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UNIVERSITY-BUSINESS COOPERATION AND ENTREPRENEURSHIP AT UNIVERSITIES – AN EMPIRICAL BASED COMPARISON OF POLAND AND GERMANY

Summary

The EU's growth strategy for the coming decade (recorded and defined by Horizon2020) and the higher education modernisation agenda force all European countries to establish a more connected and better functioning relationship between the three most important players government, business and higher education institutions (HEI's) in order to increase employment, productivity and social cohesion.

This article explores the development of University-Business Cooperation (UBC) both in Poland and in Germany, shining a spotlight on the various factors influencing UBC, as well as providing a comparison of the two countries. The focus lays on a Polish-German comparison i.e. the compared analyses of the state of UBC in Germany and Poland from the perspective of HEI managers and researchers.

Applying a UBC-ecosystem of different factors and action levels (<http://ub-cooperation.eu/pdf/UBCECO.pdf>) the major differences of both countries are identified, addressed and commented to offer opportunities for improvements.

This paper describes and discusses selected findings of a study, which had been conducted for the European Commission to analyse University-Business Cooperation in 33 European countries by the S2B Marketing Research Centre at Münster University of Applied Sciences.

Key words: University-Business Cooperation (UBC), Higher Education Institutions (HEIs), Entrepreneurship at Universities in Europe, Eco-System in UBC, Poland-Germany

1. Introduction

Over the last 30 years, the role of higher education institutions (HEIs) has undergone a major change. Although HEIs have been collaborating with business since

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the 1800's, more recently the focus and intensity of those activities have been rapidly advancing [Etzkowitz, 2001]. Nowadays, HEIs are expected to not only deliver on the first two missions of teaching and research, however the third mission of regional and society engagement is increasingly emphasised [Sam, Van der Sijde, 2014] and HEIs have become centres of potential economic and social development [Geuna, Muscio, 2009].

At the same time, for companies, innovation is increasingly likely to come from outside of the individual firm with a more open innovation supply chain being experienced. HEIs are increasingly being recognised as a source of science or technology developments [Baaken, 2013]. The rise of globalised knowledge has intensified the need for strategic partnerships that go beyond the traditional sources of innovation. Increasingly companies and universities are working together to push the barriers of knowledge, and in doing so, become a powerful engine for innovation and economic growth.

For this reason, HEIs are more actively involved in developing and marketing their innovations which in effect forces the HEI to undertake entrepreneurial activities especially with reference to the economic growth [Franco, Haase, 2010; Baaken, 2015]. Despite this shift in priorities, the university itself and its culture has been slower to respond with questions about the suitability of the university for this role being discussed and indeed whether it is even desirable to have business influence the curriculum [Gillis, McNally, 2010; Barnett, 2002] or research agendas [Carayol, 2003].

University Business Cooperation (UBC) has been defined as different types of interaction between the industrial sector and the HEIs which are aimed at transferring knowledge and technology [Santoro, Bierly, 2006]. "Entrepreneurial universities" encourage the partnerships between academics and entrepreneurs which can produce remarkable results and benefits for both partners.

UBC has traditionally been associated with cooperation in R&D and commercialisation of research. In a study into the forms of collaboration between universities and business, commercialisation and research and development collaboration were found to be just two of the eight types of UBC [Davey et al., 2011]. However, in recent years the concept of what is considered to be UBC has been extended to recognise all the ways in which HEIs can contribute to society. A set of the so-called newer types of UBC have been increasingly recognised such as lifelong learning (LLL), entrepreneurship, collaborative and professional mobility between academia and business as a means to achieve the third mission [Davey, 2015].

Some authors have looked at those issues to represent a wider array of knowledge transfer activities including entrepreneurship [Jones-Evans, Klofsten, 2000]. These authors defined 'academic entrepreneurship' as the academic's engagement in entrepreneurial activities in addition to their normal academic duties to link up with business in their region. and as the introduction of novelties in processes [Etzkowitz, Leydesdorf, 2000; Laredo, 2007] and research [Louis et al., 1989]. Such a broader definition acknowledges the dynamism and heterogeneity of academics and their motivations for carrying different UBC and entrepreneurial activities.

Owing to this, the holistic extraction of value via UBC has become more important for the viability and relevance of HEIs as the benefits of closer and better coo-

peration between HEIs and business and the benefits for the students have been increasingly recognised.

However, despite the illustrated prominence of UBC, there is still a lack of analysis on the extent of UBC within European HEIs, including the types of mechanisms that exist for UBC or the barriers and drivers influencing it. Although in the UK, UBC has received more attention [Wilson, 2012; Witty, 2013], in the German and Polish settings, UBC is still an under-researched area. Given that each European nation has its own policies and practices, limits effective European approaches to UBC [Geuna, Nesta, 2006]. Furthermore, cultural aversions and these policy differences have included legal prohibitions on academic engaging with industry as well as academic entrepreneurship [Owen-Smith et al., 2002].

Therefore, a strategic approach is needed in order to assess and extract value from the university environment most effectively benefiting all relevant stakeholders in the ecosystem. This will be addressed through the execution of this study, which will review this ecosystem for both Germany and Poland. It will specifically review the extent of collaboration happening in both nations as well as the types of collaboration occurring. Furthermore, a set of factors influencing UBC including the main barriers, drivers and perceived benefits identified for both of them will be measured and analysed. Finally, the importance of the influence of a series of supporting mechanisms will be tested.

The study is based on the data collected in a project on the cooperation between HEIs and public and private organisations in Europe conducted by the Science-to-Business Marketing Research Centre, Germany (S2BMRC) for the European Commission between 2010 and 2011.

A triangulation methodological approach was used as it was considered the most appropriate method for this kind of topic as it provides much more robust and reliable results. Firstly, research was conducted with a wide literature review, including academic and scientific journals together with reports and conference papers. A qualitative research was conducted, including in-depth interviews with experts in UBC at European level and an on-line questionnaire was sent to all registered HEIs in Europe.

