The entrepreneurial university and academics' engagement in industry interactions*

*Barbara Kalar***

Abstract

Based on the results from four samples of academics from four different European countries, this study reveals why some universities are more successful than others in terms of creating and keeping their links with industry. It suggests that it is just not enough to create an entrepreneurial environment within the university based on university-level regulations, but it is essential that academics perceive and accept the encouragement for entrepreneurial behaviour as well as recognise the benefits of technology and knowledge transfer activities.

Keywords: Entrepreneurial university; Entrepreneurial orientation; Industry interactions; Technology and knowledge transfer (T&KT); Mediator; Cross-cultural study
JEL Codes: O3, L26

Introduction

In recent decades university-industry relations have developed due to environmental changes affecting the actions of universities, firms, and government (Santoro/Bierly 2006). Following models in the United States policy initiatives to promote university technology and knowledge transfer (T&KT) were introduced in many European countries (Grimaldi et al. 2011; Van Looy et al. 2011; Abreu/Grinevich 2013). For, knowledge transfer has become paramount. It has "become a strategic issue: As a source of funding for university research and (rightly or wrongly) as a policy tool for economic development" (Geuna/Muscio, 2009:93).

Consequently, the university-industry relationship, with the exchange of knowledge and technology, has become a central theme of many economic policies in recent years (Arvanitis et al. 2008; Van Looy et al. 2011). Indeed, the extent and strength of the university-industry relationship are deemed to be a major factor contributing to the high innovation performance of the whole economy (Arvanitis et al. 2008). A key element of research and innovation policies in most developed countries in the world now entails the forging of new alliances between universities and industry (Bjerregaard 2010; Thune/Gulbrandsen 2014). However, innovation performance, as a result of university-industry collaboration, remains an issue since there exist different perspectives on the impact that the university-industry relationship has on scientific performance (Lin 2017).

* Received: 10.8.18, accepted: 18.3.20, 2 revisions.

** *Barbara Kalar*, PhD, Research fellow, Institute for Economic Research, Ljubljana, Slovenia, and Teaching assistant, School of Economics and Business, University of Ljubljana, Slovenia, Email: barbara.kalar@gmail.com. Main research interests: technology and knowledge transfer, entrepreneurial university, family business.

There is a wide variety of activities through which academics transfer their technology or knowledge (Lockett et al. 2003; Bekkers/Bodas Freitas 2008). On the one hand, academics may engage in more formal activities, usually considered as more technology-based and described as harder entrepreneurial activities, such as academic entrepreneurship (spin-off formation) and commercialisation based on patenting and licensing (Philpott et al. 2011). On the other hand, academics may engage in less formal activities, usually considered as more knowledge-based and described as softer entrepreneurial activities, such as contract or collaborative research, and consulting (Philpott et al. 2011; Muscio et al. 2014; Perkmann et al. 2013).

Despite all the incentives and environmental changes targeted at strengthening more T&KT between university and industry, many attempts of such dissemination are unsuccessful (Santoro/Bierly 2006). According to the European Commission (2014) and some prior studies (e.g. Arundel et al. 2013; Sum Chau et al. 2017), universities and other research institutions as well as T&KT organisations in Europe are less successful in commercialising their new knowledge and technology than their U.S. counterparts. As commercialisation activities may affect the main missions of the university, teaching and basic research (Rasmussen et al. 2006), fear still exists among some academics that an entrepreneurial orientation may hold the potential for conflict and lead them to neglect their core tasks (Arvanitis et al. 2008; Lam 2010). The latter view may be one of the reasons for the identified unsuccessful attempts at T&KT.

However, over the past few decades, many universities have become an entrepreneurial university (Clark 1998; Etzkowitz et al. 2000; Huang/Chen 2017). This trend has stimulated many researchers to investigate the entrepreneurial university. One of the more recent studies (Guerrero et al. 2015) aims to provide a better understanding of the impact that an entrepreneurial university and its activities in terms of teaching, research, and entrepreneurial activity have on the economic development. The findings of this study (Guerrero et al. 2015) reveal that all three activities have an economic impact. Moreover, these findings also provide important insights into creating a wider picture of an entrepreneurial university by revealing that it is vital for entrepreneurial universities to jointly develop both activities, science and commerce (Chang et al. 2016). Consequently, this may help to reduce the above-mentioned unfavourable attitude toward the entrepreneurial university. In this regard, our study might help policymakers develop measures better tailored to jointly support scientific and entrepreneurial activities and act as an incentive mechanism to improve university-industry relations and facilitate T&KT.

This study contributes to the literature in two ways. First, there is a lack of research that would cover all scientific disciplines since most of the prior research was conducted among academics from natural science disciplines only (Abreu/

Grinevich 2013). Prior studies (e.g. Bekkers/Bodas Freitas 2008; Landry et al. 2010; Philpott et al. 2011; Abreu and Grinevich 2013) found that the scientific discipline likely influences the academic's engagement in T&KT activities. Therefore, we believe that conducting a study that covers all scientific disciplines could significantly complement existing research. Another neglected issue in the literature is the lack of research considering an individual academic rather than the role of the university or technology transfer offices to gain a deeper understanding of the university-industry relationship (Jain et al. 2009; Krabel/Mueller 2009). Most of the previous research was based on university or public data rather than on data obtained from individual academics (Aldridge et al. 2014). Indeed, research on how an individual academic perceives and accepts the idea of the entrepreneurial university is limited.

According to the above discussion, it is clear that despite the growing awareness and extensive research on the entrepreneurial university and T&KT in recent years, there still exist gaps in the understanding of the university-industry relationship (Audretsch et al. 2014; Wright 2014; Guerrero et al. 2015). Particularly severe is this gap with regard to the individual academic. For, particularly little is known about individual academics' decisions of why they interact with industry (Tartari/Breschi 2012). Therefore, unlike several prior studies that examined university entrepreneurial orientation based on the existence of supporting factors, such as technology transfer offices, incubators, or venture capital funding (Di Gregorio/Shane 2003; D'Este/Patel 2007; Hunter et al. 2011), our study aims to investigate the relationship between entrepreneurially oriented university department and industry interactions by focussing on how an individual academic perceives and accepts the environment in which he or she operates. In so doing, the current study provides a better understanding of the university-industry relationship by explaining why academics engage in industry interactions.

Theoretical considerations and hypotheses

The surrounding environment significantly influences an individual's behaviour (James/James 1989; Amabile et al. 1996). An unfavourable environment, where individual success and innovation performance are not valued or even in conflict with traditional cultural values, may jeopardise entrepreneurial activity (Wdowiak et al. 2012). University culture, policies, and routines are the main environmental factors influencing an academic's behaviour (D'Este/Patel 2007) and thus may encourage or suppress an individual's entrepreneurial spirit (Pearce/Quan 2015).

To date, there has been no single definition of an entrepreneurial university. Nevertheless, based on the numerous existing definitions, it may be summarised that a general definition of an entrepreneurial university should entail formal and informal elements emphasising that an entrepreneurial university is like a natural

incubator that spreads the entrepreneurial culture among academics and students, encourages teamwork, recognises and creates opportunities, and does not hesitate to behave innovatively or take the risk (Clark 1998; Etzkowitz 2003; Kirby et al. 2011). Some of the most prestigious and top universities in the world, such as MIT, Stanford, University of California, Cambridge, or KU Leuven, are also the ones known as successful entrepreneurial universities (Philpott et al. 2011). The entrepreneurial and innovative spirit of the universities' members is an essential element in the missions of those universities.

The traditional understanding of the university's mission has changed (Oertel/Söll 2017). Indeed, nowadays, many universities incorporate into their goals and mission the elements of modern demands of being more entrepreneurial and proactive in commercialising universities' new knowledge and technology to become more efficient and collaborative (Krücken/Meier 2006). In doing so, universities are also faced with structural issues since once being traditional institutions with their core missions of teaching and research, recently they are facing a strong pressure to act more like organisations and be managed like corporations (Engwall 2008).

