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Conference Paper

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50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Delfmann, Heike; Koster, Sierdjan (2010) : Knowledge transfer between SMEs and higher education institutions: the difference between universities and colleges of higher education., 50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden, European Regional Science Association (ERSA), Louvain-la-Neuve

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Knowledge transfer between SMEs and higher education institutions:

The difference between universities and colleges of higher education.

Key words: knowledge transfer, colleges of higher education, universities, SMEs

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ABSTRACT

Knowledge transfer has been widely recognized as a key element of innovation that drives competitive advantage and regional development in knowledge-driven economies. In this respect, the role of institutes of higher education is essential, as they generate knowledge. The vast majority of research on the topic of transferring knowledge focuses on universities. In the case of the Netherlands however, because of their binary system, colleges of higher education make up a great deal of the complete higher education system. We argue that these colleges of higher education also play an important role in addressing the needs of small businesses. Colleges have a more practical educational approach, they are closely related to the industry, which enhances their accessibility and approachability for small firms. This paper explores the difference in knowledge transfer between the two types of higher education institutes. The main goal of this research is to provide the reader a concept of the differences in knowledge transfer between the two types of higher education institutes. This paper presents the results of a recent study using a survey among small organisations in the area of Groningen, the Netherlands. Using Groningen as a case study we were able to collect data from a region with one university and one college of higher education of similar size.

KEY WORDS: knowledge transfer, colleges of higher education, universities, SMEs

INTRODUCTION

Innovation is considered to be the most important driving factor for sustainable economic development (De Bruijn and Lagendijk, 2005). Knowledge transfer is widely recognized as a key element in the innovation process in knowledge-driven economies. Furthermore, the creation and transfer of knowledge are the basis for competitive advantage in organisations (Agrote and Ingram, 2000). In respect of knowledge transfer, institutes of higher education are considered to be essential, as they generate knowledge and most enterprises cannot operate without external knowledge (Muizer, 2003). A smooth transfer of knowledge is therefore crucial to ensure that the available knowledge reaches (smaller) organisations.

So far, the vast majority of research on this topic focuses on universities. University-industry linkages and their impact on innovation and on the capacity to innovate is an established object

of analysis (Agrawal 2001; Cornett, 2009; Perkmann & Walsh, 2007). However in the Netherlands, higher education is offered at two types of institutions: research universities and colleges of higher education – to be referred to as university and college in the remaining part of this article. In the case of the Netherlands, colleges make up a great deal of the complete higher education system with approximately 400.000 students enrolled (HBO-raad, 2010), as opposed to the 230.000 students enrolled in university (VSNU, 2010). There are a few differences between these types of higher education. First of all, the access requirements differ. But more importantly, their focus is different; colleges tend to be more practical oriented than university programs. In addition, in general you can get a bachelors degree in four years at a college whereas at the university you can obtain a bachelor in three years and a master degree in one or two additional years (Jonge and Berger, 2006). Students with a college bachelor can enrol in university in order to obtain a masters degree.

We argue that colleges as sources of knowledge are important as well, though be it in a different way. We expect them to play an important role in addressing the needs of small businesses. Small and medium sized enterprises (SMEs) are not assumed to have the same absorption capabilities as large organisations in order for them to be able to interact with universities in the same manner (Freel, 2006). As colleges have a more practical educational approach, with for instance compulsory internships for their students, we expect them to be closely related to the industry. This close relation to the industry should enhance their accessibility and approachability for small firms, therefore it is expected that colleges will have a higher collaboration number with SMEs than universities.

This paper explains the difference in knowledge transfer between the two types of higher education institutes. The economic value of this matter alone provides significant motivation for extending our understanding of the knowledge transfer system in colleges. Distinguishing the different ways in which colleges and universities operate and appeal to organisations in the context of knowledge transfer is fundamental for assessing their economic impact (Goldstein and Drucker, 2006). We assume the difference in focus between colleges and universities results in them having two different target groups. This would imply that they have different requirements concerning knowledge transfer, which needs to be identified to establish smooth and sustainable transfer of knowledge. Clark et al. (2009) state in their research, the failure of knowledge transfer for any of the parties involved (students, educational institutes and firms) jeopardizes the

sustainable future of the knowledge transfer process. The main goal of this research therefore, is to provide the reader with a concept of the type of SME that take part in the knowledge transfer process of specifically colleges of higher education compared to universities. Besides this, we will also identify potential differences in the nature of the contact that organisations have with colleges compared to universities.

Although large firms tend to be more often engaged in knowledge transfer with HEIs than small and medium sized enterprises (Malecki, 2008), it is acknowledged that SMEs play an important role in any economy and are increasingly being encouraged to engage with HEIs (Lockett et al, 2008). SMEs are highly heterogeneous, they are a source of innovation and entrepreneurship by which means they create healthy competition (Risseeuw and Thurik, 2003). Given their significance, there is a vast and growing literature stressing the importance of university linkages, including small firms (De Jong and Hulsink, 2010; Lockett et al., 2008; Niosi, 2006; Wright et al., 2004). However, these articles tend to focus on technological transfer and technological SMEs. Besides that, as Freel (2006) mentioned, there have been some articles dedicated to investigating the characteristics of firms engaged in cooperative innovation. However, such studies have almost exclusively been in relation to R&D collaboration. In addition, they often make the assumption that the organisations already have an innovation strategy where collaboration with an institute of higher education is, or is not part of (Bercovitz and Feldmann, 2006; Cornett, 2009; De Jong and Hulsink, 2010; Niosi, 2006). In contrast, this study starts the other way around. We examining small and medium sized enterprises, without making a pre-selection based on the type of SME (for instance industry, innovative vs. non-innovative or high- vs. low-tech), with the exception for company size (up to 50 employees). Using this broad sample of small businesses, we provide the reader with the characteristics of small firms that are some how engaged with higher education institutions (HEIs). This paper will – start to – fill the gap that exists concerning basic collaboration between SME and college.

