

Organising for Effective Academic Entrepreneurship

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Abstract

The contribution has three parts. In the first part the concept of academic entrepreneurship is explained, defined and put into the context of the entrepreneurial university. In the second part four cases are described:

- (1) The Nikos case at the University of Twente: In Nikos teaching, research and spin-off activities are combined into one research institute.*
- (2) The NICENT case at the University of Ulster: NICENT is set up under the Science and Enterprise Centre activities in the UK. It focuses on education and training of students (undergraduates, graduates and post-graduates) and the stimulation of academic entrepreneurship in the academic constituency.*
- (3) The S-CIO case at Saxion Universities for Applied Sciences: In 2004 Saxion set up this Centre to have a one-stop shop for all entrepreneurial activities at the University.*
- (4) The Chair in Technological Entrepreneurship at Tshwane University: The focus of the Chair is on education of (under)graduate students in (technological) entrepreneurship and on the stimulation of entrepreneurship in the wider community.*

Each case has its own specific angle on academic entrepreneurship and in the third part the four cases are compared and analysed according to the model presented in the first part.

Finally, some conclusions are formulated regarding the organisation of effective academic entrepreneurship.

1. Introduction

The entrepreneurial university is one that facilitates the creation of value for society and wealth for individuals through new and innovative undertakings. The term reflects a philosophical ‘maturation’ of the concept of entrepreneurship to include socio-economic value in addition to an association with job creation and new firm creation (Kao, 2002). This socio-economic mission is an expansion of the teaching and research missions that traditionally determined the priorities and direction of universities (Etzkowitz, 2003a). At the heart of the entrepreneurial university is innovation – what Drucker called “the effort to create purposeful, focused change in an enterprise’s economic or social potential” (Drucker, 1985, p. 67). The purpose of the entrepreneurial university is to transform academic knowledge into economic and social utility (Clarke, 1998). On the basis of a review of five leading European universities perceived as entrepreneurial, Clarke further identified pathways important for organisational transformation to be considered an entrepreneurial university:

- A strengthened steering core: an entrepreneurial university has a strong body that governs with vision and sets out a strategy.
- Boundary spanning structures (e.g. a technology transfer office) and mechanisms to interact with the “outside” world (region and industry).
- A diversified funding base: an entrepreneurial university does not entirely rely on government funding but has a balanced portfolio of first, second and third income streams.
- A strong academic heartland: inter/multi/transdisciplinary research is for a university a necessity to be among the best of universities (excellence).
- An integrated institutional entrepreneurial culture.

Etzkowitz (2003b) identifies at least five key elements of an entrepreneurial university:

- The organisation of group research (this relates in our opinion to Clark’s academic heartland).
- The creation of a research base with commercial potential (this relates also to Clark’s stimulated academic heartland).
- The development of organisational mechanisms to move research out of the university as protected intellectual property (similar as Clark’s boundary spanning structures).
- The capacity to organise firms within the university (we feel that this resembles Clark’s integrated entrepreneurial culture – in such an environment research group undertake entrepreneurial and commercial activities in one group – not necessarily under the same organisational structure).
- The integration of academic and business elements into new formats such as university-industry research centres (see our remarks above).

Explicit in Clark’s characteristics and implicit in Etzkowitz is the balanced portfolio of income streams. Clark’s transformational pathways and Etzkowitz’s organisational elements are a reaction to, and to a degree influence, the changing policy perspectives of how universities are perceived in knowledge-based economies is understood. This is evidenced in recent (UK) policy reviews:

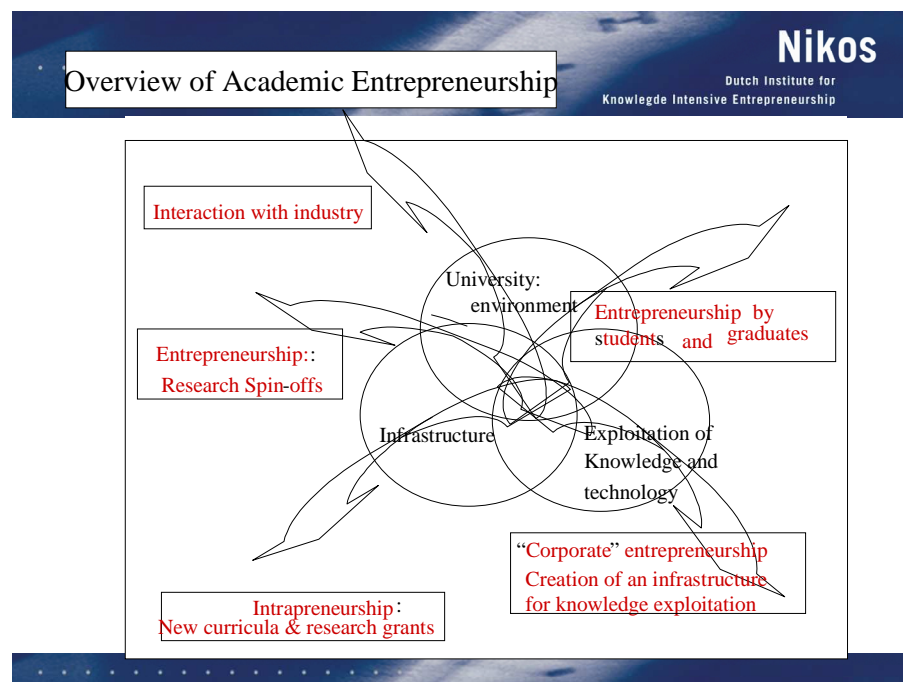
“Universities will have to get better at identifying their areas of competitive strength in research. Government will have to learn to do more to support

business – university collaboration. Business will have to learn how to exploit the innovative ideas that are being developed in the university sector” (Lambert Review of Business-University Collaboration, 2003, p. 2)
“In a knowledge based economy both our economic competitiveness and improvements in our quality of life depend on the effectiveness of knowledge sharing between business and higher education” (The Future of Higher Education 2003, p.36)

Further such policy perspectives invariably translate into funding to support such policy aspirations at different levels:

- University structures and systems (UK: the Higher Education Reach out to Business and the Community initiative; Netherlands: Subsidy arrangement for Knowledge Exploitation)
- Discipline areas (UK: the Science Enterprise Challenge; Netherlands: TechnoPartner)
- Funding academic spin out firms (UK: the University Challenge Fund; Netherlands: funding of the TOP (Univeristy of Twente’s spin-off) programme by regional development funds; Germany: eXist programme)
- Supporting knowledge transfer (UK: the Teaching Company Schemes/Knowledge Transfer Schemes; Germanyl-NRW: Trafo programme)

