UNIVERSITY OF TWENTE

Proximity factors influencing academics' decisions to co-operate with industry – a case study of the University of Twente's research institutes

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FOREWORD

This report is the final stage of my graduation project carried out at the Faculty of Management and Governance at the University of Twente. It signifies the final step in the completion of my Master Programme in European Studies. This study year has been challenging, intense and overall an eye-opening experience for me. It has given me the dynamic perspective on the world and taught to be more critical about the European Union.

During this year I met people, who have directly or indirectly contributed to this study. I would like to take this opportunity to acknowledge these people. First and foremost, I would like to express my sincere gratitude to my supervisors Dr. Paul Benneworth and Dr. Tiago Ratinho, who have provided me with guidance, positive critics and academic insights. Their valuable feedback and support during the research helped me to focus on the right direction and conduct practical survey study that finally led to this report. Thank you for your encouragement and very useful feedback on my research. I would not have managed without your help. Also I am thankful to Dr. Nico Groenendijk and Dr. Shawn Donnelly for their help in shaping my research interests and choosing the right area for this study.

The completion of this research could not have been carried out without support of my family and friends. I would like to express my thankfulness to my dear parents for supporting me throughout my life. My special gratitude is to my sister Olia and my brother-in-law Igor for their constant support and readiness to help. Most of all I am grateful to my dearest husband Michael for his support and patience. His love and inspiration has given me the strength to persist and complete the thesis. Finally, I am thankful to all my friends, old and new, for their constant support.

Milana Korotka

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ABSTRACT

Executives and university managers tend to raise the role of universities as territorial actors and maximize university-industry cooperation inside the region. However, due to certain barriers for local partnership, interaction takes place outside the region more often. The objective of this research is to explore the conditions for effective university-industry cooperation: what motivates academics to cooperate with local/distant firms; what are the constraints to university-industry partnership and in what way proximity can influence academics' choices to co-operate with industrial partners inside/outside the region. The analysis draws on data obtained from the survey sample of 62 researchers from the University of Twente, the Netherlands. Using data from the survey, the analysis reveal evidence of dependence between successful university-industry partnership and location of industrial partners. The study considers the ways in which cooperation between universities and local companies could be facilitated. It is argued that proximity does not promise university-industry interaction inside the region.

Keywords: Regional innovative development, Regional innovative system, University-industry linkages, University-industry cooperation, Proximity

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ACRONYMS

EU	European Union
NIS	National innovative system
R&D	Research and development
RIS	Regional innovative system
RTDI	Research, technological development and innovation
RQ	Research Question
SMEs	Small and medium-sized enterprises
TTO	Technology transfer office
UILs	University-industry linkages
UII	University-industry interaction
UITT	University-industry technology transfer
VSNU	Association of Universities in the Netherlands

Part I
Introduction and Research Framework

"…Market forces are powerful. If let things to go their own devices, industry would be concentrated in the north and leisure pursuits in the south."

(Jacques Delors, 1989)

Chapter 1. Introduction

Recent turmoil in global economic world has raised the importance of knowledge based industrial development. Regional innovative development is acknowledged as a necessary factor for national and global long-term sustainable growth (Hubner, 2007). In the knowledge based economy, innovative development is empowered by knowledge accumulation and technological advancement. To reduce regional disparities and strengthen national competitiveness, the executives are actively developing robust strategies for regional development. However, in all countries some regions are considerably better at knowledge-based growth than others. Boucher *et al.* (2003) explain that not all regions have developed knowledge interaction networks between regional partners. Studies of best practices in knowledge-based regional development suggest that success mainly depends on strong interactive networks between institutions, which are involved in knowledge transfer activities (Tripple & Maier, 2010).

As a part of regional innovative system (RIS)*, university-industry linkages (UILs)* produce knowledge generation and exploitation that contribute to the economic growth and society welfare. Universities and other knowledge transfer institutions are required nowadays to become territorial actors more than national or international ones (Smith, 2003). Additionally, promoting the university-industry interaction is seen as the most efficient form to increase regional technological innovation (Azagra-Caro, 2005; Freitas and Verspagen, 2009). Therefore, the university-industry partnership is a crucial part of the regional innovative development.

Optimistic voices assume that, from a regulatory perspective, university-industry cooperation contributes to regional innovative development *per se*. In principal, regional innovative system (RIS) as a part of National Innovative System (NIS) can be promoted and supported by regional, national and global governments. It becomes even more promising when we hear about sound projects initiated on the global or European Union level and directed to overcome social and regional disparities. Despite of these efforts, the regulatory actions do not necessarily promise innovative development. The European Union weakness in industrial innovation in the scientific literature is known as "European Paradox". This concept shows the inability of most EU countries to implement the constant top-level scientific output into industrial innovations and transform the research into region's competitive advantage (Dosi *et al.*, 2006). That would imply that scientific performance in this field is excellent on paper, however in practice it does not bring the desired innovative outcome. The main complexity in EU regional innovative development is that many regions have a very strong scientific performance, but weak in transforming the research results into innovations. Noteworthy, the US leadership in scientific output can be explained by the high activity of universities in collaborative research projects with industry (Dosi *et al.,* 2006). As

Cooke (2001) highlights, the model for promoting regional innovation "has changed from a hierarchical to a more networked one" (p. 38). In other words, the success of RISs mainly depends not on regulation, but on effective network communication between its actors. However, there are certain blockages that occur within the RISs and cause a lock-in of the innovative development inside the region.

Although recently there has been a significant amount of scientific interest around the regional innovation issues, it is still unclear why and on which levels the RISs face problems that stop actors from working effectively. Therefore, there is a strong need to explore how connections between academics and entrepreneurs occur on a micro-level and what facilitates the cooperation. Internal connections and developed operating principles between HEIs (Higher Educational Institutions) and SMEs (Small and Medium enterprises) is the most important condition for effective partnership between universities and companies (Freitas and Verspagen, 2008). Many scientists also argue that success of university-industry cooperation is determined by common motivations of academics and industrial researchers to interact (Lee, 2000; Perkmann & D'Este, 2010; O'Shea *et.al*., 2005).

This thesis aims to explore micro-level connections in Regional Innovative System, and in particular, connections established between universities and industry. It also aims to enhance understanding how academics make choice to cooperate with local or distant firms. Within this research, it is assumed that proximity of interaction can facilitate and strengthen the connectivity between academics and business partners. The analysis will help to define the main factors that facilitate university-industry cooperation and the aspects, which are challenging for future research.

1.1 What are the university-industry linkages?

Along with the ever growing amount of research on regional development, a scientific interest arises in university-industry linkages (UILs). University-industry linkages are considered to be the most efficient form to expand regional innovative development, to solve complex problems and to promote innovation-supportive culture in certain regions (Doloreux and Parto, 2004; OECD, 2011, Dosi, 2006; Freitas and Verspagen, 2009; Lee, 2000; Perkmann and Walsh, 2007). The most common definition offered by Schiller and Diez (2007) conceptualizes the UILs as "an important means to transfer local knowledge and technologies" (p.38). Bercovitz and Feldmann (2003) note, UILs develop "high-opportunity technology platforms", which "raise scientific and technical content of industrial production" (p. 175). Likewise, the study of Fontana *et. al*. (2006) shows that many innovations could not be very effective or even could not be realized without practical research outcomes. The university-industry links have a diverse nature and can be presented by a wide range of activities, structures and concepts from consultancy agencies, patenting and licensing of academic research, to science and technology parks (Anderson, 2003). The strategy of industrial firms to cooperate with universities allows for reduction of costs, helps to reach higher innovation rates and shortens the time-period for the development of products and services (Schiller and Diez, 2007). For academics, involvement in industrial research helps to

conduct world-class research, to receive additional funding and implement research outcomes in practice (Freitas and Verspagen, 2009).

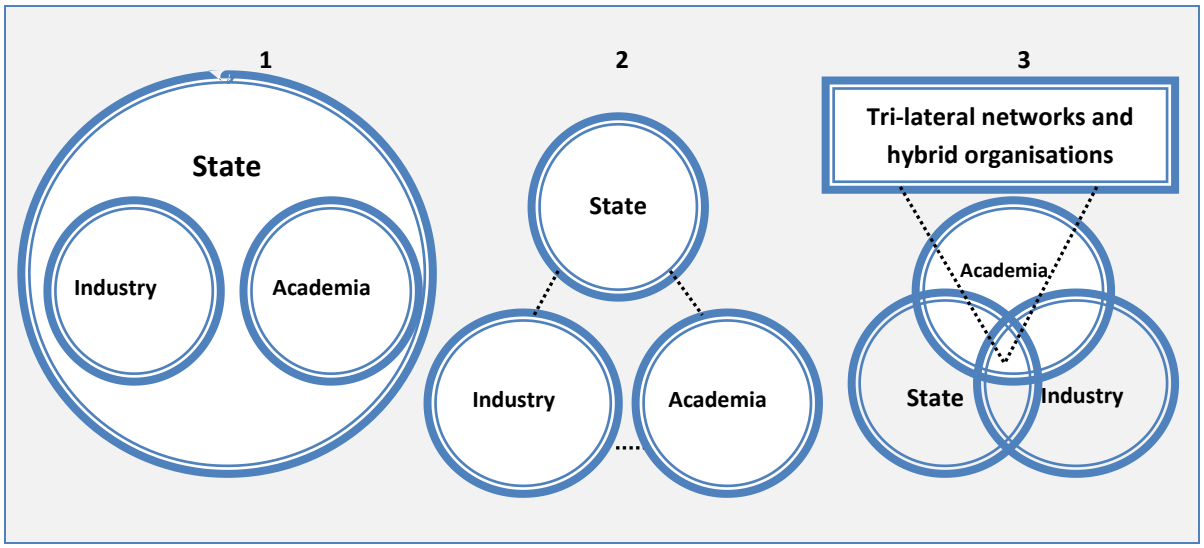
1.1.1 Evolution of university-industry linkages: the dynamics from national to regional innovation

The concept of UILs has emerged since early twentieth century and was first presented as Research Corporation in the USA (Etzkowitz, 2001). The university-industry cooperation became widespread after the transformation of university functions, known as second academic revolution when in addition to research and teaching, it encompassed the third mission of economic development (D'Este & Patel, 2007). As the university began to engage actively in cooperation with industry, it became an influential actor in social development. Etzkowitz (2001) explains that transformational processes have changed a university into an entrepreneurial identity and embedded it in an interactive innovation model of university-industry relationships. The author continues that in the new framework of networked university-industry relations academic knowledge became an intellectual property (p. 2).

Due to the growing role of university in societal processes and technological development, the innovation system of university-industry relations faced new institutional arrangements formulating university-industry-government relations. To describe the complex relationships between academia, industry and government, scholars often use the Triple-Helix (T-H) model. *Triple Helix* model is based on three components: the knowledge-producing sector (university), market (industry) and government and explains the transformational processes occurring in university-industry-government relations (Cooke, 2002). The main idea of T-H model is the prominent role of university in knowledge-based societies (Etzkowitz &. Leydesdorff, 2000). University is extending its teaching responsibilities to entrepreneurial education and becomes a source of regional development. The Figure 1 below demonstrates three configurations of university-industry-state institutional arrangements. The first configuration presents nation state as the leader in directing the university-industry relations. With very small opportunities for "bottom up" initiatives this type of regulation is not effective for regional development. This type of institutional setting was common in former Soviet Union and Eastern Europe countries characterized by socialist regimes (Etzkowitz & Leydesdorff, 2000). The second type represents academia, industry and state as separate institutional domains with clear boundaries between actors. The proponents of second configuration argue that this type of relations is effective to reduce the control of government in type 1. Both type 1 and 2 raise the role of universities in the National Innovation System (NIS). In contrast, type 3 or laissez faire configuration raises the role of university in the framework of Regional Innovative System (RIS). It demonstrates the overlapping domains with tri-lateral networks and equal interaction between all three helices for the purpose of high-tech development. The laissez faire institutional relations are the most appropriate for effective regional development. This can be explained by the fact that within the configuration 3, 'top-down' initiatives are mixed with 'bottom-up' initiatives, what makes cooperation effective and innovative process

dynamic. Therefore, it provides the best environment for innovative development (Etzkowitz & Leydesdorff, 2000).

Figure 1. Triple Helix I –Triple Helix II – Tri-lateral organisations



Source: Etzkowitz & Leydesdorff (2000). "The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations". *Elsevier,* Volume 29, Issue 2, p. 111

According to Schiller and Diez (2007), the critical point about the Triple Helix model is that it does not explain different perspectives of the actors and does now describe the micro-level connections emerging from the interactions. Similarly, Tuunainen (2002, p. 36) points out that neither the configuration 1 and 2, nor the TH model do not pay attention to vital conceptual insights, what includes problem areas in UI relations and makes these approaches inappropriate for empirical analysis. However, according to Krücken (2002, p. 130) all configurations are important for policy makers and scientists as it raises the interest to knowledge transfer and may stimulate further research. Thus, the paper of Shinn (2002, p. 14) shows that Triple-Helix perspective has a challenge to show how function the entities involved in the model and to indicate its potential in identifying rapid changes in social, economic, science and technology areas.

Due to the fact that innovative development is a non-linear and dynamic process, the evolution of UILs relations will proceed. Etzkowitz & Lejsdorff (2000) explain that transformations in UI relationships are usually influenced by dynamics of politics, economic factors, technological changes and changing environment. Therefore, the continuous ongoing transformations within the institutional setting of university-industry relationships and mechanisms of interactive networks will proceed. The next section will describe the role of the university-industry research partnership in regional innovative development.

1.1.2 Role of university-industry (UI) relationships

University-industry linkages and their impact on innovation processes have been recently a popular subject of the research analysis. Due to the increasing focus on the regional innovative development during the past years, many studies investigated the issue of

knowledge transfer from university to industry and its impact to regional development (Doloreux and Parto 2003; Dosi, *et. al*., 2006; OECD 2011; Poyago-Theotoky *et al.* 2002). One of the *main roles* of universities-industry relations is to develop knowledge-based industry and stimulate technological advancement, what in turn influences economic growth in the region. One of the most important impacts of science-technology relationships to economic growth is the reduction of regional disparities and the increase of social cohesion (Hubner, 2007).

Universities play a major *role* in the UI connection being an engine of regional growth (Chakrabarti & Rice, 2003). There is a range of mechanisms by which universities can contribute to regional development. In general, universities accumulate and transfer knowledge to industry and develop qualified human resources. In particular, there are four key areas where universities play a significant role in regional development: first, universities enhance regional innovation through their research activities. Second, universities promote enterprise, business development and growth. Third, universities contribute to the development of regional human capital and skills. Fourth, universities improve social equality through cultural development. Additionally, universities train an increasing number of high-educated professionals, and thus contribute to the competitiveness of the European economy (European Union Regional Policy, 2011, p.4, 53). Importantly, universities can help public authorities to develop innovative strategies in the field of economic development through consultancy services and training high-qualified graduates. In practice, universities have to be involved in shaping and implementing of the smart regional specialization strategies.

The contribution of companies to effectiveness of UI linkages is to provide friendly environment for technological development. In particular, major benefits of firm's collaboration according to Caloghirou *et al*. (2000, p.159) can be described in three-dimensional way. First dimension is related to the *knowledge access* or intellectual property, which improves the technological and organizational capabilities of a firm. The second dimension refers to *effective product development process*, which saves costs related to research. As a consequence, a firm gets an advantage of higher product quality and profitability. The third dimension is a capability of a firm to *explore new technologies* and products as well as being attractive for investment. Doloreux and Parto (2004) indicate that innovative firms are connected to the global level through the linkage between customers and suppliers. The firm with innovative vision and strong external networking can attract investment, develop innovative project, involve university and contribute to the regional development. Because firms are answering the demands of the society through their services and goods – meaning they stand close to reality and are aware of the market needs, the universities which cooperate with such firms can profit from this firm's pragmatism. Thus research will be directed to explore those things that society needs and the firms are willing to supply them with ideas and resources for research. Thus, the more innovative firms are engaged in Regional Innovative System (RIS), the more information about market needs and new technologies are pumped into the network, which in turn makes regional development dynamic and beneficial. The next chapter is aimed at formulating the relevance of the study.

1.2 Relevance and Motivation

Due to the growing importance of regional innovation development, university-industry linkages gain more and more attention from scientists, entrepreneurs and policy makers. Many studies in the university-industry relations field analyse institutional framework, barriers and outcomes of university-industry relations. Some scholars describe different motivations defining the types and forms of university-industry projects (Heher, 2007).

Although many other aspects described in literature prove the importance of university-industry linkages, the most attention in scientific literature is paid to the regional innovative development and its regulatory policy. Different dimensions such as government, industry, and higher education serve different functions and thus require a complex and diverse approach (Etzkowitz & Leydesdorff, 2000). Although the literature states that university-industry relations have to be supported by governmental initiative to produce regional innovative development, there is a considerable empirical gap in the scientific literature on the attitudes and driving factors that motivate academics towards a partnership with business. This research focuses exclusively on the micro-level relations in regional innovation system and the blockages occurring in the sub-system of UILs. My motivation in this study is to explore new aspects of the university-industry partnership from the perspective of attitudes of academic researchers. Thus, this research shows how and why academics choose to collaborate with business partners, and the circumstances under which local or regional partners might be chosen over national or international partners. As part of that, the study shows the role of proximity in university-industry interactions and how proximity influences the academics' choice process.

1.3 Problem statement and research questions

Having a clear picture of the phenomenon and roles of university-industry linkages makes it possible to formulate a problem statement and a research objective. Scientists suggest that the strength of national industrial development depends on the local-global connectivity between local, regional, national and global actors in developing science-industry connection support (Benneworth & Dassen, 2011; Etzkowitz & Leydesdorff, 2000). Therefore, regional innovative development is prerequisite for national progress in innovations. However, it is clear from scientific literature that the cooperation arrangement between science and industry does not automatically mean that the regional innovation will take place. According to Boucher *et al.* (2003), "institutional thickness" is the most important factor to build an economically successful region, what means that institutions have to be engaged in knowledge transfer activities. Authors also stress on importance of the regionalization of higher education. They explain that universities have to be actively engaged in regional development to contribute to region's economic development. In contrast, if the university is engaged in national or global project, it does not contribute to it's the region development. However, even if the university is engaged in regional development, there are certain blockages which occur within the RISs and cause a lock-in of innovative development. If the RIS is not functioning properly, it is possible to assume that the mechanism has some defects. This assumption leads us to the question: '*What blocks the mechanism of regional*

innovative system to produce innovative development and what are the constraints that stop actors from working effectively?'

