How Entrepreneurial is the University? A Case of the University of Technology

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Abstract

In a highly uncertain and unpredictable environment for higher education, the concept of an entrepreneurial university can be seen as an organisational response to external challenges and pressures and it is necessary to assess the capabilities of universities for meeting these challenges. An online self-assessment tool, HEInnovate, is used as a guiding framework for the entrepreneurial university, which enables universities to evaluate different components of their entrepreneurial capacity and creates the basis for the development of an entrepreneurial university.

This paper therefore seeks to find out how entrepreneurial a university is based on one university of technology and find out where the university development strategies have opportunities for further development. The results of the survey showed that all indicators received above average ratings indicating that the activities of the university in all areas are targeted at supporting entrepreneurship. The research contributes to highlighting the differences and similarities in the opinions of different groups of staff on the basis of position, gender and faculty in regard to the future development towards an entrepreneurial university.

JEL classification codes: H75, I23, M51
Keywords: entrepreneurial university, HEInnovate tool, self-assessment, staff groups, faculties

Acknowledgements

This study was financed by the "Systematic Development of Entrepreneurship Education (EE) on All Levels of Education in Estonia" programme implemented by the Estonian Ministry of Education and Research and funded by the European Social Fund.

1. Introduction

The mission and tasks of universities have changed in recent years, and the emergence of a knowledge-based economy has created challenges for the higher education sector as a whole on a global scale. Universities are viewed as proactive contributors to innovation, technological development and economic growth in a knowledge-driven society (e.g. Mansfield & Lee, 1996; Etzkowitz et al., 2000; King & Nash, 2001; Etzkowitz, 2003; Yusuf, 2007).

The concept of the entrepreneurial university carries multiple meanings and identities including notions of enterprise, innovation, commercialisation, organisational leadership and governance, new venture creation and employability (Hannon, 2013). It can be seen as an organisational response to external challenges and pressures (Gibb & Hannon, 2006; Pinheiro, 2015). Institutions across the globe are increasingly pressured to change, influenced by globalisation, social mobility, increased use of online technology, larger and more heterogeneous student populations, demographics, decreased state funding, increased funding across national borders in physical as well as virtual terms. All these changes have contributed to a highly uncertain and unpredictable environment for higher education (Gibb, 2013). The challenge is to reconceptualise the university as an academic enterprise, one that is agile, competitive, adaptable and responsive to the changing needs of society (Jameson & O'Donnel, 2015). Furthermore, the European Commission Communication and Entrepreneurship 2020 Action Plan specifically states that universities should become more entrepreneurial (European Commission, 2013).

In Europe, the European Commission working with the OECD have built an online self-assessment tool called HEInnovate, which is a guiding framework for the entrepreneurial university. This framework focuses on seven key pillars identified by a group of experts from across Europe through a thorough review of existing research and thinking. The tool aims to provide higher education institutions with the opportunity to reflect on their perceptions of strengths and weaknesses in each key area, thereby helping to identify institutional development needs. The tool enables universities to evaluate different components of their entrepreneurial capacity and creates the basis for the development of an entrepreneurial university.

The aim of this study is to find out how entrepreneurial the university is and what aspects are the most important to consider for the development of the university so it would become more entrepreneurial. The development of the entrepreneurial capacity of the university is assessed by reviewing the university's different staff groups and policies, study programmes, collaborations with enterprises, and internationalisation. The study aims to answer the following research questions:

- What is the opinion of the university staff on how entrepreneurial different aspects of the university are?
- Where are the opportunities for the further development of the university to become more entrepreneurial?

The research is based on a survey carried out at a single university of technology. The university provides opportunities for the acquisition of higher education in line with developments in science and technology at all cycles in the areas of natural and exact sciences, engineering, manufacturing and technology, social sciences, business administration and related fields. The university is recognised as a research university, providing quality research-based education, accountable to a new generation of engineers, the spirit and quality of

engineering culture, and promoting sustainable development in society and the growth of national welfare through innovative services. The vision of the university is to be a leading university of technology in the Baltic Sea region and an active partner in networks of entrepreneurship clusters and public institutions (Strategic Plan …, 2016).

The HEInnovate questionnaire was carried out among the staff of two faculties – engineering and business and governance – with the aim of evaluating the extent to which the criteria of an entrepreneurial university are currently satisfied and what is necessary for the further development of the university. The study shows that all dimensions of an entrepreneurial university were assessed above average using a Likert scale of 1–10, but differences have been found in the opinion of different categories of employees as well as in the different faculties. Specific research-based conclusions are made towards making the university more entrepreneurial in general and in the faculties under study. The university experience of growing into an entrepreneurial university might be of interest to other universities in a similar context (e.g. Central and Eastern European countries).

Following this introduction, the remainder of the paper is structured as follows: the next section lays the foundation for the paper by reviewing the relevant literature. This is followed by a methodological section and the results of the research. Finally, conclusions are drawn and future research is suggested.

2. Theoretical Framework

Universities are not only focused on transferring knowledge and conducting research but have become a link between the state and the economic environment. The new role of the university is referred to as its third mission through which the university becomes an institution that monitors development in society and is actively involved in solving its problems (Pejanovic, Demirovic & Nikic, 2015). The third mission helps to address the knowledge and human capital needs of government, industry and society in general via the knowledge, human capital, intellectual property and infrastructural resources of universities.

The global market for education has become highly competitive, with universities increasingly reaching outside of domestic markets to attract students. The mission and tasks of universities have changed and the universities are viewed as proactive contributors to innovation, technological development and economic growth in a knowledge-driven society (e.g. Mansfield & Lee, 1996; Etzkowitz et al., 2000; King & Nash, 2001; Etzkowitz, 2003; Yusuf, 2007).

Changes brought about by globalisation, the massification of higher education, technology, demographics (Allison & Javorka, 2014; Wilson, 2008), as well as resource stringency due to increasing competition, public budget cuts and performance-based allocation (Allison & Javorka, 2014) have forced higher education institutions to reassess their business models. With lower, more competitive access to resources and increased uncertainty, taking the entrepreneurial path has been a solution for an increasing number of institutions (Gibb, 2012; Mets, 2010).