This paper presents the results of a recent study using a survey among small organisations in the area of Groningen, the Netherlands. This municipality is located in the north of the Netherlands and presents us with the unique situation of housing one university, the University of Groningen (RUG), and one college of higher education, the Hanze University, both of similar size and with

no other HEIs in the immediate surrounding area; therefore providing an opportunity for good comparison.

The remainder of this paper is organised as follows. The next section defines knowledge transfer and examines previous literature regarding knowledge transfer, providing the reader with the context of knowledge transfer at HEIs. Subsequently the data and methodology are discussed. The fourth section sets out the key findings. This segment states the difference in organisational and entrepreneurial characteristics that are apparent for organisations that seek information at universities and colleges. The final section summarizes the argument of the paper and presents recommendations for further research.

THEORY

Argote and Ingram (2000) describe knowledge transfer as the process through which one unit (a group, department or division) is affected by the experience of another. Even though they focused on knowledge transfer within the organisation, it does provide a basic and proper illustration of the knowledge transfer process. Colleges translate knowledge into applications for companies and institutes, which affects those organisations. Simultaneously, these organisations create new knowledge and new contexts that can be used in HEIs, with each innovation that occurs. This way, knowledge transfer can contribute to the constant renewal of educational programmes and to the improvement of organisational processes (VNO-NCW & HBO-raad, 2004).

Colleges as sources of knowledge

There are three main reasons for focussing this research on colleges of higher education. First of all, colleges differentiate themselves from universities in several ways. As mentioned in the introduction, they have a more practical educational approach. Because of this practical orientation and the fact that there are more college students than there are university students, who all have to do an internship or work placement, colleges are closely related to the industry. This could mean that colleges have a lower barrier for organisations when looking for information. Another difference arises from this emphasis on student work placements. The channels for knowledge transfer under consideration in previous studies include some subset of publications, patents, consulting, informal meetings, recruiting, licensing, joint ventures,

research contracts and personal exchange (Agrawal, 2001; Cohen et al., 2002; Schartinger et al., 2002). However, they rarely include the one thing that colleges have the most: students. Particularly small firms are expected to benefit more from the influx of students, who bring along new knowledge from the institute (Bekker and Bodas Freitas, 2008). Schartinger et al. (2002) did consider another type of interaction between university and firm concerning students; they included joint supervision of PhDs and Masters Thesis. Their relative importance was in the upper quadrant, lower than consulting and collaborative research, but higher than joint publications, training and guest lectures. Students and graduates from colleges can contribute substantial to renewal in SMEs. This may not be high-tech innovation, though of great relevance for SMEs to gain and remain their strength and position in the competitive market (MKB Nederland & VNO-NCW, 2006). Therefore contact via students has been included in the research design. We expect that particularly college students can have significant value for the smaller organisations, also in line of their likely preference for more informal contacts (Cohen & Levinthal, 1990; De Jong and Hulsink, 2010).

Coming to the second reason; there are not only twice as many students, there are also considerably more colleges than there are universities. The university sector consists of 14 government-funded universities and 41 colleges which receive government funding (OECD, 2009). Logically, this results into different distributions of the institutes in the Netherlands. There are shorter geographical distances between SME and college and proximity can positively affect cooperation between institute and small business (EIM, 2007). Furthermore, universities often produce cross-border, specialist knowledge. Colleges of higher education on the other hand possess high-quality knowledge that deflects on a more regional level (Vermeulen, 1996), and could therefore be more suitable for small businesses. Colleges are therefore particularly important in the regional context. On the contrary, Boschma (2005) argues that geographical proximity is neither '*a necessary nor a sufficient condition for effective innovation collaboration*', it could however facilitate innovation. In case of small organisations with no more than 50 employees and relatively low absorptive capacity, geographically proximate collaborations may be their best or only option (De Jong and Freel, 2010).

Finally, the importance of innovation and knowledge transfer is also acknowledged by the Dutch government. Higher education institutes are an important part of their strategy, particularly in the north and east of the Netherlands (OECD, 2007). Since 2001, there has been a policy of

appointing a growing number of lecturers and knowledge circles at colleges. A lecturer is assigned to a college to transfer knowledge to industry, in particular SMEs, and society in general (Jonge and Berger, 2006). They have four tasks: knowledge development, professionalization of lecturers at their college, renewing education curricula and knowledge circulation from and to society (OECD, 2009). Each lecturer is expected to form a 'knowledge circle' consisting of college lecturers and professionals from the work field. Knowledge circles are expected to strengthen contacts between educational institutes and organisations in the labour market (Jonge and Berger, 2006).

University-industry linkages

By means of the absorptive capacity, firm sector and individual entrepreneurial characteristics we examine the differences between college and university. In the absence of a well developed economics literature on the specific topic of knowledge transfer between colleges of higher education and SMEs, we start here with the more abundant writing on university-industry linkages.