2. A model for Academic Entrepreneurship



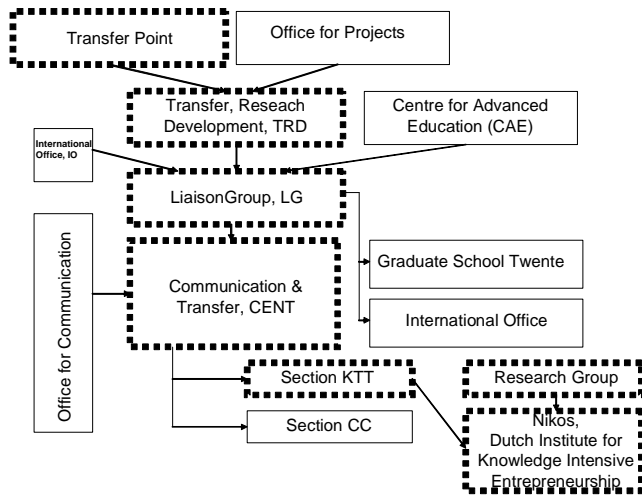
3. Four case studies

3.1 University of Twente: Nikos

The Dutch Institute for Knowledge Intensive Entrepreneurship (Nikos) is a very young research institute at the University of Twente (UT) established in 2001 and part

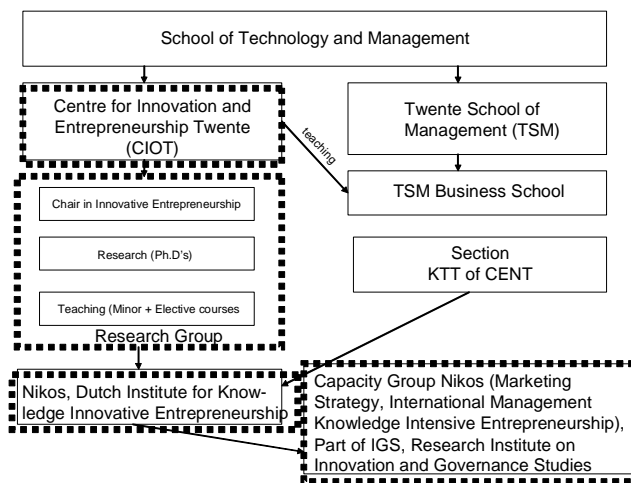
of the Institute for Governance Studies (one of the five focal research institutes of the UT), but it has a relatively long history. Nikos developed along two independent lines (from *technology transfer* and, from *research and teaching*) from the early 1980s on:

Technology Transfer: In the early 1980 the UT established as one of the first



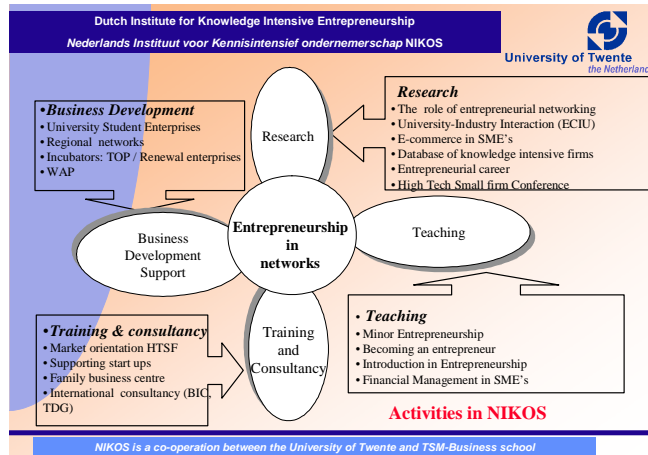
universities in The Netherlands and in Europe a technology transfer office. The finances for doing this came from the Ministry for Economic Affairs. This transfer office went to many organisational developments and changes. It started as the “Transfer Point” with main tasks to transfer technology to SMEs and since 1984 to spin-off companies via the Temporary Entrepreneurial

Positions (TOP) programme. In 1989 the Transfer Point changed into TRD (Transfer, Research & Development) and got an extra assignment from the Executive Board to acquire (research) projects from industry. Also a group of the financial department of the UT merged into the new organisation bringing the acquisition of regional and national funds as a new task. In 1994 TRD was succeeded by the Liaison Group that consisted of the “old” TRD group and tasks, the Centre for Advance Education (the CPD organisation of the UT) and the newly established International Office. In 1996 the International Office split off and in 1998 the Liaison Group merged with the Communication Department into CENT (Communications and Transfer). In 2001 the Transfer part of CENT merged with the academic research group on entrepreneurship. It brought into the new organisation its experiences with entrepreneurship (TOP programme and international experience as consultants), regional development and technology transfer.



Research and teaching: In the mid 1980 in the Faculty Technology & Management established a centre for innovation and entrepreneurship (CIOT, Centre for Innovation and Entrepreneurship Twente) with main tasks to provide training to entrepreneurs (e.g. “Managing an SME”, the owner-managers course) and teach an elective course for students (“Become your own Boss”). It also

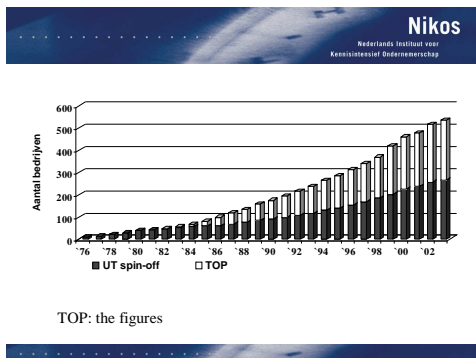
had a research task, but that never really got off the ground. CIOT split off from the university and merged with TSM Business School to become its Entrepreneurship Centre. The research activities remained in the Faculty and were further developed.



Dutch Institute for Knowledge Intensive Entrepreneurship, Nikos: In 2001 Nikos was established and brought the two groups together. Nikos is active in four different areas:

- **Research:** Nikos' research focuses on knowledge intensive, high-tech entrepreneurship in networks and university-industry interaction. Recently two Ph.D. projects were finished (one on the adoption of e-business by SMEs and one on global startups), four Ph.D. projects are in progress (strategic changes in the first year of high-tech companies, incubators, global startups, entrepreneurship in healthcare). Also the monitoring of high-tech ventures is an object of study.
- **Teaching:** Nikos teaches in both the Bachelor programme and the Master programme.
 - **Bachelor programme:** Nikos developed a Minor Entrepreneurship both for business and non-business students. This is a 20 ECT credit course and every student has to elect a Minor. This Minor attracts every year about 40 students and is in the top 5 of most selected Minor programmes. There also is a Bachelor programme in Advanced Technology and in this programme Nikos is responsible for a course in the first and in the second year.
 - **Master programme:** Nikos developed a one year Master in Innovative Entrepreneurship & Business Development (IE&BD) and has made arrangements with the University of Aalborg for a two-year Master programme. This Master programme is one of the five belonging to the Business Administration Master. IE&BD just started its first year and attracted already 20% of all registered Business Administration Master students. Nikos also delivers courses for other Master programmes: Business and IT, Industrial Design, Biomedical Technology.
- **Training and Coaching:** Nikos staff is also engaged in training and coaching activities in a diversity of settings. Since 8 years every year a Unispin Workshop (in cooperation with DIT – Ireland and Linköping, Sweden) is given. Further under ProTon Europe the training is given on “Basics of Technology Transfer”. Also training activities in Russia (Moscow) are provided to a research institute.
 - **Business Development:** Nikos carries out the TOP programme for the UT and in the region “Achterhoek” the project “Kansrijk Eigen Baas”. In both projects Nikos staff members are consultants and actively support entrepreneurs to set up their own business. Nikos also has a task inside the university in assisting the research institutes in their commercialisation processes.