Although there is a growing awareness of the importance of entrepreneurial universities in today's economy and society, only limited research has examined the entrepreneurial orientation within universities. The entrepreneurial orientation of organisations is a key concept in identifying the extent to which an individual organisation behaves entrepreneurially (Lumpkin/Dess 1996). While entrepreneurial orientation is a well-known theoretical concept in the business sector, little is known about the entrepreneurial orientation within universities, which operate in quite a different organisational field than the business sector (Todorovic et al. 2011). Innovativeness, proactiveness, and risk-taking are dimensions defining an entrepreneurial orientation within a firm (Rauch et al. 2009; Kraus et al. 2012). Todorovic et al. 2011 adapted these four dimensions to the academic context. There, research mobilisation activities, unconventionality, industry collaboration, and perception of university policies, are four main dimensions defining the entrepreneurial orientation within universities (Todorovic et al. 2011). Based on these four dimensions, Todorovic et al. (2011) developed a new scale called ENTRE-U, which assesses the entrepreneurial orientation of university departments.

Since becoming an entrepreneurially oriented university requires certain changes in university policies, management, and culture (Rip 2002; Todorovic et al. 2011), some universities are more successful than others in stimulating entrepreneurial behaviour among their academic staff (Ponomariov/Boardman 2008). Indeed, university departments vary in their entrepreneurial orientation regarding the encouragement and support they provide for entrepreneurship (Todorovic et al. 2011).

Arvanitis et al. (2008) found that scientific institutes with a stronger orientation to applied research were more likely to engage in T&KT activities. An entrepreneurial culture within the university was identified as one of the key factors for successful T&KT in studies by Clark (1998) and O'Shea et al. (2005). Based on prior research and according to the study by Philpott et al. (2011), the establishment of an adequate work environment and the creation of common entrepreneurial culture within the university are two essential conditions for encouraging academics' engagement in T&KT.

However, the transformation from a traditional to an entrepreneurial university is unlikely to be successful without academics' acceptance on a deeper cognitive level (Lam 2010). Indeed, university departments, even within the same university, may have different influences on an individual's behaviour (Todorovic et al. 2011) depending on how an individual perceives and accepts the university department and the environment surrounding him or her (Lam 2010). The latter fact is supported by Hunter et al. (2011) who argue that academics' perception of their work environment, which was measured through organisational climate, was associated with the academics' engagement in entrepreneurial activity. Moreover, when academics, as well as students, perceive their work environment as supportive of entrepreneurial activities, they are inspired to act entrepreneurially (Huang/Chen 2017). Hence, we suggest that a very significant factor in becoming an entrepreneurial university is that academics perceive and accept the entrepreneurial orientation within the university along with the related changes in policies, culture, and routines.

Most of the previous research concentrated on those more tangible academic entrepreneurial outcomes, such as patenting, licensing, and spin-off creation (D'Este/Patel 2007; Caldera/Debande 2010). Yet, other academic activities exist that are also entrepreneurial in nature and which are equally or even more important (Cohen et al. 2002; D'Este/Fontana 2007). Indeed, engagement in less formal activities was found to have a significant social and economic value for academics as well as industry partners (Abreu/Grinevich 2013). In addition, when considering only those more tangible outcomes of an entrepreneurial university, many activities that produce more intangible outcomes are neglected and thus, the breadth of the entrepreneurial university is reduced (Berggren 2017). Industry interactions are one such type of activity and more recent research has devoted more attention to this kind of activity. Some of these interactions are less formal than others. Having different kinds of interactions with the industry can often result in more tangible and formal entrepreneurial activities (Ponomariov/Boardman 2008; Philpott et al. 2011) and can have a positive impact on innovation performance and economic development (Guerrero 2015; Huang/Chen 2017). Summing up, university-industry interactions are an important activity for academics at an entrepreneurial university.

Based on this discussion, we propose that academics' perceptions of the entrepreneurial orientation within the university play an important role in academics' engagement in the activities of T&KT. Indeed, the more academics perceive an entrepreneurial orientation, as well as the incentive and support of their university department, the more likely they are to interact with the industry. This leads to our first research hypothesis:

Hypothesis 1: Academics' perception of an entrepreneurially oriented university department is positively related to industry interactions.

However, the entrepreneurial university also brings some risk and doubts which lead to scepticism and contradictions among academics and university managers (Jacob et al. 2003; Rasmussen et al. 2006). Yet, despite the fact that more and more universities are becoming entrepreneurially oriented, the activities of T&KT are not perceived in a positive way by the entire academic community (Lam 2010; Philpott et al. 2011). Some academics believe that an entrepreneurial orientation within their university may lead academics to neglect the university's two main missions, teaching and research (Arvanitis et al. 2008; Perkmann/Walsh 2008), and thus redirect academic research from basic to applied research (Etzkowitz 2003). In line with these suggestions are studies by Lam (2010) and Philpott et al. (2011) who found that successful entrepreneurial academics themselves do not always perceive T&KT in a positive way and are even anxious about their future academic work and career due to the lack of support for an entrepreneurial culture among university departments. As a consequence, even those academics who are more entrepreneurial, especially younger ones, are less likely to build relations with industry partners (Philpott et al. 2011). However, on the other side, Tartari et al. (2014) suggest that academics' engagement with industry partners is influenced by an individual desire to compete effectively in the academic career as well as by departmental peers' behaviour. Even more, Lam's (2010) study indicates that the majority of academics who interact with the industry perceive a positive influence of these interactions on their academic research and career. Summing up, the differences in academic collaborations with industry partners can be explained by academics' different attitudes to T&KT (Martinelli et al. 2008). Therefore, this discussion leads us to propose that academics who perceive the influence of engaging in T&KT in a positive way are more likely to have industry interactions. Therefore, the second research hypothesis is:

Hypothesis 2: Academics' perceived positive influence of T&KT on academic performance is positively related to industry interactions.

An entrepreneurial university seeks to create an atmosphere that inspires its academic staff to reach beyond the traditional university-industry boundaries to develop mutually effective relations (Tijssen 2006). Thus, academics who perceive

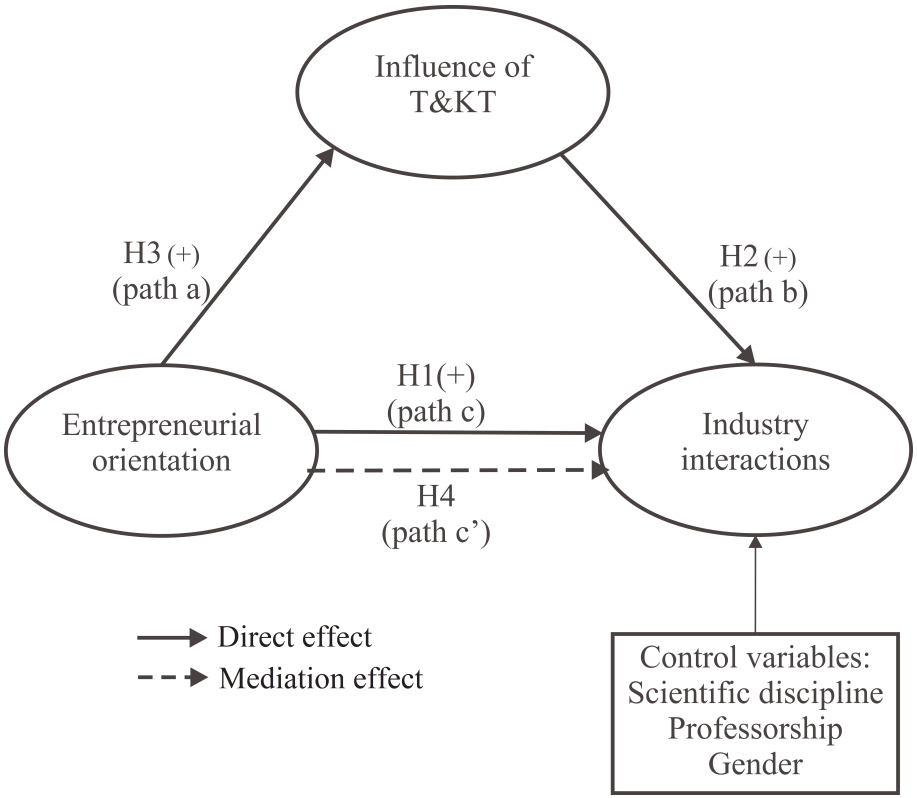
their university department as entrepreneurially oriented recognise and accept their department's support for collaboration with industry partners. The belief that cooperation with the industry improves academic research activities and performance dominates among these university departments (Todorovic et al. 2011). In any case, a positive attitude to academic entrepreneurship and T&KT is spread within more entrepreneurially oriented university departments. Based on this discussion and since university departments are very likely to have a significant influence on the culture and academics' behaviour (D'Este/Patel 2007), we propose that academics from more entrepreneurially oriented university departments are more likely to perceive that engagement in T&KT influences their academic performance in a positive way. This leads to the following research hypothesis:

Hypothesis 3: Academics' perception of an entrepreneurially oriented university department is positively related to academics' perceived positive influence of T&KT on academic performance.

Academics' motivation has an important role in their decision whether to interact with industry partners or not (Perkmann/Walsh 2009). Tartari and Breschi (2012) suggest that university-industry collaboration is influenced by academics' perceptions of the potential benefits and costs of university-industry interactions. On the one hand, the access to additional financial and nonfinancial resources encourage academics to increase their industry interactions, but on the other hand, academics' perceptions that their academic freedom would be limited due to industry collaboration is negatively associated with industry interactions (Tartari/Breschi 2012). According to this study (Tartari/Breschi 2012) and based on the above discussion, we suggest that it is not enough to simply introduce an entrepreneurial orientation within the university, but it is essential that academics perceive the support for entrepreneurial behaviour as well as they perceive a positive influence of T&KT on their academic performance which, in turn, enhances their engagement with the industry. Namely, if the academic has some doubts concerning academic performance, he or she will be less likely to perceive the benefits of T&KT. The latter indicates that when the academic perceives T&KT in a negative way, as a distraction and something that diminishes the scientific activity, it is likely to lead to little or no engagement in industry interactions despite the support for entrepreneurial behaviour provided by the university department. This leads to our last research hypothesis:

Hypothesis 4: The relationship between academics' perception of the entrepreneurial orientation of university department and academics' engagement in industry interactions is mediated by the academics' perceived positive influence of T&KT on academic performance.

Figure 1 The conceptual model



Methodology

Sampling and data collection process

The present study was conducted among academics from all scientific disciplines – natural sciences as well as social sciences – from four different European countries – the Netherlands, Belgium, Slovenia, and the United Kingdom – at four different universities – the Universities of Amsterdam, Antwerp, Ljubljana, and Oxford. Viewed broadly, the selected universities are from countries that are all members of the European Union, indicating that all four countries share some similar economic and social conditions and are obligated to follow the common strategic goals of the European Union. In this regard, our study is in line with the recommendations from Guerrero et al. (2014), who suggest that analysing universities from various countries with similar economic and social context provides a great opportunity to raise awareness about the entrepreneurial university.

Viewed narrowly, the Universities of Oxford and Amsterdam are much older compared to the Universities of Antwerp and Ljubljana. The Universities of Amsterdam and Ljubljana are the largest in their country, but most importantly, all four universities cover a wide spectrum of natural science as well as social science disciplines. Although the selected universities differ from each other by their traditions, policies, and characteristics, they also share some similar characteristics in terms of scientific and technological productivity. Namely, in terms of scientific productivity, all four universities have been recognised as actively publishing research institutions in Europe (European Commission 2003; European Commission 2013). According to the Academic Ranking of World Universities (ARWU 2018) and the Center for World University Rankings (CWUR 2018), which are two of the most widely cited annual rankings of global universities and for identifying universities' research and scientific performance, all four universities have been ranked among the top 500 universities in the world over the past few years. Furthermore, we looked at the university's surrounding environment to gain insight into the general attitude toward technological or entrepreneurial performance. Although there are some differences in the national policies and regulations, it seems that all four selected universities have been investing in the development of a friendly and supportive entrepreneurial environment. Namely, all four universities have supporting factors, such as technology and/or knowledge transfer office at the Universities of Oxford and Ljubljana, science parks at the Universities of Amsterdam, Antwerp, and Oxford, and incubators at all four universities, to stimulate cooperation between companies and university and to provide researchers with support and advice on activities concerning research commercialization. All these organizations have helped researchers to create a number of patent applications and license agreements, as well as they have actively contributed to the establishment of many companies – more than 100 companies at the Universities of Ljubljana, Amsterdam, and Oxford, and around 40 companies at the University of Antwerp (University of Amsterdam, 2020; University of Antwerp, 2020; University Incubator Ljubljana, 2020; University of Oxford, 2020). Thus, the selected universities were chosen for our study since they are similar in some ways, but at the same time differ from each other, which gives plenty of opportunities for fruitful research.

In addition, according to Aguiar-Díaz et al. (2016), who argue that issues related to university-industry interactions have gained a great interest in recent years, especially among European countries, we believe that conducting research among academics from four different European countries gives an opportunity for fruitful research that provides an important contribution to the existing literature on university-industry collaboration as well as important practical implications for policymakers and university managers.

All questionnaires were administrated electronically to e-mail addresses obtained from the websites of the individual universities – together with a person-

alised invitation letter to participate in the survey, followed by two reminders/ thank you letters,. The questionnaire was developed by following Dillman's (2007) and Couper's (2008) directions for conducting a successful and self-administrated survey that produces high quality information in a cost-effective manner. The questionnaire was initially formulated in English. The English version of the questionnaire was sent to the samples of academics at the Universities of Amsterdam, Antwerp, and Oxford, while the Slovenian version of the questionnaire was sent to the sample of academics at the University of Ljubljana. In order to focus on the questionnaire's content, an etic approach, which enables data to be generalised, was followed rather than an emic one, which refers to the local culture or context (Antoncic/Hisrich 2001). During the development process of the survey instrument, the questionnaire was checked by several experts and professors and it was pre-tested on a small group of academics. The final version of the questionnaire was designed by considering and incorporating the comments of the experts, professors, and the pilot study. This also helped reduce potential issues of common method bias by checking whether the questionnaire had been designed in a clear and simple manner and that no ambiguous constructs or items had been used in it (Podsakoff et al. 2003). In addition to reducing potential common method bias, the confidentiality and anonymity of the respondents were assured (Podsakoff et al. 2003).

In total, 1,300 questionnaires from all four universities were received, representing a 9.7 % response rate. After eliminating questionnaires containing a high proportion of missing data or which did not meet our sample's criteria (the respondent was not an academic employed at the university or reported to be not engaged in T&KT), the final number of usable responses for this analysis was 924. Despite the relatively low response rate, the distribution of each sample is quite similar to the population since it does not differ by more than 8.5 % from the population (see Table 1). The latter value indicates that the four samples of academics are representative of the overall population of academics at each university.

The potential non-response bias was assessed by comparing the later responses with the earlier responses for each of the four samples (Armstrong/Overton 1977). The analysis shows that non-response bias does not appear to be an issue in the data.

A male professor who is married or lives with a partner is the profile of the average academic at all four universities. A detailed profile of the respondents is presented in Table 1.

