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FACTORS CONDITIONING THE ROLE OF HIGHER EDUCATION INSTITUTIONS IN TRANSITION ECONOMIES: AN EXPLORATORY STUDY OF THE REPUBLIC OF BELARUS

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ABSTRACT

The global knowledge-intensive economy and the entrepreneurial society require higher education institutions (HEIs) that respond to the new challenges of becoming key players in the development of regions and countries. Thus, during the past two centuries, HEIs have evolved from "accumulators" of knowledge, which were largely separated from society, to "knowledge hubs," which are deeply embedded in systems of innovation, foster interactions and knowledge spillovers to link research with application and commercialization, and take on the role of inducing innovation-driven economic and social development.

In contrast to developed Western countries, HEIs in transition economies are not considered as key actors in cutting-edge innovation and in creating entrepreneurship capital, rather tending to focus on the teaching of jobseekers, knowledge workers, adaptation, redevelopment and dissemination of existing innovations. In addition, the Soviet heritage preconditioned the pattern of HEI transformation as well as knowledge creation and transfer in most of these economies. At the same time, observing the role of HEIs in promoting entrepreneurship and creating entrepreneurship capital in the USA and Western Europe, policy makers in many transition economies realized that such entrepreneurial transformation at HEIs is needed to respond to the challenges of the global knowledge economy.

In this regard, this dissertation investigates the contribution of HEIs to economic development of countries in different stages of progress and factors that condition the role of HEIs in transition economies. In so doing, we examine the development of contemporary HEIs at three different levels – international, national and organizational – with a specific focus on the Republic of Belarus.

As a result, the dissertation has several noteworthy contributions. Firstly, it advances knowledge on the impact of the three HEI missions at the international level in different stages of economic development. Secondly, the dissertation makes substantial progress towards identifying resources and capabilities that drive the knowledge commercialization by HEIs in a transition economy. Finally, we demonstrate how organizational and environmental factors condition entrepreneurial activities in the context of a leading post-soviet HEI – the Belarusian State University.

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Chapter 1. Antecedents and research motivation

1.1 Introduction

During the past two decades, higher education institutions (HEIs) have faced the necessity of becoming entrepreneurial organizations in which the knowledge generated is transformed into social and economic value (Kirby et al., 2011). HEIs have accepted this challenge by incorporating economic and social development as their "third mission", later called the "entrepreneurial" mission, in addition to teaching and research (Rothaermel et al., 2007). As a result, establishing close links among science, technology, and the utilization has become a crucial task for HEIs (O'Shea et al., 2005). The rationale is that, on the one hand, HEI are key sources of fundamental knowledge, innovation (Isaksen & Karlsen, 2010; González-Pernía et al., 2014) and talented human capital (Carree et al., 2014). On the other hand, HEIs they are expected to create fertile and benevolent entrepreneurial environment for development of new products and processes (O'Shea et al., 2007). Thus, being under pressure of rapidly changing global conditions and in pursuit of their "third mission" western HEIs are transforming into "entrepreneurial universities" (Gibb & Hannon, 2006) by increasing their market-like behavior and governance (Subotzky, 1999) and by developing entrepreneurial competences (Röpke, 1998).

To some extent, the evolution of HEI mandates is attributed to the development of economic growth theories (Figure 1.1). Thus, in the neoclassical growth theory proposed by Robert Solow (1956), the drivers of economic growth

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were physical capital and labor that could be unskilled; HEIs mainly played the role of providers of human capital, and their economic contribution was modest.

This model was critically revised and supplanted by the endogenous growth model introduced by Romer (1986; 1994), who argued that knowledge and technology are key factors of production. Moreover, Bilbao-Osorio and Rodríguez-Pose (2004) stated that the level of educational attainment and skills of the population determine the capacity to transform research and development into innovations. Thus, the increased role of knowledge in economic growth turned HEIs from solely human capital suppliers into key sources of knowledge and technology and, consequently, into key economic growth engines (Audretsch, 2014).

At the beginning of the twenty-first century, academics concluded that an important element missing from the majority of economic growth models is the entrepreneurship needed for human capital formation and innovations (Wennekers & Thurik, 1999; Wong et al., 2005). The new theory posits that entrepreneurship is a driving force determining economic growth (Audretsch & Keilbach, 2004; Audretsch, 2009). As a consequence, the role of HEIs has broadened from only knowledge and technology generation and transfer to providing "leadership for creating entrepreneurial thinking, action and institutions" (Audretsch, 2014, p.319). For example, American academics, such as Roberts & Eesley (2009) and Eesley & Miller (2012), studied social and economic impacts of leading American entrepreneurial HEIs. On the basis of alumni surveys, the authors computed that companies founded by MIT's and Stanford's alumni generated annual revenues of

about $2 trillion and $2.7 trillion, respectively, while the estimated number of jobs created was 3.3 million and 5.4 million, respectively.

Nevertheless, it is admitted that the concept of entrepreneurial HEI is multifaceted and is explored within different research streams ranging from knowledge transfer (Bercovitz & Feldmann, 2006; Martinelli et al., 2008) to entrepreneurship education (Laukkanen, 2000; Klofsten, 2000) and HEI management (Bernasconi, 2005; Gibb et al., 2013). Similarly, there is no consensus in understanding of the term "entrepreneurial university" (Kirby et al., 2011; Markuerkiaga et al., 2014). Many scholars representing different research domains made attempts to systematize peculiarities of entrepreneurial HEIs (Röpke, 1998; Schulte, 2004; Yusof & Jain, 2010) as well as conditioning factors of the HEI evolution (Pawlovski, 2001; Kirby, 2005; O'Shea et al., 2005; Guerrero et al., 2014). In the same line, based on the existing literature, we can define entrepreneurial HEIs as HEIs that act entrepreneurially and are natural incubators, creating a supportive environment for the startup of businesses by faculty and students, promoting an entrepreneurial culture and attitude for the purpose of responding to challenges of a knowledge-based economy, and facilitating economic and social development.

Figure 1.1. Evolution of the HEIs' missions

Dominant economic growth concept	Solow's economy →	Romer's economy →	Ausdretsch's entrepreneurial society
Key driving factors	Unskilled labor force Physical capital →	Knowledge →	Entrepreneurship
HEIs' missions	Teaching mission →	Teaching mission Research mission →	Teaching mission Research mission Entrepreneurial mission
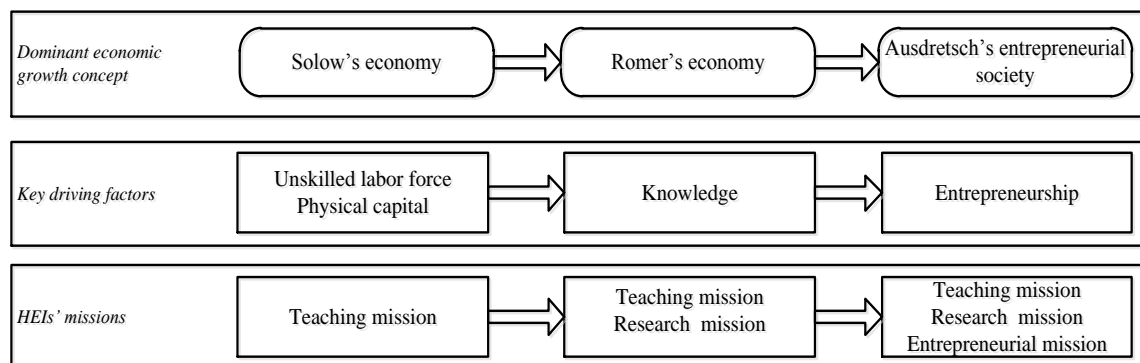
Source: Adapted from Guerrero & Urbano (2012)

Arguably, an entrepreneurial orientation by HEIs might put regions and countries in an advantageous position (Van Looy et al., 2011) in the contemporary knowledge-based and entrepreneurial society (Audretsch, 2014). In pursuit of economic growth and the welfare of citizens, state governances may expect from HEIs new knowledge-based enterprises (Di Gregorio & Shane, 2003) and the creation of high-skill jobs (O'Shea et al., 2008). HEI authorities are interested in attracting the best students and faculty, increasing funding, and diversifying income sources (Powers & McDougall, 2005; Plewa & Quester, 2007), while industry requires top-quality graduates and researchers with an entrepreneurial mindset who are able to transform their knowledge into economic value (Guerrero & Urbano, 2012). Therefore, stimulating entrepreneurship inside HEIs, change from a bureaucratic culture to an entrepreneurial one and the consequent development of entrepreneurial HEIs are in focus of HEI authorities and policy agendas against the backdrop of global reduction of governmental financial support (European Commission, 2008; OECD, 2010).

In the European Union, some strategies fostering entrepreneurship and innovations within HEIs have been officially constituted by the Bologna declaration in 1999 and the Lisbon strategy in 2000. More recently, the European Union 2020 strategy has highlighted the need to embed creativity, innovation and entrepreneurship into higher education to stimulate entrepreneurial mindsets, values, attitudes and to create favorable climate for entrepreneurship and innovation.

However, there is no single model or one best way of the HEI transformation due to economic, social, and institutional disparities among countries and regions that affect the path and the emerging type of the development towards entrepreneurial HEIs (Etzkowitz et al., 2000; Harrison & Leitch, 2010). Drivers of the HEI transformation and the influence of modern HEIs on innovative performance and international comparative advantage are being observed and studied in the most developed regions in the United States (Goldstein & Renault, 2004; O'Shea et al., 2007; Audretsch et al., 2013), the United Kingdom (Martinelli et al., 2008; Howells et al., 2012), and to a lesser extent in continental Europe (Sterlacchini, 2008; Urbano & Guerrero, 2013; Leten et al., 2014) and Southeast Asia (Mathews & Hu, 2007).

With respect to the countries in transition, the level of entrepreneurial activity and, as a consequence, of entrepreneurship within HEIs is lower in comparison with western market economies (Ivanova, 2005; Aidis et al., 2008), while the majority of such countries are still trying to develop an entrepreneurship- and innovation-friendly environment (Todorovic & Ma, 2010). Since the success

of a transition process leans on the performance of the entrepreneurial sector (McMillan & Woodruff, 2002), state authorities in such countries tend to promote entrepreneurship within higher education and foster at least some entrepreneurial and innovation activities of HEIs (Saginova & Belyansky, 2008; Tchalakov et al., 2010; Uvarov & Perevodchikov, 2012). However, a simple imitation of western good practices, models and best-of-breed tools, which are context-specific, cannot lead to similar results. This notion has propelled us to explore factors that condition the role of HEIs in transition economies and to discuss whether HEIs in fact are becoming entrepreneurial to respond to new environmental challenges.

The complexity of the phenomenon and cross-country differences in HEI roles predetermined the objectives and the structure of the dissertation.

1.2 Research questions, objectives and structure

The globalization of commerce and the shift in developed economies from traditional manufacturing to knowledge-intensive production were the impetus for focusing the attention of academics, policymakers, and HEI authorities on understanding and modeling the effects that HEIs have on regional and national economic conditions (Drucker & Goldstein, 2007; Leten et al., 2014). The ongoing financial crisis and rising competition in the global market have been increasing the interest in the economic impact of HEIs. Since external conditions precede the successes of HEIs in engagement in social and economic development of regions and countries, the following research question arises:

RQ1. What are the impacts of the three HEI missions on economic development of countries in different stages of progress?

In the context of transition economies, which are mainly efficiency-driven, HEIs are not considered as key actors in cutting-edge innovation, rather tending to focus on the teaching of knowledge workers, adaptation, redevelopment and dissemination of existing innovations (Wu & Zhou, 2012; Kwiek, 2012). The main obstacles facing HEI transformation are the unfriendly environmental conditions, such as the lack of financial resources for HEIs to innovate (Tchalakov et al., 2010); ineffective channels for knowledge and technology transfer (Etzkowitz et al., 2000; Inzelt, 2004); weak IP protection (Aidis et al., 2008), a poorly developed incentive system for HEIs; and negative attitudes toward academic entrepreneurship (Grudzinskii, 2005). However, the local post-socialist institutional transformation accompanied by the substantial cuts in public expenditures on R&D after the break-up of the Soviet Union and the precipitous fall in industry demand for R&D results propelled HEIs to actively commercialize and transfer knowledge and technology in order to survive in these new conditions (Radosevic, 1998; Yegorov, 2009). Thus, HEIs in transition economies experienced their specific entrepreneurial transformation. This leads us to the following research question:

RQ2. What is the moderation influence of HEIs' origins (socialist or post-socialist era) on the HEI-level factors that condition the knowledge transfer and commercialization?

Responding to the changes in global and domestic post-Soviet socioeconomic conditions has required from HEIs new kinds of resources, capabilities, forms of management and approaches to teaching, research and innovation activities. HEIs need to take a large stride to catch up Western HEIs in terms of creating entrepreneurial environment and thereby being contributors to the socioeconomic development of regions and countries in the knowledge-based economy and entrepreneurial society. Therefore, we try to explore the following unanswered research questions:

RQ3. What are antecedents of entrepreneurial activities at HEIs in the context of transition economies?

RQ4. How does the HEI environment influence entrepreneurial activities of students and alumni in the context of transition economies?

In its broadest sense, the purpose of this dissertation is to address these challenging questions. In so doing, we examine the development of contemporary HEIs at three different levels – international, national and organizational – with a specific focus on a transition economy. Therefore, the research is divided in three main chapters as outlined in Figure 1.2.

Figure 1.2. Research structure
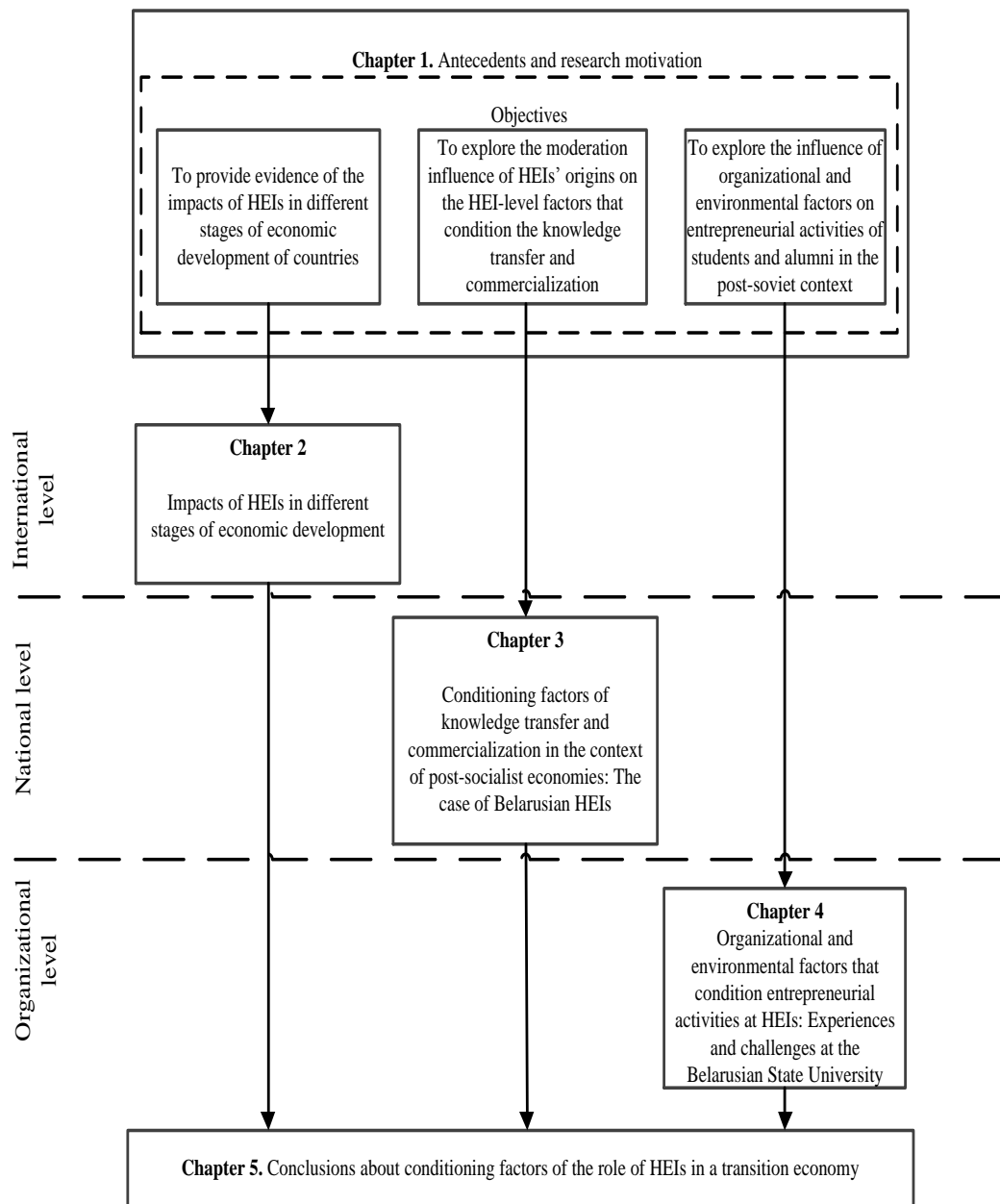
Source: Authors

Various manifestations of the social and economic impacts of HEIs are studied and estimated by scholars such as the decrease in unemployment (Lockett et al., 2003; Benneworth & Charles, 2005; O'Shea et al., 2008); attraction and retention of talented students and faculty to a region or a country (Wong et al., 2007); product and process innovation (Jaffe, 1989); creating and upgrading

industries (Isaksen & Karlsen, 2010); and the economic development of regions and countries (Bercovitz & Feldmann, 2006). However, the majority of these studies were conducted in the developed innovation-driven countries, in which an environment conducive to the development of the three HEI missions has been created.

In this regards, the aim of the second chapter is to explore the impacts of the three HEI missions on the economic development of countries in different stages, namely factor-driven, efficiency-driven, and innovation-driven. In pursuit of this research purpose, we employ the basis of the endogenous growth theory (Romer, 1986) and the concept of the stages of development proposed by Porter (1990) and adapted by the authors of the Global Competitiveness Report (Sala-i-Martin & Schwab, 2011), which may help to differentiate countries according to their level of economic development and institutional environment.

Using a specification of the Cobb-Douglas production function, which tends to explain the generation of wealth in a country as a function of the outcomes of the three HEIs' missions, we use a set of linear regression models with moderators. The sample comprises 77 countries, which are distributed between stages of economic development: factor-driven (15), efficiency-driven (30), and innovation-driven (32).

The transformation of knowledge and technology originated from HEIs into valuable economic activity has become a high priority in many policy agendas across the world. Given the data limitations, especially in post-Soviet economies, a few studies have investigated the resource base and capabilities that are required

in these processes. In connection with this, the aim of this chapter is to explore the moderation influence of HEIs' origins on the HEI-level factors that condition the knowledge transfer and commercialization. Thus, the third chapter turns to the context of an efficiency-driven transition economy, namely the Republic of Belarus since this post-Soviet country has important peculiarities interesting and relevant to our research. On the one hand, Belarus does not possess mineral resources which would drive socioeconomic development and on the other hand, the country does not display any intention to move towards Europe-like institutions and a market economy. Multinational enterprises have not become the major actors in business R&D and drivers HEI-business relations unlike the Central Eastern European transition economies (Lengyel & Cadil, 2009). In addition, Belarus is not represented in the Global Competitiveness Reports. This hinders the understanding of socioeconomic processes and institutional development and complicates international comparisons.

Given the tenets of the resource-based view (Amit & Shoemaker, 1993) as applied to contemporary HEIs, several critical types of resources and capabilities are identified in the literature: human resources, financial resources, commercial resources, knowledge creation capability, and reputation. Adopting the institutional approach (North, 1990), we test two sets of regression models with slope dummies to determine if the effect of HEI-level factors is moderated by the context in which a HEI was established. We use a sample of 41 Belarusian HEIs for a three-year period (123 HEI-year observations).

The fourth chapter substantiates and extends the findings of the third chapter by exploring organizational and environmental factors of entrepreneurial activities at a Belarusian HEI. The main rationale behind this focus is that the mandate of HEIs to play an active role in fostering entrepreneurial mindsets and intention among the HEI community is arguably more critical in the context of post-Soviet economies (McMillan & Woodruff, 2002). For example, the Belarusian economy is characterized by unsupportive institutional environment (Ivanova, 2005; Rees & Miazhevich, 2009) and the underdeveloped entrepreneurial sector (UN, 2011). The new mandate requires from HEIs an ability to be flexible, entrepreneurial and innovative which usually comes into conflict with their culture, perceived missions, governance and remuneration systems.

In this regard, the aim of this chapter is to explore the influence of certain organizational and environmental factors on entrepreneurial activities of students and alumni in the post-socialist context. We use prior research on the topic and adopt a basis of the resource-based theory (Amit & Shoemaker, 1993), the institutional approach (North, 1990; 1991), the Theory of Planned Behavior (Ajzen, 1991; Ajzen, 2002) and the Social Cognitive Theory (Bandura, 1986; Bandura, 1997) in order to achieve this objective. Methodologically, a single case study method with a mixed data collection approach was selected to embrace two levels of analysis: organizational (a HEI) and individual (students and alumni) levels. Specifically, the chapter turns to the context of a leading Belarusian HEI – the Belarusian State University. For the purposes of this chapter, we conducted ad-hoc surveys of students and alumni. Two sets of binary logistic regression models

on a sample of 316 BSU students and 257 alumni were employed to complement the findings of the case study.

In Chapter 5, we discuss the main findings of the dissertation, provide general implications and delineate future research lines.

1.3 Expected contribution of the thesis

This dissertation is expected to make several noteworthy contributions. First, in contrast to other studies focusing mainly on influence of teaching and research activities on urban and regional economies (Goldstein & Renault, 2004; Leten et al., 2014), our research provides important insights and estimates the impacts of the three HEI missions in different stages of economic development of countries.

Secondly, the dissertation makes substantial progress towards identifying the resources and capabilities that drive the commercialization of research results by HEIs in a transition economy. To the best of our knowledge, the study is the first empirical attempt to explore prevailing forms of knowledge transfer and commercialization on an institutional basis, namely, contract research and the selling of IP rights in the new context of post-Soviet countries. The empirical analysis evidences that these mechanisms of knowledge transfer and commercialization present themselves as slightly positively related and have different antecedents. In the context of Belarus, the first form reflects the capacity to commercialize HEI knowledge and research outputs relevant to business

development, while the second one is a manifestation of an HEI's provisional intention to commercialize research results through licensing or the creation of spin-offs.

Finally, the dissertation will contribute to the ongoing discussion about entrepreneurial orientation of post-Soviet HEIs and provide a better understanding of the antecedents of entrepreneurial environment within these HEIs. More concretely, the contribution consists in demonstrating how HEI-level factors shape a HEI entrepreneurial environment in the context of post-Soviet transition economies and how this environment influences entrepreneurial intentions of students and the entrepreneurial actions of alumni.

1.4 Expected implications

The dissertation is expected to reason that governments all over the world should be concerned with creating a favorable environment for the transformation of HEIs and their inclusion in systems of innovation. Moreover, developing a synergy among the three HEI missions that facilitates creating and converting human and knowledge capital into economic growth should be a priority of higher education policy agendas.

With regard to post-Soviet economies, such as Belarus, these challenges seem to be even more crucial due to the rigidity of the HEI systems and the Soviet heritage. In this regard we intend to demonstrate to policymakers and HEI authorities which factors drive knowledge and technology transfer in this context.

This may support in developing budgets, HEI strategies and allocating limited resources in order to promote interactions between science, businesses and education, and thereby to increase the economic impacts of HEIs.

In addition, we mean to stress the importance of creating an entrepreneurship-supportive environment within Belarusian HEIs in promoting entrepreneurial activities and enhancing teaching and research missions. State and HEI policies towards creating entrepreneurial ecosystems at HEIs should create incentives for knowledge-based entrepreneurship and reinforce the perceptions of students and academics that entrepreneurial activity is one of the attractive and feasible career paths. Consequently, another important issue to be pointed out is a necessity not only to acknowledge and support the three HEI missions but to evaluate and benchmark their outcomes and the changing role of HEIs in Belarusian economy and society.

Overall, the dissertation is expected to reassure the Belarusian society that, even at the efficiency-driven stage, the role of HEIs may go beyond providing high-quality graduates – employees – as it is perceived now.

Chapter 2. Impacts of HEIs in different stages of economic development

2.1 Introduction

As was evidenced in the previous chapter (Figure 1.1), multiple environmental forces have been impelling HEIs to reorganize their teaching and research activities to satisfy the demands of society for human capital and the knowledge relevant to the development of industries and the promotion of welfare. Simultaneously, contributing effectively to innovative performance requires willingness and an ability of HEIs to become entrepreneurial organizations in which the knowledge generated is transformed into social and economic value (Kirby et al., 2011; O'Shea et al., 2005; Van Looy, 2009). As a result, patterns of research, development, and production are changing and generating new organizational forms in higher education systems (Subotzky, 1999).

Certain institutional factors, such as economic, legal, political, and cultural contexts, can either reinforce or limit a HEI's transformation. However, research on the external determinants in the HEI transformation process in different economies and the possible impacts of HEIs in different stages of economic development[1] is still an interesting research opportunity (Wong et al., 2007). The influence of the evolution of HEIs on innovative performance and international comparative advantage is being observed and studied in the most developed regions in the United States (Goldstein & Renault, 2004; Audretsch et al., 2013),

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[1] The concept of the stages of development was proposed by Porter (1990) and adapted by the authors of the Global Competitiveness Report (Sala-i-Martin & Schwab, 2011)

the United Kingdom (Howells et al., 2012), and to a lesser extent in continental Europe (Sterlacchini, 2008; Urbano & Guerrero, 2013) and Southeast Asia (Mathews & Hu, 2007). In contrast to developed countries, the impact of HEIs on the productivity of enterprises and on the increase of regional incomes appears insignificant in less developed countries (Bajmócy et al., 2010).

In general, the level of teaching, research, high-tech entrepreneurial activity, and, as a consequence, the level of entrepreneurship within HEIs in such economies is lower in comparison with western market economies, while such countries face the same economic problems as their more developed counterparts. The growth of the knowledge-based society, in turn, leans on the production, transmission, distribution, and utilization of new knowledge, while modern HEIs participate in these processes (Zaharia & Gibert, 2005). The aim of this chapter is to explore the impacts of HEIs in different stages of economic development of countries, namely factor-driven, efficiency-driven, and innovation-driven. By means of a linear regression model, we tested the impact of HEIs on economic development in each of the three stages of 77 countries.

The remainder of the chapter is structured as follows: in Section 2.2, we discuss the role of HEIs in the economic development and present hypotheses. Section 2.3 describes the data and methodology employed in the study, while Section 2.4 provides the results of the regression analysis. In Section 2.5, we discuss the main findings of the study. The final section provides a conclusion and delineates future research lines.

2.2 Theoretical framework

2.2.1 The role of HEI in the economic development

The ongoing financial crisis and rising competition in the global market have been increasing the interest in the economic impact of HEIs in general (Hayter, 2013). Therefore, by fulfilling these three missions: (i) teaching, (ii) research, and (iii) economic and social development – entrepreneurial mission, HEIs can contribute to the social and economic development of their country but only if their country has reached a certain stage of economic development in which the outcomes of HEIs are relevant. Academics define various manifestations of the social and economic impacts of HEIs such as decrease in unemployment (Lockett et al., 2003; Benneworth & Charles, 2005; O'Shea et al., 2008); attraction and retention of talented students and faculty to a region or a country (Wong et al., 2007); radical product innovations (Radas & Božić, 2009); creating and upgrading industries (Isaksen & Karlsen, 2010); and the economic development of regions and countries (Bercovitz & Feldmann, 2006). Based on that, there are two main approaches for measuring the economic impact of HEIs: (i) the static approach (Steinacker, 2005), which is based on simulations through an input-output model or multiplier techniques, and (ii) the dynamic approach (Goldstein & Renault, 2004), which is based on production functions originating from the neoclassical growth theory (Solow, 1956) and enables estimating the contribution of HEIs' activities to the increase in productivity and subsequent GDP growth (Martin, 1998). Within the framework of endogenous growth theory, economic impacts of

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HEIs are based on the determinants of the production function: human, knowledge, social, and entrepreneurship capital (Urbano & Guerrero, 2013).