Previous research on entrepreneurial universities has focused on narrow issues like knowledge or technology transfer and the management of the technology transfer office (Siegel, Waldman & Link 2003; Küttim et al., 2018; Küttim, 2016) or the role of university

incubators (Clarysse et al., 2007). With the pressure on universities to find alternative sources of funding, there is research about how universities can be managed more entrepreneurially (Leih & Teece, 2016). Thorp and Goldstein (2010) see the entrepreneurial university as being defined by both a culture of entrepreneurship and the development of an entrepreneurial mindset in all graduates. There is a clear role for education and training and an educational imperative for universities in designing learning environments and providing learning opportunities that stimulate entrepreneurial mindsets, thinking and action (Hannon, 2013). The concept of the entrepreneurial university can first be presented in its simplest form through two key dimensions: 1) as an organisation adopting an entrepreneurial response to addressing the pressures and challenges it faces as described above; an organisation that renews itself to better align with its environment; an institution that inculcates entrepreneurial thinking through its governance structures and managerial policies and practices; and 2) an institution that creates an environment within which the development of entrepreneurial mindsets and behaviours are embedded, encouraged, supported, incentivised and rewarded (*Ibid*).

There is no common definition of the entrepreneurial university (Fayolle and Redford, 2014). Although academic and regional entrepreneurship are interrelated, the entrepreneurial university as a concept differs from these (Pugh et al., 2018). Zhou and Peng (2008) define the entrepreneurial university as 'the university that strongly influences the regional development of industries as well as economic growth through high-tech entrepreneurship based on strong research, technology transfer and entrepreneurship capability', thus further expanding the boundaries of scientific knowledge (Geoghegan & Pontikakis, 2008). The entrepreneurial university may be defined as a higher education establishment that safeguards knowledge transfer and the commercialisation of innovative initiatives between universities, stakeholders, governments and enterprises (Kalenyuk & Dyachenko, 2016). However, the 'services' or contributions that the entrepreneurial university offers industry and society are many and various: they include technology patenting and licensing, consultation for industry with a view to promoting existing activities, spin-offs (new venture creation), entrepreneurship education (i.e., training a top-level workforce) and the provision of precious R&D facilities (Etzkowitz & Zhou, 2008).

The entrepreneurial university contributes to the surrounding environment through offering various services, including technology transfer, consultation and spin-offs. Economic development and societal influence are academic functions that are integrated into the teaching and research (Etzkowitz, 1998). The goal of an entrepreneurial university is to support the creation of entrepreneurial thinking and actions (Audretsch, 2014). This implies that the focus is on teaching for entrepreneurship; that is, generating new start-up companies and teaching students to become entrepreneurs and managers of small companies. The outcomes are thus assessed according to the number of established companies, for example. This approach is very often referred to as the main and ultimate goal of any entrepreneurship education programme, or studies in general, although it gives a very narrow view of the potential outcomes (Hytti & Heinonen, 2010).

The entrepreneurial university plays a key role in the European economy. Yet a comparative analysis of entrepreneurship education in universities (Wilson, 2008) shows that this is a challenging mission especially in the following aspects: lack of clarity on the place and purpose of entrepreneurship education in universities; low level of interdisciplinary collaboration and (project-based) learning; teaching, study programme building and

support networks more academic and relatively isolated from the business community and an ongoing search for a common definition (Gramescu & Bibu, 2015).

This raises several interesting challenges and opportunities for entrepreneurship education in universities across Europe: universities tend to be notoriously inflexible institutions balancing the needs of very different stakeholders, regulations, traditions and multiple responsibilities going beyond the basic educational first mission. In this context, individual universities that find solutions to innovating and overcoming these challenges are the key to driving change in entrepreneurship education in Europe. Previous studies indicate that the capacities connected with entrepreneurial learning and teaching have a positive impact on entrepreneurial learning outcomes, and the higher assessments of the provision of formal and informal learning opportunities have increased the assessment of the HEI's implementation of entrepreneurial learning outcomes (Kallaste et al., 2017). Therefore, it is necessary to measure the universities different dimensions and activities to understand the strengths and needs for additional support. One way of measuring the dimensions of universities is to use the HEInnovate self-assessment tool.

The European Commission has built an online self-assessment tool called HEInnovate, as a guiding framework for the entrepreneurial university. HEInnovate is a self-assessment tool that allows higher education institutions to map their status quo on the following themes: leadership and governance; organisational capacity, people, incentives; entrepreneurship development through teaching and learning pathways for entrepreneurs; knowledge exchange; internationalisation of the university; measuring impact. The tool aims to provide higher education institutions with the opportunity to reflect on their perceptions of strengths and weaknesses in each key area, thereby creating a basis for the development of an entrepreneurial university. HEInnovate consists of 45 criteria that are divided into seven key dimensions.

The dimension "*Leadership and Governance*" highlights some of the important factors a university may consider in order to strengthen their entrepreneurial agenda, as strong leadership and good governance are crucial in order to develop an entrepreneurial culture in an institution. Many universities include the words "enterprise" and "entrepreneurship" in their mission statements but this needs to be more than a reference (Etzkowitz, 2004; Kirby, 2006; Bridgeman, 2007). For example, the organisational structure and university governance have been mentioned as one of the biggest barriers to universities becoming more entrepreneurial (Kirby, Urbano, & Guerrero, 2011). The dimension *Organisational Capacity, People and Incentives* highlights some of the key areas a university may look at if it wishes to minimise the organisational constraints to fulfilling its entrepreneurial agenda. This includes the financial strategy, attracting and retaining the right people and incentivising entrepreneurial behaviour in individuals (Gibb, 2005; Barrie, 2007). *Entrepreneurial Development in Teaching and Learning* highlights a number of areas in which entrepreneurial development can take place, reflecting the need for the organisational structure to support entrepreneurial development as well as provide the right tools to deliver education and training opportunities both internally and via the external environment. *Pathways for Entrepreneurs* provides statements for universities who wish to support "intrapreneurs" in their career development or enterprising individuals on their pathway to becoming an entrepreneur. The decision to commit to entrepreneurship is not a single act but a process. For universities to be entrepreneurial they need to support the pathways taken by would-be entrepreneurs (staff and students) from ideas to market growth

or employment. This is not just a process internal to the university but one where a pluralist approach is necessary providing access to internal and external opportunities and expertise. *University – Business/External Relationships for Knowledge Exchange* emphasises building and sustaining relationships with key partners and collaborators in achieving the full potential of the university in entrepreneurship, research, teaching and other third mission activities (Charles, 2006; Etzkowitz, 2008; Arbo & Benneworth, 2008). *The Entrepreneurial University as an Internationalised Institution* provides a number of statements that reflect the influence of the international environment on entrepreneurial aspects of teaching, research, talent development, new opportunities and culture. *Measuring the Impact of the Entrepreneurial University* identifies areas where the university might want to measure. The majority of the measurements found in the literature relate to spin-offs, IP and research outcomes rather than graduate entrepreneurship, retaining talent, local economic development or the impact of a broader entrepreneurial strategy (Gibb, 2012).

