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The Essence of Academic Entrepreneurship: Application to Chinhoyi University of Technology Thrust

Nicholas Zivengwa Kakava
School of Business Sciences & Entrepreneurship
Chinhoyi University of Technology, P. bag 7724, Chinhoyi, Zimbabwe
*E-mail: nzkakava@gmail.com

Abstract
This paper seeks to analyse the essence of Academic entrepreneurship (AE) as the Entrepreneurial Model that can guide the thrust and developmental strategic relevance of a University of Technology (UT) in Zimbabwe, related universities in the region and world wide. It is noted that there has been a rapid increase in technology based economic development initiatives, focused mainly on stimulating technological entrepreneurship in universities via patenting, licensing, start-up creation, and university–industry partnerships which is the essence of AE. The article begins with a background analysis of the mandate of Chinhoyi University of Technology (CUT) as enshrined in the CUT Act (Chapter 25:23) as an example of a UT. A thorough literature review is done and a survey was carried out of academic staff and senior administrative staff to check their knowledge and supporting activities towards achieving the university mandate. Major findings were that while members of the institution could recall off hand the mandate of the institution and sharing the same meaning of such key concepts as innovation, they did not share the same meaning of such key terms as technology and wealthy creation. It was also established that the differences in the interpretation of key concepts lead to different activities on the ground. A process approach to academic entrepreneurship was recommended. Further research and testing of the model was also recommended based on the discussion.
Keywords: Academic Entrepreneurship, University of Technology, Technology, Research

1.0. Introduction

The Chinhoyi University of Technology (CUT) Act (Chapter 25:23) section 4 sub-section 1 paragraph (b); states that one of the objectives of setting the university is, "The development and practice of design and technology" and paragraph (c); says "The teaching and application of sciences, art and design" while paragraph (f) of the same section reads; "The nurturing of entrepreneurship, innovation and creativity on the part of all the members of the university." Focusing on these objectives the University designed its motto as, 'Technology, Innovation and Wealthy'. At the end of 2012, the institution celebrated its tenth anniversary and one may want to check how far the institution has achieved its mission. Academics from different disciplines may have different meanings attached to the three pillars of the purpose of the institution, that is technology, innovation and wealthy. These can be discussed one after another according to different sources.

1.1. Technology

Rebentisch and Ferretti (1995) consider technology as any form, material or social, into which knowledge has been embodied; to include hardware, software, products, rules, procedures, organisational structure, and know-how or technical expertise. Bush cited in McOmber (1999) held that Technology is a form of human cultural activity that applies the principles of science and mechanics to the solution of problems. It includes the resources, tools, processes, personnel, and systems developed to perform tasks and create immediate particular, and personal and/or competitive advantages in a given ecological, economic, and social context. McOmber (1999) delineate three meanings of technology assumed in popular and academic discourse: technology-as-instrumentality, technology-as-industrialization, and technology-as-novelty. All meanings above make sense; a UT should apply scientific knowledge in different disciplines like business, agriculture, biotechnology, food science, etc, to solve practical Zimbabwean life problems which include industrial, commercial and domestic challenges. In addition, machinery and equipment should be developed to facilitate production and make day to day life more convenient.

1.2. Innovation

According to Schumpeter (1923) innovation is reflected in novel outputs: a new good or a new quality of a good; a new method of production; a new market; a new source of supply; or a new organizational structure, which can be summarized as 'doing things differently'. Innovation is also viewed as: production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome. **(**Crossan and Apaydin 2010) While creativity focuses on the generation of new ideas, innovation deals with the exploitation of those new ideas to solve practical human life problems. (Wills 2010). Thus scientific knowledge has to be exploited to solve social challenges by a UT. In the

context of multi-stage process model of AE that identifies the key actors, activities, and success drivers associated with each stage of the innovation commercialization process. Innovation is defined as ‘‘any invention, new technology, idea, product, or process that has been discovered through university research that has the potential to be put to commercial use’’ Wood (2009). According to (Wood 2011) the basis of such a definition is the central idea that university research leads to new innovations, and some of those innovations may have commercial applications that lead to entrepreneurial activity.