What used to be separate organisations is brought into one. Research, teaching, business development and training and coaching mutually influence each other. Most staff members are engaged in at least two or more of the activities.



From the above one message should be obvious and that is that over a period of more than 20 years the UT has a rather consistent policy with respect to entrepreneurship and commercialisation of research. One aspect in this respect has not been dealt with: in the mid 1990 the UT research institutes got a more profound interest in entrepreneurship and technology transfer – they even were of the opinion that they themselves were the best to carry out these complex tasks. The research institutes did not need support but expertise. This coincided with the formation of Nikos who takes on this expert role and the research institutes of the UT (on nano/micro technology, ICT, Mechanical & Chemical engineering, and biomedical technology) all have formulated research spin-offs and technology transfer not only in their mission but also formulated annual targets (in numbers). Of course the UT has a holding company to scout and manage its IP and other interest (in the Business & Technology Centre, Business & Science Park, Knowledge Park, Venture Fund). The UT has with its spin-offs quite an impact on the region. Depending how is counted and what is counted, the UT has been instrumental in the startup of some 500 companies. The impact of this nowadays is that annually some 1000 new jobs are created by companies originating from the UT and 80% of the companies remain in the direct vicinity of the university.

3.2 The Northern Ireland Centre for Entrepreneurship (NICENT)

NICENT was established in 2000 and funded by the Office of Science and Technology (OST) in London and the regional development agency in Northern Ireland, Invest NI. It is a partnership between the University of Ulster and Queens University Belfast. Both universities have between them some 50,000 students pursuing programmes at undergraduate, postgraduate taught and postgraduate research, in Science, Engineering, Technology, Social Science, Humanities, the Arts and Business and Management. The Centre is one of 13 established under the Science Enterprise Challenge initiative set up by the UK government in order to generate a greater entrepreneurial culture within the higher education sector across the UK. The specific challenge for NICENT is to migrate entrepreneurship out of the faculties of Business and Management, where it is traditionally lodged and into the faculties of Science, Engineering and Science, (SET), where the agenda is seen as rather a novelty, and not a particularly welcome one at that.

Since the late 90s a series of government reports and strategy documents in the UK has sought to highlight the need for radical action to change the attitudes prevailing within higher education institutions with respect to entrepreneurship and to encourage a greater engagement with it. In these publications the need for culture change to one that is distinctly more entrepreneurial and that supports new venturing activity in particular has been emphasised. In addition the need to build stronger links between

the education and the business sectors has been highlighted. In such ways it is hoped to address the inherent fear of failure that so bedevils the potential for entrepreneurship in NI and to encourage greater calculated risk-taking amongst people, particularly young people living in the region.

The Centre's efforts are first and foremost focused on curriculum development activity. Targeting specifically the faculties of Science, Engineering and Technology, (SET) the Centre has sought to embedding entrepreneurship within the curriculum at all levels of the curriculum. Recognising the pivotal role that faculty have in pushing this agenda the Centre also sought to engage the teaching and research staff within this constituency too in the entrepreneurship agenda. This has been achieved through the adoption of a series of strategies including best-practice workshops, the development of a cohort of visiting professorships in Entrepreneurship including for example the Universities of Twente and Babson, and the development of a collaborative MSC programme in Innovation and Entrepreneurship with Babson College. Other aspects of the NICENT strategy are outlined below.

Key to the success of the NICENT enterprise to date has been the support of the agenda by management at the most senior level of the partner institutions. This emphasised the importance of the agenda at the highest level and sent a clear message to course planning teams of the importance of adhering to the university's demands for greater entrepreneurship within course documentation. A rolling programme of course review and revalidation also provided NICENT with a unique opportunity to intervene and negotiate for the introduction of the learning outcomes for entrepreneurship into course. In addition the University introduced a new policy on staff promotions that reflected the commitment by senior staff in the University of Ulster to encouraging academic members of staff to engage with the entrepreneurship agenda. As a consequence faculty member's who engaged in pushing the entrepreneurship agenda within his or her faculty, either through teaching, research or new venturing activity, say by establishing a spin-out company, became eligible for promotion to more senior positions within the University. Performance in the arena of Academic Enterprise became a third way for faculty looking for promotion along with quality in teaching and/or research.

Other aspects of the NICENT strategy are:

Graduate entrepreneurship: The postgraduate constituency is probably the most likely one to provide the University with possible spinout ventures. The Centre has lately begun, through the development and presentation of specific programmes in entrepreneurship, focusing in particular on entrepreneurial new venturing, to target members of the postgraduate research constituency within the University. The programme starts with building the awareness of research students as to their entrepreneurial potential and moves to encourage them to consider in how many ways their research might have commercial value. Since starting the programme in 2003 over 150 postgraduate researcher students have undertaken the one-day programme.

25k competition: In addition the Centre is responsible for the management of a regional enterprise competition with financial rewards for winners totalling £25k. . The competition, now in its fifth year, has attracted the entrepreneurial efforts of research staff and students from within the Science, Engineering and Technology faculties within the University. Since 2000 fifty potential new ventures have won through to the final ten of the competition, 10 in each year. Of these fifty over 20%

have continued to develop their business ideas with the help of for example UU Tech at the University of Ulster.

Corporate entrepreneurship/intrapreneurship: The Centre has developed a series of web-based programmes dedicated to challenging students at all levels to consider in how many ways they might be entrepreneurial people, to help them recognise that entrepreneurs are active in many walks of life, as new venturers, within existing businesses and within the societies and communities within which they live. Recognising that over 90% of graduates will seek gainful employment after they complete their studies; the programmes seek to develop the competencies and the willingness of students to make a difference, to take calculated risks, to “have a go”. At the University of Ulster much of this learning is web-based, student centred and designed to encourage greater independent learning. Such an *enterprise for life* agenda does not preclude the possibility of graduates, after some years of employment deciding to pursue a new venturing career at some later date.

As a consequence of the Centre’s efforts since 2000, a total of 4,533 students (3,903 undergraduate and 630 postgraduate), within the faculties of Science, Engineering and Technology, (SET), have undergone an entrepreneurship programme. Each undergraduate student for example has undergone an average of 100 hours of tuition and has been formally assessed. In addition, and as a complement to the efforts of NICENT, the University is active in managing entrepreneurship apprenticeships through a government-sponsored initiative called the “Knowledge Transfer Partnership, (KTP). This programme provides students with an opportunity to undertake a two-year work-based project to resolve particular problems identified within a particular business. The student is supported and guided by both Business and University based mentors. After the two-year period the ideal solution is that the “student” has made him or herself indispensable to the business and secured permanent employment.

