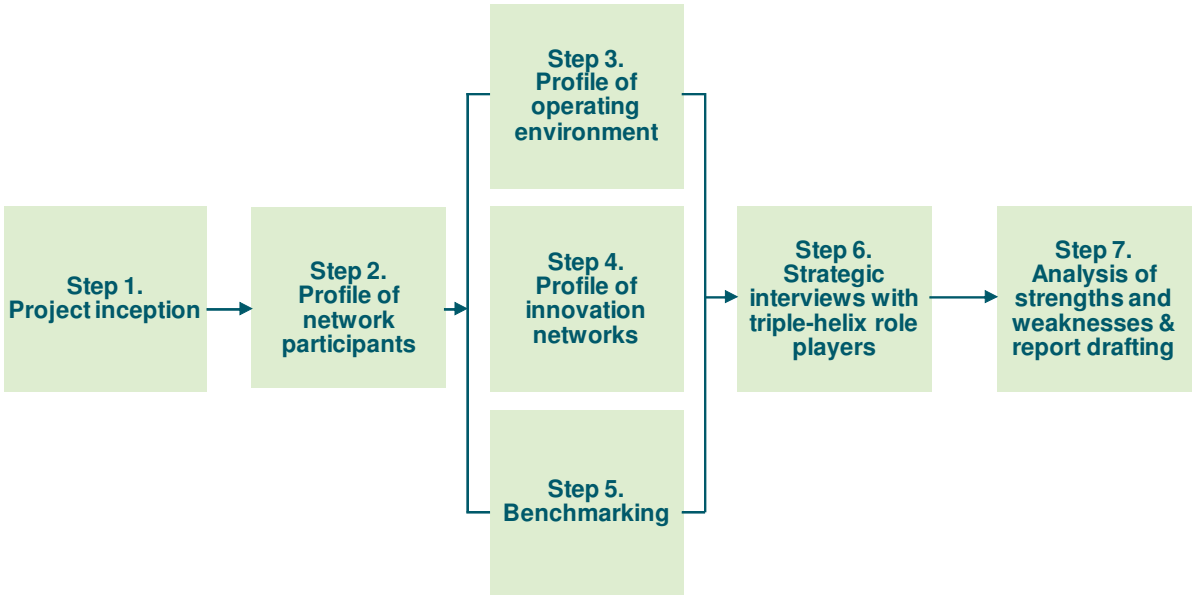
It is therefore important to supplement social network analysis with more in-depth interactions to at least understand the perceived contributions of these networks to innovation, reasons for collaborating or not collaborating, success factors and pitfalls, etc.

This study therefore made use of a combination of analysis of available secondary data and reports and in-depth interviews. Numerous case studies on knowledge networks and university-industry collaborations have been developed in previous work (in particular by Glenda Kruss of the HSRC), and this study therefore aims to supplement and build on those findings rather than duplicate efforts.

2.2 Detailed methodology

The overall approach adopted for the completion of this project is illustrated below:

Figure 1: Project plan



Based on the project plan, and the principles and challenges set out in section 2.1, a description of the main research activities undertaken is presented below.

a. Review of existing reports on innovation and innovation networks in South Africa and the Western Cape (see Appendix B for a list of reports consulted), including:
   - Drawing out insights on innovation activities from previous innovation and enterprise surveys (e.g. CeSTII Innovation Survey of 2005 and Global Entrepreneurship Monitor Adult Population Survey of 2008), although unfortunately these cannot be linked back to individual businesses in the province
   - Analysis of data on economic activity in the province based on Quantec data, the 2007 Provincial Economic Review & Outlook, and the 2005 Western Cape MEDS
   - Case studies on dynamics of existing collaborations e.g. papers by Glenda Kruss of the HSRC

b. Secondary research to gather available information on triple helix role players in the province, including institutional profiles, mandates, relevant activities and collaborations, covering[14]:
   - University research centres, institutes and bureaux
   - Sector associations and special purpose vehicles (to give insight on innovation patterns in their sectors)
   - JSE listed companies with headquarters in the Western Cape (on the assumption that major innovations were more likely to come from within headquarters, although this is not necessarily always the case)
   - Companies that have received recognition for their innovation through awards, including the Technology Top 100 awards, innovation articles on www.southafricainfo.net, and other industry-specific awards
   - EU and US-registered patents involving Western Cape participants over the past 4 years
   - Key government departments at the national, provincial and local government levels
   - Public research institutions with centres in the Western Cape
   - Government funding and incentives to Western Cape beneficiaries, including NRF research chairs, NRF-rated researchers, the Innovation Fund, THRIP, and Tshumisano Trust

- In-depth telephonic and face-to-face interviews with 49 triple helix stakeholders to gain further information on collaborations, and understand the dynamics, success factors and pitfalls of innovation collaborations (see Appendix A for a list of interviews conducted).

- Drawing on the above research, development of an initial database of innovation actors in the Western Cape across academia, business, public research institutes, government, and other support structures (see Appendix D as well as the separate Excel file which accompanies this document)

- Review of secondary sources to benchmark innovation networks and support systems, including the experiences of Finland, Australia, India and China (with particular emphasis on science park activity in these countries) as well as wider good practice guidelines for science parks

FUTURE RESEARCH

There is a clear need for more comprehensive research on innovation networks in the Western Cape to develop a more detailed database of innovation role players and their collaborations and innovation outputs.

In some cases, this research could be participatory in nature, and therefore be used as "action research" that strengthens networks and improves the effectiveness of innovation.

Appendix C of this report provides some suggested direction for this future research.

[14] It is more difficult to identify business players involved in innovation, as it is possible that any business could be innovating "on the job" through improving products, processes and applications of technology, without any data being gathered on these innovations.

3 Initial profile of triple helix innovation networks in the W. Cape

This section is structured first to provide an overview of triple helix role players in the Western Cape (whether or not they are currently collaborating around innovation), and then to discuss existing collaborations.

3.1 Introduction to key innovation role players or actors in the W. Cape

Note: The description provided below is based on secondary sources and information provided during stakeholder interviews. It is therefore not necessarily exhaustive, and may require further verification for accuracy in future research.

3.1.1 Business

Limited reliable and up-to-date measures of business innovation activity in the Western Cape are available. For example, national R&D surveys provide only a partial picture of efforts towards innovation and do not reflect whether innovation was achieved, and the most recent CeSTII Innovation Survey was in 2004.

It is therefore necessary to piece together some indication of areas of business activity, including possible innovation activity, from a range of measures, including:

- Sectoral contribution to output, value add and employment, and associated growth rates
- Presence of company headquarters in the province (based on the hypothesis that headquarters may play a key role in directing innovation and innovation-related partnerships within a company)
- Winners of innovation and related awards from 2005 to date that are based in the province
- US and EU registered patents by Western Cape based companies from 2005 to date
- Surveys relating to innovation behaviour of businesses and individuals in the province and or Cape Town e.g. 2008 Global Entrepreneurship Monitor (GEM) Adult Population Survey, GEM global comparison of cities' levels of entrepreneurship, 2004 CeSTII Innovation Survey

Sectoral contributions and growth

The table below shows an analysis of Quantec data on current economic output and value add percentages per sub-sector for South Africa as a whole, as well as for the Western Cape, City of Cape Town, Cape Winelands District (the wider district within which Stellenbosch is located) and Stellenbosch Municipality. Shaded cells indicate where the percentage contribution is above the national average, indicating some degree of specialisation within these locations.

Table 1: Sectoral output and value add in 2008[15]

Red highlights indicate higher % than national	Production: Gross value add at basic prices (Rm current prices) 2008 %				
	South Africa	Western Cape	Cape Town	Cape Winelands	Stellenbosch
0: Total					
P: Primary sector [SIC: 1-2]	**12.9%**	**5.4%**	**1.9%**	**17.4%**	**11.0%**
PA: Agriculture, forestry and fishing [SIC: 1]	3.3%	5.2%	1.7%	17.1%	10.9%
PA01: Agriculture, forestry and fishing [SIC: 11-13]	3.3%	5.2%	1.7%	17.1%	10.9%
PB: Mining and quarrying [SIC: 2]	9.6%	0.2%	0.2%	0.3%	0.1%
PB02: Mining and quarrying [SIC: 2]	9.6%	0.2%	0.2%	0.3%	0.1%
S: Secondary sector [SIC: 3-5]	**24.2%**	**24.9%**	**23.9%**	**33.0%**	**38.5%**
SC: Manufacturing [SIC: 3]	**18.8%**	**19.0%**	**18.0%**	**28.6%**	**34.7%**
SC03: Food, beverages and tobacco [SIC: 301-306]	3.2%	5.5%	3.1%	19.2%	25.7%
SC04: Textiles, clothing and leather goods [SIC: 311-317]	0.6%	0.8%	1.0%	0.5%	0.4%
SC05: Wood, paper, publishing and printing [SIC: 321-326]	1.5%	1.6%	1.8%	1.2%	1.2%
SC06: Petroleum products, chemicals, rubber and plastic [SIC: 331-338]	4.6%	4.2%	4.8%	2.8%	2.4%
SC07: Other non-metal mineral products [SIC: 341-342]	0.7%	0.6%	0.5%	0.6%	0.7%
SC08: Metals, metal products, machinery and equipment [SIC: 351-359]	4.5%	3.0%	3.1%	2.2%	2.3%
SC09: Electrical machinery and apparatus [SIC: 361-363]	0.4%	0.3%	0.3%	0.2%	0.2%
SC10: Radio, TV, instruments, watches and clocks [SIC: 371-376]	0.2%	0.2%	0.3%	0.1%	0.3%
SC11: Transport equipment [SIC: 381-387]	1.6%	1.1%	1.3%	0.6%	0.6%
SC12: Furniture and other manufacturing [SIC: 391-392]	1.4%	1.6%	1.8%	1.1%	0.8%
SD: Electricity, gas and water [SIC: 4]	2.3%	1.6%	1.7%	1.1%	0.4%
SD13: Electricity [SIC: 41]	1.9%	1.4%	1.6%	0.8%	0.2%
SD14: Water [SIC: 42]	0.4%	0.2%	0.1%	0.3%	0.2%
SE: Construction [SIC: 5]	3.1%	4.3%	4.2%	3.4%	3.4%
SE15: Construction [SIC: 51-53]	3.1%	4.3%	4.2%	3.4%	3.4%
T: Tertiary sector [SIC: 6-9, 0]	**62.9%**	**69.7%**	**74.2%**	**49.6%**	**50.5%**
TF: Wholesale and retail trade, catering and accommodation [SIC: 6]	12.7%	14.1%	14.4%	12.7%	13.3%
TF16: Wholesale and retail trade [SIC: 61-62]	11.8%	12.9%	13.3%	11.5%	11.2%
TF17: Catering and accommodation services [SIC: 63]	0.8%	1.2%	1.1%	1.2%	2.1%
TG: Transport, storage and communication [SIC: 7]	8.1%	8.5%	9.4%	5.1%	3.7%
TG18: Transport and storage [SIC: 71]	4.6%	4.5%	4.7%	3.6%	2.6%
TG19: Communication [SIC: 72]	3.5%	4.0%	4.7%	1.5%	1.2%
TH: Finance, insurance, real estate and business services [SIC: 8]	21.6%	32.2%	36.2%	16.8%	20.5%
TH20: Finance and insurance [SIC: 81-82]	10.1%	14.1%	16.5%	8.0%	7.4%
TH21: Business services [SIC: 83]	11.6%	18.1%	19.7%	8.9%	13.1%
TI: Community, social and personal services [SIC: 93]	3.8%	3.2%	3.2%	3.4%	4.0%
TI22: Community, social and personal services [SIC: 93]	3.8%	3.2%	3.2%	3.4%	4.0%
TJ: Other producers [SIC: 92, 95-6, 99, 0]	2.0%	1.6%	1.5%	1.8%	1.6%
TJ22: Community, social and personal services [SIC: 92, 95-6, 99, 0]	2.0%	1.6%	1.5%	1.8%	1.6%
TK: General government [SIC: 91, 94]	14.8%	10.0%	9.6%	9.7%	7.3%
TK23: General government [SIC: 91, 94]	14.8%	10.0%	9.6%	9.7%	7.3%

These data show the strong dominance of tertiary activities in the province, in particular wholesale and retail trade, catering and accommodation, transport and communication, financial, insurance and business services. There is also some relative specialisation within the province in:

- Agriculture
- Food and beverages
- Clothing and textiles
- Wood, paper, pulp, printing and publishing
- Radio, TV and other instruments
- Furniture

Employment statistics are not available at a similarly disaggregated level. However, sector-level data indicate the higher importance of agriculture and community services to the economy in terms of employment than their contribution to output and value add (again, shaded cells indicate relative specialisation compared to the national average in those locations).

[15] Quantec standardised regional data set

Table 2: Sectoral % contribution to employment in 2008[16]

Location / Sector	South Africa	W. Cape	Cape Town	Cape Winelands District	Stellenbosch
I100: Agriculture, forestry and fishing	7.61%	11.98%	2.86%	35.05%	19.73%
I200: Mining	4.95%	0.40%	0.25%	0.43%	0.56%
I300: Manufacturing	13.18%	14.11%	15.77%	11.75%	12.17%
I400: Electricity & water	0.54%	0.35%	0.37%	0.21%	0.39%
I500: Construction	4.73%	6.56%	6.18%	5.04%	7.71%
I600: Wholesale & retail trade; catering and accommodation	17.39%	17.41%	18.74%	12.61%	12.84%
I700: Transport & communication	3.60%	3.45%	4.13%	2.05%	4.97%
I800: Finance and business services	18.22%	19.03%	23.22%	10.79%	14.75%
I900: Community, social and other personal services	29.79%	26.71%	28.48%	22.06%	26.89%

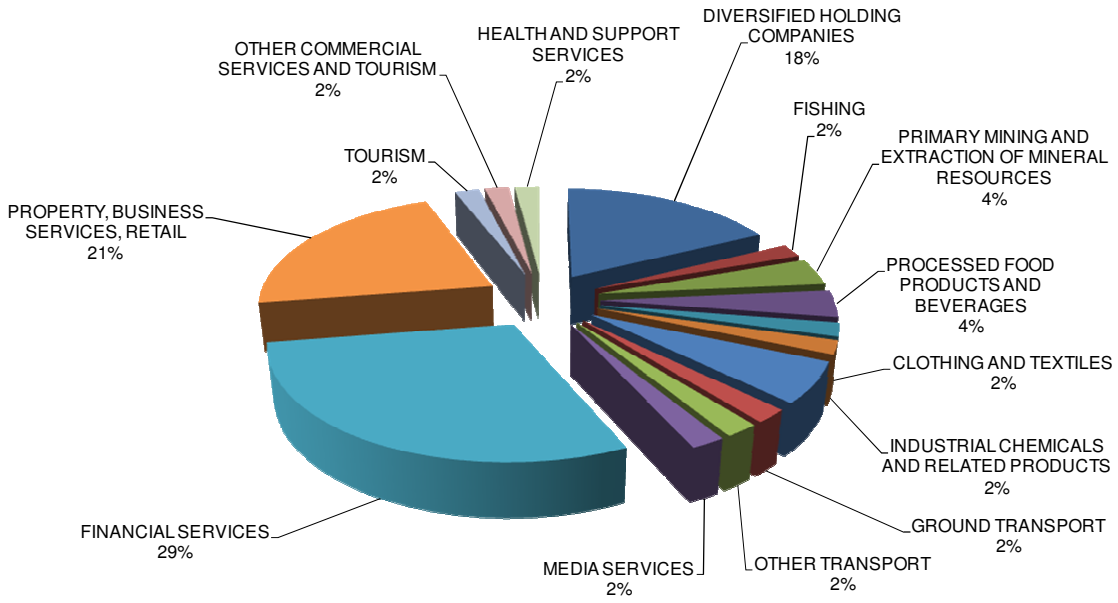
The services sector orientation of the provincial economy is likely to increase further if recent growth patterns continue, as the fastest growing sectors over the past decade have been services related. More widely, knowledge-intensive activities are considered to be on the increase across the economy (from agriculture to manufacturing and financial services), heightening the importance of effective innovation[17]. According to the OECD Territorial Review[18], Cape Town is the only major city region to increase its share of national output. This is driven by growth in knowledge-intensive sectors, expansion of globally dynamic sectors and becoming a services-based economy, as well as meeting urban consumption needs. Whilst this growth is not necessarily all driven by innovation, it is some indication of a basis of competition in knowledge-intensive sectors in the region.

Listed company headquarters

There are approximately 50 JSE listed companies with headquarters in the Western Cape. The graph below shows the strong dominance of financial services (stronger than in terms of overall economic activity and employment), diversified holding companies, and business and retail services.

[16] Quantec standardised regional data set
[17] Provincial Government of the Western Cape (2007), "Chapter 4: Regional Innovation and Growth" in Provincial Economic Review & Outlook
[18] OECD (2008) Territorial Review: Cape Town, South Africa

Figure 1: Sectoral profile of W. Cape based JSE companies



Innovative SMMEs and new enterprises

In addition to the larger, established firms that are active in the economy of the province, there are numerous SMMEs in the province that may or may not be involved in innovation. It is difficult to systematically identify innovative SMMEs amongst these, as they may not be known outside their niche area. However, anecdotal evidence points to the presence of many high quality innovative SMMEs in the province, including in the fields of software, biotech, pharmaceuticals, boatbuilding, automotive, food and natural products. There are also some signs that there is growth in new SMME businesses – for example in the IT sector, the Cape IT Initiative census of IT firms in Cape Town has shown a growth from an estimate of 248 companies in 1998 to over 3,000 businesses in the 2007 study[19].

However, in some cases these businesses have been recognised through awards and media coverage. Examples of companies identified to date that have been recognised for their innovation (e.g. Technology Top 100 awards, www.southafrica.info coverage, international awards) include:

- IT and media:
  - AfriGIS: Geographical Information Systems and mapping services
  - AmaRadio or strategy online – software to enable listening to radio online without using proprietary software
  - Billminder: Electronic bill solutions
  - Breadbin Interactive: freedom toaster (a vending machine with free digital content whose applications include long-distance education – a 'toaster' has been developed for UNISA)
  - Cellsmart: Mobile marketing
  - Cura Software Solutions: IT solutions
  - d6 media: Media monitoring
  - Grove Group: Web security
  - Khanya: Electronic Curriculum solutions for Western Cape Schools
  - Attix5 Africa: Backup and recovery software
  - Nexion: Cashflow management for medical practices
  - OrderTAlk: Catering booking management software

[19] Sources: Geoff Heinebach (CITI founder) and CITI, Frost & Sullivan (2007) Cape ICT Census

- Quirk: Online marketing
- SmartGuide: Interactive maps and guides for the Southern African region

- Food, beverage and natural products:
  - Cape Natural Tea Products: rooibos and honeybush tea product development
  - Red Espresso: new rooibos trademarked process and products
  - Stormhoek and Perdeberg wines: Innovative use of web-based and social network marketing channels
  - Various niche spice and seasoning companies that have become internationally recognised, e.g.Cape Herb & Spice Company, So!Go and NoMU

- Engineering, equipment and measurement or tools:
  - Cape Advanced Engineering: Engineering products development and testing
  - Sunspace Information Systems: Manufacturer of small and medium sized satellites
  - Vibol International: Manufacturer of an Exhaust Vibration Balancer used in the engine and exhaust systems of automobiles
  - Blue Cube Systems: Manufacturer of mineral quantification instrumentation
  - Resource Ballast Technologies: treatment system for ballast water in shipping industry
  - EDH: 3D tracking radar systems for the military and sports markets

- Renewable energy and related:
  - Freeplay Energy: Cape Town based product development (although now listed on the London Stock Exchange), with a focus on developing renewable energy based power systems for radios, torches, headlamps and standalone chargers for wireless sets and cellphones (wind-up, solar and rechargeable)
  - Magcode SA: Solar traffic light system
  - Optimal Energy: intending to produce an electric car in the Western Cape
  - Photovoltaic Technology Intellectual Property/Thin Film Solar Technology: planning to produce thin-film solar modules in the Western Cape

- Medical (pharmaceutical and medical materials and equipment):
  - Meditek-Hemko: Manufacturer of hospital equipment and furniture
  - Orthomedics: Manufacturer of various orthopaedic products (e.g. for joints, spines)
  - Vision Biotech: Manufacturer of equipment and test kits
  - BCC Pharmaceuticals: suppliers of pharmaceutical and medical goods including: medical furniture, hospital linen, medical disposables, laboratory supplies and equipment
  - Health Focus: Providers of medical billing solutions and practice management software
  - Hilfort Plastics: Manufacturer of rigid plastic bottles and caps for food, beverage, cosmetic, pharmaceutical, spirits and wine industries
  - Western Cape Physio and Medical Equipment: Manufacturer of hi-tech hospital electric beds, multiple motor posture beds, trolleys, Heath & beauty furniture, back braces, lumber rolls / cushions, mats

- Boat building and design:
  - Caudwell Marine: Manufacturer of the new Axis Drive marine propulsion system for the recreational boating market
  - Eraco Boat Builders: Manufacturer of commercial craft for use in patrol and rescue
  - Kobus Naval Design: Designers of 8m convertible yachts for private use.
  - Maverick Yachts: Manufacturer of sailing multihulls for charter/fractional use
  - Robertson and Caine: Manufacturer of sailing multihulls for charter use
  - Seartex: Manufacturer of fibreglass, carbon and aramid based multi-axial and woven textiles
  - Simonis Voogd Design: Designer and manufacturer of yachts, focus in applying computer aided design
  - Southern Spars: Manufacturer of carbon fibre glass yacht masts and rigging components

- Stealth Yachts: Manufacturer of hydrofoil supported catamarans for charter/fractional use. Wayne Robertson Yachts: Manufacturer of pocket racers for sporting and or private use

Industry organisations

There are some overarching business structures that are involved in supporting or lobbying for innovation in the Western Cape, including:

- Accelerate Cape Town: Focused on the future development of the City of Cape Town, with a base of large business members
- Cape Chamber of Business: representing both large and small business in the Cape region
- National Business Initiative: a national structure with the stated aim of enhancing the collective role of business in contributing to South Africa's success[20]

There are also a number of industry associations active in the province, most of which are regional branches of national structures. However, with some exceptions (such as the South African Association of Food Science and Technology – SAAFOST) these associations do not appear to have a significant emphasis on innovation. *For information on sectoral Special Purpose Vehicles, please refer to Section 3.2.*

Findings of previous surveys that are relevant to innovation activity by business

A 2007 assessment of regional innovation profiles indicated that the Western Cape accounted for 14% of national R&D investment in 2004, and 13% of national patent applications in 2004[21] (which is similar to the province's share of national output and gross value add). However, these measures are an imperfect indicator of innovation activity.