1.3. Wealth

Wealth is defined as total assets (deposits, life insurance, superannuation, trust funds, equity, housing, collectibles, businesses and vehicles) less total liabilities. (Doiron and Guttmann 2009) The institution should create its own valuable possessions or money through its activities; in short it has to operate on commercial basis and not simply on service provision. The wealth creation thrust in the case of CUT is denoted by the emphasis of the institution on entrepreneurship. In other words as an academic institution, the process of training candidates should have the issue of technology, innovation and wealth creation imbedded in it. Candidates should be seen creating wealth through technological innovation during and after their training. This gives room for academic entrepreneurship to be adopted as an approach to the thrust of a UT. Lee and Wong (2004) concluded that the security anchor negatively impacted on entrepreneurial intentions of research scientists and engineers, while the managerial anchor had a positive impact and on the other hand mixed results were found for the technical and creativity anchors, while no impact was found for the autonomy anchor.

2.0. Review of Literature.

It is prudent at this point to review literature of AE and related concepts.

2.1. Academic Entrepreneurship

Wood (2011) describes academic entrepreneurship as the efforts and activities that universities and their industry partners undertake in hopes of commercializing the outcomes of faculty research. Right away the definition touches all the three aspects: technology, innovation and wealth. Without commercialization, technological innovation alone may not create wealth. In recent years, there has been a rapid increase in technology based economic development initiatives, focused mainly on stimulating technological entrepreneurship in universities via patenting, licensing, start-up creation, and university–industry partnerships and such activity is “academic entrepreneurship,” since the objective of such efforts is commercialization of innovations developed by academic scientists (Grimaldi et al 2011). Rothaermel et al (2007) view the academic entrepreneurial activities as University Entrepreneurship and put it in sub areas to include entrepreneurial research university; productivity of technology transfer offices; new firm creation, and environmental context including networks of innovation. Phan and Siegel (2006) view university technology transfer as mechanisms which include licensing agreements between the university and private firms, science parks, incubators, and university-based startups. Assertions are further made that implementation of such mechanisms leads universities who choose to stress, based on their technology transfer “strategy.” For example, institutions that emphasize the entrepreneurial dimension of technology transfer must address skill deficiencies in technology transfer offices, reward systems that are inconsistent with enhanced entrepreneurial activity and the lack of training for faculty members, post-docs, and graduate students in starting new ventures or interacting with entrepreneurs (Phan and Siegal 2006). Powers and McDougall (2004) indicate that universities have been rapidly escalating their involvement in technology transfer, that is, the process of transforming university research into marketable products, stimulated by changed external expectations for economic development and internal pressures to generate new sources of income.In recent years, universities have shown a growing enthusiasm for the more risky forms of entrepreneurial activity, namely, forming start-up companies around a university-developed technology or licensing to small private firms rather than through the traditional commercialization route with large public companies. (Powers and McDougall 2004) According to Wood (2011) in the United States, the growth of academic entrepreneurship can be traced back to the federal government’s passage of the Bayh-Dole Act in 1980 which provided a mechanism by which the intellectual property generated under federal research grants could become the property of the university, rather than the funding agency sponsoring the research and the argument being that by allowing universities to secure intellectual property protection (e.g., patents), outside partners would be enticed to pursue research outputs because their investments would be protected from imitation.

Kenney and Patton (2011) discovered some suggestive evidence that inventor ownership universities can be more efficient in generating spin-offs on both per faculty and per R&D dollar expended perspective, hence suggest that governments seeking to encourage university invention commercialization and entrepreneurship should experiment with an inventor ownership system. Haeussler and Colyvas (2011) assert that characteristics reflecting professional security, advantage and productivity are strong predictors for a greater breadth of participation in academic entrepreneurship and for such academics, science and commerce go hand in hand, as they are best poised to straddle the boundary between industry and academy. Hindle and Yencken (2004) hold

that the accumulated tacit knowledge and culture of the entrepreneur are the resources essential to create wealth from research commercialisation leading to technological innovation and the creation of New Technology Based Firms (NTBFs).

Rasmussen and Borch (2010) proposed a set of three university capabilities that facilitate the venture-formation process and each capability is particularly important for specific phases in the venturing process, these include: creating new paths of action, balancing both academic and commercial interests, and lastly integrating new resources. Etzkowitz et al (2000) argue that universities around the world are increasingly shifting from their traditional primary role as educational providers and scientific knowledge creators to a more complex ''entrepreneurial'' university model that incorporates the additional role of the commercialization of knowledge and active contribution to the development of private enterprises in the local and regional economy. Wong et al (2007) indicate that increasing prominence has been given to the role of Singapore's universities in stimulating economic growth through industrially relevant research, technology commercialization, high-tech spin-offs, attracting foreign talent, and inculcating entrepreneurial mindsets. According to Markman et al (2005) University technology transfer offices (UTTOs) function as ''technology intermediaries'' as they facilitate the success of business incubators and technology parks in university settings which is often determined by how well technology is transferred from the labs to their start-up firms.