3. Methodology

3.1. Research Design

Based on the research objectives and possible gaps in defining the entrepreneurial university, the paper seeks to evaluate the relevant criteria of the technological university using an online self-assessment tool called HEInnovate (access at www.heinnovate.eu) as a guiding framework. The tool enables universities to comprehensively evaluate different dimensions of their entrepreneurial capacity and creates a basis for the development of an entrepreneurial university. HEInnovate consists of 45 criteria that are divided into seven key dimensions:

- Leadership and Governance
- Organisational Capacity, People and Incentives
- Entrepreneurial Development in Teaching and Learning
- Pathways for Entrepreneurs
- University – Business/External Relationships for Knowledge Exchange
- The Entrepreneurial University as an Internationalised Institution
- Measuring the Impact of the Entrepreneurial University

The research is based on Tallinn University of Technology, which provides opportunities to acquire higher education in line with the development of science and technology in all cycles in the areas of natural and exact sciences, engineering, manufacturing and technology, social sciences, business administration and related areas. The HEInnovate questionnaire was carried out with the aim of evaluating how the criteria of an entrepreneurial university are met.

3.2. Data Collection and Sample

The HEInnovate questionnaire was carried out among the staff of two faculties: engineering and business and governance. In the latter faculty the majority of the respondents were involved in business administration. As for the background of these faculties, the faculty of business and governance (at the time of the survey named faculty of economics and business) is characterised by a high number of international students, which is lower in

the engineering faculty. At the time of the survey entrepreneurship courses were included in all the faculty of business and governance and engineering faculty study programmes. Entrepreneurship education is one important factor in an entrepreneurial university, supporting entrepreneurial development and providing the right tools to deliver education in the field.

Table 1. The chracteristics of the sample, % of total

Variable		n	%
Position, n=113	student	14	12.4
	staff	22	19.5
	researcher	18	15.9
	professor/teacher	50	44.2
	administration	9	8.0
Age, n=99	25–35	26	26.3
	36–45	26	26.3
	46–60	30	30.3
	> 60	17	17.1
Gender, N=99	male	48	48.5
	female	51	51.5
Work experience, years, n=97	1–5	24	29.9
	6–10	24	24.7
	11–25	31	32.0
	>25	13	13.4

Source: Authors

The research was conducted during the spring semester of 2015 and 114 employees at the university were surveyed, among them 8% from faculty administration, 60.1% academic personnel and 31.9% other staff (Table 1). In the analysis, doctoral students working in the faculties are merged with the other staff because the opinion of these two groups were similar. For the same reason, researchers are merged with academic personnel. On the basis of age, the employees are divided quite evenly between one group 25–45 years old and a second group older than 46 years. The gender division was also quite similar. In terms of work experience, 54.6% have worked at the university for up to 10 years and the rest longer than 10 years. Considering the evidence of small sample groups of different indicators, the results of analysis may be not significant and we cannot be confident in some of the results. Nevertheless, it is possible to use the initial results of the self-assessment and make plans for further development in the next survey with a larger sample.

The statistical reliability analysis indicates that Cronbach's alpha ranges from 0.828 to 0.954 for the dimensions of an entrepreneurial university (Table 2), which shows good consistency and that the items in our instrument measure the same construct.

Tabel 2. The characteristics and reliability analysis of the questionnaire by dimensions

Dimensions on entrepreneurial university		Items	Mean	Std. Deviation	Cronbach alpha
1.	. Leadership and Governance	5	6.82	1.79	0.828
2.	Organisational Capacity, People, and Incentives	7	6.25	2.10	0.933
3.	Entrepreneurial Development in Teaching and Learning	6	6.66	2.18	0.939
4.	Pathways for Entrepreneurs	11	6.42	2.09	0.954
5.	University-Business External Relationships for Knowledge Exchange	6	7.16	1.96	0.929
6.	Entrepreneurial University as Internationalised Institution	5	7.59	1.77	0.89
7.	Measuring the Impact of the Entrepreneurial University	5	6.10	2.26	0.94

Source: Authors

The analysis was carried out by calculating the average opinions of the university staff using a Likert scale of 1–10, and separately among different categories of employees (e.g. administration, academic personnel, and other staff), two faculties, and groups on the basis of age, gender and work experience. The one sample t-test is used to compare the mean of single statements and between the average scores of relevant dimensions in the questionnaire. Spearman's correlation was carried out between the seven dimensions to identify the interrelation between the different criteria of an entrepreneurial university.

4. Results

4.1. The Opinion of the University Staff about how Entrepreneurial the University is

The results of the university staff analysis showed that all indicators of the entrepreneurial university received above average scores (on a Likert 10-point scale), indicating that activities at the university in all areas are targeted at the university being entrepreneurial. The highest scores in the university on average as well as on the basis of different staff groups were given for the dimension *The Entrepreneurial HEI as an Internationalised Institution* (7.59) (Appendix 1). This was followed by *University-Business/External Relationships for Knowledge Exchange* (7.16) and *Leadership and Governance* (6.82). The most highly valued individual statements among the first two dimensions are as follows:

- The higher education institution explicitly supports the international mobility of its staff and students (including PhD students) (7.83)
- The higher education institution has strong links with incubators, science parks and other external initiatives, creating opportunities for dynamic knowledge exchange (7.79)
- The higher education institution demonstrates internationalisation in its approach to teaching (7.74)
- The higher education institution, its departments and faculties actively participate in international networks (7.72).

Internationalisation as well as university-business cooperation, and university leadership and governance also received high assessment scores by all staff groups (Table 3). Such a

result is explained by the fact that the university has the largest number of foreign students (nearly 1,700) in the country, who study in twenty-two study programmes in English. In addition, it is important to underline that the university's own internationalisation and innovation strategy has been implemented systematically and the measures stipulated in the strategy have been improved. The university supports the international mobility of its staff and students and actively participates in international networks as well as demonstrating an international approach to teaching as expressed in the high scores the university staff gave for these questions in the HEInnovate questionnaire. The university has developed an environment that meets the needs of foreign students, lecturers and researchers and has improved the availability and quality of information and advice on the arrangement of studies, work and living in English both at the university as a whole and at the level of the academic units – faculties, departments and centres.

