



Industry-University relations from the industry perspective

-Is there a connection between the companies' absorptive capacity (ACAP) and the values and barriers of these relations

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Abstract

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1. Introduction

Over the past two decades the industry has become more concerned with foreign competition, increasing rapidity of technological evolution and complexity. This has led industrial firms to find that universities are viable partners who encompass the necessary resources and capabilities needed for successful technological development and commercialization (Santoro, 2000). Many scholars claim, e.g. Laursen and Salter (2004), that innovation is the key to economic growth and that external knowledge can increase the ability to innovate. It is also claimed that closer relations and cooperation between the industry and the universities (I-U) will be more productive, for both parties. I-U relationship has evolved over the last decades because of rapid technological changes, the increasing competition and because of the speed of innovation around the world (Plewa et al., 2007). Today the I-U relationship definition can be: *I-U relationship is a research partnership or formal collaborative arrangements among organizations with the goal to co-operate on research and development activities* (Perkmann & Walsh, 2007). The purpose of this study is to analyse the I-U relationship and to find out what the industry regards as its benefits and what obstacles they face.

It is understood that universities and higher educational institutions can be a knowledge resource for companies (Davey et al., 2011) but why exactly do companies engage in a relationship with the universities? Perkmann and Walsh (2007) ask the same question in their research about *University-Industry relationships and open innovation: Towards a research agenda*. They found that firms engage in I-U relationship because it gives them benefits such as; access to students, an overview on the emerging technologies and the ability to enhance their knowledge base. These benefits are more important to the firms than the desire to develop specific commercializable innovations. Firms think that participating in a professional research projects is valuable and that today's existing performance measures such as patents, spin-offs or licenses do not reflect the whole range of all the benefits that the I-U relationship provides (Perkmann & Walsh, 2007). This makes it hard to sum up and evaluate the precise benefit of the I-U relationship. According to the aforementioned research, absorbing knowledge from universities is important to firms and the outcomes can be both tangible and intangible.

Although I-U relations have been researched to some extent, the view of the industry has been left out as the focus of research has been concentrated on the perspective of the universities.

Governmental interest regarding I-U relationship has also concentrated on the universities where they have encouraged universities to become significant players in the economy. EU Commission Communication set out an agenda in 2006 to develop and structure partnerships between universities and businesses (COM (2006), 208 final). This agenda has been passed as regulations in many countries. In the past decades universities in Sweden have met their governmental requirements with a closer contact with the industry e.g. by establishing special units to help researchers to commercialize their innovations projects. These units are called “hybrid organisations” and their purpose is to strengthen the relationship with industrial partners. Examples of such hybrid organizations are: TTO’s, incubators, holding companies and innovation offices (Baraldi et al., 2011). Scholars have examined these units as well as different angles of the I-U relationship. Today the emphasis is changing towards the industries part in the relationship which is becoming more visible e.g. within the EU where different kinds of projects to investigate and improve the I-U relationship are being funded. An example of these projects is *Making industry-university partnerships works – Lesson from successful collaborations* (Edmondson et al., 2012).

As these examples show the focus is gradually shifting towards the industry perspective. This is important since universities and the industry are different organisations with very different emphasis so both parties’ point of view is of vital importance. Vedovello (1998) points out that universities and firms are different social entities and that they differ considerably in the nature and objectives of their activities. These differences can affect and limit the I-U interactions and their future relationship.

How do the industry and the universities form their relationship? In the Davey’s et al. (2011) report eight different ways I-U cooperates were identified. 1) Collaboration in research and development (R&D). 2) Mobility of academics. 3) Mobility of students. 4) Commercialisation of R&D results. 5) Curriculum development and delivery. 6) Lifelong Learning (LLL). 7) Entrepreneurship. 8) Governance. The most common means of collaboration are through research and development (R&D). According to Cohen and Levinthal (1989) R&D is crucial for the ability to identify, absorb and exploit internally and externally generated knowledge which is created by other firms or research institutions. Knowledge sharing is the key activity in I-U collaboration and is important for the industry as well as for the new technologies they create (Santoro, 2000). Knowledge development and acquisition by firms have assumed an important role in the understanding of how firms succeed and there is a close relationship between a firm’s knowledge storages and its capabilities and competences (Johnson et al.

