From Fundraising to Innovation Ecosystem development; a case study.

André Hattingh
Faculty of Engineering, North West University
Potchefstroom, North-West Province, South Africa
agh@mweb.co.za

ABSTRACT

The Innovation support Office in the Faculty of Engineering (ISO@FE) at the North-West University is a unique structure in the South African context, and might provide lessons to universities trying to cope with the some of the following constraints: operating in a developing country, constrained financial environment, transitioning from a teaching-learning / research university to an entrepreneurial university - and all of this in an environment where the maturity of the research groups differ substantially and the capacity to manage the triple-helix relationships is lacking.

The ISO@FE went through three distinct phases. The first stage started eight years ago when the ISO@FE began as a small group tasked to raise funding for research in the faculty of engineering. This was a fragmented approach, with little opportunity for growth.

A number of interventions were implemented in Stage Two in order to remove system constraints:

- A cloud-based project management system was implemented and integrated with a bespoke financial management system.
- A number of very experienced account managers with industrial, financial and project management experience were appointed.
- Instead of using the capabilities and needs of the university as the starting point in defining the relationship between the university and the company, we start with a prioritized list of company problems.

Now, in Stage Three, we focus on innovation ecosystem development. This process is based on the following capabilities: industry intelligence, funding intelligence, business development, and research-group development support. We inter alia started a Mathematics and Science school for the university, a portal linking engineering students to project and business opportunities, and furthermore we set up research groups countrywide, which are linked to national priorities and industry needs.

Keywords: Management of innovation, Ecosystem development, Technology transfer, Triple Helix clustering, Entrepreneurial universities.

1. INTRODUCTION

This paper presents the case in which a faculty of engineering at a rural university in a developing country had to continually redesign the internal and external environment in order to stay financially viable in an environment of financial constraints,. The paper gives an overview of the thought processes, the implementation plan, as well as preliminary results.

2. BACKGROUND

The North West University is in the North West province, South Africa and has the following characteristics:

- Is in a rural setting, being located more than 150 km from large cities
- Has a balanced teaching/learning-research focus.
- Can be described as a medium size university in the South African context
- Has a strong culture of academic entrepreneurship
- Operates in a developing country
- Experiences a very tight financial environment
- The university is transitioning from a teaching-learning/research university to an entrepreneurial university
- Has a wide dynamic range in the maturity of its research groups.
- Is constrained in terms of capacity to provide education, research, community development, and generating third stream income with the existing staff and infrastructure.

The faculty of engineering offers Washington-accredited engineering degrees of 4-years duration, in mechanical-, nuclear-, electrical-, industrial-, electronic-, and chemical/process- and mineral-engineering. There are a number of research groups active in these fields, while others work across the boundaries.

3. INITIAL CONDITIONS:

A decade ago the university used a model where academics had the opportunity to spend their time according to the following ratios:

- Teaching 40%,
- Research 40%
- Community service 20%.

This provided for academic freedom, and consequently diverse models were developed according to which academics focused their energy. Some academics became involved in companies; some structured themselves into research groups, while others focused on teaching. During this time the university won the prize as the most innovative university in South Africa. This was not because of a formal innovation process in the university, but it might have been because of the profile of entrepreneurial academics that were attracted to the institution.

The informal understanding was that academics could supplement their salary with consultation work in their private capacity in the time allocated for "community involvement". Some academics used this opportunity optimally and found a balance in benefitting the university and themselves. They made their expertise available to the broader community in their field of specialization while their visibility, impact and exposure to "real life" industrial problems benefitted the NWU in many ways, though not always in monetary terms.

There were a number of concerns however:

- Few academics had the skillset to do this successfully
- Fewer earned substantial income through these endeavors although they booked the time
- Some academics used their time on activities not at all related, or relevant to their NWU appointments.
- Some came close to being in competition with the university in terms of short-courses and other educational activities
- Sometimes the border between private and university work became blurred in terms of use of facilities and infrastructure.

The university had clear policies governing these behaviours, and it worked very well for academics with an entrepreneurial inclination.