Table 3. Average Scores of the Entrepreneurial University Criteria assessed by Different Staff Groups (mean)

		Administration	Academic staff	Other staff
1.	Leadership and Governance	7.78	6.64	7.04
2.	Organisational Capacity, People and Incentives	6.84	6.11	6.44
3.	Entrepreneurship Development in Teaching and Learning	7.57	6.66	6.57
4.	Pathways for Entrepreneurship	7.13	6.44	6.35
5.	University-Business/External Relationships for Knowledge Exchange	7.65	7.31	6.87
6.	The Entrepreneurial HEI as an Internationalised Institution	8.07	7.63	7.47
7.	Measuring the Impact	6.56	6.01	6.27

Note: used on a Likert scale from 1- completely disagree to 10 - completely agree.
Source: Authors

Entrepreneurship is a major part of the university strategy as entrepreneurship courses are included in every single study programme. The university also makes use of its academic potential in particular through strategic partnership with major technology-intensive companies in the world (e.g. cooperation with Mitshubishi Motors or Telia), while being an active partner for local companies, involving them in the activities and development of the university. The university has strong links with incubators, science parks and other external initiatives, and the university is committed to collaboration and knowledge exchange with industry, society and the public sector, which was one of the highest rated questions by the university staff in the HEInnovate questionnaire. The science park as well as the knowledge transfer centre are located in the university campus and the university has very strong links with both of them. The knowledge transfer centre enables students, tutors, scientists and entrepreneurs from diverse fields to collaborate in projects, solve practical product development problems and generate new intelligent ideas. There are also many start-up companies located in the university campus.

Nevertheless, some differences were found between the opinions of different staff groups regarding the dimensions of an entrepreneurial university and single statements under the

dimensions of HEInnovate questionnaire. The faculty administration gave the highest rating (total average 7.33) to all seven dimensions (see Table 3). The ratings of the academic staff and other staff are lower. In response to some questions, the lower ratings by the academic staff for three dimensions stand out (Leadership and Governance; Organisational Capacity, People and Incentives; Measuring the Impact) compared to the faculty administration and other staff. The high ratings by the faculty administration indicate their greater awareness of the university as an entrepreneurial university compared with other staff groups. At the same time, it speaks of the need to explain to all staff groups about the concept and activities of the entrepreneurial university and improve their awareness of the entrepreneurial activities at the university.

The dimensions rated the lowest were *Measuring the Impact* (6.10), *Organisational Capacity, People and Incentives* (6.25), and *Pathways for Entrepreneurship* (6.42), indicating that there are opportunities for the development of regular monitoring and evaluation of the university's knowledge exchange activities. The measurement of the university's impact is underdeveloped, which is perceived by university staff members, who also rated *Measuring the Impact* as the lowest dimension in previous studies (Gibb, 2005). The university in the current study has adopted measures in its strategic plan that are regularly monitored; however, measures for knowledge exchange are yet to be developed.

Table 4. Spearman's correlation between the dimensions of the HEInnovate assessment tool

		1.	2.	3.	4.	5.	6.	7.
1.	Leadership and Governance	1						
2.	Organisational capacity, People and Incentives	0.762**	1					
3.	Entrepreneurial Development in Teaching and Learning	0.772**	0.832**	1				
4.	Pathways for Entrepreneurs	0.773**	0.816**	0.898**	1			
5.	University-Business External Relationships for Knowledge Exchange	0.749**	0.778**	0.850**	0.850**	1		
6.	Entrepreneurial University as Internationalised Institution	0.642**	0.675**	0.691**	0.700**	0.708**	1	
7.	Measuring the Impact of the Entrepreneurial University	0.703**	0.838**	0.791**	0.797**	0.749**	0.761**	1

Note: ** Correlation is significant at the 0.01 level (2-tailed).
Source: Authors

Spearman's correlation between the seven dimensions of the model can provide us with a more detailed description of how the respondents appreciate entrepreneurship and innovation in their higher education institution (Table 4). Spearman's correlation coeficient is significant at the 0.01 level (2-tailed) and is mostly over 0.7. For *Entrepreneurial University as Internationalised Institution*, the correlation with the first three dimesions (1–3) (*Leadership and Governance; Organistaional Capacity, People and Incentives; Entrepreneurial Development in Teaching and Learning*) is 0.642, 0.675 and 0.691 respectively. The highest correlation values occur in quite a number of cases in this analysis model. There is a strong

correlation between *Entrepreneurial Development in Teaching* and *Learning and Pathways for Entrepreneurs*, where the Pearson coefficient is 0.898. The second strongest correlation is between *Entrepreneurial Development in Teaching and Learning* and *Pathways for Entrepreneurs* and the *University-Business External Relationships for Knowledge Exchange* also with a Pearson coefficient of 0.850. The analysis shows that *Entrepreneurial Development in Teaching and Learning* has a strong correlation also with two other dimensions: *Measuring the Impact of the Entrepreneurial University* and *Organisational Capacity, People, and Incentives*.

The analysis of the level of single statements from the HEInnovate questionnaire helps identify the activities necessary for the development of a more entrepreneurial university. In Table 5, the difference is calculated between the lowest score and the average score of the relevant dimension. As a result, 1–2 statements can be found from each dimension, which all or selected staff groups have rated low. Based on the one sample t-test, the opinion of academic staff shows significiant differencies between their means when compared. Based on this, it is possible to determine the most critical aspects to consider when planning activities for the development of a more entrepreneurial university.

Despite the different level of awareness of the staff groups in the study we can rely on the statements they have evaluated lower than average because in most cases the different staff groups have quite similar opinions. For example, in regard to the dimension of *Leadership and Governance* all staff groups have quite similar opinions about the existence of the model of coordination and integration of entrepreneurial activities at all levels of the institution. This refers to the need to pay more attention to the further development of this issue in the university. In the dimension of *Organisational Capacity, People and Incentives*, the opinion of the academic staff shows that the staff incentives and rewards supporting entrepreneurial development need to be strengthened. This is in close connection with the need to support the entrepreneurial mindset and skills of students and staff, and the opportunities for taking part in entrepreneurial activities with business. The issue of facilitating access to private financing for potential entrepreneurs among sudents and staff is rarely used in the university and it is therefore rated lower by the university staff, which may be due to the fact that the involvement of private capital in the university is not a tradition in the country, but it is supported at the country level. Therefore, the development of close cooperation between university and business as a support system helps to facilitate access to private financing for potential entrepreneurs (including students and staff) at the university. The entrepreneurial ecosystem for new and operating businesses in the country is an important factor affecting the entrepreneurial development of universities and businesses.