A recent HSRC paper[22] has compared the findings of the R&D and Innovation surveys to seek to understand firm-industry relationships. The report does not disaggregate the findings to provincial level, but information on the types of firms that tend to collaborate is nevertheless of interest for the Western Cape, namely:

- Collaborating firms tend to be larger in size
- They tend to seek to complement internal R&D capability
- Innovation co-operation is higher in high-technology sectors

More specifically, the findings indicate that firms that tend to collaborate with universities are larger (in terms of employment and turnover), and spend a higher proportion on innovation-related activities than those that do not collaborate with universities.

The **Global Entrepreneurship Monitor**, which surveyed South Africa along with many other countries, has only a limited number of questions relating to innovation. However, the 2008 survey findings do show some patterns relating to innovation activities and perceptions in the province. For example[23]:

- **Of those trying to start a business**:
  - 38% felt the product or service they were offering would be considered new or unfamiliar to most clients
  - 56% felt that they had few competitors offering the same products or services, whilst 44% felt that they had many competitors

[20] See www.nbi.org.za
[21] J. Lorentzen, HSRC on behalf of NACI (2007) Regional and local innovation profiles
[22] I. Petersen, G. Kruss (2009) Firm interaction with universities and public research institutions: evidence from innovation and R&D surveys in South Africa
[23] Adult Population Survey 2008 summary data

- Close to 60% of respondents considered the technologies they were using to have been around for more than 5 years, 20% between 1 and 5 years, and only 12% were using technologies that had been around less than 1 year

- **Of those already running a business:**
  - Only 15% felt the product or service they were offering would be considered new or unfamiliar to most clients
  - 50% felt that they had many competitors offering the same products or services, whilst 41% felt that they had few competitors (only 6 % felt they had no competitor)
  - Around 54% of respondents considered the technologies they were using to have been around for more than 5 years, 11% between 1 and 5 years, and 11% were using technologies that had been around less than 1 year (over 20% did not know the age of the technologies they were using)

The GEM Adult Population Survey results give some sense that the majority of businesses are not particularly focusing on providing new products or services, and are not making use of very recent technology developments (although it is possible that they are innovating around processes and modes of service delivery but these innovations were not captured in their responses). This is particularly interesting in the case of start-up companies (although they do have a higher percentage of novel products and services than established enterprises).

However, a GEM report comparing entrepreneurship in world cities[24] found that **Cape Town is the most entrepreneurial city in South Africa** (65% higher than the national average), which is second only to Hamburg (Germany) in terms of difference to the national average. Cape Town also has the largest gap of all researched cities on the measure of "early stage opportunity entrepreneurial activity" – i.e. taking advantage of an opportunity rather than starting a business because of a lack of options for work. This entrepreneurship is strongly associated with "links to the creative class", although it is less strongly oriented around job growth and use of latest technology than many other cities. However, Cape Town has the biggest negative difference with the national average of the city group on percentage who claim their product is new and who do not expect many competitors. More widely, Cape Town ranks as follows within the 34 cities researched:

- 14th for early stage entrepreneurial activity
- 20th for growth oriented early stage entrepreneurial activity as a percentage of the population between 18 and 64 years

Presence of knowledge intensive business services and knowledge brokers

Limited information is readily available on the presence and role of knowledge intensive business service (KIBS) companies in the Western Cape. However, indications are that there is some activity, e.g.:

- **Legal firms with IP capability:**
  The South African Institute of Intellectual Property Law lists the following Cape Town based firms as having some form of IP law capability (they nationally represent around 140 patent attorneys, patent agents and trademark practitioners, and have a total membership of 289 including student members and trainees)[25]
  - Adams & Adams
  - Bowman Gilfillan
  - Brian Bacon & Associates Inc

[24] Z. Acs, N. Bosma, R. Sternberg, for GEM (2008) The Entrepreneurial Advantage of World Cities: Evidence from Global Entrepreneurship Monitor Data
[25] See www.saiipl.org.za/

  - Cliffe Dekker Fuller Moore
  - Fairbridge Arderne & Lawton Inc
  - Hahn & Hahn
  - Jan S De Villiers
  - Webber Wentzel
  - Spoor & Fisher
  - Von Seidels
- **Private equity firms** (although it seems that increasingly these firms are providing growth capital to established businesses rather than start-up venture capital) e.g.:
  - Cape Venture Partners
  - Bioventures
  - HBD Venture Capital
- **Certification and accreditation of service providers**
  - South African National Accreditation System
- **Testing laboratories**
  - ARC-Elsenburg Analytical Services: Chemical and Microbiological Analysis
  - Hearshaw and Kinnes Analytical Laboratory: Chemical analysis
  - J Muller Laboratories: Chemical analysis
  - Labtest South Africa (Pty) Ltd: Physical Testing
  - Lafarge South Africa Limited: Civil Engineering Testing
  - Matrocast Laboratories (Pty) Ltd: Civil Engineering Testing
  - Microchem Lab Services (Pty) Ltd: Chemical and Microbiological Analysis
  - Micron Laboratories: Microbiological Testing: Fish, Chicken, Meat, Milk and Water
  - Mineral Services Laboratories: Chemical Analysis
  - Rhodes Food Group: Microbiological Analysis
  - Swift Micro Laboratories (Pty) Ltd: Microbiological Analysis
  - Water Analytical Laboratory: Chemical & Microbiological Analysis

Further research is required to identify technical services, consultancies and other intermediaries that support innovative companies.

3.1.2 Academia

The four universities in the Western Cape Province are:

a. Cape Peninsula University of Technology (CPUT)
b. Stellenbosch University (SU)
c. University of Cape Town (UCT)
d. University of the Western Cape (UWC)

The publicly-stated research focus areas of each university (based on what is presented on their websites) are set out the table below (note that university categorisations of focus areas vary):

Table 3: Publicly stated research focus areas of universities

CPUT	SU	UCT	UWC
Niche research areas: ▸ Computational and Applied Technologies Manufacturing ▸ Environmental Toxicity and Remediation ▸ Instrumentation Research ▸ Real-Time Distributed Systems	Research focus areas: ▸ Language and Culture in a multilingual and multicultural society ▸ The "Knowledge Economy" ▸ Building a New Society ▸ Competitive economy ▸ Biotechnology ▸ Sustainable	Signature themes: ▸ Cities in Africa ▸ Drug Discovery ▸ Minerals to Metals ▸ Brain Behaviour ▸ Marine Research	Research focus areas: ▸ Response to need & interdisciplinarity ▸ Biotechnology ▸ Biodiversity & conservation biology ▸ Community welfare ▸ Cultural studies ▸ Computer science ▸ Development studies

CPUT	SU	UCT	UWC
▸ e-Business, e-Government and Community Engagement for Shared Growth ▸ Material Science and Technology ▸ Work-Integrated Learning Research ▸ Functional Foods	biodiversity and the environment ▸ The struggle against disease and the promotion of health ▸ Technology for Industry ▸ The production and provision of food ▸ Fundamental theory, mathematics and complexity		▸ Dynamics of building a better society (DBBS) ▸ Education ▸ Environmental studies ▸ Exploration or applied geochemistry ▸ Governance & administration ▸ Health issues ▸ History & heritage studies ▸ Integrated water resource management ▸ Labour issues ▸ Language ▸ Law ▸ Lifelong learning ▸ Literature ▸ Management ▸ Material science ▸ Mathematics & statistical sciences ▸ Medical biosciences ▸ Nanotechnology ▸ Politics ▸ Women's & gender studies

Each university has some form of central management or support of research commercialisation activity by the university, namely:

- CPUT: Deputy Vice-Chancellor for Research, Technology Transfer & Innovation (appointed 2008) overseeing Directorate for Technology Transfer
- SU: InnovUS technology transfer office (established in 1999)
- UCT: Research Contracts and Intellectual Property Services (established in 1999)
- UWC: Department of Research Development, currently in the process of establishing a technology transfer office

For the purposes of measuring subsidies, revenue and staff performance, the universities have started to develop databases to track research contracts, publications and technology licenses. However, these databases are not publicly available, and universities have not shared them with this project team (in some cases stating confidentiality, in others responses could not be prepared within the required timeframes of this project). It is therefore not clear how comprehensively these databases have been populated, as well as to what extent they capture existing collaborations.

Universities have also published Annual Research Reports, although not necessarily consistently each year. These reports capture key research activities, but are generally organised by faculty rather than being consolidated across the university.

Based on university websites and Cape Higher Education Consortium documents, it is estimated that there are approximately 170 centres, research units, institutes, bureaux etc within these universities that are involved in research, and potentially could contribute to innovation (note that this does not include all departments that provide lecturing and which may have some role in research).

Together these universities employed an estimated 2,200 researchers (including PhD and postdoctoral students) and had 36,000 postgraduate students in 2006[26]. Including public research institutions, hospitals etc., there are an estimated total of 4,000 researchers in the province. In comparison, the Tuscany region in Italy has 11,000 staff in research, while Madrid had 8,402 researchers in 2005. [27]

Researchers that have been rated by the National Research Foundation (NRF) are located as follows at Western Cape universities.

Table 4: Number of NRF rated researchers by category and university (2009)[28]

NRF rating / University	A	B	C	P	Y	L	Total
Cape Peninsula University of Technology		2	7		2	3	**14**
Stellenbosch University	13	61	130	3	31	5	**243**
University of Cape Town	31	92	129	5	28	2	**287**
University of the Western Cape	1	15	38	0	4	2	**60**
Total	**45**	**170**	**304**	**8**	**65**	**12**	**604**

Key to NRF ratings:
A Leading international researcher
B Internationally acclaimed researcher
C Established researcher
P NRF President's Awardee
Y Promising young researcher
L Late entrant into research

The total of 604 NRF rated researchers based at universities in the Western Cape represents approximately 35% of the national university-based NRF researcher total. This indicates a relative concentration of research capacity in the province, with Gauteng being the only other province with a similar number of NRF rated researchers.

The project team has completed an initial categorisation of the focus areas of these research centres and NRF rated researchers based on the Australia New Zealand Fields of Research (FOR) groupings (note that allocation to categories has not been confirmed by the universities, and may therefore require refinement in future research). The tables below indicate the top ranked fields of research that emerge from this analysis, first by institution, and then in total for the province.

Note: As indicated earlier, some of the universities required more time than this project permitted to prepare data on their researchers, research publications, research contracts, invention disclosures, patents, technology licences, and spin-offs. These measures of research focus therefore could not be included.

[26] For instance, CPUT alone had 101PhD and 691 Masters students in 2008 (Source: CPUT, 2008. Research Report 2008)
[27] OECD (2008) OECD Territorial Review: Cape Town
[28] Based on NRF database

Table 5: Assessment of dominant fields of research based on centres and numbers of NRF rated researchers

CPUT	SU	UCT	UWC
Based on focus of research centres: 1. Specialist studies in education 2. Medical and health services 3. Functional Foods 4. Crystal engineering 5. Radio chemistry and ion exchange chromatography 6. Sports Science 7. Tourism and hospitality 8. Mathematics, science and technology education 9. Computational and Applied Technologies Manufacturing 10. Instrumentation Research 11. Material Science and Technology 12. Mechanics, smart structures and Microsystems 13. Wireless technologies 14. Energy 15. Power systems research	**Based on focus of research centres:** 1. Other engineering 2. Specialist studies in education 3. Language studies 4. Religion and religious studies 5. Business and management 6. Psychology 7. Agricultural biotechnology 8. Other biological sciences 9. Electrical and electronic engineering 10. Manufacturing engineering 11. Public health and health services 12. Other economics 13. Environmental science and management 14. Other technology 15. Medical microbiology	**Based on focus of research centres:** 1. Other medical and health sciences 2. Environmental science and management 3. Resources engineering and extractive metallurgy 4. Other engineering 5. Other commerce, management, tourism and services 6. Religion and religious studies 7. Other biological sciences 8. Medical microbiology 9. Other studies in human society 10. Cultural studies 11. Political sciences 12. Cardiovascular medicine and haematology 13. Public health and health services 14. Law 15. Oncology	**Based on focus of research centres:** 1. Specialist studies in education 2. Other biological sciences 3. Political science 4. Law 5. Education systems 6. Other education 7. Cultural studies 8. Environmental science and management 9. Other studies in human society 10. Public health and health services 11. Policy and administration 12. Agriculture, land and farm management 13. Business management 14. Literary studies 15. Medical microbiology
Based on focus of NRF rated researchers: 1. Education systems 2. Other education 3. Other earth sciences 4. Biochemistry and cell biology 5. Mechanical engineering 6. Other technology 7. Medical microbiology 8. Cultural studies 9. Environmental analytical chemistry	**Based on focus of NRF rated researchers:** 1. Ecology 2. Genetics 3. Medical physiology 4. Other chemical sciences 5. Other studies in creative arts and writing 6. Statistics 7. Atomic, molecular, nuclear, particle and plasma 8. Physics 9. Macromolecular and materials chemistry	**Based on focus of NRF rated researchers:** 1. Specialist studies in education 2. Genetics 3. Medical microbiology 4. Law 5. Other biological sciences 6. Ecology 7. Other studies in human society 8. Applied mathematics 9. Other engineering 10. Policy and	**Based on focus of NRF rated researchers:** 1. Other chemical sciences 2. Public health and health services 3. Microbiology 4. Specialist studies in education 5. Genetics 6. Other physical sciences 7. Historical studies 8. Nutrition and dietetics 9. Other education 10. Paediatrics and

CPUT	SU	UCT	UWC
	10. Ecological applications 11. Microbiology 12. Religion and religious studies 13. Biochemistry and cell biology 14. Numerical and computational mathematics 15. Numerical and computational mathematics	administration 11. Other law and legal studies 12. Information studies 13. Medicinal and biomolecular chemistry 14. Artificial intelligence and image processing 15. Other chemical sciences	reproductive medicine 11. Sciences 12. Law 13. Ecology 14. Applied mathematics 15. Policy and administration

Table 6: Summary of dominant fields of research at universities in the Western Cape based on existence of centres and NRF rated researchers

(Orange cells show fields that appear as specialisations for both centres and researchers)

Field of research rank by # of centres or institutes	Field of research rank by # of NRF rated researchers
1. Other engineering	1. Genetics
2. Other medical and health sciences	2. Ecology
3. Specialist studies in education	3. Specialist studies in education
4. Environmental science and management	4. Other chemical sciences
5. Other biological sciences	5. Medical microbiology
6. Political science	6. Law
7. Language studies	7. Biochemistry and cell biology
8. Religion and religious studies	8. Other studies in creative arts and writing
9. Resources engineering and extractive metallurgy	9. Other studies in human society
10. Public health and health services	10. Policy and administration
11. Business and management	11. Religion and religious studies
12. Other studies in human society	12. Other law and legal studies
13. Law	13. Applied mathematics
14. Cultural studies	14. Medical physiology
15. Agricultural biotechnology	15. Other biological sciences
16. Medical microbiology	16. Environmental science and management
17. Education systems	17. Other engineering
18. Other commerce, management, tourism and services	18. Atomic, molecular, nuclear, particle and plasma physics
19. Policy and administration	19. Microbiology
20. Agriculture, land and farm management	20. Public health and health services

The above tables provide a very rough measure of levels of activity which is being used as a broad indicator in the absence of readily accessible measures of research and innovation output. However, there is significant overlap between the above specialisations and those identified in the 2007 NACI study which made use of 2004 data on publications, although it covered science publications only. Focus areas identified in NACI research included the following (those in bold overlap with those identified in the above table).

- **Biology**
- Earth sciences
- **Industrial biotechnology and food sciences**
- **Mechanical and industrial engineering**
- Civil engineering
- Chemical and process engineering
- Electrical and electronic engineering
- **Clinical sciences**
- **Medicine**
- Human movement and sports science
- **Public health and health science**
- **Medical biochemistry and clinical chemistry**
- Immunology

The above analysis of research focus areas does not necessarily show the relative strength or competitiveness on an international footing of this knowledge generation activity. The presence of NRF A-rated researchers does give some indication of international standing of research capabilities. The dominant fields of NRF A-rated researchers in the province (in descending order of prevalence in the province) are as follows:

- Biological studies
- Medical and health sciences
- Law and legal studies
- Mathematical sciences
- Engineering
- Earth sciences
- Language, communication and culture
- Philosophy and religious studies
- Agricultural and veterinary sciences
- Commerce, management, tourism and services
- Chemical sciences
- Political science
- Education
- Physical sciences

There have been a few **spin-off companies** that have emerged from Western Cape universities. Brief descriptions of those identified to date are provided in the table below:

Table 7: Spin-off companies from W. Cape universities

Name of spin-off	University	Brief description	Available information on current status
Motornostix www.motornostix.com	UCT	Condition monitoring services and equipment to production critical machine clients in South Africa and abroad.	▸ Still operational ▸ Company based in Cape Town
CellLife www.cell-life.org	UCT	Non-profit organisation that is implementing a cellphone-based support system for HIV or Aids therapy. This system allows doctors to communicate with therapeutic counsellors and patients, and it allows semi-literate patients to enter their antiretroviral adherence data directly into a database.	▸ Still operational ▸ Company based in Cape Town

Name of spin-off	University	Brief description	Available information on current status
Hot Platinum www.hotplatinum.co.za	UCT & CPUT	Novel processing technologies for small manufacturing jewellers in the platinum industry. The technology is the product of seven years of engineering research and collaboration between the University of Cape Town's electrical engineering department and the Cape Peninsula University of Technology	▸ Still operational ▸ Company based in Cape Town
The Cape Town Stereotactic Pointer www.fibretekdev.co.za	UCT & MRC	Surgeon's tool to translate measurements taken using computed tomography (CT) or magnetic resonance imaging (MRI) to enable brain tumours to be located during neurosurgery.	▸ Technology manufactured and marketed by Fibretek Developments
AngioDesign www.angiodesign.com	UCT	Design and manufacture of 2nd-generation drugs (patented new chemical entities) with superior efficacy and side effect profiles to treat proven disease targets e.g. cardiovascular diseases	▸ Still operational ▸ Company now based in the United States
Cape Carotene http: or www.capebiotech.co.za or cape_carotene	UCT	Produces natural astaxanthin an organic antioxidant and colorant, which will be used as a feed supplement for farm reared and ornamental fish, and as a nutritional supplement for humans	▸ Still operational ▸ Pilot plant is based in the Northern Cape ▸ Maintains R&D links with UCT
Lodox/African Medical Imaging	UCT	Produces the Statscan Critical Imaging System, is a flexible format digital radiography (DR) system aimed specifically at the needs of emergency medical centres – takes complete pictures of a patient's injuries in a very short time	▸ Still operational ▸ Sales office in the United States
Aquanutro www.aquanutro.com	SU	Designs, develops & manufactures unique scientific formulated feeds for the aquaculture market	▸ Still operational ▸ Based in Malmesbury, and continues to partner with the University of Stellenbosch (Aquaculture Division)
Niocad www.niocad.co.za	SU	Software development for circuit design	▸ Recently launched (2009)
Stellenbosch University Sport Performance Institute www.suspi.co.za	SU	SUSPI is a sport company involved in research, education and training in sport science and sports medicine.	▸ Still operational Company is based in Stellenbosch

Name of spin-off	University	Brief description	Available information on current status
SunSpace www.sunspace.co.za	SU	Micro-, small and medium-sized satellites manufacturer (and associated payloads e.g. imaging, sub-systems, remote sensing)	▸ Still operational ▸ Company based in Stellenbosch
Unistel Medical Laboratories www.unistelmedical.co.za	SU	Diagnostic genetics laboratory providing human and animal diagnostic services including cytogenetics, molecular cytogenetics, molecular diagnostics genetics, forensic DNA analysis and DNA paternity testing.	▸ Still operational ▸ Based in Cape Town
Diacoustic Medical Devices www.diacoustic.co.za	SU	Design, development and manufacture of decision support systems for: auscultation signal processing electrical activity within the human body and medical mobile devices. Examples include a low cost screening device for heart murmurs that is currently under development	▸ Still operational ▸ Based in Stellenbosch
Electric Genetics Corporation www.egenetics.com	UWC	Electric Genetics aimed to provide genomic data analysis systems and validated drug targets for the pharmaceutical, biotechnology and genomics market	▸ No longer operational ▸ At one stage had offices in the US and Cape Town

This list shows a predominance of medical or health (genetics, sport, HIV treatment) and medical-engineering related spin-offs (e.g. medical devices, metal processing).

Note that anecdotal input from stakeholders is that there might well be many more companies that have indirectly spun off from universities, including:

- Academic researchers that have developed their companies separately from the university to reduce bureaucratic hassles and improve the commercial attractiveness of the venture
- Students that have established businesses after leaving university, based on ideas generated during their studies

Whilst it is encouraging that some spin-off companies have emerged, the numbers are low compared to performance in some other regions. For example[29]:

- In the Canadian provinces of Sasketchawan and Manotiba:
  - A total of 78 university spin-offs were created by 9 universities and research institutions in the 36 year period between 1972 and 2008
  - 53 of these spin-offs are still active and operational, and have created 3,600 jobs, most of them in their provinces of origin, and some have given rise to second-generation spin-offs[30]
- Hong Kong:
  - The 5 universities in Hong Kong have generated 84 spin-off and start-up companies amongst them between 1997 and 2004

[29] M Leung and JA Matthews (2006) Origins and dynamics of university spin-off enterprises in Hong Kong
[30] Prairie Intellectual Property Management Network (2008) University spin-off companies: A Sasketchawan-Manitoba success story

3.1.3 Government

All three spheres of government, as well as public research institutions, are involved in supporting innovation in the province.

