ABSTRACT: There are several key external challenges to be mastered in the transition from the traditional university towards entrepreneurial university which are transformed into internal challenges. Unlike the business schools the management structures and environment of an university of technology may be often very cautious about implementation of the entrepreneurial elements in the technology and science study and research programmes. Often they have to be confronted by the requirements of students and businesses for more entrepreneurship education and skills in the university graduate profiles to accept this. This paper examines fundamental challenges of implementation of the concept of entrepreneurial university in two European universities of technology with direct central public funding which gradually covers less and less its future development needs. The current status of transformation towards an entrepreneurial university at the Slovak University of Technology in Bratislava compared to the University of Technology Ilmenau is described, analyzed and the next steps put forward.

Key words: entrepreneurial university, entrepreneurship education, entrepreneurship

1. INTRODUCTION

The European universities appear to be in the process of transition from teaching institutions to research and entrepreneurial organisations. This move is caused mostly by external factors, e.g. growing number of students, gradual reduction of central public funding of university operation and development, university search for complementary/alternative financing, issues of employability of university graduates vs. massification of university education, demand for development of entrepreneurial skills of graduates on the part of their employers or by the student societie, internationalization of universities vs. their regional/local engagement. These external pressures turn into the internal challenges to university management and staff [1], e.g. changes in university vision, mission and strategy, leadership and organizational changes within university, new/changed study programmes and curricula up to the reaching/learning methods and outreach activities, pressure upon vs. motivation of academics in favour of efficient industry-academia collaboration, changes in qualification and skills profiles of university teachers and researchers, pressure to obtain complementary external financing trough commercialization of knowledge and technology transfer, etc.

2. ENTREPRENEURIAL UNIVERSITY

The concept of entrepreneurial university was first introduced in 1998 Burton R. Clark, who used the term as a characteristic of social systems [2]. In the period from 1998 to 2008 a lot of scientists have tried to explain the phenomenon of entrepreneurial universities in theoretical models [3],[4],[5] or in empirical studies [6],[7],[8],[9]. Today this type of university is a place where knowledge-based entrepreneurship has emerged as a driving force for economic growth, employment creation and competitiveness [5]. An entrepreneurial university could be defined as a survivor of competitive environments with a common strategy oriented to being the best in all its activities, and to creative in establishing links between education and research [6]. Based on the experience from USA, Asia and Europe [11] universities are considered to be entrepreneurial when:

a) their strategy
• considers the diminishing public funding by the state in time and active search for complementary income generation;
• accepts the combination of the scholarship of relevance and integration of knowledge and a sharing with, and learning from, the wider community;
• counts with maximum potential for commercialisation of their ideas to create value in society without considering this as a significant threat to academic values;

b) their organization culture and structure
• provides a stronger central steer to entrepreneurial endeavour while building on the natural autonomy of individual academics;
• part of an ‘organisational learning’ strategy is an active engagement with the wider stakeholder community;
• promotes the creation of, incubators, technology transfer offices and patent protection arrangements, science parks powerful means to opening up and integrating into the university activity-based relationships with the relevant stakeholders in both a formal and informal institutional manner;
• encourages a wide range of interdisciplinary activities with the creation of interdisciplinary departments and R&D centres;
• accept wider responsibility for the personal development of students and staff, particularly with respect to future, social, career and lifelong learning experiences;
• consider recruitment of entrepreneurial staff and appoint entrepreneurial leaders as change agents and academic post will be opened up to a wider constituency via adjunct and visiting appointments;
• build rewards systems well beyond those relating to research, publication and teaching criteria;
ensure that the concept of entrepreneurship education is embedded in all the faculties, owned by key staff and integrated into the curricula. All in all an entrepreneurial university keeps to the purpose of training future entrepreneurs who will build their own business and developing the entrepreneurship of students and conducting their activities in an entrepreneurial manner (organizing business incubators, technology parks, etc.). For the analysis of the universities of technology we followed the Resource-Based View Theory as a theoretical framework. According to this theory organizations are considered as unique sets of resources and capabilities of different nature enabling them to achieve a competitive advantage compared to their present or future competitors. Capability is regarded as a firm-specific, organizationally embedded and non-transferable resource whose purpose is to improve the productivity of the other resources possessed by the firm.