The statement about the evaluation of the impact of start-up support has also been rated lower compared with other statements, which may be due to the fact that business start-ups are supported through national entrepreneurship policies and are therefore neglected intra-organizationally at the university. Therefore, it is important to raise the awareness of staff members about national services available for everyone. However, based on the low ratings of the staff, the university should develop a sustainable financial strategy to support entrepreneurial development and a motivation system for the staff that actively supports the universty's entrepreneurial agenda.

Table 5. The lowest scoring statements characterising the entrepreneurial university in comparison with the average level of the relevant dimensions (mean)

		Adminis-tration	Academic staff	Other staff
1.3	The higher education institution has a model for coordinating and integrating entrepreneurial activities at all levels across the institution	-0.67	-0.72^{xx}	-0.52
2.2	The higher education institution has a sustainable financial strategy in place to support entrepreneurial development	-0.51	-0.32	-0.40
2.6	There are clear incentives and rewards for staff who actively support the higher education institution's entrepreneurial agenda	-0.17	-0.71^{xx}	-0.21
3.1	The higher education institution is structured in such a way that it stimulates and supports the development of entrepreneurial mindsets and skills	-0.46	-0.26	-0.25
4.9	Mentoring by academic and industry personnel is available	-0.35	0.16	-0.54
4.10	The higher education institution facilitates access to private financing for its potential entrepreneurs	-1.91	-1.46^{xxx}	-0.40
5.4	The higher education institution provides opportunities for staff and students to take part in entrepreneurial activities with business/ the external environment	-0.31	-0.42	-0.63
6.3	The higher education institution seeks and attracts international and entrepreneurial staff (including teaching, research and PhDs)	-0.62	-0.53^{x}	-0.29
7.5	The higher education institution carries out regular monitoring and evaluation of the impact of start-up support	-0.22	-0.34	-0.48

Note: P<0.01^{xxx}, p<0.05^{xx}; p<0.1^{x}; The average scores of dimensions see in table 2.
Source: Authors

Analysing the opinions of staff on the basis of age, work experience and gender, it can be noticed that younger staff (25–35 years) assessed the criteria of an entrepreneurial university lower than the older staff (46–60 and >60), particularly the entrepreneurial development in teaching, learning and pathways for entrepreneurs. This may be explained by their low awareness of the entrepreneurial activities at the university. The same pattern occurs among the staff with shorter work experience (1–5 years), and among those with work experience over 25 years. Unfortunately, the difference between the opinions of different age groups and work experience groups are not statistically significant, which may be affected by the small sample. A rather large difference emerged between staff groups on the basis of gender, where males evaluated the criteria of an entrepreneurial university lower and females higher than average. The significant difference between gender groups emerges in respect to entrepreneurial development in teaching and learning. Based on this information, the strategy for the development of entrepreneurial activities should consider the differences in the assessment of the criteria of an entrepreneurial university and adopt measures to increase awareness of entrepreneurship as well as increase the entrepreneurial mindset and skills in those groups with lower scores for the dimensions of an entrepreneurial university.

The development of the university's entrepreneurial features are supported in the university's strategic plan which says: "the mission of the university is to be a promoter of science, technology and innovation and a leading provider of engineering and economic education in the country… valuing professionalism and reliability, entrepreneurship and innovation, openness and cooperativeness" (strategic plan of the university 2020, 2016).

The strategic plan intends to integrate practical entrepreneurship courses into all study programmes. With this the university raises awareness of the value/importance of developing entrepreneurship competence among students, including the development of the entrepreneurial mindset and skills. Practical entrepreneurship studies cover business start-up education offered across all study programmes. To increase cooperation between the university and companies, long-term and large-scale business contracts are encouraged at the university and their volume increased in the budget. This also means closer cooperation with enterprises and increasing investments by enterprises in the university (i.e., investments by external stakeholders), which all contribute to the development of an entrepreneurial university. The university is developing active cooperation with investors, ministries, embassies and other public institutions as well as professional associations by presenting the university competences to potential foreign investors and enterprises. This contributes to the fulfilment of the criteria of an entrepreneurial university committed to collaboration and knowledge exchange with industry, society and the public sector and contributes to the development of the university as an entrepreneurial university.

4.2. A Comparison of the Ratings of Entrepreneurial University Criteria Between Two Faculties

The ratings of university employees express how entrepreneurial they think the university is. However, to a certain extent, the faculty staff ratings may also show the entrepreneurial qualities of the faculty and staff members' awareness of the university and faculty activities. Therefore, in our research the faculty of business and governance staff ratings have been compared to those of the engineering faculty.

The results of surveying the employees of the two faculties using the HEInnovate questionnaire show that in general the employees of both faculties have assessed the university higher than average following the criteria of an entrepreneurial university. There are similarities between the two faculties which both gave the highest points to the following statements: *Entrepreneurship is a major part of the university strategy*, *The university is a driving force for entrepreneurship development in the wider regional, social and community environment* and *The faculties and units within the higher education institution have autonomy to act*. The faculties have autonomy to act in order to develop their partnerships with enterprises and public institutions, find research partners and cooperate with other higher education institutions. Both faculties value the university's role as a driving force for entrepreneurial development in the wider regional, social and community environment.

The business faculty has given higher ratings to all seven criteria of an entrepreneurial university compared to the ratings given by the employees of the faculty of engineering. This can be explained by the fact that the business faculty is responsible for coordinating entrepreneurship education across the whole university and therefore is responsible for developing a model for coordinating and integrating entrepreneurial activities at all levels. Nevertheless, the biggest difference between the two faculties occurred in the ratings of three dimensions to do with how internationalised the university is, how entrepreneurship is developed in teaching and learning and the pathways to entrepreneurship. The difference was the smallest in regard to organisational capacity and leadership and governance issues.

Based on the HEInnovate questionnaire, the highest assessment from the employees of the faculty of business and governance was given to the internationalisation of the university.

This can be explained by the high number of international students (28% of all students in the faculty) from around 50 countries. Nearly 70% of the teaching staff in the business and governance faculty teaches in both the state language and English. The faculty is also a member of several international organisations uniting business schools such as EFMD, CEEMAN, BMDA, AACSB, and has the international CEEMAN IQA accreditation and EFMD BSIS label. The faculty has international lecturers from more than twenty nations and its teachers are active users of the Erasmus mobility programme teaching in other universities abroad.

