

## FOCUSING THE MANAGEMENT OF INNOVATION RESEARCH DOMAIN OF TSHWANE UNIVERSITY OF TECHNOLOGY, SOUTH AFRICA

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### ABSTRACT

*Research on the management of innovation is considered to be one of the main drivers of economic growth and prosperity in the knowledge economy and in South Africa. Understanding and managing innovation processes and structures in general and particularly in South Africa have the potential for huge benefits for actors, local clusters, and the national system of innovation. The purpose of the present research is to develop a research focus in the management of innovation at an institution of higher education in South Africa. Research in this area should promote knowledge in the fields of technopreneurship, technology management and transfer as well as intellectual property.*

**Key words:** Innovation, research niche, information packages

### Introduction

The 2004–2008 Research and Development Strategy of the Tshwane University of Technology, South Africa contains two significant statements namely that the University:

- Will focus on research, technology, demonstration and innovation; and
- Will promote and develop a “limited number of Research and Innovation Focus Areas” around themes that address some of the priorities and needs of South and Southern Africa (Strategy for the Integration of Research & Development and Technological Innovation (TI) and Technology Transfer (TT), 2005).

The above strategy implies that at Tshwane University of Technology focus and niche areas will become the primary vehicle for the full spectrum of activities in the research and innovation chain. In this regard, the focus of entrepreneurship and innovation education and research at institutions of higher education ipso facto implies a wish to enhance the quality of graduate and post-graduate business venturing prospects and business know-how in the normally pre-entrepreneurial stage. This takes place within a sense-making framework that underpins a research and education agenda for graduate entrepreneurship in a country in which a need exist to, on the one hand, develop effective entrepreneurial, management and creativity skills, and on the other hand to create a desire in graduandi to start entrepreneurship as a career (Hannon, 2005:2). It should further be of such a nature that the content guides the competitive landscape in which the prospective entrepreneur will function and not lag behind and thereby may loose its relevance.

## **Purpose**

This paper focuses on the development process of a niche research area in the field of management of innovation at Tshwane University of Technology (TUT), South Africa. Through the research process followed, the research domain was defined as participation in creating data, new product ideas and knowledge through the research and the development of models to support better understanding of the business innovation processes, and to plan and implement interventions to the benefit of the actors in the innovation system. Of particular importance in this research and innovation area is to create understanding and implementation skills on systematic innovations and incubator designs and the management thereof through empirical and participatory action research methods. Initially the focus will be on clarifying the role of the University of Technology in the National Strategic Innovation Framework, followed by a shift in the research focus domain towards:

- Technological change and the effects thereof on the business environment.
- Characteristics of innovative organisations in South Africa.
- Patterns of technological change. This area of research will typically investigate questions like how does technology evolve, what are the dominant design forms and what are the dynamics of innovation.
- Research on the management of technological transitions which include aspects like disruptive technologies, and the reconfiguration of existing technologies as well as the impact thereof on business success.
- The effects of standards and network externalities on technological and business competition.
- Research on the management of intellectual property.
- Futuristic studies assisting businesses to scan the technological environment for emerging technologies.

## **Scope**

The scope of the paper is to propose a research framework for the management of innovation suitable for a University of Technology in a developing country, enabling it to become both a producer and consumer of innovative entrepreneurial information packages and protocols. The literature review illuminates the evolutionary paradigm changes over time and is followed by the research design and methodology used to derive at a niche research area in the management of innovation. The major findings of the research are discussed, followed by a logical conclusion.

## Literature Review

According to Frederick and McIlroy (1999), in the new economy, technology and knowledge production on which it is based, have become an intrinsic part of the economy as well as the third factor of production in leading economies. As a result, it may be envisaged that education and research in institutions of higher education will need to support the complete technology development process, which also include the process of innovation. In this regard, it may be more appropriate to develop education and research policies that addresses the complete technology-innovation chain than merely the research-development chain, as the research-innovation chain involves taking ideas, turning them into technologies and taking these technologies, through research and development, out of the laboratory and proving them in real-world situations.

