UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER`S THESIS

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ENTREPRENEURSHIP IN HIGHER EDUCATION IN THE FIELDS OF NON-BUSINESS PROGRAMMES

Ljubljana, October 2015 DAMJANA PANGERČIČ

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The undersigned Damjana PANGERČIČ, a student at the University of Ljubljana, Faculty of Economics (hereafter: FELU), declare that I am the author of the master's thesis entitled Entrepreneurship in higher education within non-business studies, written under supervision of Vlado DIMOVSKI, PhD., Full Professor.

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INTRODUCTION

Past two decades have recorded an increased interest of academic studies and public policy initiatives focused on higher education institutions' (hereinafter: HEIs) influence on the regional and national economy. This interest has been growing parallel with the development of the "knowledge economy" and the recognition that comparative advantage increasingly comes from the commercialization of academic research. Therefore, universities attracted the attention of academia and government policies in both knowledge creation and technology transfer activities (Barakat & Hyclak, 2009, p. 1). Thus, university´s role in economy and society has expanded and has led to the development of the concept of entrepreneurial university which has three missions: teaching, research, and service for the economy through its entrepreneurship activities (Zhou, 2008, p. 110).

The concept of entrepreneurship should not be focused just on university as a whole but also on the development of the enterprising person and entrepreneurial mind set of students (Baker et al., 2013, p. 10). Today, the important role of HEIs, as well as educational institutions in general, in promoting more entrepreneurial attitudes and behaviours is widely recognised (European Commission, 2008a, p. 7). Currently, the EU is not fully exploiting its entrepreneurial potential and it has been widely recognised that **entrepreneurship education** (hereinafter: EE) can help Europe as a whole at transforming its economy and building its future economic and competitive strength (European Commission, 2008b, p. 1). Thus, with the help of EE, the EU needs to stimulate the entrepreneurial mind sets of young people (European Commission, 2008a, p. 7).

The goal of EE in HEIs is the promotion of creativity, innovation and self-employment. Additionally, it is important to emphasize that EE should not be confused with general business and economic studies and should include the following elements (European Commission, 2008a, p. 10):

- developing personal attributes and skills that form the basis of an entrepreneurial mind set and behaviour (creativity, sense of initiative, risk-taking, autonomy, self-confidence, leadership, team spirit, etc.);
- raising the awareness of students about self-employment and entrepreneurship as possible career options;
- working on concrete enterprise projects and activities;
- providing specific business skills and knowledge of how to start a company and run it successfully.

Currently, the majority of entrepreneurship courses are offered in business and economic studies, but it is important to systematically introduce them also into technical, scientific and creative studies as it is more likely that innovative and viable business ideas will arise from there. The goal of EE within these studies is to develop the skills necessary for fully exploiting innovation and knowledge transfer activities (European Commission, 2008a, pp. 7, 11).

Paying attention to EE is important since entrepreneurship is a competence for all (European Commission, 2008a, p. 11), supporting individuals in the workplace and enabling them to seize opportunities. At the same time, it is a foundation for more specific skills and knowledge needed by those establishing or contributing to social or commercial activity. Last but not least, it helps in everyday lives at home and in society (European Communities, 2007, p. 11).

The purpose of the master´s thesis is to examine the literature in the field of EE and entrepreneurial university to be able to see which factors influence entrepreneurial personality of students. Namely, entrepreneurial knowledge and skills are of particular importance for students to be successful at work, either as employees or entrepreneurs, due to changed economy and society demanding different personal attributes than in the past. In the empirical part of the thesis I analyse which factors of EE and entrepreneurial university influencing the entrepreneurial personality of students are present at the Graz University of Technology (hereinafter: TU Graz) and to what extent are they developed.

The objective of the master's thesis is, based on theoretical background and qualitative research, to analyse factors of EE and entrepreneurial university which influence entrepreneurial personality of students at TU Graz. These factors are the following: entrepreneurial curricula, interdisciplinarity of studies, internationalization of the university and co-operation of university with industry, non-university research establishments, clusters and associations. With the help of qualitative research I provide findings on the intensity of development of these factors at TU Graz.

This thesis is divided into a theoretical part and empirical part. The first part of the thesis presents the theoretical background of the EE. First chapter of theoretical part starts with defining EE and its placement into the broader context and the context of higher education (hereinafter: HE). Further on, I present entrepreneurial learning outcomes, teaching methods, and talk about educators and entrepreneurship chairs. Next, I present high-quality entrepreneurship curricula and afterwards focus on barriers to EE. The end of the section is dedicated to the presentation of the concept of **entrepreneurial university** and development of entrepreneurial universities in Europe. The second chapter describes EE in Europe. Specifically, I explore the role of entrepreneurship and EE in the EU and present EU measures supporting development of EE. This is followed by a description of the most extensive activities in the area of EE in Europe. I.e. I present the contribution of the EU Erasmus+ programme to the academic-business links which form an important part of EE. Furthermore, I present an EU institution, the European Institute of Innovation and Technology, which created a new, highly entrepreneurial-oriented European HE programme. Before I start with the third chapter, I talk about an organization fostering development of EE in Europe – European Forum for Entrepreneurship Research (hereinafter: EFER). In the third chapter I focus on good practices in delivering EE in the EU by presenting development of EE at the University of Cambridge and Aalto University.

In the empirical part of the thesis I form research questions which are based on four factors of EE and entrepreneurial university influencing the entrepreneurial attributes of students. These factors were determined with the help of literature review in the theoretical part of the thesis and questions read as follows:

1. Are curricula of TU Graz entrepreneurial and what makes them entrepreneurial?
2. How and to what extent do studies at TU Graz show interdisciplinarity?
3. How strongly does TU Graz work on the process of internationalization?
4. In which ways does TU Graz collaborate with industry and is the collaboration strong?

The first chapter of the empirical part includes the design of qualitative research and presentation of TU Graz and four companies which co-operate with the university. This is followed by qualitative data analysis, interpretation of data and analysis of research questions.

1 THEORETICAL BACKGROUND

EE will become an indispensable part of education at all levels. To certain extent it has already been integrated into curricula, but an even more intensive integration is expected in near future. However, in my master's thesis I focus on the development of EE in HEIs with emphasis on its integration into non-business studies. The first chapter defines EE and presents its role in HEIs and the connection it has with the concept of entrepreneurial university.

1.1 Placing the importance of entrepreneurship and entrepreneurial education into the broader context

To be technically excellent has become self-explanatory for today´s graduates within all fields of studies. In addition to knowledge of the subject area students also need to have the ability and confidence to question the status quo, critically evaluate alternatives, act ethically, work effectively as part of a team and be open enough to accept and take the advantage of changes. To develop well-rounded individuals who will cope well with rapidly changing society, educators have to offer them deep, active and reflective learning experience. To be successful in the roles taken in the future (as an employee, a self-employed person and/or a socially active and responsible citizen), today´s students therefore need more entrepreneurial education. Elements of EE should be spread through the whole curricula; it would not be enough to just add a few entrepreneurial classes (Doyle, Buckley & Caroll, 2013, pp. 1-2).

Changes which are already happening within the educational system and in the way of teaching were evoked by many factors: the generation Y currently sitting in the classrooms, the changing financial models for funding universities and the massification and globalization of HE (Doyle et al., 2013, p. 2).

Generation Y refers to people having birth dates between 1982 and 2003 (Doyle et al., 2013, p. 2). Individuals belonging to this generation are viewed as talented, educated, techno-savvy, open-minded and service-oriented. Being socially conscious and volunteer-minded (Martin & Tulgan in Eisner, 2005, p. 6) they wish to have a chance to play meaningful roles at meaningful work that helps others (Generation Y and the Challenge for Organizations, 2003). They strive to make a difference and they measure their success. Lifestyle of the generation Y used to be hectic from the childhood on, often switching between different activities. This has led to the development of their multitasking behaviour which they transferred into the workplace. Their

engagement in a wide variety of extracurricular activities also helped them mastering their social and interpersonal skills (Doyle et al., 2013, p. 2). The description of traits of generation Y tells us that this generation is substantially different from all previous generations. Thus, there is a requirement for different methods and contents of teaching - i.e. curricula with embedded EE which can prepare students for effective functioning in the changed society.

Until recently a very small part of the population took part in tertiary education. In last decades, this has changed in the developed world as higher level education is increasingly seen as a precondition for most careers. With such a substantial increase in the number of students and demographic trends it has become almost impossible for universities and faculties to be wholly funded by the state. These circumstances require greater entrepreneurial response from the institutions seeking additional sources of revenues - for instance with running postgraduate programmes and executive education courses of business schools which are not state-funded (Doyle et al., 2013, pp. 3-5).

Due to the on-going economic crisis, rising unemployment, continued down-sizing of large corporations and stiff global market competition, it is evident that innovation and entrepreneurship are one of the most important answers to the global challenges of the 21st century (Volkmann et. al., 2009, p. 14).

To be able to see the "bigger picture" of the opportunities and challenges arising on the market, young people need to be equipped with skills such as capability of analytical problem solving, innovation and creativity, self-direction and initiative, flexibility and adaptability, critical thinking, and communication and collaboration skills (Autor, Levy, & Murnane, 2007; Boyd & Vozikis, 1994; Cavanagh et al., 2006; Goldin & Katz, 2008; Pink, 2008; Porter, Ketels, & Delgado, 2007; Scherer, Adams, & Wiebe, 1989; Wagner, 2008 in Boyles, 2012, p. 42). Listed characteristics are not only important for people with a desire to become an entrepreneur, but also for people in general acting or working in any field or area. Individuals with entrepreneurial traits are therefore of crucial importance for large companies, the public sector and academia (Volkmann et. al., 2009, p. 14).

Today's employers seeking growth on the market need independent, proactive and innovative young individuals - whom they obviously do not get due to the insufficient adaptation of education system to changed global economic conditions (Boyles, 2012, p. 41). The American Society for Training and Development states that between 10% and 20% of organizations included in the survey acknowledges college graduates are deficient in skills demanded by the society and working environment - namely in leadership, critical thinking and creativity (Casner, Rosenblum & Wright, 2009, pp. 9-11).

Since the development of products has become increasingly demanding and complex and the same holds for the working environment there is a need for new approaches to solve present and future tasks and problems. Meier zu Köcker (in Schultea et al., 2013, pp. 117-118) believes that required competencies have become too broad and individuals are not able to provide all the knowledge, skills and the necessary resources by themselves any more. The complexity of innovations will even further increase and every day it will be more important to work in interdisciplinary fields and in teams.

Generation Y largely entering declining job markets is in an unpleasant situation: it can choose between unemployment, working in SMEs or setting its own business (Thompson in Matlay, 2011, p. 167). Data from the US show that since 1980, Fortune 500 companies have lost more than 5 million jobs, while on the other side more than 34 million new jobs were created (Kuratko, 2005, p. 577). Since large employers are unmistakably in decline, many students see an establishment of their own company as a viable alternative to employment in larger organizations. Encouraging are the data from the United Kingdom showing that in recent years entrepreneurship has become a common career choice for brighter and more enterprising graduates (Westhead & Matlay in Matlay, 2011, p. 167). Still, for a college graduate without significant working experience setting up a business can be a challenging task which can be diminished by an education system providing students with entrepreneurial traits which can be successfully applied both in big and smaller companies (Hermann, Hannon, Cox, & Ternouth, 2008, p. 12).

The importance of entrepreneurship is clearly demonstrated by an American example as, according to some researchers, greater entrepreneurial "vitality" is one of the factors explaining much better performance of the US economy in comparison to European countries (Acs et al. in Iacobucci & Micozzi, 2012, p. 673). In the past several decades, progress in entrepreneurship has been apparent in the US (Volkmann et. al., 2009, p. 18). The first very obvious reason, as indicated by Kuratko (2005, p. 577), is that since 1980 15% of the fastest-growing new companies were responsible for 94% of the net job creation. The second reason is the fact that of the leading 100 US companies the majority did not exist 20-30 years ago in contrast to Europe where many of the leading companies are almost 100 years old (Wilson et al., 2008, pp. 120-121).

The above mentioned different structure of the US economy in comparison to Europe can also be related to the fact that the US are considered pioneers in academic EE with the introduction of the first MBA course "Management of New Enterprises" in 1947 at Harvard Business School (Katz, 2003, p. 286). After this, entrepreneurship-related courses have notably begun rising in the early 1970s, which continued in the 1980s and 1990s up to today (Valkmann, 2004, p. 178) when they are offered by more than 1600 colleges and universities (Kuratko, 2005, p. 577).

Current and future graduates are of essential importance for national growth. Equipped with entrepreneurial knowledge, skills and attitudes, they will be prepared to seize opportunities and to solve problems either when founding a new company or working in private, public or third sector (Hermann et al., 2008, p. 8). Properly educated young people will also be a promising step closer to higher proportion of R&D in national GDP. Europe´s average growth rate has been structurally lower than of our main economic partners, which is, among others, also the result of insufficient innovation activities and R&D investments. Currently, R&D spending in Europe is lower than 2%, compared to 2.6% in the US and 3.4% in Japan. To achieve the planned 3% of R&D in the near future, efficient policies and promotion of innovation are needed, whereby EE should play a vital role (European Commission, 2012b, pp. 8, 11, 13).

Human capital is the one that generates the ideas and its knowledge results in technologies, products and services. To be innovative requires a wide variety of skills and attitudes, especially

to come up with radically new products and services which are often needed to beat the competitors, to fill a niche in the market or convince buyers with a breakthrough innovation. Formal education and therefore also EE are the basis for preparing young people's mind-sets to be able to adapt to the changing nature of innovation (OECD, 2010, p. 9). Since Europe is not able to compete in the global economy based on costs, it can only remain competitive as a knowledge-based society (European Commission, 2012a, p. 21).

1.2 What is entrepreneurship in higher education?

In the past, business and management education was focused on the development of efficient and effective leaders/managers. Mostly employees in bigger corporations were seen as resources which needed to be lead and managed, ensuring at the same time the success on the market. Till 1980s that was sufficient to stay competitive. However, knowledge and skills which were traditionally acquired through such education can today no longer meet the requirements of the changing business and the wider social environment. After 1980s, the interest in the foundation and development of SMEs became apparent, which required new skills and attitude from the founders and employees (Vyakarnam & Hartman, 2011, pp. 38–41).

Therefore, parallel with the need for EE also the need for renewed educational materials and teaching methods occurred. Due to more demanding teaching methods required by EE and the insufficient and too slow adaptation of universities to the new role in the "ecosystem" we are still today witnessing the lack of suitable contents and materials and insufficient usage of new teaching methods.

EE is usually primarily linked with economic and business studies, which is due to the fact that EE is most frequently used in these studies, but the situation has gradually begun to change. Namely, EE has also become accessible to non-business students, although it holds true that this is currently rather a bright exception than the rule (Piperopoulos, 2012, p. 471; European Commission, 2008a, p. 24).

For HEIs, the primary purpose of EE should be to provide students with entrepreneurial capacities and mind sets. It is important to show them the role of entrepreneurship in economy and that being self-employed is one of a more promising career options today. In the past, entrepreneurship has been associated with small businesses with little or no growth aspirations and thus seen as less attractive choice of a career for ambitious graduates. However, the situation in the economy has changed notably and more and more graduates see establishing and leading their own company as an option which correlates very well with their personalities and wishes. By promoting the dynamic, innovative and ambitious side of entrepreneurship within the education process, an even greater and earlier interest for entrepreneurship can be achieved (European Commission, 2008a, pp. 11–12).

Despite the acknowledged positive implications of EE, many academics, especially those in non-business studies, still do not see the wider focus of such education and its urgency for inclusion into the curricula. Both students and the staff need to recognize how important is it to spread innovation, creativity, collaboration and risk-taking skills between disciplines (Hermann,

Hannon, Cox, & Ternouth, 2008, p. 6). Recent studies made in the EU show that EE has a positive impact on the entrepreneurial mind-set of young people. Students participating in entrepreneurial courses and activities get jobs earlier after finishing their studies, establish more companies and are more innovative even when being an employee in a company (European Commission, 2012a, pp. 3, 7).

"Entrepreneurship and a sense of initiative" is also recognized by the EU as one of 8 key competencies for lifelong learning which help its citizens at personal fulfilment, social inclusion, active citizenship and employability (European Commission, 2012a, p. 22).

Technologies and the society nowadays change fast and it is almost impossible to predict the future development and trends of the business world and social environment. Therefore, the ability to adapt, to innovate, to put ideas into action and to be proactive will be common attitudes which will allow the entrance into the labour market or to start a new business (European Commission, 2012a, p. 21).

1.3 Entrepreneurial learning outcomes

The result of efficient EE is the entrepreneurial individual possessing entrepreneurial capacities in form of knowledge, skills and attitudes. EE should create empathy with entrepreneurial world and its key values, motivate for entrepreneurial career and provide understanding of the process of business entry and tasks. Concrete knowledge, skills and attitudes which should be acquired through EE are described in tables below.

Table 1: Knowledge acquired through EE

Knowledge	
Students learn to understand entrepreneurship	▪ seeing the 'bigger picture' which provides the context in which people live and work ▪ understanding of the workings of the economy ▪ having knowledge of marketing, financial management, sales, and human resource management ▪ understanding business ethics and how to be a force for good (e.g. through fair trade, social enterprise) ▪ understanding the process of entrepreneurship ▪ understanding the role of entrepreneurs ▪ knowing how to identify opportunities for personal, professional and/or business activities ▪ understanding the processes of innovation & creativity ▪ having the ability to make decisions and develop strategies ▪ having the ability to find resources ▪ understanding of business ethics

Source: European Commission, *Order 129: Mapping of teachers' preparation for entrepreneurship education*, 2011, p. 6; European Commission, *Effects and impact of entrepreneurship programme in higher education*, 2012a, p. 43; European Communities, *Key competences for lifelong learning: European Reference Framework*, 2007, p. 1; A. McCoshan et al., *Towards Greater Co-operation and Coherence in Entrepreneurship Education*, 2010, p. 10.

Table 2: Skills acquired through EE

Skills	
Students learn how to become an entrepreneur	▪ creativity ▪ networking ▪ planning ▪ organising ▪ managing ▪ leading & delegating ▪ analysing ▪ communicating ▪ evaluating ▪ effective representation & negotiation ▪ ability to work individually and in teams ▪ ability to judge & identify one's strengths and weaknesses ▪ assessment and risk-taking ▪ adaptability ▪ ability to mobilise commitment ▪ seeing problems as opportunities ▪ intuitive decision making with limited information ▪ managing complexity ▪ constantly see yourself and the business through the eyes of stakeholders and especially customers ▪ lateral thinking ▪ drafting business plan

Source: European Commission, *Order 129: Mapping of teachers' preparation for entrepreneurship education*, 2011, p. 7; European Commission, *Effects and impact of entrepreneurship programme in higher education*, 2012a, p. 43; European Communities, *Key competences for lifelong learning: European Reference Framework*, 2007, p. 11; A. Gibb, *Towards the Entrepreneurial University: Entrepreneurship education as a lever for change. A National Council for Graduate Entrepreneurship (NCGE) report presenting and shaping the environment for graduate entrepreneurship in higher education*, 2010, p. 11; A. McCoshan et al., *Towards Greater Co-operation and Coherence in Entrepreneurship Education*, 2010, p. 10.

Table 3: Attitudes acquired through EE

Attitudes	
Students learn how to become entrepreneurial	▪ sense of initiative ▪ independence & innovation in all aspects of life ▪ motivation ▪ proactivity ▪ creativity & imagination ▪ curiosity ▪ need for achievement ▪ ambition/drive ▪ determination to meet objectives (personal or business goals)

Table continues

Continued

	▪ innovation at work as well as in personal and social life ▪ selling/persuasive capacity ▪ personal locus of control (autonomy) ▪ daring/courageous ▪ passionate ▪ visionary ▪ structural behaviour ▪ risk propensity ▪ self-efficacy ▪ persistence & commitment ▪ self-belief ▪ self-awareness ▪ feeling of empowerment ▪ social confidence ▪ tolerance to failure ▪ tenacity ▪ responsibility (including social responsibility/good citizenship)

Source: European Commission, *Order 129: Mapping of teachers' preparation for entrepreneurship education*, 2011, p. 7; European Commission, *Effects and impact of entrepreneurship programme in higher education*, 2012a, p. 43; European Communities, *Key competences for lifelong learning: European Reference Framework*, 2007, p. 11; A. Gibb, *Towards the Entrepreneurial University: Entrepreneurship education as a lever for change. A National Council for Graduate Entrepreneurship (NCGE) report presenting and shaping the environment for graduate entrepreneurship in higher education*, 2010, p. 11; A. McCoshan et al., *Towards Greater Co-operation and Coherence in Entrepreneurship Education*, 2010, p. 10.

Table 4: Creating empathy with the entrepreneurial real world

Creating empathy with the entrepreneurial real world	
Students understand and 'feel' the real world of the entrepreneur	▪ living with uncertainty and complexity ▪ having to do everything under pressure ▪ coping with loneliness ▪ working flexibly and long hours ▪ holistic management ▪ no sales, no income ▪ no cash in hand, no income ▪ building know-who and trust relationships ▪ learning by doing, copying, making things up, problem solving ▪ managing interdependencies

Source: A. Gibb, *Towards the Entrepreneurial University: Entrepreneurship education as a lever for change. A National Council for Graduate Entrepreneurship (NCGE) report presenting and shaping the environment for graduate entrepreneurship in higher education*, 2010, p. 11.