Absorptive capacity. To realize effective transfer of knowledge it is necessary for both the holder of knowledge and the recipient to have certain qualities which facilitate the knowledge exchange between them. First of all, knowledge holders must be willing to share their knowledge. Usually it is within the power of the knowledge holder to regulate the amount and quality of the knowledge they share. Secondly, knowledge recipients must have sufficient absorptive capacity and must be open to new influences that are potentially capable of increasing their efficiency (Cowan et al., 2000). This role classification is not static; the holder can become the recipient, just like the recipient can become the knowledge holder.

Sufficient absorption capacity is considered to be a critical component of innovative capabilities (Cohen and Levinthal, 1990). In their research, Cohen and Levinthal (1990) describe absorptive capacity as the ability of an organisation to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. Previous studies have shown that the more absorptive capacity a firm has, the better they are able to obtain external knowledge and to engage in innovation-related collaboration (De Jong and Hulsink, 2010). The problem is that small firms are likely to have lower absorptive capacity than their

larger peers (De Jong and Freel, 2010). This means that SMEs often lack the capacity to interact and cooperate with universities. According to the WRR (2008) only a small minority of SMEs in the Netherlands has the capacity to cooperate with universities. For the vast majority of SMEs however, it is considered more realistic that they connect with colleges of higher education (WRR, 2008). Therefore we anticipate finding more interacting with colleges than universities. The overall consensus is that firm size does matter (a.o. Bekkers and Bodas Freitas, 2008; De Jong and Hulsink, 2010; Veugelers and Cassiman, 2005). Larger firms are typically better structured and professionalized. As an organisation grows, it becomes better equipped for using particular channels of university-industry knowledge transfer (De Jong and Hulsink, 2010). Results from the Eurostat-Community Innovation Survey (2009) for instance state that more than half (54%) of all large innovation active enterprises were involved in innovation partnerships compared to 22% of small enterprises. Most researches on this topic, including the Eurostat CIS, exclude firms with less than 10 employees, with a maximum of 250 or even 500 employees. Therefore we anticipate the organisations in our sample to have fewer overall contacts when it comes to universities compared to other studies, as we focus on organisations up to 50 employees. We expect however that this will be – partially – compensated by our focus on colleges of higher education.

Absorptive capacity is not only depending on company size. It has other bases such as employee skills that may be particularly relevant in non-high-tech small firm settings (De Jong and Freel, 2010; Schmidt, 2009). The company's age can also be of influence on the absorptive capacity of the firm. As an organisation gets older, their learning process continually grows along with it, and absorptive capacity depends on past knowledge (Zahra and George, 2002).

Sector. When it comes to difference in industry types, various studies find that university-industry interaction is more important in science-based technologies. However, it seems that lower-tech segments do not necessarily have less university-industry interaction (Bekkers and Bodas Freitas, 2008). Although, based on previous research (Cowan et al., 2001; Eurostat CIS, 2009) we do expect to find a difference between service sectors and industrial sectors. Traditionally, knowledge transfer mechanisms focus on the manufacturing sector. The service industry is known to engage in less formal R&D. Services are however an increasingly dynamic sector of the economy and of increasing importance for innovation (OECD, 2000). Analysis of

transfer channels reveals that service firms do use the same channels as manufacturing firms, though the appropriateness and intensity of use differs between the two sectors (Cowan et al., 2001). Given the relative importance of human capital in the service sector compared to manufacturing, we expect that especially the usage of students is important for the service sector. Therefore we anticipate finding high results for interaction between college and small service firms.

Entrepreneur. Besides the organisational characteristics, the individuality of the entrepreneur is relevant as well. The entrepreneur influences the management of an organisation (Risseuw and Thurik, 2003), and the smaller a firm, the greater the influence of one person will be. Therefore, certain characteristics of the entrepreneur will also be taken into consideration. Based on the concept of cognitive proximity we expect that younger, more recently graduated entrepreneurs are more likely to contact colleges more often. Especially those who studied at a college themselves will be more likely to interact and have a greater connection with the HEI given their path dependency. The underlying principle is that different variables, such as customs, norms and routines influence the way actors see and know the world (Knoben and Oerlemans, 2006). In their research, Knoben and Oerlemans (2006) state that in order for organisations to communicate and transfer knowledge effectively and efficiently, partakers need to have similar frames of reference (Knoben and Oerlemans, 2006).

In summary, we know that most organisations cannot continue existence in the long run without external knowledge. The existing literature predicts that smaller firms have less absorptive capacity and will have less contact with universities; colleges of higher education might be able to fill this gap. Colleges are closely related to the industry, have a more dense distribution in the Netherlands and are momentarily a priority in Dutch policy on this matter. We expect that contributions from students are particularly important for small business owners.

METHODOLOGY AND DATA

In order to gain understanding of the difference between university and college we collected and analysed empirical data. The empirical research consists of two sections. First, based on desk research, several interviews were conducted with officials from colleges of higher education,

municipalities and intermediary organisations. As there is little known about knowledge transfer between college and small business, interviews were needed to form an idea of what was already happening and what the possibilities were in the field of knowledge transfer between college and SME.

Using the results of the interviews a questionnaire was formulated to be distributed among entrepreneurs in Groningen, in order to quantify knowledge transfer in the Northern Netherlands. We thereby directed our focus on the Hanze



Figure 1. Location research area

University and the University of Groningen, being relatively isolated from other HEIs. The municipality Groningen is part of the National Urban Network Groningen-Assen. The region Groningen – Assen forms the most important concentration of population and employment in the North Netherlands (VROM, 2006). Participants of this network are the provinces of Drenthe and Groningen and the municipalities Assen, Bedum, Groningen, Haren, Hogeveen, Sappemeer, Leek, Noordenveld, Slochteren, Ten Boer, Tynaarlo, Winsum and Zuidhorn. The research area is indicated in Figure 1. The survey was set out in these municipalities.