The above requires the demonstration of entrepreneurship by universities. As far back as 1983, Miller (1983) suggested that the level of entrepreneurship present in an organisation, and thus a university, could be treated as the extend of taking risk, introducing innovation and developing pro-activity. As such, innovation is seen as an important determinant of entrepreneurship or at least of the entrepreneurial orientation of the organisation (Covin & Slevin, 1989; Lumpkin & Dess, 1996; Zahra & Covin, 1995).

However, the innovation paradigm, as a component of entrepreneurship, changed and evolved over time. Park and Kim (2006) identified four principle generations of Research and Development (R&D) systems as it relates to time:

- 1) The period 1900 – 1960: During this period little attention was given to the economic management of R&D. However, a lot of freedom was given to researchers in science-based laboratories to determine their own research focus and methodologies.
- 2) The period 1970's – 1980's: This period is characterized by a scientific and microscopic management approach to R&D.
- 3) The period 1990 – 2000: This period is delineated by a strategic and holistic approach to R&D.
- 4) The period 2000 - : In the current period a new R&D system is starting to emerge in which the primary objective is to identify the latent needs of prospective customers and to secure the technical feasibility and marketability in the very early stages of innovation. Thus, the current R&D system magnifies the role of information technology and emphasizes the platform and architecture of the whole system. In this regard, knowledge management becomes simultaneously the driving force and essential building block for the R&D system. It is therefore not surprising to find that in this system's approach, the customer is not seen as the crucial asset, but rather the knowledge. In this view the R&D process is seen as a knowledge management process that transforms information on technological advancements and market demands into knowledge which can be used for developing new product concepts and process designs.

Thus, innovation according to Park and Kim (2006) has moved from unfocussed innovation approaches to a scientific reductionistic approach to a strategic and holistic approach to the ability to identify the latent needs of customers and the technological feasibility of an innovation. The latter requires a strong platform founded on information technology. This perspective capsule and expand on the views of Sundbo (1995), whom identified a technology-driven innovation paradigm focusing on the technician as innovation agent, the

technological development paradigm which is an important determinant for innovation as well as the strategic paradigm which encompasses a market-and organization oriented perspective on innovation.

### **Assumptions**

This paper is based on the following assumptions:

- The management of innovation at the university is enhanced if it possesses up-to-date knowledge capabilities, resources and routines that will support the identification of latent consumer needs and technological developments;
- Management of innovation will improve if staff and student's entrepreneurial and management capabilities are maintained and grown in a focused and systemized manner; and
- The capacity to absorb research data will increase if the data relates to applicable knowledge in syllabi and to key entrepreneurial challenges in the local and regional environment.

### **Research Methodology**

The research methodology followed was conducted in two phases and is described below.

#### ***Phase 1: Development of a Research Framework for Entrepreneurship and Innovation***

The development of a research framework for entrepreneurship and innovation has been derived from a focus area approach. This approach was grounded in the belief that a focus area could become a centre of research excellence with a strong applied character. Through the utilization of expertise and the experience of various stakeholders ranging from government to science councils and industry, priorities and needs were identified that could form the base for the development of Research and Innovation (R&I) activities at the institution. This approach was important in the belief that R&I need to be more focussed on the applied and strategic areas, including product development and process-related work. In all of this, the transfer of expertise, the transfer and diffusion of technology and the successful demonstration and implementation of results forms an integral part of the focus area approach followed. The focus area approach thus provides the framework that guides the research activities of the group, and the individual. Within a specific focus area disciplinary, interdisciplinary and trans-disciplinary research is encouraged.

With regard to the entrepreneurship and innovation focus area development, an interpretive epistemology research design approach was followed in the belief that entrepreneurship and innovation is a socially constructed concept and seeks its articulation through human sense making on the part of academic researchers. The first objective was to determine and interpret the intent of the National Research Foundation (NRF) with regard to reforms and expectations in Science and Technology research and the Humanities. Researchers from all Universities in South Africa contributed to this debate by presenting papers at provincial conferences and afterwards debating the issues for a month through the Internet under the guidance of theme leaders. Based upon these inputs a broad National Framework for Research and Innovation in South Africa was developed.