This paper is specifically focusing on UBC in the context of Entrepreneurial Universities in Poland and Germany. With Germany being the birthplace of the Humboldt University concept, whereby universities are considered to be bastions on pure knowledge generation with independence from governments and the business world [Boulton, Lucas, 2011], and both Poland and East Germany having been part of communist Europe during the 20th century, there are unique factors affecting universities in these countries. These factors will be explored in the study.

2. Entrepreneurial University-Business Cooperation – A Comparison of Poland and Germany

The following section provides a background to the subject nations of the study, Poland and Germany generally and more specifically in relation to UBC.

2.1. Poland

During the last 25 years the Polish landscape of innovation development has changed dramatically. Poland had and has to overcome this disruptive change and is facing deep transitions. Today it is heading towards a more entrepreneurial way [Pniewska et al., 2014; Pierścieniak, 2015]. Since 1990 Polish companies had to face competition with those from the developed countries. Their success was depending on whether they could hold its own with suitable commitment against strong competitors in Europe. But starting to face those challenges many Polish companies immediately lost the free market competition.

The situation was characterised by three key impact factors:

1. One of very few competitive advantages of the Polish economy was its relatively cheap workforce, yet it was also less qualified.
2. A second weighting disadvantage was identified in the low-level technology only available in the country. High technology though is mainly developed in University-Business Cooperation and the Science-Business Partnerships. [Teczke, 2010].
3. Operations of former society and economy was based on central political control and surveillance, which caused potential distrust from the very beginning of each party [Jasiński, 2010].

In order to become more competitive an increased focus on (higher) education and – particularly – in developing UBC and Science-Business Partnerships is required. Regional development is to a great extent depending on this [Franco, Haase, 2010]. However, Polish universities were never truly used to facilitating the cooperation with industry, but focused more on basic research and theoretical education. Additionally, like other emerging economies, companies have less funds for R&D at their disposal [Pniewska et al., 2014]. Therefore, today's task is to start building trust and mutual commitment [Plewa et al., 2006; Plewa, 2010] in cooperation, partnerships and alliances [Cyert, Goodman 1997; Franco, Haase, 2012].

A special situation of Poland is based on its recent history. Poland is nowadays a society in transition [Teczke, Terblanche, 2013]. Two turning points have caused inconsistency and disruption of the situation 1989: a collapse of a centrally-planned system and 2004: the formal membership in the EU. Ten years later, in 2014, Poland celebrated its 25th anniversary of EU membership. Some figures are providing evidence on the economic change.

TABLE 1.

Poland in transition

	1994	2004	2014
GERD ¹⁾ /GDP	0.90	0.58	0.90
Domestic patent submissions	4 105	2 381	4 410
Domestic patents issued	3 242	778	1 848
Innovation intensity	0.8	2.2	1.7

¹⁾ Gross Domestic Expenditures on Research & Development

Source: [Jasiński, 2014; Weresa, Lewandowska, 2014].

Also Poland introduced a number of new laws, legal regulations and incentives to enhance innovation in the country.

TABLE 2.
Objectives of legal regulations to support innovation in Poland

	Private actors	Public actors
Organisational solutions	Establishment of a private R&D sector	Better quality of innovation policy on the national and regional level
Financial solutions	Increasing innovative activity of private sector entities as measured by higher R&D spending	Better allocation of public resources for innovative activities

Source: [Weresa, Gomulka, 2006]

Today Poland is developing fast but still is struggling with some weaknesses in its National Innovation System.

TABLE 3.
Strengths and weaknesses of Polish National Innovation System NIS

Strengths	Weaknesses
<ul style="list-style-type: none"> – high potential of R&D workers (the potential is not too big but is situated far from the market) – well-educated and skilled technical staff in enterprises: relatively many engineers work in industry – lower – in comparison with the West – costs of labour force in general and including wages of R&D workers – modern technical equipment in some sectors 	<ul style="list-style-type: none"> – a weak R&D potential within firms – obsolete technologies and old equipment in many sectors of industry – an insufficient number of IT brokers / bridging institutions between R&D sector and industry – a small role played by SMEs in the development of new technologies – a lack of sufficient marketing experience in numerous research institutions

Source: [Jasiński, 2014].

2.2. Germany

Germany has a broad range of public HEIs differing in its transfer and partnership activities. The public research infrastructure in Germany can be subdivided into three groups: traditional universities, universities of applied sciences, and non-university research.

Scientists at traditional universities as well as in universities of applied sciences, which make up 70 percent of the national research volume, spend most of their time in teaching duties and only little time on research [Beise, Stahl, 1999].

Germany's public research infrastructure evolved in a complex environment characterised by the traditional perception of science as a value in itself and by the demand from industry, by the inertia of public institutions and tensions between federal and

state responsibility for education and research. Universities have a long tradition of research and science reaching back to the middle ages. Universities of social and natural science are known mostly for teaching and basic research without aiming at any commercialization and partnership activities to industry. In contrast, technical universities have a long tradition of industry-related research. They were formed during the last century to enhance inventions and technical applications of scientific findings but have subsequently focused on basic research [Knie et al., 2002; Keck, 1993].

Universities of applied sciences have a special role in Germany. Often, they are specialised in the same technical fields as local businesses and are supposed to support small and medium sized firms through consultancy and the supply of graduates. They focus mainly on teaching, however also conduct research but on a much smaller scale than universities. They are now widespread within Germany and have gained a reputation for down-to-earth research and applicable engineering know-how, compensating the shortcomings of universities that are oriented towards basic research.

Both types of universities nowadays are pushed by politics and society to foster UBC to make science results available and to gain third party money from industry [Kliewe et al., 2013; Knie et al., 2002].

But in Germany the separation of pure and applied science was traditionally institutionalised in universities of technical and natural sciences. But it was not until the integration of the Fraunhofer-Society (and a number of other major research organisations such as the Max Planck Society or Leibniz Society) as the third pillar of the German public research system, that the division between basic and applied research was officially carried out in the non-academic public research sector as well. Those organisations are however closely linked to universities due to their research tasks often based on PhD candidates.

A first view on some general and specific figures characterizing the two countries allows some conclusions but also raised further questions.