2.2.2 Hypotheses

In general, academics agree that the outcomes of the primary teaching mission of a modern HEI, which has been developing since the Middle Ages, are expected to be highly educated graduates who are both job-seekers and job-creators with an entrepreneurial spirit and mindset (Muff, 2012). This notion is referred to as human capital. In every economic system, the main mandate of any HEI is by far to provide highly educated graduates – bearers of skills, abilities (both codified and tacit knowledge), and culture (Bramwell & Wolfe, 2008). Creating human capital is one of the most important factors of innovation, productivity, and economic development (Lucas, Jr., 1988; Sterlacchini, 2008; Leten et al., 2014). However, the role of human capital varies from one stage of economic development to another. Thus, in the factor-driven stage, a country competes relying on mainly unskilled labor and natural resources through low-cost efficiency in production (Acs & Szerb, 2011).

The competitiveness of countries that have reached the efficiency-driven stage is based to a greater extent on higher education and training systems because more efficient production processes and the increased quality of goods and services (Sala-i-Martin & Schwab, 2011) require educated human capital to harness existing technologies. Thus, economies are expected to benefit from HEI

graduates – mainly job-seekers – to increase the absorptive capacity of enterprises (Vinding, 2006).

Finally, as the innovation-driven economies are characterized by knowledge-intensive activities and the development of higher value-added sectors (Sala-i-Martin & Schwab, 2011), HEIs are driven to create talented human capital: entrepreneurs and innovators. Therefore,

H1a. Human capital generated by HEIs is positively related to economic development of a country.

H1b. Human capital generated by HEIs, moderated by the stage of progress, is positively related to economic development of a country.

In the nineteenth century, teaching was expanded to include methods for obtaining, passing on, and interpreting existing knowledge, and as a result, research was incorporated as the second HEI mission. The outcomes of this mission, besides the improvement of academic materials and scientific publications, are practical knowledge applicable to industry, consulting services, and joint research projects (Bercovitz & Feldmann, 2006; Guerrero et al., 2014), or, in other words, innovations and business ideas for companies and knowledge spillover (Audretsch et al., 2004). According to Romer (1994), knowledge and innovation are significant contributors to productivity and economic growth. In this regard, HEIs are able to facilitate economic development in the knowledge-based economy through the knowledge production and transfer. The role of HEIs

in knowledge creation and innovation was empirically confirmed by many academics (Sterlacchini, 2008; Howells et al., 2012; Audretsch et al., 2013). As factor-driven economies rarely create knowledge to innovate (Acs & Szerb, 2011), the impact of the HEI research mission on economic development is moderate. The importance of knowledge increases when a country reaches the efficiency-driven stage. Thus, the upgrade of production processes and products needs the knowledge base to duplicate and absorb existing technologies. Knowledge-intensive activities and high value-added innovative sectors are part of the most developed economies (Sala-i-Martin & Schwab, 2011), where the ability to create and exploit new knowledge is a pillar of their competitiveness. Therefore,

> *H2a. Knowledge created/transferred by HEIs is positively related to economic development of a country.*
>
> *H2b. Knowledge created/transferred by HEIs, moderated by the stage of progress, is positively related to economic development of a country.*

During the second academic revolution that started in the United States at the end of the Cold War, HEIs have begun to assume their role in economic development through the extension of teaching and research and thereby introducing their entrepreneurial mission. Scholars demonstrate several outcomes of the third mission, such as patents, creation of new firms (academic spin-offs) (Di Gregorio & Shane, 2003; O'Shea et al., 2005; Siegel & Phan, 2005), and the development of entrepreneurial culture and attitudes among graduates and

academics (Gibb & Hannon, 2006; Guerrero & Urbano, 2012). However, it is worth noting that studies focused on less developed countries pay more attention to the role of HEIs in the development of entrepreneurial culture and attitude (Uvarov & Perevodchikov, 2012). Hence, HEIs are designated as vital institutions that are able to cultivate entrepreneurial thinking and attitude.

In this sense, entrepreneurship capital contributes to economic development by serving as a conduit for knowledge spillover, promoting competition, and providing diversity among enterprises (Audretsch & Keilbach, 2004). This is an example of the great capacity of economic agents in generating new firms. HEIs promote entrepreneurial culture and values (Clark, 1998) and generate an inexhaustible stream of new ideas and technologies for incumbent firms and start-ups (Gibb & Hannon, 2006), including academic spin-offs, HEIs are essential contributors to the enhancement of their country's entrepreneurship capital (Audretsch, 2014). However, the creation of enterprises in lower-income economies may lead to employment for business owners rather than to economic growth (Wong et al., 2005), while it was empirically corroborated that entrepreneurial activity has a positive effect on economic performance in highly developed countries (Van Stel et al., 2005; Wennekers et al., 2005). In innovation-driven economies, modern HEIs are expected to contribute entrepreneurship capital, leaning on a strong interaction with innovation systems (Klofsten & Jones-Evans, 2000; Bramwell & Wolfe, 2008). Therefore,

H3a. Entrepreneurship capital created by HEIs is positively related to the economic development of a country.

H3b. Entrepreneurship capital created by HEIs, moderated by the stage of progress, is positively related to economic development of a country.

In summary, Figure 2.1 shows the conceptual framework proposed in this chapter to understand the impacts of HEIs in the different stages of economic development.

Figure 2.1. Conceptual framework
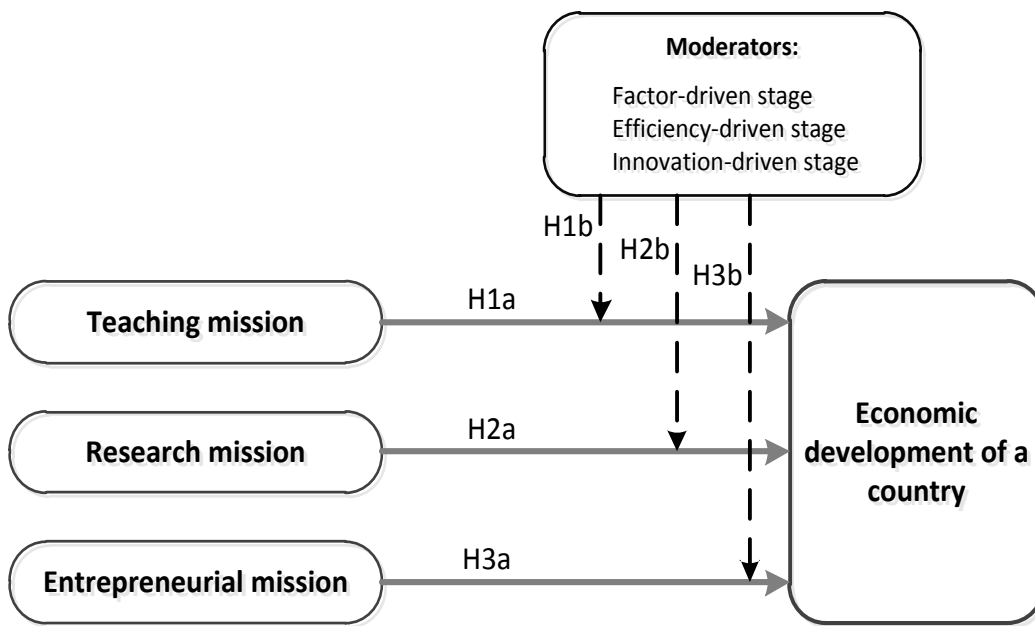
Source: Authors

2.3 Methodology

2.3.1 Data collection

Data were obtained from official open-access sources of statistical information such as the World Bank Group, the World Economic Forum, the

European Patent Office, the International Trade Centre, and the Times Higher Education World University Rankings. A database populated with countries from different parts of the world was created, representing different stages of economic development, varying in environmental factors and resources available. The final sample comprised 77 countries (Figure 2.2), which are distributed between stages of economic development: factor-driven (15), efficiency-driven (30), and innovation-driven (32). The list of countries is provided in Annex 2.1.

Figure 2.2. Sampled countries

Source: Authors

2.3.2 Definition of variables

Dependent variables

In this study, the dependent variable (*GDP_empl_2011)* is the labor productivity in 2011 measured by GDP per person employed (that is, gross

domestic product divided by total employment in the economy converted to 1990 constant international dollars using purchasing power parity rates). This measure is widely used in literature as a proxy for economic development of countries and regions (Lederman & Saenz, 2005; González-Pernía et al., 2012).

Independent variables

On the grounds of the literature studied, we identified the proxies for outcomes of the three HEI missions. As the main purpose of any HEI is to produce highly educated graduates (Bramwell & Wolfe, 2008), it is reasonable to consider the total number of graduates involved in economic activities; that is, a labor force with higher education as the outcome of the teaching mission. The high level of educational attainment predicts the great capacity to absorb and translate the available knowledge and the outcomes of research and development into innovation (Bilbao-Osorio & Rodriguez-Pose, 2004; Sterlacchini, 2008). Therefore, we used the percentage of labor force with tertiary education (T) as a proxy for the outcome of the teaching mission. The data for countries are provided by the World Bank in the World Development Indicators.

In order to capture the role of HEIs in creating and translating knowledge capital relevant to enterprises and industries, we employed the level of HEI-industry collaboration in research and development (R) in a country, which is evaluated annually by the authors of the *Global Competitiveness Report* by the World Economic Forum. As HEIs are deeply embedded in systems of innovation by participating in the knowledge production, commercialization, and utilization

through the cooperation with economic agents (Zaharia & Gibert, 2005; Perkmann & Walsh, 2007; Youtie & Shapira, 2008), this proxy seems to represent these activities adequately. Concisely, it shows the extent to which HEIs' research capacity is dictated by business environment and the capabilities of HEIs to find ways for beneficial cooperation with businesses that corresponds to the concept of the entrepreneurial HEI – the response to the increased importance of knowledge in the economy (Etzkowitz et al., 2000).

With respect to the entrepreneurial mission, entrepreneurship is a concept that is difficult to measure, to operationalize, and to define the role of entrepreneurship in economic development (Wong et al., 2005). Previous studies have used several proxies to measure entrepreneurship such as entry and exit of firms (Wennekers & Thurik, 1999), the number of new enterprises (Audretsch & Keilbach, 2004), the number of spin-offs and the number of patents, licenses, agreements (Van Looy et al., 2011). Alas, among these indicators only data on the number of HEI patents from around the world can be obtained from the EPO Worldwide Patent Statistical Database (PATSTAT) in the European Patent Office. We employed the average number of patents granted to HEIs from 2006 to 2008 per million population (E).

Control variables

Several control variables were included in the model to capture some important sources of heterogeneity between countries. The share of exports of mineral goods in total exports in 2011 was introduced to control whether the labor

productivity and the welfare of a country is based upon the extraction of resources (Sala-i-Martin & Schwab, 2011). The data were obtained from the database of the International Trade Centre. The next variable – the share of total employment in industry – is intended to capture the structural features of the economies because more industrial countries deliver higher rates of innovation and levels of labor productivity (Bilbao-Osorio & Rodriguez-Pose, 2004). In addition, we added the number of HEIs in the 2011–2012 Times Higher Education World University Rankings to test whether the number of top HEIs located in a country influence its economic development. In order to estimate how the outcomes of HEIs affect labor productivity in different stages of economic development[2], similarly to a study completed in 2005 (Van Stel et al., 2005) we included the following slope dummies:

Stage2_T: for efficiency-driven economies (factor-driven stage – reference group) and teaching mission;

Stage3_T: for innovation-driven economies (factor-driven stage – reference group) and teaching mission;

Stage2_R: for efficiency-driven economies (factor-driven stage – reference group) and research mission;

Stage3_R: for innovation-driven economies (factor-driven stage – reference group) and research mission;

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[2] For the purposes of our study, we adopt the stages of economic development of countries provided in the Global Competitiveness Report 2011−2012 (Sala-i-Martin & Schwab, 2011). If a country was in one of two transition stages, we referred it to a previous main stage.

Stage2_E: for efficiency-driven economies (factor-driven stage – reference group) and entrepreneurial mission; and

Stage3_E: for innovation-driven economies (factor-driven stage – reference group) and entrepreneurial mission.

Thus, moderator effects are constructed by interacting all predictor variables with binary variables for the stages of development.

In addition, we introduced the interaction between research and entrepreneurial missions (R_E) to test whether the outputs of these missions are correlative in our model.

It should be noted that the lack of a complete annual series of all the explanatory variables included in the model disables performing a panel analysis.

2.3.3 Model specification and estimation

Most of the production functions and cross-sectional analyses use a few limited indicators of HEI activity – expenditures on research and development, degrees awarded, publications and citations, and number of scientists (Drucker & Goldstein, 2007) – which do not enable us to capture the whole effect on economic development generated by HEIs. Thus, the entrepreneurial mission of HEIs is missing from the vast majority of studies. It is generally admitted that measuring entrepreneurship capital is a challenging task, as many of the elements determining entrepreneurial activity defy quantification (Wennekers & Thurik, 1999; Audretsch & Keilbach, 2004).

To test the hypotheses, we employed a specification of the Cobb-Douglas production function, which tends to explain the generation of wealth in a country or a region as a function of the outcomes of the HEI missions. Thus, in pursuit of our research objectives and on the grounds of previous studies (Wong et al., 2005; González-Pernía et al., 2012), we obtained the formal model, with three inputs estimating labor productivity:

$$\frac{Y_i}{L_i} = \alpha_0 + \alpha_1 T_i + \alpha_2 R_i + \alpha_3 E_i + \varepsilon_i, \quad (1)$$

where $\frac{Y_i}{L_i}$ represents the labor productivity in 2011 measured by GDP per person employed (that is, gross domestic product divided by total employment in the economy converted to 1990 constant international dollars using purchasing power parity rates) (*GDP_empl_2011*); T_i represents the outcome of the teaching mission (human capital created by HEIs); R_i represents the outcome of the research mission (knowledge created/transferred by HEIs); E_i represents the outcome of the entrepreneurial mission (entrepreneurship capital created by HEIs); and ε_i is the error term. The subscript *i* refers to countries.

In accordance with the literature on economic growth (Bilbao-Osorio & Rodriguez-Pose, 2004; Wong et al., 2005), our model was estimated by taking natural logarithms of all variables, except variables that take a value of zero for some countries, such as the average number of patents granted to HEIs and the number of HEIs in the 2011–2012 Times Higher Education World University

Rankings. In this case, the estimates are less sensitive to outliers (Furman et al., 2002). A possible problem of reverse causation (endogeneity) between dependent variable and independent variables was addressed by including in the model the value of explanatory variables with a three-year lag (Audretsch & Keilbach, 2004) compared with the dependent variable or the nearest year for which data are available. Moreover, it takes time until the outcomes of HEIs affect industrial productivity.

The equation constructed for hypothesis testing is estimated using a set of linear least squares regression models. All model specifications in Table 2.4 use the natural logarithm of the share of exports of mineral goods in total exports in 2011 (*LnMin*), the share of total employment in industry (*LnIndustry*), and the number of HEIs in the 2011–2012 Times Higher Education World University Rankings (*Top_400*) as control variables. In summary, we tested our model including only the control variables (Model 0); a model including the outcomes of HEIs and the control variables (Model 1); a model including the outcomes of HEIs, the control variables, and the interaction between research and entrepreneurial missions (Model 2); a model including the teaching mission outcome, the control variables, and the slope dummies for efficiency-driven economies and for innovation-driven economies (Model 3); a model including the research mission outcome, the control variables, and the slope dummies for efficiency-driven economies and for innovation-driven economies (Model 4); and a model including the entrepreneurial mission outcome, the control variables, and the slope dummies for efficiency-driven economies and for innovation-driven economies (Model 5).

2.3.4 Descriptive statistics and correlation analysis

Table 2.1 presents an overview of descriptive statistics for the indicators used. It is worth noting there are countries in the sample that do not boast the presence of HEIs in the rankings as well as patent activity of HEIs.

Table 2.1. Descriptive statistics

	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
LnGDP_empl_2011	8.56	11.13	10.1582	0.61482	-0.517	-0.601
LnIndustry	2.15	3.70	3.1478	0.29341	-0.933	1.616
LnMiner	-6.91	4.58	2.5257	1.58812	-2.855	15.591
Top_400	0	109.00	4.94	14.013	5.977	41.567
T	0.74	3.99	3.0077	0.62580	-1.333	2.414
R	0.64	1.76	1.2887	0.26321	-0.056	-0.676
E	0	15.73	1.1304	2.88251	3.718	14.610

Table 2.2 provides Pearson correlation coefficients between the variables employed in the subsequent empirical analysis when all 77 countries are taken into account.

Table 2.2. Results of correlation analysis

	LnGDP_ empl_2011	LnIndustry	LnMiner	Top_400	T	R	E
LnGDP_empl_2011	1						
LnIndustry	0.198	1					
LnMiner	0.038	0.172	1				

Top_400	0.382**	-0.049	-0.028	1			
T	0.641**	0.103	0.211	0.236*	1		
R	0.679**	0.051	-0.131	0.429**	0.466**	1	
E	0.400**	-0.040	0.001	0.340**	0.337**	0.0477**	1

N= 77 countries

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

All the independent variables are positively correlated with the dependent variable, while the correlation coefficients between them are lower and do not exceed the cut-off level of 0.6, which is a sign of possible multicollinearity (Hair et al., 2010). Since we expect that the relationships between the outcomes of HEIs and the independent variable vary according to the stage of economic development, it is reasonable to study correlations on sub-samples: factor-driven economies, efficiency-driven economies, and innovation driven-economies (Table 2.3).

Table 2.3. Results of correlation analysis

	Factor-driven stage				Efficiency-driven stage				Innovation-driven stage			
	Ln GDP _empl	T	R	E	Ln GDP _empl	T	R	E	Ln GDP _empl	T	R	E
LnGDP_empl	1				1				1			
T	0.559*	1			0.381*	1			0.514**	1		
R	0.248	0.234	1		0.222	0.074	1		0.609**	0.479**	1	

| E | .[b] | .[b] | .[b] | .[b] | 0.407[*] | 0.251 | .284 | 1 | 0.261 | 0.439[*] | 0.389[*] | 1 |

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

[b] Cannot be computed because at least one of the variables is constant.

Pearson correlation coefficients provided show that correlations between independent variables and GDP per person employed change as a function of the stage of development. Therefore, these relationships require further investigation with moderating variables.

2.4 Results

Overall, six models aimed at calculating the effects of HEIs' outcomes on labor productivity (i.e., economic development) were tested. The model that contains only control variables (Model 0) explains about 20% of labor productivity. The share of total employment in industry and the number of HEIs in the 2011–2012 Times Higher Education World University Rankings are found to be significant with standardized coefficient of 0.215 and 0.393 respectively. The equation appears to be reasonably defined, with significant F statistics and adjusted R squared value of about 60% when we consider the main model (Model 1). The teaching and research outcomes are found to have a significant impact on GDP per employed population. The standardized coefficients are almost equal (0.395 and 0.427 respectively) and statistically significant at the 0,001 level. Considering the effect of the entrepreneurial outcome, the standardized coefficient of 0.035 has the predicted sign but it is not statistically significant. In addition, the control variables

are found to be not significant. Collinearity statistics[3] indicate no problems of multicollinearity between independent variables as the highest value of variance inflation factor is about 1.87. Additional analysis has been conducted to determine whether interaction effects exist between the research and entrepreneurial missions. If a significant interaction effect is found, this may indicate the overlap between these two indicators. The interaction term R_E turns out to be insignificant (Model 2); thus, in our model the outcomes of the research and entrepreneurial missions are additive. To summarize the results of the regression analysis on Models 1 and 2, we observe a statistically significant relationship between both the teaching and the research outcomes and labor productivity, while the entrepreneurship outcome appears to be insignificant when we consider 77 countries. That means that countries with the higher percentage of labor force with tertiary education are expected to benefit in terms of labor productivity. Thus, the hypotheses H1a and H2a can be accepted, whereas there is no strong evidence to support H3a hypothesis.

Table 2.4. Results of regression analysis

Dependent variable: GDP per person employed, 2011						
	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
LnIndustry	0.215*	0.144	0.135	0.094	0.082	0.209*
LnMiner	0.012	-0.012	-0.005	0.041	0.126	0.012
Top_400	0.393***	0.101	0.137	0.093	0.050	0.291**
T		0.395***	0.371***	0.236**		

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[3] Collinearity statistics can be obtained upon request

R		0.427***	0.448***		0.101	
E		0.035	2.629			!
R_E			-2.612			
Stage2_T				0.287**		
Stage 3_T				0.771***		
Stage 2_R					0.342**	
Stage 3_R					0.880***	
Stage 2_E						0.073
Stage 3_E						0.315**
R square	0.193	0.623	0.637	0.708	0.678	0.282
Adjusted R square	0.160	0.591	0.600	0.683	0.651	0.232
F	5.819	19.310	17.309	28.278	24.612	5.582

! HEIs from the factor-driven economies did not register patents in the period of 2006–2008.
*** Significant at the 0.001 level.
** Significant at the 0.01 level.
* Significant at the 0.05 level.

We have tested for differences in the impact of the outcomes of HEIs among factor-driven, efficiency-driven, and innovation-driven economies by introducing slope dummies. Regardless of the stage of economic development, human capital created by HEIs is found to be a significant positive determinant of labor productivity (Model 3). It is worth noting that the highest value of the standardized coefficient – 0,771– is observed in the case of the innovation-driven stage. This coefficient is statistically significant at the 0.001 level. In regards to the factor-driven and efficiency-driven economies, the coefficients are significant at 0.01 level, while their values are similar – 0.236 and 0.287 respectively. This may signify that the more developed a country is, the more important is human capital for economic development. Therefore, our H1b hypothesis is supported. At the same time, Model 4 – in which the outcome of the research mission is allowed to be different for three groups of countries – reveals significant and positive relationships only in the efficiency-driven and innovation-driven stages that corroborates our H2b hypothesis. Not surprisingly, the value of the standardized

coefficient for the innovation-driven stage – 0.880 – is substantially higher than the value for the efficiency-driven stage – 0.342. That is, on average, each additional unit of the outcome of HEIs' research activities will entail substantially higher growth in labor productivity in the innovation-driven stage than in the efficiency-driven stage. Overall, Model 4 and Model 5 appear to be reasonably defined, with significant F statistics and adjusted R squared value of 0.683 and 0.651 respectively.

The estimated coefficients and confidence intervals for Model 5 indicate that the outcome of the entrepreneurial mission of HEIs is positively related to GDP per employed population only in the case of innovation-driven economies. For this stage, the estimated coefficient for the HEIs' entrepreneurial outcome – 0.315 – has the predicted positive sign and is statistically significant at the 0.01 level. This means that innovation-driven countries in which HEIs are more active in patenting exhibit higher labor productivity. As for other stages, the standardized coefficient is positive – 0,073 – but not significant for the efficiency-driven stage, while the coefficient is not defined for the factor-driven stage. This finding is consistent with the existing literature, which states that in developed countries HEIs are important contributors to the economic development of regions and countries. Hence, the H3b hypothesis is supported. Interestingly, HEIs from factor-driven countries did not obtain patents from EPO during 2006–2008.

It is worth noting that the results of the regression analysis should be interpreted with caution because of comparatively small number of countries, especially factor-driven economies.

2.5 Discussion

This chapter analyzed the impact of HEIs on the economic development of countries that are classified into three stages of economic development: factor-driven, efficiency-driven, and innovation-driven. The results are summarized in Table 2.5.

Table 2.5. Summary of the analysis

H	HEI's mission	Impact on economic development		Finding
		Expected	Obtained	
H1a	Teaching	+	+	Supported
H1b	Teaching moderated by the stage of economic development	+	+	Supported
H2a	Research	+	+	Supported
H2b	Research moderated by the stage of economic development	+	+	Supported
H3a	Entrepreneurial	+	N/A	No evidence to support
H3b	Entrepreneurial moderated by the stage of economic development	+	+	Supported

Overall, the regression analysis has shown that both human capital created by HEIs and knowledge capital created/translated to industry have a significant and positive effect on the economic development. These results are consistent to previous studies (Martin, 1998; Goldstein & Renault, 2004). At the same time, the output of the entrepreneurial mission expressed in the number of patents granted to HEIs per million population is not related to labor productivity of the 77 sampled countries. Our analysis also justifies the selection of the number of HEIs' patents

as a proxy for the entrepreneurial mission and concludes that at the national level, research and development activities of HEIs and patenting can be considered as two separate phenomena. It is proved by the absence of collinearity between two corresponding proxies and the insignificance of the introduced interaction term (Wong et al., 2005), such as the overlap between the outcomes of the two missions not showing to be substantial.

The study has brought to light essential disparities across countries belonging to different stages of economic development. While countries in all stages are able to benefit from human capital with HEI degrees, HEI research appears insignificant for the development of factor-driven economies. It is not surprising, as the competitive advantage of these countries is based mainly on the availability of labor and natural resources, while firms produce relatively simple products designed in more advanced countries, and technology is assimilated through imports and imitation (Lopez-Claros et al., 2004). Therefore, HEIs are required to be teaching institutions creating "knowledge for its own sake" (Audretsch, 2014). As the production process and products become more sophisticated in the efficiency-driven stage, HEIs are expected to perform as "engaged universities," or, in other words, to be involved in modernizing and introduction of new products and processes (Mathews & Hu, 2007; O'Shea et al., 2008). The regression analysis has shown that, in this stage, besides educated graduates, HEIs contribute to economic development by conducting industry-demanded research. However, the underdeveloped resource base and capabilities of HEIs along with an institutional environment, such as the weakness of the

national and regional systems of innovation in efficiency-driven countries (Kwiek, 2012), may restrain HEIs from playing a more proactive role in socioeconomic development.

By incorporating entrepreneurial missions, HEIs take responsibility for converting knowledge and innovations into economic growth and creating entrepreneurship capital (Audretsch, 2014). At the same time, the impact of the entrepreneurial activity on economic growth is not straightforward. Thus, on the grounds of the GEM survey, Wong et al. (2005) showed that high potential total entrepreneurial activity is the sole form of entrepreneurship that can explain differing rates of economic growth across countries. In addition, Van Stel et al. (2005) found that total entrepreneurial activity has a positive effect on economic development for highly developed countries. In this sense, our finding that entrepreneurship matters only in the innovation-driven stage for developed countries is in line with the existing literature on the topic. In such countries, the capacity to innovate, namely the ability to produce new-to-market products and services at the technology frontier by means of the most advanced methods, is a crucial driver of competitive advantage and economic growth (Lopez-Claros et al., 2004). Therefore, governments are concerned with the creation of an environment conducive to the development of HEIs that have the willingness and ability to fulfill all three missions.

These findings show that in Belarus – an efficiency-driven economy[4] – HEIs are expected to contribute to economic development if they successfully fulfil teaching and research missions. Although Belarus inherited from the centralized Soviet economy relatively well-developed higher education and science systems, there is still a lack of sustainable mechanisms for commercialization of research results and market-based interrelations in this sphere. Therefore, the issue of the relevance of research conducted at HEIs, as well as of the HEIs' capability to transfer knowledge is widely discussed and questioned. At the same time, since the 1990s, HEIs have been learning to act entrepreneurially in order to stand the tests of a market economy. These circumstances make Belarus interesting for an in-depth analysis.