2004). In the last twenty years *absorptive capacity* (ACAP) has become one of the most significant construct in literature, precisely because external knowledge resources are so important (Camisón & Forés, 2010). ACAP can e.g. be a firm's capacity to create values, to gain and sustain competitive advantages through the management of the external knowledge. ACAP has been used in a model as a variable that indicates how much a firm can absorb of external knowledge and use that knowledge to commercialize products and services (Cohen & Levinthal, 1989). In the literature there are different statements about how ACAP is related to different capacity within the firms. One example of such statement is: Companies with a high level of ACAP are more likely to draw knowledge from universities (Laursen & Salter, 2004). ACAP has been used as an indicator since Cohen and Levinthal created their model but Lauren and Salter (2004) statement is quite interesting for this study. It suggests the relevance of using ACAP as an indicator to point out which companies are interested in interaction with the universities. Therefore it is also of interest to find out if ACAP affects the companies' values and the barriers in I-U relationship.

This leads us to this study's two objectives. At first the aim is to understand the companies' most important values and barriers in their relationship with the universities. The second main objective is to investigate if the firm's ability to absorb and to use knowledge resources from universities is related to the main values and barriers. This study focuses on Life Sciences companies in the Stockholm-Uppsala regions and their relations to Karolinska Institute, Uppsala University and other Swedish universities.

A value is a broad concept, and it is interesting not only to analyse the main values but also to analyse if there is a correlation between ACAP and the companies expected, obtained and current values. To be more accurate, this study's research questions are:

- 1) What are the most important values for companies engaged in a relationship with universities in the field of Life Sciences?
- 2) Are obtained, current and future values related to the companies ACAP?
- 3) What are the main barriers experienced by the companies in their relationship with the universities?
- 4) Are those main barriers related to the companies ACAP?

This magister thesis is structured as follows; Section 2 provides the theoretical background to the I-U relations, the values, the barriers and ACAP. Section 3 gives an insight into the methodology, the data collection, which items are used in this research and how ACAP is

operationalized and measured. Section 4 describes the results of the data analysis, descriptive statistics and this study's correlation on ACAP and its connection with the values and the barriers experienced by companies in I-U relations. Section 5 includes conclusions and provides a discussion and suggestion for further research.

2. Theoretical review

This theoretical review will firstly analyse what the literature has to say about the I-U relationship, the I-U interactions and what connects their relationship. Secondly it will analyse today's recognised values and barriers in I-U relationship. Thirdly there is an analysis of ACAP, of how and why ACAP was created as a variable in a model and the model's main development and argument.

Today's literature concerning the relationship between I-U is, as aforementioned, mostly written from the universities perspective. The literatures main focus has been on the universities, what they can do to fulfil the EU and governmental requirements regarding I-U relationship and how to make this relationship more economically profitable. According to Plewa et al. (2005) the universities have engaged in this relationship due to increased competition and cuts in government funding. There are several reasons to why the industry has engaged in this relationship. Firstly because they face increased pressure to apply advanced technology to produce new products to be successful in today's marketplace (Plewa et al., 2005). Secondly to have access to students, thirdly to get an overview of technologies and finally to gain more knowledge (Perkmann & Walsh, 2007).

Plewa et al. (2005) and Plewa and Quester (2007) investigated the U-I relationship based on two theories, Relationship Marketing (RM) and Organisational Environmental Difference (OED). According to those research, the key drivers of successful U-I relations are trust, commitment and integration. The concept integration means sharing information as well as being active and participating in all processes (Gomes et al., 2003). The connection between the three key drivers is analysed and explained through their interrelations. Trust, commitment and integration work together and all the factors have a positive influence on the outcome of the U-I relationship (Plewa et al., 2007).

Interorganizational relation (IOR) is a theory that is relevant for this study's attempt to analyse and describe the I-U relationship. IOR helps firms to create values by combining

resources, increasing speed, gaining access to foreign markets, and increasing the ability to share knowledge (Barringer & Harrison, 2000). Firms form many kinds of interorganizational relationship with other organisations e.g. with joint venture, networks, alliances, consortia, trade associations and interlocking directorates and within these relationship the firms create values (Barringer & Harrison, 2000). I-U interactions have since 1970's become more formal, frequent and planned within research and these interactions with the universities can improve the firms ability and capacity to innovate and hence their competitive performances (Vedovello, 1998). According to Plewa et al. (2005) communication and trust are the two things that are the most important characteristics when it comes to the interactions in I-U relationship.

