

# A PROPOSAL FOR INNOVATION AND TECHNOLOGY TRANSFER AT CUT

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## Abstract

Vision 2020 represents the preferred developmental way forward for the Central University of Technology, Free State (CUT). It defines the intention of greatly increasing the involvement of its staff and students in innovation and technology transfer activities, resulting in the CUT having a greater effect on the socio-economic development of the region.

The article describes educational processes that would prepare graduates for such activities, as well as financial and other support measures to assist (prospective) entrepreneurs to convert research outputs into commercially viable products. The potential value to such individuals of participating in formal innovation and incubation activities is also described.

**Keywords:** Innovation, innovation process, incubation, business planning.

## 1. INTRODUCTION

CUT has accepted, through its different governance and management structures, the institutionally defined Vision 2020 as the guiding principle for its development in the foreseeable future. According to this document CUT should by 2020 be a university which focuses on creating social and technical innovations with a positive impact on socio-economic development in the region.

This article describes the current situation with respect to innovation and technology transfer at CUT and proposes a number of (financial) incentives that may increase the university's performance in meeting the criteria set in Vision 2020.

In order to convert newly developed knowledge – irrespective of its source - into some commercial success it needs to be converted into socio-economic solutions. Obviously the extent of commercial success derived is determined by the developers' ability to facilitate this conversion as well as the novelty and value addition of the potential product or process, without trying to change the “habits of potential users”. The overwhelming majority of technological inventions are of an incremental nature, rather than advancing the technological frontier, last mentioned of which require extensive research and development.

The principles of preparing staff and students for innovation in a technological academic environment can be considered as two complementary processes, viz.:

- Development of technologically creative skills, and
- Development of core skills for innovation and technology transfer.

## **2. DEVELOPMENT OF TECHNOLOGICALLY CREATIVE SKILLS**

Students acquire specialized technical skills whilst undergoing education and training in a higher education institution. This enables the studying, understanding and eventually development of relatively complicated practices and processes. Such knowledge acquisition takes place in the classroom, laboratory, library and during interaction with lecturers and fellow students. The ability to interact creatively within any discipline normally develops over a period of time during advanced level studies and, after completion of studies, in an industrial environment.

Graduating students normally find employment at an enterprise in the field of his or her studies. There formal enterprise-based learning takes place through the attendance of internal specialized training courses.

Employees of larger enterprises are usually also expected to attend a variety of external specialised short courses. At these they are exposed to different forms of specialized technical and non-technical training.

Through such activities, as well as exposure to normal routine operational activities in industry, the technical – largely theoretical - knowledge that students acquire during their studies are enhanced and developed. However, it is common for some of these individuals to show more technical creativity. They would normally excel at innovative technological development tasks – and would soon become increasingly involved in such – usually on the insistence of their employers. The intensity and combination of formal and informal training individuals are exposed to, as well as their individual creative aptitude, significantly influence the probable success that they would have in innovative activities.

## **3. DEVELOPMENT OF CORE SKILLS FOR INNOVATION AND TECHNOLOGY TRANSFER**

### **3.1 Innovative skills (creative capabilities)**

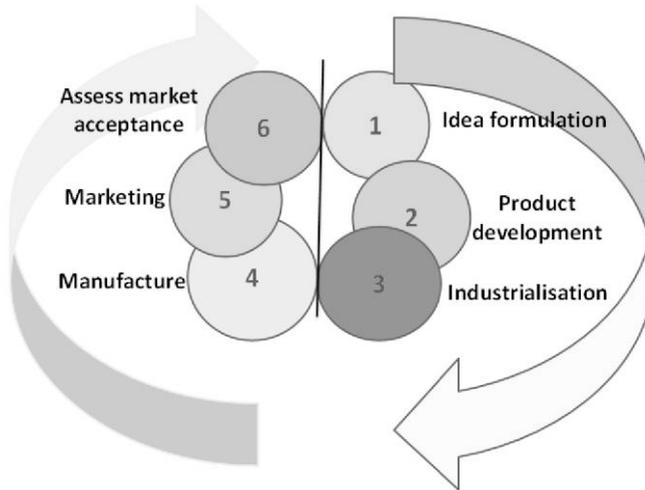
These skills are critical for the creation of a new design, process or service, as well as the ability to manage such a development process. They represent a particular link between the technical capability to develop a new system, and the characteristics of the technologies that are available to produce it. Without this link the ability of any individual to successfully develop a new device is seriously curtailed.