In general, the present chapter is expected to reinforce the assurance of state authorities in the huge influence of HEIs, especially those that have evolved into entrepreneurial institutions. In this context, the entrepreneurial transformation of HEIs is different in each stage of development and governance system. Thus, the Anglo-Saxon model is the most successful and reputable model based on higher levels of competitiveness (Rosenberg, 2003), while the Western European model retains the dominant role of state inside the higher education system (Lazzeretti & Tavoletti, 2005). In regards to developing and transition economies, the main obstacles facing HEI transformation are unfriendly environmental conditions, such

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[4] Own calculation based on the Global Competitiveness Report (Sala-i-Martin & Schwab, 2011)

as lack of financial resources for HEIs to innovate (Tchalakov et al., 2010); ineffective channels for knowledge and technology transfer (Etzkowitz et al., 2000); weak IP protection (Aidis et al., 2008), poorly developed incentive system for HEIs; and negative attitudes toward academic entrepreneurship (Grudzinskii, 2005).

2.5 Conclusions

The acceptance of the crucial roles that knowledge and research play in economic development preconditioned the "second academic revolution," which can be defined as incorporating economic development as the third mission, in addition to teaching and research. As in many other spheres, developing and transition economies lag behind North America and Western Europe in the development of HEIs that are able to accelerate economic and social development. Economic, legal, political, and cultural conditions determine the direction and the speed of HEI development. Consequently, the paths of the evolving vary from country to country.

In this chapter, we have discussed the evolution of the role of HEIs in economic growth and their impact on economic development. Owing to the disparity in environmental factors, the contribution of HEIs to national economies varies considerably across countries and stages of economic development. The results have shown that, overall, both human capital created by HEIs and knowledge capital created/translated to industry have a significant and positive

effect on the economic development of a country. However, when we consider factor-driven, efficiency-driven, and innovation-driven economies separately, the results appear different. Not surprisingly, countries in all stages are able to benefit from human capital with HEI degrees, while HEI research turns out to be insignificant for the development of factor-driven economies in which HEIs are required to be only teaching institutions creating "knowledge for its own sake" (Audretsch, 2014). At the same time, HEIs' entrepreneurial activities matter only in innovation-driven economies in which governments have successfully created an environment that facilitates the development of entrepreneurial HEIs (Clark, 1998).

This chapter contributes to the literature by providing some insights about the impacts of HEIs' missions in different stages of economic development. This research is not exempt from the limitations, which create future research lines. Arguably, HEI patents are not the best proxy for the entrepreneurial mission as its outcomes are multifaceted. Future research may try to capture the entrepreneurship capital, for example, introducing the percentage of TEA (Total Early-Stage Entrepreneurial Activity) with graduate degrees provided by GEM as a proxy. However, the current number of countries for which values of this indicator are available is limited. In addition, panel data should ideally be used for studies on the impacts of HEIs, but it is not possible, as data for many countries are only available for recent years. As the majority of studies are focused on the impact of HEIs and the development of countries, a good research opportunity is to explore these issues in the contexts of developing and transition countries.

The main implications to policymakers is that governments all over the world should be concerned with creating a favorable environment for the transformation of HEIs and their inclusion in systems of innovation in order to convert knowledge and technology into economic growth. In this regard, the next chapter focusses on factors conditioning participation of HEIs in an innovation system of a transition country, namely, Belarus through knowledge transfer and commercialization.

Chapter 3. Conditioning factors of knowledge transfer and commercialization in the context of transition economies: The case of Belarusian higher education institutions

3.1 Introduction

In the previous chapter, we identified that, in each stage of progress, HEIs are able to contribute to a varying degree to economic development. At the same time, many transition economies represent a specific case since, due to the pressures of the transition process, HEIs may follow the Chinese path. This implies that HEIs commercialize preserved knowledge and technology predominantly through consultancy and joint research. This allows experience to be gained learning to cultivate the entrepreneurial culture and raising capital in order to develop research capacity for future high-tech entrepreneurial activities. (Zhou & Peng, 2008). Along with the peculiarities of Belarus mentioned in Chapter 1, this justifies why Belarusian HEIs have been chosen for exploring factors conditioning knowledge transfer and commercialization.

In general, the collaboration and knowledge exchange between HEIs and the industrial sector is considered a relevant form of learning alliance, and an essential instrument to speed up technology innovation (Perkmann & Walsh, 2007; Harryson et al., 2008; Radas & Božić, 2009). As it was proved in the previous chapter, such HEI activities are essential for economic development of countries in the innovation-driven and even in the efficiency-driven stages. Consequently, the transfer of knowledge and technology originated from HEIs into valuable economic activity has become a high priority in many policy agendas.

Forms of HEI-industry knowledge transfer and commercialization have been explored in the context of the United States (Agrawal & Henderson, 2002; Powers & McDougall, 2005), the United Kingdom (Lockett et al., 2003; Howells et al., 2012) and Continental Europe (Caldera & Debande, 2010). In these studies, we can observe that even innovation-driven European economies can be seen to be facing the so called "European paradox" therein the wide gap between high levels of R&D performance and their minimal contributions to industrial competitiveness and development are attributed to weak science-industry links (Debackere & Veugelers, 2005) and a relatively low enterprises' propensity to innovate (Dosi et al., 2006). In transition economies, which have lower levels of productivity, this problem seems to be more acute (Inzelt, 2004). In addition, the Soviet heritage preconditioned the pattern of knowledge creation and transfer in most of these economies. In addition, the Soviet heritage preconditioned the pattern of knowledge creation and transfer in most of these economies.

As a result, the higher education sector is doubly affected by the local post-socialist institutional transformation and by deeper and longer global transformations (Kwiek, 2001). The macro- and micro-context in most transition economies often works against links between HEI and industrial enterprises and retards the development of sound and relevant innovation systems (Radosevic, 2011). In this context, governments face difficult challenges, such as the development of relevant institutions for collaboration between HEIs and the

industrial sector, as well as the stimulation of demand for HEIs' R&D results from industry, which in turn can promote the involvement of HEIs in the international division of scientific work, and develop an entrepreneurial infrastructure.

There are, however, relatively few studies on determining factors of knowledge transfer and commercialization by HEIs in transition economies.

Hence, the aim of this chapter is to explore the moderation influence of HEIs' origins (socialist or post-socialist era) on the HEI-level factors that condition the knowledge transfer and commercialization.

Adopting the resource-based theory (Amit & Shoemaker, 1993) and institutional approach (North, 1990), this chapter reveals which factors are predictive of two separate measures of the knowledge transfer and commercialization by Belarusian HEIs: revenues from scientific and technological services and the amount of patents granted. Using a sample of 123 HEI-year observations, we test regression models with slope dummies to determine if the effect of HEI-level factors is moderated by the context in which a HEI was established.

The remainder of the chapter is structured as follows: in Section 3.2, we discuss the resources and capabilities influencing the process of knowledge transfer and commercialization by Belarusian HEIs against the backdrop of environmental socioeconomic conditions. Section 3.3 describes the data and methodology employed in the study, while Section 3.4 provides the results of the

regression analysis. In Section 3.5, we discuss the main findings of the study. The final section provides a conclusion and delineates future research lines.

3.2 Theoretical framework

3.2.1 HEI-level factors of knowledge transfer and commercialization

According to Amit & Shoemaker (1993), resources are stocks of available factors owned and controlled by an organization and can be traded, while capabilities are organization-specific processes developed over time to harness resources for goal achievement. Therefore, from the perspective of the resource-based view (Wernerfelt, 1995; Lockett & Thompson, 2001), HEIs need to develop their resources and capabilities if they intend to obtain advantages in knowledge transfer and commercialization. Given the tenets of this theory as applied to contemporary HEIs, several critical types of resources and capabilities are identified in the literature: human resources, financial resources, commercial resources, knowledge creation capability, and reputation, which are described in this section.

Human resources

There is a general consensus on the relevance of human resources to sustainable knowledge commercialization and transfer (UN, 2012). O'Shea et al. (2005) argue that the recruiting and retaining of science and engineering faculty with expert knowledge, skills and talent are of great importance for the

development of relevant knowledge and technology, and faculty members tend to gain financial benefits from their intellectual potential through knowledge commercialization (Zucker et al., 1998). Simultaneously, some academics point out the importance of faculty leaders with entrepreneurial and managerial capabilities (Powers & McDougall, 2005) who are able to recognize market opportunities, to orchestrate resources and to manage multi-functional teams (Guerrero et al., 2014), in order to translate HEIs' knowledge and technology into viable products and services. Therefore, HEIs should embody a wide range of human skills, capabilities and expertise in order to succeed in knowledge transfer and commercialization as empirically corroborated by many academics (Di Gregorio & Shane, 2003; Guerrero & Urbano, 2012). In addition, evidence of the role of human resources in HEI knowledge transfer performance are provided in studies focused on developing countries, where faculty members are strongly encouraged, on the one hand, to attract external funding (Nkamnebe, 2009) to HEIs and, on the other hand, to be consultants for enterprises in order to help them take on board new knowledge and technologies (Zhou & Peng, 2008).

In this perspective, it is expected that, in transition economies, the effect of human resources on knowledge transfer and commercialization is similar, but preconditioned by the specific context. Thus, HEIs that were established in the Soviet era have preserved, to a greater or lesser extent, their human resources since research budgets have been predominately spent on wages (Yegorov, 2009).

Therefore, faculty members became the main if not only asset of these HEIs. However, the age structure of the academic personnel in the pre-1991 HEIs is substantially deteriorating (Djarova, 2011) since the higher education sector is not attractive for young people due to a low level of wages, lack of academic freedom and blurred career opportunities. This tendency jeopardizes the potential of R&D and knowledge commercialization. Additionally, a considerable number of academics do not conduct research, or at least not research relevant to national science and industry. At the same time, HEIs established after the collapse of the Soviet Union are expected to be more adapted to the transition conditions. As a result, staffing has appeared to be market-driven. Hence it is fair to argue that the context in which an HEI was established can be seen to moderate the influence of human resources on the HEI's success in knowledge transfer and commercialization. In this regard, we hypothesize that:

> *H1. Moderated by the origin of HEIs (socialist or post-socialist), human resources are positively related to knowledge commercialization.*

Knowledge creation capability

The knowledge creation capability of a HEI is one of the most important prerequisites to knowledge transfer and commercialization (Clark, 2001; Antonelli, 2008) since the industrial sector tends to capture and absorb

sophisticated cutting-edge knowledge and technology to gain a competitive advantage (Zaharia & Gibert, 2005). Similarly, state authorities and businesses are convinced that HEIs with a higher research capability can generate knowledge and technology that are more worthy of funding, buying and commercializing (Di Gregorio & Shane, 2003). In the historical perspective, the advances of HEIs in basic biomedical and biotechnological research in the 1960s and 1970s are recognized as drivers of intensive knowledge transfer and commercialization by American HEIs (Mowery et al., 2001). The support for these arguments is provided by Powers & McDougall (2005), who examined the relationship between the total number of citations that a HEI received and knowledge transfer performance. Along the same line, Van Looy et al. (2011) show that the knowledge creation capability of European HEIs expressed in the number of scientific publications is predictive of the performance in three types of knowledge commercialization, namely, patent activity, contract research and the number of spin-offs created by HEIs.

This evidence allows us to suppose that, despite the low international visibility of HEIs representing countries with transition economies as knowledge generation centres (Kwiek, 2012), knowledge transfer and commercialization by HEIs is driven, inter alia, by their capability to redevelop, adapt and create new-to-country knowledge (Varblane et al., 2007). However, we may expect various effects of this capability when we consider separately pre-1991 and post HEIs. In

pre-1991 HEIs, the fraction of basic research into expenditure on R&D is still essential (Belstat[5]). This means that the results of the research activities of such HEIs may give rise to scientific publications but fail to generate knowledge transfer to industry. At the same time, the research agendas of post-1991 HEIs focused mostly on development and services and are set to fulfil the needs of enterprises. Bearing in mind this context, we hypothesize that:

H2. Moderated by the origin of HEIs (socialist or post-socialist), knowledge creation capability is positively related to knowledge commercialization.

Financial resources

The lack of financial resources may challenge the continued legitimacy of HEI as centres of knowledge creation and transfer. These processes require essential funding during development, exploration and exploitation of knowledge (Wright et al., 2008; Rasmussen, 2008; Roessner et al., 2013). Therefore, financial resources are critically important especially in the scientific fields from which marketable knowledge and technology arise (Powers & McDougall, 2005). For example, MIT's success in knowledge transfer and commercialization is attributed

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[5] The information obtained from the data base on R&D provided by the National Statistical Committee of the Republic of Belarus hereafter referred as to Belstat

to its ability to attract large financial resources to fund cutting-edge science and engineering research (O'Shea et al., 2007). At the same time, diversity of funding sources and increasing competition for the relatively fixed pool of public funding create incentives for HEIs and scientists to actively engage in knowledge transfer and commercialization (Bercovitz & Feldmann, 2006). Thus, Coupé (2003) and O'Shea et al. (2005) demonstrate that the size and nature of financial resources allocated to American HEIs influence different forms of knowledge transfer and commercialization such as patents and spin-off creation respectively.

Based on these arguments, it is fair to argue that, in transition economies, the effect of financial resources and state subsidies on knowledge transfer and commercialization should be even more decisive (Sedaitis, 2000; Uvarov & Perevodchikov, 2012) against the backdrop of substantial cuts in public expenditure on the higher education sector in the 1990s. In this way, many research departments and groups at traditional HEIs were forced to expand into services and production activities (Radosevic, 1998). Knowledge and technology commercialization was an acute need. Traditional clunky HEIs originating from the Soviet era, which was characterized by soft budget constraints and orientation of research towards military goals (Yegorov, 2009), have had to emulate with post-1991 market-oriented HEIs, which usually have lower overhead costs and focused R&D portfolio, for limited public financial resources. Therefore, we can assume that HEIs tracing their roots to the Soviet context and those established in the post-

Soviet context differ in terms of harnessing financial resources for generating knowledge that can be transferred and commercialized. Hence, we venture the following:

H3. Moderated by the origin of HEIs (socialist or post-socialist), financial resources are positively related to knowledge.

Reputation

An organization's reputation is considered by consumers and partners as a cue of what they can expect from purchase or cooperation (Fombrun, 1996). Based on that, a favourable reputation is a critical asset for reinforcing a competitive position, especially in the knowledge-based sectors such as the higher education sector (McDonough et al., 1998; Clark, 2001), and for income generation (Shattock, 2004). This strategic asset of HEIs can be developed by historical events (Guerrero et al., 2014), academic diversity, an excellent learning environment, a success of alumni, and an advanced research portfolio (Bramwell & Wolfe, 2008). In this perspective, a high reputation in the case of HEIs broadens the horizon of relations with different stakeholders (Martinelli et al., 2008; Antonelli, 2008) and attracts funding, networks and clients of generated knowledge (Urbano & Guerrero, 2013). Moreover, the reputation of a HEI can be argued to increase the marketing potential of enterprises that use the knowledge and technology

developed at this particular HEI (Mian, 1997). Along the same line, Sine and colleagues (2003) have found that the reputation of an HEI promotes its knowledge commercialization though licensing, while Di Gregorio & Shane (2003) have revealed a statistically significant relationship between the overall academic rating score of graduate schools and another key form of knowledge commercialization which is spin off creation.

Drawing from these arguments, we may expect a similar strongly positive effect of an HEI's reputation on its knowledge commercialization performance in transition economies. As HEIs in these countries hopelessly lag behind their Western counterparts in terms of the availability of resources (Kwiek, 2012), a positive reputation seems to be the only critical asset in an increasingly competitive global knowledge and technology market and in national competitions for scarce funding. Taking into account the historical background of HEIs, we expect that the power of influence of this factor at pre-1991 and post-1991 HEIs is different. Thus, presumably, long-lasting institutional and personal links among HEIs with a Soviet background to governments and the industrial sector can to some extent diminish the effect of reputation. In view of that, we posit that:

H4. Moderated by the origin of HEIs (socialist or post-socialist), reputation is positively related to knowledge commercialization.

Commercial resources

Commercial resources have been recognized in the literature on knowledge transfer and commercialization as complementary resources for the appropriation of research outputs (O'Shea et al., 2005) or, in a nutshell, a diversity of infrastructures, such as business incubators, science parks and technology transfer offices (TTOs), industrial liaison offices, that are expected to facilitate transfer and commercial exploitation of knowledge generated by HEIs (Guerrero et al., 2014). The need for such intermediaries is justified by several inconsistencies between resources and capabilities of HEIs as knowledge producers and those necessary for successful creation of value added through knowledge commercialization. In this perspective, research capability and the absorptive capacity of enterprises are necessary but not sufficient conditions for knowledge transfer and innovation, because academics and businessmen differ substantially in their objectives, values, and even the languages they speak (Uyarra, 2010; Gál & Ptaček, 2011). In view of this, such organizational units may create synergistic networks among HEIs researchers, business managers, and venture capitalists can provide expertise in evaluating markets, writing business plans and team building (O'Shea et al., 2005).

Based on these arguments and employing statistical methods, academics provide evidence that the presence, size and experience of TTOs have a positive impact on different technology transfer activities. Thus, Thursby et al. (2001) revealed that major research HEIs in the USA with larger TTOs were more

successful in licensing, while (Powers & McDougall (2005) brought out the positive relationship between the age of a TTO as a predictor of the number of HEI spin-off companies. With respect to the European context, it was found by Coupé (2003) that a HEI with a TTO would have a number of patents that would be about 45% higher than the same HEI without a TTO.

For HEIs in countries with transition economies, TTOs became a new phenomenon because, in a highly centralized planning system with stable production chains, there was little need for mechanisms of knowledge commercialization and intellectual property rights protection (Yegorov, 2009). The political actions aiming at the encouragement of knowledge and technology transfer by HEIs have now just begun to be more greatly developed (Bajmócy et al., 2010). Since existing innovation systems are still not able to link the knowledge creation capability to knowledge exploitation (Varblane et al., 2007), many HEIs were forced to establish such links by themselves by setting up TTOs. However, traditional HEIs with a Soviet past can still rely on personal networks, long-lasting relationships with large enterprises and lobbying and, consequently, may be less dependent on such structures. With respect to post-1991 HEIs, they had to develop their networks by exploring needs and demand of industry and by providing relevant knowledge and technology in an acceptable form. Therefore, the role of organizational units dealing with technology transfer seems to be critical at these HEIs. In this regard, we hypothesize that:

H5. Moderated by the origin of HEIs (socialist or post-socialist), the presence of a technology transfer unit is positively related to knowledge commercialization.

3.2.2 Conceptual model

On the grounds of the resource-based approach, Figure 3.1 stresses the importance of the certain HEI's resources and capabilities, such as human resources, financial resources, commercial resources, knowledge creation capability, and reputation, as antecedents of the involvement of HEIs in knowledge commercialization (Di Gregorio & Shane, 2003; O'Shea et al., 2005). In addition, based on the institutional approach, we propose that the power of influence of resources and capabilities is different for HEIs established in the Soviet era and those which originated from the transition period. Therefore, the institutional context in which a HEI was set up is included in the conceptual model as a moderator.

Figure 3.1. Conceptual framework
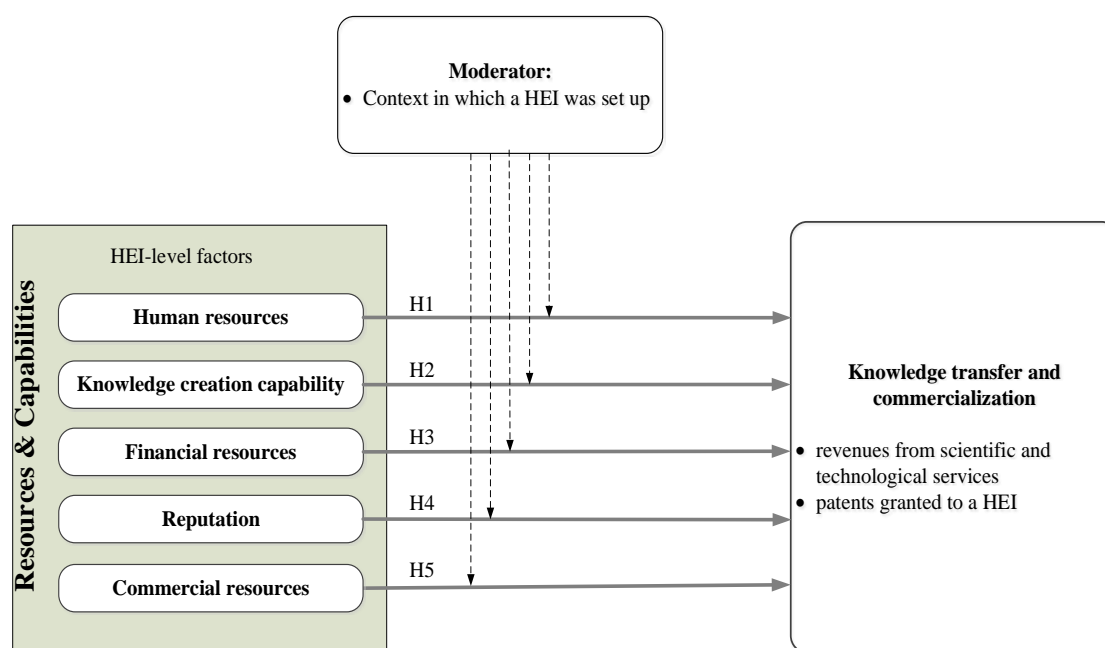
Source: Adapted from Guerrero & Urbano (2012)

3.3 Methodology

3.3.1 Belarusian higher education system

Belarus has a well-developed higher education sector represented by 46 public and 8 private institutions with the student population of approximately 420,000. The HEI are not uniformly distributed across the different regions of the country. Thus, 31 HEIs or about 57% of HEI are located in the capital city – Minsk, which hosts all private HEIs and the majority (76%) of HEIs established in the post-socialist era (Table 3.1). Public HEI institutions offer educational programs at all levels in a wide range of profiles and fields of study thus satisfying demand of the national economy.

Table 3.1. Distribution of Belarusian HEIs

	total	Public	Private	Classical	Technical	Profile	Established before 1991	Established after 1991
Minsk	31	23	8	1	4	26	18	13
Brest region	4	4	0	3	1	0	2	2
Gomel region	7	7	0	1	1	5	5	2
Grodno region	3	3	0	1	0	2	3	0
Mogilev region	4	4	0	2	0	2	4	0
Vitebsk region	5	5	0	2	1	2	5	0
Total	54	46	8	10	7	37	37	17

Source: Ministry of Education of the Republic of Belarus

According to World Bank data, the gross enrolment rate in tertiary education is extremely high, reaching 91% in 2012, while the percentage of the population between 30-34 having completed tertiary education is substantially lower – 28,4% (Belstat). However, it is fair to argue that Belarus has a well-educated labour force in comparison to European and former Soviet countries (see Annex 3.1.). The Belarusian higher education sector operates as a technology infrastructure offering R&D and consultancy services to industrial enterprises and thus compensates for the underdevelopment of the consulting sector (Djarova, 2011).

Belarusian HEIs succeed in patenting. Thus, according to the National Centre for Intellectual Property, about 40% of patents for inventions and utility models are annually granted to HEIs. In addition, HEIs tend to cooperate with the business enterprise sector and other institutions within the scope of governmental scientific and technological programs financed from the budget, while some domestic, predominantly large state-owned and foreign enterprises sign bilateral

contracts with HEIs for R&D and other knowledge-based services such as testing, quality control, measurement and standardizing. Sometimes, such contracts result in the creation of prototypes or short-run production which is performed by HEIs employing their facilities[6].

However, the overhead costs for project realization are seen to be high in many of HEIs (Pobol, 2011). This makes them less attractive to industrial partners. Overall, there are more than 40 different units that belong to the innovation infrastructure of HEIs and the Ministry of Education: techno parks at the Belarusian National Polytechnic University, the Vitebsk State Technological University, Polotsk State University, and the International State Ecological University named after A. Sakharov; innovation centres; technology transfer centres; centres for international scientific and technical cooperation and knowledge transfer and so on. Technology transfer centres and techno parks are usually established as small innovative state-owned enterprises operating in specific preferential conditions (Ranga, 2011); while HEIs are empowered to set up their own technology transfer units.

The aggregate impact of these units is not essential since they are focused mainly on providing consultancy, matchmaking, information and organizational

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[6] According the State Committee on Science and Technology, the Belarusian higher education sector possesses approximately 25% of the total scientific equipment in Belarus

support. There is an extreme lack of intermediaries and institutions providing financial means for setting up innovative enterprises (Djarova, 2011). This notwithstanding, leading Belarusian HEIs have managed to establish some successful academic spin-offs. However, their number is limited and their growth is retarded by the underdeveloped financial market in Belarus. With the exception of information provided on the official web sites of the HEIs, there is no specific and detailed statistical data on spin-off companies from R&D and/or academic institutions at present.

Our analysis of the HEI web sites has shown that there are 32 knowledge-based enterprises affiliated to Belarusian HEIs. For example, within the leading Belarusian institution – Belarusian State University, 6 unitary knowledge-intensive production enterprises operate, the majority of which were established more than 10 years ago. Nevertheless, the prevailing forms of knowledge transfer and commercialization on an institutional basis are contract research and the selling of IP rights (Kaderabkova, 2011).

3.3.2 Data collection

The National Statistical Committee of the Republic of Belarus (Belstat) annually surveys institutes, HEIs, enterprises that perform R&D activity to obtain information pertaining R&D personnel, expenditure, funding etc. For the purposes of our analysis we requested data on R&D activity from 2010 to 2012 for all HEIs

that reported this activity in this period. Thus, our sample consists of 123 HEI-year observations (41 HEIs ×3 years).

3.3.3 Description of variables

Dependent variables

To capture the different approaches of Belarusian HEIs to knowledge transfer and commercialization, we estimated two separate regression models with different dependent variables. Firstly, we considered revenues from scientific and technological services (*Sc_Tech_works*) which means undertaking specific knowledge-based activities, such as scientific and technological consulting, testing, quality control, measurement, standardizing and licensing for external organizations. This indicator is similar to contract research, which is used in literature on academic entrepreneurship and knowledge transfer and reflects the capacity to commercialize HEI's knowledge and research outputs relevant to business development. Along with consulting, it is the most popular form of technology transfer among Swedish, Irish (Klofsten & Jones-Evans, 2000) and British (Martinelli et al., 2008) academics and that may be a more effective way of transferring knowledge and technology to industry, especially tacit knowledge. Contract research is often the first (and most flexible) way to stimulate academics to commercialize their research results (Wright et al., 2007). Engaging in contract research can result in a better understanding of market potential and in the development of adequate business models. As such, contract research might act in

a number of cases as an 'incubation' device, leading to spin off creation (Van Looy et al., 2011). Values of the scientific and technological services rendered by Belarusian HEIs were obtained from the data base provided by Belstat.