The Centre at the University has also developed intensive “new venture boot-camps” for members of the SET faculties as well as graduates of the University, who for different reasons have decided that they want to explore the potential of setting up a new venture based on their experience and/or research. Research Contract staff or those engaged in post-doctoral research have been a particularly fruitful constituency within the University in this regard. Graduates of the University who, because of downsizing in their company have also joined the Centre’s programmes with a view to developing new venture ideas and seeking “spin-in” opportunities.

Interaction with industry: A factor in NICENT’s success to date has been the contribution to its efforts by members of the business practitioner community. The Centre’s Advisory Board is made up of such individuals who bring a much-needed oversight to its endeavours. Members of the Advisory Board regularly contribute to programmes being developed by the Centre. In addition the Centre has utilised its relationships within the UK SEC network and with Babson College to identify programmes to which provide training to members of business community who have declared an interest in and a preparedness to contribute time and effort to the Centre in its efforts to push the entrepreneurship agenda within the SET faculties within the University. As a consequence a cohort of adjunct faculty in entrepreneurship from amongst practitioners has begun to develop on which the Centre can call for support and guidance.

Entrepreneurship spin-offs: NICENT is first and foremost an initiative established to push the agenda for entrepreneurship through curriculum development activity, as stated earlier. Such is the infancy of the whole entrepreneurship development initiative at higher education with Northern Ireland and indeed across the UK for that matter, the raw material to support and increase the incidence of new venture starts from amongst graduates is limited. The GEM report for Northern Ireland in 2004 for example pointed out that only 5% of the NI population was engaged in entrepreneurial new venturing. NI was placed 9th out of the 12 UK regions in the entrepreneurship league table. Women were identified as being one third as likely to engage in entrepreneurial new venturing as men and "necessity entrepreneurship" in NI emerged as the highest of all the UK regions for both men and women. Fear of debt, lack of finance and fear of failure were identified as key influencers on attitudes to entrepreneurial new venturing.

The Centre through its efforts since 2000 has sought to build the awareness of and engagement in entrepreneurship of both students, at all levels and staff. While the Centre works to push more and more students and staff into the entrepreneurial pipeline others within the University are responsible for the job of converting and supporting emerging from the pipeline with a determination to set up an entrepreneurial new venture. The primary agent for this activity within the University is the Office of Innovation and Enterprise, (OIE). A part of this Office is "UU Tech", a company in its own right dedicated to accommodating and supporting University spinout activity. Another agent within the University is NIBEC, formed to explore the commercialisation potential of the specific research being undertaken by a number of dedicated individuals in the area of engineering technology

3.3 The Saxon case

A recent survey shows that the Netherlands lacks behind when it comes to starting a company; starting a company from an educational situation scores even worse. It is against this background the Ministry of Education and the Ministry of Economic Affairs made "stimulating entrepreneurship", especially via education, a policy item in 2005. The fact that "knowledge-intensive" starters receive special attention within this policy can be explained from the fact that The Netherlands wants to improve its results as a knowledge-producing country (Lisbon Agenda). That is why there must be more innovative starters from universities and universities of applied sciences (UAS).

Competence-based UAS, an historical perspective. In the mid-nineties of the previous century the first experiments were carried out with competence-based education, a process that ran parallel with developments towards an "I"-centered society. In the preceding decade international trade and industry had started employing staff not only on the basis of diplomas but also on the basis of being able/being willing/daring to. Staff must be competent to carry out their tasks. Competence-based thinking starts from the assumption that the "I", as a holistically functioning and learning being, employs his knowledge, skills and attitude situationally successfully in an integral way, while reflecting on the process and the results and translating these reflections into continually changing and hopefully improving competences. Successful behaviour contains clusters of mutually and simultaneously influencing competences. This interwovenness contains the burning question of the

reliability and validity of the assessment of the competences. (Onderwijsraad, 2002), preferably in a real-life relevant context. Competence-based education acquires its concrete translation by creating a rich learning-environment in the form of projects, thematic sessions, dialogue-meetings, meetings with experts, cooperative learning, and assessment centres etc. Showing development in the ability to learn, with the help of a large variety of assessment forms, is an essential characteristic of competence-based education. The assessment of the products of acting in this way offers a good starting point to create evaluations of competences and to express them in values (credits, salary, promotion, compliments etc.)

User-oriented learning. In the slipstream of developments in competence-thinking in trade and industry and the numerous publications from that time, such as publications about “Recognizing qualifications acquired’ (Klarus, 1993) and “Learning in the workplace’ (Onstenk 1997) the national working-group Cooperative Learning of the UAS-Council has put competence-based thinking and competence-based organising on the UAS-map (“Handbook cooperative higher education, building-blocks for quality”, 1998). These and other signals were in themselves tangible indications that a new reality in learning, working and assessing was making its way into daily UAS practice. While at the end of the nineties professional education is cautiously embracing competence-based thinking, international trade and industry is wrestling with the transition from supply-driven to demand-driven production. And, not to be forgotten, wrestling with the consequences of globalisation. Your employer is in another part of the world! Mergers and reorganisations take place in rapid succession. Company changes, such as Business Process Redesign (BPR), core-business thinking, lean and mean producing besiege companies. All these processes are strongly influenced by the incredible modernisation and affordability of ICT-technology. Rapidly changing demands by consumers must be dealt with adequately. Technology push and market demand are changing places all the time. The demand for a knowledge-based economy has been born. The demand for a new kind of employee and for a new kind of entrepreneur is growing. Supply-driven traditional education quickly loses touch with the acceleration in society in its demand for a new employee.

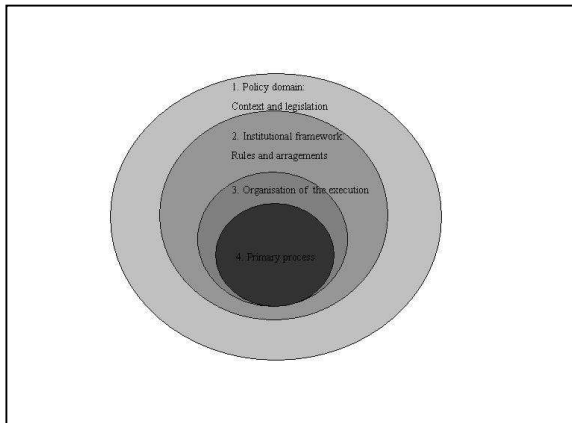
Business Process redesign	
Trade and Industry old style <ul style="list-style-type: none"> ➤ Supply-driven ➤ Aimed at function/profession ➤ Mass production ➤ Employees on fixed contract ➤ Producing for stocks ➤ Markets ➤ Static production design ➤ Competition ➤ Teaching organisation 	Trade and Industry new style <ul style="list-style-type: none"> ➤ Demand-driven ➤ Aimed at learning-process ➤ Production of small series ➤ Flexible employees/employers ➤ Just-in-time production ➤ Customers / relations ➤ Dynamic production design ➤ Cooperation ➤ Learning organisation
Education Process Redesign	
UAS old style <ul style="list-style-type: none"> ➤ Supply-driven ➤ Aimed at function/profession ➤ Mass education ➤ Employees on fixed contract (Labour) market ➤ Static curriculum design ➤ Competition ➤ Teaching organisation ➤ Knowledge in stock 	UAS new style <ul style="list-style-type: none"> ➤ Demand-driven ➤ Aimed at learning-process ➤ Individual learning-routes ➤ Flexible employees ➤ Customers / relations ➤ Flexible production design ➤ Cooperation ➤ Learning organisation ➤ Just-in-time education