Table 5: Key entrepreneurial values

Key entrepreneurial values	
Students create empathy with key entrepreneurial values	▪ strong sense of independence ▪ distrust of bureaucracy and its values ▪ self-made/self-belief ▪ strong sense of ownership ▪ belief that rewards come with own effort ▪ hard work brings its rewards ▪ belief that can make things happen ▪ strong action orientation ▪ belief in informal arrangements ▪ strong belief in the value of know-who and trust ▪ strong belief in freedom to take action ▪ belief in the individual and community not the state

Source: A. Gibb, *Towards the Entrepreneurial University: Entrepreneurship education as a lever for change. A National Council for Graduate Entrepreneurship (NCGE) report presenting and shaping the environment for graduate entrepreneurship in higher education*, 2010, p. 11.

1.4 Teaching methods

Many educators still see EE as an adapted business management education which can be taught quickly (Haase & Lautenschläger, 2011, p. 157). However, to achieve efficient acquirement of EE outcomes we need a shift from transmission models of teaching (learning 'about') to experiential learning (learning 'for') (Hermann et al., 2008, p. 21).

The main differences between curricula which intend to teach about and for entrepreneurship are listed in the table below:

Table 6: The main differences between curricula which intend to teach about and for entrepreneurship

About	For
Case studies	Role models in class
Lectures about theory and SME discussions	Effectuation
Simulation	Learn by doing
Videos	Venture creation
Essays	Internships
Exams	Project assessment blending theory with practice
Taught by academics without practice	Taught by practitioners - with curricula

Source: S. Vyakarnam, *Entrepreneurship as a catalyst for positive change*, 2012, p. 104.

Contemporary teaching methods such as learning by doing and experiential learning have motivational impact on students and they allow also emotional and intuitive dimensions of entrepreneurship which is impossible to achieve just through traditional forms of teaching (Haase & Lautenschläger, 2011, p.157). Moreover, contemporary teaching is student-centred, interactive, action-oriented and pragmatic, allowing students to understand theoretical aspects more easily.

Experiential learning is based on real-life situations, encouraging students to have a more active role in their education. This kind of teaching helps students to work and learn more independently, to take initiative, acquire a sense of accomplishment and strengthen self-confidence (McCoshan et al., 2010, p. 31). Additionally, they are allowed to be adventurous, playful and they can adopt self-directed styles of learning. Further on, they have the chance to experiment, discover new ways of thinking, and meet successful entrepreneurs (Hermann et al., 2008, pp. 7, 21, 22). Another thing which is crucial for the EE to be successful is a multidisciplinary approach. By mixing students and educators from different faculties and fields of study we bring different forms of knowledge perspectives to the learning process (European Commission, 2008a, p. 26; Hermann et al., 2008, p. 21).

In European HE, a wide range of teaching methods exist, but it is concerning that there is a gap between methods applied and those which are viewed as the most effective. According to the survey made by European Commission (hereinafter: EC) in 2008, lecturing was identified as the most often used method, although it is usually hardly mentioned as an effective tool for delivering EE. After lecturing, case studies, visits of entrepreneurs/practitioners in the classroom and work in project teams were identified as the most frequently used methods (European Commission, 2008b, p. 143).

The complete list of methods identified as the most efficient in EE is shown and described below (European Commission, 2008a, pp. 28, 36; European Commission, 2011, pp. 17-18; Kailer, 2009, p. 218; Herrmann et al., 2008, pp. 21-22):

- *group and team techniques for creating new business ideas;*
- *case studies:* existing local companies should be used in cases which further provide students with role models they can easily identify with;
- *entrepreneurs/practitioners in the classroom:* both young (e.g. alumni who have established a new company) and experienced entrepreneurs have to be involved in courses and activities;
- *mentoring of entrepreneurs and external experts:* it is important to use start-up entrepreneurs as well as experienced entrepreneurs to represent each phase of the life-cycle. Undergraduate students should learn about entrepreneurship and entrepreneurs through testimonial or case studies whereas for graduate students a mentor proves to be very important;
- *business planning workshops:* activities should be based on real business ideas;
- *project teams;*
- *co-operation of students and enterprises:* work on concrete enterprise projects;
- *business simulations:* this method gives students an opportunity to experience and evaluate the consequences of risky and costly decisions in a simplified model situation reproducing reality without exposing them to any risk. There are many such simulations and they consist

of action-based methods like role plays, case studies, practice firms, junior companies and computer simulations;

- *student´s projects:* the method is not used that frequently due to the extra resources needed for the implementation of projects;
- *use of drama and performance techniques:* it is important to use them since many entrepreneurs are continually 'acting' and 'performing' in their numerous roles;
- *mini companies;*
- *field visits;*
- *trainee programs in start-up companies;*
- *internships;*
- *interviews;*
- *discussions:* talking about entrepreneurship seems to be one of the easiest ways for educators to promote entrepreneurship education and is consequently frequently used;
- *creative problem solving techniques;*
- *traditional lectures.*

1.5 About educators

Educators should be, to some extent, also entrepreneurs by themselves, complementing their teaching with real-life experiences (McCoshan et al., 2010, p. 18). They should also maintain close relationship with the local entrepreneurial environment and be a part of relevant formal and informal networks (European Commission, 2008a, p. 36). With the greater use of experiential learning, an educator now acts more as a coach (McCoshan et al., 2010, p. 31), promoter, facilitator and manager than as a teacher (Haase & Lautenschläger, 2010, p. 157). For example, educator´s tasks are to ensure the provision of internships and establishing contacts with entrepreneurs, rather than giving a lecture on business plan development. Thus, habitual teaching should transform to experiential, which leads to more effective transmission of the "know-how" for the formation of entrepreneurial students (Haase & Lautenschläger, 2010, p. 157).

It is important to stress that educators of EE in science and technology studies should be well versed in both, their specific expertise and in entrepreneurship, since enterprising projects or ideas of their students usually derive from their own fields of studies (European Commission, 2008a, p. 29).

1.6 Entrepreneurship chairs

Despite the described educators' challenges, the situation at HEIs has been gradually, though still too slowly, improving. Although many universities in Europe do not have entrepreneurship chairs, there are examples of countries such as the UK and Germany which pioneered EE in Europe (Wilson et al., 2008, p. 123) and today already reap the fruits of invested efforts.

1.6.1 United Kingdom

In 21st century, entrepreneurship in the United Kingdom (hereinafter: the UK) has been one of the five core drivers of the government's strategy aimed at boosting the economy (HM Treasury, 2008, p. 3). The concentration on the development of entrepreneurship also included extended support for the development of enterprise skills and knowledge in the wider education system. Additionally, the country has a strong tradition in small-business research and teaching. All of this explains a large number of SME chairs, most of which were established 15 years ago. Moreover, the first entrepreneurship course in the UK was introduced as early as in 1971 at the Manchester Business School (Wilson et al., 2008, p. 173). Today, 61% of England´s HEIs have a Pro Vice-Chancellor responsible for enterprise and 49% of HEIs have explicit policies for enterprise and entrepreneurship (National Centre for Entrepreneurship in Education, 2012, p. 5).

1.6.2 German-speaking countries

EFER survey from 2007 surprisingly showed quite promising results in German-speaking countries (Germany, Austria, Liechtenstein and German-speaking Switzerland). In these countries, there are 333 universities of which 73 have entrepreneurship chairs. Those entrepreneurship chairs predominantly focus on entrepreneurship in their teaching as well as in research. Additionally, if we also add entrepreneurship-affiliated chairs the number rises to 135 chairs altogether. Entrepreneurship-affiliated chairs are chairs with a variety of focus areas, but they are all somehow connected to entrepreneurship - either in the field of teaching, research or consultancy and they significantly contribute to the efforts of entrepreneurship chairs. Encouraging is also the fact that on average four assistants per professor support the research and teaching which indicates that teams are well equipped. Hence, we can see that 35% of German-speaking Europe has an entrepreneurship or entrepreneurship-affiliated chair. Moreover, among 17 technical universities only two do not have entrepreneurship or entrepreneurship-affiliated chair (Achleitner, Kaserer, Jarchow & Wilson, 2007).

Further on, data provided by the EC equally show that importance of EE continually rises as there were already 58 entrepreneurship chairs in Germany in 2008 (22 at universities, 6 at technical universities and 30 at universities of applied sciences). Additionally, there were 40 entrepreneurship-affiliated chairs and further 14 positions planned. Numbers are quite impressive as in 1998 there was just one entrepreneurship chair (European Commission, 2008a, p. 16). The majority of these chairs were endowed for a five-year period by the public SMEs and the entrepreneurship bank or by bigger companies such as SAP (Wilson et al., 2008, p. 173).

The results of another survey made by the EC which covered 31 European countries and 153 HEIs showed that the majority of institutions have one or two entrepreneurship chairs/professorships (European Commission, 2008b, pp. 2, 118). Still, Europe falls behind the USA approximately by a factor of four regarding the number chairs (Twaalfhoven & Wilson, 2004).

1.7 Quality entrepreneurship curricula

EE can be seen as any other profession such as law or medicine where students need to conquer the theory but at the same time they equally need deep confidence and capability in the practice. To help understand the tacit knowledge it is, according to most authors, important to include practitioners into the teaching process who have the expertise and experience of entrepreneurship (Vyakarnam, 2012, p. 103).

We need to be aware of the fact that different students have different abilities to acquire entrepreneurial knowledge, skills and attitudes. But, as it is apparent from different sources, these behaviours can be, to some extent, developed and learned (Gibb, 2010, p. 6). However, the general goals of EE should be the following: generating ideas and recognising opportunities, creating a new company/organisation and growing a young company (European Commission, 2008a, p. 24).

Specific goals, contents and methods of teaching need to differ among fields of study and level of education. In general, it holds that the higher the level of studies the more complex and closer to real business is the content of EE (European Commission, 2008a, p. 26). It is also generally agreed that students of non-business studies need some basic knowledge of economics, marketing and management in order to equally successfully follow the contents of EE which have a more narrow focus (European Commission, 2008a, p. 25).

For undergraduate students it is important that EE creates entrepreneurial awareness and mind-sets. At the same time, the desire for self-employment and to start a new company should be developed (European Commission, 2008a, p. 26).

Graduate and postgraduate students should be provided with practical tools and concrete support for their business ideas (European Commission, 2008a, p. 26).

The focus of EE for students from economic and business fields should be on the start-up phase and growth of a new venture. At the same time, students should intensively connect and collaborate with students from different fields (European Commission, 2008a, p. 26).

Science and technology studies should educate about exploiting intellectual property, creating spin-off companies and venturing. It is recommended that EE also includes courses on (European Commission, 2008a, p. 27): commercialising and selling of technology-based ideas, patenting and protecting technology-based ideas as well as financing and internationalising high-tech companies.

On the other hand, students of humanities should learn about self-management and about growing potential of social entrepreneurship, which can significantly improve social environment (European Commission, 2008a, p. 27).

EE in creative arts and design studies should be especially concerned with creativity processes and preparation of graduates to work as freelancers or establish small businesses (European Commission, 2008a, p. 27).

1.8 Barriers to entrepreneurship education

There is a substantial lack of faculty collaborations, exchanges of educators, best practices, case studies and research across borders within Europe (European Commission, 2008a, p. 32; Wilson et al., 2008, p. 130). In addition, Europe also lacks enough educators as demand for EE has been increasing (European Commission, 2008a, p. 65).

Survey from 2004 showed that less than 20% of the respondents spent time teaching abroad, while the student body is increasingly becoming international (Wilson et al., 2008, p. 130). With the raise of Erasmus+ programme budget, the EU plans that by 2020 at least 20% of HE graduates should have spent some time studying or training abroad (European Commission, 2013c, p. 5). Furthermore, if the educators themselves do not have international experiences, they will also face bigger difficulties encouraging students for setting up and growing international businesses. Moreover, university exchanges should bring more than just delivering lectures at another institution – educators should spend a considerable amount of time at another HEI or in business sector in order to actually acquire the necessary experience, knowledge and skills (Wilson et al., 2008, pp. 130-131). This tends to improve considerably as Erasmus+ programme offers teaching and training opportunities for educators at HEIs, as well as for staff from enterprises (Staff Mobility for Teaching and Training, 2014).

For efficient EE, it is important to have educators with business or entrepreneurship experience as this is the case in the USA. In Europe, educators of EE often come from traditional disciplines such as economics or business administration. Additionally, EE is the domain of part-time or visiting lecturers in many European countries (Wilson et al., 2008, pp. 123, 128). Thus, the level of competencies of such educators is often inadequate, which was also confirmed by a survey of the EC which highlights this problem as one of the most important ones. Namely, less than one third of educators have practical experience outside academia and less than 20% have gone through training in order to be able to teach EE (European Commission, 2008b, p. 167). Causes for this kind of situation lie in the lack of incentives or even in disincentives when it comes to external commercial activities of academics. In Ireland, for instance, this kind of educators' engagement is prohibited. On the other hand, in France, the mobility between HEIs and business is encouraged at the state level.

In addition to having practical business experience, educators also need appropriate pedagogical training to be able to teach EE in a way which prepares students to take responsibility for their own learning and acquired knowledge. But many HEIs do not have enough resources for such activities. Moreover, this kind of education requires different approach to teaching and especially as a young discipline needs more time invested and efforts to show good results. A survey of the EC from 2008 identifies educators' lack of time to properly engage in EE as one of the main barriers for the development of EE (European Commission, 2008b, pp. 200, 202). Moreover, the quality of EE often depends on dedicated faculty staff, instead of on strategic planning and sufficiency of funds. The already mentioned survey states that 40% of the European HEIs see low involvement of staff and educators as an additional barrier for effective development of EE (European Commission, 2008b, p. 200). When choosing new lecturers for EE, academic

achievements often outweigh business experience, which additionally lowers the quality of such education. Furthermore, many of the teaching methods used in EE and practical business experience do not give academic credits. As academic activities in business administration still form the basis for academic promotion and recognition, there is a lack of motivation for academic engagement. Thus, the majority of HEIs have less than 20 educators involved in EE (European Commission, 2008b, pp. 167, 202).

Equally important is the support from the university heads (deans, rectors and vice chancellors) and outside stakeholders. Currently, it is still challenging to motivate the management and to achieve approval from all institutions within the HEI. Namely, it is easier to find understanding for EE in the traditional sense, whereas to introduce entrepreneurship approach to technical and other specialized areas is a bit harder. Indeed, many academics still perceive an entrepreneur in the traditional, narrow sense - as somebody who establishes and runs a company. As this is not something academics would usually do, it sometimes results in less interest by educators to engage in EE (European Commission, 2008b, pp. 202-203; Wilson et al., 2008, p. 123).

The EC sees additional obstacles in the participation of practitioners in the educational process. I.e. entrepreneurs are usually heavily involved in their own businesses and they may have difficulties finding time for such activities. Additionally, universities are not able to pay them as much as they would deserve or what would attract them to greater extent. Currently, practitioners in EE are present but mostly as guest lecturers with short presentations or as judges in competitions (European Commission, 2008a, pp. 38, 66).

Possible solutions for the improvement of the situation would be to increase the number of part-time positions (external lecturers, assistant professors) or to create a new category of positions for well-educated academic staff with extensive entrepreneurial/business experience and limited research experience. Universities could also offer sabbaticals to existing entrepreneurship educators in order to gain the needed entrepreneurial experience (European Commission, 2008a, p. 33).

1.9 The concept of entrepreneurial university

Many academics associate the concept of entrepreneurial university with business and the commercialisation of university intellectual property (particularly in the science and engineering fields) which leads to directing the focus on the innovation activities in co-operation with technology transfer offices, incubators and science parks. This perception and actions are further strengthened by government and even international (OECD) perspectives that perceive universities as sources of technological innovation and ‘engines of growth’. However, the concept of entrepreneurship has been clarified in the academic literature as being applicable within a wide range of contexts. The concept of entrepreneurship therefore focuses also on the development of the enterprising person and entrepreneurial mind-set. Further on, it concentrates on the application of personal enterprising skills, attributes and mind-sets to the context of

setting up a new company, developing/growing an existing company and designing an entrepreneurial organisation (Baker et al., 2013, p. 10).

All above mentioned activities need to be implemented and/or further developed to accomplish university´s third mission which lies in the enhancement of the local and regional economic development.

The circumstances which force and/or encourage the transformation of universities into entrepreneurial ones are briefly described below (Gibb, 2010, p. 3):

- in the time of information technology and global corporations universities are no longer the main source of intellectual property;
- the massification of the education;
- the constant decline in state funding forces universities to seek additional sources of income: private fund raising, commercialization of intellectual property;
- universities need to contribute more substantially to the development of local/regional economic and social environment and strengthen their links with a wider range of stakeholders in society;
- competition from the private sector is growing;
- there is a need to prepare students for a life of greater uncertainty and complexity; frequent job changes, global mobility, adaptation to cultural differences, fast-changing working environment and bigger probability of self-employment.

The need to change the role of the universities is evident, but certain new risks should not be neglected. One of the main tasks of entrepreneurial universities will be to retain their autonomy in terms of scientific quality and strength (Volkmann et al., 2009, p. 54). Until today, the traditional role of universities lied in independent creation of knowledge in absence of direct control of government although they were mainly funded by it. Research was based on curiosity and not economic interest. The main channel for introducing new knowledge to the public was the publication of scientific articles and it was common for the industry to use these materials and to act when appropriate. In last decades, economic development changed dramatically and much faster development cycles ceased to be in accordance with time lags involved in publications (Gibb, Haskins, & Robertson, 2009, p. 11).

The commercialization of the intellectual property and private financing may quickly create new dependencies, therefore the commitment to scientific excellence, maintenance of academic values and following the ethical guidelines is especially important (Volkmann et al., 2009, p. 55).

Worldwide, over 200 universities were identified by experts as demonstrating established or emerging leadership in entrepreneurship. MIT, Stanford University and the University of Cambridge were recognized as world leaders (Graham, 2014, p. i).

1.10 Development of entrepreneurial universities in Europe

The EU recognized universities as a core player in its knowledge-driven economy whose foundations were laid already with the Lisbon Strategy in 2000. In general, Europe has well-developed tertiary education producing more graduates in science and technology as well as more PhDs (Commission of the European Communities, 2005, p. 3) but in comparison with the US and Japan our share of researchers in total labour force is lagging behind (European Commission, 2013a, p. 25). Also the fact that apart from a few British universities there are no EU universities in the top 20 in the world and a few in the top 50 is concerning (Commission of the European Communities, 2005, p. 3). As Europe has already become a knowledge-driven society with knowledge-intensive industries and services, it needs the renovation of universities to keep pace with economies of the US, Japan and rising Asia. Moreover, universities need to become its main source of competitiveness. Currently, universities are not yet able to fully exploit their potential. With correct approaches, universities need to focus on perspective research agendas and generate the critical mass, excellence and flexibility in order to succeed (Commission of the European Communities, 2006, p. 4). At this moment, the European universities are still a less attractive option for talented academics and students in comparison to other non-European universities.

To create entrepreneurial universities which will drive the European economy, the EU needs to remove the below described barriers (Commission of the European Communities, 2005, pp. 3-4; Commission of the European Communities, 2006, p. 3):

- national systems aiming at uniformity and egalitarianism have provided on average high-quality universities with regard to academics, but on the other side this caused fragmentation of the sector which makes domestic and international co-operation difficult. Universities were also not able to focus on quality and differentiation which consequently led to the lack of centres of world-class excellence;
- co-operation with industry is too weak – knowledge sharing and mobility are limited. Furthermore, graduates lack the entrepreneurial skills;
- the over-regulation of universities prevents their modernization and efficiency. Until change is a matter of legislation, reforms will be rare, disruptive and uniform;
- academic mobility in terms of studying, researching, training or working abroad is substantially weak. Procedures for the recognition of qualifications for academic purposes are usually complicated and long. Additionally, mobility is prevented by limited portability of national grants/loans and pension rights.

The EU has in recent years taken several measures for the elimination of universities' bottlenecks. One of the most important steps was taken recently as in January 2014 Erasmus+ was launched, the new EU programme for education, training, youth and sport for the 2014-2020 period. The programme replaced several existing EU programmes which covered all sectors of education. As the programme budget was raised by 40% compared to current levels, this will allow further modernization and development of HE (European Commission, 2013c, p. 1). The

programme will give students and staff of HEIs opportunities to develop their skills which will improve their employability or lay the foundation for self-employment. Through Erasmus+, benefits in the field of higher education will be the following (European Commission, 2013d, p. 2):

- 2 million higher education students will be able to study or train abroad, including 450,000 traineeships;
- 200,000 Master's degree students will do a full course in another country receiving loan guarantees;
- more than 25,000 students will receive grants for joint master's degrees, which involve studying in at least two higher education institutions abroad;
- 125,000 schools, vocational education and training institutions, higher and adult education institutions, youth organisations and enterprises will receive funding to set up 25,000 "strategic partnerships" to promote the exchange of experience and links with the labour market;
- 3,500 education institutions and enterprises will receive support to create more than 300 "Knowledge Alliances" and "Sector Skills Alliances" to boost employability, innovation and entrepreneurship.