Secondly, patents are argued to be a commercial output of HEIs (Rothaermel et al., 2007; Todorovic et al., 2011). We used the number of patents granted to a HEI in each year (*Patents_granted*)[7] as a manifestation of HEIs' provisional intention to commercialize research results through licensing or creation of spin-offs (Antonelli, 2008; D'Este & Perkmann, 2011). According to UN (2012) "the economic rationale for patenting is to obtain temporary monopoly power over the use of an invention and to increase the profits of the patent holder through its commercialization thereby recompensing the patent holder for the investment made". On the one hand, patents are quite commonly used to measure an innovation outcome (Drucker & Goldstein, 2007) and by nature have a strong commercial orientation (Bilbao-Osorio & Rodriguez-Pose, 2004). On the other hand, licensing intellectual property is a valuable way to diversify the revenue base (Goldstein, 2010) and to commercialize the research by creating high-tech spin-

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[7] Since it was argued that a HEI's adherence to patent might jeopardize the willingness of firms to engage with them in contract research (Van Looy et al., 2011), we tested for correlation between two our dependent variables (see Annex 2.2). Patent activity and revenues from scientific and technological services present themselves as positively related at the 0.05 level. Therefore, there is no trade-off between different commercialization mechanisms.

offs or selling IP rights. Moreover, this indicator allows the technology or innovation development function to be separated from their more traditional research mission (Goldstein & Renault, 2004) and is a good measure of the degree to which research results can be immediately applied (Agrawal & Henderson, 2002). Data on patents on inventions and utility models granted to HEIs were obtained from the National Centre for Intellectual Property.

Independent variables

HEIs' human resources were proxied by the number of faculty involved in research and development (*Human Resources*) (Coupé, 2003; O'Shea et al., 2005). HEIs' R&D expenditures per researcher (*Financial resources)* (Van Looy, 2009; Cunningham & Link, 2014) were employed to represent financial resources controlled for HEI research staff. We extracted values of these variables from the Belstat's data base. HEI commercial resources were captured by including a binary variable *(Commercial resources)* (Caldera & Debande, 2010) that was equal to 1 if a HEI had established an organizational unit devoted to knowledge and technology transfer. Otherwise the variable was set to 0. We obtained information about the presence of such units by accessing the web sites of the HEIs. The most common metric to evaluate the research and knowledge creation capability – publication of articles in peer-reviewed journals (*Knowledge creation capability*) (Van Looy et al., 2011) was employed. We extracted the total number of scientific publications assigned to a HEI from the Scopus data base. These absolute figures

were divided by the total number of researchers, in order to obtain an indicator that controls for HEI size. Lastly, we derived a measure of HEIs' reputation from the first Rankings of Belarusian HEIs prepared by the Ministry of Education in 2013. These rankings took into account prestige and recognition of HEIs among applicants for higher education programs. The inverse of the position of a HEI in these rankings (*Reputation*) was included as a proxy for HEI's reputation (Sine et al., 2003; Di Gregorio & Shane, 2003) and was expected to be positively related to the outcome variables.

In addition, and taking into account the institutional transformation after the collapse of the Soviet system, we distinguished between traditional pre-1991 HEIs and post-1991 institutions focused mainly on mass consumption teaching services (Kwiek, 2012). Hence, in order to capture an institutional context, we included a binary variable *(Post_1991)* which was set to 1 for post-1991 HEIs and 0 otherwise.

Control variables

Several control variables were included in the model to capture some important sources of heterogeneity between HEIs, because some other factors might also explain variations in the dependent variables.

There is a consensus among academics that the presence of an engineering and/or technical department stimulates knowledge transfer and commercialization, since it focuses especially on applied fields of research such as engineering and

some natural sciences (Audretsch et al., 2004; Perkmann et al., 2013). In the context of Belarus, where the structure of the R&D system by discipline is strongly dominated by technical sciences (Palacín & Radosevic, 2011), technical orientation of HEIs or the presence of a technical/engineering department seems to be crucial as well. Therefore, we included the presence of a technological/engineering department (*Tech_Department*) as a binary control variable. This information was derived from the HEI web sites.

Next, we added another binary variable taking on the value of 1 for public HEIs and 0 otherwise (*Public*) to test whether private HEIs act more commercially and have closer links with enterprises. An additional variable was inserted to control for the regional context in which a HEI operated because the contributions of HEI-based research tend to be geographically concentrated (O'Shea et al., 2005). In the context of transition economies, regional innovation systems are expected to emerge in capitals or areas with a diversified economic structure (Radosevic, 2002). As HEIs in more competitive regions are generally more productive than those located in less competitive regions (Huggins & Johnston, 2009; MacKenzie & Zhang, 2014), we introduced the regional dummy (*Region*) that is equal to 1 if a HEI is located in the capital city. Alternatively, we inserted business density (*Business_density*) in a region where a HEI was located. Data were obtained from Statistical Yearbooks for 2010-2012 annually published by Belstat.

Finally, HEI's history (O'Shea et al., 2005) was taken into consideration by including the squared age (*Age*) because, over time, HEIs are able to develop their capabilities and networks to facilitate knowledge transfer and commercialization. In this way, a longer track record of teaching and research activities, of links with other research institutions, state authorities and enterprises is conducive to the current performance of HEIs in terms of knowledge transfer and diversification of financial sources through close HEI-industry collaboration (Bernasconi, 2005; O'Shea et al., 2007). In several models, we allowed coefficients for resources and capabilities to be different for post-1991 HEIs to test whether these HEIs perform better in terms of knowledge transfer and commercialization than do older HEIs. For this purpose we inserted the interaction terms of resources, capabilities and the dummy variable for post-1991 HEIs.

3.3.4 Estimation and model specification

We applied two different estimation methods to assess the influence of HEIs' resources and capabilities on knowledge transfer and commercialization. However, we did not use panel data methods, which have several advantages over cross-sectional analysis, because of the limited number of time series and cross sections in our data base (Hsiao, 2003). First, we employed OLS regression techniques with revenues from scientific and technological services measured in million Belarusian Roubles as a dependent variable. Additionally, with respect to the second dependent variable – the amount of patents granted to a HEI - we

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employed a negative binomial estimator because our data takes the form of discreet nonnegative count data with large numbers of zeros (Cameron & Trivedi, 2013).The equations constructed for hypothesis testing are estimated using a set of regression models for both dependent variables[8]. All model specifications in Table 3.2 (OLS) and Table 3.3 (Negative binomial) use the presence of a technological/engineering department at an HEI and the binary variable taking on the value of 1 for public HEIs and 0 otherwise as control variables.

In summary, we tested our model including only the control variables: the presence of a technological/engineering department, the binary variable for public HEIs, business density, and the age of a HEI (M0) in both constructs; a basic model including the resources and capabilities of HEIs as well as the control variables (M1); a model in which we substituted business density to the regional dummy for the capital (Model 2); a model including the resources, capabilities with the exception of the HEI's age, basic control variables and the binary variable for post-1991 HEIs (M3); a set of models allowing coefficients for resources and capabilities to be different for post-1991 HEIs (M4 to M8[9]). In Annex 3.2 we present an overview of the descriptive statistics and results of the correlation analysis. The correlation coefficients between independent variables are low and

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[8] Unfortunately, we could not enter most variables in log form to minimize the influence of outliers because all quantitative indicators contained zeros and logarithmic specification could not be computed.

[9] Our specification in Models 4-8 is equivalent to including the variable of a resource or capability and correspondent slope dummies for post -1991 HEIs

do not exceed the cut-off level of 0.6, which may be a sign of possible multicollinearity (Hair et al., 2010).

3.4 Results

3.4.1 Belarusian context

Belarus is a small, open, catching-up economy with R&D and technological system operating behind the "technology frontier". Therefore, its technology dynamics depend to a significant extent on the absorption of new foreign technology and knowledge (Leo, 2011). Many Belarusian firms, especially SMEs, do not rely on neither intramural nor extramural R&D activities since their competitiveness is based on the availability of relatively cheap resources or the low level of competition in market segments. Before 1991, Belarus was a part of the Soviet Union, which was among the leaders in world science, and had developed large R&D infrastructure oriented mainly towards the armament industry. But it lacked effective mechanisms for the commercialization of research results and market-based relations between research institutes, HEIs and enterprises (Yegorov, 2009). In this way, Belarus inherited a relatively well-developed but unbalanced science and technological system dominated by extramural R&D, and a system of weak incentives based on personal networks (Radosevic, 1998).

The critical institutional transformation accompanied by the substantial cuts in public expenditures on R&D after the break-up of the Soviet Union and the precipitous fall in industry demand for R&D results placed knowledge and technology producers in the "survival mode" (Grudzinskii, 2005). In this situation, many research institutes and research departments at HEIs were forced to expand into services and production activities (Radosevic, 1998; Sedaitis, 2000). As a result, HEIs are still more oriented towards short-term fund-raising than towards a strategic development of strong relationships within the innovation system (Gál & Ptaček, 2011). As in most developed countries, the majority of R&D expenditures are accounted for the business enterprise sector – 69,1%, while for the state organization – 20,9% and for the higher education sector – 10,0% (Belstat). The Belarusian R&D system is characterized by the high share of state funding in the business enterprise sector (see Annex 3.1) which is to a large degree state-owned, while the entrepreneurial sector and entrepreneurial infrastructure are the weakest parts of the National innovation system (NIS) (UN, 2011). Simultaneously, the government tends to exert a strong commercialization pressure on organizations and enterprises that receive state support for R&D. This has already led to changes in the structure of R&D activities towards development and services; to the relative decline of basic and applied research activities (Radosevic, 2011). The Presidential Decree #59 on Commercialization of the Results of Scientific and Technological Activities Created at the Expense of Public Funds (2013) enforces organizations

and enterprises to commercialize the results of R&D activities, with the exception of fundamental research, within a three-year period or to render IP rights to Belarusian organizations on the expiry of this period. This decree can be considered as "Belarusian Bayh-Dole act" since it tends to confer IP rights arising from state funded R&D to an organization obtaining financing.

Meanwhile, the share of R&D expenditures in the Belarusian higher education sector has decreased from 17% in 2005 to 10% in 2012. These expenditures are funded primarily from the state budget, while the percentage of the HEIs' own funds is negligible and accounts for less than 1%. Domestic organizations and enterprises provide approximately 25% of the total HEI R&D funds (Belstat). These figures demonstrate that the Belarusian higher education sector has managed against the odds to establish mutually beneficial relationships with the enterprise sector and to benefit from its own R&D capacity. It is worth noting that the Belarusian authorities and policy makers acknowledge the crucial role of HEIs in the national innovation system. Thus, the State Program for Innovative Development of the Republic of Belarus for 2011-2015 (SPID, 2011) stipulates the active involvement of HEIs in the formation of innovative industrial clusters and the development of infrastructure that is conducive to knowledge and technology commercialization.

These peculiarities have preordained patterns of knowledge creation and transfer by Belarusian HEIs, as well as the conditioning factors influencing these processes.

3.4.2 Revenue from scientific and technological services

Table 3.2 depicts the results of 9 models aimed at calculating the effects of resources and capabilities of HEIs on the revenues from scientific and technological services. The equation appears to be reasonably defined, with significant F statistics and adjusted R squared value of about 30% when we consider the basic model (M1). The human resources [0.259; $p < 0.05$], financial resources [0.208; $p < 0.05$] and commercial resources [0.211; $p < 0.05$] are found to have a significant positive impact on HEI revenues from scientific and technological services. Considering the effects of the knowledge creation capability [-0.185] and reputation [-0.047], the standardized coefficients have the signs opposite to those we predicted, but they are not statistically significant. These results indicate that, in the current economic plight, the availability of limited resources predominantly drives knowledge transfer and commercialization through scientific and technological services. Collinearity statistics indicate no problems of multicollinearity between independent variables as the highest value of variance inflation factor is about 2.12.

In pursuit of the research objectives, we have tested for differences in the impact of the HEI resources and capabilities of post-1991 mainly teaching HEIs

by introducing slope dummies (M4 to M8). It is worth noting that the results of the regression analysis with slope dummies should be interpreted with caution evaluating R square, not the significance of individual coefficients, due to high multicollinearity (Hair et al., 2010). R square in M4 to M8 is estimated to vary between 0.163 and 0.216 which is considerably lower than in the basic model. However, the results of regression analysis provide some additional insights. Thus, unlike M1, M4 has demonstrated that the human resources do not matter in the case of the post-1991 HEIs [0.114]. Although M1 to M3 do not reveal any impact of the knowledge creation capability on economic success in knowledge transfer and commercialization, the analysis allowing the coefficient to be different for post-1991 HEIs shows that the knowledge creation capability has a significant positive impact on "young" HEIs [0.217; $p < 0.05$] (M5). Presumably, this discrepancy is caused by the orientation of pre-1991 HEIs and their matured scientific schools in state-of-the-art basic research that are not demanded and cannot be absorbed by the enterprise sector, while post-1991 HEIs are supposed to adjust their research profile to the needs of industry. Despite the positive effect of the financial resources revealed in the basic model, there is no statistical evidence that the financial resources matter when we consider post-1991 HEIs (M6). The effect of HEI reputation is found to be positive and significant at post-1991 HEIs [0.226; $p < 0.05$] (M7), while long-lasting institutional and personal relationships may be the key factor attracting industrial enterprises to pre HEIs rather than

reputation. It is worth noting that post-1991 HEIs cannot benefit from their commercial resources in terms of revenues from scientific and technological services (M8). In the case of the Belarusian HEIs, as in most other cases discussed in the literature (Powers & McDougall, 2005; Caldera & Debande, 2010), we suppose that the age and experience of commercial units matter.

Table 3.2. Results of regression analysis (OLS)

Dependent variable: Revenues from scientific and technological services									
	M0	M1	M2	M3	M4	M5	M6	M7	M8
Human resources × post1991					0.114 (0.087)				
Knowledge creation capability × post1991						0.217 (0.089)*			
Financial resources × post1991							0.168 (0.093)		
Reputation × post1991								0.226 (0.106)*	
Commercial resources × post1991									-0.088 (0.091)
Human resources		0.259 (0.099)*	0.269 (0.106)*	0.263 (0.098)**	0.277 (0.088)**				
Knowledge creation capability		-0.185 (0.098)	-0.179 (0.102)	-0.166 (0.095)		-0.157 (0.087)			
Financial resources		0.208 (0.085)*	0.207 (0.085)*	0.193 (0.084)*			0.151 (0.088)		
Reputation		-0.047 (0.009)	-0.046 (0.009)	-0.136 (0.009)				-0.056 (0.115)	
Commercial resources		0.211 (0.210)*	0.209 (0.211)*	0.200 (0.208)*					0.265 (0.209)**
Post_1991				-0.146 (0.236)					
Age	0.003 (0.105)	-0.038 (0.105)	-0.061 (0.088)						
Public	0.074 (0.312)	0.010 (0.313)	0.011 (0.312)	0.005 (0.305)	0.004 (0.293)	0.022 (0.300)	-0.026 (0.315)	0.043 (0.324)	0.040 (0.292)
Tech_Department	0.316 (0.174)***	0.224 (0.195)*	0.215 (0.204)*	0.209 (0.191)*	0.245 (0.172)**	0.369 (0.173)***	0.362 (0.173)***	0.326 (0.175)***	0.205 (0.191)*
Business_density	-0.094 (0.102)	-0.034 (0.101)		-0.051 (0.083)	-0.127 (0.083)	-0.074 (0.085)	-0.085 (0.084)	-0.076 (0.085)	-0.047 (0.086)
Region			-0.036 (0.191)						
R square	0.125	0.288	0.288	0.302	0.216	0.182	0.179	0.163	0.176
Adjusted R square	0.096	0.231	0.232	0.247	0.183	0.147	0.144	0.128	0.140
F	***	***	***	***	***	***	***	***	***

Standard errors in parentheses
*** Significant at the .001 level.
** Significant at the .01 level.
* Significant at the .05 level.

In addition, we have made some replacements of the control variables (M2, M3). Thus, if we substitute business density in a region to the region dummy that is equal to 1 if a HEI is located in the capital city (M2), R square remains at the same level. Values of the coefficients do not substantially differ from those obtained in the previous model. This is fair for the M3, in which the age of an HEI is replaced by the binary variable that is set to 1 for post-1991 HEIs. To summarize the results of the regression analysis on M1, M2 and M3, HEIs with more human resources (faculty members involved in research activity), more financial resources (R&D expenditures per researcher) and commercial resources (established TTO) are expected be more successful in knowledge transfer and commercialization through scientific and technological services.

3.4.3 Patents granted to HEIs

In addition to revenues from scientific and technological services, we have performed regression analysis with the amount of patents granted to HEIs as the second dependent variable (see Table 3.3). The same set of models has been estimated.

The basic model (M1) is preferred to the model containing only control variables since the Likelihood Ratio Chi-Square reaches 186.279 with the p-value lesser than 0.001. These indicators signal that this model is a significant improvement comparing to a model without any predictors. In addition to the presence of a technological/engineering department and HEI status, the financial

resources are found to have a significant positive impact on the amount of patents granted [0.412; $p < 0.01$]. HEI reputation has an expected positive influence [0.075; $p < 0.01$]. However, the most confusing finding is that the commercial resources have a significant negative effect on patent activity [-0.690; $p < 0.01$]. That is to say, on average, the establishment of a TTO entails the decrease in the number of patents because such units, arguably, may select only those inventions for patenting that they expect to be relevant and profitable.

Table 3.3. Results of regression analysis (Negative binomial)

Dependent variable: Number of patents granted to a HEI									
	M0	M1	M2	M3	M4	M5	M6	M7	M8
Human resources × post1991					0.925 (0.137)***				
Knowledge creation capability × post1991						0.830 (0.128)***			
Financial resources × post1991							0.769 (0.146)***		
Reputation × post1991								0.023 (0.011)*	
Commercial resources × post1991									-2.942 (0.964)**
Human resources		-0.005 (0.145)	-0.042 (0.151)	0.071 (0.142)	0.095 (0.106)				
Knowledge creation capability		-0.121 (0.147)	-0.151 (0.150)	-0.020 (0.146)		0.071 (0.137)			
Financial resources		0.412 (0.135)**	0.392 (0.137)**	0.399 (0.135)**			0.458 (0.135)***		
Reputation		0.075 (0.013)***	0.076 (0.013)**	0.041 (0.014)**				0.045 (0.014)**	
Commercial resources		-0.690 (0.268)**	-0.625 (0.278)*	-0.708 (0.282)*					0.105 (0.241)
Post_1991				-1.243 (0.450)**					
Age	0.099 (0.155)	-0.159 (0.125)	-0.129 (0.106)						
Public	4.370 (0.817)***	2.701 (0.893)**	2.744 (0.897)**	2.590 (0.828)**	3.677 (0.793)***	3.619 (0.791)***	2.997 (0.804)***	2.940 (0.824)***	4.491 (0.803)***
Tech_Department	1.434 (0.201)***	2.822 (0.291)***	2.806 (0.291)***	2.466 (0.325)***	1.359 (0.212)***	1.505 (0.205)***	1.849 (0.225)***	2.009 (0.265)***	1.298 (0.236)***
Business_density	0.227 (0.152)	0.041 (0.135)		-0.008 (0.137)	0.182 (0.137)	0.253 (0.141)	0.112 (0.132)	0.208 (0.139)	0.318 (0.145)*
Region				0.187 (0.251)					
Likelihood Ratio Chi Square	121.938 ***	186.279 ***	186.742 ***	192.360 ***	161.847 ***	154.939 ***	168.955 ***	167.329 ***	130.139 ***
Log pseudo likelihood	-447.011	-414.841	-414.609	-411.800	-427.057	-430.511	-423.503	-424.316	-442.911

Standard errors in parentheses
*** Significant at the .001 level.
** Significant at the .01 level.
* Significant at the .05 level.

Notwithstanding the multicollinearity usually inherent in models with slope dummies, M4 to M8, in which we explore the impacts of resources and capabilities at "young" post-1991 HEIs, reveal extra meaningful relationships. Thus, the human resources [0.925; p < 0.01] (M4) and the knowledge creation capability [0.830; p < 0.001] (M5) are positively related to the amount of patents granted to post-1991 HEIs. We tend to explain these findings by the more parsimonious employment policy of the post-1991 institutions and forced application-oriented research agendas. The financial resources (M6) and reputation (M7) remain positively related to the outcome variable when we consider only post-1991 HEIs. It is worth noting that the regression coefficients in M6 [0.769; p < 0.001 and 0.458; p < 0.001] show that financial resources are more critical in the case of post-1991 HEIs, which may not have an experience of performing R&D in the "survival mode" of the 1990s. Surprisingly, the impact of the availability of commercial resources is significant and negative [2.942; p < 0.01] for "young" HEIs. The focus of commercially oriented units on other activities to transfer and commercialize knowledge and technology such as knowledge-intensive services may be a possible explanation of this paradox.

The results of M3, which has the highest value of the Likelihood Ratio Chi-Square – 192.360, are noteworthy as well. Thus, M3 evinces that HEIs originated in the post-socialist period are on average less successful in patenting [-1.243; p < 0.01]; whereas M1 and M2 show that the age of a HEIs does not matter.

3.5 Discussion

By means of the sets of linear and negative binomial regression models, we have analysed the influence of the HEI's resources and capabilities on two different proxies of knowledge transfer and commercialization. The results are summarized in Table 3.4.

Table 3.4. Summary of the analysis

Factor	DV: revenues from scientific and technological services			DV: Number of patents granted to a HEI		
	Basic model		Post-1991 HEIs	Basic model		Post-1991 HEIs
	Expected	Obtained		Expected	Obtained	
Human resources	+	+ *		+		+ ***
Knowledge creation capability	+		+ *	+		+ ***
Financial resources	+	+ *		+	+ **	+ ***
Reputation	+		+ *	+	+ ***	+ *
Commercial resources	+	+ *		+	- **	- **
*** Significant at the 0.001 level.						
** Significant at the 0.01 level.						
* Significant at the 0.05 level.						

The empirical analysis has evidenced that HEI revenues from knowledge-based services and patenting – the prevailing mechanisms of knowledge transfer and commercialization – present themselves as slightly positively related and have different antecedents. In the context of Belarus, the first form reflects the capacity to commercialize HEI knowledge and research outputs relevant to business development, while the second one is a manifestation of an HEI's provisional intention to commercialize research results through licensing or creation of spin-

offs. This is not surprising, as the pattern of statistical significance and the signs of the regression coefficients suggest that a necessary condition for both types of knowledge transfer and commercialization is the presence of a technical or engineering department, which was included as a control variable in all models. With respect to other control variables, if an HEI is public, it is revealed to outperform their private counterparts only in the number of patents granted. Business density in a region in which an HEI is located and even the location in the capital region influence neither revenues from science-based services nor the amount of patents supporting the argument that the role of the SME sector in innovative activities is limited. In terms of the age of HEIs, the models with both dependent variables demonstrate that a longer HEI history does not matter. Although, over time, an HEI can obtain valuable and rare resources and capabilities and, as a result, prosper in knowledge commercialization (O'Shea et al., 2005), older Belarusian HEIs are thought to be more bureaucratic, old-fashioned, reluctant and less nimble in getting involved in knowledge commercialization and academic entrepreneurship. One must not be confounded by the negative and statistically significant coefficient for post-1991 HEIs in M3 when we predict the number of patents. As we mentioned before, these institutions focus mainly on teaching services and on the needs of students rather than on research activities and the needs of academics (Kwiek, 2001).

Overall, the regression analysis has shown that financial resources allocated to R&D are crucial for the HEIs to provide knowledge-based services demanded by industry and to obtain patents. This is consistent with the Western literature on knowledge transfer and commercialization (Powers & McDougall, 2005; O'Shea et al., 2005; Coupé, 2003). However, state authorities should be admonished that rapid growth in spending money on HEIs' R&D will not solve the problem of technological capability and productivity (Varblane et al., 2007) because of the underdeveloped vertical innovation system and other formal and informal constraints such as weak incentives for most actors, imperfect IP legislation and protection, and the stunted entrepreneurial sector.

Interesting results have been obtained from models with the slope dummies for post-1991 HEIs. Thus, if we consider separately the financial resources of post-1991 HEIs when predicting the revenues from scientific and technological services (M6), the variables are not predictive, whereas it has a positive significant relationship on the number of patents (M6). Comparing these results with the outputs of the basic models, we argue that post-1991 HEIs do not substantially differ in terms of transforming financial resources into commercial output. At the same time, the knowledge creation capability expressed in the number of papers published per researcher is not related to the dependent variables if we consider all Belarusian HEIs – something that is at odds with evidence from Western countries (Di Gregorio & Shane, 2003; Powers & McDougall, 2005). These findings may

suggest that HEIs whose faculty members publish in top scientific journals are focused on basic research, outputs of which may be not relevant to patenting and industry-demanded services (Caldera & Debande, 2010). These outputs usually outstrip the needs of Belarusian large state-owned industrial enterprises tracing their roots to the Soviet times, while the entrepreneurial sector remains underdeveloped. Moreover, in catching-up economies, the role of the HEIs in industry development centres mainly on the adaptation and redevelopment of existing foreign technology, but not on creating cutting edge knowledge that may result in scientific publications (Wu & Zhou, 2012). However, for post-1991 HEIs, the knowledge creation capability appears to be a significant predictor of both commercial outputs that is consistent with the Western literature. A plausible explanation is that the R&D agendas of the post-1991 HEIs are more flexible, application-oriented and adjusted to needs of the industrial sector since these HEIs have no matured scientific schools specializing in fundamental research.

Econometric estimators reveal evidence of the importance of human resources but only for generating revenues from scientific and technological services. We tend to explain this by the fact that more academics may provide the diversity of a research portfolio and have more long-lasting institutional and personal links with the business enterprise sector often referred to as social capital (Shane & Stuart, 2002). Unlike Van Looy and colleagues (2011) who revealed that both patenting and contract research activities of European HEIs were influenced

by the available human resources, we do not find confirmation that the human resources expressed in the number of faculty members involved in R&D are predictive of the amount of patents. The main explanation for this is that the majority of faculty mainly focuses on teaching activities, while their research activities may be manifested in a limited number of non-competitive domestic publications that is necessary to secure a position and to get some additional payments. At the same time, post-1991 HEIs with more human resources involved in R&D demonstrate more intention to commercialize their research output, something that is expressed in the number of patents granted.

The results of the regression analysis concerning the influence of HEI reputation are not identical for the different outcome variables. Thus, more reputable HEIs are found to generate more patents. Surprisingly, HEIs with a higher reputation are revealed not to be more attractive to enterprises as providers of scientific and technological services – again, something that is at odds with evidence from Western countries (Sine et al., 2003; Di Gregorio & Shane, 2003). The plausible explanation for this inconsistency may be that Belarusian industrial enterprises tend to collaborate with regular partners from the higher education sector regardless of their general reputation but because of the specific needs of enterprises and established personal networks. However, post-1991 HEIs must be concerned about their reputation to succeed in both dimensions of knowledge transfer and commercialization because HEIs with a higher reputation are revealed

to receive more revenues from R&D-based services and to obtain more patents. Similarly to Europe and the United States (O'Shea et al., 2007; Guerrero et al., 2014), reputation and prestige may help HEIs to take a share in the quite steady Belarusian R&D market, which is mainly divided among the Academy of Science, R&D institutes and large old-established HEIs.