### 3.2 Operational skills

This typically comprises production, maintenance and operational skills, required for the successful production and maintenance of goods, processes and services. The innovation process typically prescribes a specified sequence of related steps. This is described in the following section.

## 4. THE INNOVATION PROCESS

The innovation process can be shown schematically as follows:



**Figure 1: Schematic of the Innovation Process.**

As indicated above, innovation seldom represents a fundamental technological breakthrough. Rather, it is an incremental step on a continuous stream of related products. Hence, successful innovation necessitates a good understanding of the current status of available products and the deficiencies of such. Questions concerning the relevant manufacturing processes, potential market value and its acceptability to its users are to be studied. Any further development should add value – where value is the ratio of the resultant benefit to its cost - to the present range of products. Only now should any real work on the development of a new idea begin – especially if it will supplement any existing product or process.

At this stage virtually all effort should go towards researching the technical solution of the problem. In this manner the idea is expanded upon and concretised, whilst being further researched in an iterative process and a comprehensive, optimal solution developed.

The solution that is arrived at in this manner, will be industrialized by considering its manufacturability with the available, or at least realistically available, manufacturing infrastructure. It is important to note that careful consideration should be given to the repeatability of the operational characteristics of the proposed design since any changes once the manufacturing sequence has been finalized is extremely expensive and may sink the complete project. Hence, the importance of adhering to multi-phased iterative principles during the developmental process.

Once the final solution to the problem has been arrived at and before it becomes part of the public domain, steps might be taken to protect any intellectual property developed in this process. This may take the form of patenting - preliminary, final and international patents may be taken out, depending on the estimated value of the development – or design registration.

At this time the problem has been solved comprehensively and almost all attention should be shifted to the commercialisation of the product. This might include the final stages of industrialization, manufacture and marketing of the product or process. Care should be taken to assess the acceptance of the product by the market and users. This should be continued for the duration of distribution of the product.

At Central University of Technology (CUT) an Innovation and Incubation Programme (IIP) is proposed to support researchers with financing the development of new products and processes once the viability of the new product or process has been proven through formal research. Researchers could therefore apply for support from the IIP for final applied research and industrialization required to enable formal commercialization of the new product, process or service.

## **5. PROPOSED CREATION OF AN INNOVATION AND INCUBATION PROGRAMME**

### **5.1 Introduction**

The management of the Central University of Technology, Free State have decided to commercialise research outputs as far as possible through directed innovation actions and to facilitate the creation of new knowledge-based micro enterprises based, where possible, on such outputs. This should serve to maximise the transfer of knowledge and technology between the academe and business – and indirectly to the community - in an effort to support and develop the local economy.

However, as a result of various limiting factors – one of which is a lack of financial resources – the innovation process often does not occur naturally, but instead requires some definite action to put it into motion.

This proposal describes a possible way in which such efforts by enterprising members of staff of students can be supported financially to enable the successful commercialisation of research outputs.

It is common knowledge that the South African Government have launched several incentive programmes to assist entrepreneurs in developing new innovations – in particular through the provision of financial assistance. Examples of these are the SPII system, Innovation Fund, THRIP, Technology Stations programme, and others. However, there is still a major limitation in the accessibility of such funds – largely through the tedious application and pay-out procedures. Consequently it is proposed that CUT institute a special fund for this purpose. This fund should be accessible to staff and students and grants should be made available, according to set criteria, at very short notice.

## **5.2 Innovation vs Incubation**

One of the main problems that any new enterprise experience is a lack of physical facilities and equipment. This often result in the eventual demise of the enterprise before any innovation process has been completed – causing the non-emergence of the enterprise from the so-called valley of death. This term refers to the large expense and long period of time usually required to fully develop a new innovation. This is often a huge drain on the new entrepreneur's financial resources and often leads to the eventual forced termination of all efforts to complete such a project.

**5.2.1 Primary research (Invention):** A well-defined problem is investigated theoretically as well as practically and possible solutions are sought. Research outputs that are especially suited for commercialisation are often identified during this phase. This might include a product, process, software or even a service<sup>1</sup> and no field of study is excluded from this kind of activity.