2.3. A general and specific spot light on the two countries

Comparing specific factors, it can be seen that Germany is ranked as markedly superior environments as compared Poland. Perceived opportunities and the high status to successful entrepreneurs particularly highlight the differences despite higher perceived capabilities, entrepreneurial intentions and entrepreneurship being a good career choice being higher in Poland.

In respect to the availability or presence of resources, once again Germany come out ahead with the global innovation index ranking both better environments for innovation. The link between GDP per capita and student entrepreneurial intentions have been recognised [Davey et al., 2011], and again, Germany is superior. This is reinforced in their greater investment in both research per capita, particularly in Germany, as well as the availability of human and technical resources.

TABLE 4.

Country comparisons

	Data area	Assessment criteria	Poland	Germany
Entrepreneurship Specific factors ¹	<i>Specific factors</i>	Ranking from the GEM	43	5
		Perceived opportunities	26.1	31.3
		Perceived capabilities	51.8	37.7
		Fear of failure	46.7	38.6
		Entrepreneurial intentions	17.3	6.8
		Entrepreneurship as a good career choice	66.8	49.4
		High status to successful entrepreneurs	59.9	75.5
		Media attention for entrepreneurship	58.5	49.9
Resource-specific data ²	<i>Financial Resources</i>	Global innovation index 2014	40.6	56
		GDP per capita 2014	23 273	43 475
		Government expenditure on R&D as a percentage of GDP	0.9	2.92
		% of government spending on total education	11.4	10.6
	<i>Human resources</i>	Number of researchers per 1 million people	1 753	4 139
	<i>Technological resources</i>	High-technology exports (\$ million)	9 559.86	183 354.36
Patent applications by residents		4410	46620	
EFC ³	<i>Institutional & policy frameworks (Worldwide Governance Indicators 2014- Governance Scores - 2.5 to +2.5)</i>	Political stability	0.95	0.93
		Government effectiveness	0.71	1.52
		Regulatory quality	1.05	1.55
		Rule of law	0.79	1.62
		Control of corruption	0.55	1.78

Source: ¹ – GEM, 2014; ² – Cornell University, INSEAD, and WIPO, 2014; ³ – The World Bank, 2014, Weresa, 2015].

The pattern of superiority continues in assessments of Entrepreneurial Framework Conditions with Germany, both rated more highly than its eastern counterpart with control of corruption an issue in Poland.

Despite this simplified view whereby Germany and Poland agglomerated, differences between the Polish and German environments exist.

3. Methodology of the empirical research

The data and survey presented in this paper was collected as part of a public tender for the European Commission labelled “The cooperation between HEIs and public

and private organisations in Europe”, which ran from 2010 to 2011 across 33 countries in Europe. The main components of the study were

1. in-depth qualitative interviews with 11 recognised UBC experts which served as a brain pool for a major quantitative survey;
2. 30 Good Practice Case Studies in Europe;
3. a large-scale quantitative survey which was translated into 22 languages and sent to three managers in each registered European HEIs (3,551) in 33 countries during March 2011.

The results outlined in this paper are based on the third component, namely the survey. The distributed of survey was done using a two-step method. The survey was distributed to HEI managers, requesting them to (1) complete the survey themselves, as well as (2) forward the survey to their academics and technology transfer agency or other internal bodies dealing with University-Business Collaboration (e.g. entrepreneurship centres, innovation centres and incubators).

A total net sample of 6,280 academics and HEI management was achieved making the study the largest study into cooperation between HEIs and business yet completed in Europe.

Questions were posed to two groups within HEIs. These groups were asked about their perception of UBC:

1. Individual academics were asked to respond on behalf of themselves.
2. HEI management (HEI managers and university professionals working with industry) were asked to respond on behalf of their HEI.

This data has been analysed using IBM SPSS Statistics 20.0, first filtering the data to use only the data from the European countries of Germany and Poland.

This has led to a remaining group of, 461 academic responses from Polish academics, of which 57.4% were male and 42.6% female, as well as 240 responses from German academics, of which 73.9% were male and 26.1% female. In addition to the academic responses, university managers were also surveyed with 159 and 281 responses from Poland and Germany respectively.

For the purpose of this paper, we focussed on a comparative means test to analyse the differences between the German and Polish HEI managers, as well as Kruskal Wallis to test the significance of the difference between German and Polish respondents.

The analyses focussed on the dependent variables:

1. the extent of University-Business Collaboration in their institution for each of the eight types of University-Business Collaboration,
2. the extent of development of the strategies, structures and approaches, operational activities in their institution,
3. the extent of relevance of the barriers hindering university-business collaboration,
4. the extent of relevance of the drivers supporting university-business collaboration and
5. the perceived benefit from undertaking university-business collaboration.

With the independent variables being the countries (i.e. Germany and Poland).

Their responses on the dependent variables were given on a scale of 1 to 10, with 1 being the lowest and 10 being the highest response.

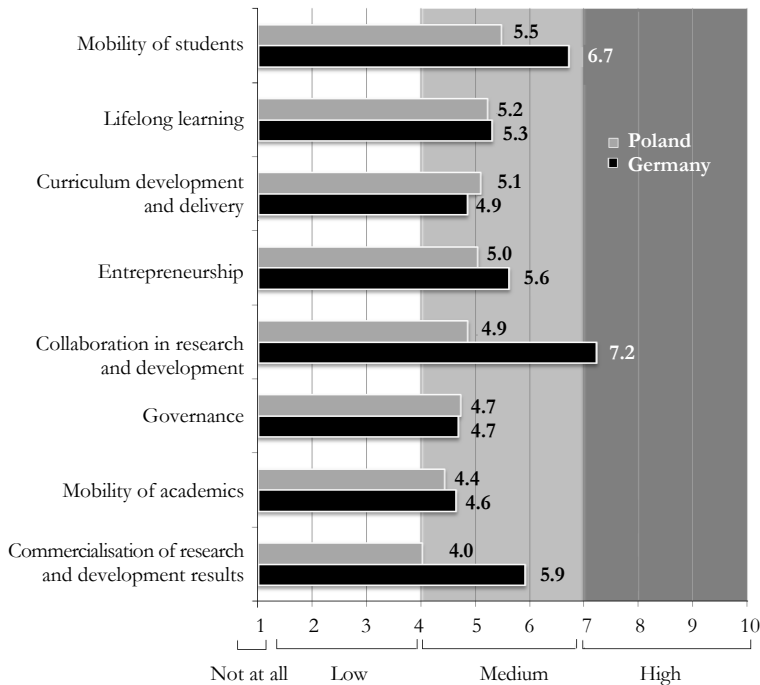
4. Results

Results are structured into three primary areas of enquiry, the extent of overall UBC, the factors influencing collaboration as well as the mechanisms supporting UBC in both Germany and Poland.