National government:

There are various DST and NRF related activities in the province, including:

- DST investigations into regional innovation systems and science parks
  - A draft national Regional Innovation Systems Strategy document has been prepared which proposes the establishment of a Provincial Innovation Council to advise provincial government on innovation policy and provide funding for Regional Innovation Forums
  - The RIS Strategy also proposes a Regional Innovation Forum to provide networking opportunities for SMMEs, fund innovation surveys, and serve as a go-between for the regional office of the Technology Innovation Agency, and local and provincial government in the Western Cape

- DST support for a feasibility assessment of the proposed Belville Science Park (as part of the DST Regional Innovation Systems Strategy)
  - The Belville Science Park is intended to facilitate the growth of SMMEs in selected sectors (e.g. pharmaceuticals, biotechnology and health, ICTs, material science, alternative energy, engineering) through innovation and collaboration across the triple helix. It is also intended to increase the number of post-graduates attracted to and retained in the Western Cape through increased opportunities for research. A draft feasibility study and business plan for the science park is underway.

- DST has recently launched a national initiative called the Technology Localisation Framework to boost the technological capacity of local manufacturing firms by providing technology benchmarking support and targeted technology assistance packages

- Tshumisano Trust: funding of agri-food and clothing & textiles technology stations in the province, and funding of Rapid Appraisal of Local Innovation Systems (RALIS)

- THRIP and Innovation Fund incentive grants to projects in the province

- The National Innovation Competition coordinator is partly based at UCT
  - Held bi-ennially, this is a student business plan competition targeting technology innovations from students enrolled at all higher education institutions in South Africa. The main prize is funding for commercialisation of the idea. All Western Cape universities have submitted entries for the 2009 competition, and according to the National Coordinator, UCT's entries have traditionally been amongst the strongest in the country.

- The following public research institutions and councils have a presence in the Western Cape:
  - Agricultural Research Council (ARC) and Department of Agriculture research and demonstration farms
  - Council for Scientific and Industrial Research (CSIR)
  - Human Sciences Research Council
  - IThemba Labs (National Research Foundation)
  - South African Astronomical Observatory
  - South African Medical Research Council (SAMRC)
  - South African National Bio-informatics Institute

Other public entities in the province that may indirectly be involved in innovation and research include the following:

- South African National Biodiversity Institute
- Small Enterprise Development Agency (through various support services to SMMEs)

Provincial government:

The Provincial Government of the Western Cape has identified knowledge intensity as a key part of the growth strategy for the province, and has stated an intention to develop an innovation framework in partnership with business and universities.

The Department of Economic Development and Tourism (DEDAT) includes technology and innovation issues in its mandate, within the context of competitiveness and sector development. Funding and oversight of sectoral Special Purpose Vehicles and research through the Micro-Economic Development Strategy (MEDS) are two important available tools to support innovation-related collaboration and knowledge sharing. One current initiative is an online portal linking all the SPVs and industry. SPVs can upload information on the services they provide, while industry can access support tools for business planning and management (e.g. templates for business plans), group discussions and upload video content to market their businesses. DEDAT has also over the years initiated various cluster programmes to bring industry stakeholders together (e.g. stainless steel) as part of its economic development strategy.

The sectors prioritised in the Western Cape's Microeconomic Development Strategy (or MEDS) are[31].

- **"Priority" sectors**:
  - Oil and gas supply industry
  - Information and Communication Technology
  - Business Process Outsourcing (BPO)
  - Tourism
- **"Significant" sectors**:
  - Creative industries
  - Film
  - Craft
  - Music
  - Clothing & textiles
  - Metals & engineering
  - Agri-processing & food-processing
  - Boat-building
- **"Watch-list" sectors**:
  - Fishing & aquaculture
  - Biotechnology
  - Chemicals
  - Printing & packaging
  - Financial services
  - Retail, wholesale & franchising
  - Environmental goods & services
  - Electronics

The 2005 Provincial Advanced Manufacturing Technology Strategy identified craft, electronics, food, metals and engineering (including tooling), and clothing as initial focus sectors, with further sectors to be identified over time. Recommendations for collaborative innovation across these

[31] Source: W. Cape Department of Finance (2009) Estimates of Provincial Expenditure: Vote 12: Department of Economic Development and Tourism, p. 587.

sectors included the establishment of a craft centre for innovation, an electronics innovation network and a food innovation network. Four technology focus areas were also identified, namely: advanced materials, advanced product technologies, advanced production technologies, and logistics.

In addition, the province's 2000 'White Paper on Preparing the Western Cape for the Knowledge Economy of the 21st Century' identifies transforming the Western Cape into a leading learning region and a centre for entrepreneurship and innovation as two of the 4 main pillars of the province's approach to the knowledge economy. Some of the proposed interventions to give effect to these two pillars include:

- Rationalising and sharing facilities between the province's higher education institutions
- Greater collaboration and sharing of information between industry-based R&D personnel, university and technikon researchers, and state-supported research councils
- Increased funding of research by corporations, as well as sponsorship of international exchanges and conferences
- Promoting co-operation and collaboration in the development and operation of ICT between government, business, the non-governmental sector and international partners
- Supporting the development of a regional cluster of ICT, new media and related industries as an engine for the Western Cape's knowledge economy
- Strengthening the role of higher and further education as an incubator for new-technology based firms, and as a source of know-how and technology to SMMEs
- Working collaboratively with all stakeholders to create a positive environment for the increasing provision of private equity and venture capital in the Western Cape
  - Establishing a Western Cape PE&VC forum (with resources for a small secretariat) to bring together all PE&VC role-players and to provide an access point for seekers of capital to obtain information and advice
  - Interacting with the commercial banking sector to encourage funding of higher risk enterprises

Local government:

The City of Cape Town has also identified knowledge intensity as a key driver of growth. In the past, the City supported innovation awards (e.g. the City previously sponsored a Mayor's Award for Technology which linked winners to venture capitalists as part of the prize). The City also used to conduct an annual survey (TechnoCape) of technology-intensive sectors in Cape Town.

Currently, the City of Cape Town is actively involved in a number of SPVs e.g. Cape IT Initiative, Cape Craft & Design Institute, and the Cape Town Boat Building Initiative. The laying of a fibre optic cable network is seen as one key contribution to the enabling environment for knowledge intensive and innovative firms in the City region, and for facilitating digital networking collaboration (by linking the universities). Other initiatives by the City of Cape Town include Cape Town Activa[32] (an initiative to bring together entrepreneurs, academia and funders), the African Entrepreneurship Competition scheduled to take place in March 2010 (which will include innovation as a focus area), funding for innovation commercialisation at the idea, start-up and growth stages, and support for skills development through interaction with CHEC and funding for schools.

The City of Cape Town is also in the process of gathering information on research capabilities at Western Cape universities in order to gain a better understanding of research focus areas in the province, and identify potential gaps relative to key economic sectors and topics of interest to business (e.g. links between innovation activities and tourism, retail and logistics).

[32] This is modelled along the example of Spain's Barcelona Activa, (www.barcelonaactiva.com) which aims to create an entrepreneurship ecosystem by providing institutional support to SMMEs in the form of coaching, skills development, and innovation networks. The Cape Town site is available at http://capetownactiva.ning.com/

Further research is required on the roles of the Cape Winelands District Municipality and Stellenbosch Municipality in relation to innovation.

3.2 Indications of existing collaborations

The sections below provide summaries of the data gathered on existing collaborations within the Western Cape. Further detail is available in Appendix D of this document and the "linkages" sheet of the Excel database which accompanies this document.

3.2.1 Collaborations within the Western Cape

The table below sets out examples of existing collaborations between organisations in the Western Cape, based on available secondary information and input from interviews. Within the table, distinctions are made between collaborations involving all three helices (academia, industry and government) and those involving all the possible combinations of two helices.

EXAMPLES OF WESTERN CAPE COLLABORATIONS
ACADEMIA-INDUSTRY-GOVERNMENT COLLABORATIONS
THRIP projects: ▸ Incentive by definition ensures collaboration between government, industry and academia ▸ 425 projects in the Western Cape since 2005 (new projects and continuations), of which: – 175 were at Stellenbosch University – 166 were at UCT – 40 were at ARC – 21 were at CPUT – 19 were at UWC – 4 were at MRC
Centres of Excellence: ▸ DST-NRF Centre for Biomedical TB Research (based at SU) and GlaxoSmithKline in America ▸ DST-NRF Centre of Excellence for Catalysis (based at UCT)
Wine industry network ▸ The ARC, UCT, University of Stellenbosch are the R&D partners of the Wine Industry Network of Expertise and Technology (Winetech), which aims to improve the competitiveness of the South African wine industry, focusing on technological innovation and human resource development ▸ Members of Winetech include South African Wine Industry Information & Systems (SAWIS), Vinpro (representative association for wine producers), labour and civil society
Special Purpose Vehicles with some academic linkages: ▸ Cape Initiative in Materials and Manufacturing: links to all four universities and iThemba Labs, based on UCT campus, has been funded by provincial government in the past, and deals with information request and queries from industry ▸ Cape Craft & Design Institute: active relationship with craft industry and wider industry, funding from province and City of Cape Town, historical relationship with CPUT (although currently HEI relationship is less active) ▸ Western Cape Tooling Initiative: funding from government, some limited relationship with CPUT and Stellenbosch (establishing stronger relationship with FET college) ▸ Cape Biotech Trust: national government funding, merger with Acorn Technologies (life sciences commercialisation and incubation with dti or seda funding), links to emerging biotech industry and venture capital (e.g. Bioventures), relationship with Stellenbosch University, as well as Medical Research Council ▸ Cape Town Boatbuilding Technology & Initiative: funding from provincial and local government, some links with Stellenbosch University and UCT, as well as CSIR plays an important information-sharing role with industry ▸ Clotex: funding from provincial and local government, links with CPUT or Tshumisano clothing technology station and UCT Graduate School of Business ▸ Cape Town Fashion Council: funding from provincial and local government, links to CPUT design faculty ▸ Performing Arts Network SA (PANSA) and Visual Arts Network SA (VANSA)– government funding, some

EXAMPLES OF WESTERN CAPE COLLABORATIONS

linkages to universities e.g. UCT
- Cape Town Partnership: through its Creative Cape Town programme, works with UCT, CPUT the City of Cape Town, Cape Town Tourism, and province to develop Cape Town's creative industries and knowledge economy
- Cape Town Routes Unlimited: research contracts awarded for various joint projects by The Centre for Tourism and Research in Africa (CPUT) and Stellenbosch University in 2008

FabLab:
- Funded by government (historically under the AMTS programme)
- Used by design and engineering students from most of the W. Cape universities
- Used by industry – crafters and designers
- Share a common space which, in a few cases, supports relationship-building

Advanced Manufacturing Technology Laboratory
- Funded by government, including provincial funding
- Based at UWC
- Aims to provide support to industry

Athlone Living Lab
- This is managed by CPUT (in partnership with UWC, UCT, civil society, local schools, COFISA)
- Aims to use innovative ICTs for local economic development (including SMME incubation, general education and awareness)

Base of the Pyramid Learning Lab (Southern Africa)
- Housed at the University of Stellenbosch
- This is part of an international initiative to build public private partnerships to tackle socioeconomic challenges at the base of the pyramid (lower income communities and consumers)– activities involved identifying opportunities for intervention, facilitating networking amongst corporates, civil society and the public sector, and providing implementation support

Tshumisano Technology Stations: Funded by government, based at CPUT, providing research and quality services to industry
- Agri-food Technology Station
- Clothing or textiles Technology Station
- Participatory Rapid Appraisals of Local Innovation systems funded by the Tshumisano Trust– in relation to the role of these technology stations

Eskom Expo for Young Scientists:
- In addition to Eskom's involvement, sponsors include DST, Intel, Armscor, University of Stellenbosch, South African Agency for Science and Technology Advancement, and MTN Science Centre (Cape Town)

CIO Forum
- Forum for Chief Information Officers at the four Western Cape Universities to engage with each other and other academics (deans, heads of department), industry and government (e.g. State Information Technology Agency, Department of Education) to discuss issues relevant to the ICT sector
- The Forum plans to establish an independent applied research centre to facilitate projects that bridge the gap between academia and commercial enterprises

ACADEMIA-INDUSTRY COLLABORATIONS

Research contracts:
- UWC has done work with, for example, Sasol, Eskom, and Petro SA
- UCT signed approximately R496m worth of contracts in 2007, including work for Sasol
  - There are also plans for a Science Shop to provide an interface between UCT and industry
- CPUT signed contracts with Airbus SA, De Beers, Aloca, Eskom, African Explosives and Tenside Chemicals in 2007. CPUT also worked with SurePure, Eskom, DBSA, AEL SA Sugar Association, SA Rooibos Council and Bloemwater in 2008.

Projects:
- CPUT has done work with, for example, ABSA, Vital Health Foods, Quickslab, Ramsden Trading, Mega Tech Incorporated, KPMG, IBM South Africa, Fedics and Stannic fleet management.

Joint patents, e.g.
- Stellenbosch University and Deciduous Fruit Producers Trust (Preservative gas generating device)

Centres of Excellence:
- DST-NRF Centre of Excellence for Catalysis (based at UCT)
- DST-NRF Centre of Excellence for Invasion Biology (based at SU)

EXAMPLES OF WESTERN CAPE COLLABORATIONS

- DST-NRF Centre for Biomedical TB Research (based at SU)
- DST-NRF Centre of Excellence in Birds and as Keys to Biodiversity (based at UCT)

Industry funding of equipment and centres or shared facilities, e.g.:

- Sasol commitment to sponsor solar thermal energy research at Stellenbosch University
- Medtronics Institute for Biomedical Research at UCT
- CPUT is in the planning stages of an Innovation Park focusing on enhancing motor vehicle performance (e.g. engine manufacturing)

Accelerate Cape Town – CHEC or university forums on innovation:

- Forums to discuss the future of innovation and collaborative approaches in the City of Cape Town

"27Dinner"

- This is an informal community of practice that brings together people interested in technology, media and business. Dinners are held on the 27th day of each month and create opportunities to share ideas, debate industry topics, and network for collaboration.
- Outputs to date have included improved ideas, finding staff and securing business partners
- 27Dinners are currently held in Cape Town, Johannesburg, Port Elizabeth and Durban.

ACADEMIA-GOVERNMENT COLLABORATIONS

MOUs between Cape Higher Education Consortium (CHEC) and Provincial Government of the Western Cape (PGWC) and City of Cape Town

- MOU with province included an appendix on support for growth clusters and innovation

NRF rated researchers:

- Based at universities and, in some cases, public research institutions, with access to government research incentives *(see analysis of locations and focus areas of NRF researchers in Section 3.1.2.)*
- 24 NRF-funded research chairs in the province
  - 0 at CPUT
  - 5 at SU
  - 18 at UCT
  - 1 at UWC
- Dominant fields of research include: health (immunology of infectious diseases, clinical neurosciences, vaccinology, post-traumatic stress disorder), law, politics and economics (land reform and democracy, language and social change, economics of social policy), mineral beneficiation and bioprocess engineering

Research contracts

- UWC has done work with state-owned enterprises and public research entities such as Eskom and the Water Research Commission
- CPUT conducted work for the national DEAT, CTRU, CHEC/Western Cape Education Department in 2008. CPUT also did contract work for the Cape Winelands District Municipality, the Stellenbosch Local Municipality and the West Coast Municipality.
- The Department of Education (DoE) subsidised publication output by staff at CPUT. A total of 92.18 units were submitted to the DoE in 2008
- CPUT has done work with public research entities such as the Water Research Commission

Innovation Fund projects:

- 2009 recipients in the Western Cape include: University of Stellenbosch (11), the Medical Research Council (11), University of the Western Cape (2)
- Focus areas include health, agriculture, energy, and marine culture

Joint centres between universities and public research institutions ,e .g.:

University of Cape Town:

- Medical Research Council-University of Cape Town Medical Imaging Research Unit
- Medical Research Council-University of Cape Town Liver Research Centre
- Medical Research Council-University of Cape Town Receptor Biology Research Group
- Medical Research Council-University of Cape Town Oesophogal Cancer Group
- Medical Research Council-University of Cape Town Human Genetics Research Unit
- UCT-CSIR, UCT-Mintek, UCT-HSRC (strategic partnerships, not formalised into joint centres or units)

Joint patents between universities and public research institutions e.g.:

- University of Cape Town and Medical Research Council: various HIV, genetics and infection related patents
- UCT and Water Resource Commission: water treatment

EXAMPLES OF WESTERN CAPE COLLABORATIONS
▸ University of Stellenbosch and the Agricultural Research Council (indigenous teas)
INDUSTRY-GOVERNMENT COLLABORATIONS
Other sectoral Special Purpose Vehicles (SPVs) with less active relationships with academia: ▸ SA Oil & Gas Alliance ▸ Cape Ship Repair ▸ Cape Town Routes Unlimited ▸ Cape IT Initiative ▸ Cape Film Commission ▸ Cape Clothing and Textiles Cluster ▸ Calling the Cape ▸ Western Cape Furniture Initiative
Accelerate Cape Town – Wesgro investment marketing: discussions on including innovation in Western Cape investment branding
Cape Town Activa: Launched in October 2009, this is an initiative by the City of Cape Town to create an 'entrepreneurship ecosystem' or supportive environment by bringing linking entrepreneurs with key role players such as academia, venture capitalists, and various government-SMME support programmes
Silicon Cape Initiative: Launched in October 2009, this is a private sector-driven initiative to raise brand awareness of the Western Cape as an innovative province. Activities include facilitating networking between entrepreneurs, investors, marketers, big business, and government through events and on-line communication.
Innovation Fund projects, e.g.: ▸ 2009 recipients in the Western Cape include: – Established industry players: Tellumat (SA) – Startups: Electric Genetics, Optimal Energy, Jirhersa Medical, Vision Biotech, Vibol Systems, Edgitech, Blue Cube Systems, Johnson Sensor Technology, Sunspace Information Systems, Nulane Investments
Joint patents, e.g.: ▸ Agricultural Research Council and Cape Natural Tea Products Pty (Ltd): process for producing rooibos tea extract

There are various existing and planned initiatives that relate to science parks and incubators in the Western Cape:

Past and current initiatives

Capricorn Business & Industrial Park, located in Muizenberg, was an attempt to establish a science park that began in 1998, initially with an innovation and ICT focus (hence it was initially named Capricorn Technology and Industrial Park). Its aims were to promote collaborative academia-industry research and technology transfer, encourage linkages between local and international research institutions and industry, and provide small business support. The park was supported by a variety of stakeholders including local government (the then Southern Peninsula Municipality), provincial and national government (both played a role in the approval of Capricorn Park's application for the Tax Holiday Incentive Scheme), and industry. Capricorn Park has now become a commercial property development that does not have an innovation or science park focus.

The **Stellenbosch Technopark** was initiated in 1986 by Stellenbosch University with financial support from Stellenbosch Municipality. The initial intention was for the Technopark to involve collaboration by all Western Cape universities, and a board was established in which the universities were initially represented. Some stakeholders interviewed during the course of this project were of the view that the original motivations for establishing the park included political reasons and the apartheid government's focus on the defence industry. The development now functions as a normal business park and has a mix of tenants, including microsatellite technology,

software, financial services, retail and engineering. The Park is required to be commercially self-sustaining, and is therefore not in a position to offer attractive lease terms or support services.

The **Bandwidth Barn** in central Cape Town is a business accelerator for IT firms (not necessarily with a focus on innovative firms). It is required to run the rentals on a commercial basis and therefore cannot afford to provide true incubation space, given the flexibility and affordability issues of serving this market. In the past it has also been involved with the Cape IT Initiative (CITI) in providing government-funded incubation and pre-start up services, but funding for these programmes was not made available this year.

Acorn Technologies, now part of the Cape Biotech Trust, serves an incubation function for biotech companies in the Western Cape. It focuses on SMME start-ups producing innovative life sciences technologies (e.g. sleep apnoea monitors to reduce infant cot deaths). Incubator services include feasibility studies, business planning and business strategy, sourcing funds (including an on-line searchable database of funders and investors in South Africa), and due diligence. **The Cape Biotech Trust** is funded by the Department of Science & Technology and aims to develop and promote the biotechnology sector in the Western Cape through project investments and capacity building. Activities to support relationship building include hosting events such as BioBuzz events, Bio2Biz conferences and wider stakeholder network facilitation.

Black Umbrellas is a private sector (non-profit) initiative to provide business incubation services for start-ups in the Western Cape, focusing on artisans from disadvantaged backgrounds who already have a skill or a history of doing a particular type of work. The incubator does not a particular focus on innovation issues. Support services to SMMEs include office space (available at subsidised rates), shared vehicle use, marketing assistance, access to finance and a mentorship programme.

The **Open Innovation Studio** is a private sector incubator for socially relevant innovation smaller organisations and individuals. It consists of a physical environment that combines the attributes of a shared office, a classroom, a coffee shop and a gallery. It also brings together elements of a business incubator, innovation agency, dynamic public space and members club. The Studio is an initiative of Brightest Young Minds, a youth driven non-profit organisation, with the assistance of Dendrite Studios, a company involved in education and consulting. The process of forming a formal alliance with the Centre for Social Innovation in Toronto, Canada has also been initiated.

Planned initiatives

The proposal for a **Belville science park** is being coordinated by the Cape Higher Education Consortium, and planning for this already involved some collaborative efforts between universities, as well as consultations with government and business structures (including Accelerate Cape Town, the National Business Initiative and the Cape Chamber of Commerce).[33] The intention is to take a collaborative approach to building on the existing physical proximity of Stellenbosch University Health Sciences Faculty, UWC Dentistry Faculty, CPUT Science Campus, and the main UWC campus, with relative proximity to UCT, Medical Research Council, as well as the offices of Vodacom, Sanlam, PetroSA, and Eskom. Expected focus areas are pharmaceuticals, biotechnology, health, ICT, alternative energy, engineering and materials science, including SMME development and bench space for postgraduates. .