**5.2.2 Innovation:** The possible commercial development of the solutions referred to above is investigated and cultivated further. Practical designs in terms of form and function are done and the repeatability and ruggedness of the operational characteristics of a product as proposed determined. A relatively small number of units are usually produced and its performance assessed.

The practical feasibility and financial viability of the activity is determined beyond reasonable doubt during this phase.

During phases 5.2.1 and 5.2.2 described above, intellectual property is often generated and possible ways of protecting it should be considered and implemented. This may include actions such as patenting and/or design registration. In those cases where intellectual property is generated by South African public funded entities such as universities, a formal system of reporting, as specified in Act 51 of 2008, has to be adhered to.

<sup>1</sup>In order to simplify the text all of these are referred to as "products" in the remainder of the document.

### 5.3 Business Planning

A preliminary business plan is essential already in the early development phase of an invention if it is to be commercialised, although a lot of the basic information is preliminary and may be adapted in time. The plan must be reviewed when more detailed facts are available for instance of the manufacturing price and competitor's products. The preliminary business plan also serves as a tool to determine, which form of exploitation is to be used. Also potential financiers, including the CUT IIP, Venture Capital companies and banks, require a business plan. The basic purpose of a business plan is to introduce the facts of the company and the innovative product as well as plans related to manufacturing and marketing. It is essential to show costs, revenues, financing and profits, as well as the capabilities of the individual/team working on the commercialization of the innovation, during the early life span of the project, for instance for the first 5–7 years.

The main items of a typical business plan include:

- a. Background and summary of the activities;
- b. Product development plan;
- c. Production plan;
- d. Potential markets and its possible development;
- e. Marketing plan;
- f. Goals, strategy;
- g. Owners, management and organization;
- h. Evaluation of risks;
- i. Financial plans, budgets and administration, and
- j. Funding proposal.

It is also important to facilitate, by means of the business plan, an evaluation of the commercial potential and risks of the invention. It may include:

- Novelty, inventiveness, patentability;
- Level of technology involved;
- Operational issues;
- Business potential and environment; and
- Commitment and particular, relevant skills of the inventor, entrepreneur and management.

**5.4 Incubation:** This activity refers to the commercial refinement of a product or process. The final prototypes are prepared and evaluated, while the manufacturing capability is planned and developed. Moderate levels of production – especially of samples for market assessment purposes - of the final product commence. The manufacturing and marketing process might be refined and optimised during this phase. Often the product is also further refined at this stage – often to simplify the manufacturing, maintenance and/or marketing processes.

This should not be confused with incubation that takes place in a formal incubator, but rather refers to a particular developmental process followed in terms of refining the design of a new product or process – even though it might well be executed in an incubator.

**5.5 Full commercialisation:** The final product is manufactured and marketed as economically as possible. In extreme cases further refinement of the product or process is still possible at this stage. However, this is often discouraged since, the later in the process any changes to the product is made, the more expensive it becomes with respect to the gain made in the characteristics of the product.

## **6. FUNDING OBJECTIVES**

The primary objective of the IIP, is to provide financial support to CUT staff and graduates (and possibly external entrepreneurs with particularly meritorious ideas) to assist them in commercialising innovative research outputs and establishing their own knowledge-based businesses. In this way, research outputs can be commercialised to the mutual benefit of the CUT and its graduates, whilst contributing to the socio-economic development of the community.

Participation in the IIP is to be limited to the campus for a period of one year, after which graduating entrepreneurs will preferably become full participants in the formal CUT incubation programme.

## **7. PARTICIPANTS**

Funding for commercialisation of CUT graduates' research outputs is the IIP's primary purpose. The target group can, however, be extended according to the need and could include CUT staff or centres within which they are involved, the graduates of other higher education institutions and even independent individuals.

## **8. POSSIBLE FORMS OF SUPPORT**

Participants in the IIP scheme are expected to work for a period of no longer than one year in the relevant faculty, under the mentorship of academics, on the development of a new product, software or process. However, depending on individual needs, in particularly meritorious cases this period can be extended after submission of a suitable written appeal. During this period of time, participants will receive the following support:

- a) **Research / Office Space:** The participant's workspace must be located in close physical proximity to the relevant professionals and facilities. The provision of such space will be the responsibility of the particular faculty.