3. ENTREPRENEURSHIP EDUCATION AT THE SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA

3.1. Mission and strategy of the Slovak University of Technology and its faculties

STU founded in 1937 has been the biggest university of technology in Slovakia with about 18.000 students studying every year. At present, the university consists of seven faculties offering 329 accredited BSc., MSc. and PhD study programmes compatible with the European Credit Transfer System (ECTS), enabling mutual mobility of students within the EU as well as within the larger European Economic Area. As stated in its mission the STU has maintained the profile of research-oriented university and ranks among the three best Slovak universities. The current STU mission does not contain any specific objectives in the field of entrepreneurship education and skills. However, it does contain “development of system of valorization of results of creative activities at the STU using protection and utilization of intellectual property rights as tools of the STU policy”, and setting-up and developing incubator companies with the technology focus. Set off of new start-up companies will be further supported through recruitment and promotion activities of the University Technology Incubator.

3.2. Organisational units within the STU supporting entrepreneurship

The University Technology Incubator has supported set-up of some 30 technology start-ups up till now, entrepreneurship trainings and contests since 2005. It has collaborated closely with some STU faculties and the STU Institute of Management and functioned as an Information and Contact Point (Inno Info) of the Slovak Institute of Industrial Property as well. Since March 2008 the STU Institute of Management integrates teaching and research resources in economics and management disciplines for the STU faculties; guarantees study programmes in management, especially the interdisciplinary programmes and university-wide programmes, and creates better conditions for entrepreneurship education on an interdisciplinary basis within the current and future STU study programmes. It takes on some educational and promotional functions of prospective Centre for Entrepreneurship and Innovation. The STU Scientific a daughter company of the STU has been operating since 2008. Its aim is valorisation of the STU research results in industry, e.g. by supporting creation of spinout companies (4 sofar), rendering of business, financial and ICT consulting and educational services. The Institute of Space Planning and Architecture is also functioning within this company transferring its research results in the urban planning practice. Since 2010 the TRANSFERTECH centre has been operating within the STU in order to support transfer of knowledge and R&D results of faculties to industry. It also provides know-how in the field of IPR protection, administers the database of STU research facilities and helps searching for partners / investors from industry and enterprise. It collaborates with the Technology Transfer Centre of the University of Oxford – ISIS Innovation Ltd. in implementation of its know-how in technology transfer, licencing and spin-off creation in the relations of STU to Slovak industry.

3.3. Entrepreneurship education and outreach activities at the STU

Analysis of the business education at STU with respect to degrees, curricula, courses, teaching methods and extra-curricula activities confirms that in the education of Economics & Management courses prevails the traditional approach to teaching business courses and programmes. Business education in an integral manner from a general entrepreneurial point of view is still not prevailing at STU. However, some entrepreneurial elements may be observed in the content, focus and teaching methods used in some courses on SME Entrepreneurship, IT Entrepreneurship and Economics and Management of Construction Businesses. Also, currently there is a limited offer of entrepreneurship related extracurricular activities by departments/institutes of the STU faculties except for the annual organization of contests for “student scientific papers” with some limited participation regarding entrepreneurship related topics. Student associations in the faculties however usually support some entrepreneurship related events organized by external bodies (banks or companies) during the year, e.g. with regard to programming contests, robot construction contests and business plan contests. The most appealing entrepreneurial elements may be found in the study programmes of Institute of Management and Faculty of Materials Science and Technology. This faculty has also its own Centre for Technology Transfer. Outreach activities on entrepreneurship mainly consist of relations to alumni and other stakeholders. Since 2007 STU as well as its individual faculties have established Industrial Councils as advisory bodies to the rector and deans on collaboration of the STU and businesses. Members of council are prominent faculty representatives and representatives of companies close to the industrial focus of the specific faculty. They meet on a quarterly or a semiannual basis and discuss the strategic issues of faculty education and R&D. The STU faculties have been maintaining their specific alumni associations following similar goals extended by student traineeships since the year 2000. An external outreach impulse for change into the “entrepreneurial direction” might stem from organizational interface between the STU and regional and municipal authorities: However, they should focus more on entrepreneurship support in the Bratislava and Trnava Regions and assign sufficient funds for this purpose. The Institute of Management has been acting as a host and coordinator of events fostering entrepreneurial mindset of the young within the worldwide initiative Global Entrepreneurship Week since its inception in 2009. In cooperation with partners in Slovakia and abroad there were organized many events, contests of business ideas, business plan contests, inspiring meetings with entrepreneurs, business angels and investors, lectures and seminars on efficient entrepreneurship methods and tools.
3.4. Types and sources of entrepreneurship education funding and budget allocation