Renewed education programme was needed as there are 6 million unemployed young people in the EU while at the same time one third of employers have difficulties in finding employees with the skills they need. This recalls the alarming skill gap in Europe which will be gradually eliminated also with the help of Erasmus+ (European Commission, 2013c, p. 5).

2 ENTREPRENEURSHIP EDUCATION IN EUROPE

The second chapter analyses the development of EE in Europe by examining the measures taken by the EU in this area and presenting the organisation which fosters EE in Europe.

2.1 Role of entrepreneurship and entrepreneurship education in European Union

New companies, especially SMEs, represent the most important source of new jobs in Europe as they create more than 4 million new jobs. Moreover, SMEs create more than 85% of new jobs. Without employments created by new companies, the net employment growth would be negative (Council of the European Union, 2013, p. 2).

According to the above described facts, the need for generation of new companies and greater focus on EE is clear. However, it is worrying that a desire for self-employment in Europe is decreasing in recent years. Namely, in 2009 45% of EU residents preferred self-employment, whereas in 2012 this percentage fell to 37% (European Commission, 2012c, p. 5). By contrast, in the USA and China this proportion is much higher: it amounts to 51% and 56% respectively (European Commission, 2013b, p. 4). On the other hand, it is encouraging that people in the EU

already have quite favourable view of entrepreneurs. More specifically, 53% of research respondents see them favourably in comparison to professionals such as lawyers and doctors (57%) and top managers (25%) (European Commission, 2012c, p. 16).

It is essential to incorporate EE efficiently into the educational system, i.e. also into HEIs, as 50% of respondents agreed that their school education had helped them to develop a sense of initiative and entrepreneurial attitude, whereas only 28% reported that their school education interested them in becoming an entrepreneur (European Commission, 2012c, pp. 17-18). Further on, the survey showed that young people who have attended entrepreneurship courses establish more companies and earlier. Namely, only 3-5% of alumni become entrepreneurs 2 to 5 years after the end of their studies, while this percentage rises to 15-20% for alumni having participated in any EE. Studies also showed that university students who had been engaged in EE formed new companies 0.7 years before graduation, while those who had not received EE formed companies 2.8 years after graduation (European Commission, 2012a, p. 17). Moreover, data show that even those who do not decide for entrepreneurial career are better positioned in the job market. 78% of EE alumni were employed directly after graduation while this percentage amounts to only 59% for a control group of HE students (Entrepreneurship education key to sustainable economic upswing, 2013).

2.2 EU measures supporting development of entrepreneurship education

EU´s strategic document Entrepreneurship 2020 Action Plan highlights the EU's active role in supporting and developing EE in HEIs as follows: "The role of higher education in entrepreneurship goes far beyond the delivery of knowledge to participants in ecosystems, partnerships and industrial alliances. With high-tech and high-growth enterprises increasingly becoming a focus of entrepreneurship-related public policies, higher education institutions are an active component of the innovation policies of the Member States and the EU (European Commission, 2013b, p. 6)".

The EU has been gradually taking measures supporting entrepreneurship and EE from the year of 2000 onwards. In March 2000, the EU set up promotion of entrepreneurship as one of its main goals within the Lisbon strategy which included improvement of the EU´s performance in the areas of employment, economic reform and social cohesion. The first progress in the area of entrepreneurship was then made by publishing a Green Paper on "Entrepreneurship in Europe" in 2003 (European Commission, 2012c, p. 2). In the Green paper, entrepreneurship was recognized as a generator of economic growth allowing Europe "to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion (European Commission, 2000, p. 19)". Along with the Lisbon strategy the European Charter for Small Enterprises (hereinafter: the Charter) was adopted in 2000, which planned to take actions for the creation of more favourable conditions for small businesses and entrepreneurship. Both documents, the Green Paper and the Charter, recognized education and training for entrepreneurship as one of the core actions needed

for long-term growth and development of entrepreneurship. Moreover, the Charter specifically proposed that EE is taught at all school levels.

The EU support for entrepreneurship development continued with the Entrepreneurship Action Plan in 2004 which committed to further promote EE and especially emphasized that at university level EE should be available to students and researchers from all fields. This is because the EU believes that scientific potential supported by entrepreneurial skills can lead to better commercialization of research results (Commission of the European Communities, 2004, p. 7).

In 2008, the EU adopted the Small Business Act, a comprehensive policy framework for small businesses, thereby showing strong political will to give SMEs a central role in its economy (Small Business Act for Europe, 2014). This document again stressed the importance of creation of an environment in which entrepreneurs could thrive. Hence, it recognized the lack of EE which could provide the skills needed for entrepreneurship. The EU committed itself to facilitate the exchange of best practices in EE. In addition, it encouraged its members to implement EE into school curricula, to correctly train entrepreneurship educators and to develop systematic strategies for EE at all school levels in co-operation with the business sector (Commission of the European Communities, 2008, pp. 5-6).

The current EU 2020 Strategy highlights the importance of embeddedness of creativity, innovation and entrepreneurship in education. Strategy´s flagship initiatives such as "Youth on the Move", "An Agenda for New Skills and Jobs" and "Innovation Union" propose a number of actions in this area.

2.3 Erasmus+ programme

Europe has in recent years concretely fostered the creation and application of knowledge with several actions and is on a good way to become a truly knowledge-based economy. One of the important EU actions in this area is the Erasmus+ programme which intends to enhance the links between education, research and business - the so called "knowledge triangle". Increased co-operation between the private sector and HE will in greater extent help develop entrepreneurial, creative and innovative skills in all disciplines (Co-operation with business, 2014).

The most extensive Erasmus+ project which aims to strengthen the co-operation between HE and business or representative associations is Knowledge Alliances.

Knowledge Alliances are transnational, structured and result-driven projects (European Commission, 2014, p. 109). Their goal is to enhance EU's innovation capacity by fostering innovation in HE through the two-way knowledge exchange with the private sector and other suitable stakeholders. Alliances will be formed with a minimum of six organizations from at least three European countries with at least two HEIs and two enterprises (Co-operation with business, 2014).

Knowledge alliances will be active in the following three groups of activities (European Commission, 2014, p. 109):

1. **Boosting innovation in higher education, business and in the broader socio-economic environment:**

- jointly developing and implementing new learning and teaching methods (like new multidisciplinary curricula, learner-centred and real problem-based teaching and learning);
- organizing continuing educational programmes and activities with and within companies;
- jointly developing solutions for challenging issues, product and process innovation (students, professors and practitioners together).

2. **Developing entrepreneurship mind-set and skills:**

- creating schemes of transversal skills learning and application throughout higher education programmes developed in co-operation with enterprises aiming at strengthening employability, creativity and new professional paths;
- introducing entrepreneurship education in any discipline to provide students, researchers, staff and educators with the knowledge, skills and motivation to engage in entrepreneurial activities in a variety of settings;
- opening up new learning opportunities through the practical application of entrepreneurial skills, which can involve and/or lead to the commercialisation of new services, products and prototypes, and to the creation of start-ups and spin-offs.

3. **Stimulating the flow and exchange of knowledge between higher education and enterprises:**

- study field related activities in enterprises which are fully embedded in the curricula, recognised and credited;
- set-ups to trial and test innovative measures;
- exchanges of students, researchers, teaching staff and company staff for a limited period;
- involvement of company staff in teaching and research.

2.4 European Institute of Innovation and Technology

Good example of EU efforts in the area of bigger co-operation of academia and the private sector is the establishment of the European Institute of Innovation and Technology (hereinafter: the EIT) which has been operating since 2010. The institute has become a key enabler of innovation in the EU and it effectively reduces the gap between education and innovation for industry (European Commission, 2013b, p. 6) by fully integrating all three sides of the 'knowledge triangle', i.e. HE, research and business. Thus, for the first time in the EU the education and entrepreneurship are simultaneously integrated with research and innovation. Delivery of incremental knowledge is taking place through a single innovation chain bringing together the best universities, research centres and companies to find solutions for key societal challenges in Europe.

The EIT is not situated in one campus like the rest of traditional institutes, but operates through the Knowledge and Innovation Communities (hereinafter: the KICs). Currently, there are 19 KICs across the EU and each KIC is organised around an independent legal entity, gathering KIC partners from all the innovation dimensions. The EIT covers a range of activities through KICs: training and education programmes, innovation projects and business incubators (Knowledge and Innovation Communities (KICs), 2014; What makes a KIC a KIC, 2014).

KICs have developed their own education programmes which have a strong focus on the development of entrepreneurship and innovation skills. Additionally, they are tailored to the needs of the European innovation system. Programmes are based on partnerships between different universities, companies and research centres that collaborate closely and offer double degrees, as well as international and cross-sectoral mobility experiences. In the first year of the education activities in 2011, KICs attracted 600 students, whereas for the period of 2014-2020 it is anticipated to train 10,000 master students and 10,000 PhD candidates (Education, 2014). The EIT along with innovative KICs' Master's and PhD programmes is expected to become an internationally recognized brand of excellence which will help to attract talent from Europe and abroad (The European Parliament and the Council of the European Union, 2013, p. 898).

2.5 European Forum for Entrepreneurship Research

One of the better known organizations which promotes research and teaching in the field of entrepreneurship at HEIs throughout Europe is EFER. The organization was founded in 1987 and since then it has been sharing good practices between faculties across Europe, generating support for European entrepreneurship case studies, providing research on entrepreneurship, training faculties across Europe and influencing policies through presentations and meetings (European Forum for Entrepreneurship Research, n.d.).

In 2001, EFER offered the programme of Harvard Business School named European Entrepreneurship Colloquium (EEC, 2014). EEC is an intensive one-week residential programme, specifically designed for European educators seeking more effective and interactive approaches in teaching entrepreneurship. From 2001 on, EFER conducted 11 successful programmes and developed an alumni network of 538 professors from 205 institutions in 48 countries (EEC, 2014).

3 GOOD PRACTICES IN DELIVERING ENTREPRENEURSHIP EDUCATION IN EUROPEAN UNION

3.1 University of Cambridge

In a relatively short time, Cambridge has evolved from a small university town to perhaps the most important centre of high tech start-up businesses in Europe. A mixture of several factors influenced the development of favourable circumstances which encouraged enterprising behaviour of academics and development of entrepreneurial culture at the university. Some

educators said that they were not prohibited from commercially exploiting the knowledge, since this supplemented their salaries which were not that high. Another factor was close connection of applied and basic research questions in engineering disciplines. I.e. university researchers more easily saw opportunities for the commercialization of their knowledge as they were in close interaction with industry researchers working in Cambridge laboratories (Barakat & Hyclak, 2009, p. 6).

Whereas the above mentioned activities demonstrated university´s passive approach to the commercial exploitation of knowledge, policy initiatives of the UK government and the growing complexity of intellectual property rights led to active and planned transformation into an entrepreneurially oriented university. Thus, in a few years the university established an enhanced technology transfer unit, a new intellectual property policy, funded student entrepreneurship, strongly encouraged applied research and developed a new entrepreneurship programme (Barakat & Hyclak, 2009, p. 6).

In 2003, after four years of operation, the Entrepreneurship centre responsible for technology transfer and EE was divided into the Cambridge Enterprise, which managed technology transfer activities, and the Centre for Entrepreneurial Learning (hereinafter: the CfEL), which took care of EE programmes (Barakat & Hyclak, 2009, p. 7).

Credit-bearing EE in Cambridge reaches students from diversified studies such as science, engineering, technology and maths, and they can whether be nascent entrepreneurs or do not have a specific interest in entrepreneurship. The content of EE is tightly connected with the specific studies and includes personal development, gaining social/entrepreneurial skills and obtaining overview of entrepreneurship. For instance, the engineering department has added modules to its curricula such as "taking technology to market" and "enterprise and business development", whereas departments of chemical engineering, material science and physics have offered an elective module on "emerging technology enterprise". However, these were almost the only entrepreneurship-related courses offered at undergraduate level. University´s main efforts were directed towards the development of six programmes within the Cambridge-MIT Institute. These programmes were implemented at Cambridge after achieving success at MIT. They combine business management core with a specific science or engineering field. The business part of the studies includes courses focused on business management, innovation and technology management and entrepreneurship (Barakat & Hyclak, 2009, pp. 8-9).

Furthermore, the CfEL has developed extracurricular entrepreneurship programmes for science and engineering students. These programmes were offered to both Cambridge students and external actors (Barakat & Hyclak, 2009, p. 9).

The CfEL has been monitoring its outcomes in the area of EE - the cumulative results are shown in the table below.

Table 7: 10-year cumulative outputs of CfEL

Key metric	Numbers
Number of students	14,000+
Programmes and events	165
Alumni ventures created	140+
Supported alumni in raising investment	£85,000,000
Practitioner contributors teaching	350
Assisting student societies with business plan competitions	14
Credit-bearing courses delivered	60

Source: S. Vyakarnam, *Entrepreneurship as a catalyst for positive change*, 2012, p. 112.

3.2 Aalto University

Aalto University from Finland was recognized as a well-developed entrepreneurial university which was able to make a transformation despite operating in a more challenging environment in comparison to, for example, the US universities which operate in a favourable entrepreneurial culture (Graham, 2014, p. i).

Aalto University was established in 2010 through the merger of three leading state-owned universities with the aim of strengthening their role in the Finnish industry, economy and culture. Under the new name Aalto University the following universities merged: Helsinki School of Economics, University of Art and Design Helsinki and Helsinki University of Technology (Aula & Tienari, 2011, pp. 7-8). The new university is a single entity with its own independent board appointed by the Finnish government and representatives of external funding. Namely, the development of the new university was financed by the Finnish government and donations (Aalto Group, 2014). The idea of a new university was strongly supported both by the government and business and industry associations who all shared the common opinion for the restructuring and increased innovativeness of Finnish universities (Aula & Tienari, 2011, pp. 14-15). In recent years, Finland radically reformed its national higher education and Aalto University represents the flagship project of this reformation. Moreover, the goal of the new university was to create a world-class university which will become an attractive and innovative global player (Aula & Tienari, 2011, pp.7-8).

One of the reports ranks Finland amongst the top five countries in the world for "university-industry collaboration in R&D". Especially the Helsinki University of Technology was already acknowledged as an institution with strong links with industry, but mainly just with major companies, and Finland as a nation of just 6 million inhabitants does not want to depend solely on innovativeness and success of a few big companies, one of them being Nokia (Graham, 2014, p. 50).

Aalto University is located in Espoo, Finland's second largest city with half a million inhabitants. The area of Espoo is country´s major R&D centre, which is home also to other HEIs and research institutes. The region has become a vibrant region for technology-driven entrepreneurship. It is important to emphasize that today´s quick development of the university and the region into an entrepreneurial hub of the country has its basis in the previously mentioned pre-existing R&D activities and strong links with bigger companies. Moreover, the university itself has begun turning into an entrepreneurial university due to the influence of extremely strong student-led movement and consequent support of university's senior management. Concretely, the university had no explicit entrepreneurship and innovation policy but senior managers played an important role in creating the conditions for the organic growth of entrepreneurial environment at the faculty for instance by providing public endorsement, financial help and physical space for activities. Moreover, student activities also had a wider national impact by changing national attitudes towards start-up activities and entrepreneurship in general (Graham, 2014, p. 26).

In 2010, the university signed a partnership agreement with the Stanford Technology Ventures Program (hereinafter: the STVP) which was initially established as a three-year agreement and involved (Graham, 2014, p. 58):

- visits from key staff from the Stanford University faculty with expertise in entrepreneurship;
- the hosting of week-long visits of Aalto University students and the senior university management at the Stanford University and in the Silicon Valley;
- a platform to host Aalto start-ups in the Silicon Valley;
- a guidance for new Aalto research tracks in entrepreneurship;
- support in the design and delivery of the Aalto Ventures Program, including the co-teaching of key undergraduate modules.

The university today offers a range of entrepreneurship courses and multidisciplinary activities to undergraduate and postgraduate students (Multidisciplinary innovation activities, 2014):

Aalto Ventures Program (hereinafter: AVP) is a course developed under the STVP partnership and tailored for the development of entrepreneurial skills of students. Currently, there are some 20 AVP courses available and a lot of them are co-taught by a faculty from the Stanford University on a remote basis. Courses available include for instance Change makers, Entrepreneurial Leadership and New Venture Formation. Moreover, AVP is developing an entrepreneurship research portfolio and in 2013 the university appointed Growth Entrepreneurship Professorships within the School of Science (Graham, 2014, pp. 54, 58).

Design, Media, Service and Health Factories are joint projects of the university called New Expertise Workshops (Aula & Tienari, 2011, p. 17; Multidisciplinary innovation activities, 2014). Aula & Tienari (2011, p. 17) describe them as follows: "The workshops are learning, teaching, research, and co-operation environments in which the academic teams and projects as well as companies or communities work together. The workshops support international

principles, open innovation, and new ways of learning and teaching as well as an interdisciplinary attitude. The objective is that the research information will be seamlessly transferred into teaching."

4 QUALITATIVE RESEARCH ON THE CASE OF GRAZ UNIVERSITY OF TECHNOLOGY

The first chapter of the empirical part covers the presentation of the main objective of my research, the explanation of selected methodology of the research and presentation of TU Graz and four companies with whom I carried out standardized open-ended interviews. In the second chapter of the empirical part, I present qualitative data analysis and interpret the data. In more detail, I present individual factors of EE and the entrepreneurial university of TU Graz, describe outcomes of conducted interviews with companies and at the end analyse the research questions.

The main objective of my qualitative research is to analyse four factors of EE and entrepreneurial university which influence entrepreneurial personality of students at TU Graz. These factors are the following: entrepreneurial curricula, interdisciplinarity of studies, internationalization of the university and co-operation of university with industry, non-university research establishments, clusters and associations. The qualitative research provides me with findings on the intensity of development of these factors at TU Graz.

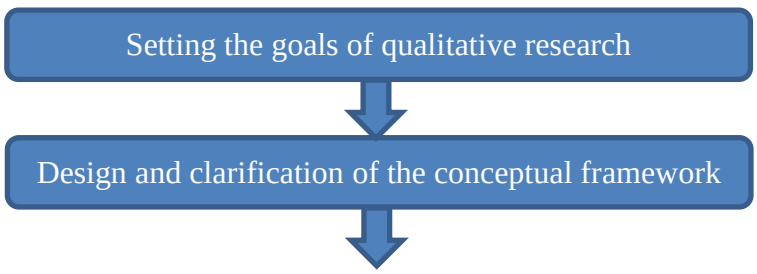
The main research questions of my qualitative research which are based on the above-mentioned four factors are the following:

1. Are curricula of TU Graz entrepreneurial and what makes them entrepreneurial?
2. How and to what extent do studies at TU Graz show interdisciplinarity?
3. How strongly does TU Graz work on the process of internationalization?
4. In which ways does TU Graz collaborate with industry and is the collaboration strong?

4.1 Methodology overview

The qualitative research design outlines the structure of my research and shows the sequence of steps I have taken.

Figure 1: A model of qualitative research design



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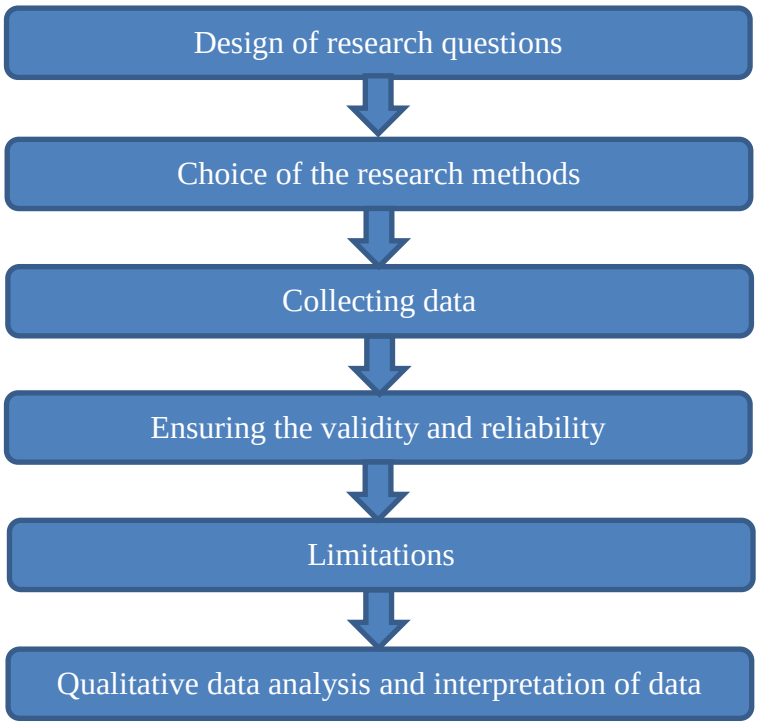


Source: Adapted from J.A. Maxwell, *Qualitative Research Design: An Interactive Approach*, 1996, p. 4.

4.1.1 Goals of qualitative research

In the empirical part of the thesis, I examine four factors of EE and entrepreneurial university at a concrete HEI, namely at TU Graz. As there are many factors of EE and entrepreneurial university, I focus in my research on the ones that affect entrepreneurial personality of students the most. Specifically, I research and analyse how these factors have developed in recent years at TU Graz. To get a comprehensive overview of the situation, I not only carried out interviews with educators from TU Graz, but also with representatives of two SMEs and two large companies which co-operate with TU Graz. Namely, the collaboration with industry and its involvement in curricula is one of the important factors influencing the quality of EE.