The questionnaire consisted primarily out of closed-end multiple-choice questions and some open-ended questions. The questionnaire was sent out to 2000 companies. A random sample was retrieved from the Chambers of Commerce. We expected a response of approximately 10 percent completed surveys. We used a database of 197 small firms in the Netherlands, in line with our expectations regarding the response. It was decided to do multi-stage sampling; of the 2000 organisations, 1500 had 2 – 50 employees, the other 500 organisations had only one full time employee. This way we assured our sample had a fair distribution of one-man businesses and somewhat larger organisations. In addition, two branches were excluded from the sample, namely retail business and the catering industry. The cover letter and survey were directed at the

owner/ entrepreneur or director of the organisation. They were asked questions regarding their usage of the Hanze University and University of Groningen.

The two HEIs. The Hanze University Groningen is a college of higher education with more than 2600 employees and over 23.000 students, founded in 1798. The Hanze University is the largest college in the north of the Netherlands and offers a wide spectrum of degree programmes in the fields of economics, technology, health care, education and teacher training, social work, labour relations, fine arts, and music (Hanze, 2009). Their mission statement is as follows: The Hanze University educates students in an inspiring environment to become responsible, entrepreneurial professionals and prepares them to perform their occupation in an international perspective (Hanze, 2009).

The University of Groningen (RUG) was established in 1614 and has grown since then into a broad university with over 4500 fte employees and 26.700 students (date of reference is 1 October 2009). There are nine graduate schools: Arts; Behavioural & Social Sciences; Economics & Business; Law, Mathematics & Natural Sciences; Medical Sciences; Philosophy; Spatial Sciences and Theology & Religious Studies.

KEY FINDINGS

In this section we will discuss the contacts of SMEs with colleges and universities. Sequentially, we will examine which organisations have contact with a HEI and what their characteristics are. Finally, those organisations that have contact are examined: those firms that solely contact the Hanze University are compared to those who only contact the University of Groningen.

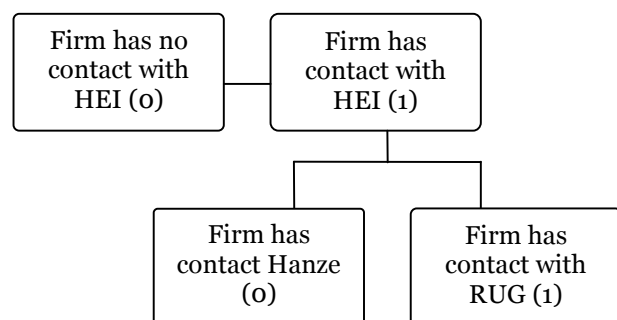


Figure 2. The last two stages in the data analysis

Basically, the responding organisations in our sample can be divided into four groups: firms that do not have any contacts with either HEI, those who contact the Hanze only, firms who contact the RUG only and firms that have contact with both. An overview is given in Table 1. It

becomes clear that when small firms decide to interact with only one HEI, that they choose to focus their attention towards the Hanze, which is an important indicator for the relevance of colleges for SMEs.

	N	%
No contact	103	55,7
Hanze only	37	20
RUG only	14	7,6
Both HEIs	31	16,8
Total	185	100

Table 1. Contact college * Contact university

Contact HEIs

Almost half of all respondents (46,8 percent) have indicated that they had contact with a HEI in the last year (including other institutes besides the Hanze and the RUG). It is difficult to provide a solid reference for this percentage as previous research focused mainly on innovative organisations. For instance, the Eurostat Community Innovation Survey shows that in 2000 less than 10% of innovative firms had cooperative agreements with universities (Veugelers and Cassiman, 2005). Even though there is no distinction made between the two different types of HEIs and they only consider SMEs with more than 10 employees, it does provide some degree of reference for our study. Especially since the vast majority of respondents indicated that their organisation did not have an intensive relationship with the Hanze University or the RUG. Firms that had contact with the Hanze University contacted them in 73 percent of the cases only on a few occasions per year. Only 7,5 percent of the organisations had contact on a daily or weekly basis, which is comparable to the cooperative agreements in the Eurostat research. For the respondents who contacted the RUG in the last year, these figures are respectively 58 percent and again 7,5 percent.

The contacts between SME and HEI appear to be a local phenomenon, in correspondence with our expectations. When we focussing solely on the Hanze and the RUG, there is only a marginal difference compared to the total amount of organisations that have used a HEI (44,3 percent). This means that small firms in the Groningen region usually contact the Hanze or the RUG when they need something from a HEI. When they do contact other HEIs, they generally do this in

addition to contacting the Hanze or the RUG. Comparing contacts of firms with both RUG and Hanze in Groningen versus firms in the direct surrounding, we found that organisations in Groningen tend to have more frequent contact and value these contacts higher. In case of the RUG this difference is significant ($p < 0,05$), for the Hanze it is not ($p 0,157$ [freq] and $p 0,130$ [value]). Initially we expected to find contacts of the Hanze to be located closer to the institute itself, compared to the RUG. Apparently the reach of the Hanze is more or less spread out over the National Urban Network. In other words, the results indicate that the Hanze is equally approachable for organisations outside and inside the city, which cannot be said for the RUG. This could imply that there are different types of organisations in cities compared to the periphery.