The operation of STU faculties and their educational activities fully depend on government funding allocated to universities via the Slovak Ministry of Education by criteria considering student numbers in study programmes, faculty qualification structure and volume and quality of publication outputs. This funding covers some 70% of the STU needs and therefore STU has to use its own sources (about 8%) and the rest has to be covered from business contracts, foreign and domestic grants. Therefore the STU clearly states in its strategy that all its faculties, institutes and their units should take best efforts to acquire further funding from national and international contests for grant programmes and from contractual educational or R&D work for third parties to secure the sufficient financial coverage of their educational and R&D activities. Building of Centres of Excellence is based on the EU structural funding. The current legislation does not allow for any specific funding criterion dedicated to entrepreneurship education. However, § 18 of this Act allows for entrepreneurial activity of the HEI if it is related to its statutory activities and does not end up with loss.

4. ENTREPRENEURSHIP EDUCATION AT ILMENAU UNIVERSITY OF TECHNOLOGY

4.1. Mission and strategy of the University of Technology Ilmenau

The history of the education in science and technology in Ilmenau dates back to the year of 1893 (Thuringisches Technikum founded by Eduard Jentzen) focusing on electrical engineering and later also mechanical engineering as Engineering School Ilmenau. The current Ilmenau University of Technology (TUI) has been functioning since 1992. It has five faculties, four university-wide institutes (e.g. Institute of Car Manufacturing and Production Technology or Institute for Media and Mobile Communication), TU Ilmenau International School and several university support institutions (e.g. university library, computing centre or patent centre PATON). Ilmenau University of Technology is a leading entity in selected competence areas of basic and applied research on a national as well as an international scale. Strategic appointment of university chairs and targeted development of the scientific infrastructure as well as the technological environment have established high competences in broad activities in its teaching and research activities. The main research areas are “Microsystems and Nanosystems” and “Intelligent Systems Engineering and IT” with six research clusters. There are six research-training groups with about 110 early stage researchers in structured PhD programmes working at the University. There are currently more than 300 co-operation contracts with the industry ranging from the services and sponsored industrial research to basic or application-specific joint collaboration projects with enterprises. Several German enterprises are currently involved in 12 cross-university projects sponsored by the EU, in which the university creates a basis for these enterprises in order to participate in research competencies and find new business contacts on the European as well as an international scale.

4.2. Organisational units within the TUI supporting entrepreneurship

The Faculty of Economic Sciences (WiWi) at the Ilmenau University of Technology (TUI) comprises 4 institutes out of which Institute for Business Management (BWL, especially Dept. of Business Management and Organization) and Institute of Business Informatics (WI) offer in their courses educational content related to entrepreneurship. Their course Business Start Up and Management offering the basic entrepreneurial knowledge and competences open to all TUI students and employees. Passing this course is linked with Certificate on Business Start Up and Management for those considering the entrepreneurship career. The entrepreneurial mindset among students is also supported by the Dept. of Research Services and Technology Transfer being together with the Dept. of Business Management and Organization and other organizations the founders of the Entrepreneurship Initiative aufakt. It is supported by the Association Grunderforum Ilmenau e.V. (started in February 2011) and by the Dept. of Research Services and Technology Transfer. Members of the aufakt are the TUI students and professors as well as external persons interested in creation of positive entrepreneurship climate at the TUI and in the region. The main activities of the aufakt are: (a) make the TUI students sensitive in favour of entrepreneurship, (b) counselling and support of the start-ups in their pre-seed, seed and development stage and (c) start up networking support (with partners, investors, potential customers). The promotion of the activities of aufakt and Grunderforum Ilmenau is carried out via the website www.aufakt.org. The University Branch of the Steinbeis Technology Transfer Network financed by the Steinbeis Foundation has been focusing on research in quality assurance, image processing and mechatronics. The Branch of the State Patent Centre of Free State of Thuringia (PATON) provides access to patent and other IPR databases, patent searches and consulting and patent registration services. It participates in the SIGNO-KMU Project aiming at support of SMEs in protecting their IPR and know-how transfer. The Head of PATON gives lectures on IPR, patents and patent search open for any interested public each semester. Besides the TUI makes optimal use of the proximity of some regional institutions for entrepreneurship support: Technology and Start Up Centre Ilmenau (TGZ Ilmenau) situated at the borders of the university campus, and the Thuringian Start Up Network EXIST. The Technology and Start Up Centre Ilmenau (TGZ Ilmenau) has been functioning as a venue for innovative technology start up companies in the region Ilmenau – Arnstadt since 1991. It is a regional tool of business and technology support in the TECHNOLOGY REGION ILMENAU ARNSTADT. Its proximity to the TUI should draw from the R&D competencies, human capital and interdisciplinary work at the university, know-how and technology transfer. The TGZ Ilmenau has no specific technology focus and offers besides office space also premises of industrial operation. The Thuringian Start Up Network EXIST is a partnership between the high education institutions (HEI) in Ilmenau, Jena, Schmalkalden and Weimar, Technology and StartUp Centres and Industry and Commerce Chambers (IHK) in the Free State of Thuringia led by the IHK East Thuringia in Gera. The EXIST provides education for starting up businesses, stipends for startups at HEIs and universities (EXIST-Grunderstipendium), counselling and consulting on business ideas, support in business financing, networking with German and foreign business partners, organization of contests of business ideas and business plans.