3.0. The Survey

The survey aimed at ascertaining the situation on the ground at CUT. The information sought related to whether the University staff: knew the mandate of the institution; shared the same meaning of the mandate; agreed on the activities staff and students should engage to fulfil the mandate; and lastly establish the gap and recommend a model for the University.

3.1. Methodology

The researcher adopted a survey approach and carried out personal interviews with 18 academic staff who were mostly deans and department chairpersons and 5 senior administrators who constituted a convenience sample. Qualitative data was gathered and the findings were as follows.

3.2. Findings

The survey revealed that 50% of the staff could restate the University mandate word for word, while the rest could partially state or simply outline their opinion which may however be related to the university mandate.

Staff had different meanings attached to the key terms guiding the university mandate, that is, technology, innovation and wealth. The term posing challenges was technology; no two people could share the same meaning of the term; across departments and schools.

Most staff members were not sure as to the actual activities to be concentrated on in order to fulfil the university mandate. The majority feel technology, innovation and wealth should be taught to students and it ends there. The majority felt that university activities should end at generating new knowledge and the issue of commercialisation should be left to industry so as not to overburden universities.

Members of staff feel that they have much support from government but not enough support from industry and commerce.

Infrastructure was cited as the major drawback for the institution to achieve its mandate since its inception; that is the lack of equipped workshops, laboratories and internet services.

Academic staff wanted to focus on areas which contribute to their promotion, that is teaching, research and community service and students were said to focus on activities that contribute to their passing.

While members feel that Technology Transfer Offices are needed at the institution, the majority were not sure as to how these operate with the current university structure.

3.3. Discussion

With the above findings, it is pertinent that a discussion be done in light of the knowledge gathered from the reviewed of literature.

Failure by members of a university of technology to show an accurate understanding of the term technology can be interpreted as a point of concern. If someone does not understand a concept it means that they can not apply it effectively. This may be attributed to the fact that for the past decade, there has not been significant initiatives of technological developments. This cuts across the university schools, since according to Rebentisch and Ferretti (1995) technology cover hardware, software, products, rules, procedures, organisational structure, and know-how or technical expertise. The old-age saying holds that a problem well defined is half solved, it seem prudent that members of the staff should agree as to what is meant by technology, so that they can have a coordinated and synchronised effort. There could be awareness of the guiding concept but lacking actual understanding as to what really has to be done. From the survey members are not in agreement as what really has to be done so that we can say the university is now focussing on technology, innovation and wealth. The majority are content with research, teaching and university service which end after appraisal and promotion. At a UT, research has to be

purpose driven, outputs should end up with some hardware, software, products, rules, procedures, organisational structure, and know-how or technical expertise. This leads to purpose driven teaching, which end up having candidates who can develop some hardware, software, products, rules, procedures, organisational structure, and know-how or technical expertise. The fact that staff are not in agreement as to what has to be done by a university of technology which has an entrepreneurial thrust may point to some deficiencies in the university structures. According to Phan and Siegel (2006) institutions that emphasize the entrepreneurial dimension of technology transfer must address skill deficiencies in technology transfer offices, reward systems that are inconsistent with enhanced entrepreneurial activity and the lack of training for faculty members, post-docs, and graduate students in starting new ventures or interacting with entrepreneurs. Furthermore, it is held that universities around the world are increasingly shifting from their traditional primary role as educational providers and scientific knowledge creators to a more complex ‘‘entrepreneurial’’ university model that incorporates the additional role of the commercialization of knowledge and active contribution to the development of private enterprises in the local and regional economy. (Etzkowitz et al 2000). This leads us to not only focus of addressing deficiencies in staff members but also to direct staff benefits, reward systems and promotional criteria towards not only research and educational qualifications but such achievements as patenting, licensing, start-up creation, and university–industry partnerships. This is also supported by Haeussler and Colyvas (2011) who hold that characteristics reflecting professional security, advantage and productivity are strong predictors for a greater breadth of participation in academic entrepreneurship and for such academics, science and commerce go hand in hand, as they are best poised to straddle the boundary between industry and academy. Thus misunderstandings between universities and industry should be settled as well as inter-school misunderstandings, especially commerce and engineering so as to have collaborative efforts to solve economic challenges. Researches and publications could be assessed against their relevance to solving current industrial and economic needs as well as the degree of commercialization feasibility. As indicated by Wong et al (2007) who stress that increasing prominence has been given to the role of Singapore’s universities in stimulating economic growth through industrially relevant research, technology commercialization, high-tech spin-offs, attracting foreign talent, and inculcating entrepreneurial mindsets. Within the structures of universities of technology are Technology Transfer Offices (TTOs) or Techno-parks which could be observed as lacking within CUT structures. Markman et al (2005) asserts that University technology transfer offices (UTTOs) function as ‘‘technology intermediaries’’ as they facilitate the success of business incubators and technology parks in university settings which is often determined by how well technology is transferred from the labs to their start-up firms. To this end, technology is useless if it is not transferred to industry and commerce.