I-U relationships form mostly through the firms R&D, as mentioned in the introduction. Vedovello (1998) indicate that R&D activities are the main factors that increase the firm's ability to gain technical progress and the more intense the R&D activity is within the firm, the faster it's economic growth becomes. For the industry it is the presence of the firm's intensive own R&D activities that are important to stimulate the relationship with the universities (Vedovello, 1998). Bercovitz and Feldman (2007) indicate that firms that have internal R&D strategies, which focus on research activities, can develop deeper and multifaceted relationship with the universities. Tangible outcomes from I-U relationships are what affects their interaction, the more successful outcome the better relationship intensity (Santoro, 2000). To quantify the companies ability to gain external knowledge, how they use that knowledge and commercialize their outcomes, this study uses as an indicator, ACAP which is better explained in section 2.2. Here it boils down to this study's research questions; is the companies ability to gain more external knowledge an indicator that affects their I-U relationships and will the companies' perceived values and barriers change according to the companies' ACAP.

When searching the literature for appropriate research, theories or other knowledge regarding the I-U relationship there is a lot to consider. Many theories are relevant to this study but the main focus will be on values, barriers and ACAP and they will be better analysed here below.

2.1. Values

There is a lack of research that analyses the value creation, outcomes and success in I-U relations and the relationship barriers (Plewa et al., 2005; Plewa & Quester, 2007; Bruneel et al., 2010). According to today's literature the key value creation for the industry is the

acquisition of knowledge and technologies (George et al., 2002) other examples of values are human capital gaining, retention, contacts and networks (Plewa et al., 2005). Value creation between I-U can be called bilateral values. Even though the university and the industry perceived different relationship outcome, both parties can gain values out of the arrangement. Perkmann and Walsh (2007) research indicates that firms consider their relationship with their universities as valuable and that the relations produce more than just patents, spin-offs and licenses. This relationship gives firms more ability and capacity to innovate and gives the company technological advantages making them more competitive (Vedovello, 1998). To examine closer the concept of value, Wilson & Jantrania (1993) work; *Understanding the values of a relationship* concludes that “any relationship and strategic alliance creates some value to both partners”. This is interesting for the I-U relationship because the universities also gain values from their relations with the firms such as the hybrid organisations, which mostly benefit the universities. The I-U relationship is valuable to the industry if it helps the firms to achieve their goals such as advance in new technology and making them more competitive on the marketplace (Santoro, 2000).

2.2 Barriers and the organisational differences

Time orientation, adherence to deadlines, lack of market orientations and the organizational bureaucracy and flexibility are the main findings in Plewa et al. (2005) research when it comes to industry-university differences or as referred in the research, the organizational environment difference (OED). According to Plewa et al. (2005), many findings related to the differences in the organizational environments and cultures between university and industry are to a considerable extent related to different motivations in the environment of industry and of universities. These motivations are related to e.g. the differences between private businesses that are totally dependent on commercialize activities to survive and educational institutions that are dependent on public funding (Plewa et al., 2005). As mentioned in the introduction the difference between the university and firms is important and it is interesting how these two organisations have different emphasis and how they consider their research. Companies are mainly interested in research outcomes that can solve problems, to capture valuable knowledge and to achieve competitive advantage. The academia however, sees their research outcome as a start for further research and they are driven to create new knowledge and to educate (Bruneel et al., 2010; Plewa et al., 2005). These differences, as described above, in industry-university environment can be a barrier for the U-I relations. Barriers are

the factors that inhibit or restrict the ability of industry and universities to create a relationship (Davey et al., 2011).

In a more recent research (Bruneel et al., 2010) the main barriers are divided into two categories: Orientation-related barriers and Transaction-related barriers (see table 1).

Table 1 Barriers divided in categories and definitions from Bruneel et al. (2010) research.