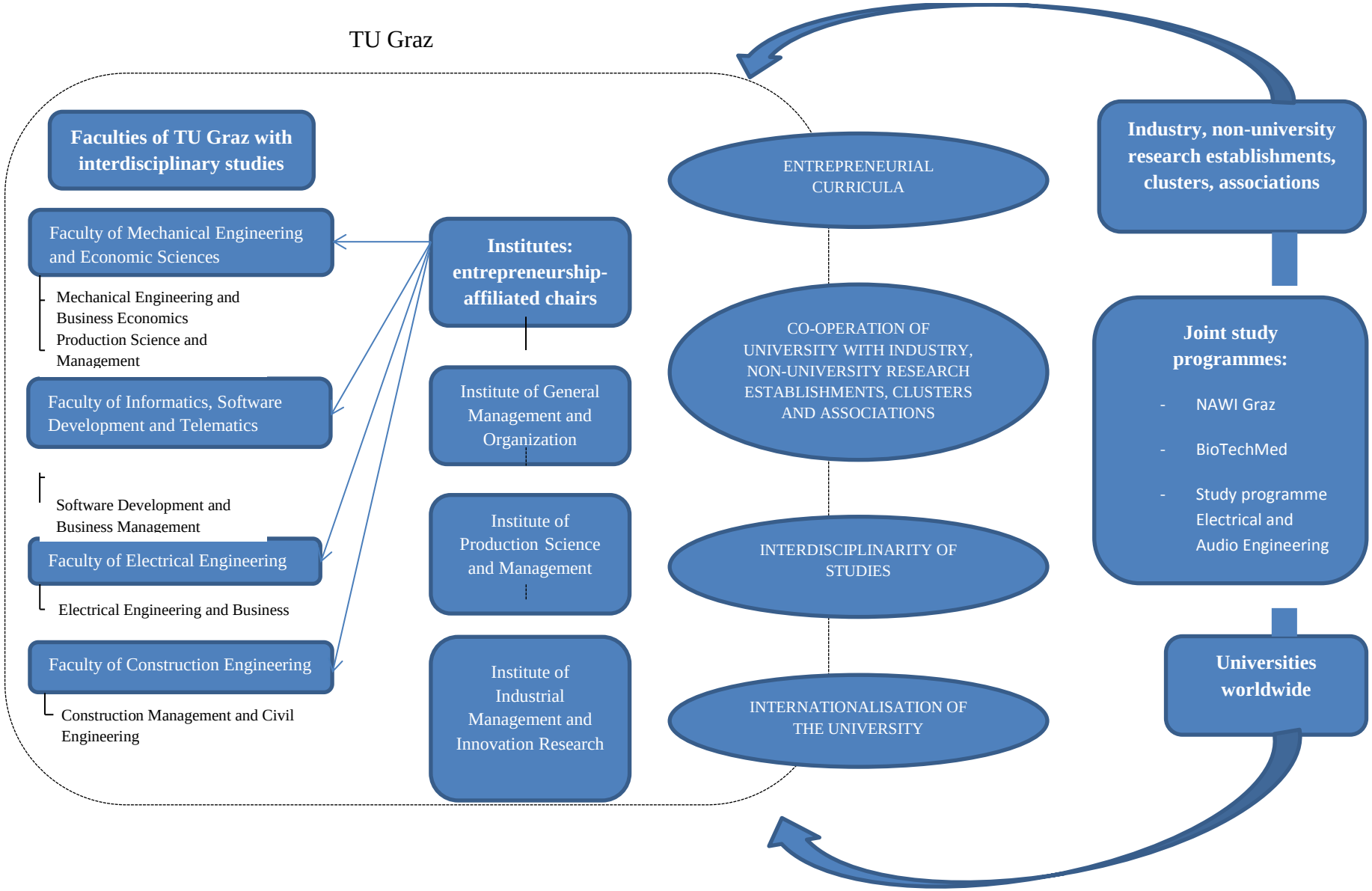
I decided for this kind of research because during literature review I noticed a lack of detailed and comprehensive case studies addressing the topic of development of EE and entrepreneurial universities in Europe. The reason for choosing TU Graz as a HEI for research lies in its geographical and cultural closeness to Slovenia. Additionally, Styria, the region where the university is located, is one of the most innovative regions in Europe which additionally contributes to intensive university-industry collaborations in the region. In 2012, Styria was selected the "European Entrepreneurial Region" for 2013. One of the main reasons for the development of the province lies in the excellent co-operation between industry and academia with TU Graz playing an important role in these co-operations (Styria, European Entrepreneurial Region 2013). University´s innovative power and top performance in research and teaching is also reflected in the invention ranking of the Austrian Patent Office. The ranking showed that in 2009 TU Graz was the most successful Austrian university which is able to compete even with

the most innovative Austrian companies (Graz University of Technology, 2010, p. 9). However, the main objective of my research was to analyse how successful is the development of the chosen four factors which influence entrepreneurial attributes of students at TU Graz. Identified good practices can serve as examples from which the Slovenian HEIs can learn and moreover adopt them.

4.1.2 Conceptual framework

On the basis of literature review in the theoretical part of the thesis and the analysis of internal and publicly available documents of TU Graz and companies in the Figure 2, I am presenting my own conceptual framework of entrepreneurial university TU Graz with an emphasis on the four factors influencing the entrepreneurial personality of students. The model shows intertwining of activities in the areas defined by four factors both within the university as well as externally in connection with local and international stakeholders. Individual factors will be discussed in detail in the second chapter of the empirical part of the thesis.

Figure 2: Conceptual framework of factors influencing entrepreneurial personality of students at TU Graz



4. 1. 3 **Research methods**

When deciding which research methodology and methods to use choices lead to consideration of the relative strengths and weaknesses of qualitative and quantitative data. Some questions demand numerical answers, some not (Patton, 2002, p. 13). We use qualitative research when we need a complex, detailed understanding of the issue and additionally to understand the contexts or settings in which participants in a study address a problem or issue. This can only be achieved by talking directly with people, going to their homes or places of work, and allowing them to tell the stories unencumbered by what we expect to find or what we have read in the literature (Creswell, 2007, p. 40). On the other hand, quantitative methods require the use of standardized measures so that the varying perspectives and experiences of people can be fit into a limited number of predetermined response categories. The advantage of quantitative research is the possibility to measure the reactions of many people answering to a limited set of questions which allows comparison and statistical aggregation of the data. This gives a broad, generalizable set of findings presented concisely. By contrast, qualitative research produces a wealth of detailed information about a much smaller number of people and cases. This allows in-depth understanding of the cases and situations studied but reduces generalisability (Patton, 2002, p. 14). In my research, I decided for the qualitative approach since my research questions demand a deeper understanding of the issues and at the same time research does not require a generalization of the findings.

Qualitative data can be grouped into four basic types of information: observation, analysing texts and documents, interviews and focus groups, audio and video recording (Silverman, 2006, p. 18). Based on the objectives of my research, I found standardized open-ended interview and analysis of internal and publicly available documents of TU Graz and companies as most suitable qualitative methods.

The main reason for the choice of standardized open-ended interview lied in the nature of the open-ended questions, allowing the respondents to fully express their viewpoints and experiences (Turner, 2010, pp. 756, 758). Moreover, such type of interview also allows asking probing questions as a means of follow-up to obtain optimal information from participants (Turner, 2010, pp. 756, 758).

Additionally, qualitative interview has some further advantages: misunderstandings about questions asked and answers given can be clarified immediately, relationship between the two discussion partners, based on confidence and security, can stimulate the degree of response and involvement of the respondent and many themes can be checked for relevance at short notice (Heyink & Tymstra, 1993, p. 295).

On the other hand, qualitative interview also has its disadvantages. The method requires considerable effort and time. In addition, it heavily relies on interviewer´s abilities. However, the most often mentioned critiques of the method are of an epistemological nature: the less the

interview has been standardized, the more difficult it is to attain positivisticly inspired reliability criteria (Heyink & Tymstra, 1993, pp. 295-296).

4.1.4 Collecting data

Qualitative approach uses the concept of purposeful sampling (Creswell, 2007, p. 125) which ensures obtaining qualified candidates that will provide the most credible information. Therefore, in my research I was looking for people with a lot of experience in the field related to the topic of my research and those who are really in the position to apply the professional practice I was interested in (Flick, 2007, p. 28).

To get access to fields, institutions or people can be a difficult task and long process (Flick, 2007, p. 34). Sampling process is somehow a negotiation running through several steps from being clear to the field of what you expect from it, experiencing immune reactions by the field to finding gatekeepers who open the doors to the right persons (Flick, 2007, p. 34). To ease the sampling process and make it more efficient, I resorted also to snowball sampling, where I asked interviewees for other people who might be relevant for my research (Flick, 2007, p. 28).

Creswell (2007, p. 122) believes that a hallmark of a good qualitative research is the acquisition of multiple perspectives that range over the entire spectrum of perspectives. Therefore, I conducted standardized open-ended interviews with respondents chosen on the basis of different criteria to obtain all relevant perspectives for my research.

Based on the main objective of my research, I decided to carry out interviews with two educators from TU Graz and with representatives of two SMEs and two large companies. The criteria for the choice of the interviewees at TU Graz were the suitability of the institutions within the university and the position of the interviewee within it. Suitable institutions for me were institutes which serve as entrepreneurship-affiliated chairs, since the university does not have an entrepreneurship chair. The university has three such institutes, all operating within the Faculty of Mechanical Engineering and Economic Sciences. I conducted interviews with academics from the two of these institutes. To be more specific, my interviewees were the Head of Institute of General Management and Organization and the Vice Dean of Studies at the Faculty of Mechanical Engineering and Economic Sciences. This was followed by an interview with a scientific assistant from the Institute of Production Science and Management. The assistant is at the same time also the project leader of the Product Innovation Project, an example of a good practice of an interdisciplinary course. When looking for interviewees in industry, my criteria were close relationship of a company with the university and company´s size. More precisely, I was looking for two SMEs and two large companies to see how different companies, in terms of size, co-operate with the university. In large companies, my interviewees were persons having an overview of the company-university co-operations, whereas in SMEs these were heads of R&Ds who directly deal with students.
Interviews were carried out in the period from October 2014 to February 2015. Primary data was obtained in one-on-one interviews which lasted for one hour on average with academics and 25 minutes with representatives of companies. Interviews with academics were conducted in person

at the TU Graz, while interviews with representatives of the companies were realized by Skype, which allowed a more flexible co-ordination for determining the date and time of the interviews.

When conducting the interviews I had a reminder sheet with questions, one intended for educators from TU Graz (see Appendix 1) and another for representatives of companies (see Appendix 2). Questions could have had different probing questions dependent on answers of individual interviewees. It could have happened also that not all questions would have been relevant for each of the interviewees or that incomplete answers would have been obtained.

The interview intended for educators at TU Graz was divided into three parts which covered topics of the three factors of EE and entrepreneurial university on which I concentrate in my research. One remaining factor of my research was not covered by a special section of questions in the interview as I obtained sufficient information through existing questions. The first part of the interview was dedicated to entrepreneurial curricula with subsections containing questions about educators, external lecturers, teaching methods and projects with master's theses. The second part of the interview addressed internationalization and the last part the co-operation of the university with industry.

Complementary to the interview for educators, I designed an interview for companies as their co-operation with the university represents an important aspect of EE and additionally, the acquired information helped me get a more comprehensive view of the researched issue. Questions in the interview were focused on the collaboration of a company with the university in areas which cover co-operation with students and the involvement of a company in the co-design of course curricula.

4.1.5 Validity and reliability

In my research, I used the form of validation particularly appropriate for the logic of qualitative research. I compared different kinds of data and different methods to see whether they confirm one another (Silverman, 2006, p. 290). I compared data derived from interviews conducted with similar interviewees. To be specific, at the TU Graz I chose interviewees working in similar institutions while in industry I chose interviewees working in companies of similar sizes. Further on, I compared different methods (Silverman, 2006, p. 282) where I compared data obtained from interviews with data from internal and publicly available documents of the university and companies. This form of comparison is called triangulation (Silverman, 2006, p. 282). Triangulation combining multiple theories, methods, observers and empirical materials helps produce a more accurate, comprehensive and objective representation of the researched phenomenon (Silverman, 2006, p. 291). Validity of the research was reached as the findings obtained with the above mentioned forms of validation drew the same or similar conclusions (Silverman, 2006, p. 291).

Reliability of findings and conclusions of the research was achieved by making the research process transparent through detailed description of the research strategy and data analysis methods. Additionally, I ensured reliability through theoretical transparency in a way that I made the theoretical stance from which the interpretation took place explicit and showed how this

produced particular interpretations and excluded others (Silverman, 2006, p. 282). Direct test of reliability was also represented by the preparation of transcripts (Silverman, 2006, p. 288).

4.1.6 Limitations

According to the objectives of my research, the sample of interviewees could have contained more respondents to get an even more comprehensive overview of the researched issues. Namely, I could not obtain candidates for the interview from all three institutes which serve as entrepreneurship- affiliated chairs, but just from two of them due to the lack of time of suitable persons from the third institute. I faced the same problem when trying to obtain a respondent for the interview focusing on the issues of the internationalization of the university. When inviting companies for co-operation, just one company was not willing to participate due to confidentiality of data required.

Although the mother tongue of the respondents was German, interviews were conducted in English due to my insufficient knowledge of German. However, the communication with respondents did not suffer any misinterpretation or non-understanding since interviewees and myself are fluent in English.

Conducting the interviews was a very time-consuming process since it took me five months to identify suitable respondents, convince them to participate and conduct the interviews. Moreover, interviews were sometimes postponed which additionally prolonged the process.

4.2 Graz University of Technology and companies overview

4.2.1 Presentation of the Graz University of Technology

TU Graz is the oldest science and technology research and educational institute in Austria, founded in 1811. It is one of the three universities of technology in Austria, the other two are located in Leoben and Vienna. Additionally, it is the second largest university in Styria after the University of Graz (Graz University of Technology, 2014b, pp. 3-4; TU Austria, Austrian Universities of Technology, 2014). In comparison with comparable institutions worldwide, the university performs top teaching and research in the fields of science and engineering. The university is extremely active and successful in research which is shown through numerous competence centres, laboratories, special research fields and large EU projects to name just a few examples (Graz University of Technology, Science - Passion - Technology, 2014). It is Austria´s leading university in terms of research agreements with business and industry from basic research to industrial implementation. What makes this university unique are also top master and PhD studies with high-quality teaching programmes in all fields. Additionally, it offers the biggest range of inter-university study programmes in Austria (Mission Statement, 2014). The university is the heart of the research community of Austria and especially Styria. As already mentioned, the university boasts excellent research which is concentrated in five promising Fields of Expertise (hereinafter: FoE): Advanced Materials Science, Human & Biotechnology, Information, Communication & Computing, Mobility & Production and Sustainable Systems (Graz University of Technology, 2012, p. 3).

Tables below present faculties and key data of the TU Graz.

Table 8: Faculties of the TU Graz

Architecture
Civil Engineering
Mechanical Engineering and Economic Sciences
Electrical and Information Engineering
Technical Mathematics and Technical Physics
Technical Chemistry, Chemical and Process Engineering, Biotechnology
Computer Science and Biomedical Engineering

Source: Graz University of Technology, *Science - Passion - Technology*, 2014b, p. 5.

Table 9: Key data of the TU Graz for academic year 2013/14

Students (WS 2013/2014)	12,565
Percentage of women	22.6%
Percentage of international students	15.9%
Percentage of exchange students	1.2%
Beginners (WS 2013/2014)	1,894
Graduates (Academic Year 2012/2013)	1,934
Bachelor´s programmes	933
Master´s programmes	549
Diploma programmes	297
Doctoral programmes	155
Federal budget 2013 (in million EUR)	138.6
Third-party funds 2013 (in million EUR)	56.7
Staff (persons as of 31/12/2013)	2,376
Percentage of academic staff	61.9%
Percentage of non-academic staff	38.1%
University spin-offs (2003-2013)	68
Number of employees in spin-offs	<500

Source: Graz University of Technology, *Science - Passion - Technology*, 2014b, p. 5.

The aim of the university is to maintain the balance between basic research and application-oriented research. Further areas on which its strategic orientation lies are internationalisation, further development of the FoE and strong co-operation with other research institutions and industry (Graz University of Technology, 2012, p. 3).

University´s mission and vision clearly communicate entrepreneurial values which are incorporated into the operation of the university. In this way, the university defines itself as a modern university which follows international trends and moreover also creates them.

Encouraging and promising is already its slogan “With enthusiasm to the top” (Graz University of Technology, 2012, p. 3).

University´s mission reads as follows (Mission Statement, 2014): Graz University of Technology is an important university in the international research and education network of engineering and science. It is rich in tradition and future oriented in equal measure, with a claim to excellence. Based on scientific bachelor’s programmes, it concentrates on research-oriented master’s and PhD programmes. Graz University of Technology produces top performers and managers much in demand and contributes to the sustainable development of society, economy and environment in a responsible way.

University´s ambitious goals are clearly reflected through its vision (Mission Statement, 2014):

- In its Fields of Expertise, Graz University of Technology counts among the top 10 European universities.
- It cultivates a well-balanced relationship between basic and applied research.
- Graz University of Technology co-operates with universities and research institutes it has chosen on the basis of defined criteria.
- Its expertise makes it a preferred co-operation partner of science, business and especially industry. The master’s and PhD programmes of Graz University of Technology are very much in demand internationally. Graz University of Technology is significantly increasing the achievement potential and attractiveness of Styria as a location for technology, science and education, and sees itself as a scientific gateway to South-Eastern Europe.
- Its competence-enhancing and family- and women-friendly orientation and its diversity management makes it an attractive employer.
- Graz University of Technology has a strong alumni network for mutual support and advancement.

4.2.2 Presentation of interviewed companies

I conducted interviews with two SMEs and two large companies which co-operate with TU Graz. In addition, both interviewed large companies are probably companies collaborating with the university most intensively.

4.2.2.1 AVL

AVL List GmbH was founded in 1948 and operates as a subsidiary of AVL Holdings Limited. The company is headquartered in Graz and has 45 affiliates worldwide (America, Asia, Australia, and Europe) (Company Overview of AVL List GmbH, 2014). AVL Holdings Limited is the world's largest independent company for the development, simulation and testing technology of powertrains (hybrid, combustion engines, transmission, electric drive, batteries and software) for passenger cars, trucks and large engines. The company employs more than 6,650 employees worldwide, including 2,950 in Graz. Turnover of AVL List GmbH in 2013 amounted to 1.05 billion EUR (AVL Facts, 2014).

4.2.2.2 Magna

Magna International Inc., a publicly listed company since 1961, is the leading and the most diversified automotive supplier in the world. It designs, develops and manufactures automotive systems, assemblies, modules and components, and engineers and assembles complete vehicles, primarily for sale to original equipment manufacturers of cars and light trucks in North America, Europe, Asia, South America and Africa (Facts & History, 2014).

The company has 312 manufacturing operations and 83 product development, engineering and sales centres in 29 countries. Magna employs over 130,000 employees (About Magna, 2014). Its turnover in 2013 amounted to 34.8 billion dollars (Magna International Inc., 2014).

Magna is one of the leading suppliers also in the European market, which is the world´s largest producer of motor vehicles. Magna Steyr, located in Graz, is with its complete vehicle engineering and assembly operations one of Magna´s most important subsidiaries (Global Reach, Europe, 2014). The company employs approximately 6,000 employees.

4.2.2.3 KWB

KWB - Kraft und Wärme aus Biomasse GmbH was founded in 1994 in Graz. From 1997, the company is headquartered in Eastern Styria in St. Margarethen an der Raab. KWB brand stands for biomass-generated power and heating. Both founders of the company are recognised thought leaders for regenerative energies in the biomass field. Additionally, one of them, former professor Dr. August Raggam, established a research institute "Alternative Energy Generation" at TU Graz in 1985. Today, KWB employs 450 employees and has four subsidiaries and seven distributorships in Germany, Italy, Slovenia and France. Its turnover in 2013 amounted to 74 million EUR. In 2006, the company opened Europe's largest and newest private research and innovation centre for biomass (KWB - Kraft und Wärme aus Biomasse GmbH, 2014, pp.3, 6, 8-10).

4.2.2.4 Ventrex

Ventrex Automotive GmbH was founded in 1949 and is headquartered in Graz. The company specialises in the development and manufacturing of compressors and valves for the automotive industry. It operates in market niches being one of the leading strategic partners in the automotive industry (Discover Ventrex, 2014; History, 2014). Ventrex employs 145 employees and its turnover amounts to over 50 million EUR (VENTREX Automotive GmbH, 2015, p. 3).

4.3 Qualitative data analysis and interpretation of data

In the following subchapters, I present the analysis based on data obtained from interviews and data from internal and publicly available documents of the university and companies with regard to four factors of EE and entrepreneurial university on the case of TU Graz.