One of the main reasons that stop academics and entrepreneurs to work effectively is the lack of interaction and connectivity (D'Este & Patel, 2007). Successful experience and exemplary UILs innovative projects show that universities choose to cooperate with firms, which have common research culture, high R&D intensity and open networks to cooperate (Fontana *et al*., 2006). Therefore, it is possible to assume that proximity may drive stronger university-industry connectivity. This assumption leads to define the central research question of this project is:

RQ. **How does proximity influence the choice of academic researchers to cooperate more with local rather than with distant firms?**

This leads us to the **research objective** of this research:

To analyse the role of proximity in the choice of academics to cooperate more with local rather than with distant firms.

To reach the research objective it is necessary to develop the analytical framework and conceptualise the way academics and firms interact and their reasons for choosing the partner. In order to address the overall research question, the following series of sub-research questions will be also answered:

RQ1. Which collaborative activities of university-industry linkages occur in regional innovative development? (Chapter 2)

RQ2. What are the elements of the regional innovation systems? (Chapter 2)

RQ3. What blockages occur in RISs and which blockages stop actors from working effectively? (Chapter 2)

RQ4. What are the facilitators of the university-industry collaborative research? (Chapter 2)

RQ5. How and why do academics choose to work with local rather than distant firms while doing the world class research? (Chapter 4)

RQ6. Which factors influence academics' choice to cooperate with local/distant firms? (Chapter 4)

RQ7. How does the choice of academics influence the regional innovative development? (Chapter 5)

1.4 Thesis structure

This master thesis is structured in the following way. Chapter 2 concerns the theoretical framework on university-industry relations including institutional framework and micro-level connections of UILs. The theoretical part will shed light on how and why academics choose

to collaborate with business partners, and the circumstances under which local partners might be chosen over distant partners. Chapter 3 discusses the methodological considerations and data collection methods that are used to perform the empirical part of this research. Chapter 4 presents the results of the conducted research and data analysis. Chapter 5 provides the discussion on the research findings and answers the main research question. It also gives recommendations on how to improve the university-industry connectivity. Finally, thesis ends with conclusions and suggestions for the future research in the Chapter 6.

Part II
Theoretical Framework

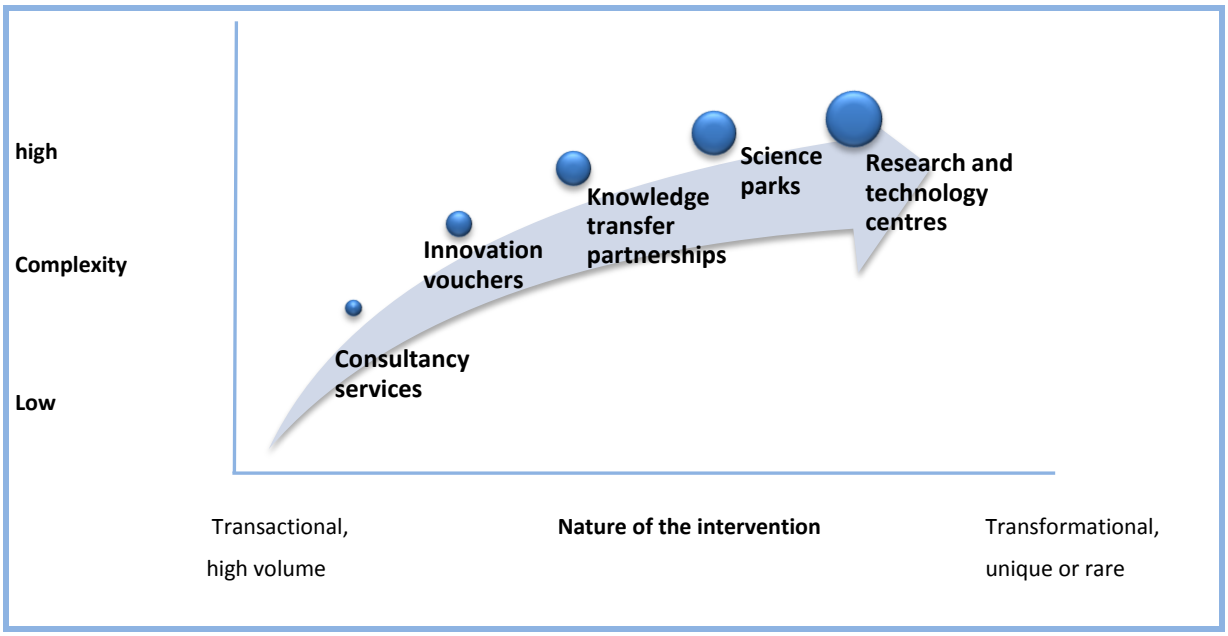
Chapter 2: University-Industry Collaboration within the Regional Innovative System

Having shortly explained the purpose of UILs, I will now develop a theoretical framework on UILs' role in regional innovative system to understand how location influences academics' decisions to collaborate with business partners. I will start with the different types of UI collaborative activities. Secondly, I will describe academics' and entrepreneurs' motives to cooperate. Thirdly, I will present the blockages to effective U-I cooperation. Next, I will explain what facilitates academics and entrepreneurs to cooperate despite of the barriers. Finally, I will show the role of proximity in university-industry relationships.

2.1 University-industry collaborative activities

In recent years, there has been growing interest in joint innovative projects due to the claim that innovation increasingly depends on the collective actions. This argument is supported by the fact that neither firms, nor research institutes are able to produce effective innovations individually (Tether, 2002). Thus, the traditional concept of linear innovation or the Schumpeterian view on the firm producing innovations in isolation has been changed to the modern concept of systemic innovation (Todtling *et al*., 2005, p.1205). The systemic approach to innovation describes innovative development as non-linear, interactive process, which involves intensive collaboration between actors (Edquist & Johnson, 1997).

Figure 2. Enhancing regional innovation through research activities



Source: European Commission (2011). European Union Regional Policy. Connecting Universities to Regional Growth: A Practical Guide, p. 7

Universities are frequently involved in different activities with firms, which range from the small-scale temporary projects to the permanent large-scale institutions with a number of industrial members (Perkmann, 2007). As the Figure 2 demonstrates the research

partnership between university and industry can be represented as the spectrum running from the most simple consultancy services, graduate expertise and university spin outs or the most complex knowledge transfer partnerships, science and technology parks and research and technology centers.

The least complex joint projects are consultancy services, innovation vouchers and graduate enterprise programmes. The *consultancy services* are 'business engagement' centers or offices aimed to enable firms to cooperate with the universities in innovative short-term pilot projects. However, up until now this mechanism faces difficulties such as inflexibility and lack of dialog between the private sector and universities. The problem is that local firms have deficiency of flexibility, unclear access points and information distortions. The challenge here is to increase governmental support in subsidizing and promoting these projects (European Commission,2011).

Next, the *innovation vouchers* give a possibility for firms to buy scientific and technical support from universities. Differently fom the consultancy service, innovation vouchers aim to develop new products and services as well as implementing innovation projects in manufacturing. The example of these is the Innovation Voucher Grant programme for enterprises to launch co-operation with universities to establish 89 innovative project (European Commission, 2011, p. 10, 49).

The last but not least in the group of the projects with low complexity is *graduate enterprise programme.* In simple words this a mechanism of promoting and supporting entrepreneurship among graduates by university. The aim of such programmes is to build close relations with existing firms and to motivate students and graduates to create own businesses. Hence universities provide assistance in developing business plans, grants, and trainings. Importantly, this method requires strong coordination. Otherwise, the graduates' businesses can become isolated from the university (European Commission, 2011: p. 18, 49).

The next group is more complex instruments with relatively high transactional volume, namely university spin-offs and knowledge partnership. First, the important factor for regional development is establishment of *university spin-offs.* This refers to the process when employees commercialize elements of the research within the university. Their main task is to create new enterprise, which could be strongly linked to the university. Spin-offs provide high quality environment for research and involves academics into commercial projects. Undoubtedly, being innovative, high-tech and growth oriented spin-offs are beneficial for the regional development. However in order to achieve significant results for the regional growth, spin outs have to be linked also to the international innovative knowledge transfer linkages through the national and regional initiatives (European Commission, 2011: p. 19).

Secondly, *knowledge transfer partnership* (KTPs) is a mechanism to transfer research from universities to local firms and communities. In the framework of such partnership, post-graduate university candidates are involved in long term research projects with the local companies and are lead by academic and commercial supervisors. In many cases, the KTPs benefit from the part-time professorship, when part-time university researchers are involved in the research projects with the company. Additionally, they are supposed to contribute to the product development or solve the technological problems faced by firms

(Freitas & Verspagen, 2009: p.21). Interestingly, this method is famous in the UK as an effective tool to attract significant national government investment (European Commission, 2011: p. 12). The results are beneficiary for both the firm and university. The university benefits from the valuable industrial experience, whereas firm gets the knowledge transfer. The important initiatives also include workforce development in the sense of training high-quality human resources for the local businesses; staff and students mobility development in the sense of encouraging the collaboration between university research and private sector R&D programmes providing internships; and widening students' participation in the research activities (European Commission, 2011: p 50).

Finally, the most complex mechanisms are research & technology centres and science & technology parks. *Research and Technology centres* focused on the new technologies exploitation. They build the bridge between science and industry for developing specific emerging technology, which is significant for the national economic growth. These institutions are extremely important for the long-term regional economic growth. They also help firms get funding for the emerging technologies development. The challenge of government is to integrate these centres within the national innovation system. It is also important that government coordinates the centres aligning it with the regional economic development strategies and promotes the functioning of the centres with the funding programmes. Noteworthy, the universities are more active in involving to the activities of research and technology centres than science parks (European Commission, 2011: p. 14).

Science and technology parks are locations for scientific research and business support. The main objectives of science and technology parks are stimulating the growth of high-tech employment, to encourage the cooperation between universities, firms and government and to support economic development in the region (OECD, 2011, p. 195). The most common forms of S&T parks:

- *Campus innovation centres*: located on the university campus;
- *Inner city innovation centres*: the buildings for multiply tasks, located close to a university;
- *Classic ex-urban park developments*: big parkland in the urban area with a combination of single and multiple occupation buildings (OECD, 2011, pp. 195-196).

To sum up this section, the university-industry linkages embrace a broad spectrum of activities. The variety of activities can be explained by the fact that UILs use multiple channels for knowledge transfer as informal contracts, collaborative research, consulting, personnel mobility, etc. As different types of innovative projects require different intensity/frequency of interaction and financial resources for cooperation, universities and firms choose the most appropriate forms of contract to cooperate. Scholars usually pay attention to the most complex UI activities as spin-offs, patenting and science parks. However, less complex types of activities are equally important for regional innovative development in terms of its frequency and economic impact. Additionally, different types of UI activities require different types of inter-organizational arrangements between actors, what makes knowledge transfer more effective (D'Este & Patel, 2007). The next section will describe the U-I relationships from the systemic perspective and discuss that

notwithstanding the number of effective collaborative projects between universities and firms, there are number of barriers to their partnership.

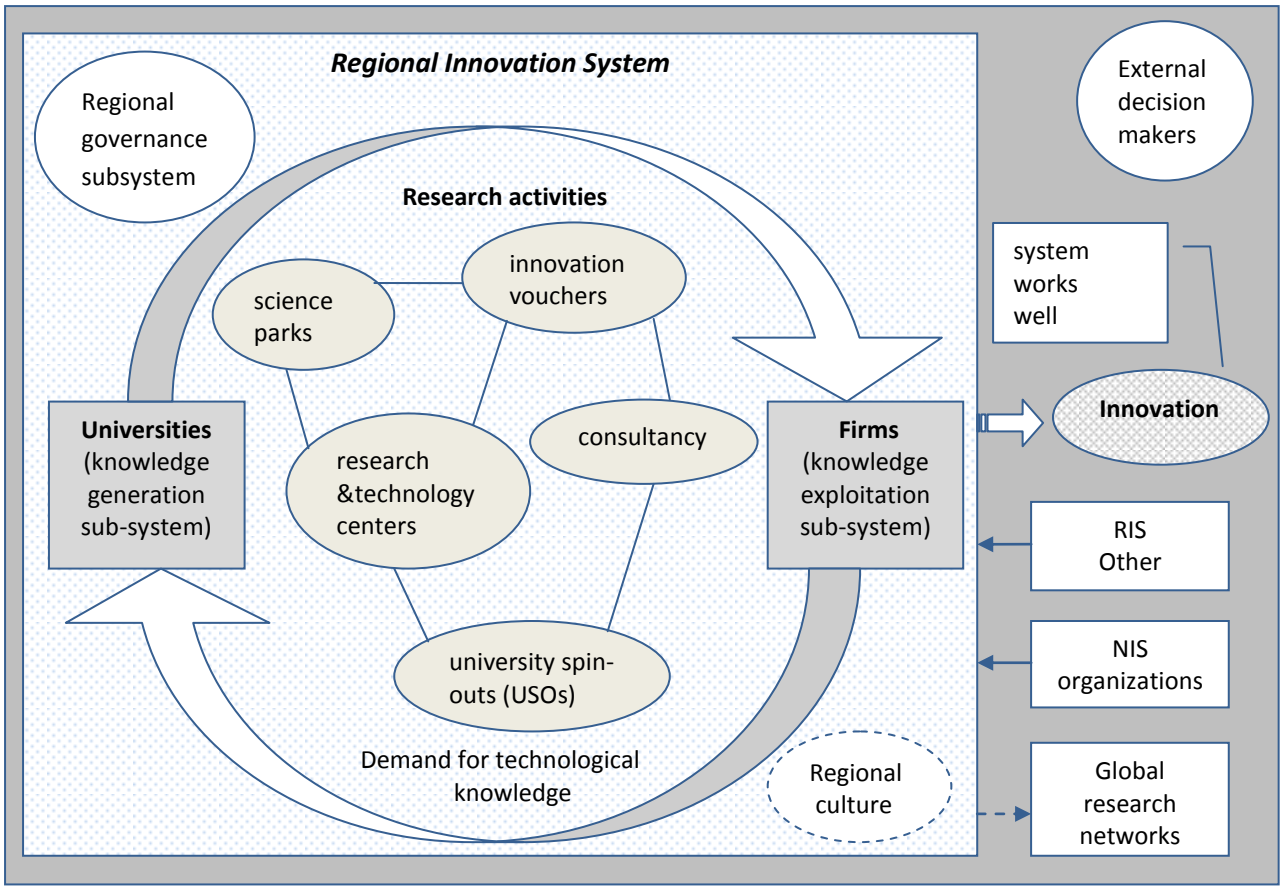
2.2 The nature of regional innovative systems (RISs)

Throughout the recent global economic and societal processes, emerged such concepts as 'innovative region and milieu', high-tech areas, clusters of knowledge based industries learning regions and industrial districts (Todtling *et al.*, 2005; Doloreux and Parto, 2004). The scientific literature stresses on the four main elements for effective innovative development in region. First, the economy of region should be characterized by regionalization, knowledge generation, smart infrastructures and strong local-global business networks. Next, the regional policy should be enhanced by multi-level governance. Third, the region should have *developed knowledge infrastructure,* what includes research universities, professional consultancy, public research organizations, etc. Finally, region should have a developed community and culture. This includes talented human capital, social tolerance and sustainability (Cooke, 2002). All the aforementioned components characterize an ideal type of *Regional Innovative System (RIS).* In the ideal type of RIS, firms and knowledge providers interact constructively, strengthening their own participation in global networks. Being a part of RIS*,* the university-industry linkages produce knowledge generation and exploitation process. This section will shed light on the RISs elements and deficiencies which block innovative development within the U-I partnership.

2.2.1 RISs elements

Generally speaking, *Regional Innovative System (RIS)* is characterized by innovative activity between industry and science creating training organizations, R&D institutes, technology transfer agencies what shapes the innovation supportive culture in region (Doloreux & Parto, 2004). The ideal type of RIS includes two sub-systems embedded in common cultural environment. In this framework universities serve as knowledge generators, and firms as knowledge exploiters that are supported by the regional policy makers on the one hand, and regional culture on the other hand. The knowledge utilization sub-system includes firms, their clients, suppliers, competitors and partners. The knowledge generation sub-system is presented by educational organizations, public research organizations, technology and workforce mediating organizations (Todtling et al., 2005). As innovation increasingly becomes an interactive process, the well-functioning RIS has a high level of connectivity between its actors. Intensive interdependencies between actors require effective networks and systems for interaction. The interactivity between the sub-systems stimulates to enhance research partnership in different ways, such as consultancy services, university spin outs, knowledge transfer partnerships, science and technology parks and research and technology centers. The RISs also have links to national and international actors (see Fig.2).