The efforts to support an **East City Design Precinct** in Cape Town are also an emerging collaboration, involving provincial government, the City of Cape Town, Cape Town Partnerships,

[33] S. Ridge, University of the Western Cape (2009) Project plan for the Belville Science Park: feasibility study and development of a business plan

CPUT and various creative SPVs. The proposed precinct entails the co-location of upstream and downstream industries in the design-related sectors to facilitate networking and collaboration, ready access to customers and suppliers, and cost savings from shared infrastructure. It is envisages that the precinct will initially focus on the fashion industry, with the possibility of later expanding to other creative industries.[34]

A **pre-feasibility study to establish a science park at Stellenbosch** to take advantage of existing innovative activities by Stellenbosch University, the Agricultural Research Council, and industry located at the Stellenbosch Technopark was conducted in 2007.[35]

There have also been some investigations by provincial government and the City of Cape Town around the **potential extension or duplication of the Bandwidth Barn model**.

3.2.2 Collaborations beyond the Western Cape

In many cases, research and innovation collaborations are with parties outside the Western Cape. In the case of university research units, their focus may be on building relationships with international universities, multilateral agencies, grant funders/donors and corporates. This is particularly the case in the medical field (immunology, genetics, drug discovery) where large project teams, multi-disciplinary problems and high costs are involved.

For corporates (and some State-Owned Enterprises), international collaborations are also present. For example, PetroSA has a joint venture with European firms to develop a demonstration plant for gas-to-liquids processing.

A non-exhaustive list of collaborations that extend beyond the Western Cape is presented below (based on available research reports and interview inputs):

[34] Mthenthe (2009) Business Case: Design precinct
[35] COFISA, 2007, 'Pre-feasibility study into Establishing Science Park activity in the Eastern and Western Cape Provinces'

EXAMPLES OF COLLABORATIONS BEYOND THE WESTERN CAPE

COLLABORATIONS BY VARIOUS W. CAPE AND INTERNATIONAL TRIPLE HELIX PARTIES

Joint projects:

- Germany's Fraunhofer Institute in Chemnitz, Department of Science and Technology, University of Cape Town, Stellenbosch University, University of Johannesburg (work on high performance machining for titanium alloys)
- **Positron emission particle tracking research at PEPT Cape Town (University of Cape Town):** PEPT seed funding: National Research Foundation, Imperial College London, the Centre for Sustainable Resource Processing (Australia), PET scanner donated to PEPT Cape Town by Imperial College London
- Cape Town Boatbuilding Technology Initiative, Finboat in Finland (planned collaboration, not yet in effect)

Joint participation in knowledge and innovation outputs, such as publications, patents, new products, conferences or processes

- South African Department of Minerals and Energy, Polytechnic University of Namibia, Eskom, Africon, Stellenbosch University (Industrial and Commercial Use of Energy Conference)

Networks:

- African Network for Drugs and Diagnostics Innovation (ANDI): participants include African government Ministries, African research institutions and researchers, science councils, donor agencies, pharmaceutical companies, non-governmental governmental (NGOs), the World Health Organisation and other international organisations; Western Cape based participants include MRC, International Centre for Genetic Engineering and Biotechnology (ICGEB) based at UCT (2nd ANDI meeting hosted in Cape Town in October 2009)

W. CAPE ACADEMIA'S INTERNATIONAL COLLABORATIONS

Funding:

- University of Cape Town, Netherlands Ministry of Foreign Affairs (South African Netherlands Research Programme on Alternatives in Development)
- University of Cape Town, European Union (Seventh Framework Programme for Research and Technological Development)
- University of Cape Town, National Institute of Health
- Institute of Infectious Diseases and Molecular Medicine (University of Cape Town), Medical Research Council, French National Centre for Scientific Research
- Environmental Policy Research Unit (University of Cape Town), Swedish International Development Agency
- Dr. Anwar Jardine (University of Cape Town), Bill & Melinda Gates Foundation (TB research)
- Cape Technology Station in Clothing & Textiles, GTZ (GTZ provides sponsorship for German academics and industry experts to visit South Africa)
- University of Cape Town (Department of Civil Engineering: Spatial Data Mapping) DFID, CIDA, IDRC, WHO
- Energy Institute (Cape Peninsula University of Technology), USAID (energy - commercialisation of technology for solar powered sewing machines

Joint participation in knowledge and innovation outputs, such as publications, patents, new products, conferences or processes

- Centre for Information Literacy (University of Cape Town), UNESCO (UNESCO information literacy workshops)
- UCT-led research being funded by Anglo Platinum, Xstrata at the University of Birmingham
- Centre for Instrumentation Research (Cape Peninsula University of Technology), Swinburne University (Australia)

Joint centres:

- University of Cape Town, European Centre for Particle Physics (UCT-CERN Research Centre)
- CPUT, TUT, and French partner ESIEE (French-South African Institute of Technology)
- CPUT is currently in negotiations to host a MEMS facility

Partnership agreements:

- Stellenbosch University: Salzburg University, Mozarteum University Salzburg, Leuven Catholic University, Antwerpen University, Gent University

Joint projects:

- South African National Bioinformatics Institute, Harvard University (cell signal analysis)
- South African National Bioinformatics Institute, Yale University (sleeping sickness disorder project)
- South African National Bioinformatics Institute, University of the Western Cape, University of Cape Town and Stanford University (Stanford South Africa Biomedical Informatics Training Programme)
- **Cardiovascular research at the Hatter Cardiovascular Institute (University of Cape Town)**: Research patrons of the institute include: The Hatter Foundation (United Kingdom), The Hatter Institute (University College London), Medical Research Council, The Wellcome Trust (United Kingdom), Roche Products (Pty) ltd (United Kingdom and South Africa), Servier (France and South Africa) , Rhône-Poulenc Rorer (South Africa), Pfizer Laboratories (Pty) Ltd, Old Mutual Life, The Liberty Life Educational Foundation
- Centre for Instrumentation Research (Cape Peninsula University of Technology), Anglo American Platinum Engineering Acoustics Inc (America)
- Department of Chemistry (CPUT), and the Institute of Chemistry Timisoara of the Romanian Academy (The title of the research project is Polyphosphonic acid organic polymers used as ion exchangers in chromatography)
- CPUT, University of Antwerpen; CPUT, University of Applied Sciences and Technology; CPUT, University of Asmara; CPUT, University of Kuopio, CPUT, Kigali Institute of Science, Technology and Management (KIST), CPUT, Namibia Institute of Pathology (NIP)

DOMESTIC GOVERNMENT AND SOE'S INTERNATIONAL COLLABORATIONS

Joint projects:

- CSIR, International Information Management Corporation Limited (Ireland): regional impact of information society technologies in Africa
- CSIR, Fraunhofer Institute, Germany, (recombinant pharmaceuticals from plants for human health)
- CSIR, University of Moastricht, (free or libre or open source software: worldwide impact study)
- Cape Programme for Rural Innovation (CAPRI): Provincial agricultural and rural development departments of Western, Northern and Eastern Cape, Wageningen University & Research Centre (innovative training and revitalisation of extension services)

W. CAPE INDUSTRY'S INTERNATIONAL COLLABORATIONS

Joint project:

- Avoir Technology - Catholic University of Mozambique, (open-source software development and capacity building project)
- Avoir Technology - University of Dar es Salaam, (open-source software development and capacity building project)
- Epsilon, Stellenbosch University (work on continuous fibre reinforced thermoplastics)

4 International experience with triple helix collaboration

This section presents the different approaches to building networks and facilitating collaboration for innovation that have been adopted in Finland, Australia, India and China. Additional international experience of science parks are then explored, with particular emphasis on success factors and challenges in the set up stages. Discussion of the potential implications of these international experiences for triple helix collaboration in the Western Cape is addressed in Sections 5 and 6.

4.1 Finland

This sub-section presents an overview of Finland's approach to triple helix collaboration by reviewing:

- The Centre of Expertise Programme: a programme specifically designed to create and facilitate triple helix innovation networks
- Tekes: a funding vehicle for innovation activities in Finland which supports collaboration indirectly through flexible eligibility criteria inclusive of collaborations, and more directly through specific interventions funded by Tekes (e.g. Strategic Centres for Science, Technology and Innovation)
- Science park activity in Finland

4.1.1 Centre of Expertise Programme (OSKE)

Introduced in 1994, OSKE is a state-funded programme for R&D in priority areas identified in national and regional innovation systems. OSKE brings together companies, academic universities and universities of applied science, the public sector (cities, municipalities, regional councils), business development service providers and funders for joint R&D projects. OSKE's objectives include:[36]

- To generate new innovations, products, services, businesses and jobs based on top-level expertise
- To support specialisation and division of tasks between regions to form internationally competitive centres of expertise
- To increase the capacity of regional innovation environments to attract internationally active businesses, investment and top professionals

The programme operates on a regional cluster-based model, and involves 13 national Clusters of Expertise or Competence and 21 regional Centres of Expertise. Technologies covered include clean technologies, energy, food development, tourism and nanotechnology. As an indicator of the scale of the OSKE network, between 1999 and 2006, about 5,100 companies annually took part in CoE activities.[37]

4.1.2 TEKES

Tekes is the Finnish funding agency for technology and innovation, investing nearly €600 million annually in R&D and innovation activities. Tekes funding is targeted at the creation of new know-how and the development of products, processes and service or business concepts, and may be a

[36] www.oske.net
[37] European Union (2008), EU Policy Report: Finland

low-interest loan or a grant, depending on the stage of the innovation and the nature of the proposed project. [38]

Public research institutions, academic institutions, and companies are eligible to apply for funding, individually or as project teams. About 50% to 60% of funding for companies is directed to small and medium-sized companies (qualification criteria include being less than 6 years old). Projects proposed by large companies (including foreign-owned companies) are required to have strong national and international links with research communities, suppliers, partners and customers, so that external impacts are significant.

Tekes has also established research units (Strategic Centres for Science, Technology and Innovation) to support enterprises. [39] At these centres, companies, universities, and research institutes agree on joint research plans to develop new practical applications that meet the needs of companies in sectors such as energy and environment, metal products and mechanical engineering, forest cluster, health and well-being, information and communication industry and services.

Tekes works with a wide range of partners nationally and internationally to provide services and funding. Key partners in Finland include The Foundation for Finnish Inventions, which provides enterprise pre-incubator support (previously offered in-house at Tekes), and the Ministry of Employment and the Economy.[40]

The impact of TEKES' activities is significant. For example, in 2008 1,954 projects were completed (including corporate R&D, public research, patent applications, academic theses, and publications). Seminars, workshops and international travel are typically built into the projects to create opportunities for networking and knowledge transfer. One of the initiatives sponsored by Tekes to increase collaboration and networking is FiDiPro (the Finland Distinguished Professor Programme), which provides research grants to talented and internationally renowned researchers or professors. At the company level, another example is the Sapuska programme for the food industry which offers funding for product development and the development of networked business and customer cooperation models.[41]

4.1.3 Science parks, innovation and collaboration in Finland

There are 24 science parks in Finland, all of them providing a range of services and facilities such as premises, incubator, education and consulting services. The Finnish Science Park Association (TEKEL) is a nationwide co-operation network of Finnish science parks and technology centres, containing 33 members in Finland's university cities. [42]

Combined, TEKEL science parks accommodate 1,600 enterprises and other organisations, bringing together 32,000 experts working on different technology fields such as ICT, healthcare and medical technology, biotechnology, environmental and food technology, materials research and digital media. Companies operating at TEKEL member science parks generate an annual turnover of €100 million. The science parks in the TEKEL network are independent companies based on regional strengths, and are managed locally (including oversight by boards representing the business, university, research institutions and local government).

[38] Tekes (2008) The Tekes Strategy
[39] Tekes (2008) Tekes Annual Report: 2008
[40] Ibid
[41] Ibid; European Union (2008) EU Policy Report: Finland
[42] www.tekel.fi

TEKEL is a key implementing partner of the OSKE programme, with many TEKEL member science parks acting as Centres of Expertise in their respective regions. TEKEL's staff also includes a Centre of Expertise Team responsible for product development and network co-operation for the OSKE programme. Science parks therefore play a crucial role in collaboration and networking in Finland through strong linkages to wider programmes and initiatives in the National Innovation System.[43]

In addition to OSKE, TEKEL's partner network includes Finpro, an association founded by Finnish companies to support the commercialisation and internationalisation of local enterprises. TEKEL and Finpro have a cooperation agreement to facilitate the expansion of Finnish technology companies into international markets whilst also attracting foreign companies, research organisations and investment to Finland.[44]

4.2 Australia

This section provides an overview of the extent of innovation collaboration by business in Australia, as well as some of the key constraints to collaboration from business' perspective. It also identifies specific initiatives and programmes to promote triple helix innovation in Australia.

4.2.1 Innovation and collaboration in the private sector

In 2006-07, 32.4% of Australian businesses reported implementing an innovation (e.g. new product or operational process, marketing methods, organisational and management process). About 17% of innovation-active businesses collaborated for the purpose of innovation in 2006-07. In terms of the types of organisations collaborated with, 42% collaborated with *clients, customers or buyers* compared with 1.6% who reported collaborating with *universities or other higher education institutions*.[45] The three industries with the highest proportion of innovating businesses were *Information Media & Telecommunications* (46.2%), *Manufacturing* (44.2%) and *Wholesale Trade* (44%).

Over one third of innovation-active businesses (34%) cited a *lack of skilled persons (in any location)* as a factor hampering innovation and this was the most commonly cited barrier for every employment size category.[46] *Profit related drivers* were the most commonly reported reason for undertaking innovative activity (76%) across all employment size categories, followed by *increase responsive to customer needs* (52%) and *increase or maintain market share* (45%). The most frequently reported sources of ideas or information for innovative activity by innovation-active businesses were *within the business or related company* (56%), followed by *clients, customers or buyers* (44%).

4.2.2 Collaboration networks to support innovation in Australia

The Cooperative Research Centres (CRC) Programme is a flagship government programme that was introduced in 1990 to encourage R&D collaboration between the private sector and public sector research bodies. The focus is on bringing together public sector research providers with private sector end-users to work on end-user problems. Another feature is industry contribution in

[43] www.oske.net
[44] Tekel (2005) 'Tekel and Finpro collaborate in promoting the internationalisation of Finnish businesses. Available [online]: http: or or www.tekel.fi or in english or newsroom or news or ?x95027513=95022071 (Accessed 21 August 2009)
[45] Australian Bureau of Statistics (2006-07) Innovation in Australian Business
[46] Ibid

CRC education programs to produce industry-ready graduates.There are currently 58 active CRCs, and to date, the programme has attracted a cumulative total of A$12bn in joint funding from government, universities, industry and other participants. Once established, CRCs also derive income from research contracts, licenses, and spin-offs; some CRCs have been able to become financially self-sustaining.[47]

There are three types of CRCs:

- CRCs operating as national benefit centres with a focus on resource sustainability
- CRCs operating on industrial research collaborations leading to industry performance improvement
- CRCs operating as business development centres, with a focus on research commercialisation

CRCs are typically multidisciplinary, but must include research in the natural sciences or engineering. Examples of CRCs include CRC for Cattle and Meat Quality, CRC for Polymers, CRC for Asthma and Airways, CRC for Antarctic Climate & Ecosystems and CRC for Mining. On average there are seven to nine partners per CRC, and the participation of at least one private sector participant and one Australian higher education institution is mandatory. Foreign partners are permitted.

Other specific examples of initiatives to promote and develop innovation networks in Australia include[48]:

- The Tourism and Resources Innovation Access Programme – this is a 5-year, A$100m programme to increase the uptake of leading edge technologies and best practice processes by Australian firms through local and international collaboration.
- InnovationXchange (IX) – this is an online 'marketplace' that seeks to match up private sector companies experiencing business problems or challenges with a wider community of innovative problem-solvers. The problem statements or 'challenge briefs' are posted online, and individuals or teams are eligible to enter to develop solutions – innovators can search the IX website for potential team members to collaborate with. The sponsoring company selects a winner and a success fee is paid to members of the winning team.
- bisNet Club is an Australian network of researchers, entrepreneurs and interested parties supporting the commercialisation of technology businesses in the states of NSW and ACT
- Techno-L is a discussion forum for patent attorneys, technology transfer and licensing professionals in universities, government, non-profit research institutions, and the private sector.
- Knowledge Commercialisation Australasia (KCA) assists in the development and maintenance of skills associated with knowledge transfer from public sector organisations. Members include universities, government research organisations and departments, medical research institutes, rural research and development corporations and TAFEs.
- The Australian Industrial Research Group aims to improve the quality of R&D in Australia, and its membership consists of managers responsible for technological innovation and R&D in public and private companies operating in Australia. It also has affiliate members from public research agencies, universities and service groups with interests in science.
- Industry TechLink is a government funded, privately run service that links small business with new and emerging technologies.

Other tools used to facilitate collaboration and foster innovation include industry-specific networks and associations e.g. AusBiotech, the Australian Materials Technology Network, the Australian Microelectronics Network, the Australian Venture Capital Association Limited, the Licensing

[47] Commonwealth of Australia (2008) Collaborating to a purpose: Review of the Cooperative Research Centres

[48] Australian Department of Education Science and Training (2005) Knowledge exchange networks in Australia's innovation system: Overview and strategic analysis

Executives Society, and The Community of Science, a web portal which, amongst other roles, stores the profiles and CVs of researchers from 1,600 institutions around the world.

4.3 India [49]

This section discusses grassroots innovation networks in India as an example of alternative models of triple helix collaboration. It also provides an overview of science park and technology incubator activity in the country, and an example of private sector support for university-based innovation activity.

4.3.1 Collaboration networks to support innovation in India

India's grassroots innovation networks provide an alternative approach to innovation collaboration. They support activities where traditional knowledge and innovative products emerge at the individual or collective level. Grassroots innovation programmes focus on poverty alleviation programs based on local people's knowledge, innovations, and practices, largely produced and maintained at the grassroots level. In some cases value may be added by the formal science and technology sector. These networks include a broad range of actors, such as government, NGOs, and the private sector.

The Honey Bee Network (HBN) consists of innovators (individuals, farmers, and entrepreneurs), policy makers, academics and NGOs committed to recognising and rewarding innovative ideas and traditional knowledge produced at the grassroots level (by individuals and communities) through local language interfaces. It seeks to protect the intellectual property rights of knowledge holders and follow the conditions they may advise under the concept of prior informed consent (PIC).

The Grassroots Innovation Augmentation Network (GIAN) was developed in 1997 with seed money from the Gujarat state government to link innovations, investment, and enterprises so that benefits could be shared widely among the community. GIAN provides small amounts of funding for prototype development, facilitates links between innovators and scientific and technological institutions, and identifies commercial enterprises interested in licensing product technologies from grassroots innovators. GIAN has facilitated the development of more than 61 enterprise efforts to manufacture and market innovations, and has filed applications for 67 patents and 3 design registrations in India.

4.3.2 Other forms of innovation support

Other proposed initiatives to promote and develop innovation networks in India include:

- Grants and other incentives to encourage the movement of researchers and teachers across organisations in the public and private sectors
- Universities and research institutions are to provide proper job security for scientists involved in technology commercialisation
- A programme to encourage engineering colleges across the country to collaborate with SMEs, with the participation of the Indian National Academy of Engineering (INAE), colleges and polytechnics
- The establishment of 170 technology business incubators and 50 technology innovation centres across India
- The use of industry funds to create "faculty chairs" in institutions
- Provision of tax exemption (125%) for all the expenditures on projects jointly conducted by academia and the industry

[49] Evaluserve (2008) R&D Ecosystem in India; World Bank (2007) Unleashing India's Innovation: Towards sustainable and inclusive growth

- A zero service tax for all royalty-based income generated out of commercialisation of a technology transferred by an academic institution to the industry
- Tapping into the diaspora by establishing a more formal diaspora network (following the Global Scot model, a network of 850 influential Scots abroad managed by Scottish Enterprise), and creating a dedicated fund for joint research projects, spin-offs, short visits and seminars, teaching and mentoring for Indian innovators

Some of the major corporate entities in India are also playing an active role in fostering innovation networks. An example of this is the TATA Group – one example of their support for research is summarised in the box below:

The Indian Institute of Science (Bangalore, India)

The Indian Institute of Science is a research institute focused on the pure sciences (including mathematics, chemistry and physics), biotechnology and health sciences, and engineering (including computer science, materials, and aerospace). The Institute was established in 1909 by Nusserwanji Tata, founder of the multinational company the TATA Group which comprises more than 50 subsidiaries in information systems and communications, engineering (including automotive), materials, services, energy, consumer products and chemicals.

The Institute has close links to industry primarily through its multifaceted relationship with the TATA Group – there is research collaboration between the Institute and the various TATA subsidiaries, and the Institute also receives funding from TATA.

Wider collaborative innovation and stakeholder engagement with the Council of Scientific and Industrial Research (CSIR) and other role players is facilitated through the Institute's Centre for Scientific and Industrial Consultancy (CSIC) and its Society for Innovation and Development (SID).

Over the years, the Institute has becoming highly respected internationally, and is now consulted by international universities and multinational companies.

Please visit www.iisc.ernet.in for more detailed information.

4.3.3 Science parks and technology incubators in India

The Science and Technology Entrepreneurs Parks (STEP) programme aims to promote active interaction between industry and academia. There are 15 STEPs functioning in India, which have collectively generated a turnover of nearly INR 1.3 billion and employ about 5,000 people. They provide common facilities and infrastructure (e.g. testing and calibration, prototype development, computing, business facilitation services and quality assurance services) where industry and academia can share their knowledge, experience and expertise. STEPs also provide R&D support to small-scale industries.

STEP's research focus areas include information technology (particularly software), electronic equipment, biotechnology, nanotechnology, software development, automobiles, pharmaceuticals, aviation, food processing, media and entertainment, and rural innovations.

In addition, India has 80 technology incubators and a few science and technology parks, whose performance has been mixed.

4.4 China[50]

This section discusses specific initiatives to promote and facilitate triple helix innovation in China, as well as some of the challenges encountered.

4.4.1 Collaboration networks to support innovation in China

Inter-firm innovation-oriented collaboration in China, whether within networks or clusters, remains rare outside science and technology industrial parks (STIPs) and university science parks, and most foreign firms have developed few linkages with domestic firms.