It seems that even though there is less contact with the university, that these contacts are better appreciated compared to the Hanze. Illustrated in Figure 3; the total percentage of small firms that contacted the Hanze and the RUG is presented in the first bar. The second bar in the graph represents those organisations that had contact with the HEI in question and

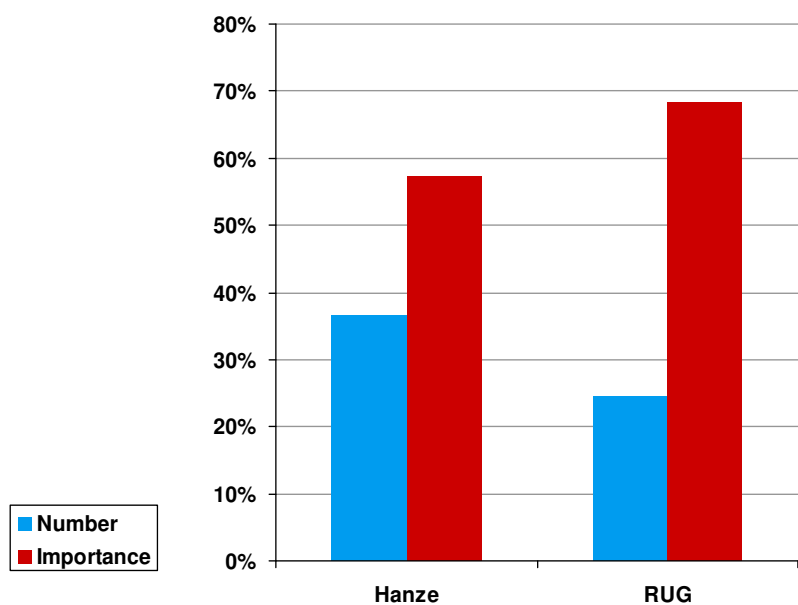


Figure 3. Frequencies and value of contacting HEIs

valued this contact as either important or very important. These percentages are quite high compared to the study of Cohen et al. (2002), where information from public research (meaning university and government R&D labs combined) was indicated by only 36.3 percent to have contributed to the completion of a project. It appears that there is some trade-off between the accessibility – higher at the Hanze – and problem solving possibilities or perceived quality, which is higher at the RUG.

Channels. Students turned out to be, by far, the most important reason why organisations initiated contact with the Hanze University. Figure 4 shows which options are used and valued most by the respondents. The percentages stand for those respondents that state that this particular option can be marked as at least important for their organisations in the last year. There is a distinction made between students who do a work placement at a firm and students who write their final thesis for or at an organisation. Even though there is no comparative material on hand for other colleges or even universities for that matter, it is striking to see how far these two options tower above the others, shown in red in the figure. In the study of Schartinger et al. (2002) joint supervision of PhDs and Master Thesis came in after consulting and collaborative research. This confirms our expectations regarding the relative importance of students for small firms compared to other possibilities within a college.

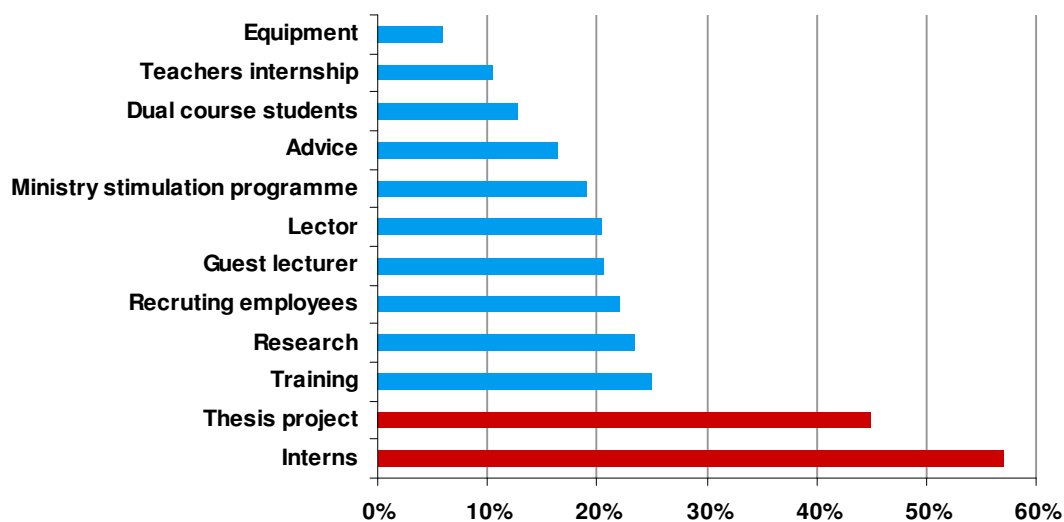


Figure 4. Percentage of respondents indicating channels as important to organisation

Contact vs. No contact

In total there are eight variables (four firm related variables and four on the individual level) which were fed into a binary logistic regression model. Four explanatory models are estimated in order to find the model that accounts for the decision of small firms to interact with an institute of higher education. First, we look at the determinants for interaction from the firms' characteristics and thereafter from the individual characteristics of the entrepreneur. In the first model we included firm size (number of employees), the firm sector, the age of the company and the firm location. As for the characteristics of the respondent, we looked at their gender, age,

year of graduation and the level of their education, as can be seen in Table 2.¹ Our starting point was with a percentage of 53,5 percent correct in an empty model. We then started with the full model and removed covariates. Four variables were eliminated in the process, resulting in Model 4. In the appendix all relevant descriptive data is provided.