The most controversial point of our findings is that the commercial resources (TTO or similar organizational units at an HEI) are negatively predictive of the number of patents granted. This is the opposite of our theoretical predictions and contradicts the existing literature on the topic (Thursby et al., 2001; Coupé, 2003; Siegel et al., 2007; Guerrero & Urbano, 2012). Such a negative relationship has been revealed for the post-1991 HEIs. The main explanation for this finding is that some HEIs may pursue a policy of patenting as much as possible to justify public money allocated to them and to demonstrate their research capabilities, whereas the quality and applicability of inventions are not taken into account. In this case, a TTO may act as "the knowledge filter" (Aldridge & Audretsch, 2011; Guerrero & Urbano, 2014) selecting only viable ideas to apply for patents. This implies that knowledge remains uncommercialized by the HEIs creating that knowledge, while entrepreneurial opportunities may arise (Acs et al., 2009). Additionally, TTOs may focus on other activities to transfer and commercialize knowledge and technology such as contract research and other knowledge-intensive services. This suggestion can be supported by the positive relationship

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between the commercial resources and revenues from scientific and technological services. Firstly, the HEIs established in the Soviet era, which was characterized by the lack of effective mechanisms for commercialization of research results and market-based relations between research institutes and enterprises (Yegorov, 2009) had to adapt their behaviour and values to the socio-economic changes by creating intermediaries between the HEI science and enterprises which can potentially commercialize the results of research. Secondly, the question of the "quality" of a TTO arises (Chapple et al., 2005). Moreover, it takes time to establish a portfolio of invention, expertise, patents and to sell licenses or to render knowledge-based services (O'Shea et al., 2005). This concern might be addressed by including indicators such as the age, size or productivity of a TTO (Powers & McDougall, 2005; Caldera & Debande, 2010), but, unfortunately, this data is not available.

To conclude, notwithstanding the statistical significance of the models constructed, their explanatory power is not high (expressed in the value of R square in ordinary least-square regression models). This implies that there are other "hidden" factors influencing HEI success in knowledge commercialization.

3.6 Conclusions

As in all countries with transition economies, Belarusian HEIs lag behind their Western counterparts in terms of knowledge creation and transfer. This can be explained by the Soviet heritage and imperfect institutional environment (Gál & Ptaček, 2011; Kwiek, 2012). The overestimation of the role of R&D in innovation systems and economic development determines the skew of the policy measures towards the allocation of resources and implementation of research output. Directions of innovation policy such as promoting the links and interactions between science, businesses, education, and infrastructure, creating incentives for knowledge commercialization often remain neglected. Similarly, Belarusian HEIs have to overcome the same obstacles to the effective knowledge transfer process as European and American HEIs, such as informational and cultural barriers between HEIs and firms, insufficient rewards and incentives for involvement in knowledge transfer and commercialization (Franklin et al., 2001; Siegel et al., 2007), and the lack of the absorptive capacity of the business sector (Uyarra, 2010). At the same time, the role of HEIs in catching-up economies should be searching for, adapting and utilizing knowledge produced outside those countries (Varblane et al., 2007).

Consequently, this chapter is expected to contribute to the literature by demonstrating which resources and capabilities drive the commercialization of research results by HEIs in a country with a transition economy, namely in Belarus. To the best of our knowledge, the chapter is the first empirical attempt to explore

knowledge transfer and commercialization activities in the new context of post-Soviet countries. Therefore, the present chapter is expected to reinforce the assurance of the Belarusian state and HEI authorities in the importance of certain drivers in the success in promoting knowledge transfer and commercialization and to emphasize the role that HEIs could play in the national innovation system.

The first finding of our research is that, in the current economic plight, the availability of limited resources predominantly drives knowledge transfer and commercialization through scientific and technological services. The set of regression models with moderators have brought to light the essential differences in conditioning factors for post-1991 HEIs. Thus, pre-1991 and post-1991 HEIs do not substantially differ in terms of transforming financial resources into commercial outputs. The knowledge creation capability appears to be a significant predictor of both measures of knowledge transfer and commercialization at post-1991 HEIs. Interestingly, only the post-1991 HEIs must be concerned about their reputation to be more attractive to enterprises as providers of scientific and technological services because Belarusian industrial enterprises often tend to collaborate with regular partners from the higher education sector regardless of their general reputation owing to the specific needs of enterprises and established personal networks. The most controversial point of our findings is that commercial resources (the presence of a TTO or similar organizational units) at an HEI is negatively predictive of the number of patents granted - something which is at

odds to our theoretical predictions. The main explanation is that TTOs may select only viable and needed ideas to apply for patents or may focus on other activities to transfer knowledge and technology such as contract research and other knowledge-intensive services.

In general, policy makers in transition economies have to tackle the problem of rigid higher education system inherited from the Soviet period. In the context of Belarus, the Soviet legacy is still apparent and manifested in the lack of academic freedom in developing academic plans and research agendas. At the same time, HEIs have made noticeable strides towards an adaptation to the pressures of market economy and globalization and towards a broader involvement in the NIS and socio-economic development. We argue that Belarusian HEIs need to be more pro-active and entrepreneurial in commercializing research outcomes, discovering new ways and forms of academic entrepreneurship, such as spin-off creation, because of relatively low demand for state-of-the-art knowledge and technology from the entrepreneurial sector. By the same token, the Presidential Decree #59 on Commercialization of the Results of Scientific and Technological Activities Created at the Expense of Public Funds (2013) – "Belarusian Bayh-Dole act" – tends to confer the IP rights arising from state funded R&D to organizations obtaining financing. This legislative initiative is of great importance since HEI R&D expenditures are funded primarily from the state budget (66%), while the percentage of HEIs' own funds is negligible and accounts for less than 1%

(Belstat). Simultaneously, HEIs are required to make striking changes in their organizational structure, incentive system, culture, and values. A greater autonomy for HEIs will be needed to diversify research portfolio and to better match market demand (Wu & Zhou, 2012). In addition, technology transfer units, business training facilities as well as consulting offices and business incubators at HEIs are required to form a part of the important but still underdeveloped entrepreneurial infrastructure. Therefore, the next chapter is devoted to antecedents of entrepreneurial activities and environment at Belarusian HEIs.

However, reforms in the higher education system of the transition economies are incomplete and marginal if they are not accompanied by reform of the whole public sector and institutions (Kwiek, 2001; Gál & Ptaček, 2011). At the same time, the experience of American and European HEIs has demonstrated that, in the knowledge-based society, there can be no alternative to close cooperation with government and businesses and to commercialization of educational and research activities.

The research is not exempt from limitations, which create future research lines. Apparently, there are other formal and informal factors (North, 1990; North, 1991) influencing the success of HEIs in knowledge commercialization in the context of transition economies (Aidis et al., 2008). The HEI-government affinity, weak incentives for knowledge commercialization and reliance on personal networks are thought to be essential antecedents in the context of Belarus and other

countries with transition economies. The impact of these factors can be explored by conducting a deep multiple case studies since there are no adequate indicators capturing all the drivers of knowledge commercialization by Belarusian HEIs. Another research opportunity can be pursued by exploring the entrepreneurial orientation of the Belarusian academic community through a survey similar to that designed by Todorovic et al. (2011) and Guerrero & Urbano (2014). In addition, future quantitative and qualitative studies may focus on the activities of TTOs and other similar units established by HEIs to identify their role in knowledge transfer.

It is worth noting that the changes in the statistical forms, which were made by Belstat in 2012-2013, will be able to provide additional data relevant to research on knowledge transfer and commercialization and HEI-industry collaboration. Therefore, we have an intention to obtain more data for a longer period to apply statistical methodologies of the panel data analysis.

Chapter 4. Organizational and environmental factors that condition entrepreneurial activities at HEIs: Experiences and challenges at the Belarusian State University

4.1 Introduction

As was argued in Chapters 1 and 2, going beyond the scope of teaching, knowledge generation and dissemination, HEIs transform themselves into entrepreneurial organizations and are expected to contribute to developing entrepreneurial thinking, values, action, and institutions (Gibb, 2012; Guerrero & David, 2014). Therefore, stimulating entrepreneurship inside HEIs and the consequent development of entrepreneurial HEIs against the backdrop of global reduction of governmental financial support (Kwiek, 2001) is one of the current foci of academics, HEI authorities and policy makers from all around the world. At the same time, in Chapters 2 and 3 we observe that the activities of Belarusian HEIs are mainly oriented to teaching and research. Based on that, in this chapter we continue exploring how Belarusian HEIs are linked to entrepreneurial activities.

While the recent literature on this phenomenon has focused on HEI knowledge transfer (Bercovitz & Feldmann, 2006; Wright, 2014), HEI spin-offs (Benneworth & Charles, 2005; Hayter, 2013), academic entrepreneurs (Prodan & Drnovsek, 2010; D'Este & Perkmann, 2011), and entrepreneurship education (Fayolle et al., 2006; Varblane & Mets, 2010), investigating the role of a HEI organizational and environmental factors in fostering entrepreneurial activities still provides relevant research opportunities (Hsu et al., 2007; Coduras et al., 2008; Busenitz et al., 2014; Guerrero & Urbano, 2014). In particular, contemporary HEIs

have to be facilitators of the creation of entrepreneurial attitudes, mindsets and intentions rather than only providers of entrepreneurial knowledge and skills (Schulte, 2004; Toledano & Urbano, 2008).

Observing the role of HEIs in promoting entrepreneurship and creating entrepreneurship capital in the USA and Western Europe, policy makers in many countries with transition economies have realized that such entrepreneurial transformation at HEIs is needed to respond to the challenges of the global knowledge economy (Kwiek, 2008; Uvarov & Perevodchikov, 2012). However, unlike many Western higher education systems, HEIs in post-Soviet economies are being transformed not by state actions, but, paradoxically, by state inaction (Shattock, 2004). Therefore, responding to the changes in global and domestic post-Soviet socioeconomic conditions has required from HEIs new kinds of resources, capabilities, forms of management and approaches to teaching, research and entrepreneurial activities.

Although many studies have advanced the understanding of HEI-level factors shaping HEI entrepreneurial environment and thereby promoting entrepreneurial activities of the HEI community (Rothaermel et al., 2007; O'Shea et al., 2008; Markuerkiaga et al., 2014; Guerrero et al., 2014), there are relatively few studies on these issues in the context of transition economies. This creates a research opportunity in conducting a detailed study. Hence, the aim of this chapter

is to explore the influence of certain organizational and environmental factors on entrepreneurial activities of students and alumni in the post-Soviet context.

In this regard, we use prior research on the topic and adopt a basis of the resource-based theory (Amit & Shoemaker, 1993), the institutional approach (North, 1990; 1991), the Theory of Planned Behavior (Ajzen, 1991; 2002) and the Social Cognitive Theory (Bandura, 1986; Bandura, 1997) in order to achieve this objective. Methodologically, we combine the case study methodology and the regression analysis to embrace two levels of analysis: organizational (a HEI) and individual (students and alumni) levels. Based on the previous research, in this chapter we explore the entrepreneurial activities of a Belarusian HEI using two proxies: (i) the entrepreneurial intentions of students and (ii) the entrepreneurial actions of alumni. In particular, we focus on the Belarusian State University (BSU) – one of the leading and most reputable classical HEIs in post-Soviet countries[10]. Its case seems to be relevant and interesting because, despite formal and informal institutions unsupportive of entrepreneurship in Belarus (Ivanova, 2005; Miazhevich, 2007), the BSU demonstrates several characteristics of HEIs with an entrepreneurial environment such as an expanded developmental periphery and a diversified funding base (Clark, 1998).

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[10] BSU takes the 2nd place in the Interfax Rankings evaluating 405 HEIs from the Commonwealth of Independent States, Georgia, Latvia, Lithuania and Estonia; is ranked 491-500 by the QS World University Rankings; takes the 1st position in the National Rankings developed by the Ministry of Education.

The chapter proceeds as follows: in Section 4.2, we discuss organizational and environmental factors influencing the entrepreneurial activities of HEIs. Section 4.3 describes the data collection and analysis methods, while, in Section 4.4, we provide results of the qualitative and quantitative analysis. Afterwards, Section 4.5 integrates and discusses main findings and propounds several initiatives to be implemented at BSU to develop entrepreneurship-friendly environment at the HEI level. The final section provides a conclusion and delineates future research lines.

4.2 Theoretical framework

4.2.1 Organizational and environmental factors that condition entrepreneurial activities at HEIs

As it was explored in Chapter 3, there are several organizational and environmental factors (O'Shea et al., 2007; Rothaermel et al., 2007; Zhou & Peng, 2008; Guerrero et al., 2014) that influence entrepreneurial activities of HEIs. In the same vein, based on the existing literature and for the purpose of this chapter, we focus on (i) HEI resources, (ii) HEI governance and leadership and (i) entrepreneurship education.

Human resources with expert knowledge, managerial skills, talent, and characteristics of leaders, who are able to recognize market opportunities, to orchestrate resources and to manage multi-functional teams, lead to converting

HEI competences, knowledge and technology into viable products and to closer HEI-industry interrelation (Zhou & Peng, 2008; Guerrero et al., 2014). In addition, the availability of office spaces, labs, co-working areas, incubators, science parks and other entrepreneurship infrastructure, which are often regarded as **physical resources** (Clarysse et al., 2005; Urbano & Guerrero, 2013), creates an opportunity to link talent, technology, capital, and know-how. In other words, such infrastructure promotes developing networks among students, academics, venture capitalists, business angels, consultants, and managers, who may facilitate entrepreneurial activities (Souitaris et al., 2007; Solesvik et al., 2013). Diversified sources of **financial resources** are important to attain financial independence from state and, as a result, to be free in conducting an entrepreneurial policy while building links with the external environment (Clark, 1998; Subotzky, 1999). Simultaneously, the scarcity of **financial resources** and inability to obtain external funds retard entrepreneurial activities at HEIs, especially, in developing and transition economies (Nkamnebe, 2009; Uvarov & Perevodchikov, 2012) since there is a gap between knowledge and technology available at HEIs and those demanded by the business sectors. In addition, the importance of **commercial resources** (technology transfer offices and industrial liaison offices) for entrepreneurial activities within HEIs is justified by the need to make a bridge between suppliers of research results (academics and students) and customers (firms, entrepreneurs, business angels) who differ in their objectives, values, and

environments (O'Shea et al., 2008; Uyarra, 2010; Gál & Ptaček, 2011). Therefore, these HEI units, if they have relevant experience and capabilities, may create the HEI-industry nexus and provide networks and expertise in evaluating markets, writing business plans and team building. (O'Shea et al., 2005; Powers & McDougall, 2005).

An appropriate non-bureaucratic **governance and leadership** system of a HEI is believed to be a crucial factor connecting teaching, research and administration functions (Guerrero & Urbano, 2012). This allows for making adequate and quick decisions, implementing entrepreneurial strategy, maintaining HEI dynamism and facilitating incessant innovations (Subotzky, 1999; Clark, 2001; Middlehurst, 2004). In the same vein, the level of decentralization of decision making, operational and strategic responsibility, the power to innovate and take risks may create stimuli and facilitate entrepreneurial activities within HEIs (Liu & Dubinsky, 2000; Gibb, 2012).

Entrepreneurship education is charged with providing individuals with the ability to recognize opportunities; with knowledge and skills to act on them, as well as to increase the willingness of individuals to consider entrepreneurship as a career path (Jones & English, 2004; Kuratko, 2005; Bernhofer & Li, 2014). The rationale behind that is an expectation that more and better entrepreneurship courses and programs delivered by HEIs can result in both the number and the quality of entrepreneurs entering an economy (Matlay, 2008) and creating goods,

services, and jobs (Lange et al., 2011; European Commission, 2015). Ideally, entrepreneurship education should be accompanied with **role models** (O'Shea et al., 2007; Toledano & Urbano, 2008) – fully-fledged entrepreneurs from among academics, staff, students, and alumni. They may serve as role models and mentors to demonstrate the attractiveness of entrepreneurial activities (Siegel & Phan, 2005; Urbano & Guerrero, 2013) and be involved in the educational process and providing support in starting a firm (Hayter, 2013).

4.2.2 Influence of HEI environmental factors on entrepreneurial intentions of students

As we mention in the introduction to this chapter, we explore the influence of a HEI environment on entrepreneurial activities. In this section, we analyze this factor understanding an entrepreneurial activity at an HEI as the entrepreneurial intentions of undergraduate students. Even though this is not the best measure, at the current stage of evolution of entrepreneurship at Belarusian HEIs, we suppose that "intention" can help us to achieve our objective.

In this perspective, previous studies recognized that one of the most adequate models to analyze entrepreneurial intention is the theory of planned behavior (TPB) (Fayolle et al., 2006; Souitaris et al., 2007; Guerrero et al., 2008). According to this theory, intentions to pursue certain behaviors are impacted and shaped by three main factors (Ajzen, 1991; 2002). In particular, (i) the attitude towards behavior is the attractiveness of this activity or personal valuation about

performing behavior; (iii) subjective norms refer to the perceived social pressures from family and friends to carry out an entrepreneurial activity and (iii) the perceived behavioral control measures the perceived easiness and ability of performing an activity.

At the same time, several studies having the TPB as a framework included directly or indirectly some conditions associated with environment (Aidis et al., 2008; Liñán et al., 2011). In this regard, this chapter explores how the HEI's environmental factors directly condition the entrepreneurial intentions of students. Concretely, we measure how undergraduate students perceive whether the HEI environment encourages idea creation and entrepreneurial activities.

In terms of the TPB, the HEI environment may change attitudes and perceived behavioral control of students and thereby influence intention towards entrepreneurship (Lüthje & Franke, 2003; Fayolle et al., 2006; Politis et al., 2012) through teaching, inspiring and developing a positive image of venture creators. Therefore, HEIs are requested to play critical roles in creating an environment that encourages students to bear uncertainty, promotes alertness and risk-taking perception as well as the propensity to evaluate and exploit business opportunities (Solesvik et al., 2013).

P1. Perceived HEI entrepreneurial environment is positively related to entrepreneurial intention of students of BSU

We should admit that, several studies did not reveal the direct effects of subjective norms and environment on entrepreneurial intentions, while these factors can influence attitudes towards behavior and perceived behavioral control (Autio et al., 2001; Liñán et al., 2011). In this connection, we propose and test on the data of BSU a conceptual model that integrates the framework of the TPB and the notion of the influence of HEI environment on students' entrepreneurial intention (Figure 4.1).

Figure 4.1. Conceptual framework of entrepreneurial intention
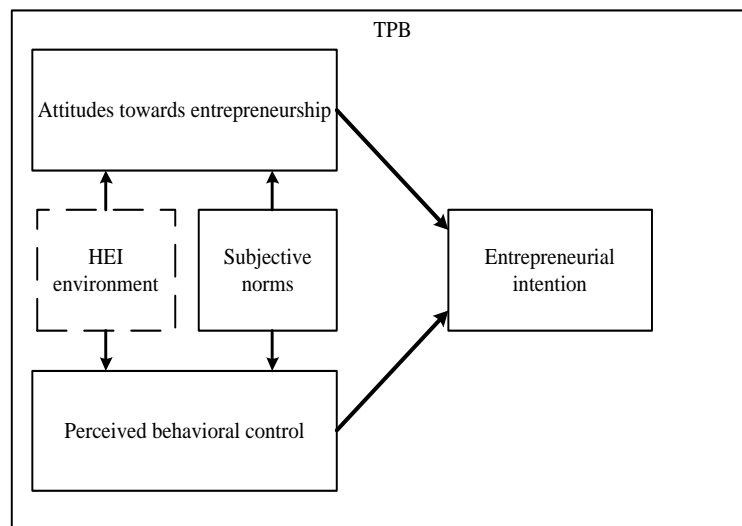
Note: ⌐ ¬ adaptation for the study

Source: Adapted from Ajzen (1991)

4.2.3 Influence of HEI environmental factors on entrepreneurial actions of alumni

The second approximation used in this chapter to analyze the impact of the HEIs' environmental factors on entrepreneurial activity is associated with entrepreneurial actions of alumni. In particular, we understand actions as doing own business. Several studies focused on the entrepreneurial behavior of a person and HEI context explore entrepreneurial activity of alumni because they can provide important insights into the influence of a HEI on their entrepreneurial activities (Hsu et al., 2007; Lange et al., 2011). The rationale behind this is a widely shared belief that it is important to gain some work experience prior to start-up as well as business contacts and the appropriate finance (Carter & Collinson, 1999).

In this regard, we adopt the basis of the Social Cognitive Theory (SCT) (Bandura, 1986; 1997). This theory helps to understand how individuals act based on their perceptions. Ideas of SCT have been applied to many areas of human functioning including learning performance and entrepreneurial behavior (Krueger Jr. & Brazeal, 1994; Hmieleski & Baron, 2009; Lange et al., 2011). In general, the theory explains how decisions are influenced by three elements: (i) self-efficacy, (ii) reward for a behavior and (iii) environment.

In the HEI context, we adopt this model in order to explore how a HEI environment influences the entrepreneurial actions of alumni. In compliance with SCT, the personal determinant reflects whether an individual has high or low self-

efficacy towards the behavior or, in other words, reflects the individual's belief in his/her capabilities to organize and execute action required to manage prospective situations (Bandura, 1989) – that is to say - to perform the roles and tasks of an entrepreneur (Boyd & Vozikis, 1994). The behavioral determinant is the response an individual receives after he/she performs a behavior– reward for a behavior, while the environmental determinant reflects aspects of the environment or setting that influences the individual's ability to successfully complete a behavior (Bandura, 2001). From this perspective, contemporary HEIs can be a fertile and benevolent environment for developing positive image of venture creators, fostering business ideas and transforming them into new firms (Laukkanen, 2000; Guerrero et al., 2014). Therefore, drawing on the role of HEI environmental factors in promoting entrepreneurial activities discussed in previous sections, we propose that:

P2. Perceived HEI entrepreneurial environment is positively related to entrepreneurial behavior of alumni of BSU.

The conceptual model based on the SCT and adapted to HEI environment is provided in Figure 4.2. Thus, we intend to estimate the direct impact elements of SCT adjusted to the HEI context on the entrepreneurial behavior of alumni.

Figure 4.2. Conceptual framework of entrepreneurial behavior
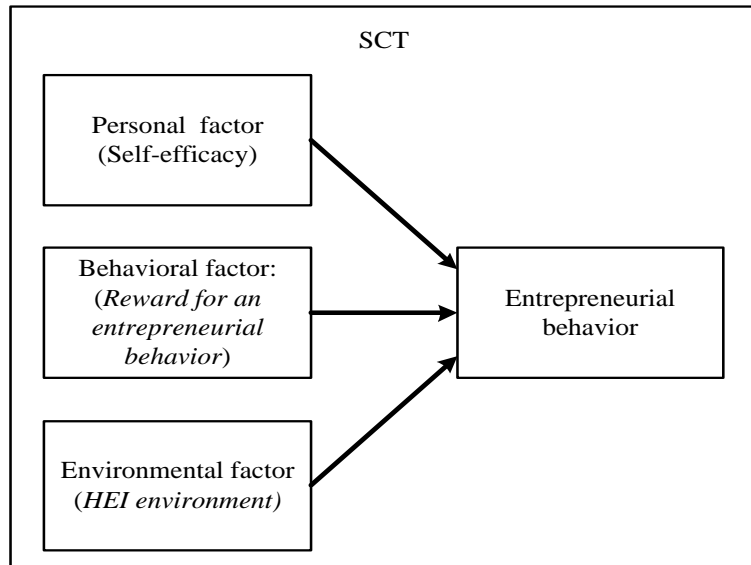
Source: Based on Bandura (2001).

4.3 Methodology

4.3.1 Methodological approach

Due to the complexity of the phenomenon under consideration in the context of transition economies, a case study methodology seems to the most appropriate for our analysis (Eisenhardt, 1989). This approach allows collecting and analyzing in-depth data aimed at developing theory and thereby providing insights to our discussion (Yin, 2014). Specifically, a single case study method with a mixed data collection approach was selected to explore the organizational and environmental factors that condition entrepreneurial activities at the Belarusian State University (BSU). It was chosen as the case because it is the largest and the most diversified HEI in the Republic of Belarus and has relatively rich experience in promoting entrepreneurial activities. The research process

consisted of two steps: qualitative and quantitative. In view of that, during the process of data collection, we gather data using both qualitative and quantitative tools in order to maximize the full potential of a case study design.

4.3.2 Data collection

Qualitative data

First of all, we used different types of secondary data sources, such as annual reports, press releases, project descriptions, statistical reports as well as the websites of the BSU and its organizational units. In addition, face-to-face interviews with several top managers of the BSU were conducted in Fall-Winter 2013. Each respondent was asked about HEI-level factors identified in the previous section as well as about BSU entrepreneurial environment in general and its potential impact on entrepreneurial intentions and actions of students and alumni respectively.

Quantitative data

Student survey

For the purposes of our case study we adapted a version of a questionnaire used in the 2013/2014 Global University Entrepreneurial Spirit Students' Survey

(GUESSS)[11] (Sieger et al., 2014). The web-based survey was conducted at the BSU in November and December of 2013 using the Google Drive platform because of the geographic dispersion of university's campuses and limited resources.

Overall, emails were sent out twice to a population of 4,540 students (about 25% of the total number of students) whose email addresses are available. Of the 4,540 students initially invited to participate, we obtained 363 completed questionnaires. Thus, the resulting response rate of 8.0 percent is relatively high as compared to the average response rate of 5.5 percent in all countries of the 2013/2014 GUESSS (Sieger et al., 2014). After eliminating questionnaires with missing data and those filled by students who were running a business at the moment of the survey, the final sample included 316 university students with a sample error of ± 5.3% at a confidence level of 95%.

Our sample contains more female students – 60.8%, while the majority of respondents seem to be students in the field of Business/Management – 53.2%. Survey respondents were on average 19.41 years old (SD=2.3). A third of respondents (34.5%) have families where at least one of parents was self-employed. General characteristics of the respondents are provided in Table 4.1.

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[11] Belarusian HEIs and BSU in particular did not participate in the survey.

Referring to entrepreneurial intention, 70.9% of respondents reported that they had the intention to become an entrepreneur or successor within a 5-year period after graduation. The description of dependent, independent and control variables used in the analysis of students' entrepreneurial intentions is provided in Table 4.2. In addition, we added interaction terms to expand understanding of the relationships among variables.

We tested the reliability of the proposed scales of independent variables using Cronbach's alpha. The scales are found to be reliable because the values of Cronbach's alpha range from 0.810 to 0.951 (Annex 4.1), while the widely acknowledged threshold level is 0.7 (Hair et al., 2010). In addition, to assess convergent validity of the independent variables we performed factor analysis (Liñan & Chen, 2009).

The appropriateness of the factor analysis is confirmed by the value of the Kaiser-Meyer-Olkin (KMO) index of 0.885 and the significance of Barlett's test of sphericity at the 0.001 level. The factor analysis revealed the existence of four factors with an eigenvalue higher than 1, which account for 79.7% of the variance (Annex 4.1). These results completely confirmed our expectations and measures used by GUESSS (Sieger et al., 2014).

Table 4.1. General characteristics of respondents

	Students		Alumni	
	N	**%**	**N**	**%**
Total number of questionnaires completed	316	100%	**257**	**100%**
Gender:				
Male	124	39.2	83	32.3
Female	192	60.8[12]	174	67.7
Age (average)	19.41			25.2
Parents entrepreneurs:				
Yes	109	34.5		
No	207	65.5		
Field of study:				
Agricultural science, forestry, and nutrition science	1	0.3		
Art, science of art	1	0.3	34	13.2
Business / Management	168	53.2	99	38.6
Economics	22	7.0	13	5.1
Engineering and architecture	1	0.3		
Information science / IT	62	19.6	23	8.9
Law	1	0.3		
Logistics	10	3.2	4	1.6
Mathematics and natural sciences	39	12.3	23	8.9
Medicine and health sciences	1	0.3		
Other social sciences (including education)	10	3.2	61	23.7
Attended at least one course on entrepreneurship:				
Yes	85	26.9	116	45.1
No	231	73.1	141	54.9
Student/alumnus of the School of Business and Management of technology (SBMT):				
Yes	178	56.3	99	38.5
No	138	43.7	158	61.5
Regular job next to your studies:				
Yes	75	23.7		
No	241	76.3		
Intention to become an entrepreneur/successor in a firm within five years after graduation:				
Yes	227	70.9		
No	96	29.1		
Years of work experience (average)			4.3	
Doing business:				
Yes			28	10.9
No			229	89.1
Income higher than an average salary in the country:				
Yes			146	56.8
No			111	43.4

[12] Female are the majority in the population of Belarusian students. According to the Statistical Committee of Belarus, in 2012 female accounted for about 58% students. Seemingly, this percentage is higher if we consider classical (not technical) HEIs.