Figure 3. A Well-Functioning Regional Innovation System (RIS)

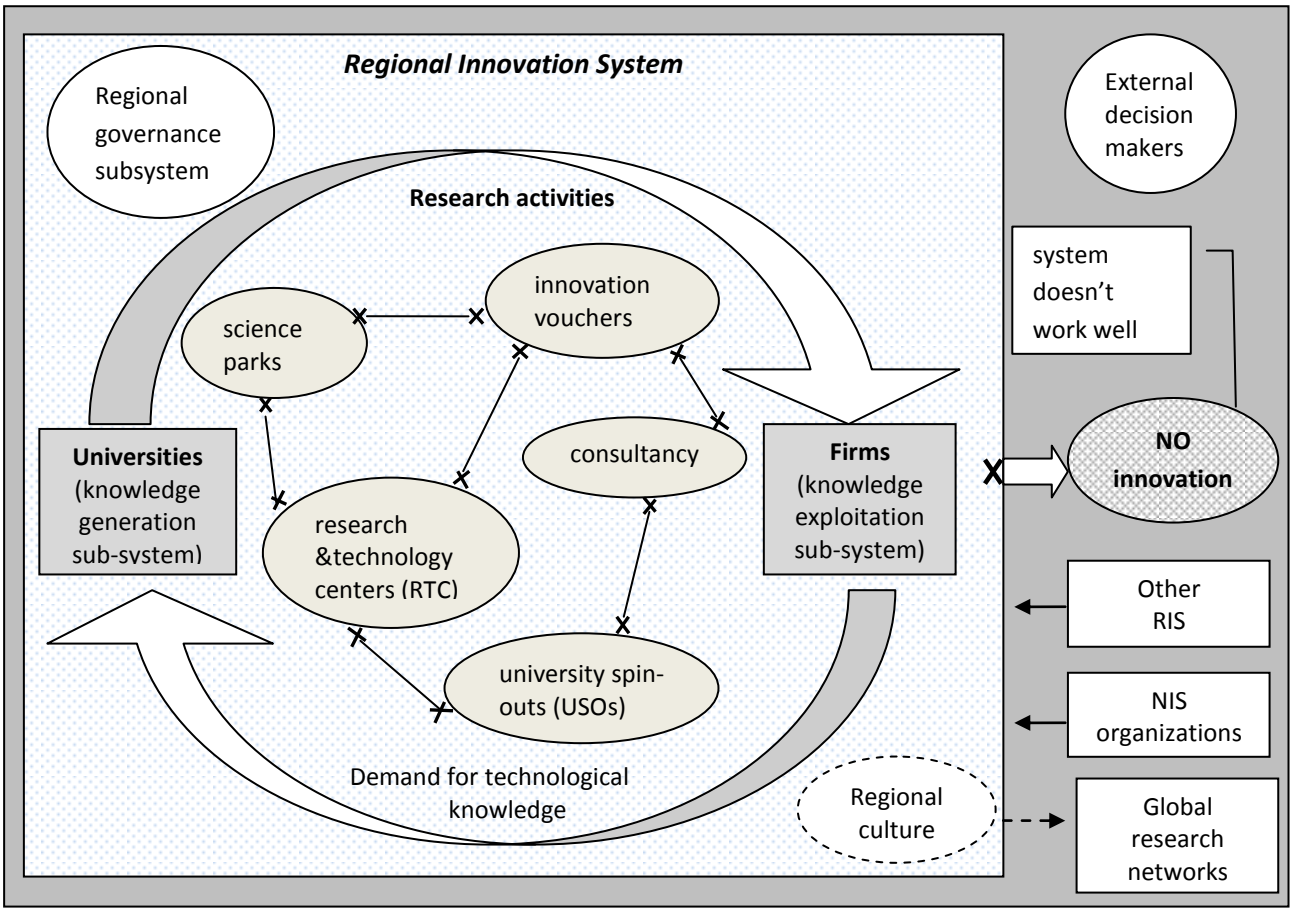


Source: Author's own design after Benneworth, P. and Dassen, A. (2011). Strengthening global-local connectivity in regional innovation approach." *OECD Regional Development Working Papers,* 2011/01*,* OECD Publishing

In the well-functioning RIS, the connections with external links support sustain innovativeness providing access to high-tech technologies, knowledge and additional funding. Under the ideal circumstances when regional innovative capability is high, region receives continuous flow of investment and knowledge capital (Todtling *et al*., 2005).

This is how it is supposed to function. However, the innovation development can be blocked within and between the subsystems when the system does not work in a proper way (see Fig. 3). In this case the elements of the RIS become systematically disconnected, what hinders to develop joint innovation projects. Importantly, to make the knowledge transfer successful, an effective transfer mechanism is a necessary condition for UILs (Schiller and Diez, 2007). Therefore an assumption that the success of RIS is directly related to the effectiveness and connectivity of its sub-systems seems to be true. This leads us to raise the issue of systemic problem and question - what exactly blocks the RIS to create innovations?

Figure 4. A Regional Innovation System (RIS) with disconnected sub-systems



Source: Author's own design after Benneworth, P. and A. Dassen, (2011). Strengthening global-local connectivity in regional innovation approach." *OECD Regional Development Working Papers,* 2011/01*,* OECD Publishing, p. 10

Much has been written about problems in UI connection. Some scholars point on different rationales of academics and entrepreneurs and lack of funding for joint partnership. There is a certain level of agreement in literature review that the main problem of RISs is lack of connectivity of university-industry linkages (Sternberg, 2000). From the systemic perspective it is very hard to solve the problems as it means that some parts of the system are missing or do not work in the proper way. In contrast to systemic problems, the interactivity problems are easier to define and solve as it does not depend on external factors.

At this point we can give two general diagnoses to the RISs' failures - systemic diagnosis and network diagnosis, which are important to distinguish. Systemic diagnosis of the RISs' failures is related to the whole system problems, which can include deficiency of funding, governmental support or lack of external interaction. By contrast the network diagnoses mean the problem of interactivity between the RIS actors. Once the diagnoses are clear, it is useful to classify barriers to U-I collaboration in two groups: barriers caused by *systemic problems* and barriers caused by *network problems*. Both network and system diagnoses support the argument that the most important in RIS is to improve the

connectivity between science and industry. The next section will elaborate on RIS' blockages more detailed.

2.2.2 RISs blockages to university-industry cooperation

As has been demonstrated in the previous sections, research and development activities play a major role in regional sustainable development by producing innovations. The key for effective innovation process is partnership among government, firms and universities. National, regional and government funding programmes are encouraging the knowledge transfer links. However, to remind again there are number of barriers on the way to effective engagement of university-firm links to the regional innovative development. Moreover, the bigger is the collaborative project, the greater are the barriers to its implementation (European Commission, 2011).

Freitas and Verspagen (2009) set a number of general barriers for effective knowledge transfer between universities and firms. The problematic issue is that national levels are responsible for the entire state including regions, what often may not fit in what research project and region need. In particular, authors point out that common universities-firms project may suffer form *market dynamics problems* as competition in a form of technology race, deficiency of customers or change of market strategy by the industrial partner. However, authors add that it may occur with the projects, which support product development. In most cases such problems may be attributed to the bad management of firms. Next, the authors refer to the *technical problems in knowledge development and adoption.* Usually these projects are aimed to develop product prototypes to implement it to the industry in the future. Technical problems are more likely to occur in longer projects, which lack the financial support to continue effective research and involve additional researchers to solve the problems. The other widespread barrier is *cultural differences.* Universities and firms face problems of different attitudes towards the technical and financial side of project development. Especially the problems occur when the projects based on indirect financing and patenting. A lot of scholars point out to the other worrying facts as the problems of misguided investment and bad planning in the local regions (Lezaic, 2010). However, all the aforementioned problems do not show the pitfalls of the university-industry relationships. So how can we detect what exactly blocks the innovation development?

As has been defined in the previous section, the diagnoses of the low university-industry cooperation effectiveness can be divided to the systemic (structure problem) diagnose and network diagnose (interaction problem). With such differentiation it is much easier to analyse the RISs' problems. More specifically, the barriers caused by structure problems mean that the RIS doesn't work properly and it influences the sub-systems of universities and firms. The interaction problems, in its turn, mean that the network cooperation between the university and firm is not functioning effectively. The most spread problems can be grouped as follows:

(i) Caused by structures problems:

- Deficiency of funding resources;
- Weak channels of engagement;

- Poor links between systems.

(ii) Caused by interaction problems (internal):

- Different institutional purposes of firms and universities;
- Deficiency of collaborative capacity and skills;
- Underdeveloped operating principles (difficulty in identifying partners);
- Lack of time to combine all university roles.

The first among (i) the structural problems is (1) *deficiency of funding resources,* what is a typical obstacle for research activities, especially deepened after the 2008 global economic crisis. Lack of appropriate government funding programmes for university-industry joint research has a negative effect on UI cooperation (Salter, 2009). According to Mowery (1999), some universities became more "entrepreneurially" oriented in seeking industrial sources of funding. Perkmann and D'Éste (2010) point out that academics are the most motivated to engage in joint research with industry when public research funding is complemented by the industrial funding.

Another worrying feature of U-I partnership is (2) *weak channels of engagement*. Clear access channels are especially important when university has tensions to engage with the region in development projects, but the information distortions and absence of engagement channels leaves universities disconnected from regional innovation development. Following this further, the problem of (3) *poor links between systems* occurs because firms might lack capacity for the knowledge transfer and the universities are often weak in providing knowledge relevant to the needs of economy. Additionally, there is the weak capability if industry to employ knowledge form universities at the same time with unclear intellectual property rights. As the result, R&D cooperation collaborative research occurs between the few firms and universities in the region, whose interests are common (Inzelt, 2004).

The second group of blockages has (ii) *interactive characteristics*. The first problem is (4) *different institutional purposes* of public and private actors may disconnect universities from regional innovative development. The conflict of interest may be explained by the fact that companies are usually profit oriented, whereas academics are oriented towards world-class research, rather than to commercialize their research results. Universities are also interested in generating income, but in case when they have no conflict with industry regarding Intellectual Property Rights (Salter, 2009). Thus, the process of transforming the research results into marketable products can mean that a business partner does not permit to publish the research results or imposes publication delays to save the secrecy of an invention (Anderson, 2001, p. 243).

Pursuing this further, (5) *deficiency of collaborative capacity and skills* may be caused by the legal restrictions in some countries on university-business cooperation. It also may depend on the deficiency of skills and resources (researchers, managers) necessary for effective cooperation. The situation is even worse if in the region is lack of capacity to stimulate research and apply it to the organizations. This may be when the regions has low

industrial composition in high-tech or the firms in the regions even not include the function of research and development to its scope[1].

Finally, the problem of (6) *underdeveloped operating principles* is caused by the positioning of academics as 'critical observers', rather than active participators in regional UILs. Researchers are often focused on achieving grants for their research, but not on collaboration with firms. The problem of underdeveloped operating principles also refers to difficulty in identifying partners with appropriate profile, absence of established procedures of interaction with industrial partners and mutual difficulty in understanding expectations and working priorities of the partner (Salter, 2009). According to Lagendijk (1999), one of the significant barriers to UI interaction is lack of substantive outcome from joint research.

As has been already mentioned, the structure problems are hard to address as it is caused by the missing element in the system or caused by external factors. Although both systemic and interaction diagnoses are very important to overcome, network problems are easier to deal with. Therefore, in the scope of this research is to focus on the problem of interaction between the RIS actors.

After we have come through the possible obstacles to the connection between the universities and firms, it is important to analyze how to overcome the barriers to U-I collaboration. But before going on with solution how to deal with these problems, attention should be paid to why the academics and entrepreneurs decide to cooperate. The next section will shed light on the different rationales of universities and firms which facilitate partnership.

2.3 Motivations for university-industry cooperation

Despite of the existing barriers to U-I cooperation, there is a considerable amount of factors, which facilitate joint partnership. Theoretically, the cooperation between firms and universities has to be built on the common interest of both parties, when the firms are willing to engage in collaborative projects with universities to solve complex problems and to get an external funding for product development and universities are interested to implement the research results in practice. The literature overview shows that firms are usually motivated by commercialization of high-tech products, whereas few are research-oriented (Perkmann, 2010). Academic researches collaborate with companies to advance their research potential rather than to contribute to the industrial progress. Moreover, if a firm has enough R&D scientists, it is less likely to cooperate with academics (Lee, 2000). Therefore, the conflict of interest often occurs in UI relationships. In order to understand what facilitates academics and entrepreneurs to work together we have to know the motivations which drive them to engage in joint research.

2.3.1 University motives

The main goal of academic researchers is to conduct high-quality scientific research and developing knowledge (Freitas and Verspagen, 2009). However, due to transformational

[1] European Union Regional Policy (2011) Connecting Universities to Regional Growth: A Practical Guide, p. 40

processes of university role, academics have become a part of coherent system with industry and government to underpin innovative development and economic growth. Thus, by actively engaging in cooperation with industry, academics can combine the role of conducting a high-quality research with producing the technology outputs (Perkmann, 2010).

According to Freitas and Verspagen (2009), among the most prevalent motivations of *university researchers* to cooperate with firms are the following:

- Applicability of previous research;
- Funding for research;
- Maintaining collaborative contacts;
- Develop future research opportunities.

In particular, (i) applicability of previous research means the implementation of achieved scientific results into practice. In the other words, it gives the academics an access to implement prototypes to manufacturing. This refers to the innovations which can substitute existing technologies. In the other words, academics commercialize their research outcomes into innovative technologies (Perkmann, 2010). This motivation is very beneficial for industry as it leads to the more efficient product development.

Pursuing this further, (ii) access to additional funding is one of the predominant academics' rationales as it allows them to conduct a world-class research, patenting the results and publishing it in publications and conferences. The university projects receive external research funding in case this projects had never been in firm-industry cooperation practice before. The external funding gives an opportunity for academics to involve high-qualified academics and students in research, what is the promising way to receive long-term local and global benefits.

Next, academics tend (iii) to maintain collaborative opportunities as it makes the project more effective due to the common goals, shared responsibilities and usage of the expertise of each collaborator. In this case both university and firm are more likely to engage in the previously patented project. In the same way the motive (iv) to develop future research opportunities in partnership with industry means that university researchers are interested to advance their present and future research agenda (Lee, 2000).

Eventually, the cooperation with industry is beneficial for science. On the other hand, in practice the cooperation of universities and firms in joint research and innovations development is rather tangled issue. The main problem in university-industry connectivity is that academics and entrepreneurs frequently have different rationales, what makes the joint research hard to organize. Additionally, innovation creation is more a business process, whereas scientists are interested to be involved in world-class research process.

2.3.2 Firms motives

University-industry interaction has become vital for competitiveness of firms (Freitas *et al.*, 2009). Likewise, Mowery (2001) points out that university-industry relation over the past

decade became significant for the commercial leadership. Freites and Verspagen (2009) classify four main firms' motivations for cooperation with science:

- Product development;
- Achieve public sponsorship;
- Solve technological problems;
- Research opportunities.

First, the motive (i) *to support product development* is based on the aim to use university knowledge, facilities and expertise. In this scope the firm eager to conduct knowledge transfer through the labour mobility, formal and informal meetings. This also includes the rationale to involve the part-time researchers into the product development. Following this further, firms are motivated (ii) *to achieve public sponsorship* for joint research on complementary to existing technologies project, what means that research rely on previously achieved results. The knowledge transfer here is conducted though product prototypes, reports and testing. In this case the firm aims to improve product development process, instead of creating the new one.

Besides that, firms are often interested (iii) *to solve technical problems* occurring in the product development process. An effective knowledge transfer means the scientists advice and developing the scientific results in technological development, known as product prototypes. Finally, firms are frequently willing (iv) *to get research opportunities* within the joint partnership with universities. This can be explained the need in reorientation of the R&D objectives of the firm. Universities are more approachable, cheaper sources of expertise than commercial consultants. Worthy to note that group of firms and foreign firms are more likely to engage in collaborative research with university due to the fact that they are better resourced and informed about potential partners (Tether, 2002).

In the light of the joint collaboration it easy to see that all the aforementioned motivations are not contradicting. The biggest rationale to involve in innovation development process for both university and firm is exemplary experience of joint partnership in the area. The firms, which are innovative leaders play a major role in industry dynamism and stimulate scientists and other firms to involve in common projects with them. The entrepreneurs and scientist who join the innovative research with leader firms are known as creative followers, who follow the example of solid innovative leaders (Lagendijk, 2005). Within time, when the best universities excel in both scientific research and technology commercialization, the innovative firms are eager to involve in partnership (Owen-Smith, 2003). As the figure 5 demonstrates, there are many factors that stimulate academics and entrepreneurs to co-operate, but only two of the motives are overlapping. Both university and firm are interested in achieving public funding for research and developing research opportunities.

Figure 5. University and industry motives to engage in joint research

University motives	Firms motives
- applicability of previous research; - funding for research; - maintaining collaborative contacts; - develop future research opportunities	- product development; - achieve public sponsorship; - solve technological problems; - research opportunities

However, despite of the motives of both academics and entrepreneurs to engage in joint research, the UI co-operation does not happen automatically. The conflict of interests of both parties makes the research partnership between university and firm very hard to arrange and conduct to be effective for regional development. One of the obstructions here is that scientists are sometimes pushed to be entrepreneurs more than academics. The other significant obstacle is that most firms are profit-oriented, what does not motivate them to cooperate with research institutions. Therefore, there can be reasons for both academics and entrepreneurs to cooperate, but also not to cooperate.

The next section will foreshadow the argument that one of the most effective ways to strengthen the connectivity is to apply the proximity on the different levels of the university-industry relationship.

2.4 Proximity Role in University-Industry Relationships

Many scholars have drawn attention on the proximity role in U-I relationships (Boschma, 2005; Knoben *et al*., 2006; Laursen *et.al*., 2011; Lagendijk, & Oïnas , 2005). According to this assumption, the universities and firms are more motivated to involve in joint innovative projects when there is proximity for interaction as it makes the connectivity more productive.

There are two competing logics of university academics to engage with firms. On the one hand, it is more interesting for scientists to be involved in world-class joint research with the distant companies. In this case they have an ability to be a part of Global Scientific Community, to receive esteemed foreign funding and to develop an international research career. On the other hand, it is much easier to facilitate interaction with firms on regional level due to the easier connectivity and availability of resources. This section aims to investigate why academics choose to work with regional firms rather than involve in joint research with distant/excellent firms. In other words, academics face the dilemma whether to cooperate with regional or distant companies.

Proximity facilitates smoothing out cooperation problems. Therefore to maximize the connectivity of university to firms, the research environment must be available in the

proximity sense. Proximity is a requirement for effective interpersonal communication and support of effective networking (Oïnas *et al*., 2002). An uncertainty arising from the networked nature of search processes is the relationship between the type of networks leading to collaboration on one hand, and the type of innovation activities pursued and innovation outputs achieved on the other hand. Proximity would explain why academics work with local firms. As has been already mentioned in the foregoing sections, the main complexity in the university-industry cooperation is deficiency of connectivity due to the number of barriers. Bad connectivity, in its turn, leads to a problem of coordination, uncertainty and spillover effects. To get an effective connection with distant firms in the sense of location, cultural and social differences, motives, availability of networks to cooperate, etc. is very hard to arrange. Admittedly, it is easier for the academics to overcome the connectivity problem with the local firms. Eventually, the innovation research partnership requires the development of effective network mechanisms based on proximity and scientist-entrepreneur interaction (Perkmann, 2007).

Boschma (2005) explains how proximity can reduce the uncertainty and increase an interactive learning, what in turn leads to better coordination. The coordination improves in the meaning of better interaction between actors, what gives them an opportunity to learn and innovate more. However, the different types of proximity can have different effects on interactive learning and innovation. Boschma (2005) describes five dimensions of proximity – cognitive, organizational, social, institutional and geographical. However, the other forms of proximity, such as cultural and technological proximity are used as well. Any type of proximity helps a scientist to work with a firm effectively and achieve a common vision of collaboration.