In 2007, the dean of the Faculty of Engineering started an Innovation Support Office in order to promote and support research in the faculty of Engineering. The aim was to increase the research outputs of the faculty, as this is one of the success- and productivity indicators used by the NWU.

Thus the expectations of researchers were for the Innovation Support Office to raise funds, identify and fund post-graduate students and find sponsors for research infrastructure. In short, the expectation was to do fundraising for researchers.

4. THE FIRST STAGE:

Initially the Innovation Support Office at the Faculty of Engineering (ISO@FE) worked as a support office for the researchers. The researcher would identify potential companies that might fund research projects and the ISO@FE would approach them, write the proposals and managed the funding administration. The researcher would be the project leader, and manage the relationships between the companies, students and other role players.

This stage did not last long because it soon became clear that the intricacies and complexities of industry-university interaction caused misunderstanding and friction. The funding that could be raised in this model was also very limited. This was also a fragmented approach, with little opportunity for growth because the approach did not promote collaboration between different research groups and alignment between research groups and industry.

5. STAGE 2:

From the ISO@FE perspective it became clear that a number of inefficiencies existed in the system, and that a theory of constraint approach was needed to identify the bottlenecks. In order to be effective it became necessary to work ON the system, as well as IN the system to remove constraints and to improve productivity. Analysis of inefficiencies in the research system led to the design and implementation of a number of interventions:

- A cloud-based project management system was implemented integrated with a bespoke financial management system. This system is linked to the university's system but has been specifically designed for a fast, entrepreneurial environment.
- The ISO@FE office appointed a number of very experienced account managers with industrial, financial and project management experience. These specialists were not appointed by the university, but by each project, and their salaries are linked to their knowledge, experience and productivity.

- And most importantly, we changed our approach in dealing with companies. Instead of using the capabilities and needs of the university as the starting point in defining the relationship between the university and the company, we now start with a prioritised list of company problems. This new approach had a profound ripple effect on everything we did. Instead of sanitized well-defined research problems, we now have to deal with important, multidisciplinary, complex problems.
- This led to the following understanding: the basic unit that the ISO@NWU will support is not a research unit, but rather a research network or cluster. In many cases the faculty of engineering, or even the university, might not have the skillset to work on a specific problem, which then requires building multi-faculty or multi-university networks.

The effect was that the number of projects doubled year on year and the funding under management grew even faster. Because the number of researchers stayed the same, it meant that the productivity and efficiency of the researchers had to improve in order to cope with the workload, and we had to continually rethink and improve structures and processes. We also had to develop specific interventions to identify, attract, fund and support post-graduate students to work on these projects.

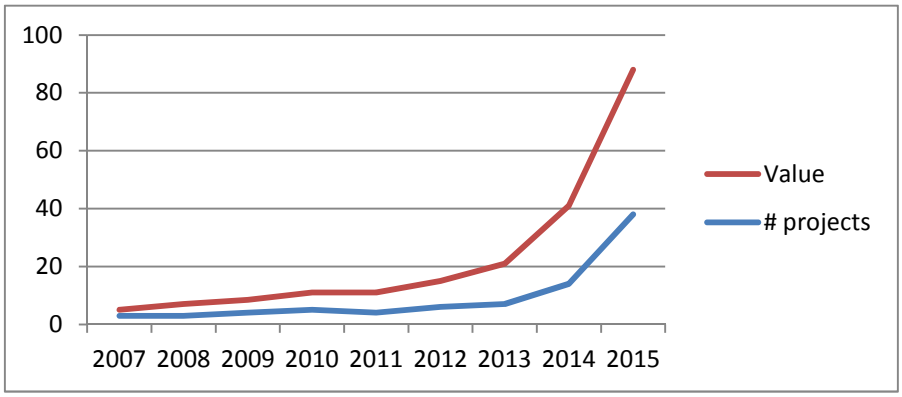

Figure 1 Number of projects and value in ZAR

One unforeseen effect of using an industry centred approach was that we had to become agile, and master the skill to define and build networks and alliances dynamically. In our context research problems are almost always complex and multidisciplinary. We have to identify the relevant skillset, negotiate partnerships, and do the project management, while working with researchers and students, within the timescales expected by industry.