Category	Definition	Barrier
Orientation-related barriers	Those related to differences in the orientations of I-U	<ul style="list-style-type: none"> -University research is extremely orientated towards pure science -Long-term orientation of U research (more) -Mutual lack of understanding about expectations and working practices
Transaction-related barriers	Those related to conflict over Intellectual Property (IP)	<ul style="list-style-type: none"> -Industrial liaison offices tend to oversell research or have unrealistic expectations -Potential conflicts with university regarding royalty payments from patents or other intellectual property rights and concerns about confidentiality -Rules and regulations imposed by universities or government fundings agencies -Absence or low profile of industrial liaison offices in the university

It is important for this study to review the results of the barriers in Bruneel et al. (2010) research because they indicate more width and a deeper analysis than previously had been done in older research, such as e.g. Plewa et al (2005). There are many barriers that hinder I-U collaborations but the universities long-term orientation, IP and administrative procedures are the most classical barriers according to Bruneel et al. (2010) results. The main barriers to the relationship from the academic and higher educational institutions viewpoint are, fundings for the relationship and the bureaucracy in the universities (Davey et al., 2011).

The key variables in I-U interaction are communication and trust, which emphasises the importance of the individuals in the I-U relationship (Plewa et al., 2005; Plewa & Quester, 2007; Bruneel et al., 2010). Subsequently a lack of communication and trust can become a barrier. High level of interaction between industry and university can be valuable for both parties as with a deeper interaction comes more productivity in the collaboration. However problems in the interaction can also become company's barrier.

2.3. Absorptive capacity (ACAP)

Internal and external knowledge (basically all knowledge in the environment) that a company absorbs over its lifetime and the company's ability to preserve and use this knowledge (e.g. commercialised) can be hard to measure. It can be said that knowledge is a company's

intangible resource and that ACAP is a company's intangible assets. To measure knowledge "precisely" is almost impossible, making knowledge an intangible and very complex asset. Within the growing literature on ACAP there is no consensus on which indicators/proxies are to be used when ACAP is measured.

Today's literature focuses on Cohen and Levinthal's research on ACAP and begins on their first theory that R&D obviously generates innovation and is fundamental for the ability to identify, assimilate and exploit knowledge from the environment (externally generated knowledge). This knowledge can be created by other firms or research institutions (Cohen & Levinthal, 1989). Later they created a model of ACAP which they defined as; a firm's ability to recognize the value of new information, how to assimilate it and apply it to commercial ends (Cohen and Levinthal, 1990) or in Cohen and Levinthal (1989) own words: "*Absorptive capacity represents the firm's learning*". According to Cohen and Levinthal's model, firms incentives to learn or to generate new knowledge's, e.g. in innovation activities, will later in the form of the company's R&D, contribute to the firm's ACAP.

The ACAP theory has developed through the past two decades. According to Flatten et al.'s (2011) research, many empirical studies have used ACAP as a valid measurement in this past two decades. Their research indicate that most of these empirical studies uses as proxies the firm R&D input such as R&D intensity and the firm's output such as patents (Cohen and Levinthal, 1998; Stock et al., 2001; Oltra and Flor, 2003; Belderbos et al., 2004). In most of those studies R&D intensity is the R&D expenditure divided by sales or investments, e.g. R&D personnel. ACAP has been known as a by-product of an organisation's R&D efforts (Camisón & Forés, 2010).

Zahra and George (2002) took Cohen and Levinthal's three dimensions of ACAP (*identity, assimilate and exploit*) and developed them into four dimensions: *acquire, assimilate, transform and exploit*. By further developing the original definition, the four dimensional ACAP can explain how companies become more competitive mostly through strategic flexibility and innovation. Studies like Flatten et al. (2011) and Jiménez-Barrionuevo et al. (2011) argue as Zahra and George (2002) do, that R&D intensity or other single dimensional measurement cannot "by themselves" fully gauge this complex concept that ACAP really is. Therefore a better procedure is to use the four dimensions in Zahra and George's (2002) theory, *acquire, assimilate, transform and exploit*.

Table 2. Shows the four dimensions by Cohen and Levinthal (1989) defined in Flatten et al.'s (2011) research.

Table 2 Zahra and George's, (2002) four dimensions definition of ACAP in Flatten et al., (2011) research.

Acquire	Assimilate	Transform	Exploit
The firms ability to identify and obtain knowledge from external sources.	The firms ability to develop processes and routines useful in analysing, interpreting and understanding externally acquired knowledge.	Developing and refining those routines that facilitate combining existing knowledge with acquired and assimilated knowledge for future use.	The firms capacity to improve, expand and use its existing routines competencies and technologies to create something new based on the "transformed" knowledge.