Firstly, the *cognitive proximity* relates to the effective communication. When the firm faces uncertainty, it conducts routine behaviour and searches for new knowledge in close proximity. In this case the innovations become cumulative, what limits further improvement. To bring the knowledge gap, the cognitive base of the firm should be close to the knowledge source in order to communicate and to conduct knowledge transfer effectively. The cognitive proximity requires competencies, novelty of ideas and creativity to maintain effective interaction process. In the other words, the cognitive proximity facilitates effective communication.

Secondly, the *organizational proximity* is related to the interactive learning. Organizational arrangements mean networks, which help to overcome uncertainty, coordinate transactions and enable to arrange an effective knowledge transfer. The networks between organizations have to be trust-based to control uncertainty.

Next, *social proximity* means the socially embedded, durable and trust-based relationships between actors on the micro-level. It significantly reduces the risk of uncertainty and contributes to the innovative performance. Social proximity includes the attitude of ‘communication rationality’, what also makes the university-industry connectivity more effective. The *institutional proximity* means the same institutional rules, cultural habits and values between the actors on the macro-level, what reduces uncertainty, provides stable for interactive learning and enables lower transaction costs.

Geographical proximity is related to territorial, spatial, local or physical proximity, which makes the connectivity between actors easier to adjust (Knoben *et al.,* 2007). The reason of this is that it is easier to organize, coordinate and conduct an innovative project with the local firms. The smaller the distance between the actors, the easier it is to transfer knowledge. Geographical proximity is usually complementary to the other forms of proximity to make an interactive learning process more effective. Importantly, the local firm doesn't literally mean that the firm is located close to the university or even in the same region (Boschma, 2005). The proximity does not only mean the spatial issue. Thus, local firms mean not geographically close, but those, which are easy to adjust for effective partnership due to the common corporate culture, rationales and optimized interaction channels. In the case of long-term assistance, it is usually easier to work with non-regional firms, since it is possible to modularize the project. Overall, the cooperation with non-regional firms strengthens the network and the competitiveness of the joint project (Lagendijk, 2005; Brostrom, 2010). According to Boschma (2005), due to advanced technologies, effective 'networks through which learning takes place are not necessarily spatially limited' (p. 69). However, the geographical factor is important for developing regional networks. Additionally, the knowledge transfer takes place when geographical proximity is combined with the other levels of proximity as cognitive, social or cultural. In the other words, geographical proximity can foster the other types of proximity. Effective partnership can be built between university and a firm, which is located in the other region, but can provide trust-based relationships. Therefore, interaction with firms on local and regional levels facilitates innovative development in case of good connectivity and availability of resources.

According to Oïnas *&* Malecki (2002), social, organizational, strategic and institutional proximity can contribute to the development of an effective network between local and external actors. Therefore, the geographical proximity need not be the main factor facilitating university-business relations. Contrarily, the knowledge transfer between local and external institutions contributes to creation of epistemic communities, networks of practice and communities of practice (Benneworth and Dassen, 2011).

Generally speaking, all dimensions of proximity have a positive effect on providing solutions to the coordination problems between university and industry. Therefore, to arrange an effective interactive learning and innovation development, it is essential to adapt a dynamic approach with all types of proximity used in parallel. This will provide effective solutions to the problems of coordination within the university-industry connections. The next section will explain the limitations of the research and the further steps undertaken to operationalize the research model in practice.

2.5 Discussion

This research contributes to the broader academic debate on university-industry (U-I) partnership in a framework that analyzes the blockages to the RISs innovative capacity. It is clear from the literature review that the U-I cooperation can be presented in a variety of forms from the simple temporary projects to the permanent, large-scale institutions with a number of industrial members. However, the cooperation arrangement between science

and industry doesn't automatically mean that the regional innovation will occur. Academics choose partners with regard on the proximity of interaction, what is possible to arrange not only with local, but also with distant industrial partners. Therefore, spatial proximity is not the main factor influencing UI interaction on the regional level.

The fact that academics choose to cooperate with local firms instead of the distant firms leads to a conclusion that by improving proximity the connectivity can be strengthened as well. Therefore, the cooperation with local firms is the gateways to regional innovation development. This leads us to the first synthesis question: *Is proximity a reason for universities and firms to work together?* To check this we can assume that if there is no blockage, then the regional innovation will happen. However, we cannot test this because we need to look at how innovation happens regionally, and how innovation in the region creates economic development. A regional processes analysis is out of the scope of this research. Consequently, it brings us to the other question: what area do we have to cover to achieve the research aim? Literature review shows that the main failure of the RIS is deficiency or absence of connectivity between the system elements. Therefore, we can concentrate on the micro-level connections between universities, different research institutes and firms.

At this point we come to the uncertainty of how can universities themselves improve the connectivity and what role the proximity plays here. Combining this assumption with the first synthesis question we come to the main scientific question of this research: *How does proximity influence academics' choice to cooperate with local/distant firms?* Overall, literature review shows a general lack of empirical analysis in the decision making process of academics in choosing for cooperation with industry (Lee, 2000). This research aims at bringing up the empirical gap in addressing connectivity problems in regional innovation systems.

2.6 Expectations

From the theoretical findings several expectations are formulated and discussed in this section.

E1: Cooperation with industrial partners has a positive effect on the researchers' career.

Academic researchers involved in cooperation with industry are usually motivated by specific collaborative research grants, part time professorships, PhD agreements and the involvement in more generic projects as university patents and technology transfer offices (TTOs) (Freitas and Verspagen, 2009). Additionally, cooperation with industry can be promising for a researcher in the sense of applicability of research results, conducting world-class research and maintaining collaborative contacts. Therefore, the expectation is that the cooperation with industry positively contributes to the researchers' career, what motivates them to engage in innovative projects more frequently.

E2: Academics are often reluctant to be involved in cooperation with industry as it forces them to become entrepreneurs and concentrate on the commercial, rather than on an academic dimension of research.

Despite the benefits of U-I cooperation, a number of disadvantages are also apparent. One of the biggest concerns among researchers is to be *"caught between two of its compelling interests"* (Bowie, 1994, p.12). Financial and legal matters of such partnership often cause a problem. Namely, academic researchers become more concentrated on a commercial, rather than on an academic dimension of their research. The industrial interests are more competitive than the academic ones and the process of transforming the research results into marketable products can also mean that an industrial partner does not permit to publish research results to save the secrecy of a new product (Anderson, 2001).

E3: The choice of academics to cooperate with local or distant firms is usually influenced by their research experience, area of expertise, type of activity, form of contact and frequency of cooperation.

Researchers' choice to engage in cooperation with industry is obviously influenced by different factors. It is important to understand what exactly influence academics' attitudes towards UI partnership. Thus, one might assume that only academics from technology based disciplines are engaged in knowledge transfer process. This study aims to check whether this and the other assumptions offered in the E4 are true.

E4: Proximity influences academics' choice to cooperate with local, rather than with distant firms.

One might assume that due to a common culture and values, it is easier for academics to build trust relationships with local firms. Cooperation with a local firm also means more frequent interaction with an industrial partner. These factors help to organise, conduct and coordinate innovative projects more effectively. If we assume that relationships between academics and entrepreneurs are effective and there are no blockages to their cooperation, than we can suggest that the regional innovation will happen. If this expectation is true, a university-industry linkage can be called a local gateway to the regional innovative development. The next part of the thesis presents the methodology for data collection.

Part III
Methodology and Design

Chapter 3: Methodology and Design

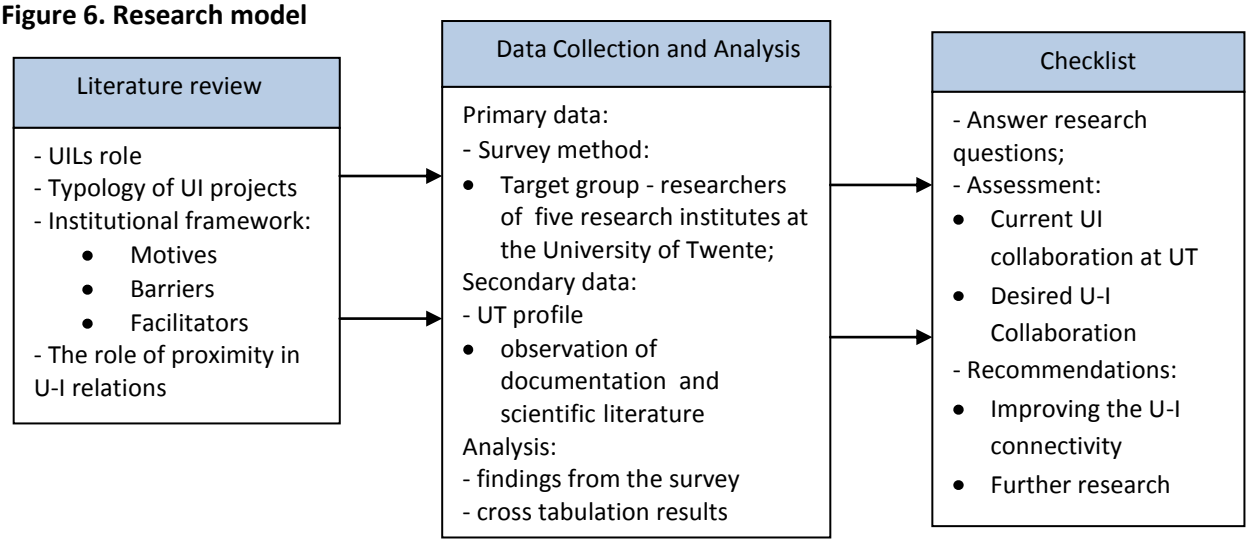
The previous Chapters 1 and 2 have laid a theoretical framework on university-industry relationships, and now we can turn our attention to the empirical part of research. The following chapters 4, 5 and 6 dealt with the empirical validation of the assumptions derived from the theoretical discussion. This chapter explains how the practical study was conducted and what methodology was used in order to reach the research objective. The methodological aspects are presented in the upcoming sections. Section 3.1 demonstrates the research model structure. Section 3.2 dealt with the explanation of survey method choice. Section 3.3 provides the description of questionnaire development. The chapter finalises with the discussion of the expectations in the Section 3.4.

3.1 Research Model

The research model is divided in a theoretical framework, empirical research and reflections on the collected results (see Fig. 5). The nature of this research is exploratory, applied to investigate new insights of the university-industry cooperation process. Main characteristics of exploratory research are to define the problems and to test feasibility of a more extensive subsequent study (Babbie, 2007). In order to answer the raised research questions and gain significant understanding of the topic, a qualitative method is chosen. academics how they make a choice through the questionnaire.

Qualitative method helps to get in-depth understanding of researchers' attitudes towards cooperation with industry and factors that influence their attitudes. The empirical part of this thesis is based on a research conducted at the University of Twente (UT) for the sake of in-depth comprehension of micro-level connections between academics and entrepreneurs. The quantitative data collection is meant for the elaboration of the threat and the attitudes, in the form of values obtained from an online survey (Ghauri and Gronhaug, 2011). The survey method was chosen as a general approach for this study. Secondary source of data is the observation of documentation and yearly scientific literature. In particular, data from the Association of Universities in the Netherlands (VSNU) and several studies, which use the University of Twente as a case study, were used. These multiple sources of evidence - questionnaire results and direct observations from the earlier reports - are critical to understand the nature of the most important factors that influence and explain the phenomenon of academics' choices in cooperation with industry. The desired output from this study is a comprehensive performance measurement framework as a result of the data obtained from the survey. The practical implementation of the framework is not discussed but recommendations and potential practical issues are presented at the end of the thesis. On the basis of this case study I will provide final analysis and recommendations on how the university-industry connectivity might be strengthened.

Figure 6. Research model



3.2 Survey method choice

The main research question (Q: *How does proximity influence the choice of academic researchers to cooperate with local/distant firms*?) is formulated with a question word '*how'*, what requires an exploratory survey study to test the theoretical assumptions discusses in the theoretical part. Therefore, the practical part of this research is based on a UBI (university-business interaction) survey study, which covered the academic researchers from the five research institutes (MESA+, MIRA, CTIT, ITC, and IGS) of the University of Twente, the Netherlands.

The choice of the survey technique as a primary method for the data collection follows three main criteria (Babbie, 2007): firstly this research requires collecting data on phenomena of academics' choices in cooperation with industry that cannot be directly observed; secondly, there is a lack of systematic quantitative evidence on the interactions that academics have with industry; and thirdly survey technique is an effective tool to get academics' opinions and to capture cause-and-effect relationships. A survey method has to take into account five main components (Babbie, 2007): competent respondents, clear format of the survey, appropriate questions format, relevant questions and acceptable response rates. By including these five components, a survey study is considered as "properly" constructed. An online type of the survey was chosen due to a number of advantages: it is easy to administrate, it is costs-effective, it takes less time than face-to-face interview and it allows applying statistical techniques in analysis (Ghauri and Gronhaug, 2011). The survey was built in the Lime Survey tool due to a number of advantages. It is an advanced online survey system, which has a professional template, provides a high level of anonymity to the respondents and allows exporting the response rates to formats, which are easy for analysis.

The choice of the researchers of the UT as the unit of analysis is based on the fact that is an entrepreneurially oriented university (Schutte, 1999). This allows making an assumption that the respondents are involved in cooperation with industry, and therefore are competent to answer the survey questions. The survey was carried out in June 2012

within the UBI (university-business interaction) working group presenting CHEPS and NIKOS research groups of the University of Twente. It was decided to develop relevant questionnaire and administer it through the university mailing system.

3.3 Questionnaire development

The UBI questionnaire was developed with regard on the literature review and propositions presented in the theoretical part. The questionnaire aimed to explore the role of proximity in scientific/ commercial interactions. As part of that, it had to explore how and why academics choose to collaborate with business partners, and the circumstances under which local/ regional partners might be chosen over national/ regional partners. On the basis of this experiment, researchers were asked whether the proximity makes a difference and does it influence them. Questionnaire consisted of 7 screens, including an invitation message introducing the study and 14 questions. Every researcher was asked about age, gender, research position and research experience. The decision to ask demographic questions can be explained by the fact that it gives an opportunity to cross-tabulate the answers for subsequent analysis as well as compare the subgroups to understand how opinions vary between the groups. As the questionnaire was focused on the researchers' attitudes towards partnership with entrepreneurs, it also included questions regarding primary location of industrial partners, primary form of contact with industrial partners, frequency of cooperation, rationales and barriers for effective partnership with industry, and facilitators for the cooperation regardless existing barriers.

Closed-ended questions were chosen as questions format with multiple-choice option for the answers. Closed-ended questions are effective in a survey study as they *"…provide greater uniformity and are more easily processed than open-ended ones"* (Babbie, 2007, p.246). The questions were built as closed type questions with multiple choice answers lists and five points Likert scale for the ranking type answers. The questions must be familiar to the respondents, thus at the beginning of the survey it was added a filter questions to determine whether the researcher is actively involved in the university cooperation. If the researcher is actively involved in cooperation with industry, he/she proceeded to participate in the questionnaire. If not, the participant was sent to the last screen of the survey with the explanation that he/she does not refer to the target group of the research.

It was decided to keep the survey anonymous to encourage more researchers to participate and to get more candid responses to some sensitive questions. The survey also included prize drawing to stimulate respondents in participation. After the survey has been live for three weeks, the follow-up mailing with kind reminding message was sent to raise the number of response rate. The results are enclosed in Annex B.

Part IV

Empirical Research and Findings

Chapter 4. Data Collection and Analysis

This chapter aims to provide and discuss the data obtained during the study. First, Section 4.1 presents the University of Twente case, its main characteristics and mission. Next, the findings from the UBI survey are discussed in the Section 4.2.

4.1 The University of Twente case, the Netherlands

The University of Twente was chosen as the case for this study due to its strong entrepreneurial vision. It has an integrated entrepreneurial culture, diversified funding base, tight relationships with internal organisations and produces excellent quality of applied research (Lazzaretti & Tavoletti, 2007). From the early 1980s the University of Twente develops managerial core and knowledge transfer periphery (Clark, 1998). According to the OECD self-evaluation report (2005), UT realised the biggest number of spin-offs among all Dutch universities. But how the University of Twente became entrepreneurially oriented?

The University of Twente (UT) is relatively young and innovative university. The industrial history of Twente region was the main factor for government to locate the university in Enschede, the biggest city of Twente province. Founded in 1961, its main mission was to increase the number of educated engineers as at that time the textile production was significantly reduced and the university had to take part in the reestablishment of region industry (Schutte, 1999). Therefore, the UT played an important role in regional development from the time of its establishment.

Consisting of 9002 students and 1752 of academic staff for 2010, University of Twente is integrating social and engineering sciences as well as developing high tech with human touch (VSNU, 2011). The research focus of the university is divided to five directions: Nanotechnology (MESA+), Telematics and information technology (CTIT), Institute Biomedical technology and technical medicine (MIRA), Innovation and governance studies (IGS) and Geo-information science and earth observation (ITC).

Apart from excellent academics development, UT has developed entrepreneurial culture and strong relation to industry. According to the research undertaken by Association of Universities in the Netherlands (VSNU), there are 600+ companies on and around the university campus, which have strong relation to industry. During the last 20 years over 700 companies have originated from the UT. With endowment of in average 303 million Euro, the University of Twente is the biggest university in the region (UT Annual report, 2010). Occupying the territory of 150 ha (375 acres) the UT has the biggest campus in the Netherlands.

UT situated in Twente region with a number of companies operating nationally and internationally, and specializing on innovative development. Collaboration of University of Twente and Kennispark Twente gives big opportunities for development of the Twente region. In addition, Twente region has a number of Higher Education Institutions (HEIs), which can be mediators in cooperation with industry (Saxion University of Applied Science, TSM Business School, The Educational Centre Edith Stein (ES), AKI visual Arts and Design academy, SMEOT: training school for metal electrical sector and other). Regional

intermediary organizations are also very beneficial for university-industry cooperation (Regional Innovation Platform, Kennispark Twente, Municipality, Chamber of Commerce, Business and Technology centre (BTC), Oost N.V., Regional development agency, Regional Innovation Centre Syntens). (OECD, 2005). Another distinctive feature of the UT is that it has considerably high knowledge transfer and stimulation of academics entrepreneurship.