The services offered by the ISO@FE can just as well be offered by an entity outside the university, but because the ISO@FE is a unit in the university, we can access and manage funding earmarked for university research. Most of our projects are therefore funded by industry, and co-funded by government. We are also embedded in the university's financial and administrative systems, and thus have access to students and staff.

This capability that we developed to design and manage Triple-Helix networks and relationships based on large complex projects became so useful that we were later approached by other universities, research councils and companies to also assist them in various ways. This capability is based on the underlying ability to identify funding sources, write proposals, manage the interfaces, and do the detail project management in order to see the research and commercialization successfully concluded.

6. STAGE 3:

During the past 3 years the financial situation of the NWU reached a tipping point, and a complete rethink of the way we do business was required. It was long in coming, and the trend was clear for those who were monitoring long-term national and international trends. The following happened:

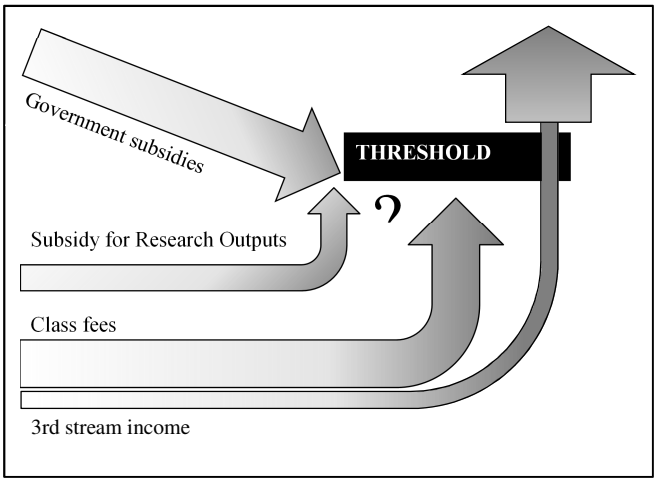

Figure 2. The potential role of 3rd stream income in profitability

- The university finds itself financially constrained. The yearly state subsidy for teaching/learning outputs has declined consistently for the last few decades.

- Whilst the quantity and quality of research outputs increase over time, the qualifying research output subsidy is not sufficient to support research groups and fund post-graduate bursaries.
- Class fees increased steadily over time, and are currently at a level where resistance is evident.
- Other state funded research support are capped, or withdrawn according to changing government ideology and pressures.

South Africa is a developing country. This means there is a big difference in technical maturity, ecosystem sophistication, and management depth in different sectors and different locations. Current government policies also have an impact. It therefore became clear that our external environment has a negative impact on the productivity and profitability of our internal activities and processes. This means that the faculty of engineering has to be an active player on the regional and sector innovation ecosystem level in order to influence the future in such a way as to ensure our own expectations. The ISO@NWU therefore decided to continually improve our internal NWU innovation system, but that we also had to be involved on the next higher level, which is the local innovation system.