Nevertheless, some progress has been made with regard to triple helix collaboration, with some examples including:

- The number of firms in technology business incubators (TBIs) has more than quadrupled since 2000 to almost 40,000 in 2005, many of which are spin-offs from publicly funded research
- About one-quarter of the 750 R&D centres established in China by foreign firms are estimated to be joint units with universities or research institutes
- Leading universities have been very active in developing linkages with industry in order to improve the quality and relevance of their teaching programmes
- Four government-supported industry-research strategic alliances (concerning steel, coal, chemistry and agricultural equipment) have been introduced; actors in the alliances include 26 enterprises, 18 universities and nine key research institutions, which are charged with enhancing these sectors' technological innovation capability by creating a stable, institutionalised industry-university research partnership based on market principles
- 45 incubators have been established dedicated to returned overseas scholars, hosting about 3,000 enterprises and employing more than 40,000 people

4.4.2 Challenges identified

Some of the key constraints to collaborative innovation in China that have been identified are:

- Innovation is not prioritised by domestic firms
- The concepts of pre-competitive research and public-private partnership are not yet well understood
- Researchers in the public sector, especially in the restructured research institutes, have weak incentives to collaborate with industry
- Science parks established under a government programme to spur domestic innovation by SMMEs have been diverted to become platforms for manufacturing exports produced by large companies and MNCs

[50] OECD (2007) Reviews of Innovation Policy: China

4.5 Overview of international lessons on science parks

Drawing on the both the country experiences discussed above, and wider experiences and research on science parks (including stakeholder interviews conducted for this project), the sections below discuss lessons relating to the potential impact, success factors and challenges of science parks.

4.5.1 Research on the impact of science parks

Available research shows interesting and mixed findings on the impact of science parks on innovation and collaboration. Two divergent examples of such research are summarised below.

A Finnish study on the performance of firms located at science parks yielded the following results[51]:

- For each additional year spent at a science park, firms were 13% - 20% more likely to patent
- Per each additional tenant located inside the park, firms were 2% - 4% more likely to patent
- The average firm's innovative activity was not related to the existence of incubators inside the science park
- Some sectors (e.g. electronics and biotech) seem to benefit more than others from co-location with academic and research institutions

A UK study on the performance of firms located at science parks as well as those not located at science parks yielded the following results[52]:

- Between 2000 and 2003, off-park New Technology Based Firms (NTBFs) launched nearly twice as many new products on average as On-park NTBFs
- On-park NTBFs launched significantly more new services than their off-park counterparts over the 3 year period
- On-park NTBFs have a significantly higher proportion of Qualified Scientists and Engineers (QSEs) than Off-park companies
- On-park companies report that access to finance is less of a problem than their Off-park counterparts
- On-park companies utilised venture capital, public sector and angel finance to establish their businesses to a significantly higher degree than Off-park companies

These findings show that positive benefits are not necessarily guaranteed by the presence of a science park.

4.5.2 Guidelines and key success factors for science parks and incubators

Based on international experience, science parks have the potential to play an important role in attracting and retaining knowledge workers and researchers, as well as stimulating wider economic development if correctly set up and managed. Drawing on secondary research[53] some of the success factors for designing and setting up science parks are outlined below.

[51] M. Squicciarini, (2009) Science parks, knowledge spillovers and firms' innovative performance: Evidence from Finland
[52] United Kingdom Science Park Association (2003) Evaluation of the UK science park movement
[53] Sources include:
N. Segal (2008) Science and technology parks and economic development: Lessons from European experience
Batelle Technology Partners, Association of university research parks (2007) Characteristics and trends in North American research parks: 21st century directions
H.C. Viljoen (1989) The science park as a vehicle for university-industry cooperation: what, where and how

a. **An enabling environment conducive to the emergence and growth of the knowledge-intensive enterprises** that will be tenants of the science park.
Factors include existing SMME activity (and support measures), cost and sophistication of key infrastructure such as transport and telecommunications, and market demand conditions.

b. **Commitment to a clear identity for the science park/s over the medium and long term**
Most successful science parks have a clear focus in terms of sectors, types of technologies or types of enterprises, incubation vs growth, and the role of the science park in city regeneration and investment promotion. Even successful science parks experience a slow growth rate during the initial years, and it is important during this time not to deviate from the initial objectives of the science park, or change course in an effort to achieve faster growth (e.g. there may be a temptation to place more emphasis on non-core activities such as property development and securing higher tenancy rates irrespective of the fit of those tenants with the core focus). These tensions are likely to become more difficult to manage given the emerging trend in some locations to incorporate live-work-play spaces into a single science park development.

c. Science parks should provide **ready access to a wide pool of highly skilled and affordable labour from universities and research institutions**
For example, this talent can be provided through internship or placement programmes, with universities taking a lead role in building relationships with industry to facilitate student and postdoctoral hiring.

d. **Supportive policy and regulatory environment**
Science parks should be incorporated into urban planning, and innovation and economic development strategies at the provincial and local government levels.

e. **Thorough feasibility studies for science parks that include inventories of existing, commercially feasible university and private sector projects in the region**
In addition to informing assessments of potential market demand, such inventories allow for initial scoping of the type of support services likely to be required at the science park, particularly those that are incubation related.

f. **Appropriate and clear selection criteria for tenants**
Science parks and incubators should focus on firms that exhibit the ability to innovate and grow. They should also achieve an appropriate balance between local and non-local firms (bearing in mind that local firms are more likely to make long term commitments and may be more easily persuaded of the value of stronger linkages with other local players).

g. **Affordable value added services**
Effective networks are a key drawcard for prospective tenants, and science parks must be actively involved in the transfer of technology and business skills to start-up and early stage companies. Potential interventions include:
- Connecting member companies to local and overseas industries
- Inter-organisational exchange programmes
- Networking functions e.g. conferences, workshops with professional organisations and international trips
- Talent pool development and other human capital related activities e.g. educational course offerings at partner universities

h. Involvement of a **higher education institution involved in the science park structure**
This can be in the form of joint partners, in consortia or standalone (but generally the HEI does not manage the day-to-day operations of the science park).

i. **Clear separation between ownership and management** of the science park
This separation is necessary to balance competing interests and manage conflicts, as well as to support the necessary management competencies being secured to operate the science park.

j. A **full time, professional park management team**
Potential skills areas include marketing and a background in R&D, in particular, it is important for senior management to include a champion who understands both the academic and business worlds, supported by staff specifically charged with relationship building. This personal commitment can play a big role in the development of informal networks of personal relationships, putting the champion in a position to play an intermediary role in facilitating relationships between tenants
  - In addition, continuity and stability in the management team is important to give tenants confidence in the consistence of the quality of services and facilities, and for the sustainability of networks

k. **Attractive and flexible location and layout**
The aesthetic appeal of the science park can be important to attract tenants and knowledge workers, and may include the amount of open space and landscaping, as well as the architecture of buildings, and design of internal and common spaces

Quality of life factors are also important to the attractiveness of a location. These can include on-site amenities such as restaurants and retail stores, and in some cases recreational facilities and accommodation. The surrounding areas should also ideally provide attractive and affordable housing, accessible transport systems, natural landscapes, good climate, schools, and active culture and entertainment scenes.

A flexible physical layout with space for expansion and reorientation can be key to the long-term viability of the science park and longer-term retention of tenants. The physical layout for both internal building structure and external landscape should allow maximum flexibility because the property requirements of technological firms change more rapidly than those of traditional and commercial users.

l. **Cost-competitiveness with tenant's alternative in the region**
Affordability by SMMEs is particularly important as they tend to be the most price sensitive but are amongst the most likely to benefit from being located at a science park.

m. **Able to tap into international networks and expertise**
These international networks are important from the early preparatory stages to ensure good practice around issues such as the park's business model, approaches to marketing the science park and winning the support of key stakeholders. International networks are also important to support local tenants' network development (e.g. access to international markets and sources of funding) and to draw in international tenants.

n. **Stakeholder support and active participation**

Drawing on international experience, the major stakeholders typically involved in science parks are:
- The host organisation or lead entity/project champion – this is usually a university, a government research laboratory or private sector organisation that would like to commercialise its technology
- National, regional and local government as well as other public entities involved in regional and local economic development
- Tenant companies, including their owners, managers and employees (and companies in the supply chains of these tenant companies)

- Private investors involved in financing the park itself or tenant companies through equity finance

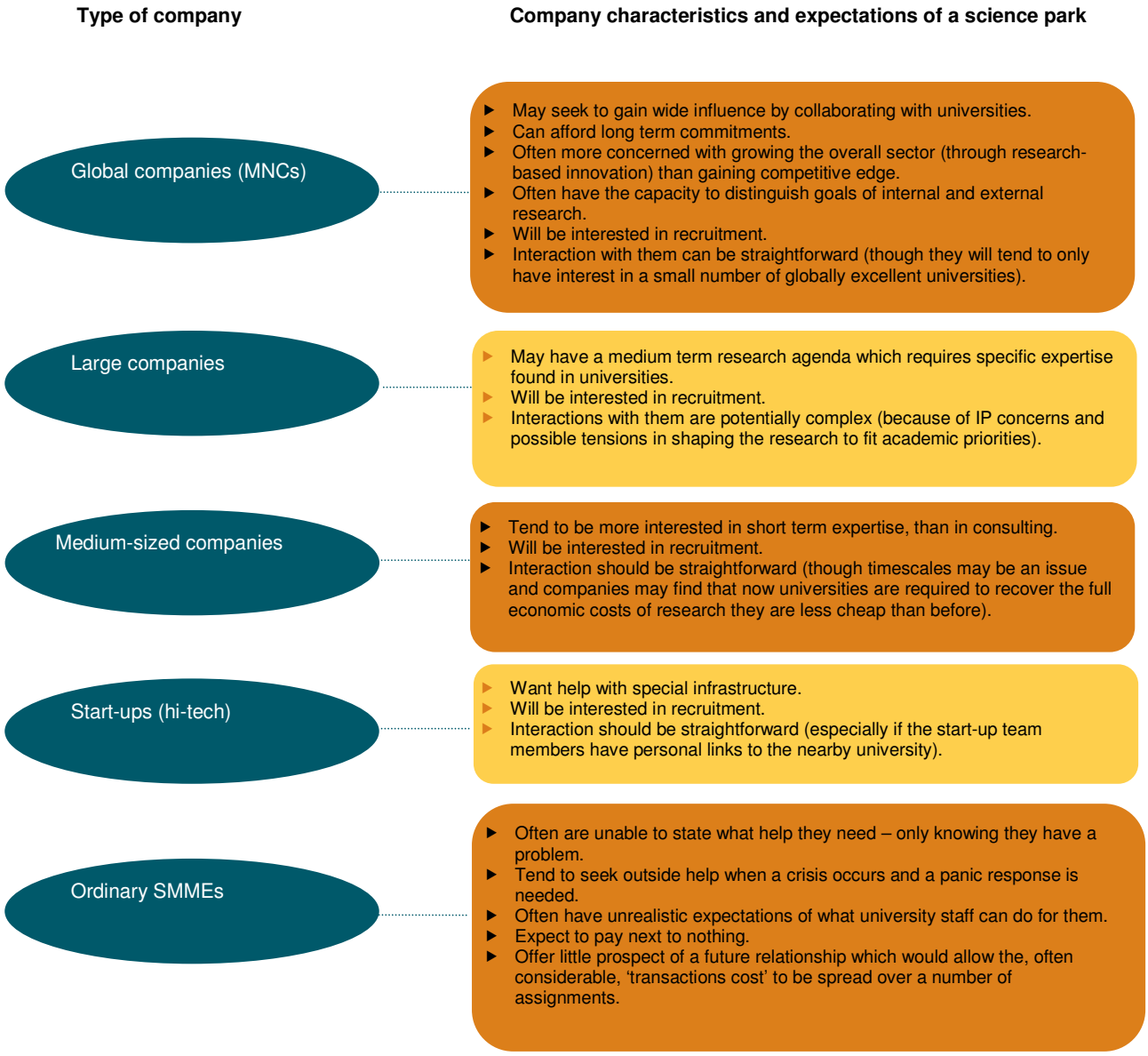
The motives or objectives of the above 4 categories of actors for involvement in science parks have been identified as follows:

Host organisations	Government and other public agencies
▸ To create a property asset which will be an independent income source (and which can be borrowed against to raise funds) ▸ To create opportunities for academic or research staff to develop technology that might be commercialised directly or transferred to businesses that are already established on the park ▸ To create the opportunity for technology transfer between academia and the private sector (including generating third stream income through licensing and service provision to tenant companies, and taking equity in successful spin-offs) ▸ To raise the profile of the host organisation as agents of change in a region	▸ To facilitate economic development through the formation and growth of new businesses that develop new market opportunities created by the evolution of technology or through research, development, design and innovation ▸ To improve population retention by helping to establish a commercial environment that will encourage young and skilled people to stay in a region ▸ To use the science parks to provide services in the public good e.g. the provision of training, access to business support services (including pre-incubation support), and advice on access to grants
Tenant companies	**Private investors**
▸ To improve recruitment and retention of staff ▸ To gain access to well qualified manpower ▸ To gain access to emerging technology that can provide a commercial advantage ▸ To present a high quality image to their customers and creating a reputation for value for money ▸ To benefit from business development services	▸ To realise and exploit commercial value and revenue generation potential ▸ To help equity finance organisations meet their objectives of extracting value from science and technology

Source: Based on 'UNESCO report on Science and Technology Parks in Egypt' (2007)

Understanding the needs and expectations of tenant companies is particularly important as this category of stakeholder is the ultimate determinant of the success, failure, and sustainability of a science park. The diagram below illustrates the different types of companies and their likely requirements from a science park:

Figure 2: Tenant expectations of science parks



Source: Based on 'UNESCO report on Science and Technology Parks in Egypt' (2007)

4.5.3 Potential challenges associated with science parks

International experiences have also identified a range of challenges that can face science park developments. Some of the most critical challenges are discussed below.

a. **Difficulty in securing funding for real estate and other development of the park**

Developing a science park is a significant, long-term investment which requires many up-front costs. Cash and in-kind contributions usually take the form of bond issuances, state appropriations and land contributions, and rental of space by sponsoring institutions.

Planning costs can be significant e.g. a typical technology park in Brazil can cost a minimum of €50m for aspects such as concept development, formulating business and strategic plans and environmental licensing.

Land for development can also be a major cost, if this is not provided by one of the science park partners such as government or a university.

Building and other development costs are dependent on the scale of the development. Costs involved are not just for buildings, but also for landscape, utilities, improvement of transport access, etc. Some examples of development costs in various international science parks are provided below:

- Barcelona Science Park[54]: Total budget of €177.35m (1997 – 2009) for a development of 85,000 sq m, including laboratories, incentives, training, business start-up and innovation services, space for multi-disciplinary public and university research centres (20), spin-offs and private companies (40 companies in 2007)
- University of South Florida Research park[55]: Construction cost of US$40m to US$45 in 2004 for 2 buildings for research centres, offices, wet and dry labs, incubation space, support services, meeting rooms and common areas, with an estimated 230,000sq ft of building space on an 87acre space on the campus. Expected sources of funding were from the university, bonds, state and federal grants and tenant contributions
- Biopolis, Singapore[56] S$500m start-up costs (2003) (approximately US$350m at current exchange rates) for a 185,000 sqm complex
- The North Jutland Science Park – Aalborg, Denmark[57]: €4.9m (50% state guaranteed) for accommodating around 70 mainly small companies within two areas (the NOVI Centre: 5,500sq m for entrepreneurs, development projects, cooperation projects and technological service institutes, and the NOVI Park: 55, 000 m^2 set aside for knowledge based firms)
- East River Science Park (New York, USA)[58] approximately US$300million(2008/9), including various development-related tax exemptions (over US$260m) and contributions to infrastructure from city and state governments (US$40m)
- Sozhou Industrial Park in China (established in 1994), has had over US$41.4billion of government investment[59].

[54] http://ec.europa.eu/regional_policy/cooperation/interregional/ecochange/goodpractice/1knowledge/3ideas/es_catalonia_barcelona.pdf
[55] www.research.usf.edu, www.tampachamber.com
[56] http://www.bii.a-star.edu.sg/aboutBII/news.php?newsid=4
[57] http://www.eukn.org/eukn/themes/Urban_Policy/Economy_knowledge_and_employment/Urban_economy/Business_support/Business_parks/NOVI_1021.html; http://www.novi.dk/novipark/
[58] http://www.wnyc.org/news/articles/137043
[59] Z. Shen (2009) Leading Asian Models of S&T Parks, Symposium: Understanding Research, Science and Technology Parks

- The recently developed IIT Madras Research Park[60] had a development cost of around Rs 3 billion (roughly US$65m at current exchange rates), primarily funded by government and bank loans, with some additional funding from alumni

The common approach to financing and constructing buildings in science parks is to hire private developers on a per-building or per-project basis. Whilst single tenant facilities may only be built on demand, shared facilities and multi-user facilities such as incubators and laboratories are likely to require up-front development and financing.

Another complicating factor is artificial spikes in property prices driven by speculators taking advantage of anticipated park-related real estate development in an area. This can reduce the affordability of both business and residential properties in the area, and become a disincentive to cluster activity.

b. Need for ongoing operational funding

Generally, few science parks and university research parks are profitable or can generate sufficient income to be self-sustaining even after the initial stages. Projects approached as a commercial property development are unlikely to meet the needs of most innovative start-ups, not just in terms of rental costs, but also in terms of flexibility of leases.

Science parks tend to have a gestation period of 10 to 15 years, and during this period are likely to require more significant support[61]. Long-term subsidies are therefore likely to be a key part of the funding model and commitment will be required from science park partners such as government, universities, and the private sector.

Operational costs can vary significantly, dependent on both the scale of developments and the nature of services offered. Some examples are provided below:

- A recent survey of North American University Research Parks showed that 56% reported operational budgets of less than US$1m per annum, with 16% having budgets between US$3m and US$10m, and 7% having budgets over US$10m[62]
  - On average, these North American research parks are able to cover around 60% of their operational costs through park operations, universities contribute close to 15%, state and local government around 10%, federal government less than 5%, corporate foundations less than 4%, and other sources the remainder
  - As an example of operational cost items, the Purdue Research Foundation strategic plan sets out a recurring budget of more than US$1m in relation to the Purdue Research Park, including building up start-up capital resources in partnership with angel investors, venture capital firms and support agencies, raising awareness, tools for marketing and licensing of IP, identification and recruitment, and human resources to support financial transactions and real estate development
  - Barcelona Science Park[63] has an expected annual budget of €15m

[60] M. S. Ananth (2009) Leading Asian Models of S&T Parks: Indian Science and Technology Parks. Symposium: Understanding Research, Science and Technology Parks

[61] According to Connaissance International, a research park consulting firm, as quoted by http://researchpark.uoregon.edu/html/information.html

[62] Batelle, Association of University Research Parks (2007) Characteristics and Trends in North American Research Parks: 21st century directions

[63] http://ec.europa.eu/regional_policy/cooperation/interregional/ecochange/goodpractice/1knowledge/3ideas/es_catalonia_barcelona.pdf

c. **Collaboration is not automatic in a science park environment**

Science parks are not guaranteed to successfully stimulate collaboration between tenants. For example, a 2003 survey of firms based at science parks and those not located at science parks the findings were:

- 41% of the on-park companies had a "link" with a university or research institution and of these, 90% indicated that their link was with a local university or research institution
- Informal connections with academics and universities were identified as the most common link but only 26% of on-park companies with linkages to universities and research institutions considered them to be strong
- These weak industry-academia linkages suggest that science parks need to actively support relationship brokering between their tenants, and constantly evaluate the impact of their activities in order to maintain relevance and responsiveness to need

Therefore, a new emphasis on linkages rather than on physical infrastructure is emerging, as described in the quotation below:

> "*The 21st century science park is a gateway and not a destination. Thus, preoccupation with location, property and place has been replaced with a focus on process … Manage the park so as to optimise serendipity. This is a function of the overall ambience and culture of the park, the services provided, the networking opportunities …*"[64]

There is a risk that creating formal, institutionalised collaboration vehicles can have damaging effects, such as loss of autonomy and independence of partner organisations, increased vested interests that seek to prolong preferences and advantages to the potential detriment of new players. A focus on formal linkages can result in a lack of attention to important weak, random, informal and personal links that can be critical to establishing innovation networks.

d. **Limited attention to innovation in most of academia**

University R&D is not usually focused on identifying and realising the commercial value of outputs, limiting the opportunities for collaboration that would be part of the commercialisation process. It is therefore a challenge for science parks to promote a culture of full engagement with the entire innovation value chain amongst university staff members who could be tenants and partners.

4.5.4 The future: science parks versus alternatives

In a recent study jointly sponsored by the International Association of Science Parks and other role players in science parks, the following three scenarios are proposed for the future of research parks[65]:

a. **Scenario one – an incremental evolution of the research parks model**
This scenario is characterised by deeper formal ties to universities and the private sector, better leveraging of universities' intellectual resources, the creation and facilitation of more creative collaborative networks, and an increased focus on biotechnology and biomedicine. However, new science networks continue to form and grow outside the parks' influence, and parks continue to struggle to tap into and coordinate regional partnerships to create global brands and manage knowledge and investment networks.

[64] J. Allen (2007) Third generation science parks
[65] A Townsend, A S-K Pang, R Weddle (2009) Future Knowledge Ecosystems: The next twenty years of technology-led economic development

b. **Scenario two – new innovation networks in the form of research clouds that exist around universities, big companies and legacy science parks**
Pop-up labs, co-working hubs and mobile incubators are key characteristics, with a heavy reliance on social networks to extend their reach. Biotechnology and biomedicine is a major focal area. In this scenario, universities play a less central role and are more important as sources of labour – their rigid IP frameworks and massive cost overheads make them uncompetitive in the new environment. The term research or science park is no longer used

c. **Scenario three – research parks are in decline**
This scenario is characterised by dwindling global figures for the establishment of new research parks, while existing ones become office parks. Innovation becomes highly **virtualised** and parks are rendered obsolete by their cost structure which makes them inaccessible to young firms, drives towards energy efficiency, a protracted global recession, and falling R&D productivity. Face-to-face collaboration only takes place at the tail end of the innovation value chain. The downside is that this high degree of virtual networking limits cross-disciplinary collaboration as online communities of interest isolate themselves from others.