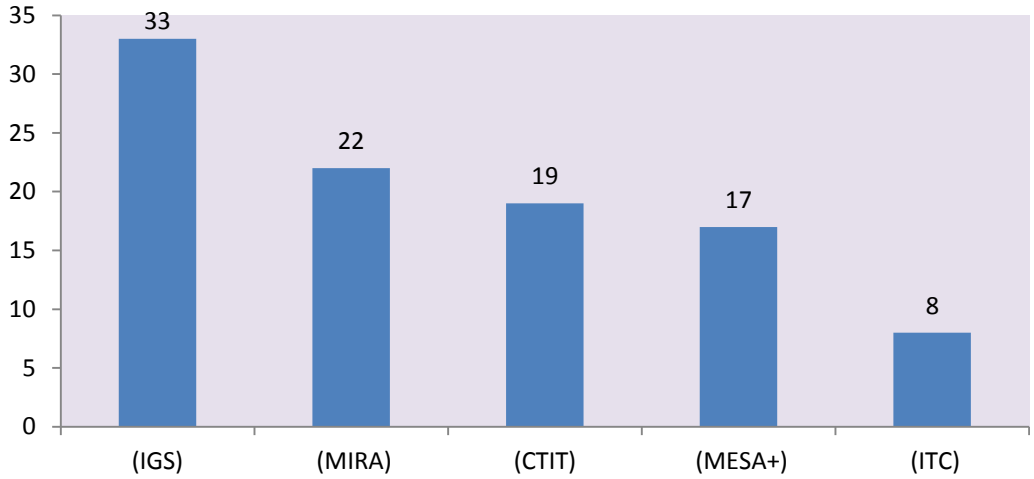
Importantly, one of the weaknesses statements of UI co-operation in Twente is low level of interaction and weak channels of engagement (Freitas and Verspagen, 2009). Benneworth and Hospers (2007) draw out the problem of significant lack of analytical literature related to entrepreneurial activity of the University of Twente. From the perspective of authors, there is an empirical gap in analysis on regional impact of the university activity in particular projects. This research aims at bringing up this gap and explores the decision making process of academics from the University of Twente.

4.2 Findings from the survey

4.2.1 Participants. Area of expertise, research experience, research position

In total 1144 participants were invited to participate in the survey. The sample consists of respondents from five research institutes of the UT: Nanotechnologies (MESA+, 199 (17%) researchers), Telematics and information technologies (CTIT, 219 (19%) researchers), Institute Biomedical technologies and technical medicine (MIRA, 256 (22%) researchers), Innovation and governance studies (IGS, 382 (33%) researchers) and Geo-information science and earth observation (ITC, 88 (8%) researchers) (see Figure 7).

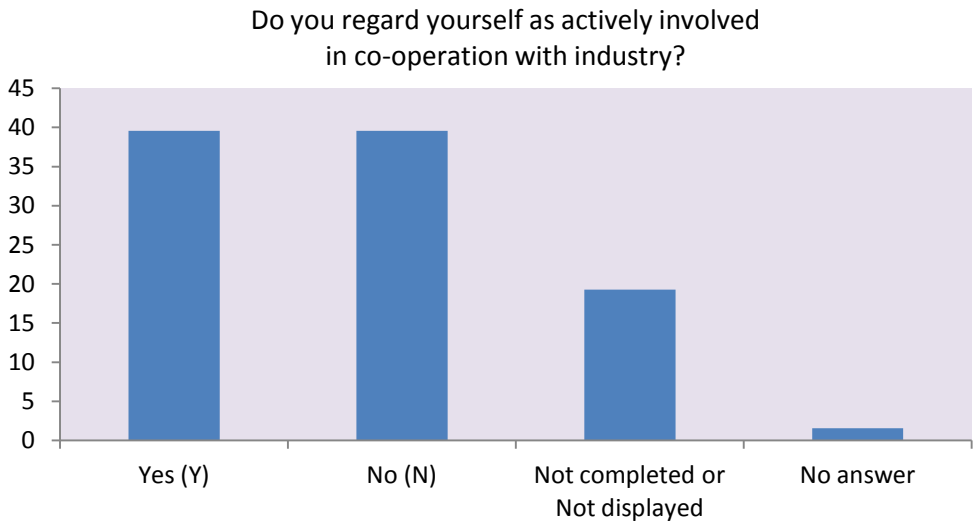
Figure 7. The number of researchers per research institute (% of invited participants)



Due to the limited time for my Master thesis, the survey was active for three weeks and the response rate is not very high. However, the 199 total response rate gives a good impression of academics attitudes towards cooperation with industry. This study aims to explore the relationships between academia and business, therefore the main target group of the study is only those researchers, who are actively involved in cooperation with industry (see fig. 8). The target group consists of 62 (33% of the respondents) academics, who are actively

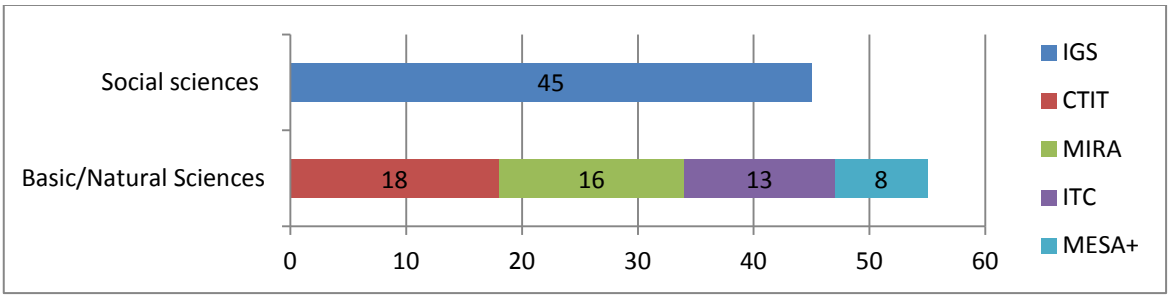
involved in cooperation with industry. Therefore, the analyses will be based on the 62 respondents (41 male and 21 female, age range 26-67).

Figure 8. The involvement of UT researchers in co-operation with industry (% of respondents)



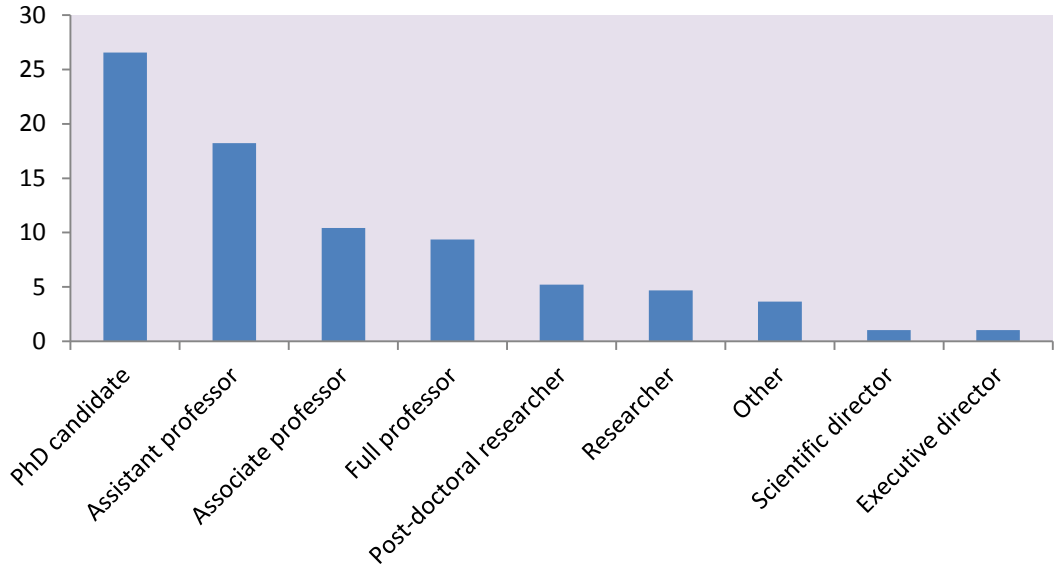
The distribution of the 62 sample respondents by area of expertise is shown in Figure 9. The sample is split between five areas of expertise: 45% of responses from social sciences department (IGS) and 55% of responses from Basic/Natural sciences departments: CTIT (18%), MIRA (16%), ITC (13%) and MESA+ (8%).

Figure 9. Area of Expertise (% of respondents)



The research positions of the respondents vary from scientific directors (1.04%), executive directors (1.04%), full professors (9.38%), associate professors (10.42%), assistant professors (18.23%) to post-doctoral researchers (5.21%,), researchers (4.69%), PhD candidates (26.56%) and other respondents (3.65%) as lecturers and visiting professors (see Figure 9).

Figure 10. Research position (% of respondents)

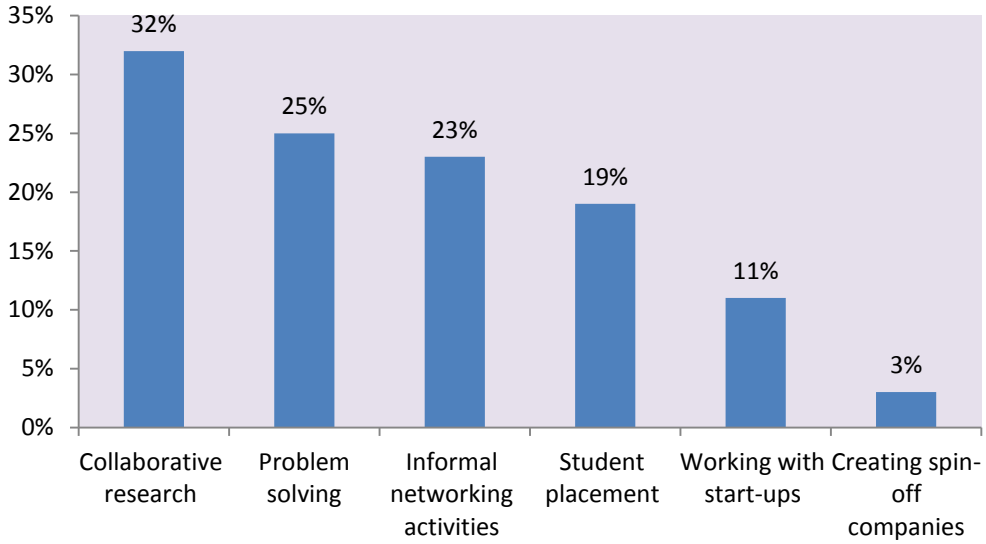


The researchers were also asked about the number of years that they have been involved in academic research. These responses were split into four categories of years (1: 1-10; 2: 11-20; 3: 21-30; 4: 31-40) for further analyses. The minimum response is one year and the maximum is forty years. The average number of years that respondents are involved in research is 14 years.

4.2.2 Types of activities, frequency of interaction and location of indusial partners

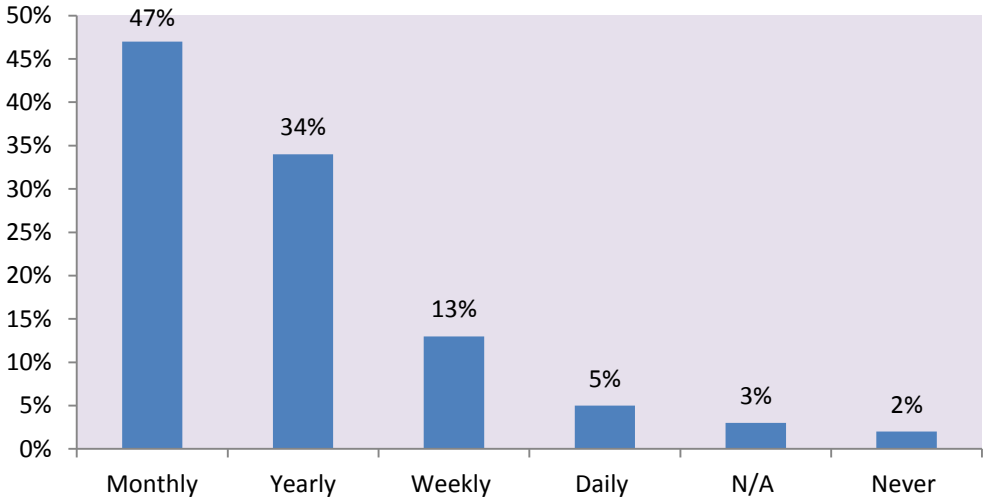
As has been discussed in the theoretical part (Chapter 2.1), researchers can be involved in a range of cooperative activities with industrial partners. These activities vary from collaborative research, problem solving activities, student placement activities to creating spin-off companies, working with start-ups and informal networking activities. To test which of the aforementioned activities are the most common in university-industry relations, researchers were asked to choose three most important to them activities. The report reflected the fact that 32% of the academics are involved in collaborative research most actively, and 25% take part in problem solving activities. Therefore the combination of collaborative research and problem solving activities are the predominant types of university-industry relationships. Over 20% chose informal networking activities and 19% opted for student placement activities. A very small portion of the sample was concerned working with start-ups and creating spin-off companies - 11% and 3% respectively (see Figure 8).

Figure 11. Types of activities (% of respondents)



After researchers have chosen three most important activities, they had to answer what is the frequency of interaction with business partners for these activities. The frequency of interaction was split into five categories: daily, weekly, monthly, yearly and never. Over 45% chose the answer 'monthly' and the other biggest response rate received category 'yearly' – 34% (see Figure 12). Over 10% of academics chose the category 'weekly'. The least significant categories are 'daily' (5%) and 'never' (2%).

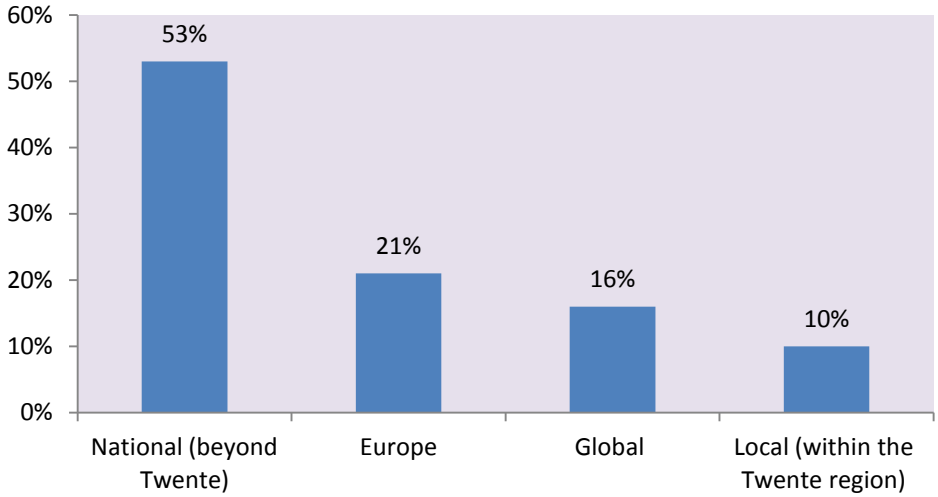
Figure 12. Frequency of interaction (% of respondents)



4.2.3 Location of industrial partners and primary form of contract

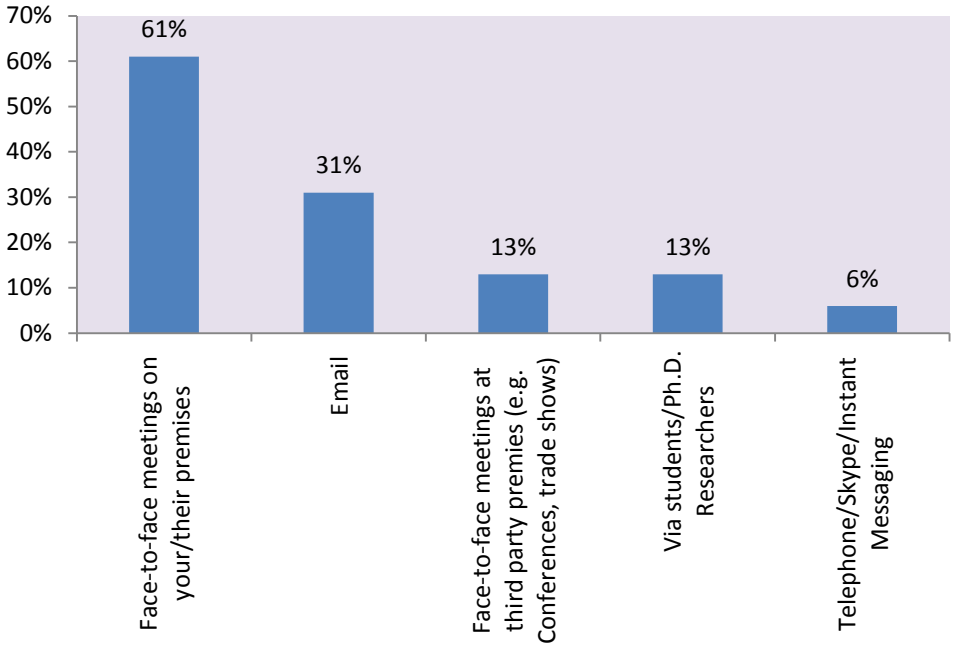
Respondents were also asked about the primary location of their industrial partners: first and perhaps the most striking outcome is that 53% of respondents consider national area as the primary location for their industrial partners. Over 20% of researchers cooperate with firms located in European area and 26% chose Global area as a primary location of their industrial partners. A very small portion of the sample showed that they cooperate within the Twente region. This is reflected in the fact that only 10% opted for the local area as a primary location of their industrial partners (see Fig. 13). It might be expected that academics have to cooperate more with the local firms due to a better connective capacity discussed in section 2.4. However, as the results show, researchers cooperate with national firms twice as often than with local firms.

Figure 13. The location of industrial partners (%of respondents)



After participants gave responses regarding the primary location of their industrial partners, they were asked to choose the primary form of contact that they use for an interaction with industry. The degree of interaction is depicted in Figure 12. Over 60% of the academics surveyed reported that they prefer face-to-face meetings with their industrial partners. The second biggest number of responses use e-mail as a primary form of contact (31%). The equal number of responses is counted in categories of face-to-face meetings at third party premises (e.g. conferences, trade shows, etc.) and interaction via students/Ph.D. researchers (13%), whilst the least number of researchers chose telephone/skype/instant messaging (6%) as a primary form of contract with industrial partners.