This study argues that to this day there is still not enough information in the literature on how to use those four dimensions to measure ACAP and which are the right proxies to use. The research that have been published, such as Flatten et al. (2011) include items which are questionable if they are suitable for such a research. Examples of two of those items are:

- Our employees cleverly transform information from internal and external sources into valuable knowledge for our company.
- Our management provides employees with enough scope for development to use the aggregated information for experimenting with alternative solution possibilities.

The author of this study argues that these questions are difficult to answer, making it hard to interpret the research result. For example, how can you identify that our employees "cleverly" transform information. These questions are too open and difficult to answer in a questionnaire with the scale e.g. 1 to 5. Even though recent studies such as Flatten et al. (2011) can be questionable when they are developing Zahra and George's theory. Beside the researchers above, the author of this magister thesis believe there is a reason to develop the original theory and to specially focus on that R&D is perhaps not the main proxy that should be used.

Many questions arise when creating a formula for ACAP. If R&D is the main proxy what about the firms that have no R&D such as sales companies or companies that are on the sale stage and no longer have a R&D department or activities. Since no studies indicate that R&D should not be used as the proxy this study is going to focus on the four dimensions (see table 2) and take into consideration if companies are missing R&D. A more detailed definition is provided in the operationalization of the variables in section 3.2.1.

This theoretical review has analysed the I-U relationship and described what other studies have distinguished as the industry's main values, barriers and ACAP. According to those research, the industries relationship with the universities is important to both parties. By cooperating with universities the industry has more capacity to innovate as the I-U relationship gives the firms both technological and competitive advantages. Now knowing how valuable and important I-U relationships are, it is interesting to find out if the firms' ACAP have any correlation to the main values and barriers analysed in this study. As stated, companies with a higher level of ACAP should be more successful in absorbing knowledge and should also be more aware of the values. Therefore this study's hypothesis concerning values is looking for a positive correlation. This leads to the fact that companies with higher ACAP should be more familiar with the university culture and routines. This could as well show that companies with a strong commercial orientation in their knowledge would not perceive barriers in the same way as other companies, such as the universities' bureaucracy. The higher the ACAP of a company the lower they will feel the barriers. Therefore the hypothesis concerning the barriers is a negative correlation. Hence this study's two hypothesis can be formulated as follows.

Hypothesis 1. The companies' perceived values in their relationship with universities are positively correlated to the company's ACAP.

Hypothesis 2. The companies' perceived barriers in their relationship with the university are negatively correlated to the company's ACAP.

3. Methodology

3.1. Data collection

In 2009 a research group from Uppsala University started a project, *The innovating University: Investigating the Direct and Indirect Efforts of Universities' efforts to commercialize Science*. The purpose of that project is to map and analyse the special units that all major Swedish universities have established to commercialize their scientific discoveries. The project analyses and maps these units' structures, their strategies and the tools the university uses to have direct or indirect effects on their innovation efforts. It also investigates the broader network in which universities are embedded in with a special focus on the industrial users. The project includes several comparative case studies centred on two major

Swedish universities, Karolinska Institutet (KI) and Uppsala University (UU). Within these two large case studies are series of smaller embedded studies. Moreover, the project includes e.g. a large online survey that started in 2012. The project is on-going and has since 2009 collected a significant amount of data.

This study is based on that database. The database is based on a survey of the Life Science Industry and aimed at obtaining information about the companies' perspective towards their relationship with universities in Sweden. The sample of companies was obtained from Stockholm-Uppsala Life Science (SULS) including all Life Science companies in the Stockholm-Uppsala region.

The survey's purpose is to view and to evaluate the companies' perspective of their relationship with Uppsala University (UU) and Karolinska Instituted (KI) or other universities if neither of these two are involved. The surveys questions (see appendix 1 and 2) are directed at investigating how the industry and universities work together, how valuable these relationships are to the industry and whether the universities fulfil the industry's expectations.

The survey's population was over 600 companies and the survey was first emailed to the companies in 2012 and received a 10 % response. In the beginning of 2014 all the population was contacted by telephone and/or emails by this study's author in an attempt to reach a significant response rate for the project group.

This study is a quantitative research based on the survey's data which was collected from companies within the Life Science Industry located in the Stockholm-Uppsala region.