Table 1 Sample structure and profile of the respondents

Attribute	Value	Amsterdam	Antwerp	Ljubljana	Oxford
Sample size	No. of academics	196	122	484	122
Social sciences	Sample (%)	56.6	35.2	29.3	32.0
	Population (%)	48.1	42.6	34.3	32.9
Natural sciences	Sample (%)	43.4	64.8	70.7	68.0
	Population (%)	51.9	57.4	65.7	67.1
Gender	Male	127	86	324	82
	Female	69	36	160	40
Age	Equal or less than 30	33	31	61	20
	Between 31 and 50	99	68	280	56
	More than 50	64	23	143	46
Scientific discipline	Social sciences	112	40	134	33
	Natural sciences	84	82	350	89
Status	Full professor	30	20	102	28
	Associate professor	28	16	86	5
	Assistant professor	41	9	112	1
	Other*	97	77	184	88
Tenure	Equal or less than 10 years	110	69	174	59
	Between 11 and 30 years	68	47	254	47
	More than 30 years	18	6	56	16
Status	Married/living with a partner	142	90	359	85

*Other includes: senior lecturer, lecturer, scientific collaborator, assistant, visiting academic, and other.

Measures

All variables used in this research were previously tested and used by other researchers. In addition, where needed, scales were adequately modified to make them relevant for our overall sample.

An independent variable, the entrepreneurial orientation of a respondent's university department, was measured with the ENTRE-U scale developed by Todorovic et al. (2011). Since the original ENTRE-U scale was developed to be responded to by department heads, the initial construct's items were slightly modified to be appropriate for the individual academic's responses. Moreover, the construct's items were also slightly modified so that the scale could be used in different cultural contexts outside the initial Canadian context. The entrepreneurial orientation of a respondent's university department was assessed through four dimensions: research mobilisation, industry collaboration, unconventionality, and university policies. A five-point Likert scale was used to indi-

cate a respondent's level of agreement, ranging from "strongly disagree" to "strongly agree", with 22 statements (for instance: "It is believed that our department should build relationships with the industry."; "Compared to most other universities, our university is very responsive to new ideas and innovative approaches.").

A mediator variable, the perceived influence of T&KT on academic performance, was measured through scales adapted from Lam (2010) and Arvanitis et al. (2008). Respondents were asked to indicate their level of agreement on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree", with five statements (for instance: "T&KT has stimulated me to develop new areas of research."; "T&KT has positively influenced my academic career.").

Industry interactions, used as a dependent variable in the conceptual model, was measured with six items adapted from Ponomariov and Boardman (2008) that ask respondents how frequently they had engaged in a particular type of interaction with the industry in the previous 3 years (for instance: "I have helped place graduate students or post-docs in industry jobs."; "I have worked directly with industry personnel in an effort to transfer or commercialise technology or applied research."). The period of the last 3 years was used to measure the academics' recent and actual interactions with industry partners.

Variables defining a scientific discipline (natural vs. social sciences), gender, and academic status (professor vs. non-professor) were included in the model as control variables.

Data analysis

All variables were standardised by using data from the overall sample. In order to check for common method bias, we performed Harman's single-factor test (Podsakoff et al. 2003) using EFA. An unrotated, fixed, one-factor test explained 25.7 % (University of Oxford) to 33.6 % (University of Antwerp) of the total variance among the four samples. In addition, we performed a common latent factor by CFA. The results of the CFA indicated that the model with the common factor did not fit the data well in any sample. Namely, several model fit indices were all well below (e.g. GFI, NFI, and CFI) or above (e.g. RMR, RMSEA) the cut-off value. The same model fit indices revealed a much better model fit of the data when applying a six-factor model. Comparing the contribution of the common factor and the contribution of the dimensions, even though both contributions are significant (the chi-square difference is significant at $p < 0.001$) for all four samples, the contribution made by the dimensions is much greater. Thus, although these tests do not exclude common method variance, they indicate that it is not a great concern since the single factor did not account for the majority of the total variance and the common latent factor did not fit the model well.

We also checked our data for linearity and multicollinearity. The curve estimation was employed for all relationships in our model, which determined that all relations were sufficiently linear. Multicollinearity between the constructs was checked by calculating a variance inflation factor (VIF). All values of VIF were below the common threshold value of 10 (Hair et al. 2010).

Further, the constructs' convergent and discriminant validity were assessed by conducting EFA and CFA. The reliability of the multi-item scales was assessed with Cronbach's alpha (Cronbach 1951). Finally, structural equation modelling was used to test the proposed direct and indirect relationships between the constructs.

Findings

Empirical evaluation of the measurement scales

ENTRE-U is a four-dimensional, second-order scale that measures the entrepreneurial orientation of a university department. It was developed and validated on a sample of university department heads at Canadian universities by Todorovic et al. (2011). Since ENTRE-U is a relatively new construct, we also examined the initial structure of the construct and checked for the construct's validity and reliability for our four samples of academics. Seven items were eliminated from the initial scale based on the EFA due to assuring construct equivalence among the four samples (Singh 1995). The KMO measure of sampling adequacy was greater than 0.80, and Bartlett's test of sphericity was statistically significant for all four samples. The explained variances for the samples of academics at the Universities of Amsterdam, Antwerp, Ljubljana, and Oxford, respectively, were the following: 59.3 %, 64.1 %, 63.6 %, and 62.2 %. Further, CFA was applied to compare the first-order factor models and the second-order factor model. Considering various fit indices suggested by several researchers (e.g. Shook et al. 2004), CFA indicated that the four first-order factors model (correlated) and the second-order factor model provided very similar results. Although the four first-order factors model (correlated) provided slightly better results, as recommended by Todorovic et al. (2011), we used the second-order factor model in our further analysis. Namely, as the authors (Todorovic et al. 2011) explain, a second-order factor model is a special case of a four first-order factors model (correlated) with the benefits of providing a higher level of abstraction and controlling for multicollinearity problems that could arise if a four first-order factors model is used in the structural model. Moreover, all standardised estimates for the individual items were greater than 0.50 (the lowest estimate was 0.597) and significant at $p < 0.001$. There were no reliability and validity issues since all construct reliability (CR) and Cronbach's alpha values exceeded the recommended threshold of 0.70 for both (Hair et al. 2010) and all average vari-

ance extracted (AVE) values were greater than the recommended threshold of 0.45 (Netemeyer et al. 2003).

For the perceived influence of T&KT on the academic performance construct, EFA was conducted on the five items for each sample. The analysis only found one factor to explain the variance in the data. The KMO measure of sampling adequacy varied between 0.76 and 0.87 among the four samples, thereby verifying the data's adequacy for the factor analysis (Field 2009; Hair et al. 2010). The overall significance of the correlations between variables was confirmed by Bartlett's test of sphericity, which was statistically significant for all four samples (Field 2009; Hair et al. 2010). The explained variance ranged from 48.3 % to 70.0 %. All factor loadings were above 0.40 (the lowest factor loading was 0.459). The internal consistency was checked by Cronbach's alpha, which varied between 0.80 and 0.92 among the four samples.

EFA was employed to examine the factor structure of the industry interactions construct. The analysis indicated only one factor for all four samples. Due to the high values of skewness and kurtosis, one item was excluded from further analysis. The value of the KMO measure of sampling adequacy was good for all four samples since it was greater than 0.70 (Field 2009). Bartlett's test of sphericity was statistically significant for all four samples and the explained variances for the samples of academics at the Universities of Amsterdam, Antwerp, Ljubljana, and Oxford, respectively, were: 35.2 %, 53.6 %, 52.0 %, and 49.6 %. The reliability value, Cronbach's alpha, exceeded the threshold value of 0.70 (Hair et al. 2010), thus indicating a reliable scale for each sample.

Reliability and validity were also checked among the constructs used in the study. Values of CR and AVE generally revealed no reliability or validity concerns.