Figure 14. Primary form of contract (% of respondents)



4.2.4 Motivation, constraints and facilitation for UI co-operation

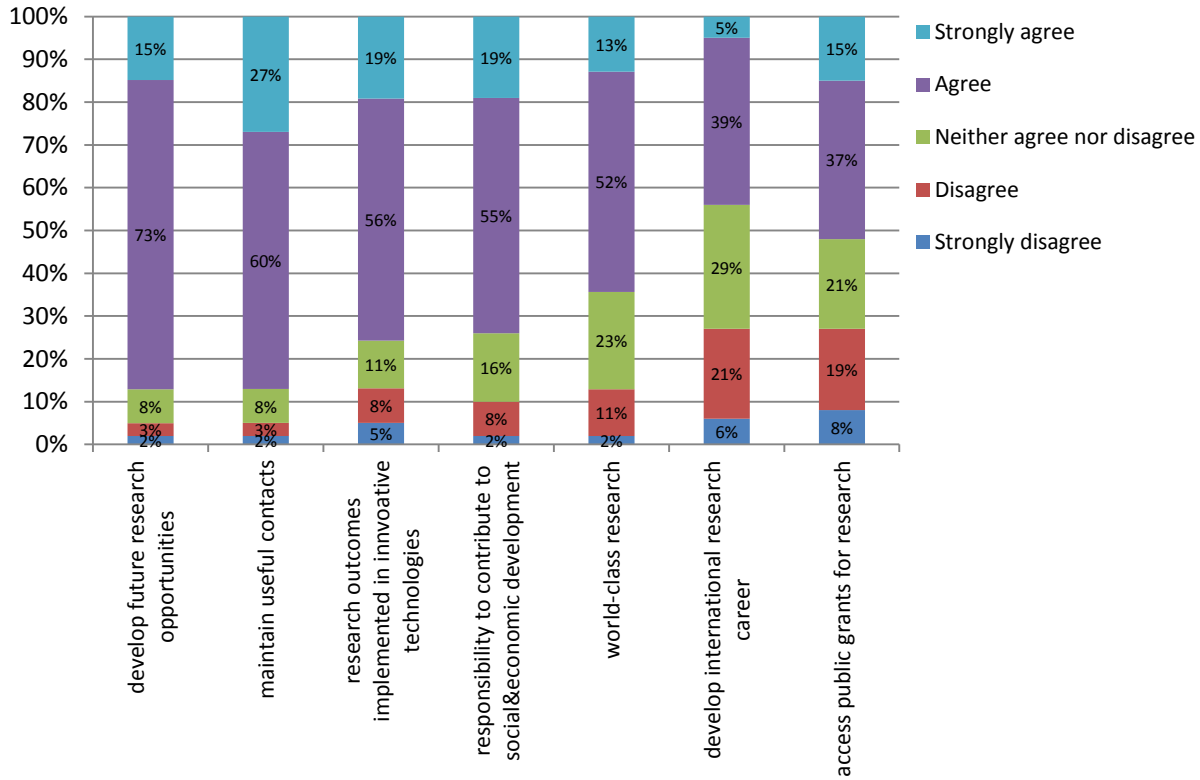
Previous sections demonstrated *how* academics engage in cooperation with industry and now it's important to understand *why* they interact with industrial partners. To understand why academics cooperate with industrial partners, we asked them to rank their attitudes on scale from 1 to 5 - where 1 is strongly agree (very important) and 5 is strongly disagree (unimportant). From the positive average ratings on motivations, it is clear that academics have positive attitude towards partnership with industry (see Table 1).

Table 1: Motivation for activities with industrial partners (average rating)

	Question Considering your most important activities within UBI, cooperation with industry…	**Average Rating**
1.	…helps me to conduct world-class research	3.6
2.	…helps me to see my research outcomes in implemented innovative technologies	3.9
3.	…helps me to access public (e.g. NWO, STW, FOM) grants for my research	3.3
4.	…helps me to maintain contacts that are useful for my work as a researcher and teacher at the university	4.2
5.	… helps me to develop future research opportunities	4.0
6.	… helps me to develop my international research career	3.2
7.	… helps me to fulfil my responsibility to contribute to the social development and economic growth	3.9

To illustrate the choice of academics, the stacked column graph with all categorical answers was built. Figure 15 shows that the most important motivations to engage with industrial partners concerned with developing the academics' research career: 73% of respondents are agree and 15% are strongly agree that cooperation with industry helps to develop future research opportunities; 60% are agree and 27% are strongly agree that it helps to maintain useful contacts; 56% are agree and 19% are strongly agree that it helps to see their research outcomes in implemented innovative technologies; 55% are agree and 19% are strongly agree that it helps them in contributing to the social development and economic growth. Slightly lower ratings are given to the world-class research (52% are agree and 13% are strongly agree). Furthermore, researchers engage in cooperation with industry as it helps to develop their international research career (39% are agree and 5% are strongly agree). The motivation that has the lowest rank is concerned with financial gain: accessing public grants for research (37% agree and 15% are strongly agree).

Figure 15. Motivation for activities with industrial partners (mean score, %)



Although the importance of partnership with industry is rated consistently high across all categories, there are factors which constrain effective interaction. As has been discussed in Chapter 2, universities and companies may have conflict of interests, as they are not natural partners (Lambert report, 2003). In order to understand the academics' attitudes towards constraints to effective partnership with industry, we asked them to rank the barriers on scale from 1 to 5 - where 1 is strongly disagree (unimportant) and 5 is strongly agree (very important).

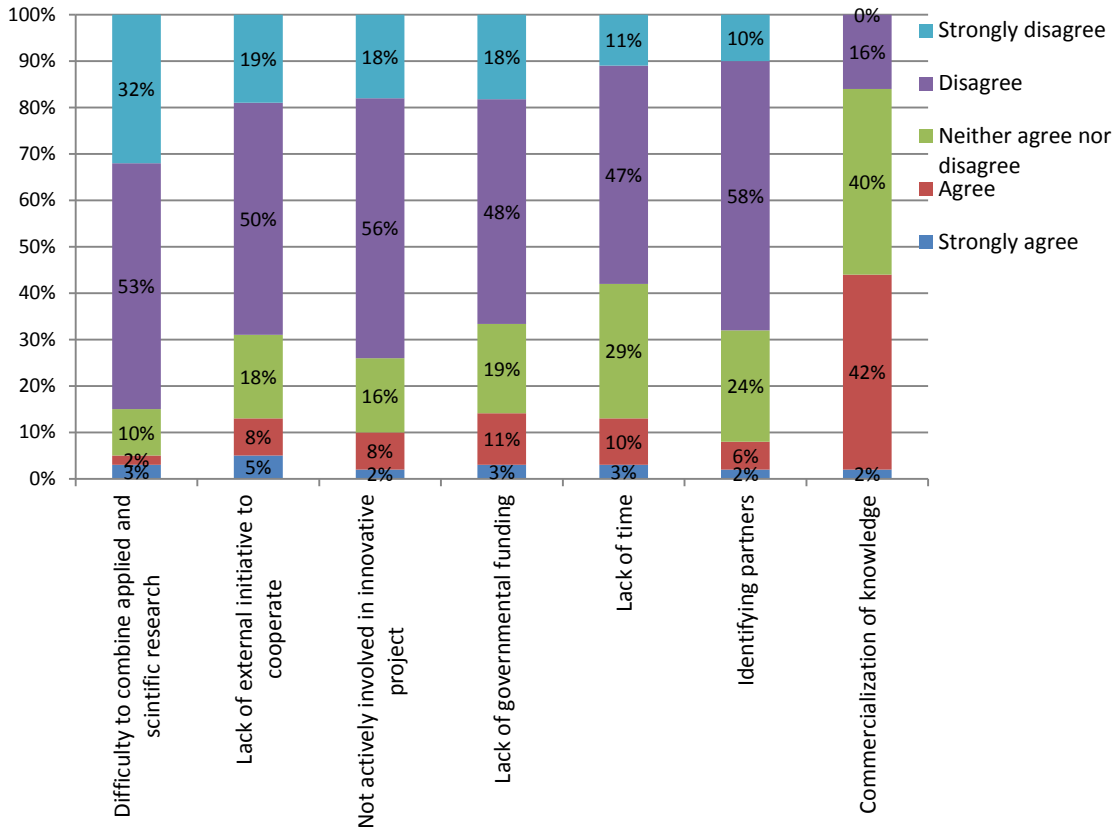
To check the negative attitudes the valence of the statements were balanced. The constraints were phrased as positive sentences and the scale was reversed for convenience in further analysis. Ratings on constraints for partnership with industry are mostly neutral to negative, which shows that most of assumptions regarding barriers to UI cooperation are not proved (see Table 2). Only the first out of seven constraints shows a rating higher than average (average is 2.50).

Table 2. Constraints for activities with industrial partners (average rating)

	Question Considering your most important activities within UBI, cooperation with industry…	**Average Rating**
1.	…helps me to concentrate on academic rather than commercial dimensions of research	**3.2**
2.	…helps me to be actively involved in innovative projects	2.2
3.	… helps me to be involved in innovative projects supported by the government	2.4
4.	…helps me to be involved in innovative projects and stay an independent researcher	2.2
5.	… helps me to be involved in applied research and development as well as scientific research	1.9
6.	… helps me to work with companies which are sympathetic to university research	2.3
7.	… helps me to combine my teaching/research responsibilities and cooperation with business	2.3

Figure 16 demonstrates the academics' attitudes towards constraints to UI cooperation. The most significant constraint is commercialisation of knowledge (44% are agree). As defined in Chapter 2, this constraint is internal, caused by interaction problems and refers to the category of different institutional purposes of firms and universities. The second important constraint are: deficiency of governmental funding (14%), which is caused by structural problems; and lack of time to combine university roles and cooperation with business (13%). The other factors are not considered to be significant barriers to UI cooperation. Overall, the other constraints are: lack of external initiative to cooperate (12%), problem of active involvement in innovative projects (10%), problem to find companies which are sympathetic to university research (identifying partner) (8%) and impossibility to combine applied R&D with scientific research – only 5% of the respondents consider it as a constraint. Therefore, from the ratings on constraints it is clear that participants consider the commercialization of knowledge as the most negative factor, whereas the other factors are not significant to be barriers to UI partnership.

Figure 16. Constraints for activities with industrial partners (mean score, %)



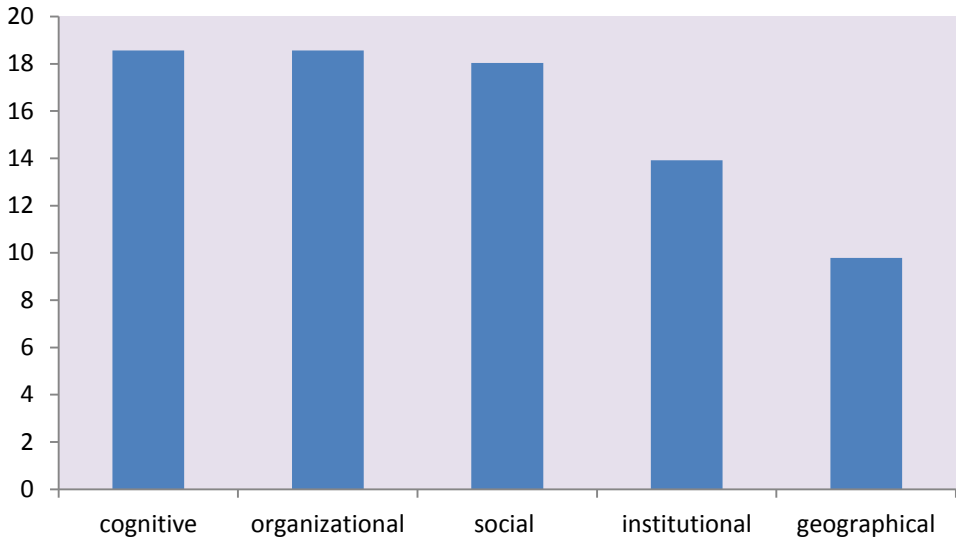
It was also important for us to know which are the facilitators for UI partnership regardless the constraints. For this reason we coded five dimensions of proximity (cognitive, organizational, social, institutional and geographical) in sentences describing the conditions, under which academics agree/disagree to cooperate with industrial partners. For negatively phrased statements (marked with an asterisk in Table 3), I reversed the rating, so that higher was always negative (disagree). Ratings on proximity were mostly positive, what proves the importance for academics of each dimension of proximity. The negative statements showed that the most important factors for researchers are to have independence in research and maintain flexibility of interaction. Geographical proximity is important for academics, but not in the sense of acquiring high-quality research grants.

Table 3. Role of proximity in UI cooperation (average rating)

	Question Considering your most important activities within UBI, cooperation with industry…	**Average Rating**
1.	... frequent communication with industrial partners helps me to conduct innovative projects more effectively (cognitive)	3.5
2.	...more frequent interaction allows me to conduct innovative projects more independently*	**3.1**
3.	… interacting through informal networks help to control innovative project more effectively (organizational)	3.3
4.	... communication through informal networks gives more flexibility in my research*	**2.7**
5.	… working with industrial partners I trust helps to raise an effectiveness of innovative project(social)	3.8
6.	...I prefer to work with different partners to maintain my independence *	**2.8**
7.	… I prefer working with industrial partners with shared culture and values (institutional)	3.8
8.	... I will work with any industrial partner if it leads to quality publications or patents*	**2.8**
9.	… working with local partners helps to organise and coordinate innovative projects more effectively (geographical)	3.1
10.	... I will work with local firms only o acquire high-quality research grants *	**3.8**

As shown in Exhibit 15, the most important belief is that academics prefer to work with industrial partners whom they trust (18,56%). The same response rate received the category “working with industrial partners with shared culture and values” (18,56%). Many researchers believe that frequent communication with firms helps to conduct innovative projects more effectively (18,04%). Furthermore, the importance of informal networks is rated consistently high among researchers from different areas of expertise. Academics agree that informal networks help to control their innovative projects more effectively (13,92%). Over 9% of respondents believe that working with local firms helps to organise and coordinate innovative project more effectively.

Figure 17. Proximity as facilitation for UI co-operation, (% of respondents)



4.3 Creating Partnership: the Perspective of Academics

How academics perceive the partnership with industry may significantly influence which partners they choose for cooperation. In response to the secondary research question '*Q7. Which factors influence academics' choice to cooperate with local/distant firms?',* this section aims to describe the analysis of results, which will answer what influences researchers to engage in partnership with local of distant firms.

To investigate the relationship between cooperation of academics with local/distant firms, we chose a set of factors to present cross-tabulation results. It was decided to present the descriptive for partnership of researchers with local/distant firms influenced by experience, background, proximity and type of activity. Further analysis were made to see if there is any dependence between the most preferred form of cooperation, its frequency and form of contact.

4.3.1 Variations in location of industrial partners influenced by the academics' research experience, background, types of activities and proximity

This section describes the variations in interaction of academics with local or distant firms influenced by different factors as: researchers' experience, area of expertise, types of collaborative activities and proximity. Local partners refer to the firms within the Twente region. Distant partners relate to the firms located in national (beyond the Twente region), European and Global area.

First we compared the choice of academics to cooperate with local/distant firms considering the number of years that they have been involved in research. Ranking on experience shows that the respondents of all four categories of years (1:1-10; 2:11-20; 3:21-30;

4:31-40 years) prefer cooperation with distant (90%) rather than with local firms (10%) (see Table 4).

Table 4. Location of industrial partner influenced by academics' experience (number and % of respondents)

Experience	Local		Distant	
1(1-10 years)	4	6%	**24**	**39%**
2(11-20 years)	1	2%	**14**	**22%**
3(21-30 years)	1	2%	**15**	**24%**
4(31-40 years)	0	0	**3**	**5%**

N=62

Next, the distribution of 62 sample respondents by discipline is shown in Table 5. It demonstrates the pattern of local/distant firms in terms of academics' background in Basic/Natural Sciences vs Social Sciences. The Table 5 shows that 51% of researchers from Basic/Natural Sciences departments work with distant firms, whereas only 4% cooperate with local industrial partners. Similarly, 39% of respondents from the Social Sciences department work with distant and only 6% work with local industrial partners. This shows that despite of researchers' area of expertise, they prefer to cooperate with distant, rather than with local firms.

Table 5. Location of industrial partner influenced by academics' background (number and % of respondents)

Background	Local		Distant	
Nanotechnologies (MESA+) (Basic/Natural Sciences)	0	-	**5**	**8%**
Biomedical Technologies (MIRA) Basic/Natural Sciences	2	4%	**5**	**8%**
Telematics and informational technologies (CTIT) Basic/Natural Sciences	0	-	**12**	**19%**
Innovation and Governance studies (IGS) Social Sciences	4	6%	**24**	**39%**
Geo-information and earth observation science (ITC) Basic/Natural Sciences	0	-	**10**	**16%**

N=62

Next pattern of comparison is types of activities influenced by location of industrial partners. The Table 6 shows that in all types of activity, except creating spin-off companies, most academics prefer to cooperate with industrial partners located in national (beyond Twente region) area (53%). The second most significant number of respondents (21%) chose European area as a primary location of their industrial partners. A further 17% of academics chose global area. Finally, the lease number academics (10%) are involved in cooperation with firms in local/regional area (within Twente region). The equal number of respondents (1%) chose national and European area as a primary location of industrial partners in creating spin-off

companies. Similarly, the same number of academics (2%) chose local and global location of industrial partners in the student placement activities row. Interestingly enough, any of participants chose local area for creating spin-offs and working with start-up companies. These results suggest that there is a substantial degree of disconnectedness between UT researchers and regional organizations.