4.3.1 Entrepreneurial curricula

4.3.1.1 Educators

To be a competent educator with regard to renewed curricula which teach for entrepreneurship instead of about entrepreneurship it is important to have practical experience. Namely, for instance 50% of educators from the Faculty of mechanical engineering have worked in industry or have some practical experience. On average, they have 10-15 years of experience, and common age for getting professorship at the university is 35-40 years. Normally, educators can spend 20% of their work time (one day per week) to any business but with the obligation to report this to the university. They are whether founders of companies or engaged in R&D departments of companies. My respondent estimates that approximately half of the educators take advantage of such an opportunity. However, the university does not allow partial employments.

To provide students with information and knowledge originating from industry, the university is strengthening external lecturing. A good example is the Institute of Production Science and Management which has the most of external lecturers and has been practising external lecturing from 2006 on. The institute co-operates with 15 external lecturers whereas other institutes on average with 4-5. External lecturers usually carry out intensive 3-5 day courses. Additionally, there are also some lecturers which give 1-2 hour lectures. Lecturers are often alumni (in approximately 80% of cases) coming from companies which collaborate with the university tightly in all aspects or those who did a PhD, already lectured and then, while working in industry, take on the role again.

Once or twice per semester, the university hosts special external lecturers such as Siegfried Wolf, the Chairman of Russian Machines, a company with 100,000 employees, or a retired former CEO of McKinsey Germany. Such guest lecturers normally lecture to 30-40 students in the class, and additionally Siegfried Wolf also likes to discuss the lectured topic with the students.

The university does not frequently prepare lectures for educators on how to teach whereas the Institute of Production Science and Management prepares a lecturer’s day once per year where they give instructions how to prepare lectures, which teaching methods to use, how to do seminar works, presentations, field trips and exams. At the end, external lecturers decide on their own how they will structure the course. Lecturers take care of the whole course including preparation and evaluation of the exams. Individual external lecturers do 3-5 day lecturing normally once a year. Lecturers are not paid, unless for accommodation costs.

4.3.1.2 Teaching methods

One of the characteristics which distinguishes entrepreneurially-led courses and studies from others at the TU Graz are: projects blending theory with practice, interdisciplinary orientation of the courses and studies and extracurricular projects.

4.3.1.2.1 Product innovation project

One of the courses which is entirely based on interdisciplinarity and team work is called "Product innovation project". The course is available from the academic year 2006/07 onwards. It is provided by the Institute of Industrial Management and Innovation Research in co-operation with the Aalto University (Finland). It is primarily aimed at students of engineering, industrial design or business. Additionally, it is also open to other students who are interested in product development or consumer goods. The course is designed for students in the final stage of their studies (About PIP, 2014).

The course was introduced at the initiative of the then student of TU Graz who attended a similar course at the Helsinki University of Technology, which is today part of the Aalto University. The course called „Product development project" has been carried out at the Helsinki University of Technology since 1997 and was therefore seen as a proven concept (Fallast, 2007, p. 1). Consequently, the course represented an important basis for the development of the "Product innovation project" at TU Graz.

The course which in all aspects follows the characteristics of EE is also internationally oriented with approximately one third of students being international students or coming from abroad. Each year, a few students participate in the project as remote members of the team coming from partner universities: Aalto University (Helsinki), University of Maribor, Pace University (New York City). These students are equivalent members of the teams communicating and working with the team via electronic media. During the course, teams are working on tasks given by industry. They are supported by the teaching staff but are independent in choosing the tools and methods to achieve the goal. The project after a study-year long period results in product concept, business plan and working prototype (About PIP, 2014).

Industry partners sponsor individual projects in an amount of EUR20,000. Half of it shall cover all the costs related to the project, and the second half is intended for other costs of the responsible university´s units and for further development of the course.

Industry funding of the project already enabled arrangement of the working environment allowing flexible use. For building prototypes, there are workshop facilities available, and additionally from other institutes also some further means for rapid prototyping with a CNC milling machine, laser cutter, 3D-printer and many more (Design Lab, 2014).

As the process of adaptation of curricula to the guidelines of entrepreneurial university is a long-term process, the university encountered a problem how to introduce this new course as students came from different studies with different curricula. Namely, there was no single course in the academic year 2006/07 that would fit the expected workload and would be valuable for different curricula. The solution lied in finding different courses for each participating student´s faculty. Consequently, also grading was carried out by different course educators. Soon, the problem was solved and currently students from different studies can choose the course as one of the courses of the master's programme Production Science and Management.

The popularity of the course has been growing both on the side of the students as well as companies. This is proven by the yearly increasing demand and enrolment of the students in the course. At the same time, the benefits of such projects were recognized at the sponsor side as companies have begun approaching the Institute by themselves. This year, the course will involve as much as six projects with 65 participating students from 20 different nationalities. Partners of the project will be Oxford University, Fronius, Google California, voestalpine and Magna Interiors (New Projects for 2014/15!, 2014).

For companies, student projects are a way of testing risky projects, developing "nice-to-have" features and for investigating the technical or market feasibility of a project idea. Such projects are especially welcome for SMEs which often do not have sufficient resources to innovate, but as seen from the range of the participating companies in the Product innovation project external support is important also for large companies (Fallast, 2007, pp. 23, 33).

4.3.1.2.2 Projects with master's theses

Basically, two types of theses are distinguished (Graz University of Technology, n.d., p. 5):

Theoretical thesis: for example deepening of a theoretical question with the help of literature search.

Practical thesis with/without company participation: theoretical and methodological processing of a practical problem provided either by an institute or by a company.

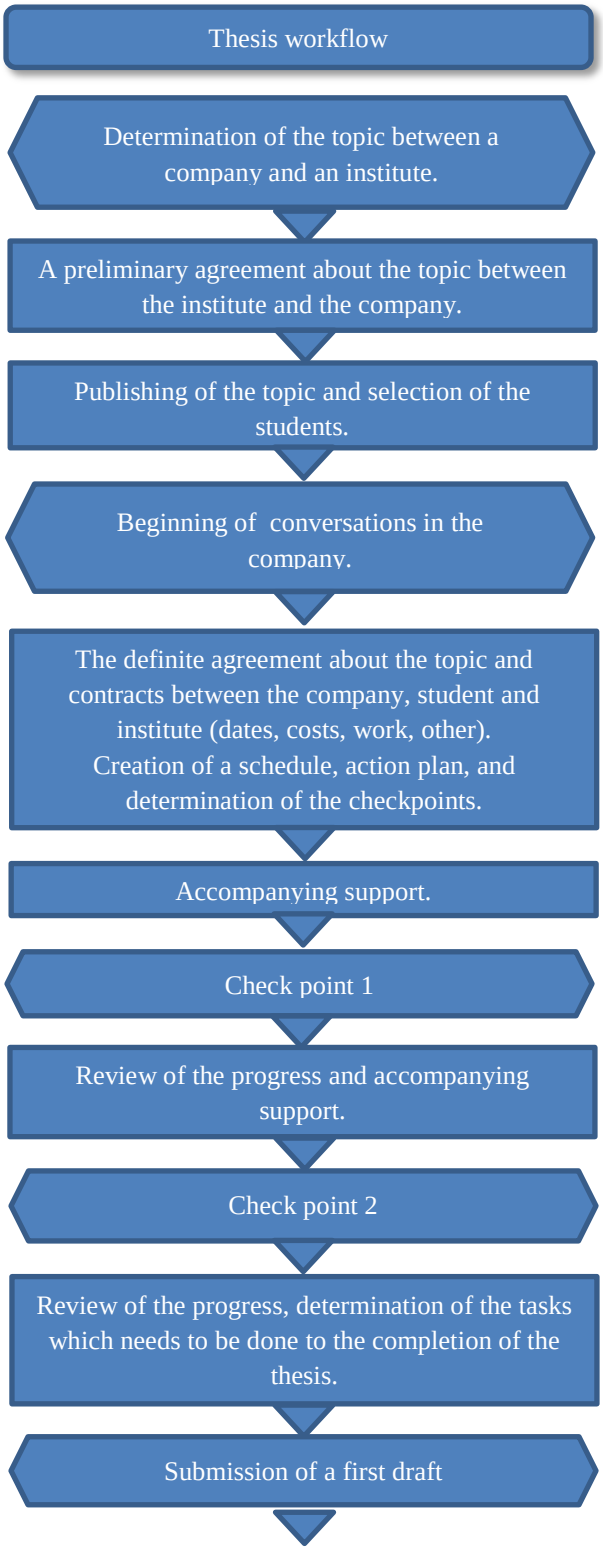
The main advantages of company-student-university collaboration are the following (Graz University of Technology, n.d., p. 5; Fallast, 2007, pp. 33-34):

- The company has the opportunity to receive solutions for pending problems with relatively little effort from their side. At the same time, experience has shown that unconventional ideas are more easily initiated with external partners.
- The company learns the qualities of a potential employee.
- The student learns about practical problems before graduation.
- The feedback from the practical experience facilitates the continuous evaluation of the quality of education. Once a student finishes his/her studies, it is difficult to obtain feedback about the usefulness and practicability of acquired knowledge and skills. If theses, as well as student projects, are carried out in collaboration with industry, the practicability of the taught content can be proved immediately which allows identification of missing contents. This helps to keep teaching and research up-to-date and to adapt to changed requirements of the industry. Therefore, a university is able to follow technological trends and changed trends in the management culture.
- Established partnerships with companies enable involvement of companies also in other forms of co-operation, for example in the form of guest lecturing.

90-95% of diplomas and master's theses at the TU Graz are done in collaboration with companies.

Since master's theses are more extensive works with greater value for the company, I am describing the process of co-operation of industry and students through projects with master's theses. Figure 3 describes the workflow of the thesis.

Figure 3: Thesis workflow



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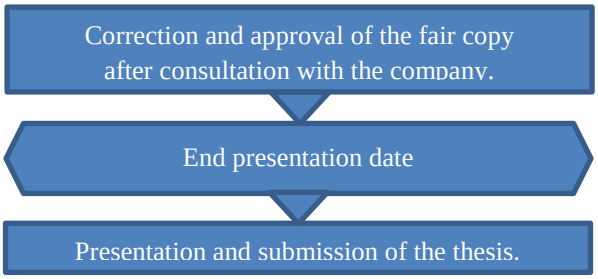


Source: Graz University of Technology, *Diplomarbeits Information [Theses information]*, n.d., p. 9.

Writing a master's thesis takes about 3-9 months. Usually the thesis comprises of 100-120 pages (official length is 80-130 pages). Co-operation of companies with TU Graz in terms of master's thesis is financially valued at 2,500 EUR/thesis. My respondent stressed that the transformation from paying nothing to paying a certain amount to the university took 5-10 years. Today, the whole university has the same standards and master's theses are valued at approximately the same amount.

Approximately 90% of the topics for master's theses is determined by the companies according to their needs in areas of R&D and/or management. Sometimes, topics for the theses are prepared also with the help of institutes on the basis of discussions which topics would be suitable for research at the university and which interesting for companies. The frequency and intensity of faculty´s co-operation with industry is reflected in the number of topics for master's thesis put forward by companies. Namely, the number of suggested topics from the side of the companies is much higher than the supply of potential students.

In companies, most of the time is spent on daily business tasks which enable business running. Employees are focused on given tasks and consequently experience lack of time and resources for the development of new or improved technical and management solutions. Additionally, continuous work on the development of similar products and dealing with constantly similar tasks diminishes the ability to see a possible variety of different approaches to the problems and challenges. Projects with master's theses can help overcome such gaps in the companies. For example some topics are new for the companies and in such case as a result of the theses companies get an overview of specific areas; sometimes, topics form a smaller part of some bigger projects within the companies which results in solutions for specific challenges. To guarantee a balance between theory and practical input, the whole process of the master's thesis is supervised by a member of the institute and a representative from the company.

Students are always heavily involved in the work at a company which refers to the topic of their master's thesis. During their work on the thesis, they are therefore present in the company. Students receive 500 to 600 EUR monthly for their engagement.

4.3.2 Interdisciplinarity of studies

4.3.2.1 Studies combining technical and management fields of knowledge

New economic and societal reality requires intertwining of different knowledge for the creation of new products and services. HE system should be adapted to these requirements with interdisciplinarity of certain studies. TU Graz follows these trends and is in certain aspects, at least in Europe, an example of best practice.

One form of interdisciplinary studies at TU Graz are studies combining technical and management fields of knowledge, which build the ability of future experts throughout the study to successfully confront also management responsibilities. These studies are presented in the table below.

Table 10: Studies at TU Graz combining technical and management fields of knowledge

Study	Level of studies available	Language of studies	Faculty
Mechanical Engineering and Business Economics	bachelor/master	German	Faculty of Mechanical Engineering and Economic Sciences
Production Science and Management	master	English	Faculty of Mechanical Engineering and Economic Sciences
Software Development and Business Management	bachelor/master	English	Faculty of Informatics, Software Development and Telematics
Electrical Engineering and Business	bachelor/master	German	Faculty of Electrical Engineering
Construction Management and Civil Engineering	bachelor	German	Faculty of Construction Engineering

Source: *Courses of Study*, 2014.

TU Graz does not have an entrepreneurship chair, however three institutes, all operating within the Faculty of Mechanical Engineering and Economic Sciences, can be identified as entrepreneurship-affiliated chairs. Those institutes are the Institute of General Management and Organization, Institute of Production Science and Management and Institute of Industrial Management and Innovation Research. Contents of institute´s courses relate to economic sciences connecting economy and technology with focus on interdisciplinarity (Management and Technology, 2014). Courses at the Institute of Production Science and Management are entirely held in English, the Institute of General Management and Organization has 60-80% of courses in

English whereas the Institute of Industrial Management and Innovation Research offers only a few courses held both in German and English.

Courses provided by individual institutes are listed in tables below:

Table 11: Courses provided by the Institute of Production Science and Management

Master courses
Warehouse Logistics
Teambuilding
Leadership and Motivation
Quality Management
Production Strategies
Management Topics of Automotive Industry
Change Management
Product Innovation Management
Manufacturing and Supply Chain Network
Career Management
Safety and Sustainability
Operational Risk Management
Marketing in Automotive Business

Source: *PSM Lectures 2014/2015*, 2014.

Table 12: Courses provided by the Institute of General Management and Organization

Bachelor courses
Project Management
Bachelor Project
Master courses
General Management and Organization
Information Management
Process Management
Entrepreneurship
General Management Case Studies

Table continues

Continued

Selected Topics in Management
Technology Management
General Management Simulation

Source: *Courses*, 2014.

Table 13: Courses provided by the Institute of Industrial Management and Innovation Research

Bachelor and master courses
Industrial Management
Industrial Engineering
Industrial Management - Seminar
Value Management I
Energy Economics
Quality Management
Product Innovation Project
Logistic Management
Safety at Work
Creativity Techniques

Source: *Courses at the IBL*, 2014.

A master study programme standing out within studies combining technical and management fields of knowledge is certainly Production Science and Management. To successfully realize the study programme, the Institute of Production Science and Management was founded (Production Science and Management, 2014).

One of the stronger indicators showing that TU Graz has been adapting to wider economic changes is the formation of the public-private partnership in the form of Franc Stronach Institute (hereinafter: FSI). FSI was established in 2003 by partners TU Graz and company Magna. The institute is an independent academic institution which is integrated into the Faculty of Mechanical Engineering and Economic Sciences. FSI provides world-class teaching and research in the field of vehicle technology. Automotive industry is very strong in Styria and formation of such an institute was therefore very welcome bringing together science, education and business in a unique way (About FSI, 2014). Today, FSI represents a best practice model of a public-private partnership between university and industry with its optimum thematic and scientific integration into the Styrian automotive cluster (Production Science and Management (PSM), Study Programme, 2014).

In 2004, FSI and more specifically the Institute of Production Science and Management within it introduced a branch-specific master's programme Production Science and Management. This

study programme educates future engineers based on the latest developments in research and teaching in the field of automotive technology. Traditional studies produce engineers who are hardly prepared for management responsibilities, consequently the new study programme offers the rare combination of production science, leadership and management teaching. The content of teaching and research at the FSI is from the start also supported by other industrial partners in addition to Magna. The study programme is internationally oriented and contains a high degree of interdisciplinarity. Till recently, this has been the only study programme completely held in English. This top-level study programme represents a first-rate educational offer for the best students in the fields of Mechanical Engineering, Mechanical Engineering and Business Economics and for excellent students from all over the world (Production Science and Management (PSM), Study Programme, 2014).

Another advantage and added value of the study is a possibility to do an internship in a non-German speaking country (Europe, Asia, the US). Internships are organized in co-operation with partner companies of the FSI and it is recommended that they last for eight weeks or longer. Companies offering internships provide versatile and hands-on placement profiles which allow students to gain in-depth knowledge and to consolidate acquired skills in technical, methodical and social matters (PSM-Internship 2014, 2014).

Table below lists courses related to leadership and management teaching. Names of the courses show that the study programme is taking into account the needs of the industry, its trends, and that it is following contemporary contents of management studies which intertwine with study-specific industry topics. Additionally, the study programme allows greater freedom and flexibility in the formation of the study. The study is therefore more customized which at the end results in greater utilization of student´s potentials.

Table 14: Courses provided by the Institute of Production Science and Management related to leadership and management teaching

Compulsory courses
Engineering and Business Informatics
Industrial Management Seminar
Controlling
General Management and Organisation
Product Innovation Management
Production Planning and Control
Production Strategies
Quality Management
Optional compulsory courses
Creativity Techniques

Table continues

Continued

Change Management
General Management, Case Studies
Leadership and Motivation
Marketing in Automotive Business
Product Innovation Project
Success Factors in Management
Teambuilding
Quantitative Methods for Business
Optional courses
Business Economics, Case Studies
Career Management
Economics General Management, Simulation
Information Management
Life Cycle Analysis
Marketing Management
Project Management
Rhetoric and Presentation

Source: *Production Science and Management (PSM), Study Programme*, 2014.

4.3.2.2 Joint study programmes

University is strongly interlinked also with local universities, providing joint study programmes research and activities.

TU Graz is a member of the Association of Austria´s University of Technology (hereinafter: TU Austria) which was founded in 2010. Austria has three universities of technology; TU Austria in addition to TU Graz combines the Vienna University of Technology and the University of Leoben. With almost 43,000 students and some 8,600 staff it represents a nationally and internationally important university forum. Synergies are visible in teaching, research and university educational policy (Graz University of Technology, 2014a, p. 51).

Styrian University Conference represents a common academic platform for research and education of five Styrian universities, two universities of applied sciences and two educational colleges. With more than 55,000 students and an overall budget of EUR700 million, universities act as drivers of innovation and economic growth in Styria. Till now, a joint web platform for Science Space Styria has been established, while future plans include a virtual Styrian campus. With platforms such as the Styrian University Conference, Styria tries to further boost co-

operation and raise its profile as a research location (Graz University of Technology, 2014a, p. 51; First anniversary of the Styrian Universities Conference, 2015).

Below, I am outlining two cases of best practise in terms of joint study programmes and research which are in this form unique in Austria.

NAWI Graz is a co-operation project between TU Graz and the University of Graz which is perceived as the best practice model of the Austrian university community awarded with several prizes. It happened for the first time in the history that two Austrian universities entered into a comprehensive strategic co-operation in teaching and research. NAWI Graz was established in 2004 and means the sharing of teaching, research, doctoral programmes and infrastructure projects in the field of natural sciences. NAWI Graz offers 18 bachelor's and master's joint study programmes in Bioscience, Chemistry, Earth, Space and Environmental Sciences, Mathematics and Physics with a total of 4,600 students. For the purpose of joint research, close co-operation and interdisciplinarity were established as well as joint laboratories (Graz University of Technology, 2012, pp. 4, 12-13; Teaching, 2014).

BioTechMed is the inter-university initiative for joint research area in which scientific foundations, medical science and technological development can work together. BioTechMed was established in 2011 by three partner universities: the University of Graz, the Medical University of Graz and Graz University of Technology (Graz University of Technology, 2012, p. 14).

The University of Music and Performing Arts Graz and TU Graz offer a joint study programme Electrical and Audio Engineering which is the longest existing inter-university course of studies in Austria. The universities together obtained federal funds which helped improve basic education and research-led teaching by establishing an inter-university research facility “Sound Studio” and a research area “acoustics and audio engineering” (Graz University of Technology, 2012, p. 88).

4.3.2.3 Extracurricular projects

The university also supports and encourages extracurricular activities such as projects described in subchapters.

A good example of interdisciplinarity and team work on a demanding task preparing students for their future work environment is project TU Graz Racing Team. Each year, more than 60 students work on the development, construction, and production of a racing car. Students with different backgrounds, such as mechanical and electrical engineering as well as business economics, combine their knowledge which results in a complex product. This project is also a basis for many bachelor’s and master’s theses which significantly impact the outcome of the project (About, 2014; Graz University of Technology, 2014a, p. 23).

Tera TU Graz is an annual team project of 20-30 students who work on efficient automotive technologies and design of a racing car for the Shell Eco-Marathon in Rotterdam. In 2014, students from TU Graz won the competition among 3,000 students from 24 participating countries (Fennek 2014, 2014; Graz University of Technology, 2014a, p. 24).