Firm size. In conformity with our expectations it proved that the firm size coefficient is statistically significant. The exponent(B) is 1.154, which means that for each employee extra, the organisation is 1.154 times² as likely to contact the university or college. In other words, a difference of 5 employees means that the organisation in question is already twice (2.05) as likely to reach out to the RUG or Hanze.

Variables in the Equation		Model 1	Model 2	Model 3	Model 4
		B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)
FIRM TRADES	Number of Employees	0,125 (0,04)***	0,115 (0,04)***	0,14 (0,04)***	0,144 (0,04)***
	Sector (service)	Ref	Ref *	Ref *	Ref **
	Sector (manufacturing)	-1,331 (0,68)**	-1,479 (0,66)**	-1,431 (0,65)**	-1,575 (0,63)**
	Sector (other)	-0,048 (0,53)	-0,141 (0,51)	-0,077 (0,5)	-0,132 (0,5)
	Company age	0,015 (0,01)	0,015 (0,01)	x	x
	Location (0 = Groningen)	-0,679 (0,47)	-0,54 (0,45)	-0,448 (0,44)	x
INDIVIDUAL TRADES	Gender (0 = men)	-0,064 (0,51)	x	x	x
	Age respondent	0,022 (0,05)	x	x	x
	Graduation year	0,067 (0,04)	0,05 (0,02)**	0,042 (0,02)**	0,046 (0,02) **
	Education (no continued education)	Ref	Ref *	Ref *	Ref *
	Education (lower & middle education)	1,335 (0,96)	1,23 (0,91)	1,069 (0,85)	1,032 (0,84)
	Education (college)	0,753 (0,87)	0,839 (0,8)	0,753 (0,74)	0,7 (0,74)
	Education (university)	1,805 (0,94)*	2,033 (0,86)**	1,863 (0,79)**	1,877 (0,79)**
Percentage Correct	72,5	73	72,1	77,6	
N	120	126	129	134	
R ² Nagelkerke	0,407	0,41	0,408	0,417	

*, **, *** Indicates statistically significant at the 10%, 5% and 1% level, respectively.

Table 2. Determinants of interactions: parameter estimates of logistic regressions

¹ In the model is 0 = firm did not have contact, 1 = firm did have contact with a HEI (either the Hanze or the RUG) in the last year.

² Calculated as e^x where x is the coefficient, in this case 0.144

Sector. The propensity to interact with an institute of higher education turned out to be profoundly determined by the sector of the company. Compared to the total sample, construction and agriculture have relatively few contacts with both college and university. Most contacts with colleges of higher education are found in the financial sector. Interaction with the RUG has also a relative strong presence in this sector, though less than for colleges. In the healthcare sector this is the other way around; more interaction with HEIs, but especially with the RUG.

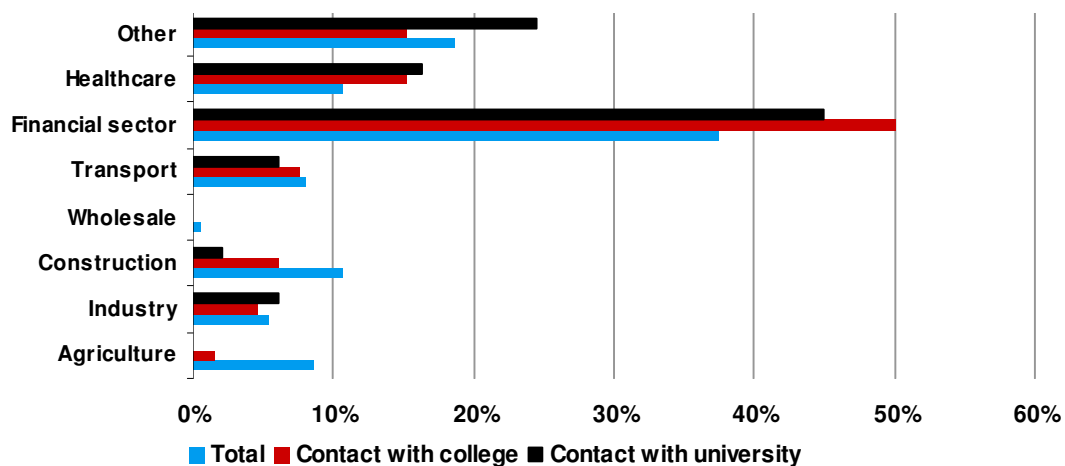


Figure 5. Branches

The sectors shown in Figure 5 are merged together for the purpose of the regression analysis into three sectors: service, manufacturing and other. As reference category we used the service sector. Small firms in the manufacturing sector are less likely to have contact with a HEI in Groningen. To rephrase this, a service sector organisation is almost five times more likely to have contact with institutes of higher education than a manufacturing firm.

In previous research the focus was on the manufacturing sector, as the service industry is traditionally less engaged in formal R&D. As discussed however, the service industry is growing and becoming increasingly important for innovation. Therefore it was expected that the service sector would play an important role, besides manufacturing. It is surprising however that they turn out to be such an important determinant in predicting whether an organisation contacts the Hanze or RUG. This can be explained by our shift in focus towards students as important channel as the service sectors relies more on human capital, less on physical capital or technology.