These scenarios are **based on trends** such as:

- The changing role of universities in regional and national economies, with some shifting towards entrepreneurialism and others rejecting the prospect of playing a larger role in the economy
- Biosciences occupying a more central role as the source of great technological and innovation breakthroughs
- The economic and financial crisis of 2008/9, which has impacts such as: companies trimming their R&D spending and focusing more on short term, quick-to-market innovation, and real estate players experiencing difficulty in financing new projects and becoming more risk-averse
- The emergence of new thinking and tools for collaboration – growing preference for ad hoc gatherings and meetings to discuss interests and current events with different infrastructure needs to those supplied by the traditional research park (demand for temporary, flexible and mobile space and venues)
- The emergence of a new generation of scientists who will:
  - Want work environments that maintain connections to social networks and outside sources of knowledge e.g. corporate or park alumni networks
  - Operate in an environment where the means by which scientists create professional reputation is different e.g. publishing is more open, collaborative and real time, and academic entrepreneurialism is more legitimate and institutionalised (e.g. entrepreneurship is rewarded in tenure review)
- Growing emphasis on climate change and environmental sustainability in the public and private sectors

An alternative model to science parks that is being considered internationally is that of research intensive clusters (discussed in the box below):

Research intensive clusters[66]

Research intensive clusters (RICs) are market-driven clusters that predominantly rely on research and development (R&D) as a source of their innovativeness and competitiveness. They consist of intense links between a wide variety of economic players, e.g. researchers, entrepreneurs and enterprise representatives, government administrations and agencies, investors and enabling organisations.

RICs differ from classical clusters in that they have a stronger science and research base and are able to generate a greater frequency of innovative enterprises which are able to commercialise and exploit research. Research intensive clusters can be formal (government driven) or informal (loose network of regional stakeholders). In terms of their spatial dimensions, they can occur at the local or provincial level.

The RIC model has the following features:

- In an RIC, higher education institutions and research centres play a key role – Due to their research intensity, RICs evolve in the proximity of universities or R&D institutes enabling strong network relations that foster the exchange of knowledge and human resources.
- Strong emphasis on entrepreneurship – RICs focus on generating high growth companies, and are able to generate new firms (including university spin-offs) and serial entrepreneurs. They also aim to increase the use of technology by existing SMEs. Towards this end, RICs develop strong financial value chains (public and private research funding, business angels, seed capital funds, venture capitalists, banks and guarantee providers), and extensive business development services (market information, business planning, legal services etc.)
- Science parks and incubators are not prerequisites, provided there are other mechanisms or delivery channels for key features such as business development and acceleration services and research capabilities – it is therefore an alternative way of thinking about regional innovation as it does not regard science parks as an inevitable or automatic next step in developing a functioning regional innovation system

[66] European Commission (2007) Regional research Intensive clusters and science parks

5 Initial assessment of Western Cape triple helix innovation networks

Available evidence shows that the Western Cape is relatively innovative, entrepreneurial and knowledge-intensive in the South African context. The province is also endowed with various assets and institutions that lay the foundation for innovation networks. The sections below reflect on the extent to which these potential innovation networks are developing in reality, based on the research conducted.

5.1 Assessment against key issues raised in the Terms of Reference

The sections below address the issues raised in the Terms of Reference.

5.1.1 What productive linkages currently exist between players in related technology fields (in particular longer-term strategic relationships with sustainable outcomes)?

Some productive triple helix relationships have been formed in the province – for instance Synexa Life Sciences, a biotechology company, has strong research ties to Stellenbosch University (one of the founders is a former faculty member at the university) as well as international universities, and initially received partial funding by the IDC and the Cape Biotech Trust. However, most relationships are only between two parties, and it seems that the majority of people within university, business and government organisations (and the individuals within them) are not innovation or collaboration oriented.

In many cases, business seems to be utilising academic research input for ad hoc needs and short-term problems, rather than on a systematic or long-term basis. Universities tend to focus on relationships with larger businesses (rather than SMMEs) – in the opinion of interviewees, this pattern relates to historical reasons and the potential for better financial returns. With the exception of active public research institutions such as the ARC, MRC and WRC, government's role is primarily as a funder.

There are few brokers to support collaboration. The few active venture capitalists in the province (e.g. Bioventures, Cape Venture Partners, HBD Venture Capital) are playing this role to some degree. Those "entrepreneurial academics" with experience in innovation sometimes also become brokers for other like-minded researchers, students and business people.

5.1.2 What is the extent of technology transfer, commercialisation or industrial application derived from local HEI and R&D institutions?

Ideas generated in universities are often not taken through to commercialisation (as in the case of CPUT informatics and design students' ideas and competition winners[67]). In other cases the commercialisation has taken place outside of the Western Cape - this may relate to gaps in productive capacity here, higher costs, or a decision to produce closer to large markets.

At least 13 spin-off companies have emerged from Western Cape HEI institutions. Universities and public research institutions have been partners in approximately 16 American registered patents. 46 European Union registered patents have also been recorded in the past 4 years. In terms of technology licenses and associated royalty payments, there is limited information available regarding their revenue contribution to universities. However, anecdotal evidence

[67] East City Design Initiative proposal (2009)

suggests they have contributed limited revenues to universities (e.g. Hot Platinum, established in 2005, is one example of a university spin-off that has produced royalty payments).

Based on the findings of this research, instances where the innovation value chain is complete seem to occur most often where the academic is entrepreneurial by nature, or where strong partnerships exist between anacademic and an entrepreneur (with the academic actively identifying and building relationships with potential business partners).

5.1.3 In which sectors do regional innovation chains exist or have good potential?

In the view of the OECD Territorial Review for Cape Town, research is disconnected from key regional value chains, including agro-food, logistics and tourism, and there is a lack of sufficient collaboration between firms and universities towards commercialisation in areas such as medical and environmental equipment, agro-food and biotechnology[68].

The research within this project would support this assessment to some degree, but with some caveats. There are examples of collaboration within innovation value chains, including:

- Agriculture, food and beverages, e.g. post harvest technologies, indigenous teas (honeybush, rooibos), plant cultivars, wine
- Creative industries: with some links with CPUT, the FabLab and UCT
- Strengths in ICT, information management, media etc. being applied to address the needs of various service sectors e.g. financial services, marketing, catering and tourism
- Consumer goods serving low income/base of the pyramid markets

Whilst research activity related to the significant and priority sectors in the province is not necessarily the strongest or most active within the region's universities and public research institutions, there is nevertheless relevant capacity within these and other institutions that could support innovation in these sectors. Examples are provided in the table below:

Table 8: Research capacity to support major economic sectors in the Western Cape

Sector in Western Cape	Examples of existing institutions
Tourism	▶ Centre for Tourism Research in Africa (CPUT) ▶ Cape Town Routes Unlimited
Oil and gas services	▶ Institute for Hydraulic and Environmental Engineering (SU) ▶ Institute for Structural Engineering (SU) ▶ Institute for Transport Engineering (SU) ▶ Institute for Water and Environmental Engineering (SU) ▶ Unit for Industrial Engineering (SU) ▶ Centre for Catalysis Research (UCT)
Agriculture	▶ Commercial Products from the Wild (SU) ▶ Faculty of Agriculture and Forestry (SU) ▶ Agricultural Economics (SU) ▶ Biostatistics Unit (CSIR) ▶ The South African Agri-Academy ▶ ARC, including research farms: – Elsenberg Research Farm – The South African Agri-Academy – Langgewens Research Farm – Nelspoort Research Farm – Nortier Research Farm – Oudtshoorn Research Farm – Outeniqua Research Farm – Worcester Research Farm

[68] OECD (2008) Territorial Review: Cape Town, South Africa

Sector in Western Cape	Examples of existing institutions
Aquaculture/fishing	▸ Marine Research Institute (UCT) ▸ Marine Biology Research Centre (UCT) ▸ Marine Living Resources Fund ▸ Freshwater Research Unit (UCT) ▸ South African Institute for Aquatic Biodiversity ▸ Aquaculture Institute of South Africa ▸ Marine and Coastal Management ▸ Department of Oceanography at UCT
Food and beverages	▸ Agrifood Technology Station (CPUT) ▸ SA Association for Food Science and Technology ▸ Post-harvest and Wine Technology and Infruitec-Nietvoorbij (ARC) ▸ PlantBio
Clothing and textiles	▸ Technology Station in Clothing and Textiles (CPUT) ▸ Institute for Plant Biotechnology (SU) ▸ Cape Town Fashion Council ▸ Cape Clothing and Textile Cluster ▸ Cape Craft and Design Institute ▸ Biotechnology Partnership for Africa's Development ▸ South African Textile Industry Export Council ▸ Fablab
Printing and publishing	▸ Water, Environment & Forestry Technology (CSIR) ▸ DST-NRF Centre of Excellence in Tree Health Biotechnology ▸ Cape Craft and Design Institute ▸ Fablab ▸ Unit for Document Design (SU)
Instrumentation, sensors, radio	▸ Bioprocess Research Engineering Unit (UCT) ▸ Bureau for Bio-engineering (SU) ▸ Centre for Materials Engineering (UCT) ▸ Centre for Process Engineering (US) ▸ Centre for Research in Computational and Applied Mechanics (UCT) ▸ Unit for Industrial Engineering (SU) ▸ Centre for High Performance Computing (UCT) ▸ Council for Scientific and Industrial Research
Metals and engineering, tooling	▸ Centre for Minerals Research (UCT) ▸ The Centre for Catalysis Research (UCT) ▸ Computational and Applied Technologies Manufacturing (CPUT) ▸ Materials Science and Manufacturing (CSIR) ▸ Cape Initiative in Materials and Manufacturing ▸ Western Cape Tooling Initiative ▸ Department of Electrical Engineering at UCT
Furniture	▸ Computational and Applied Technologies Manufacturing (CPUT) ▸ The Centre for Catalysis Research (UCT) ▸ Water, Environment & Forestry Technology (CSIR) ▸ DST-NRF Centre of Excellence in Tree Health Biotechnology at FABI ▸ Cape Initiative in Materials and Manufacturing ▸ Materials Science and Manufacturing (CSIR)
Cultural/creative industries	▸ Unit for Document Design (SU) ▸ Centre for Popular Memory (UCT) ▸ Information Centre for Children's Literature and Media (SU) ▸ Media Centre (SU) ▸ The Centre for Creative Writing (UCT) ▸ Writing Centre (UWC) ▸ Cape Music Industry Council ▸ Centre for Research in Applied Technology (CPUT) ▸ Performing Arts Network SA ▸ Visual Arts Network SA ▸ Cape Film Commission ▸ Cape Craft and Design Institute

Sector in Western Cape	Examples of existing institutions
Crafts	▸ CPUT Design faculty ▸ Cape Craft and Design Institute ▸ Fablab
Film	▸ Cape Film Commission ▸ Media Centre (SU) ▸ The Centre for Creative Writing (UCT) ▸ Centre for Research in Applied Technology (CPUT) ▸ African Cinema Unit (UCT) ▸ Centre for African Studies (UCT)
Wholesale and retail trade	▸ Centre for Supply Chain Management (SU) ▸ Graduate School of Business (UCT) ▸ SU Business School ▸ Centre for Real Time Distributed Systems (CPUT)
Transport and Communication	▸ Institute for Transport Engineering (SU) ▸ Built Environment unit at CSIR ▸ Centre for Real Time Distributed Systems (CPUT)
Financial, insurance and business services	▸ Bureau for Industrial Mathematics (SU) ▸ Bureau of Economic Research (SU) ▸ Institute for Mathematics and Science Education (SU) ▸ Centre for High Computing (UCT) ▸ Statistics South Africa ▸ African Institute for Mathematical Sciences (SU) ▸ Centre for Actuarial Research ▸ Institute for Futures Research (SU) ▸ The Entrepreneurship Development Unit (UWC) ▸ Graduate School of Business (UCT) ▸ SU Business School

The table below provides a comparison of specialisations within R&D spend, technology and publications within the province from the NACI regional innovation study[69]

Production	R&D investment	Technology (patents)		Science (publications)
		Produced by	Used by	
Primary				
Agriculture, fishing	Vegetables, horticultural specialties, nursery products	Agriculture	Vegetables, horticultural specialties, nursery products	Biology
	Fishing, fish hatcheries, and fish farms	Fishing, fish hatcheries and fish farms	Fruits, nuts, beverage and spice crops	Earth sciences
			Forestry and logging	Industrial biotechnology and food sciences
Secondary				Mechanical and industrial engineering
Food, beverages	Food products, beverages	Food, beverages	Food, beverages	Civil engineering
Textiles, clothing, leather	Textiles	Textiles	Wearing apparel	Chemical and process engineering
	Publishing, printing, media	Wearing apparel	Paper, paper products	Electrical and electronic engineering
	Pesticides	Paper, paper products	Rubber and plastics products	Clinical sciences
	Rubber and plastics products	Rubber and plastics products	Ships, boats	Medicine
	Machinery, equipment	Ships, boats		Human movement and sport science
	Electronic valves, tubes			Public health and health science
	TV and radio transmitters			Medical biochemistry and clinical chemistry
	Medical and surgical equipment			Medical microbiology
	Instruments, appliances			Immunology
	Aircraft, spacecraft			
	Transport equipment			
Tertiary				
Finance, business	Trade and repair of motor vehicles		Water transport	
	Retail trade		Sewage and refuse disposal	
	Land transport		Private households	
	Water transport			
	Air transport			
	Financial intermediation			
	Insurance and pension funding			
	Other business activities			
	Advertising			
	Public administration, defence, social security			
	Health, social work			

These NACI findings also support that there are some areas of common interest across universities and industry.

[69] J. Lorentzen (2007) as represented in Provincial Government of the Western Cape (2007), "Chapter 4: Regional Innovation and Growth" in Provincial Economic Review & Outlook, p. 105

The Provincial Economic Review & Outlook of 2007 raises questions about whether the diversity of outputs from the knowledge sector is an indication of greater sophistication than the productive sector in the Western Cape. This may not necessarily be true, but there are certainly different strengths e.g. medical research (e.g. genetics, drug discovery and immunology) in the province is internationally recognised, and there may be small businesses emerging in the province.

5.1.4 What are the trust dynamics and issues between triple helix players?

Stakeholder interviewees stated far more cases of distrust than trust. Those cases where trust was perceived to exist seem to be based on pre-existing relationships between role players (e.g. shared study or employment history), the existence of a reliable system to 'vet' potential partners e.g. word-of-mouth, databases such as Web of Science/PubMed (used by scientists to check papers published, number of citations), industry dynamics (e.g. some pockets of the ICT sector are generally less formal in the way they conduct business and open to new ways of thinking and operating), and personal relationships between actors.

The different dimensions of distrust raised by interviewees across the triple helix include:

a. ***Distrust in the abilities and competence of potential partners***

Some industry members see most of academia as out of touch with current trends, and focusing on areas that are either irrelevant or too theoretical to have real-world application. There also seems to be a perception that although there are pockets of excellence, overall academia in the Western Cape has little to offer most of industry**.** The highly varied levels research capacities of academic and research institutions in the province may contribute to these negative perceptions as it may not be obvious "who is good at what". On the other hand, some academics consider the "real" industry players to be international rather than local.

Respect for government partners and their hands-on understanding of innovation issues was limited across many stakeholders.

b. ***Distrust of intentions (in particular, fear of abuse of intellectual property)***

Even where legal agreements have been entered into, there are often concerns that IP will be stolen. Some role players view this more as a perception, and a matter of unclear expectations, than widespread abuse. Others point to actual cases where IP rights have been abused by partners, including both business and government partners.

c. ***Distrust of predictability, consistency and delivery on promises (in particular in relation to government)***

The trust of both local and provincial government has been undermined by a perceived history of failing to live up to promises of funding and other support, as well as political instability carrying through to policy and strategy uncertainty. This has resulted in reluctance by many parties to forge relationships with government, or depend on government funding or programmes that may not be available in a year or two.

d. ***Distrust of other actors' principles and ethics***

Some stakeholders have raised the issue that many academics do not trust the principles of the business world (some specifically chose academia so as not to be in the business environment) and feel that they will not be able to "see eye-to-eye" with business collaborators. Importantly, there is also historically-driven lack of trust both within and across stakeholder groups, largely attributable to a culture of exclusion and lack of transparency.

5.1.5 Which government incentives, policies and funding promise have proved to be effective in promoting innovation, and what impediments do government initiatives represent?

Government initiatives seen as promoting innovation networks

Incentives and support funds such as THRIP and the Tshumisano Trust are playing a role in stimulating collaborations. There is respect for the capability of researchers within the public research institutions.

At the national government level, the Department of Science and Technology and the dti have been cited by companies in the Western Cape as having facilitated partnerships or participation in national and international events.

The National Innovation Fund Competition brings together university students, industry (including venture capitalists, IP firms), academia and government in helping students to fine-tune their ideas throughout the competition (winners proceed to the commercialisation stage).

The COFISA foresighting workshops held in the province were mentioned by one respondent as having provided them with a platform to meet partners they may not otherwise have encountered.

The potential of sectoral special purpose vehicles (SPVs) to bridge this gap remains mainly underutilised, due to challenges such as insufficient funding, and poor relationships with universities and research institutions. However, despite these limitations some of the SPVs have attempted to promote innovation networks e.g. The Cape Institute for Materials and Manufacturing (CIMM) cooperates with other SPVs in the tooling, boatbuilding and crafts sectors, has strong relationships with UWC and CPUT, and also interacts directly with industry

Government initiatives seen as impediments to innovation networks

In terms of IP, the new Intellectual Property Rights from Publicly Financed Research and Development Act of 2008 requires universities to assess and report on all research that could potentially be commercially viable, and stipulates that intellectual property creators at an institution (i.e. academics) are entitled to at least 20% of the revenues accruing to the institution. The Act therefore incentivises academic entrepreneurialism. The Act also requires universities to establish offices of technology transfer whose responsibilities will include analysing disclosures for any commercial potential, the likely success of such commercialisation, and the existence and form of the intellectual property rights. Another objective of the Act is to give small enterprises and BBBEE entities preferential access to opportunities arising from the production of knowledge from publicly financed research and development.

There are however wider concerns that the Act may stifle, rather than support innovation. SMMEs typically struggle to finance R&D entirely on their own and usually require additional financial support. However, they may be discouraged from partnering with universities as the current legislation does not appear to set any limits on universities' share of IP or set conditions for proportionality between minimum financial investment and share of IP rights. This creates the potential for abuse by universities (i.e. the Act stipulates that any private entity or organisation may become a co-owner of the intellectual property if for instance, there has been a contribution of resources, or there is joint intellectual property creatorship; but it does not provide more specific detail about what share of IP rights a university is entitled to when it covers for instance 5% versus 50% of research costs). Clarity on this is particularly important in instances where ownership of IP rights (as opposed to licensing) is essential to business competitiveness and growth.

If not carefully managed, there may also be possible abuses of the system where basic services provided by universities to industry such as materials testing, product certification and lease of equipment are interpreted to mean that the university is entitled to IP rights

The Act requires universities to give preference to granting non-exclusive licenses to third parties for IP owned by the university (except in exceptional circumstances). Small and large industry players therefore have equal access to the same technology developed by universities, potentially hampering the competitiveness of SMMEs by depriving them of the advantages that come with exclusivity. In this environment, industry players are unlikely to be willing to invest resources in collaborating with universities to develop technology which will be shared with everyone.

Another concern is that historically disadvantaged universities which typically do not have the same level of resources as advantaged ones may not be able to compete in terms of the number of patents, and could end up paying the advantaged universities for patented research that previously was more readily accessible. This could in turn have a negative impact on the nature and frequency of joint research projects, including spin-offs.

Some researchers within universities also find the increased formalisation and bureaucracy a disincentive to register IP.

5.1.6 What is the depth of understanding of science parks and innovation centres? Can the anticipated level of output justify investments in science parks?

Some stakeholders see the potential role of science parks as iconic developments that could support the marketing and positioning of both their institutions and the region. They see the potential to support linkages, provide shared equipment and infrastructure. However, few of those interviewed would be willing to relocate their activities to a science park or cluster.

More widely, other comments and observations have been made by stakeholders about the appropriateness of science parks in the province. In the view of some, science parks may not be the best option for the Western Cape for a number of reasons.

Diverse innovative SMMEs in multiple locations
Support is mainly needed by a large number of SMMEs, many of them informal, dispersed over various locations. A science park may exclude many of these industry players if it is not affordable, and does not significantly lower other operational costs (or offer competitively priced but high quality value-added services). These SMMEs may be better served by decentralised support services and basic infrastructure where there is already innovation activity.

Real priority and commitment vs. following a trend?
Some feel that planning for science parks in the Western Cape at this stage seems to be more about following a trend and the need for visible, flagship projects than a thorough analysis of the barriers to innovation in the province. In addition, concerns were expressed that insufficient analysis had been conducted on the causes of the failure of Stellenbosch Technopark and Capricorn Business Park to operate as fully-fledged science parks, and whether these issues were fundamental or could be avoided in future efforts.

Timings: now vs. a longer term goal?
There were also views that science parks may be a good idea in the long term, but in the short to medium term there are fundamental issues that need to be addressed before a science park can succeed e.g. promoting a culture where learning and innovation are prioritised by the majority of triple helix players, building trust across the triple helix, and generating a sufficient volume of innovation activity to sustain a science park.

Relevance to the socio-economic challenges facing the province

Concerns were raised that science parks do not necessarily generate innovations that are socially relevant and address core community needs. The Western Cape therefore needs to be careful to ensure that innovations that take place outside a science park are not marginalised, and that outputs from science parks show wider benefits for the province.

5.2 Further assessment of factors impacting on innovation networks

In addition to the issues raised directly in the ToR objectives of this project, some other issues of interest emerged during the research. These are discussed below.