4.0. Proposed Model

The motto of CUT is Technology, Innovation and Wealth, implemented through Research, Teaching and University Service. The paper holds that the thrust of the institution can best be followed by adopting academic entrepreneurship as the guiding principle. The basic definition 0f academic entrepreneurship being according to Wood (2011) the efforts and activities that universities and their industry partners undertake in hopes of commercializing the outcomes of faculty research. Put in further terms Grimaldi et al (2011) express it as technology based economic development initiatives, focused mainly on stimulating technological entrepreneurship in universities via patenting, licensing, start-up creation, and university–industry partnerships. Wood (2011) suggests an academic entrepreneurship multi-stage process model that identifies the key actors activities and success drivers associated with each stage of the innovation commercialization process. It consist of four stages: (1) Innovation disclosure and intellectual property protection stage; (2) Awareness and securing industry partnership stage; (3) Commercialisation mechanism selection stage; (4) Commercialisation stage. The model may not be very relevant to a fairly new university in a developing country in some economic crisis. We therefore suggest a process model that may apply to a developing country and new university. Phase 1: Proposal development; Phase 2: Proposal evaluation and approval; Phase 3: Research projects; Phase 4: Innovation; Phase 5: Patenting, licensing, start-up creation, University-Industry partnerships; Phase 6: Commercialisation; Phase 7: Continuous improvement Diagrammatical the model can be displayed as **Figure 1**.