3.2. Operationalization of the variables

3.2.1. ACAP

Zahra and George (2002) divides the four dimension into two categories, potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP). Acquiring and assimilating go under potential ACAP and transforming and exploiting go under realized ACAP. This study uses both PACAP and RACAP when calculating the companies ACAP (see table 3). To calculate the companies ACAP four items were used from the survey, each item indicating Zahra and George's dimensions (see table 3).

Table 3 Zahra and George’s dimensions of ACAP as operationalized in this study.

This study’s ACAP	A	B	C	D
	Acquire	Assimilate	Transform	Exploit
Potential ACAP Questions from the survey:	Item about research intensity: Can you please indicate the percentage of R&D personnel in the Company over the total workforce in the year 2012?	The item about the R&D cooperation’s of the company: How many R&D projects that involved external partners did the company have in the past 5 years?		
Realized ACAP Questions from the survey:			Item about the R&D intensity: Can you please indicate the percentage of the company’s R&D budget over its turnover for the year 2011?	Item about the company’s stage. Which of the following stages has the Company as a whole reached in 2012?

The four dimensions can each assume a number between 0-1 and are then divided by four according to the formula below and table 3 above.

$$\frac{A + B + C + D}{4} = ACAP$$

- A. To represent **acquire** the item in the questionnaire about research intensity was used: “Can you please indicate the percentage of R&D personnel in the Company over the total workforce in the year 2012?” This figure was a percentage value that was given a number from 0.1 to 0.9 e.g. 0-20% got the number 0.1, 81-100% got the number 0.9 (and a number there between).
- B. To represent **assimilate** the item about the R&D cooperation’s of the company was used: “How many R&D projects that involved external partners did the company have in the past 5 years?” For this item the minimum number of projects was 1 and maximum was more than 20 projects. The number of the projects got a represented number from 0 to 1 based on their performances in relation to the rest of the companies. For example companies with 1 project got the number 0.05, 10 project got the number 0.5 and 20 project got the number 1.0 (and a number there between).
- C. To represent **transform** the item about the R&D intensity was used: “Can you please indicate the percentage of the company’s R&D budget over its turnover for the year

2011?” This figure was a percentage value that was given a number from 0.1 to 0.9 e.g. 0-20% got the number 0.1, 81-100% got the number 0.9 (and a number there between).

- D. To represent **exploit** the item about the company’s stage was used. “Which of the following stages has the Company as a whole reached in 2012?” Companies that had reached the sales were assigned the value 1, while companies with no products on the market were assigned the value 0, indicating a lack of exploitative ACAP. Companies where given 0 to 1 and nothing there between.

Another study supports this author’s decision when deciding the proxy’s to calculate ACAP. That study is Bruneel et al. (2010), where they do not use R&D as their main proxy because in their survey’s sample there was a high number of service companies that have no R&D. They choose instead to use the percentage of staff with higher education degree.

Therefore when deciding the fourth dimension, **Exploit**, this study uses the item of the company’s stage as a proxy. The reason for using that item is that it shows which companies are sales companies and which are not. As mentioned in section 2.2 companies that have low R&D or even none at all such as certain sales companies will not receive correctly calculated ACAP. To measure e.g. sales companies’ ACAP with only the R&D intensity, is not accurate. To correct this it was decided to give the sales companies the number 1 which represents 25% of the whole equation and the rest of the companies got the number 0. This was a dichotomic element (i.e. 0 or 1, nothing in between).

3.2.2. Items

Three items used in the survey (see below) indicate which are the most important *expected*, *current* and *future* values in the companies’ relationship with the universities. Each item then has in the questionnaire a list of 12-13 values that could be chosen and evaluated by companies (see questionnaire in Appendix 2, showing the list of these values, for the three items).

Item 12 in the questionnaire: “Which of the following advantages did the Company expect to obtain from the relationship with Universities before starting it?”

Item 13 in the questionnaire: “To what extent can the Company exploit its current relationship with universities to obtain the following advantages?”

Item 14 in the questionnaire: “To what extent do you expect that the Company will exploit its relationship with universities to obtain the following advantages in the future?”

One item used in the survey (see below) indicates which are the main barriers in the company’s relationship with the universities, the list of the barriers can be seen in the questionnaire in Appendix 2.

Item 16 in the questionnaire: “In your opinion, what is the impact of the following barriers to developing the relationship with universities?”