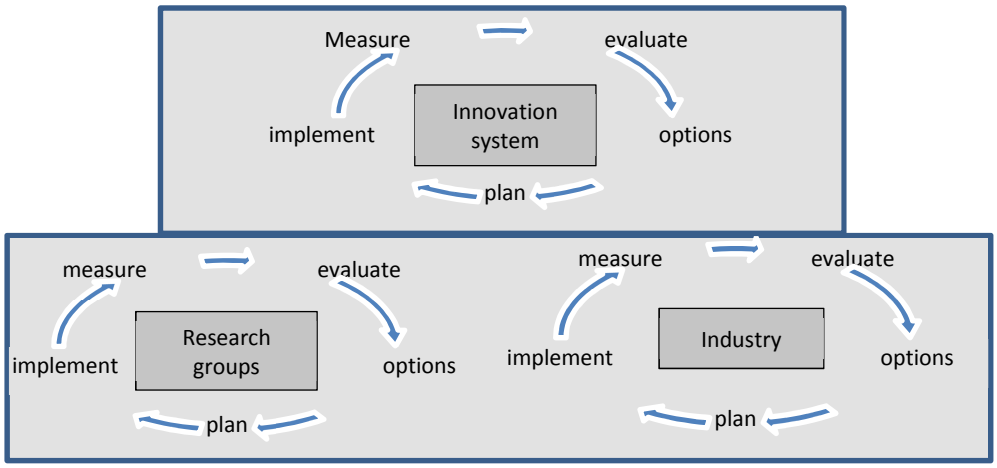

Figure 3. Innovating the innovation system

This means that we had to have a process to innovate the research system of the faculty, whilst being involved in the industry, using the local innovation system as the unit of operation. We have to improve alignment, productivity and identify constraints and opportunities for the system, and then find ways to generate income through synergies.

Innovating the Faculty of Engineering research system

This is done in a number of ways:

- Measure the productivity of staff. The NWU added a process to the current job evaluation system where every person is measured in terms of productivity and efficiency. In short it means that each academic has to "generate" at least 3 times his/ her salary through all the normal academic endeavours.
- Re-align faculty research groups in order to develop income generating systems. This means that researchers should cluster around themes, and each group should investigate and implement ways to exploit their offerings in order to make their group financially sustainable. The following matrix shows the options available.

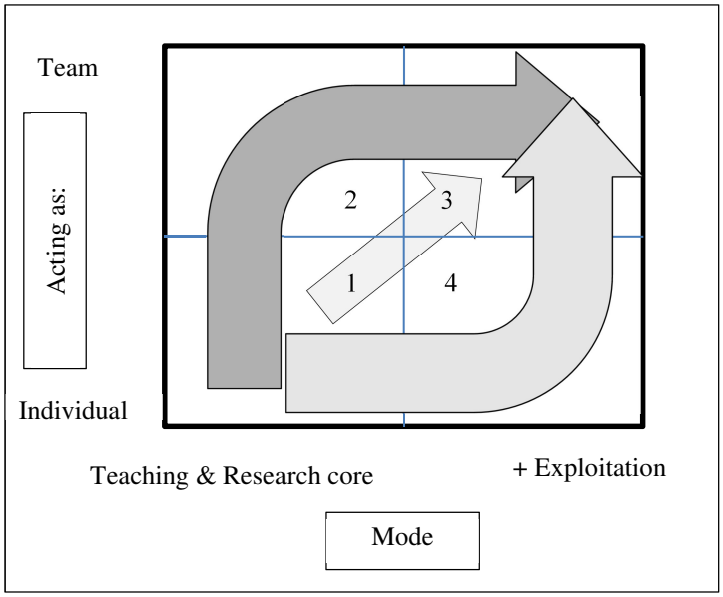

Figure 4. Changing the culture

- Change the culture. Over time individuals or groups developed preferred ways of working in each of the quadrants. The culture of the whole faculty had to change from a cost-based framework towards a profit-based framework and this means that individuals and groups also have to make transitions. It is important to note that each of the quadrants has to be populated with individuals that fit the activities of the quadrant, and this is linked to personality, skills and experience. It is not implied that everybody should move to quadrant 3, but rather that an aligned system is established that will provide for high productivity in quadrant 3.
    - Quadrant 1: Individuals in this quadrant might be highly specialised, and focussed, but the danger exists that their impact might be low. They might need financial and other support, and a system or framework might provide structure and improve alignment. With assistance these individuals might grow into quadrant 2, 3, or 4. A consultation portal might assist them to operate in quadrant 4, while networking might make their expertise available to a team.

- Quadrant 2: Individuals working in this quadrant are already part of a team. Their main outputs would be students and/or research outputs such as papers and articles. However with assistance the team might be developed into a team that are also working further along the innovation pipeline.
- Quadrant 3. These teams are characterised by having deep expertise in a number of fields, and the capability to exploit their knowledge, skills, infrastructure and systems as part of larger projects.
- Quadrant 4: These individuals are usually working alone and are doing consultation work on an individual basis. With support, their productivity can be increased if provided a consultation portal. They might have highly specialised skills but will still benefit if they become part of a team. With assistance they could become part of Quadrant 3 teams in order to bring specialised knowledge and skills.