4.3.3 Internationalization of the university

Internationalization is a part of TU Graz strategic orientation since 2011 when a new rector was elected (Graz University of Technology, 2012, p. 8). Currently, TU Graz is defining ten strategic partnerships with best ranked universities. The university co-operates with about 200 universities but in the future it will focus on and intensify ties with the previously mentioned ten universities. To reinforce internationalisation, the university started a three-year financially well supported programme in 2012 for a mobilisation of the following activities (Graz University of Technology, 2013, p. 40):

- further introduction of master´s and doctoral programmes in English;
- establishment of strategic university co-operations;
- evaluation of existing co-operations;
- promotion of mobility;
- broadening of the continuous education programme for teaching staff, e.g. teaching in English.

4.3.3.1 Mobility programmes

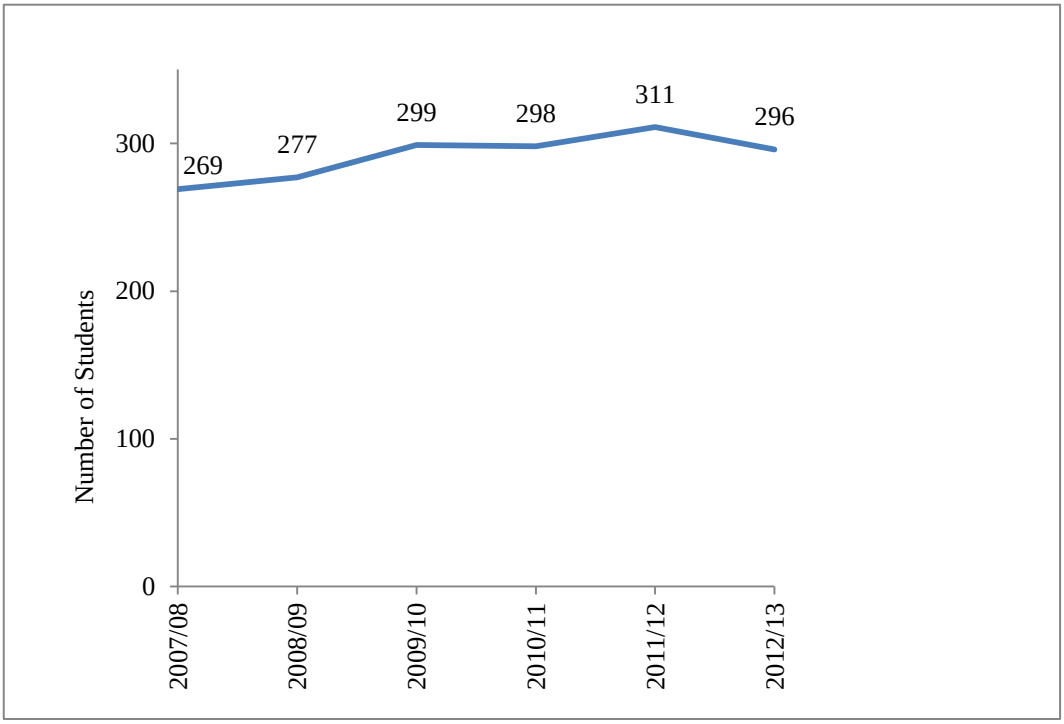
In addition to student mobility amounting to 1.2%, TU Graz also tries to intensify staff mobility. My respondent estimates that 20-25% of educators at the university are mobile. Educators for example do guest researches during the summer months at foreign faculties and before getting full professorships or heading for associate professorship they are encouraged to stay abroad for at least six months. Lately, the mobility of staff has been stimulated by awarding internationally active educators.

At the EU level, students and/or staff have a possibility to go abroad via ERASMUS, ERASMUS MUNDUS, CEEPUS and TEMPUS programmes. At the international level, mobility programmes available for TU Graz include ISEP, ASEA-Uninet network and Eurasia-Pacific-Uninet.

ERASMUS programme offers the highest number of places to study abroad, thus a high proportion of ERASMUS incoming and outgoing students is not surprising. ERASMUS students represent more than 50% of student exchanges at the university. In 2011, the university had ERASMUS agreements with 176 partner institutions. In general, figures for all outgoing and incoming students from 2010 onwards show an increase of student mobility compared to the average noted for the period of 2005-2010. Additionally, it is encouraging to see how TU Graz is becoming an increasingly popular destination also for students from third countries, such as the

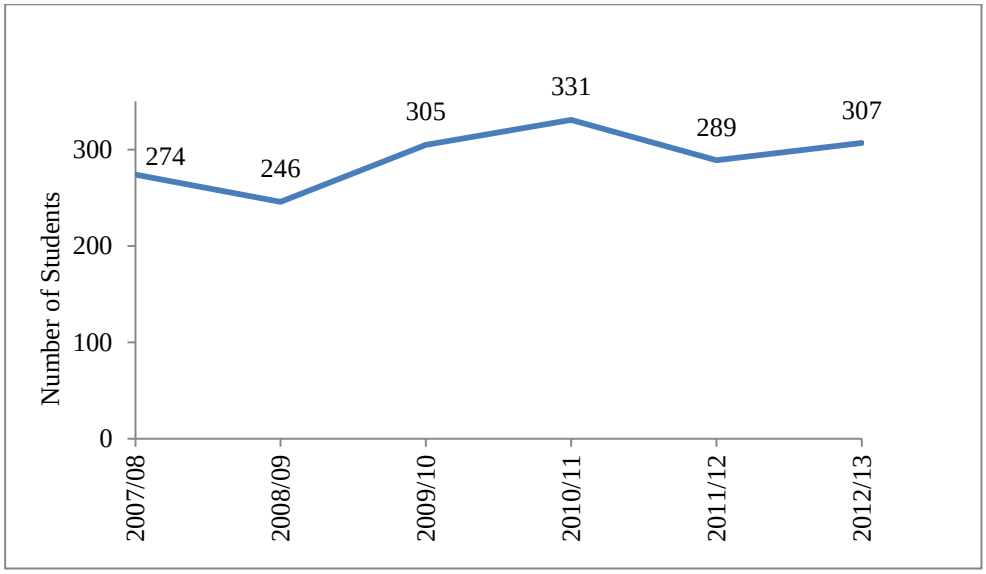
US, who come to the university via the ISEP Network (Graz University of Technology, 2012, pp. 49-50).

Figure 4: Student mobility - development of incoming students in the period from 2007/08 to 2012/13



Source: Graz University of Technology, *Facts and Figures 2013, 2014c*, p. 23.

Figure 5: Student mobility - development of outgoing students in the period from 2007/08 to 2012/13



Source: Graz University of Technology, *Facts and Figures 2013, 2014c*, p. 23.

The most successful students of the university also have an opportunity to receive a scholarship from a company for studying abroad. Students can obtain this scholarship in addition to being sponsored through the traditional mobility programmes. In 2013, altogether 10 companies equipped 26 students with scholarships in the sum of EUR52,000 (Graz University of Technology, 2014a, p. 43).

On average, approx. 40 members of the university take advantage of the ERASMUS staff mobility scheme on a yearly basis. The scheme offers teaching and continuous education at a higher education partner institution or in a company (Graz University of Technology, 2012, p. 50; Graz University of Technology, 2014a, p. 44).

In 2013, the university hosted three visiting educators working at the university for one semester. These educators were sponsored for the first time using international funds. Another five persons came to the university for shorter visiting professorships (Graz University of Technology, 2014a, p. 46).

In 2013, the university took part for the first time in the ERASMUS MUNDUS partnership. This partnership consists of 9 universities and ten partners from third countries. With 300 received applications for university personnel visits, TU Graz was the most popular visiting institution together with the Technical University of Berlin (Graz University of Technology, 2014a, p. 47).

The largest international network for the exchange of students, the International Student Exchange (hereinafter: the ISEP), has recorded an increase in incoming students at TU Graz and the university has gradually become the preferred destination. The ISEP includes more than 300 universities and 42 countries worldwide offering study visits abroad (Graz University of Technology, 2012, p. 51).

The university is also very active in the European-South East Asian ASEA-Uninet network. This network includes 60 member universities from 15 European and Asian countries and its role is to promote teaching and research co-operation among members (Graz University of Technology, 2012, p. 51).

The university is also strongly linked with universities and further education institutions in its immediate neighbouring countries by being a member of the Alpe-Adria Rectors´ Conference and Danube Rectors´ Conference (Graz University of Technology, 2012, p. 51).

4.3.3.2 Teaching in English

Teaching in English is important to prepare students, educators and university for global demands (Graz University of Technology, 2014a, p. 42). The university has been intensively establishing strategic partnerships in research and teaching with the world´s leading universities.

Doctoral training at the university has mostly been carried out in English for many years, but from the winter semester of 2013/14 onwards all doctoral degree programmes are offered in English. Due to studies in English, PhD curricula have the highest percentage of international students. Apart from the longer existing English master programme Production Science and Management further three master programmes completely held in English were offered in winter semester of 2014/15 (Graz University of Technology, 2014a, pp. 41, 47).

Some courses at the university have long been offered both in German and in English or just in English. The Faculty of Mechanical Engineering and Economic Sciences is for instance the only faculty which decided to offer some courses exclusively in English, others traditionally offer some courses in both languages. From about 600 courses offered by the Faculty of Mechanical Engineering and Economic Sciences approximately 25% of them are offered in English or in both languages. Moreover, more than half of the courses offered by three institutes of this faculty which are identified as entrepreneurship-affiliated chairs are held in English. Some educators offer courses sequentially, one semester in German and one in English. But this is more of an exception than a rule and also Austrian students usually prefer to choose lectures in their mother tongue. In order to utilize internationalisation as much as possible, greater integration of students within the courses is needed. Therefore, educators would like to encourage more local students to study in English and mix them with foreign students. Currently, courses held in English are mostly chosen by foreign students. Currently, a common practice is to provide lecture materials in English and then if participants are foreigners lecture is held in English, and if participants are local students then lectures are held in German. Due to resource problems, implementation of parallel courses is not possible to a large extent.

Although internationalisation of teaching is inevitable, there are some challenges and barriers to overcome. As my respondent commented, the top down approach will always use English, and the bottom-up German. Namely, the level of English of some educators is not sufficient, and on the other hand some educators are afraid to lose the quality of their lectures. Some basic courses like mathematics and mechanics have demanding content and teaching in a foreign language would make them even more difficult and of a lesser quality. Additionally, some countries, like

Germany, have already experienced some difficulties due to the change of the teaching language into English. Specifically, there is an increase in the number of Asian students and universities experienced some quality problems due to their unsatisfactory level of English. Some universities which started to offer study programmes in English massively started with reorganization and now offer certain parts of the courses in their mother tongue again.

4.3.4 Co-operation of university with industry, non-university research establishments, clusters and associations

4.3.4.1 Co-operation with industry - Partnerships and fundraising

The majority of sponsors of the university are united in the Technology and Society Forum whose aim is to promote interest in technology and the natural sciences. Activities of the forum include information and discussion events and its own series of publications (Graz University of Technology, 2012, p. 95). The university has some 40-50 companies in total acting as sponsors and donors. Sponsorships can be performed in one of the forms of the three-step sponsorship model described in the table below.

Table 15: A three-step sponsorship model of TU Graz

Type of sponsorship	Number of sponsors	Financial value of sponsorship
Basic and career sponsorships	22	EUR3,600 or 8,500 per partner/year
Lecture hall and seminar room sponsorships	10	EUR11,000 to 20,000 per partner/year for a minimum duration of three years
Strategic partnerships, endowed professorships	6	EUR100,000 to 300,000 per partner/year for a minimum duration of five years; Magna has an especially extensive partnership worth EUR2,000,000 per year

Source: *Become a partner of Graz University of Technology*, 2014.

Strategic partnership represents co-operation within one of the FoE. Partnership brings close networking of the university and corporate R&D, shared further and continuous education as well as availability of excellent infrastructure (Become a partner of Graz University of Technology, 2014).

As lecture hall and seminar room sponsors, companies can brand themselves among future employees. Company´s contribution will help ensure that TU Graz can provide optimum infrastructure to its students (Become a partner of Graz University of Technology, 2014).

As basic sponsors, companies can support top class events for the broad public and reward students' final papers which show special relevance to society. Additionally, they can sponsor study visits abroad and make contacts with the best and most mobile students of TU Graz (Become a partner of Graz University of Technology, 2014).

As career sponsors, companies can support the recruiting platform supporting students' entry into professional life and get the direct link between company and students (Become a partner of Graz University of Technology, 2014).

To manage relationships with businesses, being regional SMEs or global corporations, the university established the Research & Technology House (hereinafter: the R&T House). This institution acts as an interface between industry, businesses and other RTOs providing many services for knowledge and technology transfer. R&T House selects suitable institutes/researchers, convenes R&D project initiation meetings, gives advice on funding opportunities etc. The EU has recognized activities of the R&T House as a good practice (Competitiveness through R&D collaboration, 2014; Research & Technology (R&T) House, 2014).

For many companies, strategic and/or short-term collaboration with TU Graz has become a standard business in innovation projects (Brokering of collaborative projects/regional technology transfer initiatives for SMEs). TU Graz currently has approximately 500 ongoing projects excluding diploma theses and student team projects. In terms of proportions, companies are equally dispersed among SMEs and large companies.

Table 16: The most common forms of university´s co-operation with companies

Form of co-operation	Team	Duration
Student team projects	students, senior supervisor (TU Graz researcher)	a few weeks to several months
Bachelor´s thesis	student, supervisor (TU Graz researcher)	3 months
Master´s thesis	student, supervisor (TU Graz researcher), instructor (company)	3-9 months
Dissertation	TU Graz researcher (PhD student)	2-6 years
Feasibility studies / technological and scientific services and counselling	TU Graz researchers	a few weeks to several months
Contract research projects / R&D collaboration	TU Graz researchers, graduate students	> 6 months

Source: *Brokering of collaborative projects / regional technology transfer initiatives for SMEs*, 2014; M. Fallast, *Success Factors in the Implementation of an Interdisciplinary Product Innovation Project (master's thesis)*, 2007, p. 38.

4.3.4.2 Co-operation with non-university research establishments, clusters and associations

TU Graz strongly co-operates also with some non-university research establishments such as Joanneum Research (co-operation in the field of nanoscience) and Lustbühel Observatory (co-operation in the field of space research). Additionally, the university has its shareholdings in

more than 15 research and technology oriented companies (Graz University of Technology, 2012, pp. 88-89, 91).

Partnerships with clusters and associations additionally strengthen university´s integration into the local, national and international environment. Table below presents individual partnerships of TU Graz.

Table 17: Partnerships of TU Graz with clusters and associations

TECHFORTASTE-net: foodstuffs cluster
ACstyria: automotive cluster
Holzcluster Steiermark GmbH: forestry-wood-paper cluster
Human technology Styria: cluster for life science and related industries
ECO WORLD STYRIA: environmental engineering cluster (the world´s leading cluster in power engineering and environmental technology)
NANONET-Styria: information and communication platform for experts of nanotechnology and Austrian nanotechnology networks
FELMI-ZFE Graz: association for the promotion of electron microscopy and fine structure research
European sustainable energy innovation alliance
A - SIT - Secure Information Technology Centre: competence centre for IT-security

Source: Graz University of Technology, *TU Graz 2011, Annual Report,* 2012, pp. 93-94.

4.3.4.3 Industry-university co-operations through the eyes of interviewed companies

When interviewing companies, I mainly focused on their co-operation with the university in terms of projects with diploma and master's theses, internships and external lecturing since these are the activities helping develop entrepreneurial personality of students.

4.3.4.3.1 Magna

Magna is a company which forms one the most comprehensive strategic partnerships with TU Graz which includes co-operation in the field of research as well as education. Establishment of the FSI at the TU Graz in 2004 represented a milestone in joint co-operation for both the company and the university. Typical for the FSI is close interaction with the economy which begins at the bachelor's thesis and goes to large research projects. Topics range from innovative heating technology over the factory of the future to urban mobility. In the ten years of the FSI, more than 900 scientific papers were created and 8 common patents. Due to very fruitful results, in 2014 marking the 10th anniversary of the FSI, partners prolonged their co-operation for another five years (TU Graz und Magna: 10 Jahre Partnerschaft, 2014).

Magna in Austria further established a special entity called Magna Education & Research whose main task is to manage activities with educational institutions. Co-operation with universities is

of strategic importance for the company, which consequently puts a lot of effort into it. Company co-operates with different universities in Austria, but co-operation is most intensive with TU Graz. Automotive industry demands long-term R&D planning and also Magna defines their R&D goals well in advance. Company´s R&D plans are defined for the period of five years and are afterwards co-developed in co-operation with academia. Magna Education & Research is the one who takes care of identifying and coordinating suitable university partners for R&D activities and co-developing of curricula. Concretely, company´s efforts resulted for instance in the establishment of a programme such as Production Science and Management, which is especially tailored to the needs of automotive industry. The company, together with AVL, was an important partner of the university at designing this master programme. When preparing the new programme, creators were focused on the output of the study programme, i.e. on the graduates who will be more tailored to the needs of the industry. At the same time, they wanted to offer students greater freedom and flexibility at designing their study programme.

Magna and the university also support certain diploma/master's or doctoral theses at the FSI. FSI scholarship is granted to most promising students of the TU Graz. Scholarship amounts to a maximum of EUR4,000 for diploma/master's thesis and EUR8,000 for doctoral theses (FSI Scholarships).

4.3.4.3.2 AVL

To stay a global leader in its fields of operation, AVL continuously invests in in-house research programmes. The company co-operates in its research area intensively with more than 50 universities on national and international level (Research Co-operations, 2014). One of the universities they work a lot with is also TU Graz. As my interviewee mentioned, AVL is probably the company which works most closely with TU Graz in Austria and each year the co-operation is more intense as company´s business model has become so diverse and complex. In addition to R&D activities, the company works a lot with students in many different forms. The co-operation of AVL with faculties is in all aspects carefully and strategically planned.

AVL is very happy with the quality of the TU Graz and therefore also with the quality of students. Company each year offers 200 internships, lasting from a month to six months, to students which mostly come from TU Graz. Those 200 internships range from ordinary internships, projects with diploma and master's theses to PhD theses. The majority of the students come from TU Graz. There are 100-120 research topics offered by the company on a yearly basis for diploma and master's theses. Each year, there are only 50-60 master's theses written, which means that the potential of research topics is not fully exploited due to lack of students. In addition to diploma and master's theses, the company currently runs 25 doctoral co-operations. While working on the thesis, doctoral co-operations being an exception, each student has a mentor, whereby company´s practice is to have one mentor per three students. At this point the interviewee emphasized that the relationship between students, the university and the company needs to be very close and that it is important for the mentors to build a strong relationship from the first moment onwards. Students usually work on their thesis from six to nine months. Further on, the interviewee especially stressed out that results of the co-operation in

form of the theses are very good and valuable for the company. Additionally, their close relationship with the university and good reputation allow them to choose the best students in accordance with their needs which is especially important because of the lack of students. Later on, the company employs a lot of students working with them as interns.

AVL´s employees are very active also as external lecturers. 15-20 employees are currently giving lectures at TU Graz. Normally, these lectures are given in a form of a three-day intensive course, although some lecturers also give lectures every month. Additionally, AVL employs two professors who work at AVL once per week.

4.3.4.3.3 KWB

Collaboration of the company with TU Graz is longstanding, as it has been lasting for nearly 20 years. This is not surprising as one of the founders of KWB was a professor at the university. Moreover, approximately ten employees are university´s graduates, which additionally strengthens the ties. The scope of the co-operation with the university has been nearly constant, but the content of research has changed as currently the focus is more on business-related topics. The reason for this lies in the increased volume of co-operation with the newly established non-university research institute for biomass.

Each year, 3-4 students write their master's theses on the topic proposed by the company. Half of the master's theses are done by the students from TU Graz, others by the students from other faculties, usually the faculties of applied sciences. Additionally, the company offers 1-2 internships per year. During the summer time, 10-15 positions are available for summer jobs for students coming from different faculties.

Few employees carry out external lectures at different faculties, or mainly at the faculties of applied sciences. Two of company's employees give lectures at TU Graz once or twice per year as they have been previously employed at the institutes of TU Graz.

4.3.4.3.4 Ventrex

Ventrex offers 3-4 internships each year, whereby 1-2 internships are performed by the students of TU Graz. Their interns are often also international students joining them via the IAESTE association. The company only carries out 1-2 projects with master's theses due to lack of time and human resources. Namely, company´s R&D department has only 11 employees who are heavily occupied with their daily tasks and consequently do not find enough time for high-quality mentoring of the students. In the future, the company plans more intensive co-operation with students in the form of master's theses, since it finds their outcomes very valuable. The aim of the theses is usually a deepened knowledge about specific topics for which the internal R&D team does not find sufficient time. For the same reason, the company is also thinking about taking part in the Product innovation project next year. Moreover, the co-operation with the university will be extended in general as the company has recently signed a five-year strategic partnership with the Institute of Industrial Management and Innovation Research.

4.4 Analysis of research questions

On the basis of the analysis of four factors of EE and entrepreneurial university, I analyse the research questions which are based on these factors.