4.1. Extent of collaboration

The following results present the responses received from university management in respect to the perceived development of eight types of cooperation recognised between university and business [Davey et al. 2011].

CHART 1.
Extent of UBC perceived by university management in Germany and Poland



Source: Own elaboration.

There is a high degree of diversity in the development of the different types of UBC in Germany, with 'collaboration in R&D' (7.2), 'mobility of students' (6.7) and 'commercialisation of R&D results' (6.7) being the most developed types, exhibiting a focus

on research-related UBC. 'Mobility of academics' (4.6), 'governance' (4.7) and 'curriculum development and delivery' (4.9) are, on the other hand, the least developed forms.

In comparison to Poland, Kruskal-Wallis test shows that German HEI management report a significantly higher extent of development in 'collaboration in R&D', 'mobility of students', 'commercialisation of R&D results' and 'entrepreneurship'. 'Curriculum development and delivery' is higher in Poland, which also has as the highest forms of cooperation 'student mobility' and 'lifelong learning', showing how Polish universities have a focus on education-related UBC.

4.2. Factors influencing the extent of UBC

The extent to which a number of factors affect cooperation with business in Germany and Poland will now be outlined. These factors have been found to significantly influence cooperation within the European context [Davey et al. 2011] and include barriers, drivers and perceived benefits received from UBC.

4.2.1. Barriers hindering UBC

Barriers are those obstacles that restrict or inhibit the ability of academics or HEIs to engage in UBC. The following figure explains the extent of relevance of barriers to UBC by both German and Polish university managers and stated as averages.

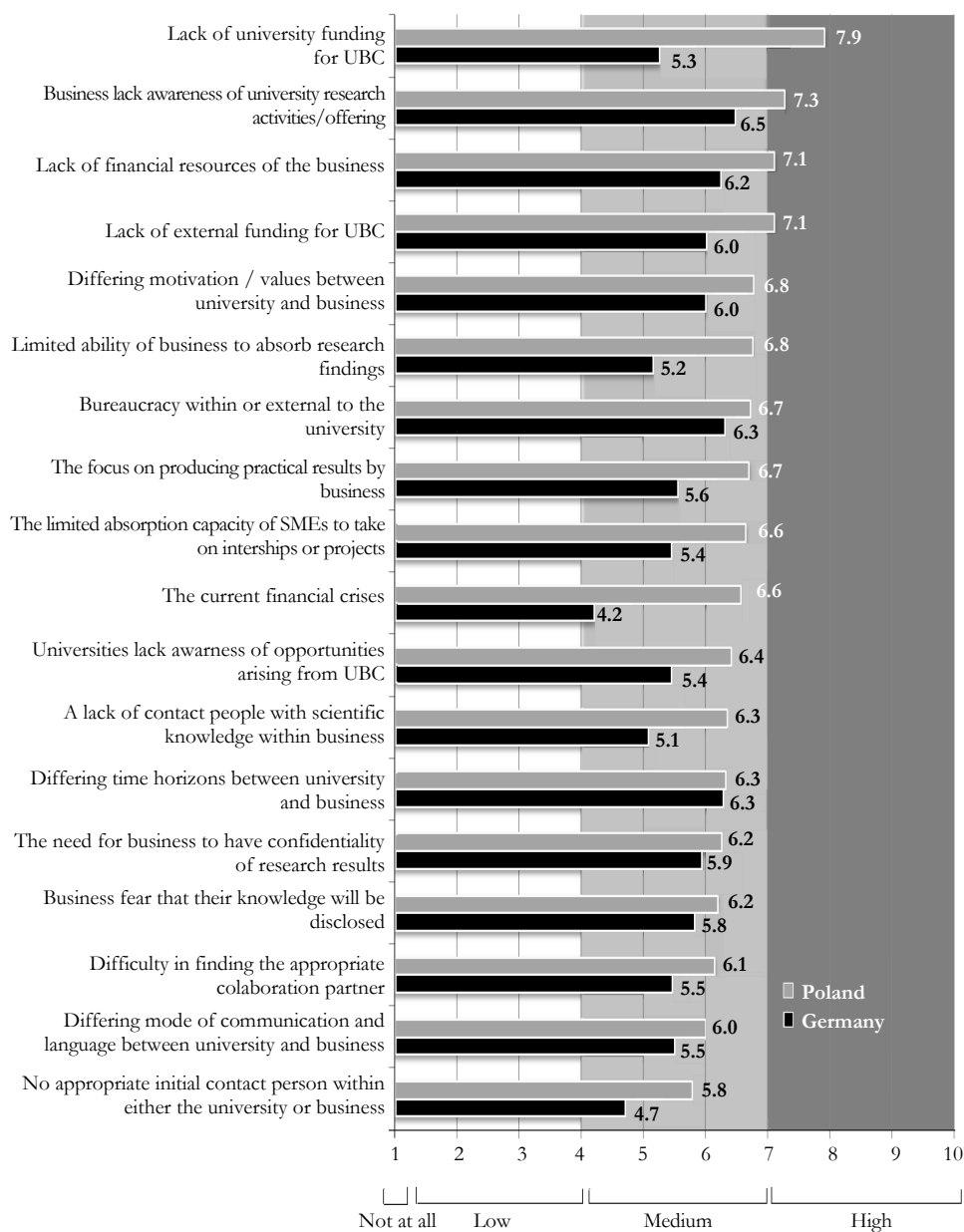
Within the German context, university management perceived the major UBC barriers as 'business lack awareness of university research activities/offerings', 'bureaucracy within or external to the HEI' and 'lack of financial resources of the business'.