- b) Research facilities: As far as possible, available specialised research equipment must be put at the disposal of the participant. The IIF entrepreneur will also have use of the Library and Information Centre facilities – as a student.
- c) Mentorship: IIF entrepreneurs are entitled to daily mentorship from the academic unit in question throughout the period of innovation. Academics could, with the consent of the IIF entrepreneur, attempt to recruit industrial experts who have already launched successful businesses, to assist in the mentorship. No fees will be payable to such consultants except for the once-off payment referred to in paragraph 6 below.
- d) Communication media: The participant may, within reasonable limits and under the supervision of the academic department in question, make use of all available CUT communication media such as telephones, fax machines, photocopiers and computer facilities within the limitations as prescribed for staff.
- e) Business expertise: Besides professional support, relevant business expertise must be made available to participants. In the case of participants who are not business science graduates, such actions should preferably be in the form of a fully-fledged course in this field, or rather a series of short courses as offered to participants in the formal CUT incubation programme.
- f) Financing: The IIF entrepreneur, who has successfully completed his/her formal studies and does not qualify any longer for any research grant funding, qualifies for a once-off monetary award of no more than R100 000. These funds are to be utilised exclusively to finance the execution of the project. This monetary award is a personal loan and is repayable without any interest from the second year of the project over a period of five years.

## **9. PROTECTION OF INTELLECTUAL PROPERTY**

As a public-funded higher education institution CUT falls under Act 51 of 2008. Hence all intellectual property developed by students and staff of the university is to be handled and reported on to the National Intellectual Property Management Office (NIPMO) according to the processes as described in this act and its accompanying regulations.

Proceeds of the IIP can also be utilised for the registration of intellectual property such as patents, aesthetic and functional design registration or trademarks.

After the university Technology Transfer Office (TTO), received an invention disclosure, the inventor is interviewed and the level of technology, etc. are discussed. The TTO now takes one of the three decisions:

- a. The university will take ownership of the technology with agreement to pursue licensing. In this circumstance, the university will seek appropriate patent, design, copyright, and trademark protection and attempt to market the technology to appropriate commercialization partners through a licensing agreement.
- b. The university may decide that the invention does not have enough commercial potential for any number of reasons such as non-patentability, limited market potential, and competitive products and will decline its interest in the technology.
- c. The university will decide that the invention is not ready for commercialization and opt for further development.

Any intellectual property developed in the course of the project must be declared as such and be registered according to the prescriptions of Act 51 of 2008. Patents arising from the innovation process must be registered in the names of CUT with the inventor identified as such.

Suspension of activities: In the case of any substantial suspension of the activities of an IIF entrepreneur, the CUT should immediately demand repayment of the loan. The mentor is responsible for reporting any such action by the participant to the University.

## **10. CONDITIONS OF FUNDING**

The following aspects must be addressed in the written application for participation in the IIP:

- a) A detailed description of the planned knowledge-based innovative activity – with an indication of the timeframes involved.
- b) A description of problems still to be addressed and a discussion of the expected possibility of these being resolved effectively. Typical research equipment utilised and required to continue with the project must also be specified.
- c) The identification of a suitably qualified and knowledgeable member of staff who is prepared to provide required mentorship to participate in the innovation process.
- d) A projected layout of the expected financial outcomes of participation in the IIF programme.
- e) A discussion of possible participation in the CUT incubation programme after the first year of participation in the innovation programme.

Participants in the Innovation and Incubation Programme qualify – if activities are transferred to the incubation programme as from the second year – for possible participation in the institutional Incubation Programme and the resultant financial incentives associated with such.

## **11. SUMMARY**

With the acceptance of Vision 2020, CUT management expressed itself in support of the innovation and commercialisation of research outputs in support of the socio-economic development of the community it serves. This undertaking will only materialise if prospective entrepreneurs are supported financially and otherwise to assist them in overcoming the innovation chasm. The possible creation of an Innovation and Incubation Programme in support of these activities are motivated and described in the article.

The system described is closely related to a number of actions put in place in the international arena for the same purpose and, although there have naturally been unsuccessful initiatives in this regard, certain programmes have produced excellent results. In light of the substantial benefits foreseen as a consequence of the initiative, it is recommended that such a programme be launched without delay.