- Measure and grow the research groups: The mapping instrument shown in Figure 5 is useful to categorize the status of a group, and to design a development path for it. On the vertical axis is shown the progressive levels of a research group,
  - From a single academic with a few post graduate students needing financial and other support, to a level where the research group can add value to a project, based on knowledge, expertise or facilities, to the next level where the research group acts as a pseudo enterprise.
- The horizontal axis shows the continuum of the participation of the group in a project:
  - Admin portal: provides research topics, funding and administrative support to master and PhD students, whilst relying on contracted academics and experts to mentor students.
  - Academic manager: provides research leadership and academic mentoring to students
  - Team player: The researcher and the team brings expertise, experience, skills, IP or facilities to the project
  - Core competency: The researcher or team bring the core competency top the project
  - Add IP: The researcher or team brings the core IP to the project

The diagram gives an idea of the maturation of the groups, the number of persons involved on each level, as well as the role each group plays in the projects that they are involved in. It does not give an idea of the quality or quantity of the work. It helps however to get an idea of the level of integration of the researchers in the system of innovation. What is, however, very important to note is that the policy environment, as well as the support given to groups operating in different spaces should be targeted to that space. A completely different approach is needed to support researchers in the left-hand bottom corner in comparison to researchers working in the top-right corner.

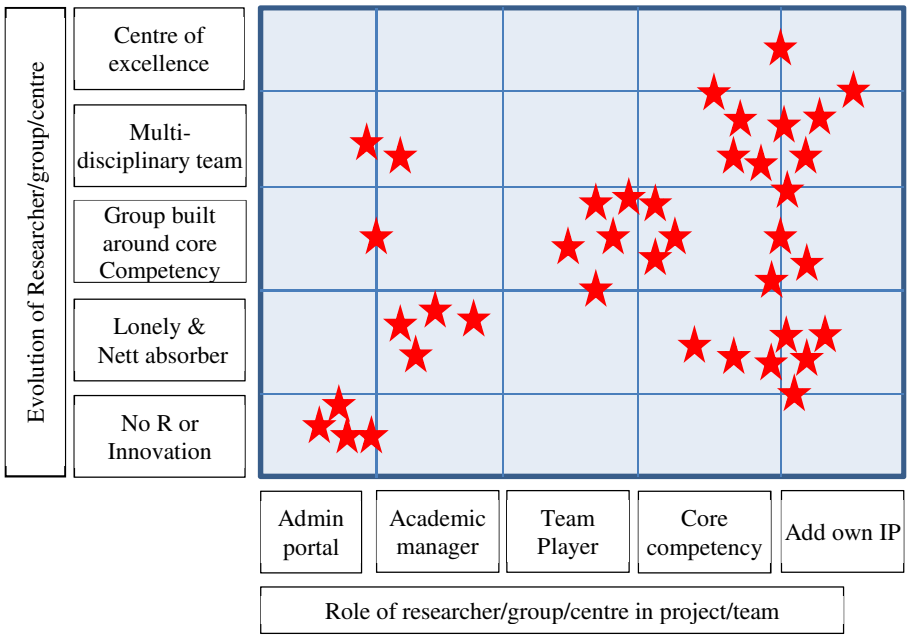

Figure 5. Mapping of research groups and their impact

The following should be inferred from the matrix:

- The core activity remains high-quality research. It is the basis of the whole system.
- It is now possible to design and add to the research capability of each group a specific intervention that will assist the group to mature, which will empower them to generate value from their outputs in a variety of ways.
- Each space on the matrix has to be managed in a specific and different way in order to support the development thereof.
- Few groups will have the internal expertise to manage the transformation of the group on their own. In our case, we have appointed business development specialists, who will, in collaboration with the leadership of the group, develop business plans, budgets, and strategies.
- In our case, we found that the same business development assistance needed to incubate and accelerate startups, is needed to support research groups.