1. Are curricula at TU Graz entrepreneurial and what makes them entrepreneurial?

On the basis of available documents of the university, companies and conducted interviews, I consider curricula of TU Graz to be entrepreneurial, although there is some room for improvements and more extensive use of new teaching methods. Educators have good predispositions for implementing and exercising EE as a relatively big proportion of them have extensive practical experience. On the other hand, I see great potential in external lecturing which could be enhanced quite easily due to very good relations of the university with industry. Additionally, among the courses offered by institutes determined as entrepreneurship-affiliated chairs I miss more courses dedicated to entrepreneurship and specific start-up topics. Currently, most of the courses belong to traditional economic and management fields. New courses would need to concentrate on the commercialisation of technology-based ideas, patenting and protecting ideas as well as on financing and internationalisation of high-tech companies. Moreover, the content of some courses would need to pay more attention to the growth phases of young companies.

By examining all available data, I came to the conclusion that university´s strong links with industry importantly contribute to the implementation and use of new forms of teaching preparing students for changed demands of the business environment. Namely, strong business links contribute to more spontaneous, efficient and faster development of new activities implemented into courses. Concretely, extensive co-operation of academia with industry allows formal as well as informal networking which leads to good relationships with many people from industry. This helps identify suitable partners and persons for external lecturing and enterprise projects. Another way for effective connection of students and practice are internships, diploma and master's theses projects. Here, the quality and strength of university´s links with industry on one side and the awareness of companies of the added value of student knowledge on the other side bring students a possibility to focus on the area and company he/she is most interested in. The fact is that the demand on the side of companies exceeds the supply of students. Therefore, companies try to attract and identify the best and most suitable students according to their needs. Company´s awareness of the potential of student´s knowledge brings big synergies for both, industry and students. Industry obtains new knowledge or deepens the existing one and students obtain important insights into the business environment. Due to the big offer of proposed topics for theses from the side of industry more than 95% of master's theses are done in co-operation with companies. Being aware of difficulties at identifying suitable future work force, companies strongly co-operate with individual institutes which help them at choosing the right students for offered diploma and master's theses topics and internships. All the above mentioned activities ensure the biggest possible matching of student potentials and industry needs.

Entrepreneurship curricula which stand out according to my findings are, the master programme Production Science and Management and additionally the course Product Innovation Project.

The programme Production Science and Management is tailored to the needs of automotive industry and was, as mentioned, co-created with the help of experts from industry. Thus, from the very beginning the study programme has been designed to allow more intensive contact with industry and

use new forms of teaching better preparing students for real life. Concretely, this results in a large proportion of external lecturers. The programme yearly hosts 15 external lecturers who form and teach their lectures independently.

The course Product Innovation Project stands out by following the concept of learning by doing and using team techniques for creating new business ideas. By working on tasks given by an industrial partner, students check and apply their knowledge in practice and further develop knowledge, skills and attitudes typical for entrepreneurial individuals.

One important identifier of entrepreneurial curricula are also educators possessing specific knowledge and experience. As I could not obtain information for the whole university, I am describing educators of the Faculty of Mechanical Engineering and Economic Sciences. The majority of educators from this faculty can be identified as educators who are capable of providing knowledge and skills demanded by the changed economy and society. Namely, about 50% of professors have worked in industry, having on average 10-15 years of experience. Additionally, approximately 50% of educators take advantage of spending 20% of their work time working for some company or running their own business. Additionally, institutes serving as entrepreneurship-affiliated chairs employ educators who, in vast majority, have practical experience.

As stressed several times due to university´s strong co-operation with industry, educators have very good relationships with the local business environment, which enables them to enrich curricula with external lecturers and projects, ensure internships and connect students with companies to work on projects with master's theses.

2. How and to what extent do studies at TU Graz show interdisciplinarity?

Interdisciplinarity of studies at TU Graz is demonstrated on one hand through studies linking technical and management fields of knowledge and on the other hand through the formation of studies combining different fields of natural sciences from two universities.

The highest number of interdisciplinary programmes in terms of technical studies supplemented by knowledge of business is offered by the Faculty of Mechanical Engineering and Economic Sciences with bachelor and master programmes in Engineering and Business Economics. Additionally, in 2004 the university together with industry developed a new interdisciplinary master programme called Production Science and Management intended for the specific business sector. Namely, the programme is tailored to the needs of automotive industry, which is very strong in Styria, and also one of the FoE relates to the field of mobility. Further on, some

interdisciplinary studies are also provided by the following faculties: Faculty of Informatics, Software Development and Telematics, Faculty of Electrical Engineering and Faculty of Construction Engineering.

Another, even bigger step forward was the development of mutual interdisciplinary studies in the field of natural sciences with the University of Graz and the Medical University of Graz. These initiatives were recognized as examples of best practices in the Austrian university community. With creation of such studies, the university follows the needs of industry and provides students with knowledge and skills required by the modern business environment. On the other hand, it is clearly seen that interdisciplinary studies help at strengthening university´s FoE, which forms the basis for research activities. Knowledge acquired through these studies allows new and more relevant basic and applied research, which makes academic knowledge more attractive for the private sector. Thus, the university pursues on the long run its third mission in greater extent.

3. How strongly does TU Graz work on the process of internationalization?

TU Graz has been heavily working in recent years on intensifying the process of internationalisation, as in 2012 it started a three-year financially well supported programme to make significant progress in this area. A greater emphasis has been given to the issues of internationalization with the election of new university leadership in 2011, which has set internationalization as one of its main goals. Activities in this field include the intensification of co-operation in international research and stronger international orientation in teaching and student activities. The significance of the internationalization to the university leadership is also shown by its active engagement in choosing universities to enter with them into partnership. Moreover, the university is currently focusing on the establishment of ten strategic partnerships with best ranked universities with whom it plans intensive co-operation.

Experience abroad and international networking have been recognized as a key factor for success both in Austria and in the EU. Education policies of the EU strongly focus on further development of the region as a centre of excellence in education and training and, to this end, carries out a lot of activities including regular policy dialogues, bilateral agreements and mobility programmes (Musil & Reyhani, 2012, p. 39; European Commission, 2012d, p. 6). On the other hand, Austria indicated in the 2002 Universities Act that national and international mobility of students and university scientific staff is one of the guiding principles to be observed by universities in fulfilling their missions (Racké, n.d., p. 5).

Student mobility at TU Graz has been showing slight increase from 2010 onwards compared to the average noted for the period of 2005-2010. Figures show that the share of exchange students in 2012/13 amounted to 1.2%. The share covers all outgoing students participating in any exchange programme available at the university wherein it is important to emphasize that Erasmus students represent more than half of all outgoing students. In comparison to EU countries, the share of outgoing students at TU Graz is quite below the average as study on mobility of students participating in just Erasmus programme amounts to 1.5% on average. Thus, the relative comparison of the student mobility to the EU average is even poorer. There is still

room for improvement in the future as the aim of the Austrian government is that by 2020 every second graduate will be able to demonstrate at least one period of residence abroad, which is an even more ambitious goal compared to the EU which plans that by the same year at least every fifth graduate should have attended some exchange programme. To reach this goal, Austria plans to deepen relevant programmes and co-operations which will enhance the mobility of students into selected countries, increase participation in the Erasmus Mundus programme and bring more young international scientists to Austria through PhD programmes (Musil & Reyhani, 2012, p. 39).

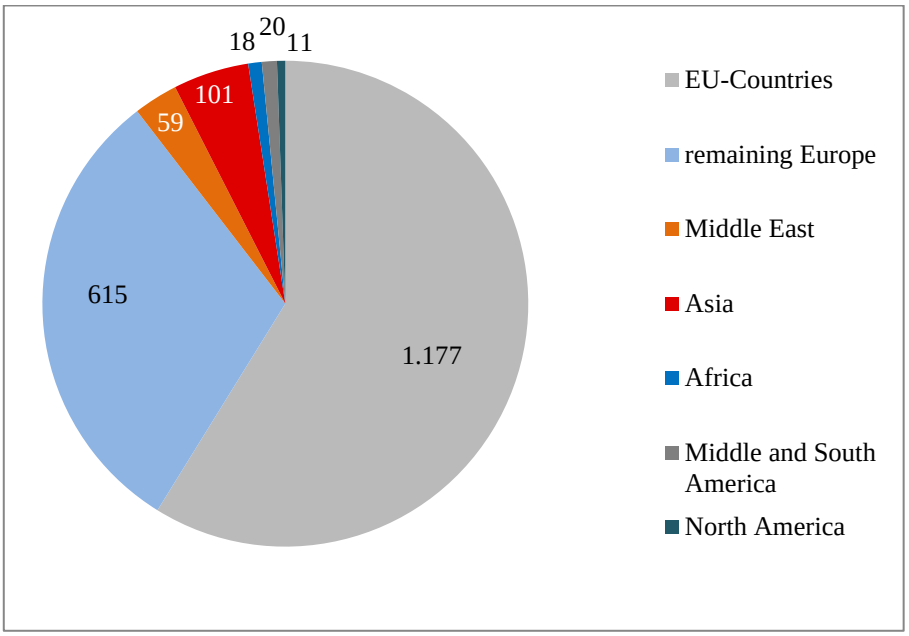
In the academic year of 2012/13, 41 members of the university took advantage of the Erasmus staff mobility scheme (Graz University of Technology, 2012, p. 50; Graz University of Technology, 2014a, p. 44), which amounts to 1.7% of total staff (academic and non-academic). In comparison to the Erasmus student mobility, Erasmus staff mobility demonstrates even greater opportunities for improvement as the European share of mobile staff amounted to 7.3% in the academic year of 2011/12 (Orr & Haaristo, 2013, p. 26). Although staff mobility in the framework of Erasmus is relatively weak at the TU Graz, the interviewee estimated that in total 20-25% of academic staff is mobile and the university tries to further boost mobility by providing educators with additional financial support and awarding them for being active internationally.

In terms of "internationalization at home", TU Graz with 18.3% of international students is one of the more advanced universities both in national and international aspects. Namely, in the academic year of 2010/11 the share of international students in the tertiary level in Austria amounted to 15%, which ranks the country, after Luxembourg, Australia and the United Kingdom, among the countries with the highest percentage of international students (OECD, 2012, p. 360). It is important to emphasize that the share of international students holding for Austria includes both students who follow their whole course of studies at the university as well as exchange students coming for a short period of time, whereas the share of TU Graz only includes the first ones. High share of international students can be partially attributed to the specifics of the country, namely to the low tuition fees and a high concentration of students from the Former Yugoslavia and Turkey. However, the aim of Austria is to establish a more varied distribution of third-country students with more intensive attraction of students from regions such as South-East Asia or Latin America which are of strategic importance for the Austrian economy, industry, science and research. At present, almost three quarters of the international students in Austria are represented by students from another EU countries, whereas students from non-EU/EEA countries amount to just 27% or 4% of all students (Musil & Reyhani, 2012, pp. 33, 41). Quite similar situation can be observed at TU Graz as well, as the share of international students coming from third countries (with exclusion of the EU and other European countries) amounts to 10.4% or 1.7% of all students. However, the share of international students varies among the level of studies: in the academic year of 2010/11, their proportion at the bachelor level was 15%, at the master level 17 % and in advanced research programmes/PhDs 22 % (Musil & Reyhani, 2012, pp. 10-11). Regarding TU Graz, I could only obtain data for doctoral studies where the share of international students amounted to 22.1%,

which is satisfactory but the university is aiming at further growth of this share. A high number of international PhD students comes as no surprise as doctoral training at the university has mostly been carried out in English for many years and additionally from the winter semester of 2013/14 onwards all doctoral studies are offered in English. The faculty has therefore been successfully following the guidelines of Austria which plans to foster the next generations of scientists for the country through attractive PhD programmes (Musil & Reyhani, 2012, p. 39).

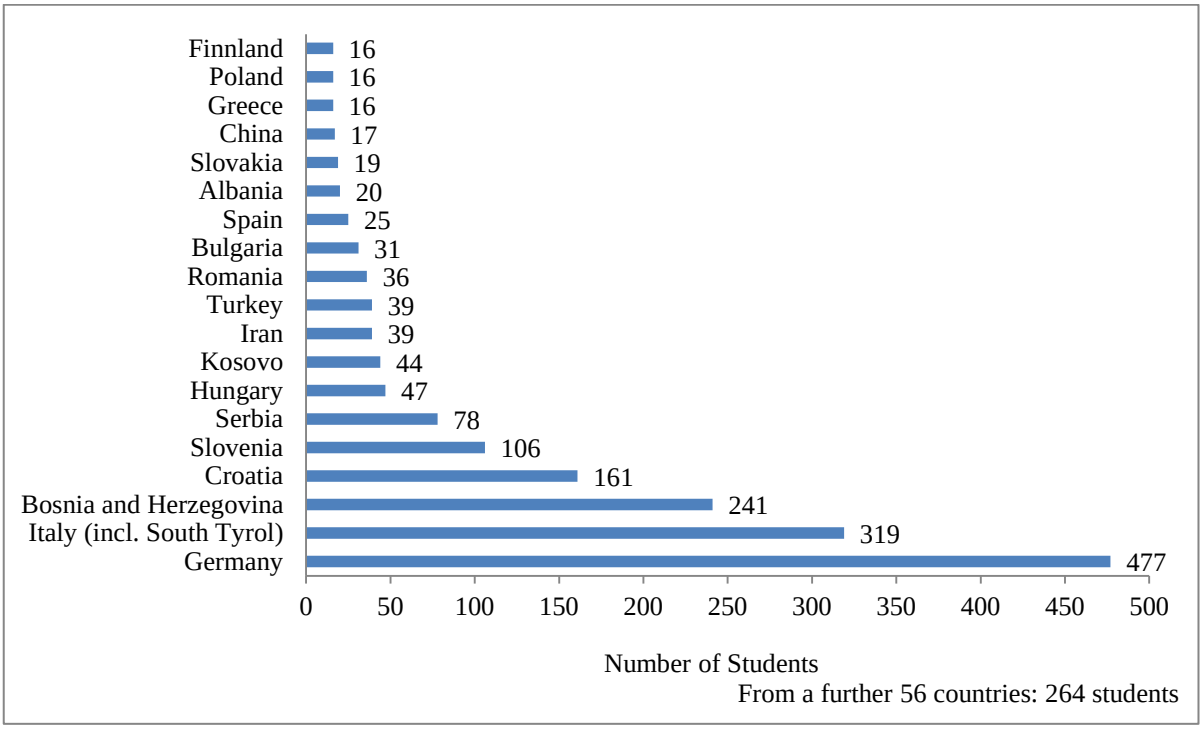
Figures 6 and 7 show the shares of students coming from different parts of the world and the nationalities of international students at TU Graz.

Figure 6: International students in WS 2013/14



Source: Graz University of Technology, *Facts and Figures 2013*, 2014c, p. 20.

Figure 7: Nationalities of international students in WS 2013/14



Source: Graz University of Technology, *Facts and Figures 2013*, 2014c, p. 21.

4. In which ways does TU Graz collaborate with industry and is the collaboration strong?

TU Graz's collaboration with industry is very strong in many aspects. In particular, intensive university´s technology transfer activities result in strong collaboration with companies in all other areas as well. Extensive scope of co-operation with industry can be partially attributed to the efforts of the university and partially to the fact that the university is a part of a highly innovative business environment. Namely, Styria is one of the most research-intensive regions in Europe which is especially strong in co-operation and networks (Das Land Steiermark, n.d., pp. 3-4). These interdisciplinary lines of connection are concentrated in a large number of non-academic and university institutions, i.e. in six clusters, five universities, two universities of applied sciences, two educational colleges and 19 centres of excellence (Styria, European Entrepreneurial Region 2013). Additionally, Styria is the province bringing the highest number of innovations onto the market (Ritsch, 2010, p. 20). With its regional R&D ratio of 4.3%, it has already exceeded the targets of Europe 2020 and has been holding a leading position for many years even within the European region (Styria, European Entrepreneurial Region 2013). Styria is especially strong in application-oriented research and in engineering- and technology-related disciplines. As a consequence, more than half (55%) of the academic technical researchers in the country work and teach in Styria (The Strategy of the Province of Styria for the Promotion of Science and Research, pp. 4-5).

Based on the solid foundation of the current economic environment, Styria has a clear goal to become a pan-European benchmark for intelligent transformation towards a knowledge-based manufacturing economy by the year of 2020 (Economic strategy Styria 2020, p. 19). Moreover,

the region would like to become a leading international ”shared space for science and innovation“, for interdisciplinary collaboration using know-how at the cutting edge in engineering technology (Das Land Steiermark, n.d., p. 8).

Since the whole region is research-oriented and especially successful in applied research, the success of TU Graz in technology transfer is not surprising. Currently, the university runs approximately 500 ongoing projects with companies which are equally dispersed among large companies and SMEs. Further on, some 40-50 companies support the university acting as sponsors and donors. Such intensive co-operation with industry, among others, brings the university a high proportion of third-party funding which has now reached levels of more than 45% (Das Land Steiermark, n.d., p. 5).

CONCLUSION

Economy has changed substantially in the last two decades and the main job creators have become SMEs. Europe has become the so called “knowledge economy”, and at the same time the competition on the market is becoming more and more stiff. As a consequence, the market demands workforce with different personal attributes and personality than in the past. Therefore, new demands of the market require changes in the educational system. In the master’s thesis, I focus on the adaptation of the HEIs to new realities in economy and society. According to the literature review, Europe lags behind the US which are leading in the area of EE and entrepreneurial universities. Namely, in the US universities are tightly connected with business, which is reflected in the operation of universities. Universities are more entrepreneurial and have developed EE. On the other hand, Europe has been experiencing substantial changes in this area only in recent decade and even these changes are slow and not intensive enough.

For Europe to stay a “knowledge economy” which can equally compete with the US and probably soon with Asia, the European HE system needs to enhance the third mission of the universities and moreover comprehensively integrate EE into the curricula. EE is the one that equips students with knowledge, skills and attitudes necessary for successful functioning in the working environment, whether being an employee in a company or an entrepreneur. Currently, EE is primarily present in the economic and business studies, but it is important to implement it into the technical and scientific studies as these are the main generators of ideas which can be commercialized.

To be able to successfully form the entrepreneurial personality of students, educators need to use modern teaching methods which are more effective at delivering both entrepreneurial knowledge and knowledge in general. These methods include team work, case studies, practitioners in the

classrooms, student´s projects with industry, internships, to name just a few. Problem arises since currently these methods are used too rarely and at the same time the usage and content of these methods heavily depends on the type of educators. To be competent educators who are able to provide students with adequate knowledge, educators themselves would need to have experience

from the industry and additionally, they would need to have an extensive network of contacts with business people. Today, most educators lack practical experience as academic achievements still form the basis for academic promotion. EE in HEIs has not reached a satisfactory level yet also due to often weak support from universities leadership, lack of entrepreneurship chairs and the overall slow transformation of universities into entrepreneurial ones.

The EU has recognized the significance of SMEs in its economy and consequently EE only in the last decade. One of the first important steps of the EU at acknowledging the importance of SMEs is represented by the acceptance of the Small Business Act in 2008. Further on, the EU 2020 Strategy highlights the importance of presence of creativity, innovation and entrepreneurship in education at all levels. Moreover, the strategy involves flagship initiatives in this area. The next very concrete action of the EU is the renewed Erasmus+ programme which, with substantially increased budget, foresees enhanced activities in the field of student and staff mobility and strengthened co-operation between HE and business.

In the empirical part of the thesis, I analyse how well developed is in terms of EE a HEI which is close to Slovenia both culturally as well as geographically. I chose TU Graz which is considered to be a university which co-operates most closely with industry in Austria. Therefore, I anticipated that the university is quite developed in terms of EE. Overview of the literature in the theoretical part of the thesis helped me determine the following four factors of EE and entrepreneurial university which substantially influence entrepreneurial attributes of students: entrepreneurial curricula, interdisciplinarity of studies, internationalization of the university and co-operation of university with industry and non-university research establishments, clusters and associations. These factors were analysed with the help of a qualitative research and usage of the method of standardized open-ended interviews. Interviews were conducted with educators from the university´s institutes which are identified as entrepreneurship-affiliated chairs. To get as comprehensive picture as possible, I conducted additional interviews with the representatives of four companies - two SMEs and two large companies which collaborate with TU Graz.

Analysis of the factors showed that EE is developing well, progress has been especially evident from 2011 onwards when new leadership put even bigger attention to certain areas, i.e. to internationalisation and co-operation of the university with industry. Below, I list the main findings of the analysis of individual factors of EE and entrepreneurial university and the research questions which were formed on the basis of these factors.

Entrepreneurship curricula have good potential for development, and it is encouraging that there already exist good predispositions in this area as educators possess qualities required for providing good EE. My interviewee assessed that educators have substantial experience from practice; for instance 50% of educators from the Faculty of Mechanical Engineering and Economic Sciences have worked in industry and the majority of educators from institutes being identified as entrepreneurship-affiliated chairs have practical experience as well. Additionally, 20-25% of educators are mobile which also contributes to the quality of EE. Further on, the

contents of the courses show the potential for further improvement with enrichment of courses with entrepreneurial contents and usage of new teaching methods. Currently, the course "Product innovation project" stands out in this context, which is based on interdisciplinarity and team work. External lecturers have been quite intensively present in the curricula, but with the exception of the Institute of Production Science and Management, there is still room for improvement. To continue, projects with diploma and master's theses are typical for university´s curricula which especially well connect students with industry since 90-95% of the theses are made in collaboration with industry.

