Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium, Volume 21, No. 1, ISSN 1726-9679
ISBN 978-3-901509-73-5, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2010
Make Harmony Between Technology and Nature, and Your Mind will Fly Free as a Bird
3rd DAAAM-ICAT

A BUSINESS MODEL FOR RAPID PROTOTYPING IN SOUTH AFRICA

JORDAAN, G[ert] D[aniel]

Abstract: *Central University of Technology, Free State (CUT) has an extensive additive manufacturing centre, commonly referred to as CRPM, incorporating a variety of different technologies. This arrangement has been arrived at through a concerted effort at the development and implementation of a unique business model for commercialization, in collaboration with several industrial partners, from within the academe. The paper deals with the business model of the centre, the role of the centre in the academic enterprise of the CUT, as well as the strategies followed to develop it over a period of several years into its present form.*
Key words: *business model, additive manufacturing, commercial centres, technology station*

1. INTRODUCTION

Technology transfer between the university and industry is a fundamental philosophy of the CUT where technology transfer is the process of passing theoretical and practical skills, knowledge, processes, technologies and manufacturing methods from the owner of a technology to a wider range of users in ensuring that scientific and technological developments become more widely available in industry whilst ensuring skills development of university staff. This can take place between organizations through licensing or marketing agreements, co-development agreements, training or the exchange of personnel.

A good example of technology transfer at CUT is with respect to additive manufacturing technologies. The Centre for Rapid Prototyping and Manufacturing (CRPM) embarked on a process of developing its infrastructure and skills-base in this area about ten years ago, at a time when there were only approximately three such machines in South Africa. During these ten years CUT's position in this field of specialization improved to such an extent that it became the leader in terms of such technology in South Africa. This created a position where the rapid prototyping principles introduced by CRPM to South Africa, became accepted by the local industry to such an extent that there were approximately 90 additive manufacturing machines in South Africa at the end of 2006 (De Beer, 2009). Hence, revolutionary technology was accessed by CUT and subsequently transferred to the relevant industry.

2. THE ROLE OF AM IN SOUTH AFRICA

South Africa is a developing country, but with some unique characteristics. Umongst these is the presence of a relative sophisticated technological, industrial base. This is a potential strength which must be maintained if the country is to maintain its leading industrial role in Africa.

It is from this premise, that CRPM was established approximately ten years ago. Whilst there were very few AM machines available in South Africa, an awareness of the international growth in the importance of (then) rapid prototyping – which since became AM - resulted in efforts to establish a local capability in this field of study.

These efforts were in the main successful and created such a national awareness of AM that it resulted in a huge increase in the availability and utilisation of AM technology in our country.

This could potentially have led to tension between industrial users of AM and the CUT as a government-supported initiative. However, this has been limited to a large extent by the university not vying with industry for commercial work, but concentrating on the acquisition of higer level, more expensive types of AM machines and research in the discipline. Consequently a mutually supporting situation has been reached between local industry and the university.

3. THE ROLE OF AM AT CUT

Hence, the problem was to introduce a relatively new, expensive technology to the South African industry via a university in order to facilitate research in the discipline in a financially sustainable manner, as well as assisting the local industry in incorporating such in its daily manufacturing processes. This necessitated the development and implementation of a specially-tailored business plan.

South Africa is in a particularly difficult situation with respect to the upgrading of its technology base in manufacturing. Efforts at incorporating high-tech facilities in factories are seen as a possible threat to employment opportunities of semi-skilled employees. But, in order to compete globally, the SA industry has to incorporate facilities which would enable international competitiveness. Additive manufacturing technologies are perceived as an example of such – but only once it has been commercialized by translating the use thereof into socio-economic solutions (Wamae, 2009).

Hence, a variety of AM technologies was introduced to South Africa over a period of time to study its respective operational characteristics, whilst providing AM services so as to finance the cost of acquiring and maintaining the facilities. To manage this essentially commercial activity within a teaching and research environment, a system of commercial centres was created by the CUT. This bridged the gap between the faculty and industry. See Figure 1 below.

This created a unique situation at CUT within the South African higher educational system in that: (1) A course in mechanical engineering, which is unique within the South African context, (2) a highly specialized facility became available to the university, but also to the South African manufacturing industry, (3) a moderately successful generator of third stream income was created, (4) an opportunity was created for the development of a multi-disciplinary research activity in evolvable manufacturing systems, and (5) enhancement of the academic status of the university.

These different activities were realized in the following manner:

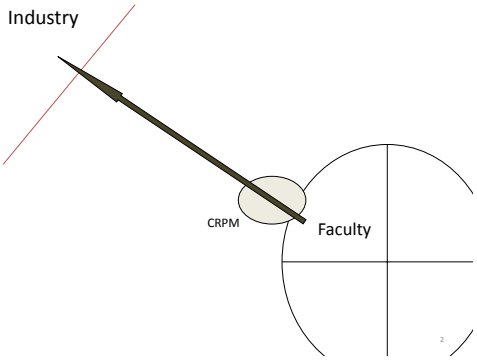

Fig. 1. Operational position of the Faculty of Engineering and CRPM

3.1 Unique academic offering:

Students of CUT are formally introduced to the principles of AM, whilst being afforded the opportunity to experimentally test their design assignments by utilising one or more of the available technologies. In addition, a research group in Integrated Product Development, was created within the relevant academic unit.