The second objective was to encourage different Academic Faculties to develop specific research focus area in which each could develop a specific strengths and expertise as well as the correct mixture of research type. Therefore, the second objective was to obtain clarification on what entrepreneurial and innovation research was already conducted at the university in the realisation that horizontal links or interactions between research institutions in the various faculties hardly existed. The results obtained indicated great variety and lack in research focus, research methodology and were sporadic in nature. It furthermore revealed that research conducted was aimed more at solving specific problems with limited financial resources and that research efforts were closely linked to the particular interests of a specific researcher. The need was thus established to create a research structure and focus that could accommodate the research interests and needs of the particular researchers, support the national research needs of the country, have long term scientific value and that could attract more research and innovation funds from the NRF, industry and other donor organizations nationally and internationally.

A workshop was organised in which the current status of research and innovation in entrepreneurship were explained to researchers. Under the leadership of a workshop facilitator, core ideas were developed that were aimed at guiding the new appointed research focus- and niche-area leaders to develop an unique, comprehensive but focused entrepreneurial and innovation research and development initiative for the University.

Based upon the guiding principles provided, a five-round Delphi technique was used in which 32 academics from three academic faculties representing 11 departments and six centres of excellence, participated. Four advisors from the Research and Development Office provided guidance and advice regarding the alignment of ideas with that of the National Research Foundation's priorities and specifications. Data was consolidated and interpreted by the research focus area leader. Representativeness of responses was sought based upon the plausibility and the similarity of the logical reasoning of participants. Data was then classified into three principle research niche areas: business clustering, business development and management of innovation. Basic content for each research niche area was created and refined under the leadership of each niche area leader. A research focus area document was compiled, submitted for approval, firstly at Faculty Research Committee (FRC) level and then for final approval by the Central Research Committee (CRC) of the University.

### ***Phase 2: Development of the Research Niche Area on the Management of Innovation***

The purpose of the second phase was to clarify the content of each niche area to a critical mass of people interested to do research under a central theme. Whilst the titles of each niche area were decided upon, a central theme that could act as guiding principle was required in order to create knowledge excellence in each niche area. This was done in the realization that research excellence would largely depend on the interrelatedness of the research, quality of research conducted, alignment of research topics, quality of researchers and support that could be mobilized for the research niche area.

The process started with a briefing in which the aim and objectives of focused area research was again explained to the 22 participants from various departments attending the workshop. This was followed by an academic input in which the focus area: Entrepreneurship and Innovation were explained and elaborated on. The UNESCO Chair in Technological Entrepreneurship then provided a perspective on the Management of Innovation. These three

inputs served as point of departure for the development of the niche area on the management of innovation. The 22 participants were then divided into three groups with the task of:

- Formulating a central theme and research domain for the niche area;
- Defining nominal definitions for key concepts identified;
- Offering a motivation and a rationale for the central theme;
- Indicating the unique features of the niche area for the university; and
- Specifying the specific aims and objectives of the niche area.

This phase was completed after utilization of a three-round Delphi technique in which feedback was provided to the niche area leader responsible for consolidating the information and ensuring final approval from firstly the Central Research and Innovation Committee of Tshwane University of Technology and secondly from the National Research Foundation (NRF) of South Africa.

## **Findings**

### ***Defining the Niche Area***

The principle aim of this research niche area is to develop specialised knowledge management systems and information packages for the Management of Innovation in terms of specific knowledge management activities as well as knowledge management functions that needs to be performed in order to support and facilitate entrepreneurship and innovation in the SADC business context.

### ***Nominal Definitions of Key Concepts***

*Knowledge Management Activities* relates to all activities needed to facilitate the ability to transform information based upon technological advancements and market demands into knowledge which can be used for developing new product concepts and process designs.

*Knowledge Management Functions* relates to those functions supporting the execution of knowledge management activities by providing specific and practical technologies or tools to the researchers.