Structural model assessment

In order to check the proposed hypotheses, two individual structural models were assessed using EQS software. First, the model without a mediator was assessed to examine hypothesis H1. The model's results offer support for hypothesis H1 (path c), which predicts a positive relation between academics' perception of an entrepreneurially oriented university department and their engagement in industry interactions. Namely, as Table 2 shows, the standardised coefficient is positive and significant with all four samples. The values of the unstandardized coefficients indicate that the entrepreneurial orientation of the university department is the most important predictor of the engagement in industry interactions at the University of Antwerp and the least important one at the University of Amsterdam. The explained total variance ranged from 0.10 to 0.48, indicating that perceiving one's university department as entrepreneurially oriented explains 10 % to 48 % of the total variance of the academics' industry interactions.

Second, the model with a mediator was analysed to check the other three proposed hypotheses. Table 3 reports the standardised and unstandardised coefficients of the direct and indirect effects.

Table 2 Results of structural equations for the model without mediator

Universities of:		Amsterdam		Antwerp		Ljubljana		Oxford	
	Path	St. coeff.	Unst. coeff.	St. coeff.	Unst. coeff.	St. coeff.	Unst. coeff.	St. coeff.	Unst. coeff.
Direct and total effect without mediator									
Entrepreneurial orientation → Industry interactions	c	0.22	0.23*	0.46	0.52***	0.40	0.40***	0.34	0.37**
Control variables									
Scientific discipline		0.14	0.09	-0.10	-0.08	0.15	0.12***	-0.15	-0.10
Professorship		0.12	0.08	0.50	0.41***	0.32	0.25***	0.13	0.09
Gender		0.13	0.09	0.04	0.03	0.15	0.11***	0.33	0.22**
R^2		0.10		0.48		0.31		0.26	

* sig. < 0.05; **sig. < 0.01; ***sig. < 0.001.
Scientific discipline, professorship, and gender are binary variables, coded as: natural sciences = 1 and social sciences = 0, professor = 1, otherwise = 0; male = 1 and female = 0.

The overall model's results confirm our proposed mediation model. Namely, the positive and significant path coefficients support hypothesis H2 (path b), which for all four samples suggests a positive relationship between the perceived positive influence of T&KT on academic performance and engagement in industry interactions. A comparison of the unstandardized coefficients reveals that the academics' perceived positive influence of T&KT on their academic performance is quite similar and a very important predictor of industry interactions among all four samples of academics. Hypothesis H3 (path a) proposing a positive effect of perceiving one's university department as entrepreneurially oriented on academics' perceived positive influence of T&KT on academic performance is also supported for all four samples.

Table 3 Results of structural equations for the model with mediator

Universities of:		Amsterdam		Antwerp		Ljubljana		Oxford	
	Path	St. coeff.	Unst. coeff.	St. coeff.	Unst. coeff.	St. coeff.	Unst. coeff.	St. coeff.	Unst. coeff.
Direct effects with mediator									
Entrepreneurial orientation → Influence of T&KT	a	0.49	0.34**	0.52	0.32***	0.37	0.15***	0.50	0.41***
Influence of T&KT → Industry interactions	b	0.57	0.82***	0.39	0.74***	0.34	0.84***	0.49	0.71***
Entrepreneurial orientation → Industry interactions	c'	-0.06	-0.06	0.27	0.32**	0.29	0.29***	0.12	0.15
Indirect effect									
Entrepreneurial orientation → Industry interactions	a×b	0.28	0.28***	0.20	0.24***	0.12	0.12***	0.24	0.29**
Control variables									
Scientific discipline		0.18	0.12*	-0.14	-0.12*	0.12	0.09**	-0.13	-0.09
Professorship		0.16	0.10*	0.50	0.42***	0.33	0.26***	0.13	0.09
Gender		0.06	0.04	0.04	0.04	0.14	0.11**	0.23	0.15**
R^2		0.36		0.61		0.41		0.40	
		Full mediator		Partial mediator		Partial mediator		Full mediator	

* sig. < 0.05; **sig. < 0.01; ***sig. < 0.001.
Scientific discipline, professorship, and gender are binary variables, coded as: natural sciences = 1 and social sciences = 0, professor = 1, otherwise = 0; male = 1 and female = 0.

The significant results of hypotheses H1, H2, and H3 (path c in the non-mediator model and paths b and a in the mediator model) are conditions that should be met in order to check whether a mediation effect is in place (Baron/Kenny 1986; Wu/Zumbo 2008). According to Baron and Kenny (1986), if all these conditions hold, then the effect of the independent variable on the dependent variable must be less in the model with the mediator (path c') than in the model without the mediator (path c). The non-significant coefficient of path c' indicates full mediation, while the reduced but still significant coefficient of path c' indicates partial mediation (Little et al. 2007). As shown in Table 3, path c', the relation between perceiving one's university department as entrepreneurially oriented and engagement in industry interactions is no longer significant in the samples of academics at the Universities of Amsterdam and Oxford, whereas in the samples of academics at the Universities of Antwerp and Ljubljana the path coefficient decreases but remains significant.

Finally, the results support hypothesis H4, which examines whether the relationship between perceiving one's university department as entrepreneurially oriented and the engagement in industry interactions is mediated by the perceived positive influence of T&KT on academic performance. The standardised coefficient is positive and significant for all four samples of academics. The value of the unstandardised coefficient among the samples suggests that the degree of indirect effect is quite similar in the samples of academics at the Universities of Amsterdam, Antwerp, and Oxford, and an approximately twice as important predictor of the engagement in industry interactions than in the sample of academics at the University of Ljubljana. In addition, the indirect effect was assessed using a bootstrap method in IBM AMOS, which confirmed our initial results, supporting the relationship proposed in hypothesis H4.

Both models, without and with the mediator, were also checked regarding control variables. The findings reveal that the results of the main proposed hypotheses (H1 to H4) are almost the same regardless of whether the control variables are included in the models or not. The latter findings indicate that although control variables are important since they have some significant direct effect on the engagement in industry interactions (see Table 2 and Table 3), they do not significantly influence the main models.

Moreover, the value of the explained total variance (R^2) for engagement in industry interactions is greater in the model with than without the mediator for all four samples. The latter finding indicates that the model with the mediator fits the data better than the model without the mediator. Moreover, several goodness-of-fit indices for the model with the mediator also show a moderately good model fit for all four samples (see Table 4).

Table 4 Summary of the fit statistics based on CFA for the model with mediator

Sample of academics	χ^2	df	χ^2/df	Proba-bility	NFI	NNFI	CFI	GFI	SRMR	RMSEA
University of Amsterdam	597.59	343	1.74	0.000	0.892	0.946	0.951	0.808	0.084	0.062
University of Antwerp	460.40	343	1.34	0.000	0.901	0.970	0.973	0.770	0.105	0.053
University of Ljubljana	984.66	343	2.87	0.000	0.932	0.950	0.955	0.858	0.072	0.062
University of Oxford	493.94	343	1.44	0.000	0.866	0.950	0.954	0.762	0.103	0.060

Discussion and implications

This study provides insight into the university-industry relationship by highlighting the importance of academics' perception of the environment surrounding them and their engagement in industry interactions. It shows that at universities, where entrepreneurial behaviour of academics is encouraged and accepted by academics, academics' engagement in industry interactions is explained by their perceptions of the influence T&KT has on academic performance. It suggests that it is not enough just to create an environment within the university based on regulations that encourage entrepreneurial behaviour and university-industry collaboration, but it is essential that academics perceive the encouragement for entrepreneurial behaviour and the benefits of T&KT activities as a whole.