A difference between the faculty of business and governance and the engineering faculty also emerged in the dimensions *Entrepreneurship Development in Teaching and Learning and Pathways for Entrepreneurship*, where the teachers of the faculty of business and governance are teaching entrepreneurship courses in all faculties of the university. Therefore this faculty has a better position in respect to these two dimensions since it is teaching entrepreneurship itself. Currently, entrepreneurship courses are included in all the programmes in every faculty at the university, and this supports the university becoming more entrepreneurial in the future. The development of entrepreneurship is part of the strategy of the faculty of business and governance and the faculty is teaching and developing research in this field. The faculty has a professor of entrepreneurship and its own entrepreneurship research group, which also supports the integration of research results into entrepreneurship education and training.

When analysing the lowest scores of single statements in the HEInnovate questionnaire in these two faculties in comparison with the average level of relevant dimensions, it is possible to identify the issues that need to be developed further to help make the university be more entrepreneurial. There are of course some criteria that were assessed lower in both faculties and where the opinion of different staff groups are in agreement (see 4.1. above). These are, for example, issues related to coordinating and integrating entrepreneurial activities at all levels of the university, a sustainable financing strategy and incentives for staff to support entrepreneurial development, supporting the development of an entrepreneurial mindset and skills, and opportunities for cooperating with businesses. In some criteria, it is possible to find differences between the two faculties. For example, the engineering faculty assessed the commitment to implementing the entrepreneurial strategy, coordinating and integrating entrepreneurial activities at all levels across the university, incentives and rewards for staff who actively support the higher education institution's entrepreneurial agenda, and the impact of the entrepreneurial strategy considerably lower (based on statistically significiant differences) than the faculty of business and governance. The faculty of business and governance has assessed the existence of business start-up courses according to different start-up phases, the validation of entrepreneurship learning outcomes, and the regular evaluation of the impact of start-up support as lower. From here it can be concluded that the differentiation of entrepreneurship courses in addition to the basic courses is expected and the development of the assessement of learning outcomes and the impact of entrepreneurship education is necessary.

Table 6. A selection of the lowest scores for statements characterising the entrepreneurial university in comparison with the average level of relevant dimensions (mean)

		Business and Governance	Engineering
1.2	There is commitment at a high level to implementing the entrepreneurial strategy.	-0.24^{x}	-0.65^{x}
1.3	The higher education institution has a model for coordinating and integrating entrepreneurial activities at all levels across the institution.	-0.51^{xx}	-0.94^{xx}
2.2	The higher education institution has a sustainable financial strategy in place to support entrepreneurial development.	-0.36^{x}	-0.32
2.6	There are clear incentives and rewards for staff who actively support the higher education institution's entrepreneurial agenda.	-0.54^{xx}	-0.74^{x}
3.1	The higher education institution is structured in such a way that it stimulates and supports the development of entrepreneurial mindsets and skills.	-0.26^{x}	-0.30
3.4	The higher education institution validates entrepreneurship learning outcomes.	-0.41^{x}	-0.01
4.6	The suite of business start-up courses has a differentiated offer that covers the pre-start-up phase, the start-up phase and the growth phase. For certain courses active recruitment is practised.	-0.71^{xxx}	-0.26
4.8	The higher education institution provides support for individuals and groups to move from entrepreneurial ideas to action.	-0.14	-0.43
4.10	The higher education institution facilitates access to private financing for its potential entrepreneurs.	-1.38^{xxx}	-1.19^{xxx}
5.4	The higher education institution provides opportunities for staff and students to take part in entrepreneurial activities with business/the external environment.	-0.43^{xx}	-0.49
6.3	The higher education institution seeks and attracts international and entrepreneurial staff (including teaching, research and PhDs).	-0.47^{xxx}	-0.60^{x}
7.1	The higher education institution assesses the impact of its entrepreneurial strategy.	0.12^{x}	-0.24^{x}
7.5	The higher education institution carries out regular monitoring and evaluation of the impact of start-up support.	-0.51^{xxx}	-0.09^{x}

Note: P<0.01^{xxx},p<0.05^{xx}; p<0.1^{x}; The average scores of dimensions see in table 2.
Source: Authors

Both faculties need to find ways to motivate and reward staff who actively support the higher education institution's entrepreneurial agenda. Actually, both faculties are open to recruiting and engaging individuals with entrepreneurial attitudes, behaviours and experience and they offer status and recognition to other stakeholders who contribute to the university's entrepreneurial agenda, they also have established good contacts with companies. Many entrepreneurs are invited to give guest lectures, be thesis advisers, mentors and project team leaders. The faculty of business and governance has a sustainable financial strategy in place to support entrepreneurial development. This faculty has applied and received funds to develop entrepreneurship education from different European projects, and provides business support services for students interested in starting a new company. The faculty is continuously promoting innovation in teaching and learning. The use of an e-environment and e-learning is supported, as is running training courses on innovative teaching methods and strategies.

In the dimension *University-Business/External Relationships for Knowledge Exchange*, both faculties have a strong opinion that the university is actively collaborating and exchanging knowledge with incubators, science parks and other external initiatives, as well as with industry, society and the public sector. The knowledge transfer centre provides opportunities for students, tutors, scientists and entrepreneurs from diverse fields to collaborate on projects, solve practical product development problems, and generate new intelligent ideas. A number of start-up companies are located in the university campus area. The staff of the faculty of business and governance value highly the criterion that the university links research, education and industry (and wider community) activities together to affect the whole knowledge ecosystem.

The difference between the two faculties is greatest in respect to the dimension *The Entrepreneurial HEI as an Internationalised Institution* in the sense that internationalisation is a key part of the higher education institution's entrepreneurial strategy. The faculties invite international professors to deliver lectures, and are members of international organisations and participate actively in many international projects. In both faculties the staff believe that the university provides enough support for the international mobility of staff and students.

The difference between the business faculty and the engineering faculty is greatest in respect to the dimension *Measuring the Impact* in terms of the criteria that the higher education institution uses to assess the level of engagement in entrepreneurship teaching and learning across the institution and the impact of its entrepreneurial strategy.