Item 12 had yes/no and “I don't know” answer possibilities and Item 13, 14 and 16 had a scale from 1 – 5 “Not at all” to “To a very large extent” (see appendix 2).

3.2.3. Correlations

To analyse if the correlation between the companies ACAP and their perceived values and barriers is positive or negative, this study uses two types of statistical tests in the Statistical Package for Social Sciences (SPSS). For item 12 a One-way Anova test is used a Person correlation test for item 13, 14 and 16. The reason for these different tests is that answer 12 had yes/no and “I don’t know” answers, and is therefore a dichotomic variable, while the other items had answers placed on a scale from 1 to 5 (not at all – to a very large extent). For each item, the four highest scored values and barriers, in average from the survey’s standard report, were correlated with the companies ACAP.

As mentioned in the introduction the survey focuses on Karolinska Institutet (KI), Uppsala University (UU) and other universities. 26 companies have relationship with other universities and 24 companies have collaborations with both KI and UU. If a company had not answered the questions used to calculate ACAP it was excluded from the sample. For those companies that had answered for two universities, that company was duplicated, the calculated ACAP followed the company and this study used both answers. Companies that did not fully answer the questions (some of the options in the survey were left empty) were also excluded from the sample. Therefore the total sample size (n) in the correlation does not match the surveys total n. Likewise only the companies that had or have a relationship with a university could answer the items about the values and the barriers to the relationship and consequently the companies that have no I-U relationship were also excluded. This means that there are no missing values in the correlations tests. Section 4 (and tables 7 and 8) shows which value were correlated and their results.

4. Results

The results are presented by first reviewing descriptive statistics regarding the population and the standard report averages for the main values and barriers, section 4.1. Second is a statistical correlation for ACAP and the four main expected, current and future values, section 4.2. Third is a statistical correlation for ACAP and the barriers, section 4.3. All results are also shown in tables.

4.1 Descriptive statistics and the main values and barriers

The survey obtained 125 answers (approximately 10% of which are somehow incomplete) corresponding to 20.7 % of the total population. 75,4 % of these 125 companies are currently having collaborative relationships with a university in Sweden. These are the companies that are analysed in this study. The average turnover for the companies is 11-20 million SEK and the average number of employees is 11-20 persons (see table 4).

Table 4 Average number of the employees and the average turnover

	n	Min	Max	Mean	SD
Numbers of employees	120	0-5	>5001	11-20	2,46
The total turnover	118	0-1	>5	11-20	2,86

0-5 employees	0-1 million SEK
11-20 employees	11-20 million SEK
> 5001 employees	> 5 billion SEK

n = number of participants

Items 12, 13 and 14 (expected, current and future values) had 12 values in a list that the companies had to choose from (see the questionnaire, appendix 2 and in table 5). As seen in table 5, the five values with the highest average score are very similar between the 3 items. They are; 1) Opening up new perspective, 2) acquisition of general knowledge, 3) acquisition of specific knowledge, 4) opening up other relationship with other actors and 5) improving the company's recognition. These five main values are illustrated in table 5 below, the highest scored value in average from the standard report, for each category expected, current and the future values.

Table 5 The four highest scored values in average from the standard report for items 12, 13 and 14 (expected, current and future values). Each question is given a percentage value based on the 1-5 scale from the questionnaire

	Highest scored values in average from the standard report	Value on 1-5 scale in %
Item 12 Expected	Acquisition of specific knowledge	78.5
	Opening up new perspective	60
	Improving the Company's recognition	55
	Opening up other relationship with other actors	54
Item 13 Current	Acquisition of specific knowledge	45
	Opening up new perspective	36
	Opening up other relationship with other actors	34
	Acquisition of general knowledge	33
Item 14 Future	Acquisition of specific knowledge	44
	Opening up new perspective	36
	Opening up other relationship with other actors	36
	Improving the Company's recognition	33

For item 16 there were 11 barriers in a list that the companies had to choose from (see questionnaire appendix 2 and table 6). The five barriers with the highest averages score are; 1) bureaucracy in the university, 2) lack of resources and time at the university, 3) lack of resources and time at the company, 4) the company needs quick response, but the university follows a long-term logic and 5) cultural differences between the university & the company. These five barriers are illustrated in table 6 below, the highest scored barrier in average from the standard report.