Developments in real-world trade and industry (fig.1) are reflected in a process of Education Process Redesign (fig.2) in UAS. In 2000 trade and industry (MKB

Nederland) and UAS (HBO Raad), together with representatives of the Ministry of Education and the Department of Trade and Industry, meet and decide on an in-depth investment in a large nation-wide experiment in which all elements of ERP (fig.2) will be given a place and a chance. The design of the curriculum, which had always been owned by the school organisation, was transferred to the owners of the learning-process, the student (being aimed at the Learning-process, individual learning-routes, user-oriented learning).In close cooperation with the work field, being the owner of a rich learning-environment (Kessels, 1998) the student learns to match his personal curriculum and the corporate curriculum (Kessels, 1998; customer relations, cooperation, flexible curriculum design and just-in-time education). This self-directed learning (Ratering and Hafkamp, 2000) is limited by the demands made by the board of examiners on the personal development plan (POP). These UAS demands originate in the Higher Education Act and in the competence profiles of the education in question. In the large nation-wide experiment “ Vouchers in user-oriented cooperative learning” an important place was given to the teacher, in addition to the central role by the student. (Geerligs-Smulders 2002, 2003, 2004, De Weerd & Van der Velde 2004). The teacher promotes the changes (flexible employers) in the education. This also guaranteed direct access for the students. Representatives of the various lines of business joined them in obtaining access to the companies.

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At a national level there have been extensive experiments with competence-aimed user-oriented learning and working the past 8 years (1996 – 2004) by two social interest groups, viz., MKB Nederland (the Organisation for Small and Medium-sized Companies) and the HBO-Raad (the Council of Universities of Applied Sciences), under the auspices of and financed by Ministry of Education and the Department of Trade and Industry. The outcome of these experiments has influenced the course of policies in higher education and its legislation. The new Higher Education Act will introduce competence-aimed education and user-oriented learning, with learning rights for students as a funding means. The past few decades higher education has left its solitary position in society and has more explicitly positioned itself in an open relation with its (regional) surroundings, which is considered as very desirable and as important for the development towards a knowledge-based economy. A pro-active role of the UAS towards small end medium-sized companies (trade and industry) is an indispensable link in the ‘ open innovation model’(Cherbourg, Haour, 2004). In the ‘open innovation model’ the relation of small and medium- sized companies with institutions for knowledge has been designed in such a way that the chance of improving the innovative power of small and medium-sized companies will greatly increase. So, circulation of knowledge must be used as an intentional political strategy and it must be improved continually. After this, we will deal with developments in competence-aimed education, user-oriented cooperative learning and entrepreneurship.



The learning process in the context of society

The changes in the primary learning process have consequences for the organisation of the execution at the level of institutions, rules and arrangements in society and for the philosophical context and legislation at the policy level. “If in each of the spheres strategic choices are made in-line, the experiment can be successful”. Four themes form the

red thread and the critical success factors in user-oriented learning: ownership, partnership, diversity and ability to learn. User-oriented learning means connecting learning to yourself. As the ownership increases in the governing elements in learning, such as time, speed, talent and language, learning will become more and more connected to yourself. Additional value in learning is created when learners know where to find each other, how to appreciate each other and know how to cooperate as partners in their learning process, on the basis of equality and with great respect for each other’s characteristics (Kuipers, 2004). The particular traits of people produce as many differences. Matching these differences means finding out about the power of it. This diversity is housed in the personal qualities of people, and unlocking them means growth. The ability to learn is required to make the unconscious conscious and, in that way, to make ability grow. The meaning of these four themes plays a part at all levels in the system. In the primary process learning to be an entrepreneur is taking place, the other layers of the system must create the conditions, preferably challenging conditions. How should that be achieved in large institutions of knowledge?

Stimulating entrepreneurship in general

The changing views on learning and working as a consequence of competence-based and user-oriented learning make great demands on the UAS. The changes in the primary learning process are enormous. The big UAS institutions, the result of series of mergers, are sometimes jokingly referred to as learning factories. There is an element of truth in this. Planning the learning, when, but also the speed at which, the form in which and the what, with whom and where, is for the greater part of the study determined by the institution’s teachers and managers. This present image, of the learning factory, does not seem to match the changing views on learning, leave alone the view on stimulating entrepreneurship. For entrepreneurs sense in a surprising, often inimitable way where needs arise with others. Whether it is about a basic need by people for a product or a service, an entrepreneur, being able to satisfy this need at minimal effort, gets a kick out of this, direct feed-back on his good judgement and a great feeling of being useful, not only for himself but also for his immediate surroundings, his family and friends. Having a great feeling of responsibility for the effects of his actions for his direct and immediate surroundings is an integral part of his learning, curious basic attitude.

The surroundings (market, competition), not the school, dictate the speed, time, the what, the with whom and the how of learning to be an entrepreneur. All these factors have their price, a value, stakes. An entrepreneur plays (learns to play with) and controls these ingredients in his very own way. It is especially this from which being an entrepreneur derives its meaning and from which it offers a perspective on a most meaningful existence.

Being an entrepreneur and learning in higher education. Who is the owner of the ingredients time, speed, language and talent? To what extent is it a serious option that the UAS allows education in general, the student to retain the responsibility for learning to mix the ingredients in their own way, the ingredients that are so extremely important for learning? Are entrepreneurial competences developed in a better way and more quickly as ownership, partnership, diversity and learning ability are taken into account? Entrepreneurial competences like the power of initiative, self-confidence, motivation, creativity, perseverance, willingness to take risks, sense of realism, they will all flourish better in a learning environment with more self-control. In general, the proper or improper match between the institution's way of determining the learning path and the student's own possibility of determining his learning path is reflected in the number of drop-outs, low involvement, wrong choice of study / wrong diploma etc., and a low percentage of starters during and immediately after an education when it comes to stimulating entrepreneurship.