Implications for the theory and research on T&KT in academia

The findings of our study, first, confirm a positive relationship between academics' perception of their university department as entrepreneurially oriented and their engagement in industry interactions. Second, the perceived positive influence of T&KT on academic performance proved to be an important predictor of academics' involvement in industry interactions at all four universities. Third, it is found that academics who perceive their university department as entrepreneurially oriented are more likely to perceive a positive influence of T&KT on academic performance. Finally, the results support our hypothesis on the mediating role of academics' perceived positive influence of T&KT on academic performance in the relationship between academics perceiving their university department as entrepreneurially oriented and their engagement in industry interactions. Namely, the high and positive significant coefficients of an indirect effect indicate that academics from more entrepreneurially oriented university departments are more likely to perceive that T&KT influence their academic performance in a positive way and are thus more willing to interact with industry partners. In this regard, our study offers several contributions to the existing literature.

This study explains why academics engage in industry interactions which are an important type of T&KT between the university and the industry but are rarely considered due to the importance placed on analysing patents, licenses, and spin-offs (Caldera/Debande 2010; D'Este/Patel 2007). We have shown that academics who perceive their university department as more entrepreneurially oriented are more likely to perceive a positive influence of T&KT on their academic performance, which results in greater interactions with industry partners. Indeed, this study shows that there is a more complex, indirect relationship than just a simple direct one between entrepreneurial orientation and industry interactions. Indeed, academics are more willing to interact with industry partners when they perceive that their academic career and scientific reputation are improved because of T&KT. Finally, academics are more likely to partially alter their research to meet industrial demands and thus, find the benefits of T&KT in creating opportunities for developing new areas of research, which in turn is linked with their better academic performance.

Second, to move beyond prior research work, this study includes academics from all scientific disciplines. While most of the prior research was conducted among academics from natural science disciplines, such as engineering, physics, computer, and biological sciences, this study is one of the few (e.g. Abreu/Grinevich 2013) to include all scientific disciplines. In particular, this study demonstrates that industry interactions are an important activity of T&KT not just among academics in the natural sciences, but also for academics in the social sciences. Additionally, to enhance theory and to enable the research findings to be generalised, our study was conducted on four samples of academics from four different European countries.

Third, an important contribution of this paper lies in the unit of observation. As suggested by several scholars (e.g. Jain et al. 2009; Krabel/Mueller 2009), this study focusses on an individual academic who is the key actor in the T&KT process. In doing so, we complement existing research which mainly relied on the university, technology transfer offices, or public data (Aldridge et al. 2014).

Finally, the results indicate that the ENTRE-U scale is a reliable and valid instrument to assess the entrepreneurial orientation of university departments across the four samples of academics. To complement the work of Todorovic et al. (2011), we used the ENTRE-U scale as an independent variable to predict the engagement of academics in industry interactions by using structural equation modelling. Our results show that an entrepreneurial orientation of the university department, measured with the ENTRE-U scale, is an important predictor of the engagement in industry interactions. Even more, in our study, we showed that the entrepreneurial orientation of the university department has not only a simple direct influence but also an indirect influence on industry interactions.

Implications for university managers and policymakers

In terms of policy perspective, this study offers directions on how to refine and improve current policies, regulations, and/or incentive systems to enhance the university-industry relationship. Namely, policymakers need to gain a deeper understanding of universities, their values and behaviour, in order to be able to create an adequate policy system to achieve a strong and successful university-industry relationship that results in technological change and economic development (Muscio et al. 2014; Kruss/Visser 2017). Identifying the entrepreneurial orientation of a university through the eyes of academics considerably helps to improve our understanding of why academics engage in industry interactions.

A supportive environment is important, but it is not the key factor for fruitful relations between the university and the industry. It is crucial to develop an adequate environment, a culture, and an orientation that is perceived and accepted in a positive way by academics. Academics need to perceive and assess the benefits and costs of engagement in T&KT activities as a whole. Similarly, as Tartari and Breschi (2012) suggested, university managers as well as university administrations should try to spread awareness about the university-industry interactions and the possible additional opportunities and options these kinds of interactions may enable. In doing so, academics who think that their university department is encouraging entrepreneurial behaviour are also more likely to perceive a positive influence of T&KT on their academic performance, which in turn results in greater industry interactions. One reason for academics to behave like this may be because they are not afraid of being negatively accepted and criticised by an academic society that supports entrepreneurial behaviour. Hence, we suggest that it is not enough to simply introduce an entrepreneurial orientation within the university based on the university-level regulations, but it is important that university departments try to convince their academics to develop a positive attitude to entrepreneurship and believe in it. University departments should try to assure such support by taking real steps to gain the awareness and trust of academics. In this regard, a valid instrument should be implemented to encourage university T&KT and to stimulate behavioural change (Walter et al. 2018). University departments should try to design an appropriate incentive system by providing entrepreneurial courses and workshops, incorporating entrepreneurs in curricula and introducing role models, developing an adequate reward system, creating a flexible organisational culture, encouraging academics to build links with the industry, and collaborate with non-academic professionals. In doing so, greater awareness of entrepreneurial behaviour and its consequences may be achieved among academics since the above-mentioned activities were also listed by academics themselves as some of the factors that make universities more entrepreneurial (Kirby et al. 2011).

Moreover, all these various activities, through which academics can interact with the industry and generate and transform technology and knowledge, may be introduced in a positive way as a career path in line with an academic career and its growth, as similarly proposed by O'Shea et al. (2005) and Muscio et al. (2014). Indeed, it is essential that academics truly believe and perceive that the entrepreneurial orientation is not harmful to their academic performance and thus achieving the right synergy between teaching, research, and entrepreneurship may be the key to ensuring greater engagement in industry interactions. Thus, our findings are congruent with Hülsbeck et al. (2013) who suggest that in order to improve university-industry interactions it is important that excellent academic research and orientation toward T&KT are seen as complements and not as substitutes. Indeed, mutual support for the scientific and commercial activity should be encouraged (Chang et al. 2016). Thus, this study suggests that academics' entrepreneurial activity and T&KT activities should be incorporated into performance indicators for career progression, which is also one of the European Commission's (2014) recommendations for boosting knowledge transfer and open innovation in the European Union.

Finally, this study highlights the significance of an individual academic's perception of the entrepreneurial university for their engagement in industry interactions. The differences in academics' decisions on whether or not to interact with the industry largely depend on the entrepreneurial orientation within their university (D'Este/Patel 2007; Hunter et al. 2011). Hence, policies and measures stimulating entrepreneurial behaviour and industry interactions should be defined and directed to individual academics rather than based on the university level with the aim of improving university-industry interactions and facilitating T&KT.

Limitations and future research

Like with any research, this study has several limitations that provide possible avenues for future research. First, although this study was conducted in four countries with similar economic and social conditions, there may still be some specific cultural determinants that could affect the results. Therefore, it would be interesting to conduct the same research in some other European countries and compare the findings with those of this study. Second, our findings of partial mediation suggest that some other variables exist that would also help explain why academics engage in industry interactions. Moreover, other significant variables influencing industry interactions could be considered and included in the model. Namely, universities should be proactive and continuously encourage their academics to interact with industry partners alongside their traditional academic activity. Thus, more knowledge is needed on how this activity could be integrated into their regular scientific activities. Additionally, this study indirect-

ly highlights various factors that could motivate academics to interact with industry. The latter might open opportunities for further research on analysing and defining the main motivating factors that encourage and improve industry interactions. Furthermore, another important perspective to analyse university-industry interactions is from the perspective of industry partners and how they perceive this kind of interactions. Namely, in order to maintain strong and successful university-industry relationships, both sides, academics as well as industry partners, are important. Finally, longitudinal research should be conducted to determine the causal relationships.

References

Abreu, M./Grinevich, V. (2013): The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities, in: Research Policy, 42, 2, 408–422.

Academic Ranking of world Universities (ARWU) (2018): Retrieved from http://www.shanghairanking.com/index.html#

Acs, Z. J./Plummer, L. A. (2005): Penetrating the "knowledge filter" in regional economies, in: The Annals of Regional Science, 39, 3, 439–456.

Aguiar-Díaz, I./Díaz-Díaz, N. L./Ballesteros-Rodríguez, J. L./De Sáa-Pérez, P. (2016): University–industry relations and research group production: is there a bidirectional relationship?, in: Industrial and Corporate Change, 25, 4, 611–632.