5.2.1 Why do people collaborate in their innovation?

Drivers of innovation collaboration in the province identified to date include:

- A shared vision or idea across stakeholders, which may extend as far as a sense of being part of a community
- Identification of an opportunity (e.g. a product or process or technology, market access to international destinations) or need (e.g. an industrial problem) that cannot be addressed alone
- Lack of sufficient internal capacity in terms of finances, skills, and specific technologies – examples of this include research contracts where the private sector engages the ARC and universities, and the province's SPVs which are mandated to support industry including filling gaps in technology
- Seeking a lower cost approach e.g. shared facilities, access to research to avoid duplication of effort
- Tapping into financial or fiscal incentives to collaborate e.g.THRIP funding for a project is conditional on the participation of both a higher education and industrial partner
- There are some individuals who have moved across the helix or are playing multiplying roles, thus bringing the various institutions represented by that one individual closer together (e.g. a former provincial government employee now leads an engineering spin-off company)
- The sophistication and technical complexity of some fields (e.g. biotechnology) sometimes necessitates collaboration between large multidisciplinary teams as individual institutions do not have the 'total package' to go it alone
- University policy at some universities in the province allows academics to devote 20% of their time to research, consulting etc without compromising their tenure, giving staff the opportunity to devote time to seek out and participate in collaborative research and commercialisation activities

5.2.2 How do people choose who to collaborate with?

The decision of who to collaborate with depends on a variety of factors, including technical capabilities needed, reputation of individual or institution (both in terms of trustworthiness and attractiveness to other funders and partners), professional and social networks (friendships, referrals or people directly encountered through conferences, trips, forums), and stipulations by funders (for instance, some funders go so far as to specify exactly who they would like actors to collaborate with).

Based on interview input, in most cases relationships between people are far more important than formal institutional relationships when selecting partners. These interpersonal relationships endure beyond the particular institutional role of a person. In instances where formal institutional relationships exist, they tend to originate from informal, person-to-person collaborations which were then later formalised.

In the opinion of some innovation role players, weak links that provide access to a wide network are more important than close, intense networks. These are not restricted to professional networks and can just as easily be social networks e.g. church or mosque, children going to the same school, living in the same area, eating lunch at the same spot, or having gone to the same school. Access to these networks is not necessarily well captured by the analysis of

more structured links such as joint research or funding ties. These views are supported by work such as Grannoveter's "strength of weak ties" theory which states that weak ties enable reaching populations and audiences that are not accessible via strong ties, implying that the process of encountering potential innovation partners is more likely to be successful if it is not limited to actors' immediate networks.[70] .

For some actors, the limited local availability of funding, skills, and specialised equipment in the Western Cape leads to collaborations with international partners (this reliance on international partners applies to all parts of the innovation value chain, including manufacturing capacity for commercialisation e.g. the University of Stellenbosch has developed solar panel technology which is now being manufactured in Germany due to the lack of local capacity).

5.2.3 What inhibits or prevents collaboration in the Western Cape?

There is an **apparent lack of facilitators or brokers to support collaboration**. Many actors have to rely on their own resources to find partners and do not have recourse to intermediaries to provide support functions such as introductory services, commercialisation, education about IP etc. Those government-supported intermediaries that do exist (such as the Cape Initiative for Materials and Manufacturing) consider themselves under-resourced. Private equity firms also play the role of intermediaries to some extent for their clients and potential clients.

Differing, potentially divergent (and competing) objectives are also an issue. Finding common ground on which to base collaboration can therefore be a challenge. Various role players interviewed mentioned the tensions that can arise when industry and academia work together on a project – business expects "bottom line" and short-term benefits, whilst postgraduate students may be more interested in finishing a project for an assignment, and academics in contributing to the body of knowledge, publishing a report, having their paper cited frequently etc. These differences can cause significant tensions and dissatisfaction in shared projects.

SMMEs are often relatively isolated from universities. Universities tend to focus on developing relationships with corporates who have greater funds available, and some are hesitant to approach universities **believing their problems to be too simple to merit attention from universities.**

There is also, in many cases, **limited awareness of the potential value and benefits of collaboration** by both academia and industry - there is a tendency to use the time and effort required to initiate and manage collaborations as an excuse not to engage with others. A related issue is lack of information and common understanding about innovation and what it means at the sector or firm level.

Institutional bureaucracy within universities has also been cited as a constraint to collaboration. Where the collaboration is formalised and contracts have been agreed to, researchers experience delays in the finalisation of paperwork by university administrators which can prevent collaboration from taking place at all, or hamstring collaboration once research has reached a certain stage.

There can be shallow, and therefore detrimental, understandings of what is meant by collaboration. There is a **tendency to view formal agreements such as Memoranda of Understanding (MoUs) as constituting collaboration resulting in agreements that exist in name only** and are not acted on. There is therefore a need to change mindsets so that actors realise that collaboration is action-oriented and does not have to be formalised in order to be valid.

[70] M. Granovetter (1983) The strength of weak ties: A network theory revisited

There are significant **differences in "ways of doing"** between academia and industry – there tends to be a mismatch between the **time frames** within which industry expects and needs problems to be addressed (short turnaround times), and time taken by universities to respond (often long turnaround times – anecdotal examples given included academics taking 3 weeks to respond to a query). University decision-making and implementation can be dictated by other priorities such as teaching obligations and producing publications, and are therefore not seen as responsive to industry demands for immediate feedback. The attitude towards innovation in academia is also often different, as university R&D is seldom oriented towards identifying and realising the commercial value of outputs, reinforced by the general lack of an entrepreneurial culture amongst academics.

In some cases, there is misalignment between the relative strengths and weaknesses of business and universities e.g. academic and clinical research, including drug discovery, is considered world class, but the pharmaceutical and medical equipment industries in the Western Cape consist of relatively unknown small players (as opposed to major multinational corporations).

There is a gap in financing for technology-based and other start-ups in the Western Cape, particularly for those at the idea stage (with or without working prototype), proof of concept and early operational stages. The innovation-related private equity market in the province is small and relatively risk averse, preferring to deal with entrepreneurs once production or service provision has been in place for some time (i.e. expansion or growth capital rather true start-up venture capital). Private equity companies interviewed indicate that they had started out trying to provide start-up capital, but could not find a sustainable business model (entrepreneurs were unable to pay fees and were resistant to providing equity). UCT provides some pre-seed commercialisation funding for start-ups, but the amounts are small (R20,000 and up to R100,000 per project for the Explore and Concept funding respectively). This limits the scope for collaboration as a critical mass of start-ups is required who will seek out partnerships for product and service delivery.

5.2.4 What are the success factors for collaboration in the Western Cape?

There are some instances where strong collaborative networks have been successfully established in the Western Cape e.g. the UCT Medtronics Institute for Biomedical Research (an example of university-firm interaction), and Winetech (university-industry collaboration).

Some of the success factors for effective collaboration in the Western Cape identified through stakeholder interviews include:

- Long-standing personal and professional relationships between collaborators where trust has been established (and tested)
- The nature of the collaboration is clearly defined, usually taking the form of:
  - Agreements for joint R&D, including patenting and commercialisation
  - Research contracts to conduct out-sourced research
  - Sponsorship of infrastructure and facilities, events
- The presence of institutional or project champions who are committed to implementation and possess characteristics such as good networking abilities and contacts, being visionaries who are able to see the big picture and understand how different role players fit together
- Understanding when (and if) to progress from informal to formal relations, including managing the timing and maintaining the essence of the relationship
- A platform to facilitate or broker the relationships (these may be product or sector specific, and should unite people around clear, common objectives and expectations)

- The vehicles used to broker relationships are well-resourced with sustainable sources of funding to ensure relationship building takes place over a sufficient period of time and at a large enough scale to make a significant impact
- Team dynamics and the ability to work together are just as important as finding people with the right skills – selection criteria for partners should include other attributes as compatibility, as putting together a team based solely on best-in-class skills sets does not guarantee productive collaboration
- Similar levels of familiarity with the Western Cape context in the field of research in which the collaboration is taking place, particularly where applied research is concerned e.g. when partnering with actors outside the province, valuable time and resources may be spent educating partners about conditions in the Western Cape, thus slowing down and potentially limiting the scope of problem-solving innovation
- Direct participation of senior officials or representatives with the authority to make decisions in the partnership
- Partner organisations should be evenly matched in terms of their relative commitment to and prioritisation of the collaboration project, as well as their ability to make and influence decisions e.g. bigger, more powerful partners may dominate decision-making and abuse their position by acting in their own interests rather than the best interests of the collaborative project

6 Support options for triple helix networks in the Western Cape

6.1 Thoughts on science parks

Based on the research to date, in principle science parks and clusters could make a significant contribution to innovation collaboration in the province by, for example:

- Creating physical and social space for greater collaboration
- Reducing the cost of access to critical equipment
- Providing shared services to support innovation
- Having affordable and flexible space for innovative start-ups
- Help to attract and retain knowledge workers in the province
- Providing a symbolic development that would raise the profile of innovation in the province

However, in order to achieve this contribution, science parks in the Western Cape would have to address the critical success factors identified. The table below assesses the fit of current conditions within the Western Cape with these critical success factors, based on existing reports and stakeholder input through interviews.

Critical success factor	Fit with current W. Cape conditions
Enabling environment	
▸ Culture of innovation within academia, business and government	▸ Cape Town is considered more innovative and entrepreneurial than all other cities in the country, and is one of the 34 most entrepreneurial cities in the world[71] ▸ However, the majority of business and academia are not innovation oriented ▸ The existing culture of innovation may not be aligned with a science park environment – anecdotal reports suggest that private sector innovation tends to be at a small scale and take place at low-cost venues such as home garages
▸ Existing base of matching competencies across academia and business	▸ There are some common areas of strength between research and industry e.g. agro-processing and food, wine, materials development and applications in boatbuilding, software, etc. ▸ Medical, drug discovery, immunology-related research in the province is very strong, and there are some small medical equipment and pharmaceutical businesses in the province
▸ Base of highly skilled knowledge workers	▸ Relative to the rest of South Africa, the Western Cape has greater availability of university graduates[72] ▸ However, there are also challenges in retaining skilled workers (more attractive salaries can draw them internationally and to Gauteng) ▸ Some stakeholders have stated anecdotal examples where the lack of large numbers of mid-level skilled staff and management has encouraged companies to shift offshore
▸ Some established trust between innovation players	▸ Trust relationships between triple helix players are present in pockets, primarily based on relationships between individuals rather than formal institutional cooperation ▸ However, trust is not widespread ▸ Stakeholders have expressed many reasons for lack of trust, such as lack of confidence in the competence of other groups,

[71] GEM, 2008, 'Entrepreneurial advantage of world cities'

[72] According to the World Economic Forum's 2009/10 Global Competitiveness Report, South Africa is ranked 123rd out of 133 countries on the availability of scientists and engineers. The country performs better on other innovation indicators however e.g. SA is ranked 36th on capacity for innovation, 25th on university-industry collaboration in R&D, and 29th on the quality of scientific research institutions.

Critical success factor	Fit with current W. Cape conditions
	lack of predictability, differing mindsets and values, lack of ethics and concerns about abuse of IP ▸ South Africa and the Western Cape's political and economic history are also factors in undermining trust and the creation of new productive relationships, including continued presence of racially-based social networks, inward-looking industry mindsets, tensions dynamics between dominant large firms and small businesses or new entrants, and party politics within the province resulting in policy uncertainty
▸ Base infrastructure – roads, public transport, affordable broadband etc	▸ Cape Town has the following factors in its favour: – City of Cape Town's planned fibre optic network – this is expected to improve accessibility and affordability of broadband in various locations in the city – Existing road and rail infrastructure – Planned bus rapid transport system – Port and airport access
▸ Supportive policy and regulatory environment – urban planning, intellectual property, business registration etc	▸ Specific "ease of doing business" rankings for the Western Cape are not available – South Africa ranks overall 34th of 183 countries in the world for ease of doing business, placing second in Africa after Mauritius (which is ranked 17th). Positive reforms have included simplifying small business registration and tax payment. However, South Africa still ranks relatively poorly on a number of sub-indices relevant to innovation and commercialisation, such as starting a business (ranked 67), employing workers (ranked 102) and enforcing contracts (ranked 85).[73] ▸ There are mixed views on intellectual property regulation in South Africa by stakeholders interviewed: – The South African patent system was criticised by various interviewees for the inadequacy of its assessment of applications, and the lack of easy access to information – Various interviewees expressed that the new Intellectual Property Rights from Publicly Financed Research and Development Act had the potential to discourage collaborative activities with universities because of both increased bureaucracy and the extent of the university's rights to IP related to a collaboration – The culture of open innovation and collaborative IP is not seen as well entrenched within South Africa ▸ The Department of Science and Technology is currently involved in the following activities in the Western Cape: – Sponsoring feasibility studies on science parks in the Western Cape and other provinces – Establishing a funding mechanisms for regional innovation forums – Establishing a Provincial Innovation Council which will act as a go-between for the Technology Innovation Agency, and local and provincial government ▸ Urban planners within the City of Cape Town have been involved in discussions to develop innovative precincts within the City, drawing on the 22@Barcelona model[74]
Strategic issues	
Comprehensive market demand analysis for science park (including	No detailed market demand studies have been conducted to date on commercially viable university projects and ideas in the private

[73] World Bank and IFC (2009) Doing Business 2010, available at www.doingbusiness.org
[74] See www.22barcelona.com

Critical success factor	Fit with current W. Cape conditions
identification of priority sub-sectors)	sector which could be supported by a science park (although it is understood that this is included to some extent in the feasibility study for the Belville science park).
Selection of appealing and accessible location: ▸ Close to universities ▸ Accessible by road and public transport ▸ Aesthetically appealing ▸ Close to amenities, accommodation and recreation facilities (or including them internally) ▸ A flexible physical layout with space for expansion and reorientation	▸ The site identified for the Belville science park is close to various universities, and relatively accessible by road transport; however, it is relative distance from the "iconic" lifestyle attractors of the Central City, Atlantic Seaboard etc. ▸ Sites have been identified for expansion of the Bandwidth Barn incubator (e.g. Foreshore area) and the East City design precinct ▸ There are other publicly owned land and buildings which could be considered subject to government cooperation
Reliable ongoing operational funding to incentivise the science park environment – e.g. shared facilities and recreation, flexible rentals that are cost-competitive with privately developed alternatives in the region	Long-term operational funding from government funding is unlikely to be guaranteed in the current environment due to: ▸ Existing pattern of uncertain funding to existing initiatives, e.g. SPVs ▸ Pressure on budgets by National Treasury to address the fiscal deficit and in response to the global financial crisis ▸ Current city and provincial government administrations may not able to guarantee funding beyond the medium-term expenditure period (3 years) ▸ Private sector investors and real estate developers are less cash-flush and more risk averse due to the global financial crisis ▸ There may be scepticism in the private sector due to the failure of Capricorn Park and the Stellenbosch Technopark to operate as science parks
Operational issues	
Involvement of a higher education institution in their structure, whether as joint partners, in consortia or standalone (but generally the HEI does not manage the day-to-day operations of the science park)	▸ UCT, SU, UWC and CPUT are all strong institutions which have the potential to make a meaningful contribution to a science park ▸ In addition, the fact that there are only 4 universities in the Western Cape makes it easier to scope and coordinate their role in a science park, particularly given that they already have a formal representative structure in place (the Cape Higher Education Consortium) ▸ The ARC, MRC and HSRC are also represented in the Western Cape and have established relationships with the 4 universities
A full time, professional park management team with a suitable skills profile (marketing, management, research, innovation) and ensuring the continuity of that team	▸ Assembling and retaining a management team may be difficult given limited regional and national experience with science parks (i.e. there is no pipeline of science park professionals) e.g. the Innovation Hub is the only science park in South Africa ▸ The DST, through its Draft National Science Park Plan and Draft Regional Innovation Systems Strategy has committed funds to training and skills development for science park management and for Provincial and local government to embed innovation in PGDS and IDPs ▸ However, TIA, the implementing agent of the National Science Park Plan and the RIS Strategy is not yet operational, casting uncertainty over funding availability in the short to medium term
Linkages with international networks and expertise	▸ Universities and some businesses in the Western Cape already have a strong base on international networks ▸ The COFISA team has been very active in developing the Western Cape's regional innovation system, and could be leveraged to access TEKEL (the Finnish Association of Science Parks) to provide support services in setting up a science park in the Western Cape

6.2 Thoughts on other potential support areas

Below are some ideas on other areas of support to innovation networks in the Western Cape that could be explored through further research and consultation.

For the purposes of discussion, possible initiatives have been organised by categories as follows (if implemented, initiatives these would be packaged together and organised by lead entity):
a. Information and knowledge generation and sharing
b. Awareness raising, shifting mindsets and frames of reference across triple helix players
c. Networking and relationship building
d. Institutional reforms
e. Strengthened support services
f. Enabling infrastructure
g. Pre-start-up and start-up funding

Initial ideas on potential support initiatives within these categories are set out below:

a. Information and knowledge generation and sharing

- Deliberate efforts to "snowball research" to identify innovative small businesses and research networks in the Western Cape i.e. consolidating and building on current and past research on innovation and collaboration
- Develop and make available an online searchable database of innovation role players (focus areas and contact details), potentially using the database developed as part of this project as a starting point
- Develop an online searchable database of patents in the Western Cape which innovators and entrepreneurs can use as inspiration, and to bolster patent holders' confidence in the regulatory environment
- Support further participatory assessments and rapid innovation appraisals in sub-sectors or focus areas (e.g. the Rapid Appraisal of Local Innovation Systems conducted for the two Tshumisano technology stations in the Western Cape agrifood and clothing and textiles)
- Mapping of and support for existing private sector initiatives to cluster and foster collaborative networks e.g. some stakeholders in the arts and entertainment sector in Cape Town have purchased their own buildings and sub-let space to product and service providers in their sub-sector's value chain

b. Raising awareness and shifting mindsets across triple helix players

- Market success stories, and integrate innovation into destination marketing for the Western Cape, Cape Town and Stellenbosch e.g. Accelerate Cape Town is working with Wesgro to develop an innovation-based brand for Cape Town
- Re-instate city or province level innovation awards and annual innovation audits to ensure there is up-to-date information that can be used for marketing and promotional purposes
- Changing attitudes to innovation through awareness campaigns to emphasise the nature and importance of triple helix collaboration e.g. implementation of a RIS Strategy proposal to provide government officials with training on how innovation can be integrated into PGDSs and IDPs
- It is also important to remain current and keep up with international trends

- At the university level, performance appraisals of teaching and research staff should recognise and reward entrepreneurial and innovative activities

c. Networking and relationship building

- Provide additional support for networking events (e.g. dinners, drinks), drawing on international trends and best practices to ensure relevance and sufficient volumes of the right kinds of people e.g.:
  - 27Dinner which is already operating in Cape Town (please refer to section 3.2 for more detailed information)
  - The CPUT Tshumisano Clothing and Textile Technology Station's 'Get Connected' business to business matchmaking events which bring together designers, CMTs and other industry professionals (activities including presentations and exhibitions by CMTs)
  - PICNIC[75] in the Netherlands is a 3-day conference that brings together, creatives and innovation professionals in business, technology, science, media and entertainment. It is a networking event where people meet and interact with new technologies (e.g. use of ikTags worn by all participants to identify people they have arranged to meet, and to provide feedback on their experiences at PICNIC). Young people are also included – the PICNIC YOUNG Creative Playground targets youths aged 12 to 18, and encourages them to experiment with creative technologies through interactive workshops with their peers and education professionals who assist them with talent development

  Another element of the networking events could be to ensure that they are recorded and can easily be shared via accessible digital media such as cellphones and e-mail – support in this area could include covering the the costs of audio and video recording, and sensitising participants to structure talks or presentations so that they are short and easily digestible

- Matchmaking between technical and business or marketing people – across universities, and between universities and business

- Establish opportunity-based or problem solving forums: Cross-disciplinary working groups to address particular challenges identified e.g. with clusters of SPVs and academics, or Cape Town-based Quirk e-Marketing's 'Idea Bounty'[76] which brings together corporates experiencing problems or challenges in aspects of their business with innovative problem solvers in the general public (individuals or teams may submit entries, and the Idea Bounty website allows potential entrants to network and collaborate online - those who provide the best solution receive a financial reward)
  - More emphasis on identifying real consumer and community needs and challenges in the Western Cape, and approaching triple helix players to address them

- Education or skills development and innovation linkages
  - Additional joint student appointments between universities and public research institutions
  - Support and facilitation for student placements or projects in corporates e.g. fiscal incentives such as tax breaks and subsidies for private sector companies to take on university students for mentorships or internships

- Further interaction between industry and universities on knowledge-intensive skills requirements in their field (over and above SETA interactions)

[75] Please refer to www.picnicnetwork.org for more detailed information
[76] Please visit www.ideabounty.com for more detailed information

- Develop a "Western Cape diaspora knowledge network" similar to the Western Hemisphere African Diaspora Network[77], an African Union initiative established in 2002 to tap into diaspora skills, networks and funding in the Americas and the Caribbean. The Network's Working Committee on Science, Research and Technology has proposed measures such as an electronic database of African institutions and individuals in the diaspora (focus on biotechnology and intellectual property rights), developing a database of expired patents, and giving preferential status to bids for government work which have at least 20% contractual participation from the African diaspora

- Identifying and supporting grassroots innovation networks in the Western Cape such as the Cape Town-based Broccoli Project[78], which rewards the poor for making positive life steps e.g. vouchers for food, clothing and shelter in exchange for attending skills training workshops or going for HIV testing; biometric technology is used to keep track of participants

d. **Institutional reforms**

- Create a more supportive framework for joint academic or business appointments or exchanges, potentially with government assistance (including scope for accommodating ongoing relationships with local institutions during international appointments)

- Increase recognition of innovation as a form of academic contribution within academic performance measurement at all 4 universities – a common policy on innovation and academic performance reviews could potentially be formulated by CHEC

e. **Strengthened support services**

- Further integration of international approaches to Collaborative Research Centres (e.g. Australia and Finland) into local sectoral SPV and centres of excellence

- Improving the support infrastructure for SMMEs through greater coordination and alignment between different role players such as the Innovation Fund, THRIP, SPVs, SEDA, and local and provincial government (which manage SMME support programmes such as RED Door)

- Improve support for intellectual property management and technology commercialisation at universities to address the challenge of lack of capacity through:
  - Shared services, with Western Cape universities and research institutions creating a collective of technology transfer/commercialisation offices that cooperate with each other e.g. Tektique[79], a recently launched inter-university technology transfer office initiative which identifies opportunities for technology licensing and collaborative development. Funded by the DST, Tektique aims to link TTOs in universities and MRC offices across the country; Western Cape members of Tektique so far are Stellenbosch University, UCT and the MRC
  - Capacity building or exchanges for IP and commercialisation officials
  - Communication of IP issues and solutions e.g. circulation of simple guidelines (such as SARIMA booklet) and standardised templates for non-disclosure agreements to all university technology transfer offices