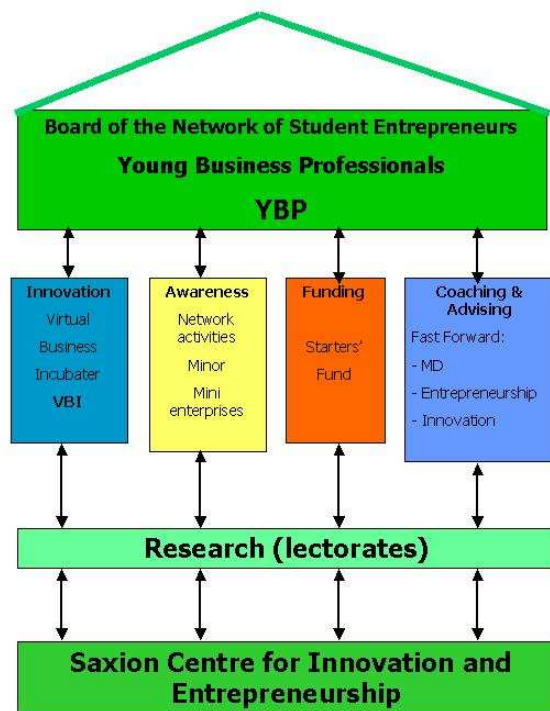
The policy at the level of institutions, Saxion Hogescholen

Saxion Hogescholen has translated the national policy and the experimental experiences in its strategy 2005 – 2009 (level 2 and 3, fig.3). Saxion has opted for the personal learning pathway. By means of this, the student is invited to design his curriculum himself, within the framework of a competence profile and the context of the profession he has chosen. The quality of the personal learning pathway will increase as the student seizes more ownership of his preferred context, with the speed to match, dimension of time and choosing the persons he feels he needs for coaching and assessing him. Entrepreneurship, acquiring income at your own risk and at your own expenses by offering goods or services, is such a choice for a context. Your own enterprise in a preferred context is a powerful, innovative form of the personal learning pathway, a form in which both the personal learning pathway and the link between learning and the needs of the markets (demand-driven) are given shape at the same time. Saxion's well-intended ambition to give entrepreneurship a central position in all professional settings means, seen against the background of the above, a major operation to the very nerves of the system. The personal learning pathway offers a way out. But in order to start and nurture an enterprise more is needed than just a personal learning pathway. A change of culture is needed! The Small Business education of Saxion Hogescholen has passed on ownership of time, speed, talent etc. to the students. This extreme form of user-oriented learning scores significantly higher in the number of starters during and immediately after the study than comparable educations. In 2004 the Saxion University of Applied Sciences set up the Saxion Centre of Innovation and Entrepreneurship (S-CIO). It looks like a one-stop shop for all entrepreneurial activities. Why was it set up? What is the philosophy of the centre? How did it come to do what it is doing? Is

there a policy? Came it out of the blue or was it something inevitable when you look at the global, european and dutch social and economic signals?

The Saxion student entrepreneurs' house

Being an entrepreneur is a mentality. Daring to run risks, being customer-oriented, getting a kick out of realizing an idea, an invention, a discovery, etc. The satisfaction of seeing other people use your service or product. The tension of continuity. Competition, the challenge to stay ahead. The loneliness when making a decision, the options. The art of growing, motivating staff, acquiring new customers. Summarizing, entrepreneurship knows its own habits, let's say culture. It all starts with cooperation. Having good networks gets entrepreneurs on the way, they grow better and go bankrupt less often. They can organize the networking themselves but learning to network is an art. A knowledge institute can do something about this, namely facilitate a network of student entrepreneurs. Young Business Professional is a network of student entrepreneurs. They are leading in the process of developing culture. They negotiate and discuss with the Saxion Board and the province about matters that are relevant to them. Students that have not yet got that far, the budding starters benefit from being seduced into thinking about entrepreneurship. An attractive programme of meetings with entrepreneurs in the form of entrepreneur cafés, visits to companies, workshops, inspiring discussions etc. helps these students in their voyage of discovery to entrepreneurship. A certain category of early starters can borrow money at 0 % interest. In the initial growth stage seed capital is available. Obtaining coaching and training in the subject of entrepreneurship is absolutely necessary, but it should be user-oriented, not course-driven. As a knowledge institute you should know how work user-oriented if you want to coach student entrepreneurs just in time. Surveys show that in the initial growth phase a good incubator works miracles. Many forms of incubators are buildings that have especially been set up and equipped for that target group, virtual incubators and incubators in the form of accelerators in the start and growth phase, combined with fixed business models. Saxion has chosen for a mix of all this in the form of a Virtual Business Incubator. Student entrepreneurs are housed in existing companies that have square metres to spare and that make available this space, including parking places, restaurant, meeting room, secretarial office, IT-provisions etc. to this target group. The virtual skin around all these out-placed student entrepreneurs helps them with both the virtual service needed and their own network, a network of Virtual Business Incubators. The informal role of the incubatorship of the 'mother' company is considered a very powerful form of informal coaching. Organising a structural facility provision in the organisation in the shape of the Saxion Centre for Innovation and Entrepreneurship, manned by motivated staff, is an indispensable condition for the success of the goals in the medium-long term. The Centre is an organisational instrument for the sustainable stimulation of entrepreneurship.



The “house” adapts to every environment, whether it is entrepreneurship in health care or in the engineering world, it has its function everywhere. Structural longitudinal research into the way the various elements work, apart and together, should get the function of a means of reflection when learning, thus reinforcing the learning ability of the inhabitants of the house.

Regional and national importance.

The provincial authorities have drawn up a ‘letter of intent’ with Saxion Hogescholen. In this space

has been created for entrepreneurship and innovation. This administrative move is one to more administrative user-orientation. A possible consequence of this approach may be that at a regional level it will become possible to formulate an independent policy in the field of ‘education and entrepreneurship’. At a national level we see that the Ministry of Education and the Department of Trade and Industry are jointly making a case for this theme. Expert meetings and work visits at home and abroad give ministries a better idea of threats and opportunities.

3.4 Tshwane University of Technology, South Africa

Background: The **National System of Innovation (NIS)**, as outlined in the White Paper on Science and Technology (1997) of the South African government emphasizes the importance of innovation as the underlying engine for modern economic development, and challenges the higher education system to take the lead in human capital development by equipping them with appropriate skills and competencies. The **Research and Development Strategy (2002)** of the Department of Science and Technology is geared to ensure a major increase in support for R&D programmes, of which the various outputs have to lead to an improvement of South Africa’s world competitiveness.

Universities of Technology: The fundamental mission of research universities and their academic units and programmes is the advancement of excellence in the creation, sharing and application of knowledge, typically described in terms of teaching and scholarship, research and public service or outreach. To fulfil this mission requires a distinguished faculty, high level research activities, innovative and engaging teaching-learning processes, supporting technology and quality facilities, capable students, competent faculty and staff, and effective legislative and policy support. Universities of Technology aim to further these missions by placing greater emphasis on innovation and technology transfer than traditional academic institutions. In this sense a University of Technology can be compared to an entrepreneurial university.