5. Conclusions

The HEInnovate questionnaire was used to evaluate how the criteria of an entrepreneurial university have been met at the university of technology. The results of the survey with the university staff showed that all indicators of the entrepreneurial university received above average ratings, indicating that activities at the university in all areas are targeted at supporting entrepreneurship. In this, the highest ratings in the university on average as well as by different staff groups were given to the dimension *The Entrepreneurial University as Internationalised Institution*. This is followed by high ratings for *University-Business/ External Relationships for Knowledge Exchange* and *Leadership and Governance*. The

correlation between the HEInnovate dimensions shows that *Entrepreneurial Development in Teaching and Learning* has the stongest connection with other dimensions, indicating that this dimension influences the development of university towards being entrepreneurial the most. The lowest ratings were given to *Measuring the Impact* of entrepreneurial activities, *Organisational Capacity, People and Incentives*, and *Pathways for Entrepreneurship*, indicating that the university needs further development in carrying out regular monitoring and evaluation of its entrepreneurial activities and knowledge exchange activities. As pointed out by Gibb (2005), previous research has shown that impact measurement in universities is underdeveloped.

Nevertheless, some differences between different staff groups have been found. The highest rating of the university as an entrepreneurial university was given by the faculty of administration, who valued all seven dimensions higher than the academic staff and others. This can be explained by their better awareness about the university's strategy and activities towards the development of an entrepreneurial university. From here it can be concluded that an increase in the awareness of academic and other staff about the strategies of the university is needed for future development and strengthening the criteria characterising the university as entrepreneurial. The research has brought out aspects that require the development of activities that support the university becoming more entrepreneurial.

The research also presents a comparison of the opinions of the staff in two faculties about the university being entrepreneurial – the faculty of business and governance and the faculty of engineering. Despite the general scores from both faculties being above average, it is possible to find some differences between the faculties. The biggest difference between these faculties emerged in the assessment on how internationalised the university is, which was followed by the development of entrepreneurship in teaching and learning, and entrepreneurship commitment issues. The difference was the smallest in the area of organisational capacity, leadership and governance issues. Based on the opinions of different staff groups and the staff of the faculties in this study, and relying on the statistically significiant differencies between the lowest and average ratings for single statements from the HEInnovate tool, the research has highlighted areas the university needs to develop to become more entrepreneurial. Both faculties need to:

- increase the commitment to implementing the entrepreneurial strategy;
- develop a model for coordinating and integrating entrepreneurial activities at all levels across the university;
- introduce clear incentives and rewards for staff who actively support the higher education institution's entrepreneurial agenda;
- facilitate access to private financing for potential entrepreneurs;
- seek and attract international entrepreneurial staff (including teaching, research and PhDs);
- assess the impact of the entrepreneurial strategy;
- carry out regular monitoring and evaluation of the impact of start-up support.

In addition, the opinion of the staff of the faculty of business and governance indicates a need to:

- stimulate and support the development of entrepreneurial mindsets and skills;
- create a sustainable financial strategy to support entrepreneurial development;
- validate entrepreneurship learning outcomes;
- diversify the business start-up courses covering all phases of business development.

Among the differencies between the faculties, the staff of the engineering faculty assessed the commitment to implementing the entrepreneurial strategy as considerably lower (based on statistically significant differences) compared with the faculty of business and governance. In addition, the coordination and integration of entrepreneurial activities at all levels across the university, incentives and rewards for staff who actively support the higher education institution's entrepreneurial agenda and assessing the impact of the entrepreneurial strategy, were also mentioned. The staff of the faculty of business and governance gave a low assessment of the existence of business start-up courses according to different start-up phases, the validation of entrepreneurship learning outcomes, and the regular evaluation of the impact of the start-up support.

Therefore, this research contributes to the in-depth analysis of the criteria of an entrepreneurial university and identified areas in critical need of further development. The research has proved that instead of viewing the general university level, analysis is required through different staff groups and faculties or other structural units to better understand the issues in need of improvement.

The results of the study support the importance of being an entrepreneurial university and contribute to the potential of increasing competitiveness by further developing the university, especially in the areas of the conceptualisation of entrepreneurship; strategies for embedding entrepreneurship across the campus; opportunities for entrepreneurial learning; and new combinations of multidisciplinary knowledge. Future research could focus on how the adherence to the criteria of the entrepreneurial university will affect internal structures, processes, functions, values and norms, as well as behavioural patterns and academic identities, and finally, how these changes will influence the role of the university in regional development.

Cooperation between the different faculties in developing entrepreneurship networks and/or conducting research projects, as well as developing joint study programmes would significantly enhance the implementation of the principles of an entrepreneurial university in the technical universities. An important benefit for students could be the integration of the entrepreneurial approach in teaching and learning in all study programmes. The university should also use mentors and coaches to inspire and support entrepreneurial development opportunities in all faculties and create dynamic and effective entrepreneurial ecosystems. It is necessary to have different sources of financing, which would ensure greater success in business, and provide opportunities for new projects and training for employees.

The limitation of the current research is that the survey has carried out in only one university, which limits the possibilities for making generalisations based on the research results. Furthermore, the small sample of staff groups limits the conclusions about differences in the staff opinions, which influences the statistical significance of the research results. The research showed that the HEInnovate tool makes it possible to analyse a single university and different staff groups, which also deepens the self-assessment possibilities for universities so that they can identify the most critical aspects the university needs to develop to become more entrepreneurial. In addition to the self-assessment, future research should also include secondary data and indicators characterising the performance of the university.

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Appendix 1. Average Scores of the Entrepreneurial University Criteria assessed by Different Staff Groups and faculties (mean)

		Faculty; administ-ration	Academic staff	Other staff	Faculty of busi-ness and gov-ernance	Faculty of engi-neering
1.	Leadership and governance	7.78	6.74	6.93	7.17	6.48
1.1	Entrepreneurship is a major part of the university strategy	8.11	7.34	6.95	7.53	7.22
1.2	There is commitment at a high level to implementing the entrepreneurial strategy	7.67	6.28	6.50	6.93	5.83
1.3	The higher education institution has a model for coordinating and integrating entrepreneurial activities at all levels across the institution	7.11	6.01	6.41	6.66	5.54
1.4	The faculties and units within the higher education institution have autonomy to act	7.67	6.98	7.59	7.32	6.98
1.5	The higher education institution is a driving force for entrepreneurship development in the wider regional, social and community environment	8.33	7.07	7.18	7.43	6.83
2.	Organisational Capacity, People and Incentives	6.84	6.15	6.53	6.58	5.98
2.1	The higher education institution's entrepreneurial objectives are supported by a wide variety of funding sources/investment, including investment by external stakeholders	6.89	6.00	6.68	6.46	6.00
2.2	The higher education institution has a sustainable financial strategy in place to support entrepreneurial development.	6.33	5.83	6.14	6.22	5.66
2.3	There are mechanisms in place for breaking down traditional boundaries and fostering new relationships – bringing internal stakeholders together (staff and students) and building synergies between them.	7.67	6.28	6.64	6.66	6.46
2.4	The higher education institution is open to recruiting and engaging with individuals who have entrepreneurial attitudes, behaviours and experience.	6.89	6.73	6.55	7.01	6.34
2.5	The higher education institution invests in staff development to support its entrepreneurial agenda.	6.78	6.22	6.68	6.75	5.95