The *SADC* refers to the 14 member states of the Southern African Developing Community and include Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

### ***Rationale and Motivation***

The Management of Innovation niche area intends to transfer entrepreneurship and innovation research from the laboratory or research phase to the intellectual property right phase and through to the marketplace in collaboration and in partnership with industry and other relevant stakeholders. The intention of the research phase is to locate the principle responsibility of the research up to the prototype phase within the higher education environment, after which the commercialisation of the prototypes and protocols will gradually shift to industry. Following this approach scientists and researchers and Tshwane University of Technology, as creators of Intellectual Property information prototypes and

protocols, will gain direct financial benefit from the successful transfer of their inventions to the marketplace.

### ***Unique and Outstanding Features of the Niche Area***

This research niche area will generate aggregate data and information packages and prototypes that could be used by all potential beneficiaries operating in the field of innovation. The research results will also stimulate the transfer of knowledge and cross-pollination of regional development through the transfer of information and knowledge to individual business domains. The innovation information packages and prototypes provided, will not duplicate information of other institutions of higher education, but will rather complement the current body of knowledge and create new opportunities on which to build new innovations. Research in this niche area takes as departure point that information and knowledge is the principle driving force that underpins innovation, stimulates the development of new technologies, and creates the ability to identify latent consumer needs and creates the possibility to determine ex ante the technical feasibility of an innovation.

The Entrepreneurship and Innovation Barometer glossy publication envisaged will provide information on an annual basis whether Southern Africa is improving or deteriorating regarding entrepreneurship and innovation.

### ***Goals***

The specific goals to pursue include:

- The development and publication of a glossy journal that is based upon similar lines as the European Innovation Scoreboard will serve as an innovation barometer for the SADC. The barometer will be designed based upon the development of an index composed of two main groups namely Innovation Input and Innovation Output. Innovation drivers, knowledge creation and innovation entrepreneurship indicator sets will capture the development of Innovation Input indicators. The Innovation Output indicators will be captured using intellectual property indicator sets;
- The development of Innovation Business Case Studies that culminated in high-growth business start-ups in the SADC;
- To capacitate and support the innovation of products and processes by creating and integrating utility information packages and prototypes ready for registration as intellectual property for commercialisation purposes and for application and usage by entrepreneurs, innovators and institutions of higher education in the SADC;
- Exploration and description of a common knowledge framework for innovation creation taking into account the specificity and particularities of the SADC region in relation to other regions of the world;
- Investigating the process of managing the sustainable application and utilisation of novice technology in an optimal manner; and
- Making innovations in the areas of business processes, manufacturing, materials composition, information software, written work, design, imaging and knowledge systems useful in practice through the development of skills upliftments and entrepreneurial programmes and contextualising the unique innovation driving forces and constraints in the SADC regional framework.

### ***Specific Research Objectives include:***

- Provision of community lay knowledge and scientific knowledge information packages and prototypes that will facilitate the development and commercialisation of truly Southern African products and services;
- The development of comprehensive entrepreneurship and innovation indicators that will facilitate the development of entrepreneurial and innovation strategies for Southern Africa;
- The enhancement of the international competitiveness of Southern Africa through design and manufacturing, protection of intellectual property rights and the establishment of an innovative culture in the region;
- Emphasis will be given to the understanding of innovative technology and the applications thereof;
- Technological change and the effects thereof on the business environment;
- Identifying characteristics of innovative organisations in Southern Africa;
- Describing patterns of technological change. This area of research will typically investigate questions like how does technology evolve, what are the dominant design forms and what are the dynamics of innovation;
- Research on the management of technological transitions which include aspects like disruptive technologies, and the reconfiguration of existing technologies as well as the impact thereof on business success;
- The effects of standards and network externalities on technological and business competition;
- Research on the management of intellectual property; and
- Futuristic studies assisting businesses to scan the technological environment for emerging technologies.