Aldridge, T. T./Audretsch, D./Desai, S./Nadella, V. (2014): Scientist entrepreneurship across scientific fields, in: The Journal of Technology Transfer, 39, 6, 819–835.

Amabile, T. M./Conti, R./Coon, H./Lazenby, J./Herron, M. (1996): Assessing the work environment for creativity, in: The Academy of Management Journal, 39, 5, 1154–1184.

Antoncic, B./Hisrich, R. D. (2001): Intrapreneurship: Construct refinement and cross-cultural validation, in: Journal of Business Venturing, 16, 5, 495–527.

Armstrong, J. S./Overton, T. S. (1977): Estimating nonresponse bias in mail surveys, in: Journal of Marketing Research, 14, 3, 396–402.

Arundel, A./Es-Sadki, N./Barjak, F./Perrett, P./Lilischkis, S. (2013): Knowledge transfer study 2010–2012: Final report. Luxembourg: Publications Office of the European Union.

Arvanitis, S./Kubli, U./Woerter, M. (2008): University-industry knowledge and technology transfer in Switzerland: What university scientists think about co-operation with private enterprises, in: Research Policy, 37, 10, 1865–1883.

Audretsch, D. B./Lehmann, E. E./Wright, M. (2014): Technology transfer in a global economy, in: The Journal of Technology Transfer, 39, 3, 301–312.

Baron, R. M./Kenny, D. A. (1986): The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations, in: Journal of personality and social psychology, 51, 6, 1173–1182.

Bekkers, R./Bodas Freitas, I. M. (2008): Analysing knowledge transfer channels between universities and industry: to what degree do sectors also matter?, in: Research Policy, 37, 1837–1853.

Berggren, E. (2017): Researchers as enablers of commercialization at an entrepreneurial university, in: Journal of Management Development, 36, 2, 217–232.

Bjerregaard, T. (2010): Industry and academia in convergence: Micro-institutional dimensions of R&D collaboration, in: Technovation, 30, 2, 100–108.

Caldera, A./Debande, O. (2010): Performance of Spanish universities in technology transfer: An empirical analysis, in: Research Policy, 39, 9, 1160–1173.

Chang, Y.-C./Yang, P.Y./Martin, B.R./Chi, H.-R./Tsai-Lin, T.-F. (2016): Entrepreneurial universities and research ambidexterity: A multilevel analysis, in: Technovation, 54, 7–21.

Clark, B. R. (1998): Creating entrepreneurial universities: Organizational pathways of transformation. Issues in higher education. New York: IAU Press.

Cohen, W. M./Nelson, R. R./Walsh, J. P. (2002): Links and impacts: The influence of public research on industrial R&D, in: Management Science, 48, 1, 1–23.

Couper, M. P. (2008): Designing effective Web surveys. New York: Cambridge University Press.

Cronbach, L. (1951): Coefficient alpha and the internal structure of tests, in: Psychometrika, 16, 3, 297–334.

Center for World University Rankings (CWUR) (2018). Retrieved form https://cwur.org/about.php

D'Este, P./Fontana, R. (2007): What drives the emergence of entrepreneurial academics? A study on collaborative research partnerships in the UK, in: Research Evaluation, 16, 4, 257–270.

D'Este, P./Patel, P. (2007): University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?, in: Research Policy, 36, 9, 1295–1313.

Di Gregorio, D./Shane, S. (2003): Why do some universities generate more start-ups than others?, in: Research Policy, 32, 2, 209–227.

Dillman, D. A. (2007): Mail and internet surveys: The tailored design method (2nd ed.). New Jersey: John Wiley & Sons.

Engwall, L. (2008): The university: A multinational corporation?, in: Engwall, L./Weaire, D. (eds.): The university in the market, London: Portland Press, 9–21.

Etzkowitz, H./Webster, A. /Gebhardt, C. /Terra, B. R. C. (2000). The future of the university and the university of the future: Evolution of ivory tower to entrepreneurial paradigm, in: Research Policy, 29, 2, 313–330.

Etzkowitz, H. (2003): Research groups as 'quasi-firms': The invention of the entrepreneurial university, in: Research Policy, 32, 1, 109–121.

European Commission (2003): Third European report on science & technology indicators: Towards a knowledge-based economy. Luxembourg: Office for Official Publications of the European Communities.

European Commission (2013): Scientific output and collaboration of European universities. Luxembourg: Publications Office of the European Union.

European Commission (ed.) (2014): Boosting open innovation and knowledge transfer in the European Union. Luxembourg: Publications Office of the European Union.

European Commission (ed.) (2016): Science, research and innovation performance of the EU:

A contribution to the open innovation, open science, open to the world agenda. Luxembourg: Publications Office of the European Union.

Field, A. (2009): Discovering statistics using SPSS: (And sex and drugs and rock 'n' roll) (3rd ed.). London: SAGE.

Geuna, A./Muscio, A. (2009): The governance of university knowledge transfer: A critical review of the literature, in: Minerva: A Review of Science, Learning and Policy, 47, 1, 93–114.

Grimaldi, R./Kenney, M./Siegel, D. S./Wright, M. (2011): 30 years after Bayh-Dole: Reassessing academic entrepreneurship, in: Research Policy, 40, 8, 1045–1057.

Guerrero, M./Cunningham, J.A./Urbano, D. (2015): Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom, in: Research Policy, 44, 3, 748–764.

Guerrero, M./Urbano, D./Cunningham, J./Organ, D. (2014): Entrepreneurial universities in two European regions: A case study comparison, in: The Journal of Technology Transfer, 39, 3, 415–434.

Hair, J. F./Black, W. C./Babin, B. J./Anderson, R. E. (2010): Multivariate data analysis (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Huang, M.-H./Chen, D.Z. (2017): How can academic innovation performance in university–industry collaboration be improved?, in: Technological Forecasting and Social Change, 123, 210–215.

Hülsbeck, M./Lehmann, E. E./Starnecker, A. (2013): Performance of technology transfer offices in Germany, in: The Journal of Technology Transfer, 38, 3, 199–215.

Hunter, E. M./Perry, S. J./Currall, S. C. (2011): Inside multi-disciplinary science and engineering research centers: The impact of organizational climate on invention disclosures and patents, in: Research Policy, 40, 9, 1226–1239.

Jacob, M./Lundqvist, M./Hellsmark, H. (2003): Entrepreneurial transformations in the Swedish University system: The case of Chalmers University of Technology, in: Research Policy, 32, 9, 1555–1568.

Jain, S./George, G./Maltarich, M. (2009): Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity, in: Research Policy, 38, 6, 922–935.

James, L. A./James, L. R. (1989): Integrating work environment perceptions: Explorations into the measurement of meaning, in: Journal of Applied Psychology, 74, 5, 739–751.

Kirby, D. A./Guerrero, M./Urbano, D. (2011): Making universities more entrepreneurial: Development of a model, in: Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration, 28, 3, 302–316.

Krabel, S./Mueller, P. (2009): What drives scientists to start their own company? An empirical investigation of Max Planck Society scientists, in: Research Policy, 38, 6, 947–956.

Kraus, S./Rigtering, J. P. C./Hughes, M./Hosman, V. (2012): Entrepreneurial orientation and the business performance of SMEs: A quantitative study from the Netherlands, in: Review of Managerial Science, 6, 2, 161–182.

Krücken, G.,/Meier, F. (2006): Turning the university into an organizational actor, in: Drori, G. S./Meyer, J. W./Hwang, H. (eds.): Globalization and organization, Oxford: Oxford University Press, 241–257.

Kruss, G./Visser, M.J. (2017): Putting university–industry interaction into perspective: A differentiated view from inside South African universities, in: The Journal of Technology Transfer, 42, 4, 884–908.