3.2 Financial self-sustainability:

Self-sustainability in the context of this paper is defined as (a) the ability to completely finance the maintenance of the available AM technologies, (b) pay the salaries of the staff involved in the CRPM, as well as all relevant consumables.

3.3 Generator of third-stream income:

The CRPM proved itself capable of earning a moderate amount in access of its day-to-day needs to enable the gradual expansion of the centre's infrastructure and range of services provided.

3.4 Multi-disciplinary research activity

Parallel to the development of the CRPM and the research niche in Integrated Product Development, a Research Group in Evolvable Manufacturing Systems was established. The CRPM is able to provide this unit with specialised mechanical devices required in the construction of its research facilities and vice versa (Jordaan & Vermaak, 2009) and vice versa.

3.5 Enhancement of academic status of the university:

The CUT's AM facility has been functional for approximately ten years. Whilst it was basically a stand-alone unit at the time of its inception, it created such a positive external perception of the university's capabilities, that a wide range of subsidiary units has since been implemented (see Figure 2), primarily through external funding.

The government-supported Technology Station (PDTS) was the first unit of its kind established at a South African university and the national department of Science and Technology funded the establishment of the CUT Fabrication Laboratory (Fablab) on the principles of a similar unit established at the Sound End Technology Centre in Boston, USA (Gershenfeld, 2005).

4. FUTURE DEVELOPMENTS

It is obvious that the establishment and functioning of CRPM had a huge confidence building effect. This increasingly eases the definition and creation of additional commercial and research units, funded by external partners. Every possible effort should be made to maintain this momentum, whilst being sensitive to the changing local industrial and community needs.

5. CONCLUSION

CUT proved that it is possible for a university with limited financial capacity to establish a financially sustainable AM unit with a wide variety of sophisticated equipment.

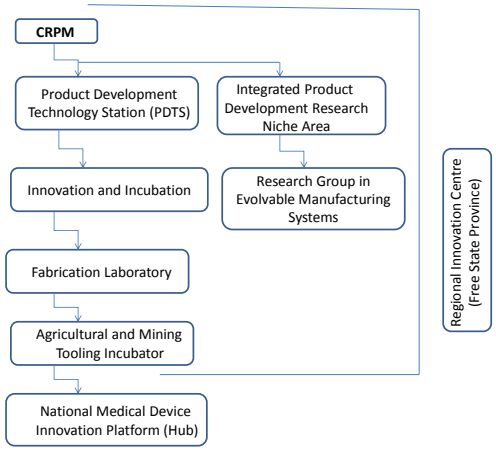

Fig. 2. Operational units supporting CRPM

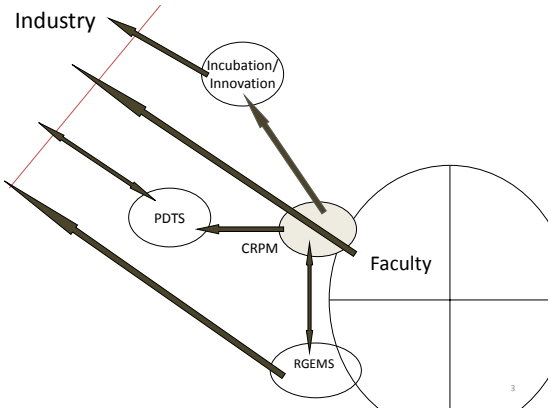

Fig. 3. The relative operational positions of the Faculty and some support units

Such a facility can be utilised in the interest of the academic enterprise of the university as well as industry. Future AM developments might necessitate careful strategic planning.

6. ACKNOWLEDGEMENTS

This material is based upon work financially supported by the National Research Foundation and the Central University of Technology, Free State. Any opinion, findings and conclusions or recommendations expressed in this material are those of the author and therefore the NRF does not accept liability in regard thereto.

7. REFERENCES

De Beer, Deon J. (2009). The CRPM Story: A Case Study in Commercialisation and Technology Transfer, In: *Managing Applied Research*: *Theories, Cases and Perspectives*, Laetus O.K. Lategan and Ulrich D Holzbaur, (Ed), pp. 112-125, Shaker Verlag, ISBN 978-3-8322-8191-5, Aachen

Gershenfeld, N. (2005) *The Coming Revolution on Your Desk-Top – From Personal Computers to Personal Fabrication.* Basic Books. ISBN 0-465-02745-8, New York

Jordaan, G.D. and Vermaak, H.J. (2009) Design of a Three-Dimensional Scanning System Utilising a Single Digital Camera, *Proceedings of 20th International Scientific Conference*, pp. 5-8. ISSN 1437-7624, University of Applied Sciences, Mittweida

Wamae, W. (2009). Enhancing the Role of Knowledge and Innovation for Development. In: *International Journal of Technology Management and Sustainable Development*, Vol. 8. No. 3, 2009, pp. 199-220, ISSN 1474-2748