4.3. Entrepreneurship education and outreach activities at the TUI

The entrepreneurship education at the TUI is not concentrated in a study programme but rather dispersed in several study
programmes, courses and their elements, e.g. Dept. of Media Management provides to the students of Media Management lecture „The Art of Entrepreneurship and Communication“ and media projects related to entrepreneurial issues in PR and media business. The Dept. of Business Management provides students of WiWi Faculty lecture on Strategic Management & Entrepreneurship, and proseminar on the Development of Company Business Plan. Students may also opt for bachelor or master theses in the field of entrepreneurship. This department also offers a course Business Start Up and Management open to all TUI students and employees interested in entrepreneurship and potential entrepreneurial career. They can learn the fundamental competences required for starting up a business successfully and gain a specific certificate on passing this course. Every year 20 to 30 students are awarded these entrepreneurship certificates.

4.4. Types and sources of entrepreneurship funding and resource allocation

Entrepreneurship funding may rely on grants for projects related to research and entrepreneurship. One of them is a grant VIP (Validation of Innovation Potential of Scientific Research) supported by the Federal Ministry for Education and Research (BMBF) as a part of the Hightech-Strategy of the federal government. It should be a bridge between academic research and industry practice in assisting the scientists and researchers from universities and R&D institutions to validate the applicability of their research results, innovative products, processes and services. The EXIST- Gruenderstipendium (Start-up stipend) co-financed by the European Social Fund is aimed to assist university students, graduates and scientists to turn their business idea into a business plan of a potential new company, especially if it will be a technology or science-oriented company. The project IP - SIGNO (Protection of ideas for business application) is financed via the branch of PATON (Federal Ministry of Economy and Technology - BMWi) supporting the inventors in universities and SMEs in legal protection of their intellectual property rights. Within the Thuringia there are offered several financing concepts based on combination of equity and debt (banks, VC, business angels).

5. CONCLUSION

- The key challenge to overcome is the work inertia and doubts on entrepreneurship among the university management and staff predominantly involved in the teaching and research activities of the faculties/institutes that should spread and support the entrepreneurship mindset leading to intrapreneurship or entrepreneurship activities of students, graduates and staff.
- The next challenge is lack of clear-cut university-wide strategy for entrepreneurship education within an university supported by a central organization unit steering the university education and outreach activities focused on entrepreneurship.
- For both the STU and TUI there is an urgent need to restructure the current teaching of dispersed courses of economy and management at STU into an “Entrepreneurship Education Module”, especially within the MSc. study programmes utilizing experience of study programmes of universities of technology abroad as benchmarks. Optimal conditions for realization of such an intention may be created by an efficient transformation of the STU Institute of Management into a Faculty of Entrepreneurship and Interdisciplinary Studies teaching Engineering, Economics and Management courses relevant for students developing innovative technologically –oriented entrepreneurship, reinforcement of this the faculty with university teachers with sufficient business experience, and managers experienced in technology transfer and venture capital appear to be important prerequisites for viability of the proposed schemes and structures.
- In order to motivate university teachers, researchers and students in favour of commercialization of their work results, a transparent IPR policy and clear rules on division of commercialization revenues of should be implemented and promoted within the university faculties and and accepted by their organizational units.
- The experience of the TUI shows that a well organized collaboration with regional and municipal authorities and industrial partners based on state or regional entrepreneurship support programmes and infrastructure can substantially accelerate the development of entrepreneurial mindset and action among the university students and in the region. This comprehensive pattern of collaboration may assist in alleviating some financing issues related to this collaboration.
- The experience of the STU proves the catalyzing effect of the outreach activities in favour of entrepreneurship upon students, especially via university participation in the worldwide initiative Global Entrepreneurship Week. It also improves the image of the university towards the interested public and its partners in these activities.

6. REFERENCES