Interdisciplinarity of studies is another strength of TU Graz. The university offers five study programmes within four faculties combining technical and management fields of knowledge. Study programmes are supported by three institutes operating in the management field. Moreover, the university together with the University of Graz offers joint study programmes in the field of natural sciences which are recognised as an example of best practice in the Austrian university community.
As already mentioned, the university has dedicated more attention to internationalisation in recent years. Still, student and staff mobility is a bit under the European average, but mobility has increased on average in recent years and it is expected to further strengthen due to enhanced activities of the university in this area. Well-developed is teaching in English as from the previous academic year onwards all PhD studies have been held in English, and from this academic year onwards a total of four master programmes are taught in English. Additionally, many individual courses at faculties are provided in English; for instance, the Faculty of Mechanical Engineering and Economic Sciences offers approximately 25% of courses in English or in both languages. Additionally, to stay competitive the university is currently building strategic partnerships with the ten best-ranked universities in the world.

Collaboration with industry is very strong as TU Graz is a university with intensive activities in the field of research and technology transfer. This was additionally confirmed by the invention ranking of the Austrian Patent Office showing that TU Graz was the most successful Austrian university in 2009 which is able to compete even with the most innovative Austrian companies. Currently, the university runs approximately 500 ongoing projects with industry, and some 40-50 companies support the university as sponsors and donors. Strong ties with industry are also reflected in the quality of EE since the university can enable students numerous contacts with industry already during their studies.

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APPENDIXES

TABLE OF APPENDIXES

APPENDIX 1: REMINDER INTERVIEW QUESTIONS – TU GRAZ

Introduction and explanation of the purpose and topics of the interview.

1 GENERAL INFORMATION

Higher education institution

Contact person (*name and position*)

Date and time of the interview

2 ENTREPRENEURIAL CURRICULA

2.1 Entrepreneurship curricula

Does the university have entrepreneurship or entrepreneurship-affiliated chair/s?

Which activities connected with entrepreneurship education do/does entrepreneurship or entrepreneurship-affiliated chair/s perform?

Does the university have entrepreneurship curricula? If yes, please describe how they are incorporated into general curricula?

Does the university design, develop and/or deliver curricula/entrepreneurship curricula in co-operation with industry? If yes, can you describe how do you mutually design, develop and/or deliver curricula/entrepreneurship curricula?

2.2 Educators (academic staff)

Is academic staff required/recommended to have experience from practice to teach entrepreneurship/entrepreneurship-related courses?

Is academic staff in general required/recommended to have experience from practice?

Does academic staff of entrepreneurship/entrepreneurship-related courses receive any training aimed at developing/improving their teaching skills?

Does academic staff in general receive any teacher training? If so, what kind of entrepreneurship training does it receive? How long does an individual training last?

2.3 External lecturers

How many external lecturers does the university have per year?

Where do external lecturers come from (are these lecturers also former alumni)?

At which faculties and in which courses are external lecturers most often involved?

In what form are external lecturers involved in courses (one time lecturing, longer lecturing, preparation of case studies, development of teaching materials, etc.)?

What kind of teaching methods do external lecturers most commonly use?

Do external lecturers receive any teacher training (or instructions and guidance) which allows them quality teaching? If yes, please describe the teacher training (or instructions and guidance) they receive.

Are external lecturers willing to co-operate with the university or does the university face any difficulties or obstacles to attract them?

If difficulties or obstacles exist, how can you overcome them in your opinion?

If difficulties or obstacles exist, does the university take any actions to overcome them?

2.4 Teaching methods

Do you use new forms of teaching methods in courses? If yes, please list and shortly describe what kind of new forms of teaching methods do you use?

Can you point of some new forms of teaching methods as especially successful and explain the reasons for their success?

To what extent does the university use technologies while teaching entrepreneurship/entrepreneurship-related courses (e.g. real world simulations)?

Are new forms of teaching methods integrated in entire curricula or are they used mainly in entrepreneurship/entrepreneurship-related courses?

Do students prefer new forms of teaching methods and are they more motivated?

2.5 Projects with master's theses

How do students choose the topic of their master's thesis?

Do students write master's theses in co-operation with companies? If yes, what is the percentage of such master's theses?

When writing master's thesis in co-operation with a company how do students choose a suitable company?

What activities does the collaboration of the company and student involve?

How does reporting of the student to the university look like (if demanded)?

Do students use faculty resources and/or also company´s resources for their research for the purpose of the master's thesis?

What are in your opinion the main factors of successful collaboration of a student and the chosen company?

Do you see any obstacles which in general prevent successful co-operation of students and companies? If yes, how do you think they could be overcome?

3 INTERNATIONALIZATION

To what extent did academic staff from your university in the last five years underwent teaching or continuous education at a foreign higher education institution?

Can you please indicate from which faculties did the academic staff that underwent mobility programmes come from and what kind of activities did it perform abroad (guest lecturing, lecturing through the whole course, engagement in research etc.)?

How many foreign academics came to your university in the last five years and from which institutions? Does academic staff mainly come from partner institutions?

At which institutions/in which companies did foreign academic staff carry out mobility programmes and what kind of activities did it perform (guest lecturing, lecturing through the whole course, engagement in research etc.)?

Can you point of any of the programmes as an example of good practice?

4 CO-OPERATION OF UNIVERSITY WITH INDUSTRY

How many industry partners acting as sponsors and donors does the university have?

Does strong university-industry partnership in terms of technology transfer influence the decisions of companies to act also as sponsors, donors and/or external lecturers?

Which are the companies which co-operate the most with the university in terms of master's theses and internships?

APPENDIX 2: REMINDER INTERVIEW QUESTIONS – COMPANIES

Introduction and explanation of the purpose and topics of the interview.

1 GENERAL INFORMATION

Company

Contact person (*name and position*)

Date and time of the interview

2 UNIVERSITY-COMPANY CO-OPERATION

Please, describe how and in what ways do you collaborate with the Graz University of Technology (internships, bachelor's/master's/doctoral theses, extracurricular activities, external lecturing, co-design of course curricula etc.)? Please, estimate the scope of co-operation on a yearly basis.

How important is the role of the company mentor for a student when undergoing an internship or writing his/her master's thesis? Are mentors heavily engaged?

How long have you been co-operating with the Graz University of Technology? Has the scope of the co-operation extended over time?

Do you think that the collaboration with the Graz University of Technology could have achieved, or could achieve, more than it has actually achieved (or is achieving at the moment)? If yes, what do you think are the obstacles preventing more efficient/successful co-operation?

APPENDIX 3: POVZETEK V SLOVENŠČINI

V zadnjih dveh desetletjih je mogoče opaziti povečano zanimanje akademikov in politike glede vpliva visokošolskih zavodov (v nadaljevanju: VŠZ) na regionalno in nacionalno gospodarstvo. To zanimanje je raslo vzporedno z razvojem »gospodarstva znanja« in priznanjem, da primerjalna prednost vse bolj izvira iz komercializacije univerzitetne intelektualne lastnine. Posledično so univerze zbudile pozornost akademikov in vladne politike tako na področju ustvarjanja znanja kot prenosa slednjega v gospodarstvo (Barakat & Hyclak, 2009, str. 1). Vloga univerze v gospodarstvu in družbi se je tako razširila in privedla do razvoja koncepta podjetniške univerze, ki ima tri poslanstva: poučevanje, raziskave in nudenje storitev gospodarstvu prek svojih podjetniških dejavnosti (Zhou, 2008, str. 110).

Kot že omenjeno, mnogi povezujejo koncept podjetniške univerze z gospodarstvom in komercializacijo intelektualne lastnine (zlasti na področju znanstvenih in tehniških ved), kar vodi k usmerjanju pozornosti v inovacijske dejavnosti v sodelovanju z uradi za prenos tehnologije, inkubatorji in tehnološkimi parki. Koncept podjetništva pa se mora osredotočati tudi na razvoj podjetne osebe in podjetniške miselnosti. Nadalje se mora osredotočati na uporabo osebnostnih podjetniških sposobnosti, lastnosti in miselnosti v okviru ustanovitve novega podjetja, razvoja/rasti obstoječega podjetja in oblikovanja podjetniške organizacije (Baker et al., 2013, str. 10).

Danes je vloga visokošolskih ustanov kot tudi izobraževalnih institucij na splošno pri spodbujanju bolj podjetniškega ravnanja in vedenja široko prepoznana (Evropska Komisija, 2008a, str. 7). Kljub temu EU svojega podjetniškega potenciala trenutno ne izkorišča v celoti, splošno znano pa je, da podjetniško izobraževanje (v nadaljevanju: PI) lahko pomaga Evropi kot celoti pri preoblikovanju njenega gospodarstva in gradnji njene prihodnje gospodarske in konkurenčne moči (Evropska Komisija, 2008b, str. 1). S pomočjo PI mora EU spodbuditi podjetniško miselnost mladih (Evropska Komisija, 2008a, str. 7).

Cilj PI v visokošolskih ustanovah je spodbujanje ustvarjalnosti, inovativnosti in samozaposlitve. Poleg tega je pomembno poudariti, da PI ne bi smeli zamenjevati s splošnimi poslovnimi in ekonomskimi študiji. Priporočljivo je, da PI vsebuje naslednje elemente (Evropska Komisija, 2008a, str. 10):

- razvoj osebnostnih lastnosti in sposobnosti, ki so podlaga podjetniške miselnosti in vedenja (kreativnost, samoiniciativnost, prevzemanje tveganja, samostojnost, samozavest, vodstvene lastnosti, timsko delovanje itd.);
- ozaveščanje študentov o samozaposlovanju in podjetništvu kot eni izmed kariernih možnosti;
- delo na konkretnih projektih in aktivnostih podjetij;
- zagotavljanje specifičnih poslovnih sposobnosti in znanj o tem, kako ustanoviti podjetje in ga uspešno voditi.

Trenutno je večina podjetniških predmetov na voljo v sklopu poslovnih in ekonomskih študijev, vendar pa je pomembno, da se jih sistematično uvede tudi v tehnične, znanstvene in ustvarjalne

študije, kjer je večja verjetnost, da se pojavijo inovativne in izvedljive poslovne ideje. Cilj PI znotraj teh študijev je razviti veščine, potrebne za popolno izkoriščanje inovacij in aktivnosti prenosa znanja (Evropska Komisija, 2008a, str. 7, 11). Hkrati je pomembno, da se PI znotraj učnih načrtov študijev osredotoča na najbolj relevantne vsebine, primerne za posamezno vrsto študija.

Poudarek PI za študente ekonomskih in poslovnih študijev bi moral biti na fazah zagona in rasti novega podjetja. Hkrati bi se morali študenti intenzivno povezovati in sodelovati s študenti iz različnih študijskih smeri (Evropska Komisija, 2008a, str. 26).

Znanstveni in tehnični študiji bi morali izobraževati o izkoriščanju intelektualne lastnine ter ustanavljanju odcepljenih (spin-off) in zagonskih (start-up) podjetij. Priporočljivo je, da PI vključuje tudi predmete o komercializaciji in prodaji tehnoloških idej, patentiranju in zaščiti le teh ter o financiranju in internacionalizaciji visokotehnoloških podjetij (Evropska Komisija, 2008a, str. 27).

Študenti humanističnih študijev bi se morali učiti o samostojnem upravljanju in o rastočem potencialu socialnega podjetništva, ki lahko bistveno izboljša socialno okolje (Evropska Komisija, 2008a, str. 27).

PI v študijih ustvarjalnih umetnosti in oblikovanja bi moralo biti še posebej usmerjeno v kreativne procese in pripravo diplomantov za delo svobodnjakov ali za ustanavljanje malih podjetij (Evropska Komisija, 2008a, str. 27).

V magistrski nalogi sem se osredotočila na razvoj PI in podjetniške univerze v Evropi ter nato preverila, kako se omenjena pristopa razvijata na primeru Tehniške univerze v Gradcu (v nadaljevanju: TU Gradec). Namen magistrskega dela je tako preučiti literaturo na področju PI in podjetniške univerze ter ugotoviti, kateri dejavniki PI in podjetniške univerze imajo največji vpliv na podjetniško osebnost študentov. V empiričnem delu magistrskega dela nato preverim, v kolikšni meri so ti dejavniki razviti na TU Gradec.

Cilj magistrskega dela je na osnovi teoretičnega ozadja in kvalitativne raziskave analizirati štiri dejavnike PI in podjetniške univerze, ki vplivajo na podjetniško osebnost študentov na TU Gradec. S pomočjo kvalitativne raziskave pridem do ugotovitev, kako intenzivno so ti dejavniki razviti.

Magistrsko delo je razdeljeno na teoretični in empirični del. Prvi del magistrskega dela predstavlja teoretično ozadje PI. Prvo poglavje teoretičnega dela se prične z opredelitvijo PI in njegovo umestitvijo v širši kontekst in v kontekst visokošolskega izobraževanja. V nadaljevanju predstavim podjetniške učne rezultate, metode poučevanja ter spregovorim o nosilcih izobraževanja in katedrah za podjetništvo. Nato sledi predstavitev kakovostnega podjetniškega učnega načrta. Nadalje se osredotočim na ovire v PI. Konec poglavja je namenjen predstavitvi koncepta podjetniške univerze in razvoju podjetniških univerz v Evropi. Drugo poglavje opisuje

PI v EU. Natančneje, raziskujem vlogo podjetništva in PI v EU ter predstavim ukrepe EU, ki podpirajo razvoj PI. Sledi opis najobsežnejših aktivnosti na področju PI v Evropi. Natančneje, predstavim prispevek programa EU Erasmus+ h krepitvi in nastajanju novih akademsko-poslovnih vezi, ki predstavljajo pomemben del PI. Nadalje predstavim še eno institucijo EU, Evropski inštitut za inovacije in tehnologijo, ki je oblikoval nov, izrazito podjetniško usmerjen evropski visokošolski program. Konec drugega poglavja se zaključi s predstavitvijo organizacije, ki spodbuja razvoj PI v Evropi - Evropskega foruma za raziskovanje podjetništva. V tretjem poglavju se osredotočim na dobre prakse PI v Evropi s predstavitvijo razvoja PI na univerzah Cambridge in Aalto.

V empiričnem delu magistrske naloge sem oblikovala raziskovalna vprašanja, ki temeljijo na štirih dejavnikih PI in podjetniške univerze, ki vplivajo na podjetniške lastnosti študentov. Ti dejavniki vključujejo: podjetniške učne načrte, interdisciplinarnost študijev, internacionalizacijo univerze in sodelovanje univerze z industrijo ter neuniverzitetne raziskovalne ustanove, poslovne grozde in društva. Dejavniki so bili določeni s pomočjo pregleda literature v teoretičnem delu naloge. Raziskovalna vprašanja se glasijo:

1. Ali so učni načrti TU Gradec podjetniški in kaj jih naredi podjetniške?
2. Kako in v kolikšni meri študiji na TU Gradec izkazujejo interdisciplinarnost?
3. Kako intenziven je proces internacionalizacije na TU Gradec?
4. Na kakšne načine TU Gradec sodeluje z industrijo in ali je sodelovanje intenzivno?

Prvo poglavje empiričnega dela vključuje oblikovanje kvalitativne raziskave in predstavitev TU Gradec ter štirih podjetij, ki sodelujejo z univerzo. S predstavniki univerze in podjetij sem opravila standardizirane intervjuje z odprtim tipom vprašanj. Sledijo kvalitativna analiza podatkov, njihova interpretacija in analiza raziskovalnih vprašanj.

Za raziskavo na primeru TU Gradec sem se odločila, ker sem med pregledom literature opazila pomanjkanje poglobljenih in celovitih študij primerov, ki se nanašajo na razvoj PI in podjetniških univerz v Evropi. Razlog za izbiro omenjene univerze kot visokošolskega zavoda za raziskavo izhaja iz njene geografske in kulturne bližine Sloveniji. Hkrati je avstrijska Štajerska, regija v kateri se univerza nahaja, ena izmed najbolj inovativnih regij v Evropi, kar še dodatno prispeva k intenzivnim povezavam univerze z industrijo. Opredeljene dobre prakse na primeru TU Gradec lahko služijo kot primeri, iz katerih se lahko slovenski visokošolski zavodi učijo oz. jih uvedejo v svoje sisteme.

Kvalitativna analiza že omenjenih štirih dejavnikov in analiza raziskovalnih vprašanj sta pokazali, da se PI na TU Gradec dobro razvija, še posebej pa je opazen napredek od leta 2011 dalje, ko je bilo izvoljeno novo vodstvo, ki določenim področjem namenja še dodatno pozornost. Ti področji sta internacionalizacija in sodelovanje univerze z industrijo. V spodnjih poglavjih podajam glavne ugotovitve analize posameznih dejavnikov PI in podjetniške univerze ter raziskovalnih vprašanj, ki se nanašajo nanje.

Podjetniški učni načrt ima še kar nekaj možnosti za napredek in razvoj, hkrati pa je spodbudno to, da so temelji na tem področju zelo dobri, kajti nosilce izobraževanja že odlikujejo potrebne lastnosti za zagotavljanje kakovostnega PI. Moj sogovornik z univerze ocenjuje, da imajo nosilci izobraževanja znatne izkušnje iz prakse; na primer 50 % nosilcev izobraževanja s Fakultete za strojništvo in ekonomijo v Gradcu ima izkušnje iz industrije, prav tako ima praktične izkušnje večina nosilcev izobraževanja z inštitutov, opredeljenih kot povezane katedre za podjetništvo. Poleg tega je 20-25 % nosilcev izobraževanja mobilnih, kar prav tako pomembno prispeva h kakovosti PI. Pomembna odlika podjetniškega učnega načrta so tudi zunanji predavatelji. Ti so precej pogosto prisotni pri posameznih predmetih, vendar so z izjemo Inštituta za proizvodno znanost in upravljanje še možnosti za izboljšave. Nadalje so značilnost učnih načrtov univerze projekti z diplomskimi in magistrskimi deli, ki še posebej učinkovito povezujejo študente z industrijo; namreč kar 90-95 % del je spisanih v sodelovanju z industrijo. Prav tako tudi same vsebine predmetov izkazujejo potencial za nadaljnji razvoj z njihovo obogatitvijo s podjetniškimi vsebinami in novimi metodami poučevanja. Trenutno na tem področju izstopa predmet »Projekt inovativnih izdelkov« , ki temelji na interdisciplinarnosti in timskem delu ter študentom zastavlja izziv razviti nov ali izboljšan izdelek za določeno podjetje. Predmet je nastal v sodelovanju Inštituta za industrijsko upravljanje in raziskave inovacij in podjetniške Univerze Aalto (Finska) ter je prvenstveno namenjen študentom inženirstva, industrijskega oblikovanja in poslovnih ved.

Interdisciplinarnost študijev je ena od pomembnejših prednosti univerze. Univerza nudi pet študijev v sklopu štirih fakultet, ki združujejo tehnična in vodstvena področja znanja. Za študijske predmete, povezane z ekonomskimi znanji in znanjem menedžmenta, skrbijo trije inštituti, ki delujejo na omenjenih področjih. Hkrati univerza skupaj z Univerzo v Gradcu nudi še skupne študijske programe s področja naravoslovja, ki so v avstrijski univerzitetni skupnosti prepoznani kot primer dobre prakse.

Kot sem že omenila, je univerza dodatno, še intenzivnejšo pozornost namenila internacionalizaciji. Leta 2012 je začela izvajati triletni finančno močno podprti program, namenjen aktivnostim internacionalizacije. Kljub temu je mobilnost študentov in osebja še vedno nekoliko pod evropskim povprečjem, vendar pa v zadnjih letih v povprečju narašča in je pričakovano, da se bo to področje še dodatno razvilo glede na okrepljene aktivnosti na tem področju. Zelo dobro pa je že razvito poučevanje v angleškem jeziku, saj so od preteklega študijskega leta vsi doktorski študiji na voljo v angleščini, hkrati pa se od letošnjega študijskega leta dalje v angleščini poučujejo štirje magistrski programi, v prihodnje pa naj bi se jih še več. Poleg tega so v angleškem jeziku na voljo številni posamezni študijski predmeti; na primer Fakulteta za strojništvo in ekonomijo nudi približno 25 % predmetov v angleščini ali v maternem jeziku in angleškem jeziku. Da bi univerza ohranila konkurenčnost na vseh področjih, trenutno gradi strateška partnerstva z desetimi najbolje uvrščenimi univerzami na svetu.

Sodelovanje z industrijo je zelo močno, saj je TU Gradec univerza z intenzivnimi aktivnostmi na področju raziskav in prenosa znanja v gospodarstvo. To dejstvo še dodatno potrjuje uvrstitev na lestvici inovacij Avstrijskega patentnega urada, ki je pokazala, da je bila TU Gradec v letu 2009 najuspešnejša avstrijska univerza, sposobna tekmovati tudi z najbolj inovativnimi avstrijskimi

podjetji. Trenutno ima univerza v teku približno 500 projektov z industrijo, hkrati pa 40-50 podjetij podpira univerzo v vlogi sponzorjev in donatorjev. Tako močne vezi z industrijo se seveda odražajo tudi v kakovosti PI, saj so študentom že med časom študija omogočeni številni stiki s podjetji.