Table 4.2. Description of variables used for the analysis of entrepreneurial intentions

	Variable	Measure	References
Dependent	Entrepreneurial intention	1 – if a student wants to be either an entrepreneur (founder of a firm) or a successor in a firm of parents or another firm. 0 – otherwise	Lange et al. (2011); Sieger et al.. (2014).
Independent	Entrepreneurial environment at BSU (*HEI environment*)	1. 'The atmosphere at my university inspires me to develop ideas for new businesses'. 2 'There is a favorable climate for becoming an entrepreneur at my university'. 3 'At my university, students are encouraged to engage in entrepreneurial activities'. 1 – not at all; 7 – very much	Sieger et al.. (2014)
	Attitude towards Entrepreneurship (*Attitude*)	1. 'Being an entrepreneur implies more advantages than disadvantages to me'. 2. 'A career as entrepreneur is attractive for me'. 3. 'If I had the opportunity and resources, I would become an entrepreneur'. 4. 'Being an entrepreneur would entail great satisfactions for me'. 5. 'Among various options. I would rather become an entrepreneur'. 1 – strongly disagree; 7 – strongly agree.	Liñan & Chen, (2009), Sieger et al.. (2014).
	Subjective norms (*Norms*)	1. 'How would react student's close family if a student became an entrepreneur'? 2. 'How would react student's friends if a student became an entrepreneur'? 3. 'How would react fellow students friends if a student became an entrepreneur? 1 – very negatively; 7 – very positively.	Liñan & Chen, (2009), Sieger et al.. (2014).
	Perceived behavioral control (*PBC*)	1. 'For me, being self-employed would be very easy'. 2. 'If I wanted to, I could easily pursue a career as self-employed'. 3. 'As self-employed, I would have complete control over the situation'. 4. 'If I became self-employed, the chances of success would be very high'. 1 – strongly disagree; 7 – strongly agree.	Tkachev & Kolvereid (1999); Iakovleva et al. (2011); Sieger et al.. (2014).
Control	Gender (*Male*)	1 – male; 0 – female	Karhunen & Ledyaeva (2010); Packham et al. (2010); Ertuna & Gurel (2011)
	Business/Economics specialties (*Business field*)	1 – Business/Economics students[13] 0 – students of other specialties	Sieger et al.. (2014); Souitaris et al. (2007); Bae et al. (2014)
	Students of SBMT (*SBMT*)	1 – students of SBMT[14]; 0 – students of other faculties.	
	Entrepreneurship courses (*Entrepr. course*)	1 – a student had attended at least one entrepreneurship course; 0 – otherwise.	Hamidi et al. (2008); Packham et al. (2010) Zhang et al. (2014)
	Self-employed parents (*Self-empl. parents*)	1 – a student reported that at least one of parents was self-employed and 0 – otherwise	Toledano & Urbano (2008); Laspita et al.(2012); Dohse & Walter (2012)
	Age squared (*Age squared*)		Liñan & Chen (2009); Hamidi et al. (2008)
	Employment (*Employment*)	1 – if a student was employed; 0 – otherwise	Lange et al. (2011); Liñán et al. (2011).

[13] We assigned to this group students who indicated as their field of study Business/Management, Economics, and Logistics.

[14] Students of SBMT might be better theoretically and practically prepared for doing business and might study in a slightly different HEI environment

Alumni survey

In order to explore the entrepreneurial behavior of alumni we applied a web-based survey using the Google Drive platform (Annex 4.2). It was administered by the Career Development Center of the School of Business and Management of Technology of BSU (SBMT) in July and June of 2014.

The population included 8780 alumni graduated from 1999 to 2014. Thus, during June and July 2014 the link to the anonymous online questionnaire was sent out to 8780 BSU alumni. However, 3548 reports about delivery problems stating that an address did not exist were received.

In total, 268 (5.1%) questionnaire responses were received within the survey period. After eliminating questionnaires with missing data, the sample included 263 university alumni with a sample error of $\pm 6.0\%$ at a confidence level of 95%. For the purposes of our study, we excluded six alumni who continued their study elsewhere and who were on maternity leave. Interestingly, none of respondents was unemployed at the time of filling the questionnaire. As a result, our final sample included 257 BSU alumni. As in the case of the student survey, our sample is overpopulated with alumni of SBMT since its Career Center maintains a more reliable data base. Thus, approximately 37% of respondents obtained their degree in the field of Business Administration. In total, 32.3% of the sample was male and 67.7% female. Alumni were on average 25.2 years old (SD = 2.6) with an average work experience of 4.3 years (SD = 2.7). Approximately

11% of alumni were engaged in business - almost equal to the percentage reported by Scottish alumni (Galloway & Brown, 2002). At the same time, 26.5% reported that they had created a business or participated in business creation. General characteristics of the respondents are provided in Table 4.1. In our sample, approximately 11% of alumni were running their own business.

The description of dependent, independent and control variables used in the analysis of alumni entrepreneurial actions is provided in Table 4.3. In addition, we added several interaction terms to expand understanding of the relationships among variables.

In order to assess the convergent validity of this construct of the HEI environment, we performed factor analysis. The value of Kaiser-Meyer-Olkin (KMO) index of 0.730 and the significance of Barlett's test of sphericity at the 0.001 level confirm the appropriateness of the analysis. Three measures were loaded on one factor as we expected. We tested the reliability of the construct using Cronbach's alpha which appeared to be higher (0.865) than the cut-off level of 0.7.

Table 4.3. Description of variables used for the analysis of entrepreneurial actions

	Variable	Measure	References
Dependent variable	Entrepreneurial action of alumni	1 – if an alumnus reported that he/she was running a business; 0 – otherwise.	Galloway & Brown (2002); Lange et al. (2011).
Independent variables	Entrepreneurial self-efficacy (*Personal: doing business skills*)	The level of doing business skills acquired at the university. 1 – very low; 5 – very high.	Galloway & Brown (2002)
	Reward for an entrepreneurial behavior (*Behavioral: higher income*)	Whether his/her monthly income is above an average monthly salary in Belarus. 1 – yes; 0 – no.	Bandura (2001)
	HEI environment (*Environmental: HEI*)	1. 'The atmosphere at my university inspired me to develop ideas for new businesses'. 2 'There was a favorable climate for becoming an entrepreneur at my university'. 3 'At my university, students were encouraged to engage in entrepreneurial activities'. 1 – not at all; 5 – very much	Coduras et al. (2008); Sieger et al.. (2014).
Control variables	Gender (*Male*)	1 – male; 0 – female	Karhunen & Ledyaeva (2010); Packham et al. (2010)
	Business/Economics specialties (*Business field*)	1 – Business/Economics students[15] 0 – students of other specialties	Sieger et al.. (2014), Souitaris et al. (2007) Bae et al. (2014)
	Students of SBMT (*SBMT*)	1 – students of SBMT[16]; 0 – students of other faculties.	
	Entrepreneurship courses (*Entrepr. course*)	1 – a student had attended at least one entrepreneurship course; 0 – otherwise.	Toledano & Urbano (2008); Packham et al. (2010); Zhang et al. (2014)
	Self-employed parents (*Self-empl. parents*)	1 – a student reported that at least one of parents was self-employed; 0 – otherwise	Toledano & Urbano (2008); Laspita et al.(2012)
	Age squared (*Age squared*)		Liñan & Chen (2009)
	Years of work experience (*Work experience*)		Carter & Collinson (1999); Autio et al. (2001); Dohse & Walter (2012).
	Years after graduation (*Years after graduation*)		

[15] We assigned to this group students who indicated as their field of study Business/Management, Economics, and Logistics.

[16] Students of SBMT might be better theoretically and practically prepared for doing business and might study in a slightly different HEI environment

4.3.3 Data analysis

The utilization of these sources of quantitative and qualitative data enabled methodological triangulation of the case findings and enhancing the validity of the study (Yin, 2014). It is worth noting that, based on the existing literature, we pre-defined antecedents of an entrepreneurial environment at an HEI. This approach facilitated systematic collection and analysis of relevant qualitative data. Annexes 4.3 and 4.4 contain descriptive statistics and correlation coefficients between the variables employed in the subsequent empirical analyses.

Since the dependent variables in both cases take on a value of 1 or, a binary logistic regression model is appropriate for the analysis. Regression scores for each factor obtained from the factor analysis and representing independent variables were introduced in the models. In order to test our propositions on both entrepreneurial intentions of students and entrepreneurial actions of alumni we ran two separate sets of models (Table 4.4 and Table 4.5).

M1 in the set predicting entrepreneurial intentions of students included the main independent variables. In M2, we excluded the binary for a current employment status of a student, because it might be correlated to age squared. In M3 and M4, we substituted the binary variable of Business/Economics students for binary variables for SBMT students and those attended at least one entrepreneurship course respectively. These three variables were entered stepwise to regression models to control for potential instability caused by correlation between them. In addition, we tested several models with interaction terms (M5-M7).

When we tested the probability that an alumnus is running their own business against a variety of HEI-level and individual variables, M1 included the main independent variables.

In M2 and M3, we inserted the number of years of work experience and the number of years after graduation respectively instead of age squared. These variables were introduced stepwise to avoid collinearity problems. In M4 and M5, we substituted the binary variable of Business/Economics students for binary variables for SBMT students and those who attended at least one entrepreneurship course respectively.

4.4 Results

4.4.1 The organizational and environmental factors of BSU

The social, political and cultural contexts of Belarus are characterized by significant government control, lack of transparency and isolation from the Western market economy and from the democratization processes (Miazhevich, 2007), while many management practices, especially in the higher education system, trace their roots to the Soviet times (Rees & Miazhevich, 2009). The higher education system remains rigid and unreformed creating a daunting policy challenge. This sector is represented by 45 public and 9 private institutions with the student population of approximately 420 000. In general, the history of higher education in Belarus has been dominated by the state although many private HEIs were established and liquidated after the break-up of the Soviet Union in the in the early 1990s as a response to the removing of former socialist restrictions concerning the total number of annual students admitted to the HEIs (Tchalakov et al., 2010). The Ministry of Education of the Republic of Belarus has considerable influence on student recruitment regulations, standards of teaching, the curriculum, awarding of qualifications, faculty hiring procedures,

postgraduate and doctoral studies, licensing and certification of HEIs and educational programs at all HEIs (Kuznetsov & Yakavenka, 2005).

According the World Bank data, the gross enrolment rate in tertiary education is extremely high, reaching 91% in 2012, while the percentage of population between 30-34 having completed tertiary education is substantially lower – 28,4% (Belstat). It is worth noting that Belarus does not officially participate in the Bologna Process because the principles and values of the Bologna Process, such as academic freedom, institutional autonomy and student participation in managing higher education, are not being upheld sufficiently in Belarus (Independent Bologna Committee, 2013). This decision will remain valid until 2015[17].

The Belarusian State University (BSU) – the largest educational, scientific and cultural center in the Republic of Belarus – was founded in 1921 and currently is a flagship of the Belarusian higher education sector. It is located in the capital city – Minsk, which accounts for 1900 thousand inhabitants (about 20% of the population of Belarus) and 24% of Belarusian GDP (Belstat).

During the period of the socio-political transformations of the early 1990's, the BSU has been able to successfully develop its potential under new circumstances and contributed to the strengthening the Belarusian statehood and conducting social and economic reforms. Presently, the BSU is an integral complex consisting of academic, research, production, social and cultural, administrative, auxiliary and other units and integrating corresponding activities. The structure includes 17 educational faculties offering programs in 34 study fields at

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[17] According to the decision of European Higher Education Area ministers

bachelor, master and doctoral levels, 8 educational establishments, 7 research and development establishments, 6 scientific-production enterprises, and 2 innovation centers. It is worth noting that the BSU is only Belarusian HEI that owns a business school – the School of Business and Management of Technology (SBMT).

The excellence of BSU in teaching, research and innovation activities is proved by including the university in several international university rankings. Thus, according to the Interfax Rankings[18] evaluating 405 HEIs from the Commonwealth of Independent States, Georgia, Latvia, Lithuania and Estonia, the BSU took the 2nd place in 2013. In 2014, the BSU was for the first time ranked 491-500 by the QS World University Rankings[19]. Finally, the BSU takes the first position in the National Rankings developed by the Ministry of Education.

The BSU employs approximately 7,850 staff members and enrolls over 30,000 bachelors, 600 Master's, 850 PhD students (Figure 4.3).

The research and innovative potential of BSU is attested by its leading position among all Belarusian HEIs in terms of scientific publications in international journals[20] and the third place in terms of patents granted[21].

Figure 4.3. Human resources of BSU

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[18] For further information, please consult http://univer-rating.ru/international/top_rat.asp

[19] For further information, please visit: http://www.topuniversities.com/

[20] According to the Scopus data base

[21] Data were obtained from the National Center for Intellectual Property
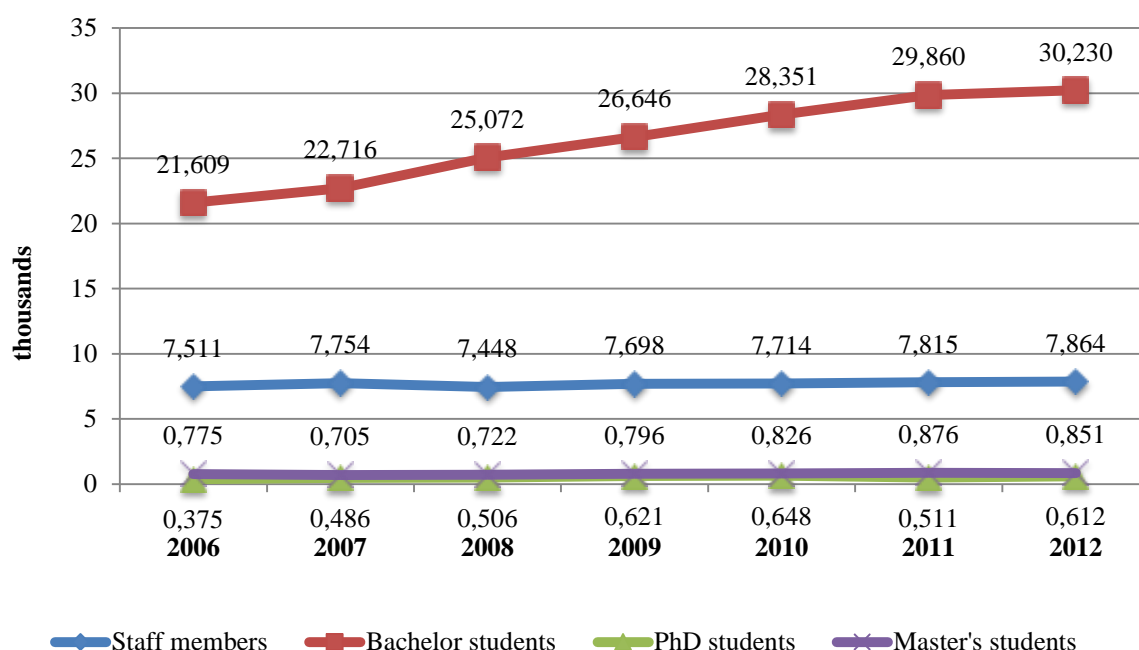
Source: Rector's report

Organizational factors

Similarly to other post-Soviet countries, a massification of higher education took place without much increase in teaching staff or funding (Sangren, 2004). Thus, the number of undergraduate students increased by about 50% from 20,500 in 2001 to 30,200 in 2012, while the teaching staff increased by less than 2 percent (2,500 in 2001, 2,540 in 2012). These figures may imply the decrease of the quality of education and cooperation between students and faculty members. Approximately 45 percent of teaching staff have academic degrees of "Candidate of sciences" or "Doctor of sciences". At the same time, a considerable proportion of faculty do not conduct research, or at least not research close to the frontiers of knowledge production. Employment at BSU as well as at other Belarusian HEIs is not attractive to people with a business and entrepreneurial background since the level of salaries in the Belarusian education sector is substantially lower than in the private sector. Competences of such people

are demanded only in the expensive retraining, advanced training, and MBA programs. Therefore, their contribution to an entrepreneurial environment is limited.

About 400 staff members were involved in R&D activities in 2012, of which about 250 were researchers. In these terms, BSU takes the first place among Belarusian higher education institutions (Belstat). BSU R&D personnel are employed at 4 scientific research institutes, 8 research centers, 3 National research centers, 7 innovative enterprises, 42 scientific research laboratories. The human potential is being harnessed as annually BSU units carry out almost 100 international projects in the frameworks of such programs as INTAC, ISTC, NATO, CERN, UNDP, ENPI, UNESCO, TEMPUS, Erasmus-Mundus and so forth.

Currently, the university complex possesses 174 buildings with a total square of 384.7 thousand square meters. Noteworthy examples of physical resources devoted to idea and technology development are shared use research and technological centers, which provide quite modern scientific equipment and render science-based services. In addition, there are about 40 student research laboratories aimed at involving BSU students in R&D activities in a wide range of scientific areas. Overall, activities of these centers and laboratories encompass only the first – research – stage of the development of university-based enterprises (Vohora et al., 2004) and are not aimed at business incubation.

At the same time, BSU lacks office, networking and co-working spaces for subsequent stages, such as opportunity framing and pre-organization phases. In this context, it is worth noting that BSU puts lecture rooms at disposal of coordinators of the Start-up Technologies[22]

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[22] For further information, please visit the official website: http://startupweekend.by/st/

– the first and most mature Belarusian Center for promotion entrepreneurship; as well as of the IT House[23] – a business incubator for IT ideas, initiatives and projects providing physical facilities, mentoring, networking and fundraising services.

After the breakdown of the Soviet Union, many leading HEIs in the region including BSU started to develop entrepreneurial activities imitating Western HEIs, using various methods of income generation (Sangren, 2004) such as student fees, renting out of facilities, grants from international foundations, short-term courses etc. Following these tendencies, BSU has managed to develop a diversified funding base. Non-budget sources account for about 44 per cent of total revenues in 2012 (Figure 4.4). Tuition fees constitute a major part of revenues – 60.7 per cent, while revenues from R&D activities and production activities account for 13.1 and 26.2 per cent respectively (Figure 4.5).

At the same time, there are no special university funds for the financial support of innovative projects and new enterprises initiated by staff members or organizational units. Every business initiative goes through a long chain of departments that are supposed to be involved in project realization but their participation is usually not rewarded. This often leads to rejecting ideas and projects due to the lack of stimuli and capability of managing new ventures.

Figure 4.4. Sources of revenues of BSU

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[23] For further information, please visit the official website: http://ithouse.by/
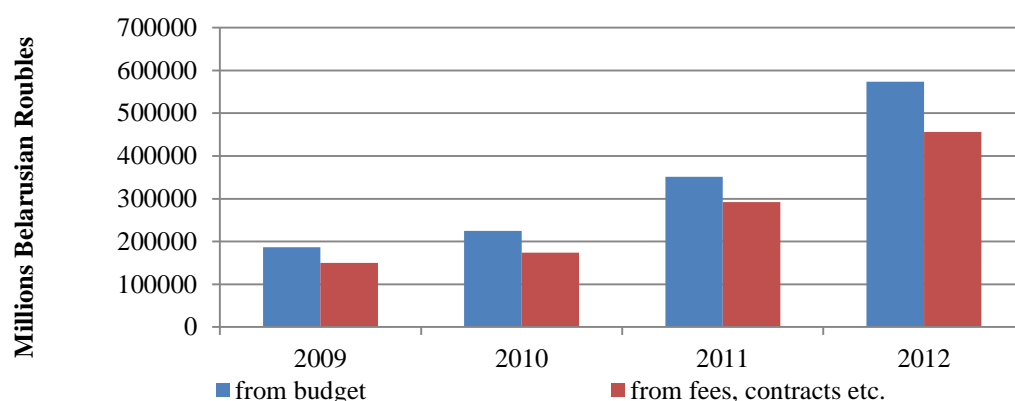
Source: Rector's report

Figure 4.5. Distribution of revenues of BSU
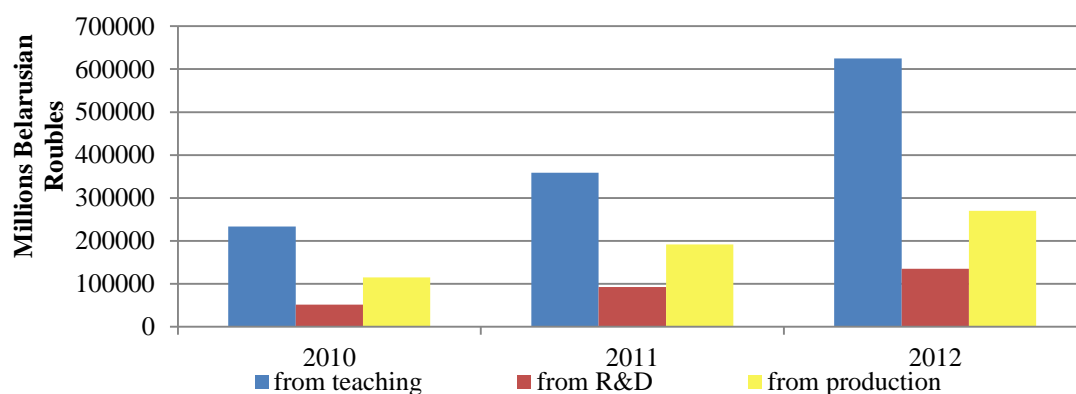
Source: Rector's report

With respect to students' entrepreneurial initiatives, BSU does not provide any financial support or fundraising services. Limited financial resources to facilitate venture creation by students are allocated within the framework of the Tempus project "Inter-university Start-up centers for students' innovations development & promotion" [24].

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[24] 530349-TEMPUS-1-2012-1-FR-TEMPUS-JPHES

Specific organizational units – commercial resources – were set up at BSU to facilitate entrepreneurial activities related to knowledge transfer and commercialization. The Department for Maintenance of Innovative Projects is responsible for examination of business plans, innovative projects and agreements on production development as well as consulting on issues related to the development and implementation of products and services. The Department for Intellectual Property Protection established in 2009 aims at revealing objects of intellectual property, preparing and submitting patent applications, providing intellectual property protection and consulting services on acquisition and transfer of intellectual property. This evidences that BSU has created a formal structure which is expected to lead to the implementation of innovative projects and development of knowledge-based enterprise. However, the activities of the departments are focused mainly on consulting, patenting and promotion, while such crucial functions as market research, evaluation of market value of knowledge and technology, developing strategy, attracting investors and establishing synergistic relationships among BSU units as well as close university-industry networks are neglected. In addition, the aforementioned units tend to rely mainly on internal human resources and do not employ personnel with a business and entrepreneurial attitude, expertise and experience that are argued to be essential for HEI entrepreneurship (Chapple et al., 2005).

Environmental factors

During the Soviet times, all HEIs were parts of the centralized state system and consequently were managed, funded and controlled through a uniform plan (Groudzinski, 2004). In general, HEIs were considered as servants of the state educating a defined number of specialists in certain study fields and conducting research required by industries and

according to state development plans. Therefore, in the 1990s, BSU was enforced to begin internal reforms towards new organizational and managerial structures aimed at promoting the development of educational and research activities. During the transition period, the HEIs, on the one hand, gained more freedom for their own decision-making than they had before. On the other hand, the need for self-development in the new conditions required changes in governance and organizational structure as well as high-quality management and an entrepreneurial style of work. Thus, the lack of governmental funding preconditioned the market orientation of BSU and pushed it to set up new trendy faculties (Faculty of Philosophy, Faculty of Economics, Faculty of International Relations etc.), fee-paying educational programs at undergraduate and graduate levels, training programs for private enterprises, and science-based spin-offs. An important milestone in the history of BSU was the establishment of the School of Business and Management of Technology in 1996, whose task was the providing of training of highly qualified specialists in the field of business management and management of new technologies for working in a market economy.

BSU is directly accountable to the Ministry of Education of the Republic of Belarus, while its Rector is appointed and dismissed by the President of the Republic of Belarus. According to the BSU Statute, the Rector ensures a fulfilment of the BSU Statute appoints and dismisses vice-rectors and the head of the accounting department with the approval of the Ministry of Education, deals with the International Relations activity, appoints and dismisses the heads and other workers of structural divisions of the BSU, and chairs the Academic Council.

As a matter of fact, BSU has a rigid vertical organizational structure (central administration – faculties – chairs). At the same time, during the past two decades, BSU has developed "the expanded developmental periphery" (Clark, 1998) represented by educational establishments, R&D centers and institutes, branches, and innovative enterprises which are more or less independent in decision making and strategy implementing. These units have a certain degree of autonomy to act. Thus, they have separate bank accounts, can purchase and exercise property rights, found affiliated enterprises; have to participate in the academic, research and manufacturing processes, to form a centralized fund of BSU rendering profit at the value not more than 25% remained at the disposal after taxes. In this regard, entrepreneurial forms of management are most likely to be found at these units since they are empowered to keep a substantial part of their income and are enforced to be effective in taking and managing risks to prosper or to survive. On the one hand, such decentralization contributes to increased efficiency through increasing quality and speed of decision making, stimulating local initiatives and promoting leadership. On the other hand, BSU and its peripheral units continue to suffer from the lack of highly-qualified managers with entrepreneurial thinking and attitude at all management level that is a common problem in many transition countries (Sangren, 2004). The vast majority of university managers are appointed from among academics that have no business or entrepreneurial background. Moreover a Soviet style of higher education management prevails. Arguably, these circumstances explain a steady decrease in the number of spin-offs affiliated to the university and the absence of a university strategy or a development plan.

We can conclude that an entrepreneurial vision is missing from the mission statement (Annex 4.5.). An emphasis is put on the preservation of classical HEI traditions while neglecting contemporary processes in higher education and environmental challenges. At the same time, the BSU Statute stipulates that BSU "executes entrepreneurship activities needed for the BSU to accomplish its objectives". In this context, entrepreneurship activities can be interpreted as a necessity to maintain the status quo rather than going beyond traditional boundaries

It is worth noting that the development of a strategic plan is ongoing and is coordinated by one of the vice-rectors. However, from tentative drafts of this plan, we can deduce the entrepreneurial agenda and a necessity to for coordinating, integrating entrepreneurial activities across BSU and a role in building an entrepreneurship ecosystem and generating entrepreneurship capital have not been taken into consideration. Currently, BSU is mainly focused on executing plans and achieving goals that are set by the government. These circumstances can be explained by dominating traditional values and institutions inherited from the Soviet times and immature new market and social institutions (Aidis et al., 2008; Uvarov & Perevodchikov, 2012).

In general, the remuneration and promotion system for academics of BSU does not go beyond current teaching, research and publication criteria, whereas university managers are remunerated if plans developed by the state government for BSU and allocated by university authorities to organizational units are executed. Such a system substantially retards entrepreneurial initiative at the level of departments, educational establishments, research institutes and university-based enterprise. At the same time, staff members are encouraged to

get involved in educational, research and development projects within the scope of state research programs and international programs, such as Tempus, Erasmus Mundus, Jean Monnet and son on..