Lam, A. (2010): From 'ivory tower traditionalists' to 'entrepreneurial scientists'?: Academic scientists in fuzzy university-industry boundaries, in: Social Studies of Science, 40, 2, 307–340.

Landry, R./Saïhi, M./Amara, N.,/Ouimet, M. (2010): Evidence on how academics manage their portfolio of knowledge transfer activities, in: Research Policy, 39, 10, 1387–1403.

Lin, J.-Y. (2017): Balancing industry collaboration and academic innovation: The contingent role of collaboration-specific attributes, in: Technological Forecasting and Social Change, 123, 216–228.

Little, T. D./Card, N. A./Bovaird, J. A./Preacher, K. J./Crandall, C. S. (2007): Structural equation modeling of mediation and moderation with contextual factors, in: Little, T. D./ Bovaird, J.A./Card, N. A. (Eds.): Modeling contextual effects in longitudinal studies, Mahwah: Lawrence Erlbaum Associates, 207–230.

Lockett, A./Wright, M./Franklin, S. (2003): Technology transfer and universities' spin-out strategies, in: Small Business Economics, 20, 2, 185–200.

Lumpkin, G. T./Dess, G. G. (1996): Clarifying the entrepreneurial orientation construct and linking it to performance, in: The Academy of Management Review, 21, 1, 135–172.

Martinelli, A./Meyer, M./von Tunzelmann, N. (2008): Becoming an entrepreneurial university? A case study of knowledge exchange relationships and faculty attitudes in a medium-sized, research-oriented university, in: The Journal of Technology Transfer, 33, 3, 259–283.

Muscio, A./Quaglione, D./Vallanti, G. (2014): University regulation and university–industry interaction: A performance analysis of Italian academic departments, in: Industrial and Corporate Change, 24, 5, 1047–1079.

Netemeyer, R. G./Bearden, W. O./Sharma, S. (2003): Scaling procedures: Issues and applications. Thousand Oaks (CA): Sage Publications.

Oertel, S./Söll, M. (2017): Universities between traditional forces and modern demands: The role of imprinting on the missions of German universities, in: Higher Education, 73, 1, 1–18.

O'Shea, R. P./Allen, T. J./Chevalier, A./Roche, F. (2005): Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities, in: Research Policy, 34, 7, 994–1009.

Pearce, A./Quan, R. (2015): International staff mobility in higher education: To what extent could an intra-European entrepreneurial approach be applied to Sino-CEE initiatives?, in: Journal of East European Management Studies, 20, 2, 226–254.

Perkmann, M./Walsh, K. (2008): Engaging the scholar: Three types of academic consulting and their impact on universities and industry, in: Research Policy, 37, 10, 1884–1891.

Perkmann, M./Walsh, K. (2009): The two faces of collaboration: Impacts of university-industry relations on public research, in: Industrial and Corporate Change, 18, 6, 1033–1065.

Perkmann, M./Tartari, V./McKelvey, M./Autio, E./Broström, A./D'Este, P./Fini, R./Geuna, A./Grimaldi, R./Hughes, A./Krabel, S./Kitson, M./Llerena, P./Lissoni, F./Salter, A./Sobrero, M. (2013): Academic engagement and commercialisation: A review of the literature on university–industry relations, in: Research Policy, 42, 2, 423–442.

Philpott, K./Dooley, L./O'Reilly, C./Lupton, G. (2011): The entrepreneurial university: Examining the underlying academic tensions, in: Technovation, 31, 4, 161–170.

Podsakoff, P. M./MacKenzie, S. B./Lee, J.-Y./Podsakoff, N. P. (2003): Common method biases in behavioral research: A critical review of the literature and recommended remedies, in: The Journal of applied psychology, 88, 5, 879–903.

Ponomariov, B./Boardman, C. P. (2008): The effect of informal industry contacts on the time university scientists allocate to collaborative research with industry, in: The Journal of Technology Transfer, 33, 3, 301–313.

Rasmussen, E. (2008): Government instruments to support the commercialization of university research: Lessons from Canada, in: Technovation, 28, 8, 506–517.

Rasmussen, E./Moen, Ř./Gulbrandsen, M. (2006): Initiatives to promote commercialization of university knowledge, in: Technovation, 26, 4, 518–533.

Rauch, A./Wiklund, J./Lumpkin, G. T./Frese, M. (2009): Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future, in: Entrepreneurship Theory and Practice, 33, 3, 761–787.

Rip, A. (2002): Regional innovation systems and the advent of strategic science, in: The Journal of Technology Transfer, 27, 1, 123–131.

Santoro, M. D./Bierly, P. E. (2006): Facilitators of knowledge transfer in university-industry collaborations: A knowledge-based perspective, in: IEEE Transactions on Engineering Management, 53, 4, 495–507.

Shook, C. L./Ketchen, D. J./Hult, G. T. M./Kacmar, K. M. (2004): An assessment of the use of structural equation modeling in strategic management research, in: Strategic Management Journal, 25, 4, 397–404.

Singh, J. (1995): Measurement issues in cross-national research, in: Journal of International Business Studies, 26, 3, 597–619.

Sum Chau, V./Gilman, M./Serbanica, C. (2017): Aligning university–industry interactions: The role of boundary spanning in intellectual capital transfer, in: Technological Forecasting and Social Change, 123, 199–209.

Tartari, V./Perkmann, M./Salter, A. (2014): In good company: The influence of peers on industry engagement by academic scientists, in: Research Policy, 43, 7, 1189–1203.

Tartari, V./Breschi, S. (2012): Set them free: scientists' evaluations of the benefits and costs of university–industry research collaboration, in: Industrial and Corporate Change, 21, 5, 1117–1147.

Thune, T./Gulbrandsen, M. (2014): Dynamics of collaboration in university-industry partnerships: Do initial conditions explain development patterns?, in: The Journal of Technology Transfer, 39, 6, 977–993.

Tijssen, R. J. W. (2006): Universities and industrially relevant science: Towards measurement models and indicators of entrepreneurial orientation, in: Research Policy, 35, 10, 1569–1585.

Todorovic, Z. W./ McNaughton, R. B./Guild, P. (2011): ENTRE-U: An entrepreneurial orientation scale for universities, in: Technovation, 31, 2–3, 128–137.

University of Amsterdam. (2020): Our campuses. Retrieved from: https://www.uva.nl/en/about-the-uva/the-uva-in-amsterdam/our-campuses/our-campuses.html

University of Antwerp. (2020): Science Park University of Antwerp. Retrieved from: https://www.uantwerpen.be/en/research/info-for-companies/spin-offs/

University of Ljubljana. (2020): Cooperation with economy and society. Retrieved from: https://www.uni-lj.si/ul_in_cooperation_with_economy_and_society/

University of Oxford. (2020). Oxford University Innovation. Retrieved from: https://innovation.ox.ac.uk/

Van Looy, B./Landoni, P./Callaert, J./van Pottelsberghe, B./Sapsalis, E./Debackere, K. (2011): Entrepreneurial effectiveness of European universities: An empirical assessment of antecedents and trade-offs, in: Research Policy, 40, 4, 553–564.

Walter, T./Ihl, C./Mauer, R./Brettel, M. (2018): Grace, gold, or glory? Exploring incentives for invention disclosure in the university context, in: The Journal of Technology Transfer, 1–35.

Wdowiak, M.A./Schwarz, E.J./Breitenecker, R.J./Wright, R.W. (2012): Linking the cultural capital of the entrepreneur and early performance of new ventures: A cross-country comparison, in: Journal for East European Management Studies, 17, 2, 149–183.

Wright, M. (2014): Academic entrepreneurship, technology transfer and society: Where next?, in: The Journal of Technology Transfer, 39, 3, 322–334.

Wu, A. D./Zumbo, B. D. (2008): Understanding and using mediators and moderators, in: Social Indicators Research, 87, 3, 367–392.