Year of graduation. We find a positive relation with the year of graduation of the respondent. The more recent the entrepreneur finished his or her education, the higher the probability that the organisation will contact a HEI. The extent of this variable for predicting contact is only slight, with a coefficient of 0.046. In context however, this indicates that a person who graduated in 2008 is twice as likely to contact a HEI as someone who graduated fifteen years before in 1993. This result corresponds with our line of thought; people who ‘just’ finished their school still have a greater connection with the institute, as their cognitive distance is still small.

Education. The same line of reasoning applies to the level of education of the respondent. The educational background of the respondent turned out to make a significant difference. Several correlations were found: Respondents who enjoyed higher education themselves had more frequently contact with a HEI. Respondents who studied at a university contacted the RUG more often in the last year (p 0,002). These results are very much in line with previous stated ideas on cognitive proximity and path dependency. Continuing, entrepreneurs with no continuing education (p 0.001) and with low or middle high education (p 0,000) had less contact with the RUG. It is interesting that this difference is only found for the frequency of contacting the RUG and not for the Hanze. This supports our statement that a college is more accessible and approachable for SMEs; entrepreneurs without higher education still interact with colleges. In the model above, we find that education indeed predicts the likelihood to interact with a HEI. There is a positive relation with all categories of education compared to the reference category ‘no continued education’. This means that the likelihood of interaction increases when the level of education is higher. Of this clear trend, only the relation between respondents with no continued education and those with a university degree are significantly differentiated.

Location. The firm location is not included in the final model for predicting whether or not an organisation will contact an institute of higher education, as there is no significant relation found and the *percentage correct* of the model drops more than five percent when it is included. Comparing the output of Model 3 and 4 depicted in Table 2, the impact of excluding the location as a determinant is evident. We had expected to find that a firms’ location in Groningen would result in a higher probability for a company to interact with HEIs. As we did find that the respondents almost exclusively contacted the two HEIs in Groningen, we can conclude that

interacting with colleges and universities is a localized phenomenon. We cannot however, establish a difference between Groningen and its direct surrounding.

Hanze University vs. University of Groningen

After establishing that the company size, sector and education – including the year of graduation and the level of education – of the respondent are the most important determinants for interaction between firm and HEI, we take a step further and look only at those organisations that have contact. In order to construct a model that predicts whether an organisation decides to contact a college or rather a university, we could only include those respondents who had contact with *only* the Hanze or *only* with the RUG. This resulted in a relative low number of respondents included in the model.³ Because of this limited N, there was too little data to construct a model that included all variables; therefore this step was not included in Table 3 below. Given the instability of the model, the results listed below should be interpreted with care. This model started with a *correct percentage* of 73.5 in an empty model.

Variables in the Equation		Model 1	Model 2	Model 3
		B (S.E.)	B (S.E.)	B (S.E.)
FIRM TRADES	Number of Employees	-0,053 (0,05)	-0,066 (0,05)	x
	Sector (service)	x	x	x
	Sector (manufacturing)	x	x	x
	Sector (other)	x	x	x
	Company age	x	x	x
	Location (0 = Groningen)	-0,9 (0,84)	x	-1,181 (0,81)
INDIVIDUAL TRADES	Graduation year	x	x	x
	Gender (0 = men)	x	x	x
	Age respondent	x	x	x
	Education (no continued education)	Ref **	Ref **	Ref **
	Education (lower and middle education)	-1,725 (1,78)	-1,594 (1,7)	-1,535 (1,71)
	Education (college)	-3,163 (1,879)*	-3,208 (1,81)*	-3,067 (1,81)*
	Education (university)	-0,093 (1,65)	-0,01 (1,56)	0,092 (1,56)
	Percentage Correct	79,2	79,6	81,6
	N	48	49	49
	R ² Nagelkerke	0,41	0,405	0,387

*, **, *** Indicates statistically significant at the 10%, 5% and 1% level, respectively.

Table 3. Determinants of interactions: parameter estimates of logistic regressions

³ In the model is 0 = firm had contact with the Hanze University, 1 = firm had contact with the University of Groningen in the last year.

Several variables from the first model that contributed in predicting whether or not an organisation would interact with a HEI are not significant in this stage of analysis. The most striking difference between the two models is the firm size. The decision between college and university does not seem to be affected by the number of employees, which is in contrast with what we expected based on the absorptive capacity of organisations.

Considering that the first model we constructed did not flag any significant variables, we excluded those variables with very high scores on significance (as high as 0.8 or 0.9) and without significant results in the descriptive statistics. As a result, the level of education turned out to have a significant impact. Using respondents without continued education as a reference category again, there is a significant negative relation with respondents who have a college degree. Given the fact that the Hanze University is marked as zero in the model, this means that entrepreneurs with a college degree actually have more contact with the Hanze University than with the University of Groningen. This indicates that colleges could for instance expand their networks with small businesses by improving their own alumni policy.

In addition to the impact that education has as a determinant, we also found several correlations between the level of education and firms' interaction with the Hanze or RUG. There was a significant difference found between respondents who did not study at a HEI themselves and those who did, concerning the value they credited to those contacts. In other words, it does not matter whether you have studied at a college or a university concerning the value one ascribes to, for instance, an intern. However, when you have not studied at either one of the higher educational institutes, chances are that you will appreciate them less. There was no difference found among the organisations that either only interacts with the Hanze or only with the RUG and also there were no differences with organisations that contact both HEIs when looking at the level of education of the respondent.