It can be observed that in Poland, with 'lack of HEI funding', 'lack of financial resources of the business' and 'lack of external funding' to be three of the top four barriers, showing how funding is perceived to be major issues hindering Polish UBC.

Overall, Germany university management perceived a lower level of barriers than their Polish counterparts for all barriers analysed. The Kruskal-Wallis tests show that all differences are statistically significant except those related with confidentiality of results, different communication and different time horizons.

CHART 2.

UBC barriers perceived by university management in Germany and Poland

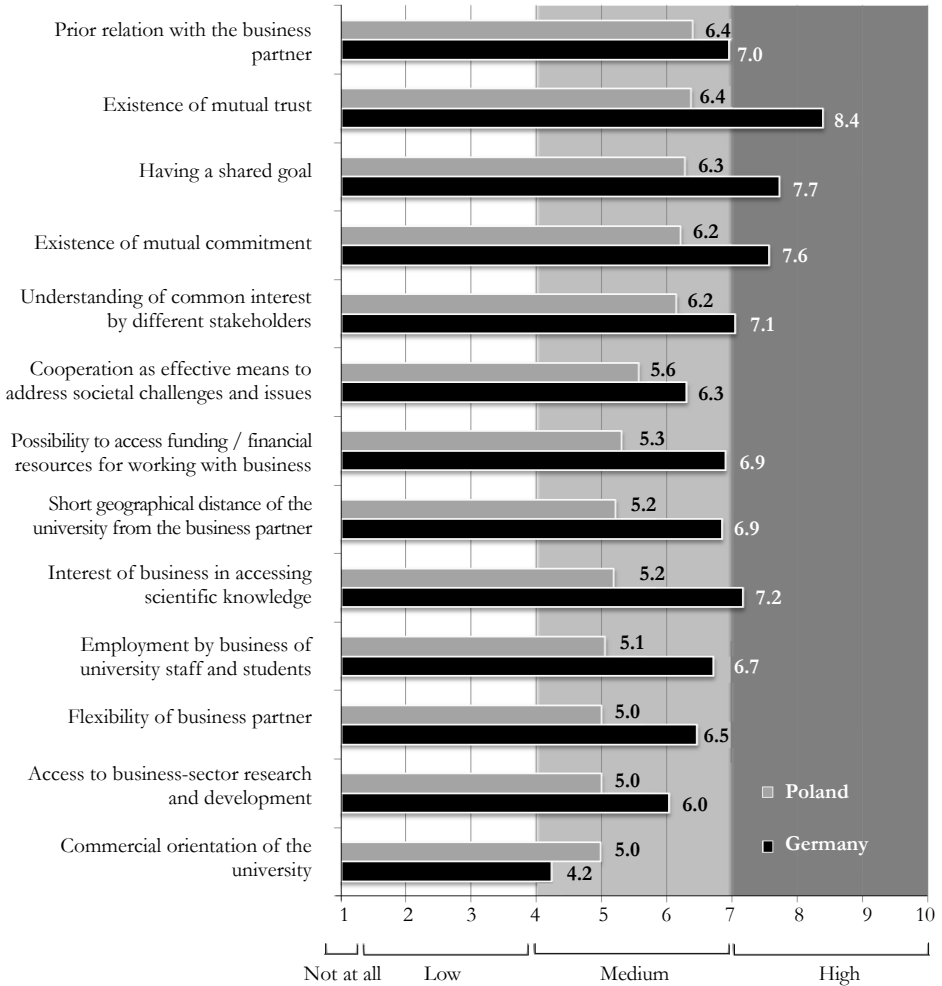


Source: Own elaboration.

4.2.2. UBC Drivers

Drivers are those factors that encourage academics or HEIs to engage in UBC. Drivers of UBC were assessed by both German and Polish university managers and stated as averages.

CHART 3.
UBC drivers perceived by university management in Germany and Poland



Source: Own elaboration.

German university management were relatively positive in respect to drivers for UBC with so-called 'relationship drivers' such as 'existence of mutual trust', 'existence of mutual commitment' and 'having a shared goal' being nominated as the biggest drivers.

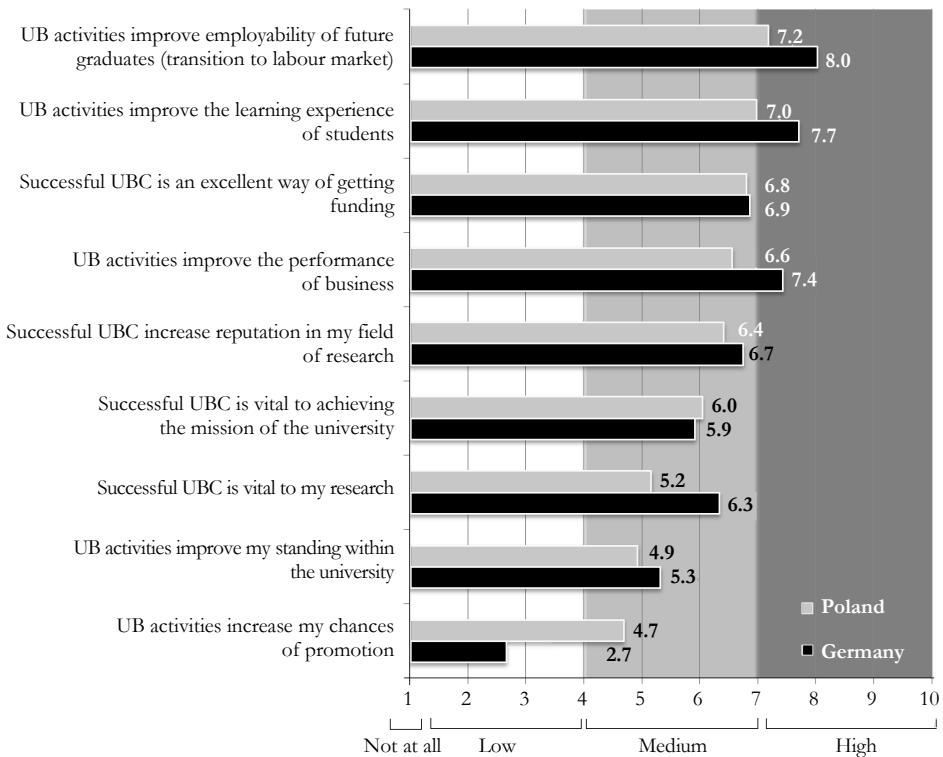
The drivers for universities to collaborate with business in Poland were not so obvious. With no driver being rated as high, Polish universities management still rated ‘relationship drivers’ as the biggest drivers, however all drivers except ‘commercial orientation of the university’ were rated lower than in Germany. Comparatively, Kruskal-Wallis test show how the differences of all drivers analysed are statistically significant.