In comparison with other Belarusian HEIs, BSU can be proud of the entrepreneurship and business education system, which has been developed during the past two decades. From this perspective, SBMT established in the post-socialist era can be considered as a stronghold of entrepreneurship education, while some entrepreneurship- and business-oriented courses are provided at the Faculty of Economics and the State Institute of Management and Social Technologies. SBMT offers a wide range of educational programs at undergraduate, graduate and executive levels. Over 3,500 people have graduated from SBMT, with more than 700 acquiring their Master's Degrees (the first MBA program in Belarus) and Specialist's Degrees in Business Administration and Logistics, over 1,200 completing advanced training courses, and 1500 having improved their professional skills within the scope of retraining programs. We should note that, according to the State Classifier "Specialties and Qualification" of the Republic of Belarus, entrepreneurs are supposed to be trained only in Business Administration programs.

From the perspective of our study, several educational and practice-oriented initiatives of SBMT deserve specific attention. Firstly, SBMT initiated and carried out four Forums of Young Managers – an event providing an open platform for networking that focused on the development of a business environment and the private-public partnership in Belarus and annually gathered about 250-300 entrepreneurs, managers, MBA program alumni, state authorities, and foreign university professors to discuss modern business practices, the

challenges of knowledge-based economy, to promote creating a new business community and business ethics.

Secondly, from the inception of the Business Administration program at the undergraduate level in 2004, students are encouraged by professors to develop down-to-earth business ideas and business plans as parts of curricula or as course assignments and diploma theses. These works are usually highly appreciated. Such a policy enabled SBMT to conduct a business plan contest, whose winners were provided with an opportunity to participate, free of charge and without preliminary expert appraisal, in the main Belarusian start-up event – the Start-up Weekend.

Finally, one of the recent students' initiatives was the creation of the Business Intelligence Club. Coordinators of this educational and networking project from among SBMT students weekly organize meetings with successful entrepreneurs and businessmen, trainings, workshops and debates on business and management topics as well as on elocution and presentation skills.

At the BSU level, the Youth educational club "BRIZ" was established in 2007 with similar objectives and scope of activities. This club has organized more than 10 business forums and trainings for initiative students of BSU involving business leaders and representatives and thereby providing a network platform.

In order to reinforce the role of young people in the innovative development of Belarus, the Center for Systematic Investigation of Problems of Youth was set up in 2006. The first educational project – the School of Entrepreneurship and Management for Youth "Own Business" – was launched. This annual paid five-to-six month program aimed at providing

BSU students with entrepreneurial knowledge and skills through a set of courses such as Marketing, Financial Management, Business Planning, and so on. At the same time, less attention is paid to fostering entrepreneurial attitudes and intentions. At the end of the course, participants are requested to develop and to defend a business plan. The course is outside the main curriculum and, participation is not considered as academic activity.

The Start-up Center of BSU became a successor of the program and one of the outcomes of the SUCSID project financed within the scope of the Tempus program. In April 2014, the first free of charge course on innovative entrepreneurship started. For six weeks participants completed 5 main courses such as Entrepreneurship, Leadership and Team Building, Innovation Management, Business Planning and Intellectual Property Rights Protection. As a result, 6 business ideas were developed, which were highly evaluated by the international Tempus consortium. The next step is supposed to be finding investors to implement these projects. Therefore, it is still impossible to estimate the impacts of the Start-up Center and its sustainability after the termination of the SUCSID project in 2016.

The BSU is an important actor in the promotion of entrepreneurship and start-up development at country level. Thus, along with the Ministry of Education, the Belarusian Innovation Fund and the IT House, the university is one of the coordinators of the annual Republican innovative project contest "Belarus Startup" aimed at promoting innovative ideas, technology and projects in the IT area as well as at developing innovative entrepreneurship and evolving the innovative potential of Belarusian youth.

Nevertheless, the rigorous curricula of natural sciences and IT specialties delivered at BSU are not supplemented with formal and experiential entrepreneurship education.

Innovative methodologies and entrepreneurial approaches to teaching as well as faculty entrepreneurial role models are rare. Moreover, all changes in degree syllabuses need state approval that makes BSU and its educational units less flexible and nimble, while supporting entrepreneurial activity has not been an important part of the culture of the university.

4.4.2 The impact of BSU's environmental factors on students' entrepreneurial activities

Table 4.4 depicts the results of 7 models aimed at calculating the effects of HEI factors and individual on students' entrepreneurial intention. The Hosmer-Lemeshow statistic indicates that the models adequately fit the data since the significance value is substantially higher than 0.05 (Hosmer & Lemeshow, 2004) in all models. The values of Nagelkerke R square, which are interpreted as reflecting the amount of variation accounted for by the binary logistic model (Hair et al., 2010), range from 0.153 to 0.164.

The university environment is found not to be a significant predictor of students' entrepreneurial intentions at BSU in all models. With respect to other predictors, the results provide evidence of the positive relationship between attitude towards entrepreneurship and entrepreneurial intention [0.428; 0.001] as well as between perceived behavioral control and entrepreneurial intention [0.507; 0.001] (M1). These findings confirm TPB (Ajzen, 1991) and concur with previous studies in the field (Souitaris et al., 2007; Coduras et al., 2008; Iakovleva et al., 2011). However, subjective norms appeared insignificant that is at odds with results obtained even in another transition economy – Russia (Karhunen & Ledyaeva, 2010), which is characterized by hostile entrepreneurial environment (Aidis et al., 2008). However, in the entrepreneurship literature, several studies reported no significant relationship between subjective norms and entrepreneurial intention (Krueger Jr. et al., 2000; Autio et al., 2001).

Surprisingly, none of the control variables frequently introduced into empirical studies are positively related to entrepreneurial intention. This may signify that demographic characteristics may affect the dependent variable only to the extent they influence attitude, subjective norms, and perceived behavioral control (Tkachev & Kolvereid, 1999; Carter & Collinson, 1999).

Importantly, we can deduce that Business/Economics students (M2), students of SBMT (M3), and those attended at least one entrepreneurship course (M4) did not report higher entrepreneurial intention in comparison to other students of BSU.

In addition, models with interaction terms (M5-M7) provided additional insights. Thus, a positive value of the interaction between social norms and perceived behavioral control (*Norms x PBC*) in M5 [0.269; p < 0.05] and M7 [0.271; p < 0.05] may imply that the higher a value of perceived social norms is, the greater the effect of perceived behavioral control on student's entrepreneurial intention is. Other interaction terms appeared insignificant.

In general, these results demonstrate that there is no evidence to support the proposition P1 that perceived HEI entrepreneurial environment is positively related to entrepreneurial intention of BSU students.

Table 4.4. Binary logistic regression

DV: Entrepreneurial intention (to become an entrepreneur/successor within 5 years after completion studies)							
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**
HEI environment_factor	0.210	0.213	0.198	0.189	0.194	0.207	0.179
Attitude_factor	0.428***	0.422***	0.409**	0.398**	0.455**	0.402**	0.441**
Norms_factor	0.142	0.142	0.119	0.165	0.213	0.115	0.168
PBC_factor	0.507***	0.503***	0.491***	0.462***	0.562***	0.530***	0.582***
Norms x Attitude					0.055		0.060

Norms x PBC						0.269*	0.271*
Environment x Attitude						-0.067	-0.071
Environment x PBC						0.043	-0.007
Environment x Norms						-0.086	-0.089
Male (1/0)	-0.346	-0.356	-0.295	-0.350	-0.295	-0.358	-0.299
Business field	0.076	0.071			0.142	0.078	0.145
SBMT			0.308				
Entrep. course				0.737			
Self-empl. parents	0.326	0.334	0.316	0.237	0.272	0.326	0.269
Age squared	0.001	-0.001	0.001	-0.001	0.001	-0.001	-0.001
Employment	-0.114						
Nagelkerke R Square	0.154	0.153	0.158	0.172	0.170	0.157	0.173
Hosmer and Lemeshow Test, p-value > .05	0.793	0.873	0.941	0.724	0.389	0.662	0.309

N = 316

*** Significant at the 0.001 level

** Significant at the 0.01 level

* Significant at the 0.05 level

4.4.3 The impact of BSU's environmental factors on alumni's entrepreneurial activities

In Table 4.5 we provide the results of 4 models predicting the entrepreneurial behavior of BSU alumni on the basis of SCP. Although the models adequately fit the data (the significance values of the Hosmer-Lemeshow statistic range between 0.208 and 0.897, Nagelkerke R square range between 0.196 and 0.258), personal, behavioral, and environmental determinants are found not to be significant antecedents of entrepreneurial actions. This means that a perceived level of doing business skills acquired at the university, income higher above average, a perceived HEI environment does not increase the probability of alumni being entrepreneurs.

Table 4.5. Binary logistic regression

DV: Doing Business					
	M1	**M2**	**M3**	**M4**	**M5**
Personal: doing business skills	-0.413	-0.400	-0.462	-0.313	-0.280
Reward for a behavior: higher income	0.409	0.351	0.441	0.551	0.562
Environmental: HEI factor	0.209	0.175	0.275	0.252	0.228
Male	1.712***	1.664***	1.771***	1.693***	1.723***
Business field (Business vs. others)	1.867***	1.973***	1.684**		
SBMT				1.070*	
Entrepr. course					1.024*
Age squared	-0.001			0.001	-0.001
Work experience		0.152			
Years after graduation			-0.120		
Nagelkerke R Square	0.252	0.257	0.258	0.196	0.198
Hosmer and Lemeshow Test, p-value > .05	0.208	0.897	0.609	0.459	0.450

257 alumni

*** Significant at the 0.001 level.

* Significant at the 0.05 level.

Not surprisingly, male alumni are more likely to be involved in entrepreneurial activity. The coefficient is positive and statistically significant at the 0.001 level in all four models that corresponds previous research focused on alumni and in the UK (Carter & Collinson, 1999) and the USA (Hsu et al., 2007). Similarly, we have found evidence that graduation from both Business/Economics specialties [1.867; 0.001] (M1) and SBMT [1.070; 0.05] (M4) increases the probability of running a business by alumni. Thus, drawing on exponentiated coefficients, alumni graduated from a Business/Economic specialty are 5.5 times more likely to become an entrepreneur than their counterparts graduated from other specialties, whereas SBMT graduates are 1.9 times more likely to be engaged in entrepreneurial activity (M4). Likewise, if an alumnus attended at least one entrepreneurship

course [1.024; 0.05], the probability of them running their own business appears to be 1.8 times higher (M5).

M2 and M3 demonstrate that excluding one of the correlated independent variables – age squared, the number of alumnus' years of work experience, the number of years after graduation – does not substantially change regression coefficients and their significance levels.

To summarize, we have not found strong support for the proposition P2, which claims that perceived HEI entrepreneurial environment is positively related to an entrepreneurial actions of BSU alumni.

4.5 Discussion

Our qualitative study demonstrates that, being a leading Belarusian HEI, BSU has at its disposal the necessary human, physical, financial and commercial resources to create a benevolent entrepreneurial environment, but it is not capable and lacks role models to harness these resources for entrepreneurial organization and the fostering of an entrepreneurial attitude and intention among students and faculty. Therefore, in terms of Kirby et al. (2011), the natural incubator does not work since there are no clear and generally accessible mechanisms, procedures and support measures to transform abundant knowledge, ideas and intention into entrepreneurial activities. This can be confirmed by the results of our empirical analysis that the perceived BSU environment is predictive neither of entrepreneurial

intentions of students nor entrepreneurial actions of alumni. Even though there some scattered "entrepreneurial hubs" such as SBMT, the Start-up Center etc., their influence on the university environment is still negligible. Moreover, entrepreneurship as a mission, a part of a strategy or an approach to current activities is not designated at the top management level. Trying to respond to environmental changes, BSU still enjoys its outstanding reputation and state resources mostly available to maintain the status quo – confirming the notion of Clark (1998) that flagships of higher education systems can be more unhurried in transforming their governance, culture and attitudes.

Notwithstanding an unsupportive BSU environment, serious institutional weakness and quite a hostile atmosphere for entrepreneurship in post-Soviet countries in general (Ivanova, 2005; Aidis et al., 2008), students of BSU have a strong level of entrepreneurial intention – 4.6 – if we compare with HEIs from other countries participating in GUESSS in 2013 (Sieger et al., 2014). If BSU represented Belarus in GUESSS, it would be ranked 5th or 6th among 34 countries, while the evaluated level of the entrepreneurial environment would be below average. Interestingly, the students' entrepreneurial intention appears not related to whether or not a student's field of study is Business/Economics, whether or not he/she is a student of SBMT, or whether or not he/she has attended at least one entrepreneurship course. One the one hand, this evidences that business education at BSU in general and at SBMT in particular, and entrepreneurship courses do not perform well in terms of promoting entrepreneurial intentions. On the other hand, when we compare the entrepreneurial actions of alumni, we can deduce that these factors matter. This signifies that, since curricula of the majority of BSU students do not include any entrepreneurship or business courses providing

them at least with some relevant knowledge, the high proportion of potential entrepreneurs is not transformed into entrepreneurship capital (Audretsch, 2014). Therefore, the country loses educated and innovative potential entrepreneurs, who would be able to increase the amount of economic activity and generate value and employment if they were exposed to entrepreneurship education at the HEI level (Todorovic & Ma, 2010; Lange et al., 2011).

In view of that, BSU, as with all Belarusian HEIs, needs to take serious strides to catch up with Western HEIs in terms of creating entrepreneurial ecosystems and thereby being contributors to the socioeconomic development of regions and countries (Bramwell & Wolfe, 2008; Goldstein, 2010). Our qualitative study has shown that BSU has two out of five characteristics of the entrepreneurial HEI proposed by Clark (1998) such as the expanded developmental periphery and the diversified funding base which should be pivots of the inevitable future transformation. Hence, we propose several initiatives to be implemented at BSU to develop an entrepreneurship-friendly environment at the university level.

First and foremost, BSU needs to adopt and coordinate apparent and shared strategy across its critical activities (Guerrero et al., 2014): teaching, research and production to integrate organizational units. A strategic plan should empower entrepreneurial actions, synergies and cooperation among individuals, organizational units as well as university-business relations

Next, peripheral units such as educational establishments and innovative enterprises, which are the most nimble structures, should be treated as contributors to the university development in the broad sense rather than income generators. Moreover, close interrelation among educational, research and production units should be established and stimulated. In

this sense, the presence of the business school is a substantial advantage. As the formation of an entrepreneurial ecosystem and HEI transformation requires skills, competences, attitudes not associated with a traditional HEI community (Siegel & Phan, 2005), BSU should utilize the potential of the SBMT faculty and staff to provide consulting, training and mentoring to individuals and units, to establish relationships with the business sector and to support activities more targeted at supporting university spin-outs and start-ups (Wright et al., 2009).

In the same vein, BSU should be concerned about the development of the periphery. Thus, extensive support (IP management, business planning, marketing, PR etc.) should be given to entrepreneurial teams (including students and alumni) attracting and motivating the participation of existing units. BSU should adopt and implement the Supportive model of spinning out new enterprises (Clarysse et al., 2005) securing sustainability of ventures by providing access to university resources and capabilities. University-based enterprises, in turn, can act as test beds for new idea technologies generated in BSU, as bases for fellowships and internships of students and researchers and as cases for problem-based learning (Klofsten, 2000). In addition, entrepreneurs and entrepreneurial teams could be the best role models for their counterparts (Schulte, 2004).

In addition, BSU should concentrate efforts on providing all members of the academic community with entrepreneurship-specific education to equip them with relevant knowledge and competences as well as with entrepreneurial alertness and risk-taking assets (Solesvik et al., 2013). More enterprising and action-oriented approaches and activities aimed at developing critical thinking, independence and readiness to assume responsibility (Toledano & Urbano, 2008) supplemented with cross-disciplinary projects should gradually supplant

traditional passive methods of education aiming at "feeding" learning material to students (Kuznetsov & Yakavenka, 2005). Therefore, SBMT should play the key role in this process relying on its experience and competences as well as on national and international networks.

Similarly, SBMT can be considered as an umbrella organization integrating and coordinating the entrepreneurship-related activities of organizational units and the university in general (Lazzeretti & Tavoletti, 2005) in pursuit of the BSU strategic goals. A primary task should be to build up synergies between internal and external resources and capabilities.

Another rudiment of the Soviet higher education system that should certainly be pruned is the promotion and remuneration system, which is still focused only on teaching and research activities. As a matter of fact, this system closes the door to people with a business and entrepreneurship background, while such people are of great importance in changing 'the hearts and minds' (Souitaris et al., 2007) of students and colleagues and thereby creating an entrepreneurial environment within the university.

We should admit that BSU is not able to manage such striking changes by itself. Firstly, it needs state approval and support. Secondly, only foreign HEIs that experienced such transformation can draw a road map for the transformation and adaptation to the global knowledge based economy. Consequently, a substantial effort should be made at BSU to participate in international programs and projects targeted at enhancing higher education systems. A great opportunity could be the Erasmus+: Capacity-building projects in higher education, building on the success of the former Alfa, Edu-link and Tempus programs aimed at supporting the modernization and internationalization of higher education.

4.6 Conclusions

The mandate of HEIs to play an active role in fostering entrepreneurial mindsets and intention among the academic community is arguably more critical in the context of post-Soviet economies and, in particular, Belarus, which are characterized by the unsupportive institutional environment and the underdeveloped entrepreneurial sector. At the same time, playing this role, the HEIs need to be flexible, entrepreneurial and innovative something which is often at odds with their governance, promotion and remuneration systems as well as with their values and perceived missions.

In this sense, the main contribution of this chapter consists in demonstrating how organizational and environmental factors shape a HEI entrepreneurial environment in the context of post-Soviet economies and how this environment influences the entrepreneurial intentions of students and the entrepreneurial actions of alumni.

While the entrepreneurial environment and education at the majority of post-socialist HEIs substantially lag behind Western developed economies, policy makers are starting to pay more attention to these issues to use potential of HEIs to create entrepreneurship capital. Thus, the State Programme for Development of Higher Education the Republic of Belarus for 2011-2015 (SPDHE, 2011) stipulates the creation of business incubators at each university to promote a joint innovative and entrepreneurial activity of students and faculty. However, while on the one hand, these plans seem to be unrealistic, on the other hand, there are no clear measures targeted at the development of an entrepreneurial spirit and attitude among HEI community. Consequently, entrepreneurship education appears to be well out of policy agendas.

Against this backdrop, the Belarusian State University is taking substantial strides. Benefitting from the greatest reputation, state support, and international cooperation, the university has managed to develop several attributes to create a sustainable entrepreneurial environment. The general conclusion to be drawn from this single case study is that underdeveloped entrepreneurial and business competences and the Soviet heritage still visible in attitudes and values restrain employing the abundant human and physical resources of BSU to contribute to economic development not only by educating job-seekers but by fostering job-creators and transforming research activity into economic value (Kirby et al., 2011). Nevertheless, as the regression analysis has shown, existing formal business-related education provided by BSU does facilitate an entrepreneurial activity of its alumni that is consistent with previous studies (Martin et al., 2013). Therefore, from a policy perspective, further efforts need to be made to extend entrepreneurship education or some facets of it to all specialties to equip university graduates with the competences, attitudes and motivation for being leaders in innovative development.

We acknowledge that the chapter has some limitations. Firstly, the economic and social environment that is external to the university (Dohse & Walter, 2012; MacKenzie & Zhang, 2014) has remained beyond the scope of our study. Secondly, the size of the both samples used for the quantitative analysis was quite small for such studies. Thirdly, our samples do not match the proportions in the total population of BSU students and alumni in terms of a study field. In view of that, larger samples and proportional quota sampling should ideally be used. Fourthly, we estimated a direct effect of the HEI environment on entrepreneurial intention to make a comparison between its influences on both the students' entrepreneurial

intention and the alumni's entrepreneurial behavior. Finally, our quantitative analyses concentrated only on students and alumni as representatives of one HEI community. Therefore, future quantitative studies may focus on faculty's perceptions of an entrepreneurial environment at HEIs and their entrepreneurial activities (Guerrero & Urbano, 2014) at HEIs of different profiles and at HEIs with the Soviet past and those established in the post-socialist era.

Chapter 5. Conclusions about conditioning factors of the role of HEIs in a transition economy

5.1 Main findings

There is a general consensus that traditional European HEIs will not be able to retain their place in knowledge creation and dissemination and to fit into knowledge-based entrepreneurial society if they do not reconsider their missions and values, are not restructured and are not deeply integrated into the economy (Kwiek, 2008). Frequently, teaching and research activities are not directed to a significant extent towards specific pressing economic and social objectives, while globalization and mass higher education require new kinds of resources and capabilities, new forms of management and leadership and new self-sustainable HEI models (Chatterton & Goddard, 2000; Shattock, 2005; Dooley & Kirk, 2007). At the same time, HEI-industry-government interaction is considered as a key to improving the conditions for innovation and consequent economic development in a knowledge-based society (Redford & Fayolle, 2014). Therefore, HEIs from around the world are increasingly experiencing profound transformations which are shaped by unique institutional settings (Harrison & Leitch, 2010).

HEIs have enormous potential for innovation and growth at least on a national scale, which is manifested in educated students, graduates and knowledge creation and accumulation capabilities. At the same time, HEIs are required to effectively foster entrepreneurial values, mindsets, attitudes among the academic community and mobilize entrepreneurial careers (Markowska, 2014) since the current dynamics of change and the creation of higher degrees of uncertainty and

complexity for governments, organizations, communities and individuals demand entrepreneurship capital (Gibb, 2002; Audretsch & Keilbach, 2004). However, contributing to entrepreneurship capital and supporting entrepreneurial actions are often new tasks for the majority of HEIs, which have to become entrepreneurial and innovative themselves.

Admittedly, as in many other spheres, developing and transition economies, which have not reached the innovation-driven stage, substantially lag behind North America and Western Europe in the development of HEIs that are able to accelerate economic and social development since economic, legal, political, and cultural conditions determine the path and the speed of the evolution of HEIs. Owing to the disparity between these factors, the contribution of contemporary HEIs to national economies varies considerably across countries and stages of economic development. In this regard, our results (Chapter 2) have shown that both human capital created by HEIs and knowledge capital created/transferred to industry have a significant and positive effect on the economic development of a country. However, when we consider factor-driven, efficiency-driven, and innovation-driven economies separately, the results appear different. Not surprisingly, countries in all stages are able to benefit from human capital with HEI degrees, while HEI research turns out to be insignificant for the development of factor-driven economies in which HEIs are required to be only teaching institutions creating "knowledge for its own sake" (Audretsch, 2014). At the same

time, HEIs' entrepreneurial activities matter only in innovation-driven economies. Therefore, governments of such countries have to be concerned with the creation of an environment conducive to the development of HEIs that have the willingness and ability to fulfill all three missions. Thus, we have found an answer to the research question 1.

The impact of economic conditions specific to the transformation process (liberalizing economic activity, prices, and market operations; achieving effective enterprise management and economic efficiency; imposing hard budget constraints) is pointed out by academics from Eastern Europe (Tchalakov et al., 2010; Uvarov & Perevodchikov, 2012; Kwiek, 2012). In addition, violations of intellectual property rights, bureaucracy and corruption, the lack of communication and collaboration between the scientific community the business sector, and the lack of private investment in R&D – all these factors remain major obstacles to innovation in many emerging market and transition economies (UN, 2012). As opposed to the American experience, Eastern European HEIs in transition economies were compelled to commercialize research activities because of the drastic reduction of state funding during the early 1990s and the precipitous fall in industry demand for R&D results that placed knowledge and technology producers in the "survival mode" (Grudzinskii, 2005). Nevertheless, HEIs with a Soviet past have more or less preserved engineering competences and capabilities in research and development. Notwithstanding the absence of a legal framework,

academic entrepreneurship became, to some extent, a restraining force for the brain drain to developed countries and to other sectors of the economy (Yegorov, 2009). This preconditioned the market orientation and entrepreneurial activities of many HEIs (Welter et al., 2002; Sangren, 2004), which are manifested in knowledge transfer and commercialization.

In connection with this and answering the research question 2, we have conducted a pioneering empirical study at the county level in the new context of a post-Soviet economy (Chapter 3) and have analyzed the determining factors of knowledge transfer and commercialization by HEIs in Belarus. Although the role of the HEIs in industry development centres mainly on the adaptation and redevelopment of existing foreign technology, but not on creating cutting edge knowledge, the Belarusian higher education sector has managed, against the odds, to establish mutually beneficial relationships with the enterprise sector and to benefit from its own R&D capacity. The statistical analysis has shown that, in the current economic plight, the availability of limited resources predominantly drives knowledge transfer and commercialization through scientific and technological services. The regression models with moderators have brought to light the essential differences in conditioning factors for HEIs established after the collapse of the Soviet Union. Thus, the knowledge creation capability has appeared to be a significant predictor of both measures of knowledge transfer and commercialization, namely contract research and patenting, at post-1991 HEIs.

Interestingly, only the post-1991 HEIs must be concerned about their reputation to be more attractive to enterprises as providers of scientific and technological services because Belarusian industrial enterprises often tend to collaborate with regular partners from the higher education sector regardless of their general reputation owing to the specific needs of enterprises and established personal networks. The most controversial point of our findings is that having commercial resources (the presence of a TTO or similar organizational units) at an HEI is negatively predictive of the number of patents granted - something which is at odds to our theoretical predictions. We have proposed an explanation that, in the context of Belarus, TTOs may act as a knowledge filter - selecting only viable and needed ideas to apply for patents or may focus on other activities to transfer knowledge and technology such as contract research and other knowledge-intensive services.

Turning to the organization level, the results of the case study (Chapter 4) allows us to answer the research questions 3 and 4. Thus, we have found that the lack of entrepreneurial competences, role models and capabilities to harness available and to attract additional resources disables the Belarusian State University from creating a favorable environment for entrepreneurial activities. Moreover, the Soviet heritage is still visible in the attitudes and values of the university community and restrains employing abundant human and physical resources of BSU to contribute to economic development – not only by educating

job-seekers but by fostering job-creators and transforming research activity into economic value.

The results of our empirical analysis have confirmed that a perceived BSU environment is predictive neither of entrepreneurial intention of students nor entrepreneurial behavior of alumni. Moreover, introducing a set of control variables, we have provided evidence that, in the context of the leading post-Soviet HEI, formal business-related education does not perform well in terms of promoting entrepreneurial intentions. The main findings of the dissertation are summarized in Table 5.1.

To sum up, we have combined different theoretical and analytical perspectives to sequentially investigate the development and interrelation of HEIs' missions at three different levels – international, national and organizational – and factors conditioning these processes. Consequently, the dissertation has several important academic contributions at each of these levels.

Firstly, based on numerous studies focusing on the socioeconomic role of modern HEIs in regions and single countries located mainly in North America and Western Europe, we have confirmed previous propositions on the sample of 77 countries. Thus, we have made the first empirical attempt to test the impacts of the three HEIs' missions in factor-driven, efficiency-driven and innovation-driven economies within the framework of the endogenous growth theory.