The sector of the firm does not have any explanatory function in predicting whether firms contact the Hanze or the RUG either. On top of that, the location of the firm did not turned out to be a determinant for predicting interaction with a particular HEI as well. In this second model, the firm location has no statistical significance however; the influence of this specific variable in the model does have a positive influence. When we exclude the firm location in Model 3, the *percentage correct* drops with 5 percent, indicating the importance of the location.

CONCLUSION

The objective of this study was to analyse certain aspects of knowledge interactions between industry and college, and between industry and university. We assumed that patterns of interactions between SME and HEI vary, based on the type of HEI.

Empirical data was gathered by a survey among small business holders focussing on the two major institutes of higher education in the northern Netherlands, thus covering interaction for a relative secluded area on a representative basis. The analysis of the characteristics of firms interacting with higher educational institutes carried out above makes it possible to draw the following conclusions:

The total amount of contact is relative high compared to other studies, considering those focus on innovative organisations and this study does not. Also bearing in mind that the responding organisations in this study had for 80 percent less than 10 employees. The ascribed value of the interaction is quite high as well. This study confirms that colleges are slightly more accessible for SMEs compared to universities and that links in terms students are of great importance to small businesses.

Sufficient absorptive capacity of the SME and cognitive proximity are two critical elements for interacting with a HEI. Our results show that in explaining the likeliness of an organisation to interact with an institute of higher education four variables are significant: firm size and sector, the level of education and the year of graduation of the respondent. In line with previous studies, the results confirm that the firm size is an important determinant in predicting SME behaviour when it comes to deciding to interact with a HEI or not.

The number of employees however did not turn out to be a predicting variable for the decision to interact with a college or a university. Though, absorptive capacity is not only depending on the size of the firm, but also on the qualities of the personal for instance. Given the fact that the entrepreneur can leave his or her mark on the organisation and seeing that the level of education did have a significant influence on this decision, we would have to conclude that the absorptive capacity is indeed an important predictor.

Unfortunately our data was too limited in terms of numbers to provide a stable model for differentiating university and college. It is necessary therefore, to emphasize that complete generalisations are not feasible, especially since small businesses are very heterogeneous.

A third conclusion concerns the location. Even though we had expected to find a significant difference between the city and the surrounding districts we can still conclude that knowledge transfer is a regional phenomenon: interaction is mainly limited to the HEIs in Groningen. The contacts of organisations in this area were almost exclusively with the Hanze and the RUG.

Our findings have a number of implications for policy makers, both at the national and regional level. First of all regarding the absorptive capacity of organisations in a region; Schmidt's research (2009) showed that not only does an organisation need enough absorption capacity to effectively transfer knowledge, it seems to work the other way around as well. The stimulation of innovation activities and knowledge transfer has proven to be an important building block of absorptive capacity. This means that by increasing the quality and quantity of knowledge transfer between SME and college, the organisations absorptive capacity grows and it becomes better equipped to cooperate with institutes of higher education: creating a positive spiral. Secondly, these localized activities should be organized on a regional level instead of national. A certain degree of decentralisation in this matter is therefore desirable. Finally, some sector differentiation in policy is required. There needs to be a shift in focus, or rather a broader focus, concerning the sector. The attention should not only be directed at the high tech businesses. Of all SMEs, especially the truly small organisations, the ones in the service sector can benefit a lot from collaborating with colleges.

Overall the results seem to suggest that firm size is not the best way to predict whether a firm will choose for a college or a university. Firm proximity is relevant in the matter of contacting a HEI and also a factor of influence in the decision process between college and university, however, not per sé proximity in terms of geographical distance. Further research could identify which other forms of proximity are determinants for assessing to interact with a HEI.

Furthermore, the analysis should be extended toward the different channels within the knowledge institute in order to determine the impact of students. Finally, it would be worth extending the analysis beyond whether interaction occurs or not, towards examining the effect and efficiency of such interaction.

DISCLAIMER

This project was commissioned by Nicis Institute. The survey aimed to make an inventory of knowledge transfer between small firms and colleges of higher education. The questionnaire was set out in four municipalities. Other than Groningen, it was also sent out in Leeuwarden, Deventer and Dordrecht. Although the survey was not specifically conducted for the current paper – it was meant to collect information to inform policy makers – the data is well suited for exploring the differences in knowledge transfer between university and college.

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APPENDIX

Table descriptive statistics: Characteristics firm and individual (N=185)

	<i>Variable</i>	<i>Contact with RUG or Hanze</i>			<i>No Contact</i>		
		MEAN	SD	MIN/MAX	MEAN	SD	MIN/MAX
Firm characteristics	Number of employees	10.71 (10.30) (1/46)			4.68 (5.7) (1/35)		
	Sector – service	55,3%			39,6%		
	Sector – manufacturing	9,2%			34,7%		
	Sector – other	35,5%			25,7%		
	Organisations' age	16.67 (18.54) (0/84)			16.87 (18.54) (0/139)		
	Location – Groningen	61,0%			31,3%		
	Location – National Urban Network	39,0%			68,7%		
	Graduation year respondent	1988.15 (10.38) (1970/2009)			1983.07 (11.17) (1957/2006)		
	Gender – men	76,8%			79,4%		
Gender – women	23,2%			20,6%			
Individual Characteristics	Age of respondent	46.97 (9.69) (22/66)			50.04 (10.32) (19/78)		
	Education – no continued education	6,1%			21,8%		
	Education – lower and middle education	12,2%			30,7%		
	Education – college	42,7%			33,7%		
	Education – university	39,0%			13,9%		