4.2.3. Perceived UBC benefits

It is the perceived positive outcome (financial and non-financial) from undertaking UBC for the different stakeholders groups that can potentially participate in UBC. This perception can be a reason to increase or decrease their participation or the involvement of other groups. For example, if academics perceive their own benefits to be low, that might cause a low participation in UBC and if they perceive that benefits for students are high, they might undertake actions that contribute to students’ involvement in UBC. Results are presented below from both German and Polish academics.

CHART 4.

UBC benefits perceived by academics in Germany and Poland



Source: Own elaboration.

German academics perceived a somewhat positive situation regarding the benefits received from UBC, although the ability of UBC to increase the academics' standing at the university and increase their chance of promotion were related substantially lower. They especially recognised the benefits for students and business for UBC at lesser benefit for the university and themselves.

Rating all UBC benefits lower than their German academic colleagues, except for 'UBC activities increase my chance of promotion', Polish academics perceived much lower benefits from UBC. They too recognised the largest benefits go to students and business followed by the university and finally themselves.

4.3. UBC supporting mechanisms

The UBC supporting mechanisms constitute the 'action-level', where all stakeholders need to focus their efforts when they want to influence the extent of UBC. The specific role and importance of supporting mechanisms at HEIs has long been recognised in both practice and literature supporting both academic and student entrepreneurship [Baldini et al., 2006]. They are often recognised in multiple ways including (i) in a variety of different names (e.g. interventions, enablers), (ii) captured in a model (e.g. ecosystem, regional innovation system) or (iii) known as individual elements (e.g. activities, infrastructure).

4.3.1. Strategies

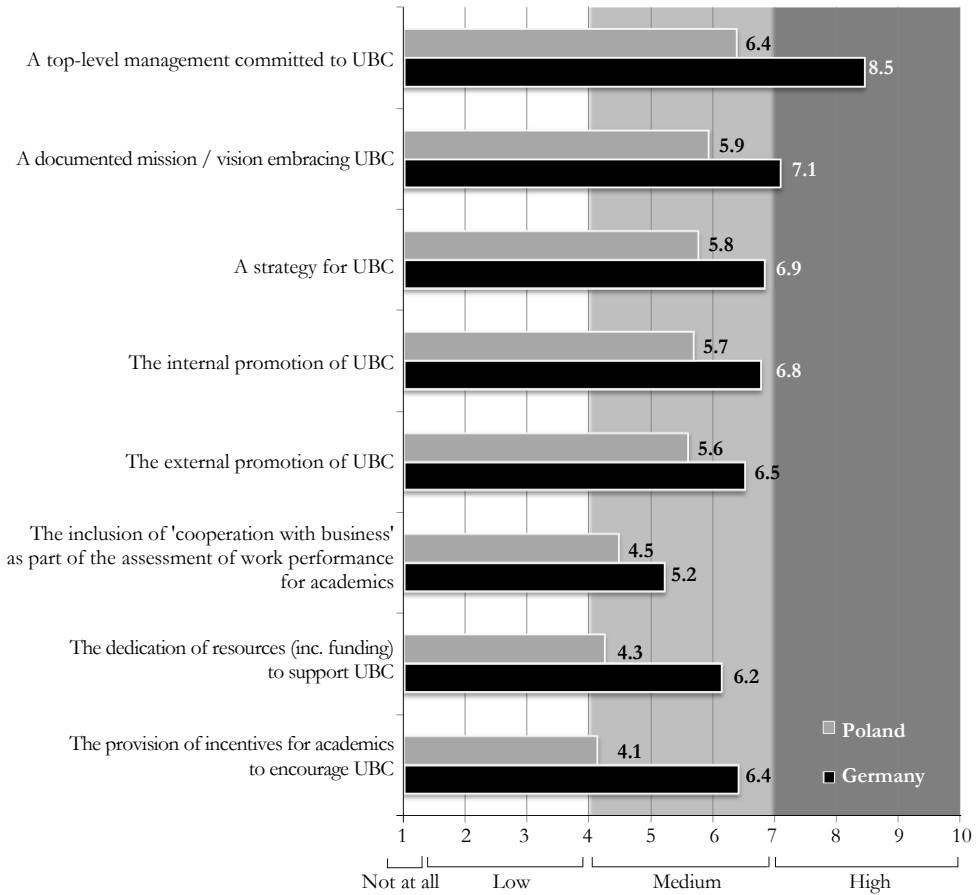
Strategies are the drafting and implementation of cross-functional decisions by a HEI that will enable it to achieve its long-term objectives with respect to UBC. The primary responsibility for the creation of UBC strategies is for HEI management as a strategic instrument is usually created by decisions made at a HEI board level. The following figure highlights the perceived extent of development of UBC strategies in German and Polish universities, assessed by university managers.

In terms of the strategic mechanisms supporting UBC, 'paper' strategies, such as top management commitment and having a mission/vision and UBC strategy, were the most developed strategies. Despite this, there is room for development of 'implementation strategies' in terms of providing incentives and including UBC in the assessment of academics'. Polish university managers also rated 'paper' strategies as the most developed form of UBC strategies.