Table 5.1. Summary of main findings

#	Hypothesis/Proposition	Expected impact	Obtained impact		Finding	
	Chapter 2					
H1a	Human capital generated by HEIs is positively related to economic development of a country.	+	+		Supported	
H1b.	Human capital generated by HEIs, moderated by the stage of progress, is positively related to economic development of a country.	+	+		Supported	
H2a.	Knowledge created/transferred by HEIs is positively related to economic development of a country.	+	+		Supported	
H2b.	Knowledge created/transferred by HEIs, moderated by the stage of progress, is positively related to economic development of a country.	+	+		Supported	
H3a.	Entrepreneurship capital created by HEIs is positively related to the economic development of a country.	+	N/A		No evidence to support	
H3b.	Entrepreneurship capital created by HEIs, moderated by the stage of progress, is positively related to economic development of a country.	+	+		Supported	
	Chapter 3		revenues[25]	patents	revenues	patents
H1.	Moderated by the origin of HEIs (socialist or post-socialist), human resources are positively related to knowledge commercialization.	+	+	+	Supported	Supported
H2.	Moderated by the origin of HEIs (socialist or post-socialist), knowledge creation capability is positively related to knowledge commercialization.	+	+	+	Supported	Supported
H3.	Moderated by the origin of HEIs (socialist or post-socialist), financial resources are positively related to knowledge.	+	+	+	Supported	Supported
H4.	Moderated by the origin of HEIs (socialist or post-socialist), reputation is positively related to knowledge commercialization.	+	+	+	Supported	Supported
H5.	Moderated by the origin of HEIs (socialist or post-socialist), the presence of a technology transfer unit is positively related to knowledge commercialization.	+	+	-	Supported	No evidence to support
	Chapter 4					
P1.	Perceived HEI entrepreneurial environment is positively related to entrepreneurial intention of students of BSU	+	N/A		No evidence to support	
P2.	Perceived HEI entrepreneurial environment is positively related to an entrepreneurial behavior of alumni of BSU.	+	N/A		No evidence to support	

[25] Revenues from scientific and technological services

Secondly, we have demonstrated which resources and capabilities drive knowledge transfer and commercialization through scientific and technological services and patenting in the context of a transition economy – the Republic of Belarus. In addition, we have found that these relationships are moderated by the context in which a HEI was established – the socialist era or the transitional period.

Thirdly, we have contributed to a better understanding of the antecedents of entrepreneurial environment within post-Soviet HEIs on the case of one of the leading HEIs. Moreover, it has been shown how a perceived environment at this HEI is related to entrepreneurial activities of students and alumni.

Finally, in the last section of the dissertation, we provide a conceptual model that can be employed by academics in order to investigate the phenomenon of the entrepreneurial transformation of HEIs in post-Soviet countries

5.2 Implications for policy makers

This research study examined how HEIs contribute to the economic development of countries by fulfilling the three missions. As a result of closely investigating this influence, the present dissertation is expected to reinforce the assurance of state authorities in the huge influence of HEIs, especially those that have evolved into entrepreneurial institutions. In this context, the entrepreneurial transformation of HEIs is different in each stage of development and governance system. Therefore, governments all over the world should be concerned with

creating a favorable environment for the transformation of HEIs and their inclusion into systems of innovation in order to convert human capital, knowledge and technology into economic growth.

With respect to transition economies, which are predominantly efficiency-driven, policy makers have to tackle the problem of the rigid higher education system inherited from the Soviet period. In the context of Belarus, the Soviet legacy is still apparent and manifested in the lack of academic freedom in developing academic plans and research agendas. At the same time, HEIs have made noticeable strides towards an adaptation to the pressures of market economy and globalization and towards a broader involvement in the National innovation system and socio-economic development. A greater autonomy for HEIs will be needed to diversify educational and research portfolios and to better match market demand (Wu & Zhou, 2012). In addition, technology transfer units, business training facilities as well as consulting offices and business incubators at HEIs are required to form a part of the important but still underdeveloped entrepreneurial infrastructure. These reforms are expected to facilitate the catching-up process and prepare the higher education system to enter the increasingly innovation-driven stage.

However, reforms in the higher education system of the transition economies are incomplete and marginal if they are not accompanied by reform of the whole public sector and institutions (Kwiek, 2001; Gál & Ptaček, 2011).

Moreover, state authorities should be admonished in that the rapid growth in spending money on HEIs' R&D and innovative activities will not solve the problem of technological capability and productivity (Varblane et al., 2007) because of the underdeveloped vertical innovation system and other formal and informal constraints such as weak incentives for most actors, imperfect IP legislation and protection, and the stunted entrepreneurial sector, which does not consider HEIs as partners and is convinced that the purpose of higher education is to provide employees

In this regard, the innovation policy should be aimed at promoting the links and interactions between science, businesses, education, and infrastructure, creating incentives for knowledge-based entrepreneurship.

5.3 Implications for HEI stakeholders

At the organizational level, we evince that Belarusian HEIs need to be more pro-active and entrepreneurial in commercializing research outcomes, discovering new ways and forms of academic entrepreneurship, such as spin-off creation, because of relatively low demand for state-of-the-art knowledge and technology from the entrepreneurial sector. Thus, Belarusian HEIs could adopt and implement the Supportive model of spinning out new enterprises (Clarysse et al., 2005) and securing the sustainability of ventures by providing access to HEI resources and capabilities. HEI-based enterprises should be considered not as only income

generators but also as test beds for new ideas technologies, as bases for fellowships and internships of students and researchers and as cases for problem-based learning. In addition, entrepreneurs and entrepreneurial teams of HEI-based enterprises could be the best role models for their counterparts.

These activities require striking changes in the organizational structure of HEIs', incentive system, culture, and values. The first step towards this could be adopting and coordinating apparent and shared strategy across the main HEI activities: teaching, research and production to integrate organizational units. A strategic plan should empower entrepreneurial actions, synergies and cooperation among individuals, organizational units as well as HEI-business relations.

Moreover, special efforts should be concentrated on on providing all members of the HEI community with entrepreneurship-specific education to equip them with relevant knowledge and competences. More enterprising and action-oriented approaches and activities aimed at developing critical thinking, independence and readiness to assume responsibility should be implemented in all fields of study.

Many Belarusian HEIs feel a necessity and have a willingness to engage in entrepreneurship education and activities but lack the know-how. It is worth noting that HEIs, first of all, need state approval and support. Secondly, they need experienced practitioners who are able to drive the entrepreneurial transformation.

Such expertise can be obtained from participating in international programs and projects targeted at enhancing higher education systems.

5.4 Limitations and future research lines

While our results provide several important implications for existing theory as well as for policy makers and HEI stakeholders, we acknowledge that the study has several limitations, which create future research lines.

At the international level, we used HEI patents as a proxy for the entrepreneurial mission of contemporary HEIs, while, in fact, the outcomes are versatile. Therefore, future research may try to capture the entrepreneurship capital created by HEIs, for example, introducing the percentage of TEA (Total Early-Stage Entrepreneurial Activity) with graduate degrees provided by GEM. In addition, panel data should ideally be used for studies on the impacts of HEIs, but it is not possible, as data for many countries are only available for recent years. Moreover, as the majority of studies are focused on the impact the HEI outcomes on the socioeconomic development of developed innovation-driven countries, a good research opportunity would be to explore these issues in the contexts of developing and transition countries as well as on the development of regions in these countries.

Next, when we investigated the antecedents of knowledge transfer and commercialization as a manifestation of the entrepreneurial mission of Belarusian

HEIs, external formal and informal factors (North, 1990) endemic to transition economies (Aidis et al., 2008) remained beyond the scope of the study. The HEI-government affinity, weak incentives for knowledge commercialization and reliance on personal networks are thought to be essential antecedents in the context of Belarus and other countries with transition economies. The impact of these factors could be explored by conducting a deep multiple case study since there are no adequate indicators capturing all the drivers of knowledge commercialization by Belarusian HEIs.

In addition, while conducting an in-depth case study of the Belarusian State University, we used relatively small samples of students and alumni, which do not match the proportions in the total population students and alumni in terms of a study field. Although this problem is inherent in such studies, larger samples and proportional quota sampling should ideally be used.

Last but not least, we explored only students and alumni as representatives of one HEI community. Therefore, future quantitative studies may focus on faculty perceptions of an entrepreneurial environment, its influence on their entrepreneurial activities at HEIs of different profiles and at HEIs with the Soviet past and those established in the post-socialist era. In the same vein, another research opportunity could be exploring the entrepreneurial orientation of the Belarusian faculty members.

Drawing on the existing literature and our findings, we can propose a conceptual model that embodies the entrepreneurial development of HEIs in transition economies and may be used by researchers focussing on this phenomenon (Figure 5.1). The model integrates HEI-level factors conditioning a fulfilment of the three HEIs' missions as well as the outcomes of these missions contributing to the socioeconomic development of transition economies such as Belarus. Next, the model stresses the importance of entrepreneurship education that should move from teaching "about entrepreneurship" to a more interactive and action-oriented approach – educating "through entrepreneurship" – aimed at fostering entrepreneurial values, attitudes and intentions. Also, we emphasize that, in the context of transition economies, which are mainly efficiency-driven, activities of HEIs are predominately oriented to teaching and research. At the same time, first-priority measures for the incorporating of the entrepreneurial mission should be focused on promoting of effective knowledge transfer and commercialization as well as on creating of a supportive entrepreneurial environment within HEIs.

Figure 5.1. Conceptual model for future research

Post-Soviet context

Supporting contextual factors:
Orientation towards applied research & services
Preserved stock of knowledge & technology
"Survival mode" experience
Recent changes in legislation

Impeding contextual factors:
Weak entrepreneurial sector
Low demand for R&D results
Lack of venture capital
Weak protection of IPR
Bureaucratized state-governed HEI system
Ineffective management practices
Underdeveloped stock market
Negative attitude towards entrepreneurship in society

HEI-level factors

Human resources
Knowledge creation capability
Financial resources
Commercial resources
Physical resources
Reputation
Governance & leadership
Policy towards entrepreneurship
International cooperation
Role models
Entrepreneurship education

- Education through entrepreneurship
- Fostering of leadership, spirit, attitudes, intentions

HEI's missions

Teaching

Research

Entrepreneurial
- Knowledge transfer & commercialization
- Entrepreneurial environment

HEI's outcomes

Human capital

Knowledge capital

Entrepreneurship capital

Socioeconomic development

Source: Authors, based on Guerrero & Urbano (2012).

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As emphasized in the model, the specific post-Soviet context moderates all the relationships integrated into the model. It is worth noting that such context has a dual effect since it is characterized by factors that either facilitate or retard the entrepreneurial transformation of HEIs.

To conclude, we would like to point out that HEIs are one of the most durable institutions (Röpke, 1998), with their rules, rewards, incentives, and, above all, educational and social objectives. At the same time, HEIs are learning to cultivate pragmatism and capabilities to respond to societal challenges without neglecting their traditionally inherent values of basic research, independence, and objectivity (Laukkanen, 2000). In this regard, HEIs' mandates must not be ignored in pursuit of the entrepreneurial mission, while this mission must not be wrongly considered as only having a profit driven outcome.

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Annexes

Annex 2.1 Sampled countries

Factor-driven stage	Efficiency-driven stage	Innovation-driven
Algeria	Albania	Australia
Armenia	Argentina	Austria
Azerbaijan	Bosnia & Herzegovina	Belgium
Bolivia	Brazil	Canada
Cambodia	Bulgaria	Cyprus
Georgia	Chile	Czech Republic
Guatemala	Costa Rica	Denmark
India	Croatia	Finland
Iran	Dominican Republic	France
Kazahstan	Ecuador	Germany
Kyrgyz Republic	Estonia	Greece
Pakistan	Hungary	Hong Kong
Philippines	Indonesia	Iceland
Sri Lanka	Latvia	Ireland
Syria	Lithuania	Israel
	Macedonia	Italy
	Malaysia	Japan
	Mexico	Korea
	Morocco	Luxembourg
	Oman	Malta
	Peru	Netherlands
	Poland	New Zealand
	Romania	Norway
	Russian Federation	Portugal
	Slovak Republic	Singapore
	South Africa	Slovenia
	Thailand	Spain
	Trinidad & Tobago	Sweden
	Turkey	Switzerland
	Uruguay	United Arab Emirates
		United Kingdom
		United States

Annex 3.1 International comparisons

	Gross domestic expenditure on R&D (as percent of GDP), 2011	Share of the business sector in GERD, 2011	Share of the government sector in GERD, 2011	Share of the higher education sector in GERD	Share of GERD financed by Government	New doctorate graduates (ISCED 6) per 1000 population aged 25-34 IUS–2011	Percentage population aged 30-34 having completed tertiary education IUS–2011	Share of public R&D expenditures as percent of GDP IUS–2011	Employment in knowledge-intensive activities (manufacturing and services) as % of total employment IUS–2011	Patent applications, residents (WIPO), 2012	Scientific and technical journal articles (World bank), 2011
Belarus	0.70	69.1	20.9	10.0	43.60	0.8	28.4	0.21	27.36	1681	342
Austria	2.77	68.78	5.14	25.59	35.76	2.1	23.5	0.87	14.40	2.258	5130
Belgium	2.21	67.78	8.16	23.15	23.42	1.4	44.4	0.65	14.60	755	7484
Czech Republic	1.64	53.61	18.41	27.47	41.72	1.4	20.4	0.58	11.80	867	4127
Denmark	2.98	65.66	2.20	31.77	28.87	1.7	47.0	0.96	16.10	1406	6071
Estonia	2.37	57.53	9.29	32.13	32.75	0.8	40.0	0.79	9.80	20	514
Finland	3.80	68.72	9.01	21.58	25.03	2.9	45.7	1.10	15.20	1698	4878
France	2.25	64.63	13.56	20.59	35.38	1.5	43.5	0.85	13.80	14540	31686
Germany	2.89	67.76	14.29	17.95	29.83	2.6	29.8	0.92	15.30	46620	46259
Greece	0.67	34.29	24.81	39.94	49.24	0.8	28.4	0.43	10.90	628	4534
Hungary	1.22	65.63	14.44	18.41	38.10	0.9	25.7	0.44	12.80	692	2289
Ireland	1.61	72.03	4.85	23.12	28.32	1.5	49.9	0.57	19.50	492	3186
Italy	1.25	54.52	13.73	28.62	41.90	1.6	19.8	0.54	13.70	8439	26503
Netherlands	2.03	56.60	10.73	32.66	35.54	1.7	41.4	0.97	15.20	2375	15508
Norway	1.65	52.28	16.42	31.30	46.55	1.7	47.3	0.83	14.20	1009	4777
Poland	0.76	37.21	27.96	34.43	55.80	0.8	35.3	0.53	9.10	441	7564
Portugal	1.52	47.01	6.50	38.66	41.81	2.7	23.5	0.70	8.60	621	4621
Slovak Republic	0.68	41.35	24.52	34.03	49.75	2.1	22.1	0.36	10.10	168	1099
Slovenia	2.47	75.74	13.09	11.13	31.51	1.5	34.8	0.67	13.40	442	1239
Spain	1.36	52.98	19.09	27.75	44.48	1.0	40.6	0.67	11.50	3266	22910
Sweden	3.39	67.79	4.80	27.12	27.68	3.1	45.8	1.07	17.10	2288	9473
United Kingdom	1.78	63.42	8.24	26.49	30.45	2.2	43.0	0.65	17.00	15370	46035
Russian Federation	1.09	58.34	32.19	9.29	67.08					28701	14151
Azerbaijan	0.25	22.2	71.1	6.7						144	149
Armenia	0.27	..	88.8	11.2						137	185
Kazakhstan	0.23	32.7	38.6	15.2						1415	87
Ukraine	0.86	54.8	38.7	6.5						2491	1727

Source: National Statistical Committee of the Republic of Belarus (2013), Science and Innovation Activity in the Republic Of Belarus. Statistical book; Innovation Union Scoreboard 2011; World Bank, World Bank Development indicators; OECD

Annex 3.2 Descriptive statistics and correlation matrix

Pearson and Spearman correlation coefficients[26]

	Mean	Std. Deviation	1	2	3	4	5	6	7	8	9	10
	Patents	22.37	41.52										
1	Human resources	156.15	241.37	1									
2	Knowledge creation capability	0.13	0.4132	-0.022	1								
3	Financial resources	22.29	25.90	-0.055	0.141	1							
4	Reputation	-21.93	13.26599	0.360**	0.313**	0.259**	1						
5	Commercial resources	0.34	0.48	0.337**	0.347**	0.109	0.245**	1					
6	Post_1991	0.20	0.40	-0.206*	-0.134	-0.236**	-0.520**	-0.225*	1				
7	Age	4266.64	4965.01	0.214*	-0.005	0.011	0.334**	-0.051	-0.400**	1			
8	Public	0.90	0.30	0.168	0.107	0.199*	0.419**	0.237**	-0.253**	0.247**	1		
9	Tech_Department	0.51	0.50	0.279**	0.172	-0.103	-0.109	0.394**	-0.012	0.046	0.172	1	
10	Sc_Tech_works	325.97	782.41	0.284**	0.111	0.136	0.208*	0.170	-0.239**	0.109	0.177	0.359**	0.196*

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

[26] Spearman correlation coefficients were computed for binary variables (Post_1991, Public, TTO, Tech_Department)

Annex 4.1 Rotated component matrix and reliability indicators

Items	Component			
	Attitude	PBC	Envir.	Norms
Being an entrepreneur implies more advantages than disadvantages to me.	0.812			
A career as entrepreneur is attractive for me.	0.892			
If I had the opportunity and resources, I would become an entrepreneur.	0.888			
Being an entrepreneur would entail great satisfactions for me.	0.904			
Among various options, I would rather become an entrepreneur.	0.856			
For me, being an entrepreneur would be very easy.		0.810		
If I wanted to, I could easily pursue a career as entrepreneur.		0.852		
As entrepreneur, I would have complete control over the situation.		0.777		
If I become an entrepreneur, the chances of success would be very high.		0.749		
How would react student's close family if a student became an entrepreneur?				0.733
How would react student's friends if a student became an entrepreneur?				0.866
How would react fellow students friends if a student became an entrepreneur?				0.830
The atmosphere at my university inspires me to develop ideas for new businesses.			0.886	
There is a favorable climate for becoming an entrepreneur at my university.			0.888	
At my university, students are encouraged to engage in entrepreneurial activities.			0.819	
Cronbach's alpha	0.951	0.893	0.887	0.810

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Annex 4.2 Alumni Survey

Year of graduation

Year of Birth

Gender

Field of education: Business Administration; Logistics; Economics; Management; Other Social sciences; Art, Humanities, Linguistics; Natural sciences; IT

Form of education: full-time; part-time

Year of the first employment

Kind of professional activity:
Doing business/Management and administration; Practical work according to profession acquired; R&D; Teaching; Professional activity is not related to specialization acquired; Baby-sitting; Study; Unemployed

How often do you apply knowledge obtained at university?: constantly; often; rarely

Type of organization you are employed at: private; public; non-commercial

Have you created or participated in business creation? Yes/No

Is it a family firm? Yes/No

Did you receive any support from the university during the creation of your company? Yes/No

Where is your firm located?

Which sector is your firm active in?
Information technology and communication; Trade (wholesale/retail); Consulting (law, tax, management, HR); Advertising/Marketing/Design; Education and training; Tourism and gastronomy; Health services; Other services (including finance, insurance, etc.); Architecture and engineering; Construction and manufacturing; Other

Number of employees at your firm

How many employees do you expect to have in 5 years?

What are your market expectations?: Regional market; National Market; International market

How many enterprises have created?

Have you initiated or participated in the creation of non-commercial organizations? Yes/No

Have you initiated organizational/process/product innovations in the firm you work for? Yes/No

What is proximally your personal income per month before taxes and without extra payments?

Is your salary/business income more than an average salary in the country? Yes/No

Please indicate the extent to which you agree to the following statements about the university environment. (1= lower level of agreement, 5=higher level of agreement):
The atmosphere at my university inspires me to develop ideas for new businesses
There was a favorable climate for becoming an entrepreneur at my university
At my university, students were encouraged to engage in entrepreneurial activities
My university influence in my propensity to becoming self-employment
I feel proud of being alumni of this university

Entrepreneurship course/program/education:
I did not attend a course on entrepreneurship
I attended at least one entrepreneurship course as elective
I attended at least one entrepreneurship course as compulsory part of my studies
I studied in a specific program on entrepreneurship

What did your university provide for business creation:
Financial support (yes / no); Contact points (yes / no); Mentoring/Coaching Programs (yes / no); Business plan contests (yes / no); Contact platform with investors (yes / no); Workshops/Networking with entrepreneurs.

Evaluate the level of your managerial skills acquired at a university: (1= low level, 5=high level)

Evaluate the level of your skills of doing business acquired at a university: (1= low level, 5=high level)

Evaluate the level of your academic (theoretical) education: (1= low level, 5=high level)

Evaluate the level of your practical education: (1= low level, 5=high level)

Evaluate the level of your education for R&D activity: (1= low level, 5=high level)

Evaluate the level of your computer skills and skills in using Internet acquired at a university: (1= low level, 5=high level)

Evaluate the level of your skills in independent work acquired at a university: (1= low level, 5=high level)

Evaluate the level of your foreign language skills acquired at a university: (1= low level, 5=high level)

Evaluate the level of your business communication skills and skills of team work acquired at a university: (1= low level, 5=high level)

To what extent are you satisfied with your education level obtained at a university: (1= low level, 5=high level)

Annex 4.3 Descriptive statistics and correlation matrix on the sample of BSU students

Pearson and Spearman correlation coefficients[27]

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 The atmosphere at my university inspires me to develop ideas for new businesses.	4.14	1.58																						
2 There is a favorable climate for becoming an entrepreneur at my university.	4.29	1.59	0.827**																					
3 At my university, students are encouraged to engage in entrepreneurial activities.	4.19	1.80	0.668**	0.702**																				
4 Being an entrepreneur implies more advantages than disadvantages to me.	4.82	1.66	0.299**	0.330**	0.332**																			
5 A career as entrepreneur is attractive for me.	4.75	1.66	0.291**	0.322**	0.287**	0.819**																		
6 If I had the opportunity and resources, I would become an entrepreneur.	4.91	1.77	0.274**	0.260**	0.236**	0.724**	0.819**																	
7 Being an entrepreneur would entail great satisfactions for me.	4.97	1.65	0.301**	0.311**	0.293**	0.767**	0.834**	0.877**																
8 Among various options, I would rather become an entrepreneur.	4.79	1.73	0.307**	0.347**	0.306**	0.703**	0.816**	0.775**	0.823**															
9 Your close family	5.91	1.27	0.316**	0.300**	0.314**	0.377**	0.343**	0.374**	0.360**	0.340**														
10 Your friends	5.78	1.19	0.260**	0.286**	0.256**	0.298**	0.266**	0.322**	0.293**	0.277**	0.679**													
11 Your fellow students	5.27	1.40	0.239**	0.256**	0.197**	0.189**	0.186**	0.218**	0.230**	0.188**	0.471**	0.636**												
12 For me, being an entrepreneur would be very easy.	4.20	1.44	0.354**	0.408**	0.388**	0.453**	0.492**	0.407**	0.446**	0.416**	0.381**	0.287**	0.201**											
13 If I wanted to, I could easily pursue a career as entrepreneur.	4.26	1.47	0.316**	0.374**	0.363**	0.416**	0.420**	0.348**	0.372**	0.393**	0.348**	0.341**	0.211**	0.767**										
14 As entrepreneur, I would have complete control over the situation.	4.94	1.44	0.326**	0.340**	0.348**	0.437**	0.424**	0.416**	0.440**	0.411**	0.420**	0.395**	0.303**	0.640**	0.659**									
15 If I become an entrepreneur, the chances of success would be very high.	4.81	1.45	0.363**	0.391**	0.336**	0.459**	0.454**	0.427**	0.418**	0.445**	0.485**	0.406**	0.292**	0.628**	0.648**	0.714**								
16 Male	0.39	0.49	-0.134*	-0.104	-0.083	-0.021	-0.051	-0.079	-0.063	-0.074	-0.125*	-0.056	-0.068	0.084	0.052	0.035	-0.047							
17 Self-empl. parents	0.35	0.48	0.099	0.121*	0.156**	0.109	0.146*	0.113	0.127*	0.116*	0.017	0.014	0.021	0.216**	0.194**	0.120*	0.118*	0.139*						
18 Age Squared	382.15	102.22	-0.229**	-0.245**	-0.232**	-0.161**	-0.102	0.013	-0.044	-0.053	-0.067	-0.072	0.008	-0.182**	-0.154**	-0.103	-0.147**	0.000	-0.147**					
19 Employment	0.24	0.43	-0.145*	-0.132*	-0.039	0.080	0.116*	0.126*	0.069	0.034	0.008	0.026	-0.039	0.059	-0.002	0.050	-0.045	0.085	-0.076	0.273**				
20 Business field	0.63	0.48	0.248**	0.274**	0.323**	0.166**	0.218**	0.194**	0.205**	0.206**	0.333**	0.204**	0.190**	0.242**	0.242**	0.177**	0.209**	-0.289**	0.083	-0.252**	-0.054			
21 SBMT	0.56	0.50	0.213**	0.244**	0.279**	0.184**	0.225**	0.210**	0.204**	0.202**	0.334**	0.189**	0.203**	0.236**	0.199**	0.183**	0.211**	-0.259**	0.089	-0.224**	0.011	0.865**		
22 Entr.course	0.27	0.44	0.140*	0.144*	0.177**	0.167**	0.195**	0.132*	0.163**	0.149**	0.058	-0.004	0.025	0.240**	0.189**	0.176**	0.154**	-0.034	0.175**	0.006	0.114*	0.166**	0.203**	
23 Entrepr.intention	0.71	0.46	0.181**	0.181**	0.143*	0.186**	0.256**	0.203**	0.246**	0.284**	0.155**	0.153**	0.105	0.267**	0.241**	0.253**	0.253**	-0.070	0.113*	-0.085	-0.019	0.133*	0.166**	0.185**

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

[27] Spearman correlation coefficients were computed for binary variables

Annex 4.4 Descriptive statistics and correlation matrix on the sample of BSU alumni

Pearson and Spearman correlation coefficients[28]

		Mean	Std. Deviation	1	2	3	4	5	6	7	8	9	10	11	12
1	Personal (doing business skills)	2.37	1.193												
2	Behavioral (higher income)	0.56	0.497	0.041											
3	The atmosphere at my university inspires me to develop ideas for new businesses.	2.62	1.242	0.499**	0.108										
4	There is a favorable climate for becoming an entrepreneur at my university.	2.43	1.221	0.601**	0.046	0.737**									
5	At my university, students are encouraged to engage in entrepreneurial activities.	2.15	1.132	0.541**	0.011	0.644**	0.684**								
6	Male	0.32	0.466	0.005	0.125*	0.131*	0.101	-0.012							
7	Age squared	640.095	137.928	-0.202**	0.020	-0.158*	-0.084	-0.105	0.103						
8	Work experience	4.289	2.659	-0.149*	0.140*	-0.110	-0.048	-0.082	0.120	0.788**					
9	Years after graduation	3.37	2.483	-0.173**	0.055	-0.117	-0.035	-0.063	0.087	0.925**	0.771**				
10	Business field	0.46	0.499	0.505**	0.129*	0.347**	0.398**	0.402**	-0.036	-0.324**	-0.299**	-0.297**			
11	SBMT	0.384	0.487	0.493**	0.135*	0.364**	0.393**	0.385**	-0.048	-0.333**	-0.319**	-0.278**	0.855**		
12	Entr.course	0.456	0.499	0.476**	0.091	0.413**	0.413**	0.370**	-0.064	-0.193**	-0.163**	-0.149*	0.671**	0.658**	
13	Doing business	0.11	0.309	0.008	0.133*	0.097	0.120	0.041	0.270**	-0.015	0.041	-0.066	0.201**	0.133*	0.129*

* Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

[28] Spearman correlation coefficients were computed for binary variables

Annex 4.5. The mission of BSU

"Being a leading scientific, educational, cultural and innovation center of Belarus, Belarusian State University employs its potential based on the best country and international experience to satisfy intellectual, cultural, social requests and interests of individuals, the society and state, conduces to sustainable development of Belarus. The strategy of the university is oriented towards a creative cooperation between students and lecturers, implementation of educational, research and innovation programs, creation of conditions conducive to spiritual development of individuals, disclosure of their creative potential, preservation and development of the best traditions of classical education, providing a deserving position in the worldwide educational space".