Tshwane University of Technology Vision and Mission

Tshwane University of Technology (TUT) was formed in January 2004 through the merger of three former technikons - Technikon Pretoria, Technikon Northern Gauteng, and Technikon Northwest. It has around 40,000 full-time and 15,000 part-time students, and about 2,000 academic staff members in 12 Faculties, and is located at 9 learning sites (Pretoria – 3 Campuses, Soshanguve - 2 Campuses, Ga-Rankuwe, Polokwane, Witbank, and Nelspruit), spread over 3 Provinces (Gauteng, Northwest, and Mpumalanga) of South Africa. Its vision is *'to be a leading higher education institution with an entrepreneurial ethos that promotes knowledge and technology, and provides professional career education of an international standard which is relevant to the needs and aspirations of South Africa's people'*. As TUT places emphasises technological innovation by making knowledge useful through focused applied research and development, a strategy for technological innovation and technology transfer was developed in support of this objective. Specific strategies to are adopted to ensure the implementation of its vision:

- The promotion and establishment of a culture for innovation and technology transfer amongst staff and students of TUT, to be measured by its incorporation into education and R&D programmes, number of patents, licenses, spinout companies and financial benefits;
- The establishment of appropriate innovation and technology transfer strategies, systems, support services, and infrastructure, to be measured by the optimal utilization of tangible intellectual assets and client satisfaction;
- The development and implementation of specific models for establishing knowledge and technology intensive enterprises, incubators, and SME technology centres, to be measured by the financial sustainability of these entities;
- The formulation of the Total Value Chain has to link with the educational programmes and R&D projects.

TUT Regional strategy: Competitive regional clusters: Capital and technology are mobile commodities, but are attracted by immobile factors such as competitive locations (modern infrastructure, strong institutions, specialized skills, clusters of enterprises, providers of business support, etc.), political stability, and absence of crime. To attract trans-national corporations or investments, competitive regional clusters should be developed. The establishment of such clusters in a region will bring benefits such as investment, job opportunities, technology transfer, new skills, and market access and will have a marked effect on regional and technological growth. Growing regional technological maturity will require that the industrial sector move from easy to complex technologies (knowledge intensive) and, within given technologies from 'know-how' to 'know-why'. The raising of a region's levels of technological development, as well as capacity development, can only be effective under the leadership of dynamic institutions specializing in technological education and transfer (technology interchange) which is the strategic direction of TUT.

Establishment and promotion of a TI&TT culture (entrepreneurial culture): Within the TUT environment the concept of entrepreneurship is not always readily accepted by academics, whereas the idea being innovative is more readily understood. For this reason TUT emphasizes being an innovative university rather than being an entrepreneurial university. The establishment and promotion of a culture for TI&TT is

a major task and needs full support from top management. The establishment and promotion of a TI&TT culture includes specific attention to the following list of requirements that need to be implemented as part of developing a culture for TI&TT:

- Awareness creation through road shows on campuses and seminars, sharing successful case studies;
- Appointment of at least one technological innovator / leader / Professor for TI&TT in each Faculty (e.g. from the CSIR, industry, SME);
- Establishing pre-incubator environments as part of culture promotion, which is a costly exercise;
- Developing educational courses / modules for students to create awareness and understanding, through exposure to successful case studies and enabling them to create ideas;
- Launching sabbaticals for staff into industry for R&D and TI&TT;
- Promoting the passion for innovation and introduce flexible management models;
- Promoting a team approach for participation in TI&TT projects;
- Marketing current projects and have an on-line showcase on projects.

Capacity development: A high priority is placed on building staff capacity for TI&TT as serious reservations and concerns have been raised on the current available capacity for TI&TT. This is mainly due to the existing high student: staff ratios, high teaching loads, and involvement in R&D. Capacity development entails the following:

- Launching development programmes for staff and students in which they can experience and have exposure to TI&TT needs that is closely related to R&D activities;
- Recognising the diversity of people's capabilities in the areas of teaching and learning programmes, R&D and TI&TT;
- Identifying role models and leaders for TI&TT and appoint champions and brokers for involvement in the whole process of TI&TT;
- Appointing relevant role models as Professors for TI&TT;
- Building capacity in local communities for TI&TT.

Learner involvement: The strategy to involve undergraduate and postgraduate students during their formal programmes in R&D-related as well as TI&TT activities, such as laboratory work, project work in industry or community development aspects, could create an interest and enthusiasm. This entails the following:

- Integrate components of TI&TT into the curriculae at under- and postgraduate levels;
- Offering a compulsory module on TI&TT at undergraduate level as part of the teaching, learning and technology strategy;
- Exposing students to Science & Technology parks and incubators;
- Exposing learners to TI&TT activities within industry during the work integrated learning period (experiential learning).

Creating an enabling environment:

In order for TUT to be successful in TI&TT, an enabling environment needs to be established. The different institutional support services needs to be flexible and geared to accommodate new types of programmes, projects, and structures such as centres of excellence and incubators.

Requirements that need to be implemented as part of developing an enabling environment:

- Address the barriers of high student:staff ratios and high teaching loads, as well as administrative responsibilities;
- Establish an appropriate support service to facilitate TI&TT and the commercialization of technology process;
- Develop appropriate incentive schemes that will make it attractive for innovators and leaders in TI&TT to join and participate in this initiative;
- Develop appropriate incentive schemes for staff and students contributing to TI&TT;
- Mobilize and initialize the existing available intellectual property (IP) and products to demonstrate opportunities and potential successes;
- Establish pre-incubator environments that are conducive to TI&TT;
- Develop a sound value chain for TI&TT to cover idea to commercialization (cradle-to-grave strategy);
- Establish innovation think tanks with various partners internally and externally;

Partnership network:

Regional collaboration between higher education institutions, strong organizations, specialized skills, clusters of enterprises, providers of business support, need to be established and expanded. In the case of TUT, it has entered into joint TI&TT programmes and projects.

This entails the following requirements:

- Opportunities through national and international initiatives, such as the Innovation Fund (DST), THRIP (DTI), IFCO, GODISA, NEPAD, EU 6th and 7th Framework need to be explored and included into strategies;
- A team approach is needed for successful TI&TT, involving the different expertise needed both from within and outside TUT;
- Community involvement needs to be continuously expanded with a clear focus on a number of areas or themes;
- Establish partnerships with other higher education institutions, science councils, government and industry to optimally utilize opportunities and resources.

Management of TI&TT at TUT:

Toward the end of 2005, TUT made a strategic change in the management of R&D and TI&TT. Previously there were separate structures for managing these two functions, but from the start of 2006, TUT established a single strategy, and structures to manage the two functions, and has established a Central Research and Innovation Committee (CRIC) under the leadership of the DVC (Research, Innovation and Partnerships). Similar Faculty Research and Innovation Committees were also established. The actual management of R&D and TI&TT has been delegated to the deans of the different Faculties, under supervision of the DVC (Academic) in their line of reporting. As from the beginning of 2006, R&D and TI&TT will be referred to as Research and Innovation (R&I). The motivation for this major strategic change, is intended to support a smoother transition of research into the innovation chain for successful commercialisation of university technology.

Office for Innovation and Technology Transfer (OITT):

TUT currently has an administrative support service in the form of an Office for Innovation and Technology Transfer (OITT). The OITT is linked to the Directorate R&I. The tasks of the Office include the following:

- Provide consultancy, advice and support services on TI&TT matters;
- Suggest systems for the management of IP assets of TUT;
- Contribute to the promotion of an institutional culture for TI&TT;
- Contribute towards human potential development for TI&TT;
- Support the establishment of technology pre-incubators and incubators;
- Assist staff and students with technology-based enterprise development; and
- Assist to build international linkages in innovation and technology transfer.