Comparatively, German university management assessed all mechanisms higher than Polish managers and the Kruskal-Wallis test show that all the differences between them are statistically significant except the inclusion of UBC in academics work performance.

CHART 5.

UBC strategies in Germany and Poland



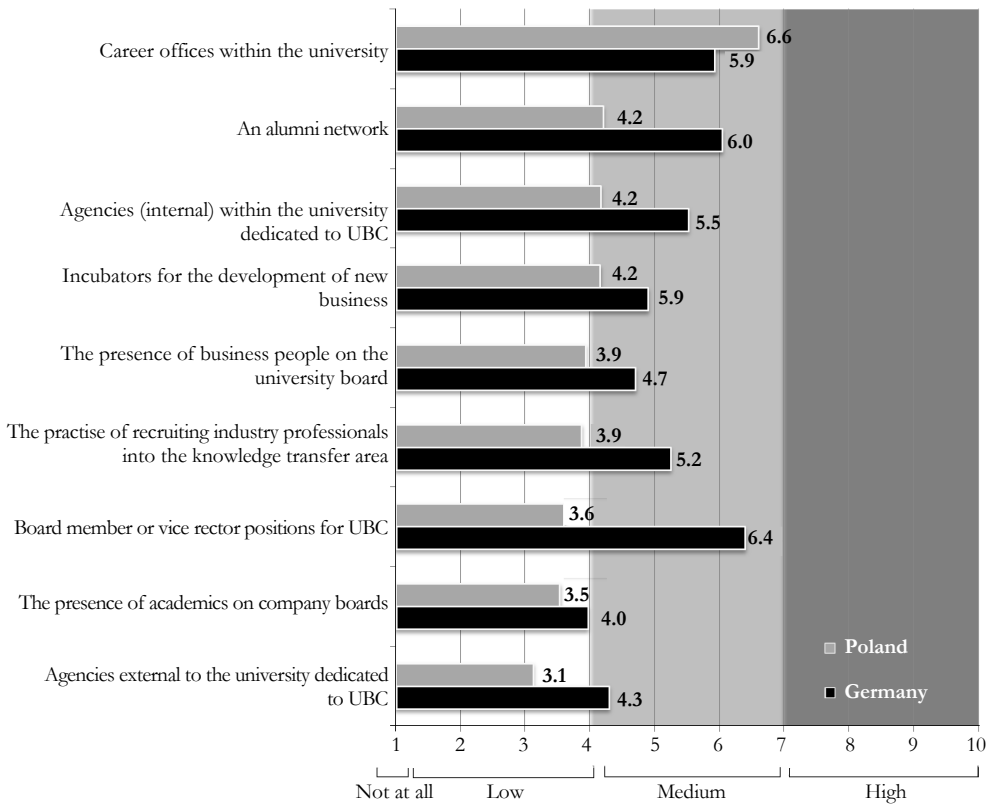
Source: Own elaboration.

4.3.2. Structures

UBC structures are elements created as a result of top-level strategic decisions within (or related to) a HEI that are 'enablers' of UBC and include the creation or development of institutions, positions, methods and policies and programmes. They are put in place in order to promote, develop or implement UBC with a mid to long-term focus and can be created within the HEI or as a bridge between the HEI and business. Structures and approaches usually involve significant investment and can be funded by the HEI, the government, business or a combination of these sources. The following figure depicts the perceived extent of development of UBC structures and approaches in German and Polish universities, assessed by university managers.

CHART 6.

UBC structures in Germany and Poland



Source: Own elaboration.

Board member or vice rector positions for UBC, alumni networks and career offices are the most developed UBC structures in Germany, revealing a focus on those structures related with students. Overall, there is a medium level of development of all structured analysed.

Matching the focus on education-related UBC types, Polish universities have the highest level of development of UBC structures for alumni network and career offices as well; however rate nearly all other structures as low.

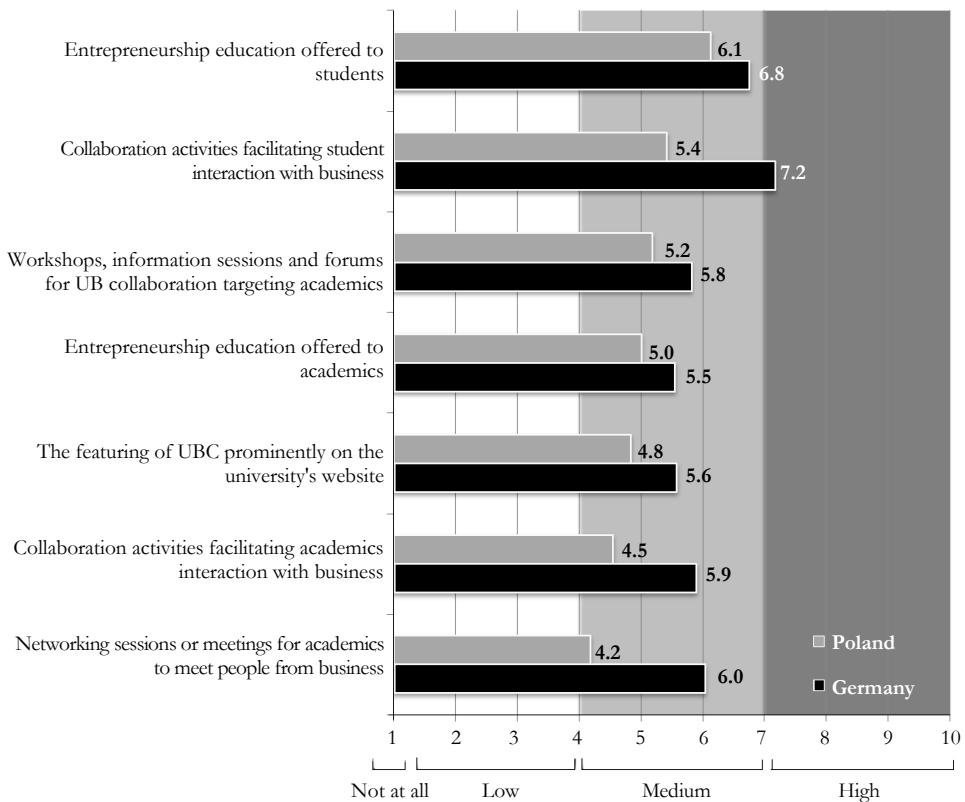
When comparing the results of both countries, the Kruskal-Wallis tests show significant differences for the presence of recruiting industry professionals into the knowledge transfer area, board member or vice-rector positions for UBC, alumni network and agencies (internal and external) dedicated to UBC.