[77] Please visit www.whadn.org for more detailed information
[78] Please visit www.broccoliproject.org for more detailed information
[79] Please visit www.tektique.co.za for more detailed information

- Launch of initiative similar to Gauteng's Activator Programme[80] in the Western Cape – the Activator programme is a tool to promote triple helix collaboration for the development of SMMEs in high technology sectors (ICTs, biotechnology, and aerospace) in Gauteng

- Support knowledge brokers and Knowledge Intensive Business Services:
  - This could include incorporation into SEDA or IDC or Umsobomvu programmes or voucher schemes
  - Another possible approach could be identification and grooming of suitable postgraduate students that have the potential to understand both technical and business worlds and language

- Provide additional support for international exchanges with successful innovators internationally (academic, business or government) on an annual basis – build international networks with high achieving innovators e.g. the CPUT Tshumisano Clothing and Textile Technology Station has an annual exchange programme with German technology experts and innovators

f. Enabling infrastructure

- Provide high speed bandwidth or optic fibre access (potentially addressed by the current City of Cape Town fibre optics network development), and lobby for direct network links between academic and research institutions (to facilitate virtual collaboration) in planning the route of the network

- Increase shared equipment across fields and stakeholders e.g. rapid prototyping facilities. There is already some collaboration amongst the Western Cape universities in this area with joint purchasing and use of some equipment

- Provide or rent out creative innovation space to young entrepreneurs equipped and designed in a way to facilitate free thinking e.g. colourful, playful, ergonomically friendly, interactive (tactile, whiteboards and markers, ability to write on walls) with designated workshops and lounge areas. It should also play a role in developing entrepreneurial networks, debate and gatherings. The Open Innovation Space Studio in Cape Town's CDB is one example of this approach.

g. Pre-start-up and start-up funding

- Provincial and local government SMME support programmes could be tweaked to increase their focus on this under-served market segment
- Venture capitalists could be lobbied to experiment with different models that cater to this market without undermining their sustainability

[80] Please visit www.activator.co.za for more detailed information

7 Way forward

As COFISA is winding down its activities, it is recommended that provincial role players should provide the leadership to support innovation collaboration in the province. This might include:

- Supporting more comprehensive and long-term research on innovation collaboration, potentially including social network analysis and participatory research
- Reaching agreement on priority support initiatives (short, medium and long-term)
- Integration with initiatives of the Technology and Innovation Agency (TIA) and the Regional Innovation Forum as they emerge
- Committing to lead, fund and support the prioritised initiatives
- Adapting institutions monitoring and evaluation systems to capture progress in implementation

Appendix A: List of stakeholders consulted

The following institutions and stakeholders have been consulted during the preparation of this report to date (in alphabetical order by first name):

1. Ahmed Kajee, Cellsmart
2. Alan Alborough, AMTS FabLab (Innovation Manager)
3. Alan Manning, Stellenbosch Technology Park
4. Alan Christoffels, Associate Professor: Evolutionary and comparative Genomics of Pathogens, South African National Bioinformatics Institute
5. Ali Brey, Hot Platinum (CEO)
6. Andrew Rens, Research Fellow: Intellectual Property (Mark Shuttleworth Foundation)
7. Anita Nel, InnovUS (CEO)
8. Charlene Steyn, Cape Initiative in Materials and Manufacturing (CEO)
9. Chris Nhlapo, Cape Peninsula University of Technology (DVC : Research, Technology Innovation & Partnerships)
10. Cornelia Malherbe, University of Stellenbosch (Coordinator: THRIP & Research Contracts)
11. David Gretton, City of Cape Town (Special Project & Manager Regional Service Area)
12. Erica Elk, Cape Craft and Design Initiative (Executive director, artistic director and fundraising)
13. Ernst Uken, Energy Institute, CPUT
14. Florian Bauer, Wine Biotech, Stellenbosch University (Professor, Wine biotechnology)
15. Frank Brombacher, UCT or MRC Immunology at the Institute for Infectious Disease and Molecular Medicine (Principal investigator)
16. Geoff Hainebach, Cape Venture Partners
17. Glenda Kruss, Human Sciences Research Council (Chief research specialist in the Education, Science and Skills Development research programme)
18. Guy Lundy, Accelerate Cape Town (CEO)
19. Jo Lorentzen, Human Sciences Research Council (Chief research specialist in the Education, Science and Skills Development research programme)
20. Jo-Anne Johnson, W. Cape Department of Economic Development (DEDAT)
21. Johann Strauss, Department of Science and Technology (Deputy director: manufacturing and local innovation)
22. Johann van Zyl, ARC Infruitec-Nietvoorbij (Institute for Deciduous Fruit, Vines and Wine)
23. John Lawson, Cape town tooling initiative (Provincial coordinator) and facilitator of Rapid Appraisal of Local Innovation Systems (RALIS)
24. John-Luke Hutchinson, SA solutions (Business analyst)
25. Jonathan Tapson, University of Cape Town, CellLife, Hot Platinum, Motornostix (Professor, Department of Electrical Engineering)
26. JP Kloppers Innovation Fund Competition (National Coordinator)
27. Justin Smith, Woolworths: The Good Business Journey (Manager)
28. Khalid Khan: Department of Economic Development and Tourism (Workforce Development and Innovation)
29. Larry Dolley, Agrifood Technology Station (Manager)
30. Mark Parsons, d6 media
31. Mansoor Mohammed, City of Cape Town (Executive Director: Economic, Social Development and Tourism)
32. Nasima Badsha, CHEC (CEO)
33. Nick Segal, former head of UCT Graduate School of Business
34. Njodzi Zizhou, Cape Carotene (CEO)
35. Paul O'Riordan, Synexa (CEO)
36. Paul Raphaely (Managing Director: Nomu)
37. Paul Scott, African Virtual Open Initiatives & Resources, UWC

38. Piet Barnard, Research contracts and intellectual property services, University of Cape Town (Director)
39. Ramesh Bharuthram, University of the Western Cape (Deputy VC: Academic)
40. Shamil Isaacs, Cape Peninsula University of Technology (Manager: Clothing & Textiles Technology Station)
41. Stan Ridge, University of Western Cape (Pro Vice-Chancellor)
42. Thembinkosi Semwayo (Knowledge Crucible)
43. Therina Theron, University of Stellenbosch (Director of Research)
44. Tim Shier, Quirk eMarketing (Marketing Manager)
45. Ulrike Rivett, UCT Department of Civil Engineering or Cell-Life
46. Veda Raubenheimer, Cape Town Boat Building Technology Initiative (CEO)
47. Vuyani Lingela, Department of Science and Technology (Chief Director: International Research)
48. Wynand Coetzer, DataFusion (Co-founder)
49. Zayd Minty, Creative Cape Town (Coordinator)

In addition, the following stakeholders were approached for interviews (but interviews were not conducted):

1. Al Harris, South African Oil and Gas Alliance
2. Angelo Manzoni, Wesgro (CEO)
3. Ashoek Adhikari, Media 24
4. Bart Cilliers, Sunspace Technologies (CEO)
5. David Pietersen, I&J
6. Dirk Knoesen, University of the Western Cape (Physics Department)
7. Elise Levendal, South African Aids Vaccine Initiative
8. Elton Jefthas, ASNAPP (Country Director: South Africa)
9. Gary Levinsohn, Ogilvy
10. Glen Fisher, National Business Initiative
11. Godwin Sweto, Petro SA
12. Hanif Moola, University of the Western Cape (Dean of Dentistry)
13. Jian Swiegers: Optimal Energy (Manager: Development)
14. Kevin Bennett, University of Cape Town (Director:Energy Research Centre)
15. Kit Vaughan, MRC or UCT Medical Imaging Research Unit (Director)
16. Leslie Petrik, SA Institute of Advanced Materials Chemistry (Research Manager)
17. Leonora van Niekerk, Acuo Technologies
18. Marang Seleka, Chevron
19. Marius van der Merwe, AfriGIS
20. Mario Ehlers, Angio Design
21. Marlon Parker, Cape Peninsula University of Technology (Coordinator: Athlone Living Lab)
22. Ratilal Rowji, Optimal Energy (Manager: Production Engineering)
23. Renfrew Christie, University of the Western Cape (Dean of Research)
24. Sue Harrison, UCT Bioprocessing Engineering Unit
25. T Kemp, Acuo
26. VC de Vries, Distell

Appendix B: Reports consulted

Reports reviewed included the following:

1. Acs, Z., Bosma, N., Steenberg, R., 2008. *The Entrepreneurial Advantage of World Cities: Evidence from Global Entrepreneurship Monitor Data*
2. Allen, J., 2007. *Third genereation science parks*
3. Ananth, M.S., 2009. *Leading Asian Models of S&T Parks: Indian Science and Technology Parks*. Symposium: Understanding Research, Science and Technology Parks
4. Austrialian Business Foundation, 2008. *Inside the Innovation Matrix.*
5. Australia Bureau of Statistics, 2006-07. *Innovation in Australian Business*
6. Australian Department of Education Science and Training, 2005. *Knowledge exchange networks in Australia's innovation system: Overview and strategic analysis*
7. Batelle Technology Partners, Association of University Research Parks, 2007, *Characteristics and trends in North American research parks: 21st century directions*
8. Cape Town Partnership, 2009. *A proposal for the East City Design Precinct or Park*
9. CHEC, 2009. *Project Plan for Bellville Science Park FeasibilityStudy*
10. COFISA, 2007. *Pre-feasibility study into Establishing Science Park activity in the Eastern and Western Cape.*
11. Commonwealth of Australia, 2008. *Collaborating for a purpose: Review of the Cooperative Research Centers*
12. Coulon, F., 2005. *The use of social network analysis in innovation research: A literature review*
13. Department of Science and Technology, 2009. *Draft Regional Innovation Systems Strategy*
14. Department of Science and Technology, 2009. *Draft National Science Park Plan*
15. European Commission, 2007. *Regional research intensive clusters and science parks*
16. European Union, 2008. *EU Policy Report: Finland*
17. Evaluserve, 2008. *R&D Ecosystem in India*
18. Frost & Sullivan, 2007. *Cape ICT Census*
19. Global Entrepreneurship Monitor, 2008. *Adult Population Survey*
20. Global Entrepreneurship Monitor, 2008. *Entrepreneurial advantage of world cities*
21. Granovetter, M., 1983. *The strength of weak ties: A network theory revisited*
22. Herrington, M., Maas, G., Bisset, E., 2007. *The role of innovation in promoting entrepreneurial activity in South Africa*
23. *HSRC, 2008.Creating knowledge networks (edited by Glenda Kruss)*
24. International Association of Science Parks, Institute for the Future, The Research Triangle Park, 2009. *Future Knowledge Ecosystems: The next 20 years of technology-led economic development*
25. Kennedy, N., 2009. *Speech to innovation Conference Sydney*
26. Kruss, G., 2008. *Knowledge-intensive university spin-off firms in South Africa: fragile network alignment*
27. Kruss, G., 2008. *Evidence from case studies of university practice in South Africa*
28. Kruss, G.*, Petersen, I., 2009. Firm interactions with universities and public research institutes: evidence from innovation and R&D surveys in South Africa*
29. Lorentzen, J., HSRC on behalf of NACI, 2007. *Regional and local innovation profiles*
30. Leung, M., Matthews, J.A., 2006. *Origins and dynamics of university spin-off enterprises in Hong Kong*
31. NACI, 2006. *The South African National System Of Innovation: Structures, Policies and Performance*, Background Report To The OECD Country Review of South Africa's National System of Innovation
32. National Business Initiative, 2009. *The Role of Business in Society* [online] Available from: http://www.nbi.org.za
33. National Institute for Science and Technology, 2006. *21st century innovation systems for Japan and the United States: Lessons from a decade of change* (International Symposium Report)

34. OECD, 2008. *Territorial Review: Cape Town*
35. OECD, 2007. *Reviews of Innovation Policy: China*
36. Mthenthe, 2009. *Business Case: Design precinct*
37. Petersen, I., Kruss, G., 2009. *Firm Interaction with Universities and public institutions: evidence from innovation and R&D surveys in South Africa*
38. Prairie Intellectual Property Management Network, 2008. *University spin-off companies: A Sasketchawan-Manitoba success story*
39. Provincial Government of the Western Cape.,2007 *Provincial Economic Review & Outlook*
40. Quantec, 2008. *Regional output and value add*
41. Ridge, S., 2009. *Project plan for the Belville Science Park: feasibility study and development of a business plan* (University of Western Cape)
42. Rogan, R.W., 1998. *How the interactive networks between Capricorn Technology and Industrial Park and key stakeholders can spur economic growth in the Western Cape region* (MBA thesis, UCT Graduate School of Business)
43. Segal, N., 2008. *Science and technology parks and economic development: Lessons from European experience*
44. Simanis, E., & Hart, S., 2008. T*he Base of the Pyramid Protocol: Towards Next Generation BoP Strategy*, 2nd edition
45. Shen, Z., 2009. *Leading Asian Models of S&T Parks, Symposium: Understanding Research, Science and Technology Parks*
46. Steen, J., Macaulay, S., Kastelle, T., 2008. *Mapping and Managing Networks for Innovation Performance: New Perspective and New Tools in Human Dimension of Innovation*, University of Queensland Business School
47. Squicciarini, M., 2009. *Science parks, knowledge spillovers and firms' innovative performance: Evidence from Finland*
48. Tekel, 2005. *Tekel and finpro collaborate in promoting the internationalisation of Finnish businesses* [online] Available: http://www.tekel.fi/inenglish/news/?x95027513=95022071
49. Tekes, 2008. *The Tekes Strategy*
50. The Triple Helix Institute, 2009. *Taxonomy of Triple Helix Innovation* [online] Available from : http://www.triplehelixinstitute.org
51. Townsend, A., Pang, A., Weddle, R., 2009. *Future Knowledge Ecosystems: The next twenty years of technology-led economic development*
52. United Kingdom Science Park Association, 2003. *Evaluation of the past and future economic contribution of the UK science park movement*
53. UNESCO, 2007. *Report for UNESCO on the proposal for a pilot science park in Egypt*
54. United Nations Industrial Development Organisation, *2005. Advising and monitoring the planning of a technology park: Guidelines for an ICT park in Iran*
55. Viljoen, H.C., 1989. *The science park as a vehicle for university-industry cooperation: what, where and how*
56. Western Cape Department of Finance, 2009. *Estimates of Provincial Expenditure: Vote 12: Department of Economic Development and Tourism*
57. Western Cape Provincial Government, 2000. *Preparing the Western Cape for the knowledge economy of the 21st century*
58. Western Cape Provincial Government, 2007. *Institutional framework to accelerate the implementation of economic development initiatives: Institutional review process*
59. Western Cape Provincial Treasury, 2007. *Provincial Economic Review and Outlook 2007*
60. Winetech, 2009. [online] Available at: http://www.winetech.co.za
61. World Bank, 2007. *Unleashing India's Innovation: Towards sustainable and inclusive growth*
62. World Bank, 2010. *Doing Business Report 2010*

Appendix C: Notes on research method and future research

Further areas for research and methodologies

Key areas of research to supplement the data on innovation networks gathered as part of this project include the following:

- Mapping of innovation actors physical locations
- Further details on links between actors, including:
  - Joint research publications
  - Joint research projects (some joint research projects gathered)
  - Spin-off companies
  - SA patents
  - Funding

Furthermore, a process of verification, completion of partial data, and updating would need to be conducted.

The table below gives further detail on potential further research.

Area	Data to be captured	Potential data source
Actors	▸ Physical location of actors ▸ Additional actors, in particular: intermediaries, technical services, consultancies, innovative companies ▸ Local government actors ▸ International partners	▸ Local university websites including: – University of Cape Town www.uct.ac.za – Stellenbosch University www.sun.ac.za – University of the Western Cape www.uwc.ac.za – Cape Peninsula University of Technology www.cput.ac.za ▸ International university research institutes including: – Stanford University's Technology Ventures Program – European Centre for Particle Physics ▸ Local government information providers: – The Department of Government Communication and Information System www.gcis.gov.za – The Department of Cooperative Governance and Traditional Affairs www.thedplg.gov.za ▸ Company profile websites such as: – Mbendi www.mbendi.co.za – Anazi www.nanazi.co.za ▸ International public research institutions such as: – US National Institutes of Health www.nih.gov – French National Institute for Agricultural Research ▸ International government departments such as: – United States Agency for International Development www.usaid.gov.za – UK Department of International Development www.dfid.gov.uk ▸ Non-profits and foundations: – Mark Shuttleworth Foundation ▸ International technology and innovation awards: – Technology top 100 – The Wall Street Journal Technology and Innovation Awards – UK Technology Innovation and Growth Awards

Area	Data to be captured	Potential data source
Relationship details	▸ Dates of employment ▸ Employment position ▸ Funding amounts ▸ Duration of funding ▸ Additional relationships ▸ Relationship outputs (e.g. new products)	▸ Human resource departments at companies ▸ Local intellectual property offices at universities including: – University of Cape Town's Research contracts and Intellectual Property Services ▸ International university technology transfer offices/companies such as – University of Oxford's ISIS innovation www.isis-innovation.com ▸ Local and government departments: – South Africa's Department of Trade and Industry – South Africa's Department of Science and Technology

Potential research methods could include the following:

- "Snowballing" to identify actors and links: this would include requesting referrals to people within main actors' innovation network, and subsequently approaching them to supply contacts within their immediate innovation network. In this way, both actors and their links within the innovation network will be captured
- Additional rapid innovation appraisals involving gathering data from scans of triple helix players websites and available documentation
- Case studies of collaborations on innovation
- "Crowd-sourcing": this could include using a web portal to post the data and allow innovation players to verify, add and edit data. This could also then serve as a tool to enhance network relations.

For this last method to be successful, both as a research methodology and a tool for network interaction, the portal would most likely need the following success factors:

- The initiative should be led by a "champion", who has strong innovation network connections
- The nature of interaction should remain quite informal
- The portal should provide benefits to the users, for example, functionality could include being able to locate actors in specific areas, and map potential paths through contacts from the user to that person. The portal could showcase collaborative research outputs, and also allow for creation of online forums for discussion of specific topics. It could also suggest potential innovation partners, based on profiles of actors.
- Provide information on events, such as conferences, informal network dinners, etc.

This network could also link into existing web initiatives, such as the portal aiming to link SPVs to industry.

Further areas of analysis

Various analytical and visualisation tools can then be used to describe the qualities of the networks and its sub-components (such as pairs of actors, sub-groups and groups), as well as to assess how well these networks function.

Examples of aspects that can be described include:

- **Direction** – whether relationships one-way or multi-directional
- **Strength of ties** – formality or informality
- **Ego** – nodes or actors who are focal points and have a particularly high number of ties to them, potentially indicating a high degree of influence
- **Weighted ties** – strength or value of ties between two nodes (although this is less regularly used because of the difficulties and complexities in allocating quantitative values to the ties in a meaningful way)

- **Distance or path length** – how many nodes or ties have to be passed through to get from one particular person or organisation to another – similar to the lay person understanding of "degrees of separation"
- **Density** – actual number of ties as a proportion of the total possible number of ties
- **Centrality** – refers to a particular node within the network, that has the highest number of ties within the network (or potentially a sub-group within the network) (either direct ties, or the shortest ties to the global network)
- **Betweenness** –nodes that forms link between other nodes –these can potentially play an intermediary or broker role, but can also potentially be a gatekeeper (but this measure is difficult to calculate)
- **Centralisation** – extent to which the whole network has a centralised structure – comparing number of connections of the most central node with those of other nodes

Measures of network performance include the following:

- **Robustness** – assessing how fragmented the network becomes as nodes are removed i.e. is there "redundancy" in the linkages between people and organisations that will help these links to survive if some people move – depending on clustering of groups where the whole group knows each other
- **Efficiency** – access to large number of nodes through a small number of ties – thus making it quicker to access information, find partners – avg. path length relative to the size of the network
- **Effectiveness** – clusters of nodes that can be reached through non-redundant contacts(each cluster is likely to have similar knowledge and networks)
- **Diversity** – of history and background of people involved in the network

Specifically, analysis can be conducted on the following:

- Network dynamics for innovation input vs output links, to assess relationship (although causality cannot be assumed)
- Geographical locations of networks, including clustering of actors and intersection of links
- Network dynamics over time
- Potential for increased collaboration, based on links across triple helix players (e.g. previous employment, study)
- Sub-groups of the network in relation to sectoral groupings, highlighting areas of required coordination

Appendix D: Western Cape innovation triple helix stakeholder database

(See separate Excel file which accompanies this document)

- **Organisation sheet**: this sheet lists and describes organisations that play a role, or could potentially play a role, in the Western Cape innovation network. They are listed according to their type of organisation (university, industry, industry association, government and other support institution, incubator, national research facility, special purpose vehicle) and are described in the subsequent columns. Defining characteristics of organisations such as JSE-listed companies, technology top 100 companies, centres of excellence are also indicated.
- **People sheet**: people that do or could potentially play a role in the innovation network in the Western Cape are listed and described in the people sheet. These people include NRF-rated researchers at Western Cape universities, key industry players, entrepreneurs and government players.
- **Links sheet**: this sheet indicates links between players (people and/or organisations) in the innovation network. The types of relationships are described in subsequent columns and include funding, employment and patent relationships, and should in future be expanded to include joint publications, joint long-term projects, shared facilities etc. Where a link has direction (e.g. a funding or employment relationship), these have been captured consistently (e.g. the funder as actor 1, the fund recipient as actor 2).

The nature and objectives of the organisation and people in the network are defined using the Australian and New Zealand research categorisation system for Fields of Research (FOR) and Socio-Economic Objectives. Descriptions of FORs and SEOs are found in the FOR coding description and SEO coding description sheets in the database respectively. Organisations are also assigned an ‘Ocode’ and people, a ‘Pcode’ as unique identifiers.

Note: This is an initial database to serve as a foundation for future research to more comprehensively capture innovation stakeholders in the Western Cape.