The OITT aims to provide the following services:

- Assistance with identification and formal disclosure of Intellectual Property, technology assessment and evaluation and subsequent Patent registrations;
- Assistance with Business Plan development;
- Coordination of the ‘Seed Fund’ for Innovation and Technology Transfer;
- Coordination of the TUT Intellectual Property policy;
- Advisory services on matters pertaining to Intellectual Property; and
- Its subsequent transfer to Industry partners by licensing and royalty agreements;
- Coordinating the institutional part of the Innovation Fund’s National Innovation Competition (NIC);
- Assist with the monitoring licensing and royalty agreements; and
- Assist with the collection and equitable disbursement of these royalty funds due to TUT.

TUT has additional support structures and centres that form an integral part of the network and challenges for the expansion of TI&TT initiatives, including: Assist with the monitoring licensing and royalty agreements; and

- On-campus pre-incubator environments;
- The UNESCO Chair in Technological Entrepreneurship;
- Centres for Entrepreneurship at various campuses.

The UNESCO Chair in Technological Entrepreneurship: Around 1997 the National Research Foundation (NRF) took a strategic decision to venture into entrepreneurship training to support a climate for development of new Small, Medium and Micro Enterprises (SMME’s). Three Chairs (Professorship) in Entrepreneurship, were established, one of which, the UNESCO Chair in Technological Entrepreneurship, is located at TUT. This decision was driven by recognition that higher education in South Africa, as a major source of developing the leaders of the future, is challenged to focus research and training activities to produce people with skills, vision and drive which are appropriate to generating socio-economic growth and development. More specifically a challenge for higher education is to contribute to the promotion and development of S&T-based enterprises/activities, with a special focus on advancing S&T-based SMME's. It was envisaged that institutions participating in this initiative would have offices to assist researchers with commercialisation, with the development of business plans and with linkages to possible sources of venture capital funding. An agreement was reached with the University of Twente, The Netherlands, which would enable TUT to benefit from the experience gained by the European partner university

over the 30 years in which they had been practised entrepreneurship training. The participation of South African businesses in the initiative was considered to be of key importance in ensuring that the quality and relevance of the initiative is in line with local and international market requirements. In mid-2005, the TUT Chair in Technological Entrepreneurship became the UNESCO Chair in Technological Entrepreneurship, with the signing of an agreement with UNESCO. Objective of the UNESCO Chair:

- Promote a culture of technological entrepreneurship for TUT at all graduate levels, and in the surrounding industrial and commercial community;
- Mentor and advise on strategic and operational business plan and curriculum development;
- Initiate and manage education programs and initiatives on entrepreneurship;
- Manage innovation and technology transfer activities with specific focus on Sub-Saharan Africa, by establishing suitable infrastructure and support for these activities;
- Advancing co-operation between business, academia, government and foreign expertise in the development of an entrepreneurial-minded workforce in South Africa;
- Establish and operate technology and business incubators, and assist staff and students to establish S&T-based enterprises that generate wealth and job opportunities;
- Supervise research assistants and support staff.

Research & innovation focus	
Automotive component & systems manufacturing	Information and communication technology
Chemical separations and spectrometry	Intervention technologies in Health Sciences
Communication dynamics in South African performance	Materials processing and utilization
Conservation, wildlife and ecotourism management	Mathematical Technology
Computer aided design in development	Pollution and waste management
Electrical and electronics systems and technology	Responsible tourism, hospitality and leisure
Entrepreneurship and innovation	Sustainable built environments
Environmental and governmental accountability for Africa	Sustainable livelihoods and poverty alleviation
Food technology and biotechnology	Political economy of innovation and local development

Initiatives	
CITPROD - Centre for IT Product Development	Research Chairs appointed in all Faculties
INCENTIF - Technology Incubator linked to F'SATIE (French – South Africa Technology Institute for Electronics)	Design Team Service Centre
SME Technology Centre	Centre for Polymer Technology
SME Technology Centre	Platinum Centre - Design and technology centre for platinum jewellery
Chair in Technological Entrepreneurship	Centre for Tissue Engineering
Chair in Automotive Engineering	Centre for Tissue Engineering

Support structures at TUT			
CITPROD - Centre for IT Product Development	TEC Centre (Soshanguve Campus) – EU funded TABEISA programme	Technology Enterprise Centre (Soshanguve Campus)	Institute for Technology Innovation (Automotive) (Soshanguve Campus)
Office for Innovation and Technology Transfer	Entrepreneurship Development Centre (Polokwane Campus)	Tshumisano Technology Stations in Electronics (Pretoria Campus), Chemicals (Ga-Rankuwa Campus) and Tooling	Automotive Technology Incubator

		(Soshanguve Campus).	
Centre for Entrepreneurship (Pretoria Campus)	SME Technology Centre (Ga-Rankuwa Campus)	Mechatronics Automotive Technology Centre	AIDC Tooling Incubator (Rosslyn automotive supplier park)

4. Comparison of the Cases & Conclusions

All cases are similar in that via all centres entrepreneurship is stimulated in the wider academic community

All institutions have similar tasks: Nikos, Nicent, S-CIO and the Chair in Technological Entrepreneurship (CTE) have similar tasks in pushing the entrepreneurship agenda in their universities and work with students from all scientific backgrounds in their programmes. The specific target groups of students depend on the type of university and the way the centres are embedded in their universities.

All cases are different: Twente and Ulster are universities, while Tshwane is a technical university originating from three Technicons (“polytechnics”) and Saxion is a university of applied science (“polytechnic”). In Twente and Tshwane the entrepreneurship activities are carried out by academic departments, in Ulster and Saxion by administrative departments.

All universities of our case studies have adopted “entrepreneurship” as a policy item. All four universities have entrepreneurship as one of the most important policy items of the university. All universities plant and want to play a role in its (regional) context.

All institutions are embedded in a larger network of entrepreneurship activities in the university: Next to the centres that we describe in our case studies there are other units (academic and non-academic) in all universities to deal with the wider portfolio of entrepreneurial activities.

Activities carried out by the Centres:

	TWEN	ULST	SAXI	TSHW
Entrepreneurship: graduates & students	Yes	Yes	Yes	Unknown
Entrepreneurship: research spin-off	No	No	No	Unknown
Corporate entrepreneurship	No	No	Yes	Unknown
Intrapreneurship	Yes	Yes	Yes	Yes
Interaction with Industry	No	No	Yes	Unknown

Activities carried out by the Universities:

	TWEN	ULST	SAXI	TSHW
Entrepreneurship: graduates & students	Yes	Yes	Starting	Starting
Entrepreneurship: research spin-off	Yes	Yes	Unkown	Unknown
Corporate entrepreneurship	Yes	Yes	Yes	Yes
Intrapreneurship	Yes	Yes	Yes	Yes
Interaction with Industry	Yes	Yes	Yes	Yes

5. References

[to be filled out later]