Innovating industry clusters

During stage 3 we are simultaneously improving the responsiveness of our research groups to work on industry related projects, while at the same time supporting and developing regional innovation ecosystems. During stage 1, we developed the systems and processes to manage large projects; during stage 2 we developed the skills to identify opportunities, build large multi-university teams, and manage the government university interfaces. We are now actively assuming the role of actor in the

regional innovation system, in identified industry sectors and also in defining new innovation ecosystems. This approach is needed because few people in the industry and government possess deep understanding of the intricacies of triple helix interactions. Therefore, in our case it makes sense that the university assumes the role as driver in the Triple Helix interactions.

This is not how Technology Transfer offices (TTO) usually operate: they focus on university IP and then develop processes and systems to push the IP down the innovation pipeline in order unlock value for the university. The ultimate aim is to patent, licence and develop SMEs based on university research and IP. In a developmental environment there is, however, a number of hurdles that need to be overcome before such a technology transfer system can be implemented successfully:

- In our environment, the TTO systems are usually not profitable. They are expensive to administer.
- The number of inventions is too few because the production of IP is restricted by funding, staff, and other constraints.
- The expectations of management are too high and unrealistic.
- Some TTO staff might have the right qualifications but the tacit knowledge needed to manage this system has not yet been developed.
- Support expertise and experience are not available.
- Support from management is not always forthcoming.

The NWU possesses a TTO and they perform their function according to legal and other guidelines. Because the NWU is ‘n developing university, they have to deal with some of the above issues.

In contrast, the ISO@FE does not work from a technology push paradigm, but rather an opportunity seeking, and network building paradigm. We start with the needs of business, and then search for collaboration opportunities and synergies. We use a range of tools to assist us in identifying trends, niches and opportunities, and we use networking events to discuss possible scenarios with experts. We then use a structured approach to rank the identified opportunities, and allocate resources to do further investigation thereof.

In practice, this would mean that we would identify an opportunity in a specific sector. This could be as easy as bringing two companies together, or making a company aware of a funding opportunity. It

could also be as complex as identifying and setting up a new technology cluster based on large new investments in a new sector.

Because we are based in the faculty of engineering, we are able to bring expertise, research capacity, funding, human resources, and infrastructure together in order to bring value to a network. If solving the problem is important to companies, and the industry partners are already committing resources to solve it, we can then share in the funding that is available. In short: we build regional triple-helix innovation ecosystems.

We believe that the success of ISO@FE is determined by a number of factors:

- ISO@FE operates as a unit in the faculty of engineering, and not on university, local government, or national government level.
- It is entrepreneurial and agile.
- It self-funded.
- It can modify internal systems and processes at the operational level where this will have the greatest impact, while simultaneously influencing external systems from the bottom up.
- We appoint staff that are themselves entrepreneurial and are networkers.

This concept can be simplified by an analogy: System of innovation and triple helix interventions on regional and national level can be compared to conventional warfare, while metaphorically the ISO@FE is building triple helix relations using special forces tactics - directed, focussed, fast, and agile.

The ISO@FE has therefore appointed staff with the following responsibilities:

- Industry intelligence group to follow the fortunes of small to medium companies.
- A funding intelligence group to investigate and identify funding opportunities per project.
- A business- and research group business development consultancy. Their task is to simultaneously work with SMME's and the smaller research groups in order to grow their businesses using the current project as the vehicle.
- A Mathematics and Science focus-school for the university. The aim of this structure is to build education pipelines to link universities and companies with schools, offering specialised problem and project based programmes. The Academy aims to increase the number of professionals that will eventually become entrepreneurs and leaders in high-tech companies.
- A new venture pipeline, linking engineering students to project opportunities.

- To identify the need for, and set up of, new research groups linked to national priorities and industry needs

7. CONCLUSION

A few of the current initiatives were explained in this paper, together with the thinking behind the processes that led to the restructuring of the faculty of Engineering, and the seeding of these initiatives. An important predicator for success was proved to be the measuring and reward systems that will ensure that all the core activities such as teaching/learning, research, consultation work, new venture creation and wealth creation are aligned with the university's mission. Though this was not discussed in this work, it will be presented in a future paper.