Table 6. Location of industrial partner influenced by type of activities (number and % of respondents)

Activities	Local/Regional (within Twente)		National (beyond Twente)		Europe		Global	
Collaborative research	2	3%	**9.3**	**15%**	4.3	7%	3	5%
Problem solving	1.6	3%	**7.3**	**12%**	3	5%	2.6	4%
Student placement activities	1.3	2%	**6.6**	**11%**	2	3%	1.3	2%
Creating spin-off companies	0	-	0.6	1%	0.66	1%	0.3	1%
Working with start-ups	0	-	**1.6**	**3%**	0	-	0.3	1%
Informal networking activities	1	2%	**7**	**11%**	3	5%	2.6	4%
Total		10%		**53%**		21%		17%

N=62

The pattern of location of industrial partner influenced by five dimensions of proximity (cognitive, organizational, social, institutional and geographical) is presented in Table 7. All results of average ratings (1 – unimportant; 5 –very important) are positive, what shows a strong dependence between proximity and location of industrial partners. In other words, academics agree to cooperate with an industrial partner located in any area if the cooperation is supported by a high level of proximity. Furthermore, it is worth mentioning which dimension of proximity is the most important for different location of industrial partners. Firstly, for local firms academics consider social proximity as the most important dimension of proximity. Secondly, academics chose institutional proximity as the most significant in cooperation with national industrial partners. Thirdly, cognitive and social proximity is equally important in cooperation with European firms. Finally, institutional proximity was chosen as a primary for interaction with global industrial partners.

Table 7. Location of industrial partner influenced by proximity (average rating)

Location / Proximity	Cognitive	Organizational	Social	Institutional	Geographical
Local	3.8	3.3	**4.3**	3.7	3.5
National	3.5	3.3	3.8	**3.9**	3.1
Europe	**3.7**	3.1	**3.7**	3.5	3.4
Global	3.3	3.4	3.5	**3.9**	2.7

Taken as a whole, the results in this section suggest that patterns of interaction do vary across different location of industrial partners. Despite experience, background and types of activities academics choose to cooperate with distant, rather than with local firms. Highly intensive interactions in all types of activities occur with industrial partners located in national (beyond Twente region) area.

4.3.2 Variations in collaborative activities by frequency of cooperation and form of contact

This section presents the analysis on relation between the most preferred form of cooperation with industrial partners, its frequency and form of contact. As shown in Table 8, the most frequently cited category is 'monthly' (47%) and the least frequently cited is 'daily' (2%). In particular, the frequency of interaction between academics and firms in collaborative research, problem solving and student placement activities is monthly (16%, 12% and 9% respectively). Academics are engaged in creating spin-off companies (3%) and informal network activities (11%) weekly. Finally, academics work with start-ups yearly (3%).

Table 8. Preferred form of cooperation influenced by frequency of interaction (number and % of respondents)

Activities	Yearly		Monthly		Weekly		Daily	
Collaborative research	3	5%	**10**	**16%**	4,3	7%	0	-
Problem solving	2	3%	**8**	**12%**	4	6%	0	-
Student placement activities	2	3%	**6**	**9%**	4	6%	0	-
Creating spin-off companies	0	-	1	1%	**2**	**3%**	1	1%
Working with start-ups	**2**	**3%**	1	1%	1	1%	0	-
Informal networking activities	2	3%	5	8%	**7**	**11%**	1	1%
Total		17%		**47%**		34%		2%

N=62

Pattern of types of UI cooperation influenced by a form of contact is shown in Table 9.The most preferred form of contact in each activity is face-to-face meetings on academic'/industrial partner' premises (50%). The second most important form of contract with firms is via Email (25%). The third most important forms of contact are face-to-face meetings at third party premises (e.g. conferences, trade show) (11%) and cooperation via students/PhD researchers (10%). The least preferred is cooperation with industrial partners via telephone/Skype/instant messaging (4%).

Table 9. Preferred form of cooperation influenced by form of contact (number and % of respondents)

Activities	Face-to-face meetings on your/their premises		Face-to-face meetings at third party premises (e.g. conferences, trade show)		Telephone/Skype/Instant Messaging		Email		Via students/ PhD researches	
Collaborative research	**9**	**15%**	2	4%	0,6	1%	4,6	8%	1,3	2%
Problem solving	**7**	**11%**	1	2%	0,6	1%	3,6	6%	1,6	3%
Student placement activities	**6**	**9%**	2	3%	0	-	1,6	3%	1,6	3%
Creating spin-off companies	**1**	**2%**	0	-	0	-	0,3	1%	0	-
Working with start-ups	**1**	**2%**	0	-	0,3	1%	0,6	1%	0	-
Informal networking activities	**7**	**11%**	1	2%	0,3	1%	4	6%	1	2%
Total		**50%**		11%		4%		25%		10%

N=62

In sum, the survey with amount of 62 responses allows us to have a clear picture of: the types of activities of UI cooperation in which academics are engaged; the location of industrial partners; the frequency and intensity of interaction; the form of contact with industry; what motivates and constraints cooperation; and how academics see the role of proximity in cooperation with industry.

After the results have been collected and analysed, it is important to have a clear picture of what are the main factors influencing the academics' choice in co-operation with industry. The main facts obtained from this research are:

Box 1. Summary of facts: interaction of academics with industrial partners at the University of Twente

- The 31 % (62 researchers) of all participants (199 researchers) consider themselves as actively involved in co-operation with industry;
- Collaborative research and problem solving activities are the predominant types of university-industry relationships;
- The frequency of interaction with industrial partners in all collaborative activities is monthly and yearly;
- The most preferred form of contact in each activity is face-to-face meetings on academic'/industrial partner' premises
- The most important motivation for academics to cooperate with industry is developing future research opportunities and maintaining useful contacts;
- The most significant constraints for activities with industrial partners is commercialisation of knowledge and deficiency of public sponsorship;
- The most important facilitators for interaction with industry despite of the constraints, is cognitive, organisational and social proximity, what means the co-operation with reliable partners and those, which have shared culture and values;
- The comparison of academics attitudes from Social Sciences and Natural/Basic Sciences departments towards the location of industrial partner showed that all of them cooperate more with distant rather than with local firms;
- In any type of UI collaborative activities most academics prefer to cooperate with industrial partners located in national (beyond Twente region) area.

Findings from the survey show the positive attitude of academics' towards co-operation with industry. The location of industrial is important for researchers in the sense of proximity of interaction. Therefore, academics co-operate with both local and distant partners if the interaction is supported by proximity.

Chapter 5. Discussion and Recommendations

5.1 Current Situation

The results of the survey showed that half of the academics from the University of Twente, who participated in survey, regard themselves as actively involved in cooperation with industry. They are engaged in a wide range of activities with a wide range of partners. The intensity of cooperation is relatively high. The models of interactions are multi-faceted and innovative. It varies from consultancy services and student placement activities to creating spin-off companies. Most researchers chose collaborative research and problem solving as the primary activities in co-operation with industry.

The least number of researchers are involved in creating spin-offs and working with start-up companies. The frequency of cooperation varies from monthly to weekly interaction, but the highest number of respondents chose 'monthly' and 'yearly' categories. Academics interact with industrial partners by different means, including face-to-face meetings, telephone and mail. But the primary form of contract is face-to-face meeting on first premises. Academics are less likely to interact with industrial partners via students/PhD researchers or by telephone/skype. According to response rates, the most preferable location of industrial partners is national (beyond Twente region).

The second most common location of industrial partners is European and global area. The least important partners are located within the Twente region. Furthermore, it is important to emphasize that the diversity of responses vary due to their research experience, ambitions and research expertise. The results showed that researchers from different disciplines are actively engaged in partnership with industry. Thus, not only researchers from Basic/Natural Sciences research institutes, but also from Social Sciences cooperate with firms.

In this research it was important to explore why and how the academics make choice to cooperate with industrial partners. The chief assumption, which I had to test, is whether academics really choose to cooperate with local/regional rather than with distant (national/European/global) companies due to proximity in interaction. However, the findings from the survey and further analysis show that academics cooperate with national/distant firms rather than with local partners. This argument supports the assumptions derived from the theoretical discussion on RISs blockages from Chapter 2. In particular, the results showed that there are micro-level connections between academics and entrepreneurs on the regional level. However, the spatial proximity does not protect to have the blockages to interaction.

Several expectations were discussed in the Chapter 3. After the results were collected and analysed, it is possible to give the reflection to the expectations.

E1: Cooperation with industrial partners has a positive effect on the researchers' career.

The cooperation with industry can be promising for a researcher in the sense of applicability of research results, conducting world-class research and maintenance of collaborative contacts (Freitas and Verspagen, 2009). The survey results showed relatively high rate of

positive responses in the category of researchers' motives. Therefore, the expectation that the cooperation with industry contributes to the researchers' career is true, but it does not depend on the location of company.

E2: Academics are often reluctant to be involved in cooperation with industry as it forces them to become entrepreneurs and concentrate on the commercial, rather than on an academic dimension of research.

This expectation held true in practice. What we saw in analysis part is that the most significant constraint is commercialisation of knowledge. As was defined in the theoretical part, this constraint is internal, caused by interaction problems and refers to the category of different institutional purposes of firms and universities. It is possible to conclude that conflict of interests makes it impossible to build effective partnership.

E3: The choice of academics to cooperate with local or distant firms is usually influenced by their research experience, area of expertise, type of activity, form of contact and frequency of cooperation.

Results from the analysis show that regardless the researchers' background, research experience, type of activity, frequency of cooperation or form of contact they prefer to work with distant industrial partners.

E4: Proximity influences academics' choice to cooperate with local, rather than with distant firms.

The last and most important expectation was that proximity influences academics' choice to co-operate with local, rather than with distant firms. Due to common culture and values, it's easier for academics to build trust relationships with local firms. Cooperation with a local firm also means more frequent interaction with industrial partners. These factors help to organise, conduct and coordinate innovative projects more effectively (Boschma, 2005). The results showed strong dependence between proximity and location of industrial partners. However, academics are agree to cooperate with an industrial partner located in any area if the cooperation is supported by a high level of proximity. Therefore, the results showed that geographical proximity is not the most important factor for effective UI partnership.

Finally, in response to the last secondary research question *RQ7. How does the choice of academics influence the regional innovative development?* it is enough to note the fact that academics cooperate with national, European and global industrial partners rather than with local, what means that this partnership is not aimed to contribute to the Twente regional development. Although it was assumed in the theoretical framework that university-industry linkage is a local gateway to regional innovative development and regional innovation will happen if there are no blockages to effective relationships between academics and entrepreneurs, the results of UT case analysis did not prove that academics are actively engaged in cooperation with local companies, but showed a high degree of interactive constraints.

5.2 Model of academics' decision making process in co-operation with industry

After the expectations have been compared with results obtained from the survey, it is now possible to summarize the facts influencing academics' decision making process. The analysis showed that academics are co-operating with industrial partners rather actively. Although both researchers and entrepreneurs are interested in collaboration, there are certain blocking factors influencing the UI connectivity that have been described in the earlier sections. The following Table 10 provides an overview of the most important factors influencing the connectedness of university to industry in terms of the conditions likely to have an effect on interaction starting from the least complex to the more transformational activities.

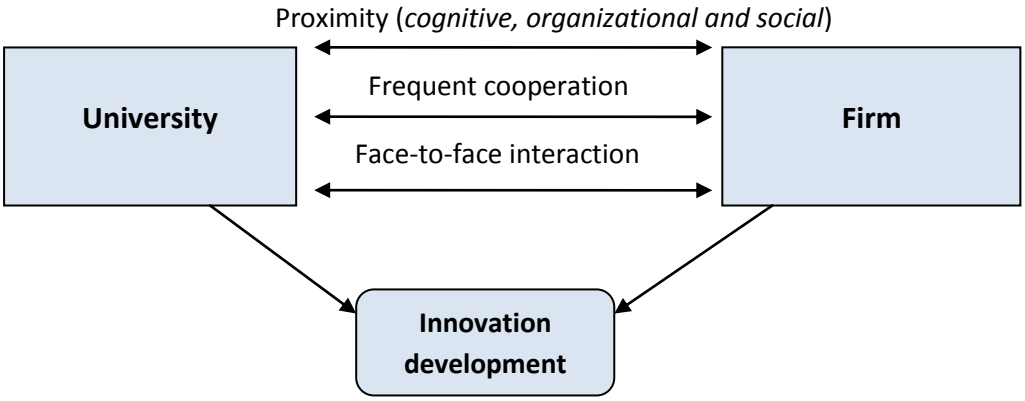
Table 10. Summary of mechanism influencing effectiveness of UI relationships

Activity	Most effective when
1. Less complex activities, transactional with clear time bounds and outcomes	
Collaborative research	Location: National (beyond Twente) area; Proximity: cognitive, organizational and social; Frequency of interaction: monthly; Form of cooperation: face-to-face meetings
Student placement activities	Location: National (beyond Twente) area, Proximity: cognitive, organizational and social; Frequency of interaction: monthly; Form of cooperation: face-to-face meetings
Informal network activities	Location : National (beyond Twente) area; Proximity: cognitive, organizational and social; Frequency of interaction: monthly; Form of cooperation: face-to-face meetings
2. More complex activities with less clear outcomes and unclear time bounds	
Problem solving	Location: National (beyond Twente) area; Proximity: cognitive, organizational and social; Frequency of interaction: monthly; Form of cooperation: face-to-face meetings
Creating spin-offs	Location : National (beyond Twente) area; Europe, Global Proximity: cognitive, organizational and social; Frequency of interaction: yearly; Form of cooperation: face-to-face meetings
Working with start-ups	Location: National (beyond Twente) area, Proximity: cognitive, organizational and social; Frequency of interaction: yearly; Form of cooperation: face-to-face meetings.

The Table 10 shows four main factors influencing the choice of academics to co-operate with industry – location of firm, proximity of interaction, frequency of interaction and form of contact. The analysis showed that the choice of academics is almost the same in each activity.

Thus, academics usually work with national (beyond Twente area) firms. The factor of cognitive, organizational and social proximity is important for academics in each activity. The frequency of interaction is weekly and the most preferred form of contact is face-to-face meetings. The most important factor influencing the choice of academics in co-operation with industrial partners is proximity. The factors of location, frequency of interaction and form of contact depend on proximity of interaction. The Figure 11 below demonstrates the model on how academics choose partners to collaboration and what kinds of proximity are important.

Figure 11. Model of main factors influencing academics' choice to co-operate with industry



5.3 Improvement of the UT connectedness with industrial partners

The geographical location, research capacity and entrepreneurial vision provide the University of Twente with a wide range of opportunities to contribute to the regional development and economic growth of the Twente region. The Twente regional system has a developed infrastructure, developed institutional system (regional large companies, SMEs, intermediary organisations) and regional governmental support to make the regional development effective (see Appendix C). However, the results of this study show that there is no regular interaction between academics and local firms. Therefore, currently the university lacks improved interaction with local SMEs, what allows concluding that there is a problem of interaction blockages within the Twente regional innovative system. The university and industry as the subsystems of the Twente RIS are disconnected. To improve the connectedness, several recommendations could be taken into consideration:

- to develop strong public research programme which is essential to satisfy the evolving needs of Twente region and address significant economic, social and environmental problems;
- to involve in research key stakeholders as: local SMEs, interest groups and government;
- to improve innovative capacity;
- to keep up-to date with technological developments;
- to reduce academic bureaucracies, which slows the knowledge transfer process (Ankrah, 2007);
- to raise the exploitation of research capabilities to obtain patents (Ankrah, 2007);

- to define potential partners and establish the purpose of cooperation.

The next part will provide the final discussion on conclusions, limitations and further possibilities for research in this topic.

Part VI
Conclusions and Implications

Chapter 6. Conclusion

6.1Retrospective

The research process (illustrated in section 3.1) proved itself as a challenging process to achieve the study objective. The exploratory case in combination with survey results revealed important aspects of university-business relationships. It is demonstrated in Chapter 2 that university-industry linkages as a part of regional innovative system can promote regional development. In the scope of UI relations universities can be engaged in various kinds of knowledge transfer activities with industrial partners. However, in case of interactive and structural problems the regional innovative system is not functioning properly and academics do not cooperate with industry for the purpose of regional innovative development. It was explained as the problem of interactivity due to weak channels of engagement and poor links between RISs actors. Several hypotheses were derived from the theoretical discussion. The chief assumption of this research was to test whether there is a relation between proximity and cooperation with local firms.

Chapter 3 introduced the research design of the study. It was decided to conduct a combination of qualitative and quantitative approach for research. Qualitative approach aimed to describe the university-industry relations using practical example of entrepreneurial university. It was presented by the OECD report of the University of Twente, Annual report of the UT for 2010 and scientific journals related to performance indicators of the UT. Quantitative approach was used for elaboration of threat and the attitudes of academics in form of values. The quantitative data is presented by the responses obtained from the mail survey sent to the academics of the University of Twente.

The questionnaire had to provide a picture of the academics' choices in cooperation with entrepreneurs. It also had to approve or reject main research assumption: proximity influences academics' choice to co-operate with local rather than with distant firms. The research model showed how different kinds of proximity influence academics' decision-making process. The findings from the survey and subsequent analysis allow me to conclude that proximity certainly influences academics' in cooperation with industry. The category of 'proximity' didn't show the significant response rate regarding the location of industrial partners. It is important for academics to conduct research independently, to conduct frequent interaction and to work with companies with shared research culture and values. Although it seems that local companies can promise higher level of proximity, during the process of interpreting and analysing the results, it became clear that it is not critical for academics to work exceptionally with local companies. UT researchers showed that they cooperate with national partners most frequently.

At this point it is important to remind that if there were no interactive and structural barriers to university-industry cooperation on regional level, academics would cooperate with local partners more frequently and effectively. This is primarily a matter of local regulation and thinking. Global oriented thinking is effective and important, but it puts a bridge to regional development too far. Finally, it is possible to conclude that all research

questioned raised in the section 1.4 were answered. In the next section I will discuss future work directions and challenges in exploring the university-industry collaborative workspaces.

6.2Theoretical contributions and implications

This research conceptualizes U-I partnership in a new theoretical framework that analyses the blockages to the RISs innovative capacity with a special emphasis on academics' choice to cooperate with local/distant industrial partners. The analysis confirmed the proposition that proximity influences the researchers' choice in cooperation with industry, but rejected the assumption that cooperation with local firms can provide higher level of proximity and raise the innovative capacity. This, however, does not mean that local firms are unable to be good partners, but shows that there is lack of connectivity between actors. Therefore, the results confirmed the influence of structural and interactive problems influencing the RISs. Poor links between actors and weak channels of engagement showed the significant practical impact on the UT researchers' opinions (Freitas & Verspagen, 2009).