2.6	There are clear incentives and rewards for staff who actively support the higher education institution's entrepreneurial agenda.	6.67	5.44	6.32	6.04	5.24
2.7	The higher education institution gives status and recognition to other stakeholders who contribute to the institution's entrepreneurial agenda.	6.67	6.52	6.73	6.93	6.17
3.	Entrepreneurship Development in Teaching and Learning	7.57	6.66	6.52	7.2	6.08
3.1	The higher education institution is structured in such a way that it stimulates and supports the development of entrepreneurial mindsets and skills	7.11	6.40	6.27	6.94	5.78
3.2	Staff take an entrepreneurial approach to teaching in all departments, promoting diversity and innovation in teaching and learning.	7.67	6.77	6.55	7.37	6.05
3.3	Entrepreneurial behaviour is supported throughout the higher education experience; from creating awareness and stimulating ideas through to development and implementation.	7.78	6.82	6.73	7.26	6.39
3.4	The higher education institution validates entrepreneurship learning outcomes	7.22	6.40	6.36	6.79	6.07
3.5	Collaborating and engaging with external stakeholders is a key component of teaching and learning development in an entrepreneurial higher education institution	8.33	7.07	6.64	7.60	6.41
3.6	Research results are integrated into entrepreneurship education and training	7.33	6.49	6.59	7.22	5.76
4.	Pathways for Entrepreneurship	7.13	6.45	6.26	6.95	5.82
4.1	The higher education institution raises awareness of the value/importance of developing entrepreneurial abilities among staff and students.	7.56	6.96	6.68	7.24	6.51
4.2	The higher education institution actively encourages individuals to become entrepreneurial.	6.89	6.50	6.50	6.74	6.32
4.3	Business start-up education is offered across the curricula and faculties.	8.56	6.88	6.45	7.47	6.29
4.4	The business start-up education offer is widely communicated, and measures are undertaken to increase the rate and capacity of take-up.	7.67	6.44	6.27	7.09	5.76

4.5	A suite of business start-up courses exists, which uses creative teaching methods and is tailored to the needs of undergraduate, graduate and post-graduate students.	7.22	6.63	6.73	7.29	5.98
4.6	The suite of business start-up courses has a differentiated offer that covers the pre-start-up phase, the start-up phase and the growth phase. For certain courses active recruitment is practised.	7.11	5.73	6.00	6.24	5.56
4.7	The higher education institution provides opportunities to experience entrepreneurship.	7.33	6.60	6.18	7.09	5.93
4.8	The higher education institution provides support for individuals and groups to move from entrepreneurial ideas to action.	6.89	6.26	5.91	6.81	5.39
4.9	Mentoring by academic and industry personnel is available.	6.78	6.61	5.73	7.09	5.54
4.10	The higher education institution facilitates access to private financing for its potential entrepreneurs.	5.22	4.99	5.86	5.57	4.63
4.11	The higher education institution provides access to business incubation facilities.	7.22	7.33	6.59	7.87	6.15
5.	University-Business/External Relationships for Knowledge Exchange	7.65	7.25	6.83	7.56	6.76
5.1	The higher education institution is committed to collaboration and knowledge exchange with industry, society and the public sector.	7.44	7.35	6.91	7.56	6.83
5.2	The higher education institution demonstrates active involvement in partnerships and relationships with a wide range of stakeholders.	8.11	7.24	6.68	7.49	6.90
5.3	The higher education institution has strong links with incubators, science parks and other external initiatives, creating opportunities for dynamic knowledge exchange	8.44	7.94	7.05	8.25	7.27
5.4	The higher education institution provides opportunities for staff and students to take part in entrepreneurial activities with business/the external environment.	7.33	6.83	6.18	7.13	6.27
5.5	The higher education institution specifically supports staff and student mobility between academia and the external environment.	7.44	7.00	7.36	7.44	6.68

5.6	The higher education institution links research, education and industry (wider community) activities together to affect the whole knowledge ecosystem.	7.11	7.15	6.77	7.50	6.61
6.	The Entrepreneurial HEI as an Internationalised Institution	8.07	7.65	7.29	8.19	6.77
6.1	Internationalisation is a key part of the higher education institution's entrepreneurial strategy.	8.11	7.50	7.59	8.35	6.49
6.2	The higher education institution explicitly supports the international mobility of its staff and students (including PhD students).	8.33	7.88	7.64	8.34	7.10
6.3	The higher education institution seeks and attracts international and entrepreneurial staff (including teaching, research and PhDs)	7.44	7.12	7.00	7.72	6.17
6.4	The higher education institution demonstrates internationalisation in its approach to teaching.	8.22	7.82	7.41	8.29	7.05
6.5	The higher education institution, its departments and faculties actively participate in international networks	8.22	7.93	6.82	8.22	7.02
7.	Measuring the Impact	6.56	6.02	6.39	6.6	5.53
7.1	The higher education institution assesses the impact of its entrepreneurial strategy	6.22	6.06	6.41	6.72	5.29
7.2	The higher education institution assesses the level of engagement in entrepreneurial teaching and learning across the institution	6.89	6.09	6.64	6.88	5.37
7.3	The higher education institution regularly assesses the impact of entrepreneurship teaching and learning.	6.89	6.33	6.41	6.90	5.76
7.4	The higher education institution carries out regular monitoring and evaluation of the institution's knowledge exchange activities.	6.44	5.96	6.59	6.43	5.78
7.5	The higher education institution carries out regular monitoring and evaluation of the impact of start-up support.	6.33	5.68	5.91	6.09	5.44
	AVERAGE	**7.33**	**6.65**	**6.62**	**7.13**	**6.15**