4.3.3. Operational Activities

Operational activities are actions of a practical and immediate nature undertaken by HEIs, governments, regional agencies, HEIs and business to create and support UBC. Operational activities are usually the cheaper to implement of all the supporting mechanisms, require a lower commitment from HEI management and its scope and volume can be measured. The perceived extent of development of UBC activities in Germany and Polish universities, as assessed by university managers, is depicted in the following figures.

CHART 7.

UBC operational activities in Germany and Poland



Source: Own elaboration.

A focus on student-related UBC activities was identified by university managers in Germany, with entrepreneurship activities and activities fostering student’s collaboration with business as the most developed activities. Contrary, the least developed ones are related with academics interactions with business. A similar trend can be ob-

served in Poland with student-focussed activities the most developed, whilst the least developed are academic-focussed activities.

Comparatively, German university managers again rate the development of UBC activities higher than Polish managers for all activities presented. However, in this case only four of the items are rated significantly higher from Germany (entrepreneurship education to students, networking sessions or meetings for academics to meet people from business, collaboration activities facilitating academics interactions with business and collaboration activities facilitating students' interactions with business).

5. Discussion and conclusions

Comparatively, the main findings of this paper are the following:

- Poland is generally lagging behind Germany in respect to the development of UBC, although this can be explained largely by the fact that German universities started carrying out UBC activities earlier in time and that the German technical universities and universities of applied sciences generally operate in a very close connection with business.
- Most types of UBC are less developed in Poland than in Germany (all except curriculum development and delivery) and in half of the cases this differences are significant.
- Both countries differ in the approach when interacting with business, since German universities have a focus on research-related UBC, whilst Polish universities have a focus on education-related UBC.
- Polish university managers and academics are negative towards their UBC environment. They rate barriers comparatively higher (especially those regarding funding) and drivers comparatively lower than German university managers. The differences in the reported development of all drivers and most barriers are statistically significant between the two countries.
- Polish university managers and academics do not seem to perceive important reasons for undertaking cooperation with business.
- Both German and Polish academics perceive benefits for students and business higher than for the university and for themselves.
- All UBC supporting mechanisms are more developed in Germany than in Poland, with many differences being statistically significant.
- All UBC strategies are further developed in Germany and in the majority of them these differences are statistically significant.
- All UBC structures (except career offices) are more developed in Germany, some of them with significant differences in development, although both countries focus on those structures related to students.
- UBC operational activities are also more developed in Germany, and again those involving students are in both countries more developed than those involving academics.

Specific UBC recommendations for Poland are derived from previous studies that suggested that universities should adopt context specific strategies, rather than merely imitating developed nations [Bernasconi, 2005; Eun et al., 2006; Davey et al., 2015]. The comparative approach taken in this study should serve for sizing the differences in contexts from both countries and recognize that Poland would not derive optimal results from higher education investments if they merely imitate developed countries. Table I depicts the differences between both countries in resource availability, particularly resources that are detrimental for innovation.

In this respect a context specific understanding of the UBC dynamics, particularly in Poland, would be necessary to develop domestic research capacities that would deliver positive social benefits [Patel, 2003]. For Poland, the results of the extent of UBC development suggest that the engagement form academics with business in education related activities could be a good starting point to initiate and further develop UBC capacities.

Figure 7 shows that the most developed operational activities for UBC in Poland, from the managers' perspective, are education related activities: "entrepreneurship education offered to students (6.1/7.0)" and "collaboration activities facilitating student interaction with business (5.4/7.0)". Previous studies have reported that these first contacts of academics with business for education related purposes have the potential to improve the knowledge and skills [D'Este et al., 2010] and professional networks of academics [Siegel et al., 2007] that could further develop in longer and stronger UBC activities.

Therefore, it is recommended that universities in Poland should pay more attention to this process of collaboration between business and academics for education related purposes, and take a developmental view on this relationship, than to the UBC activities that presses academics and staff from Technology Transfer Offices for research and technology commercialisation.

6. Limitations and further research

While this research contributes to more and extensive knowledge in UBC in Poland and Germany, its results should be briefly interpreted in view of its limitations. Those limitations are mainly based on the sampling methodology.

Firstly, respondents not involved in UBC may have been less willing to answer the questionnaire. The topic is besides their interest and also potentially they would have to admit more negative answers on the questions themselves. A non-response analysis showed that the results are clearly influenced by this.

Secondly, a limited sample size was achieved for the samples due to availability of a contact database, in spite of this, that the final figures are comparatively large. Whereas this is coherent with previous research, in which the requirement of corresponding responses led to small and imbalanced samples suitable for use despite large potential samples at the beginning of the fieldwork [Medlin et al., 2005].

Thirdly, the sample itself was based on the willingness and disposition of first layer target persons to forward it to other potential respondents in the university. In addition,

this could have caused an imbalance due to selection process of those second layer target persons.

Further research could be focussed on how historic events have affected UBC development in both Germany and Poland. Also future research on the different mechanisms in place which are unique to each of the countries could provide better insights as could a discussion on the role of universities of applied sciences and technical universities (polytechnics, universities of technology) as well as the traditional universities in UBC for the sake of the economies of both countries.

Further research also has to consider the business side. The studies so far have not researched the view of businesses and their decision makers. This would be needed to get a full picture of the situation.

What has been seen in this and other studies is also the role of intermediaries (regional development agencies, associations, etc.) and the regional strengths and weaknesses in a country, therefore this could be an option to develop this further.

Finally, in order to explore both countries to a more detailed levels, and due to the fact that each of the two countries have a number of different regions that are characterised by economic, cultural and social differences, a set of regional analyses should be undertaken.

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