Overall, the results achieved in this study contribute to the extensive theoretical discussion on knowledge transfer. As the literature review shows an empirical gap in quantitative analysis of academics' choices in cooperation with industry, this study contributes to the quantitative analysis research on UI partnership. What was examined in this study appropriately represented the attitude of academics towards partnership with business. It confirmed and idea that social, organisational, strategic and institutional proximity can contribute to the development of an effective network between local and external actors. Therefore, this study proved that geographical proximity is not a prerequisite for effective relationships between university and industry (Ratinho & Henriques, 2010). As known, knowledge transfer between local and external institutions contributes to creation of epistemic communities, networks of practice and communities of practice (Benneworth & Dassen, 2011; Oinas & Malecki, 2002). The responses of UBI survey showed that academics mostly work with national, European and global industrial partners.

6.3 Limitations and further research

This study has certain degree of limitations, what leads to the challenge of future research. This study is based on detailed analysis obtained from survey, which had 62 target group participants. Future research has to be active for longer time to have a clearer picture of academics' attitudes. Also, collecting UBI survey results from the other Dutch universities would give more insights into the UI interaction. It would be useful to conduct several interviews with industry representatives to investigate what are the main constraints to their opinion in cooperation with universities and how would they strengthen the connectivity with academics. More in-depth studies are required to investigate how to strengthen the connectivity between universities and local companies to produce effective regional innovative development.

In addition, future research could include the developing of theoretical framework further. For example, the critical requirement for regional development is diverse knowledge bases and skills of academics and their industrial partners, novelty of ides and ability to

commercialise them. The novelty of ideas is most effectively resulting in innovation within specialized cluster (Lagendijk & Oinas, 2005). Therefore, in further research it might be challenging to explore how to engage UI linkages in development of diverse novelty projects, which have to set the basis for further cluster building in region.

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Appendices

Appendix A: Questionnaire
University-Business Interaction (UBI) Survey

Page 1. Introduction

In the scope of this survey we are seeing to explore how and why academics choose to collaborate with business partners, and the circumstances under which local/ regional partners might be chosen over national/ international partners. The study is being led by Dr. Paul Benneworth (CHEPS) and Dr. Tiago Ratinho (BK) as part of an on-going work-stream exploring the relationships between universities and businesses. The survey will take no more than 10 minutes to complete. Your answers will be treated completely anonymously and confidentially.

If you have any questions about the questionnaire or project, then please do not hesitate to contact Milana Korotka: m.korotka@student.utwente.nl.

Thank you for your willingness to help!
Milana Korotka
(on behalf of UBI working group)

Page 2. General Information

Q1. Research institute within UT:

- MESA+
- MIRA
- CTIT
- IGS
- ITC

Q2. Research position:

- Scientific director
- Executive director
- Full professor
- Associate professor
- Assistant professor
- Post-doctoral researcher
- Researcher
- PhD candidate
- Other:……

Q3. Please indicate a number of years that you've been involved in research:

- drop down menu with numbers

Q4. Do you regard yourself as actively involved in co-operation with industry?

- yes
- no

Q5. What is the primary location of your industrial partners?

- Local/Regional (within Twente)
- National (beyond Twente)
- Europe
- Global

Q6. What is the primary form of contact with your industrial partners?

- Face-to-face meetings on your/ their premises
- Face-to-face meetings at third party premises (e.g. conferences, trade shows)
- Telephone/ skype/ Instant Messaging
- Email
- Via students/ Ph.D. researchers
- Other forms of contract, please specify:

Page 3. The Effects of Industrial Cooperation

Q7. Please, indicate to what extent you agree/disagree with the following statements.

Considering your most important activities within UBI, cooperation with industry…

(5-point Likert scale: strongly disagree/disagree/neither agree nor disagree/agree/strongly agree)

1. …helps me to conduct **world-class research**.
2. …helps me to concentrate on academic rather than commercial dimensions of research.
3. …helps me to see my research **outcomes in implemented innovative technologies**.
4. …helps me to be actively involved in innovative projects.
5. …helps me to **access public (e.g. NWO, STW, FOM) grants** for my research.
6. … helps me to be involved in innovative projects supported by the government.
7. …helps me to maintain contacts that are useful for my work as a researcher and teacher at the university.
8. …helps me to be involved in innovative projects.
9. … helps me to develop future research opportunities.
10. … helps me to be involved in applied research and development as well as scientific research.
11. … helps me to develop my international research career.
12. … helps me to work with companies which are sympathetic to university research.
13. … helps me to **fulfil my responsibility to contribute to the social development** and economic growth.

14. … helps me to combine my teaching/research responsibilities and cooperation with business.

Page 4. Importance and Frequency of Interaction

Q8. Which of the following activities is the most important in cooperating with industry?

Q8a. How often are you involved in this activity?

Q8(1). Which of the following activities is the second most important in cooperating with industry?

Q8b. How often are you involved in this activity?

Q8(2). Which of the following activities is the third most important in cooperating with industry?

Q8c. How often are you involved in this activity?

	Importance				Frequency					
					Never	Yearly	Monthly	Weekly	Daily	N/A
	1	2	3		1	2	3	4	5	6
Collaborative research										
Problem solving										
Student placement activities										
Creating spin-off companies										
Working with start-ups										
Informal networking activities										

Explanation:

Collaborative research - providing consultancy expertise, arranging research contracts and/or service agreements;

Problem solving - providing assistance to companies in technical issues/specific problems/establishing prototypes;

Student placement activities - graduate enterprise programmes (funding, supporting students/Ph.D.s/post-docs working in businesses);

Creating spin-off companies - creating or working with a company that organises knowledge transfer to clients;

Working with start-ups - providing incubation and support to new high-technology start-ups (business & technology centres);

Informal networking activities - innovation workshops, networking dinners, structured matchmaking events, alumni societies.

Page 5. Intensity of cooperation

Q9. Please, indicate to what extent you agree with the following statements (5-point Likert scale: strongly disagree/disagree/neither agree nor disagree/agree/strongly agree):

1. Collaborative research projects allow me to engage in knowledge transfer work that fits with my research.
2. Collaborative research projects work better where my industrial partners have the same goals and targets.
3. Problem solving activities allows me to provide scientific and technical support to industry.
4. Problem solving activities lead to my research results being used in the development of innovative products and services.
5. Students placement activities allow me to support graduate entrepreneurship.
6. My student placement activities brings graduates' businesses closer to the university.
7. Creating spin-off companies allows me to apply my research in commercial projects.
8. I benefit from specific funding subsidies to create spin-off companies.
9. Working with start-up businesses helps me to make my research useful to society and the economy**.**
10. I benefit from public subsidies in working with start-up businesses.
11. Informal networking activities help me to be closer to entrepreneurs.
12. I participate in Informal networking activities to allow me to fulfil my ambitions as a researcher.

Page 6. Facilitation of cooperation

Q10. This part of questionnaire concerns the factors facilitating cooperation between university and industry. Please indicate to what extent you agree with the following statements (5-point Likert scale: strongly disagree/disagree/neither agree nor disagree/agree/strongly agree)

1. Frequent communication between with firms helps me to conduct my innovative projects more effectively.
2. More frequent interaction with companies allows me to conduct my research independently.
3. Informal networks with firms helps me to control my innovative projects more effectively.
4. Communication with firms through informal networks gives me more flexibility in my research.
5. Working with industrial partners I trust helps me to raise the effectiveness of innovative projects.
6. I prefer to work with different partners on each project to maintain my independence.

7. I find it easier to work with firms that share my ways of working, research culture and values.
8. I will work with any industrial partner if it leads to quality publications or patents.
9. Working with local firms helps me to organize and coordinate my innovative projects more effectively.
10. I will work with local firms only to acquire high-quality research grants. geographical

Page 7. Demographics

Q11. Gender: male/female

Q12. Age: [ ]

Q13. If you want to participate in the drawing of the bottle of wine, please, write down your e-mail.
Your e-mail will not be tied to your answers and will be used only for the purpose of drawing the winner:

[ ]

Q14. If you have a question or comment, please put it below. Thank you!

[ ]

Thank you for your participation!

Appendix B: Results of the UBI questionnaire

Field summary for Q1 Research institute within UT:		
Answer	**Count**	**%**
MESA+	5	8
MIRA	10	16%
CTIT	11	18%
IGS	28	45%
ITC	8	13%

Field summary for Q2 Research position:		
Answer	**Count**	**%**
Scientific director	2	1.04%
Executive director	2	1.04%
Full professor	18	9.38%
Associate professor	20	10.42%
Assistant professor	35	18.23%
Post-doctoral researcher	10	5.21%
Researcher	9	4.69%
PhD candidate	51	26.56%
Other	7	3.65%

Field summary for Q3 Please indicate a number of years that you've been involved in research:		
Answer	**Count**	**%**
1-10	28	45%
11-20	15	24%
21-30	16	26%
31-40	3	5%

Field summary for Q4 Do you regard yourself as actively involved in co-operation with industry?:		
Answer	**Count**	**%**
Yes	76	39.58%
No	76	39.58%
No answer	3	1.56%
Not completed or Not displayed	37	19.27%

Field summary for Q5 What is the primary location of your industrial partners?:		
Answer	**Count**	**%**
Local (within the Twente region)	6	10%
National (beyond Twente)	33	53%
Europe	13	21%
Global	10	16%

Field summary for Q6 What is the primary form of contact with your industrial partners?:		
Answer	**Count**	**%**
Face-to-face meetings on your/their premises	38	61%
Face-to-face meetings at third party premies (e.g. Conferences, trade shows)	8	13%
Telephone/Skype/Instant Messaging	4	6%
Email	19	31%
Via students/Ph.D. Researchers	8	13%

Field summary for Q7

Please, indicate to what extent you agree/disagree with the following statements. Considering your most important activities within UBI, cooperation with industry…

	Answer									
	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
Question	Count	%	Count	%	Count	%	Count	%	Count	%
…helps me to conduct world-class research.	1	2%	7	11%	14	23%	32	52%	8	13%
…helps me to concentrate on academic rather than commercial dimensions of research.	3	5%	5	8%	7	11%	35	56%	12	19%
…helps me to see my research outcomes in implemented innovative technologies.	5	8%	12	19%	13	21%	23	37%	9	15%
…helps me to be actively involved in innovative projects.	1	2%	2	3%	5	8%	37	60%	17	27%
…helps me to access public (e.g. NWO, STW, FOM) grants for my research.	1	2%	2	3%	5	8%	45	73%	9	15%
… helps me to be involved in innovative projects supported by the government.	4	6%	13	21%	18	29%	24	39%	3	5%
…helps me to maintain contacts that are useful for my work as a	1	2%	5	8%	10	16%	34	55%	12	19%

researcher and teacher at the university.										
…helps me to be involved in innovative projects.	1	2%	26	42%	25	40%	10	16%	0	0%
… helps me to develop future research opportunities.	1	2%	5	8%	10	16%	35	56%	11	18%
… helps me to be involved in applied research and development as well as scientific research.	2	3%	7	11%	12	19%	30	48%	11	18%
… helps me to develop my international research career	3	5%	5	8%	11	18%	31	50%	12	19%
… helps me to work with companies which are sympathetic to university research.	2	3%	1	2%	6	10%	33	53%	20	32%
… helps me to fulfil my responsibility to contribute to the social development and economic growth.	1	2%	4	6%	15	24%	40	58%	6	10%
… helps me to combine my teaching/research responsibilities and cooperation with business.	2	3%	6	10%	18	29%	29	47%	7	11%

Field summary for Q8,Q8a,Q81,Q8b,Q82
Which of the following activities is … in cooperating with industry?
How often do you have professional contact with industrial partners in this activity?

Question	Answer											
	Collaborative research		Problem solving		Informal networking activities		Student placement		Working with start-ups		Creating spin-off companies	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
… the most important	32	52%	14	23%	8	13%	0	-	3	5%	4	6%
How often…	Daily		Weekly		Monthly		Yearly		Never		N/A	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
	3	5%	15	24%	36	58%	8	13%	0	-	0	-
… the second most important	18	29%	15	24%	13	21%	2	3%	2	3%	12	19%
How often…	Daily		Weekly		Monthly		Yearly		Never		N/A	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
	3	5%	4	6%	28	45%	25	40%	1	2%	1	2%
… the third most important	6	10%	15	24%	12	19%	2	3%	2	3%	25	40%
How often…	Daily		Weekly		Monthly		Yearly		Never		N/A	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
	2	3%	4	6%	21	34%	29	47%	2	3%	4	6%

Field summary for Q9
Please, indicate to what extent you agree with the following statements:

Question	Answer									
	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	Count	%	Count	%	Count	%	Count	%	Count	%
Collaborative research projects allow me to engage in knowledge transfer work that fits with my research.	0	-	0	-	2	3%	49	79%	11	18%
Collaborative research projects work better where my industrial partners have the same goals and targets.	0	-	3	5%	11	18%	36	58%	12	19%
Problem solving activities allows me to provide scientific and technical support to industry.	0	-	2	3%	15	24%	39	63%	6	10%
Problem solving activities lead to my research results being used in the development of innovative products and services.	0	-	1	2%	20	32%	35	56%	6	10%
Students placement activities allow me to support graduate entrepreneurship.	2	3%	11	18%	34	55%	11	18%	4	6%
My student placement activities brings graduates' businesses closer to the university.	2	3%	10	16%	30	48%	14	23%	6	10%
Creating spin-off companies allows me to apply my research in commercial projects.	7	11%	11	18%	29	47%	11	18%	4	6%
I benefit from specific funding subsidies to create spin-off companies	19	31%	17	27%	20	32%	4	6%	2	3%
Working with start-up businesses helps me to make my research useful to society and the economy.	9	15%	5	8%	26	42%	16	26%	6	10%
I benefit from public subsidies in working with start-up businesses.	16	26%	12	19%	25	40%	5	8%	4	6%
Informal networking activities help me to be closer to entrepreneurs.	1	2%	4	6%	16	26%	27	44%	14	23%
I participate in Informal networking activities to allow me to fulfil my ambitions as a researcher.	0	-	8	13%	18	29%	29	47%	7	11%

Field summary for Q10
This part of questionnaire concerns the factors facilitating cooperation between university and industry. Please indicate to what extent you agree with the following statements

Question	Answer									
	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	Count	%	Count	%	Count	%	Count	%	Count	%
Frequent communication between with firms helps me to conduct my innovative projects more effectively.	1	2%	6	10%	17	27%	35	56%	3	5%
More frequent interaction with companies allows me to conduct my research independently.	2	3%	20	32%	27	44%	10	16%	3	5%

Informal networks with firms helps me to control my innovative projects more effectively.	2	3%	9	15%	22	35%	27	44%	2	3%
Communication with firms through informal networks gives me more flexibility in my research.	3	5%	10	16%	19	31%	26	42%	4	6%
Working with industrial partners I trust helps me to raise the effectiveness of innovative projects.	1	2%	4	6%	11	18%	36	58%	10	16%
I prefer to work with different partners on each project to maintain my independence.	2	3%	15	24%	20	32%	20	32%	5	8%
I find it easier to work with firms that share my ways of working, research culture and values.	0	-	6	10%	10	16%	36	58%	10	16%
I will work with any industrial partner if it leads to quality publications or patents.	4	6%	18	29%	8	13%	26	42%	6	10%
Working with local firms helps me to organize and coordinate my innovative projects more effectively.	2	3%	9	15%	31	50%	19	31%	1	2%
I will work with local firms only to acquire high-quality research grants.	17	27%	22	35%	16	26%	7	11%	0	-

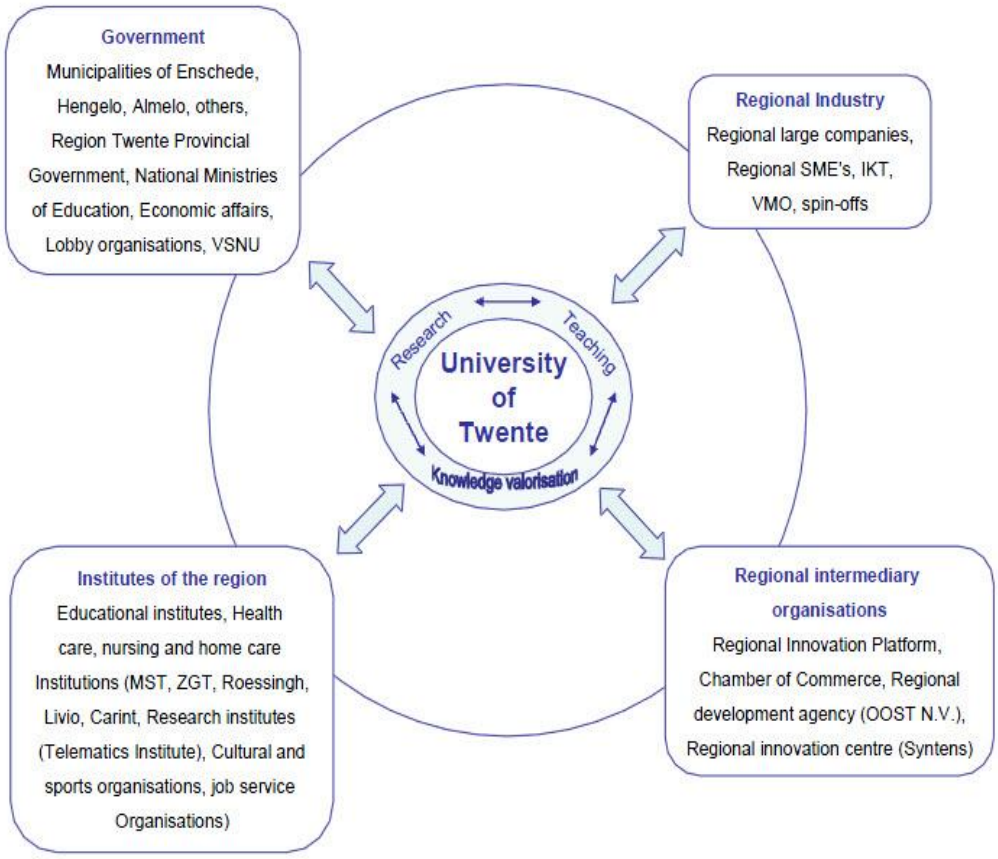
Field summary for Q11
Gender:

	count	%	count	%
male	41	66%	41	66%
female	21	34%	21	34%

Field summary for Q12
Gender:

	25-35		36-45		46-55		56-65	
age	count	%	count	%	count	%	count	%
	26	42%	12	19%	17	27%	7	11%

Appendix C: University of Twente and its regional stakeholders



Source: OECD (2005). OECD Self- Evaluation Report of Twente, 2005