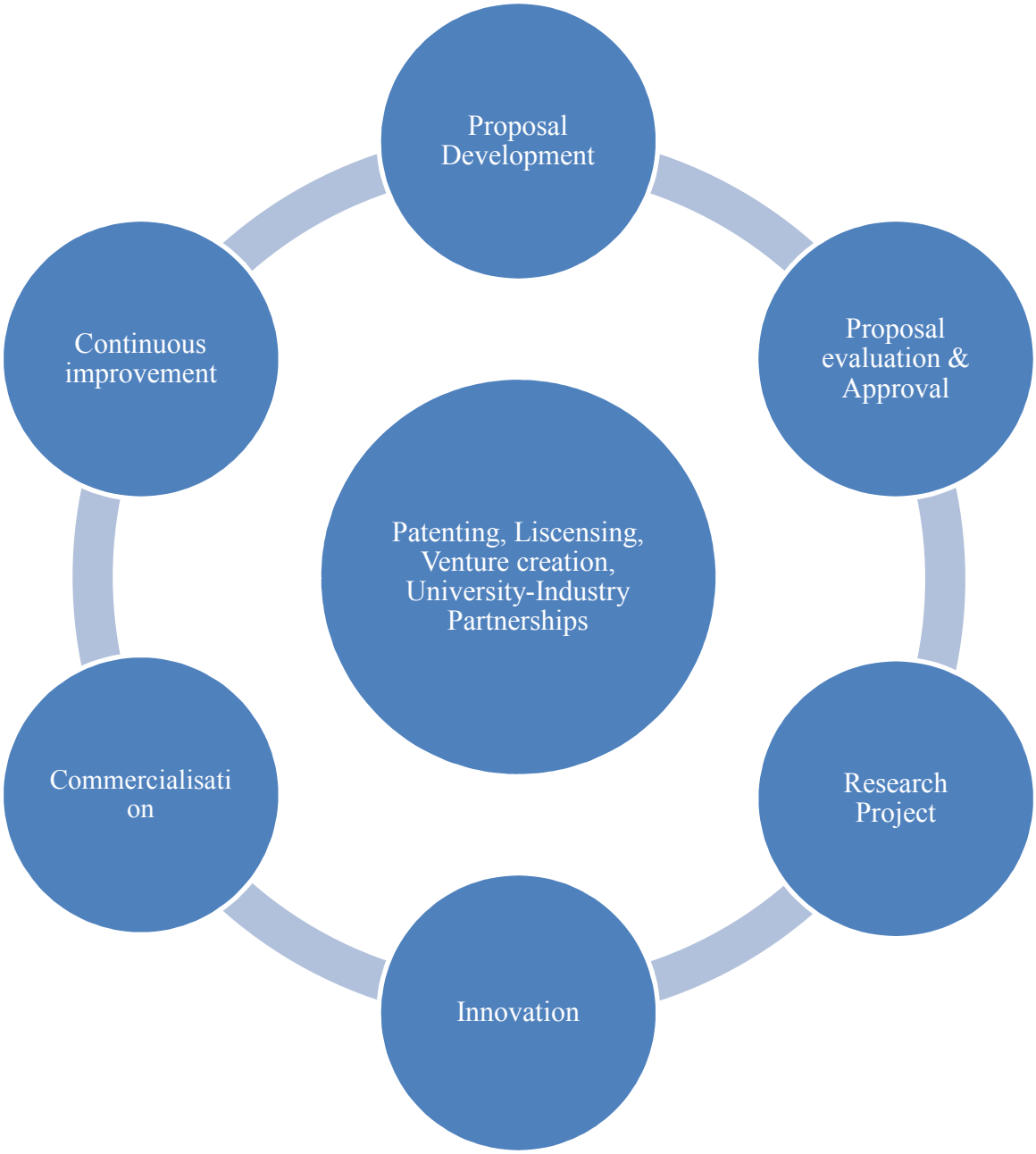

Figure 1: An Academic Entrepreneurship Model (Adapted by the Author)

Figure 1presents the seven phase academic entrepreneurship model with emphasis on the fifth phase which is placed at the centre as the core of the process. It is stressed that what ever activity is done, the result should be patenting, venture creation, licensing and/or university industry partnerships.

4.1. Phase 1: Proposal development

In this model, proposals fall into two main categories, research project proposals and developmental project proposals. Their structure and contents mainly depend on the organization funding the project. However, for the purpose of this model which ever type of proposal it has to be linked to the other type. In other words, a developmental project has some information gaps which are filled by a research project; and on the other hand a research project should have some practical industrial or commercial problem to solve and should be implemented. This is the essence of research and development (R&D), the proposals dove tail one another. Proposals are originated by either academics or industrialists or collaboratively by both in a partnership in order to solve specific pertinent challenges. The question that remains is, "which problem do you want to solve? And is it pertinent or of priority given the current situation?"

4.2. Phase 2: Proposal evaluation and approval

While this phase begins with the last questions posed on phase one, it goes further to the research board of the funding organization which will begin by asking the same questions. The board also has to go further to probe into research, development and commercialization feasibility and apart from relying on a written proposal, rigorous vivas may be helpful at this stage. Objectivity is important so that proposals with the highest degree of commercialization are allowed through. If there will be nothing to commercialise its pointless to sponsor such a project since it is a misdirection of resources – thus it is not part of academic entrepreneurship. Board members could be experts in different areas who may have some achievements in research as well as the commercialization of research outputs.

4.3. Phase 3: Research projects

This stage represents the actual gathering of any information gaps and generation of new knowledge. It is at this phase where researchers disseminate the new knowledge through publications, workshops, conferences or any other forum.

4.4. Phase 4: Innovation

The stage represents the actual development of an innovation in the form of a product, procedure etc.

4.5. Phase 5: Patenting, licensing, Venture creation, University-industry partnerships

What ever is developed requires some legal protection so that the developers can reap their benefits.

4.6. Phase 6: Commercialisation

This involves the actual operation in industry and commerce at a large scale. The choice is between having a wholly university owned operation - spin-off or licensing a separate organization.

4.7. Phase 7: Continuous improvement

Whether it is a licensed operation or a spin-off there is need to continuously improve existing products and operations, which is a fertile ground for further proposals.

5.0. Conclusion

The paper has analysed the situation on the ground at CUT as a case study of a UT; related what is on the ground to literature of academic entrepreneurship and designed a recommended model for a UT like CUT and other institutions in developing economies. It however, has to be noted that the model has not been tested in practice. It is recommended the testing of the model be taken as need for further research.

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