### ***Scope and Future Direction of Research Niche Area***

To ensure the sustainability, growth and relevance of this niche area within the SADC region the following initiatives will be pursued:

- Development of local and international strategic partnerships and alliances through amongst others UNESCO, the African Union (AU) and the European Union (EU).
- Research results will be integrated into the local curricula of Tshwane University of Technology, enabling the application of knowledge in a specific region without losing global relevance.
- Quick-building of specific innovative knowledge through the pooling of an interdisciplinary yet focussed research approach as well as through strong coalition forming between indigenous knowledge systems and scientific knowledge systems.
- Synergy forming in thinking approaches amongst different stakeholders within the SADC region.
- The development of innovation information packages and prototypes tailored to the SADC context to address the needs of the SADC and suitable to the resource capabilities of the region.

### ***Strategy***

In order to take the research niche area forward it was decided that strategic partnerships and

alliances should be formed with amongst others UNESCO, AU and EU. A multilateral UNESCO application (Tshwane University of Technology of South Africa, Saint Thomas University of Mozambique and the University of Trento, Italy) has already been submitted to support local development in Southern Africa. The Management of Innovation niche area would benefit from this application. An Erasmus Mundus grant was also secured for the period 2006 – 2009 to research innovative processes whereby SMME's could be better organised to support growth and development. A SANPAD application was also submitted to investigate innovative ways for the greening of grape product chains to the EU.

To ensure the sustainability of the niche area a goal was set that the niche area should be supported by at least 15 fulltime post-graduate students from different academic disciplines and the in-sourcing of experts on a part-time basis to provide a strong research source for this focussed research approach. Course supervisors from the different involved faculties were therefore approached to ensure that students are sensitised towards the management of innovation in curricula and that possible research topics in this area should be proposed to students in order to activate this particular research domain. This process would be facilitated by the Centre for Entrepreneurship which would act as a virtual academic department across faculties.

In order to ensure participation, two workshops will be organised with the emphasis on defining and clarifying the content of the niche area: Management of Innovation to participating members. Further, the Centre for Entrepreneurship will host the fourth International Conference on Entrepreneurship and Innovation during October 2006. At this event participants will get the opportunity to present their research results. A post-graduate session will also be organised during this event.

### ***Mentoring, Supervision and Training***

In order to ensure the scientific integrity of the research, the Faculty of Management Sciences will utilise and in-source expertise from EU universities to provide insights with regard to general research trends and methodologies in the field of the management of innovation. In 2006 Prof. B. Dallago from the University of Trento will specifically assist to develop a three year operational research agenda in this field in order to ensure that comparable and aligned research is conducted. Through the UNESCO Chair in Technological Entrepreneurship, a coordinating research network for SADC researchers will be established to finalise, coordinate and supervise research conducted in the field on Management of Innovation.

### ***Constraints Imposed on Researchers***

To foster specialized expertise in this field, the following constraints have been imposed on TUT researchers operating in this field:

- The research outputs should guide the development of information packages, protocols or prototypes that could be used by entrepreneurs, educators and other stakeholders for educational purposes and the development of incubators for commercialization purposes of the innovative idea(s);
- The departure point of the Management of Innovation should be based upon a venture-oriented approach by stimulating researchers' action rationality and innovative ideas through business generation models and activities;

- The research should be embedded in the entrepreneurship educational and research philosophy, ideology and value system of TUT and in which institutional infrastructure will be created to enhance the competitive positioning in the latent entrepreneurial student market; and
- The research in this niche area may occur on three levels. First-level research will refer to “up-stream” research which is primarily curiosity driven, either experimental or theoretical in approach, aiming at advancing the frontiers of Management of Innovation knowledge. The second level known as “mid-stream” research will refer to project driven research linked to a development purpose, whilst third-level research, known as “down-stream” research will focus on research projects committed to further commercialisation processes.

## Conclusion

It is envisaged that the approval of the Management of Innovation niche area will lead to an increase in project-based research and innovation (R&I) and a shift in the relationship between researchers and funders, which will require corporate support of the university as staff will require more guidance on available opportunities and how to apply for them, to best effect and adhere to complex contractual arrangements.

The successful implementation of the research niche area on the Management of Innovation is dependent not only on support mechanisms provided by the University of Technology, but also the motivation of staff and students to actively engage in and focus their research efforts on the specified niche area, as well as the infrastructure created to develop information packages and protocols.

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