Table 6 The five highest scored barriers in average from the standard report, each question is given a percentage value based on the 1-5 scale from the questionnaire

	Highest scored barriers in average from the standard report	Value on 1-5 scale in %
Item 16	Bureaucracy in the university	32
	Lack of resources and time at the university	36
	Lack of resources and time at the company	33
	The company needs quick response, but the university follows a long-term logic	31
	Cultural differences between the university & the company	30

4.2 Statistical correlation between ACAP and the values

In order to see if there is a correlations between the ACAP and the values it was necessary to use two different tests, The One Way Anova test and The Pearson Correlation. Table 7 and figure 1 show the results from item 12 (One Way Anova test) and table 8 and figures 2 show the results for item 13 and 14. For each item the four highest scored values in terms of average from the standard report were correlated with the companies' ACAP.

Table 7 shows the Anova test results for item 12; “Which of the following advantages did the company expect to obtain from the relationship with universities before starting it?”

Table 7 One Way Anova test for Item 12 and the four highest scored values in average from the standard report

		n	Mean	SD	Significant factor (p)
Item 12, expected values	Opening up new perspective	58	Yes 0,4485	0,18	0,277
		22	No 0,3773	0,17	
		12	I don't know 0,4344	0,15	
	Acquisition of specific knowledge	69	Yes 0,4672	0,16	0,000**
		17	No 0,2647	0,16	
		6	I don't know 0,4979	0,11	
	Improving the Company's recognition	56	Yes 0,4518	0,18	0,044*
		30	No 0,3696	0,16	
		7	I don't know 0,5196	0,08	
	Opening up other relationship with other actors	55	Yes 0,4230	0,18	0,601
		30	No 0,4279	0,19	
		8	I don't know 0,4906	0,18	

n = sample size

*p < 0,05

**p < 0,01

As seen in the table 7 and in figure 1 there are positively significant correlation for the optional value, “acquisition of specific knowledge” with 95% coefficient/confident (p<0.05) and “improving the company's recognition” with 99% coefficient/confident (p<0.01). Companies with higher ACAP say rather yes then no.

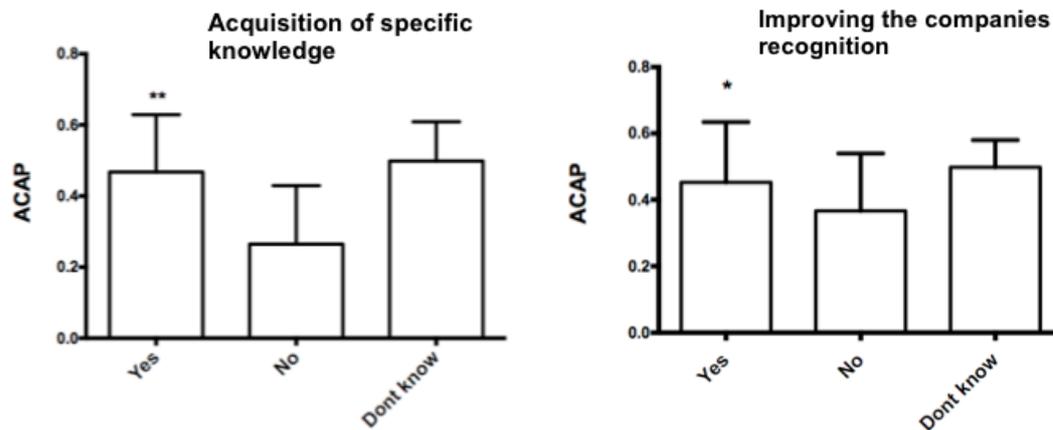


Figure 1 Item 12: expected values “acquisition of specific knowledge” and “improving the company’s recognition”

Table 8 shows the correlation results between the companies ACAP and the four highest scored option values in averaged from the standard report for item 13 and 14. Item 13; “To what extent can the Company exploit its current relationship with universities to obtain the following advantages?” Item 14; “To what extent do you expect that the Company will exploit its relationship with universities to obtain the following advantages in the future?”

Table 8 Correlation between ACAP and the values in item 13 and 14

	Values for correlation	n	Mean	SD	R-values
Item 13, current values	Opening up new perspective	89	2,93	1,13	.054
	Acquisition of general knowledge	89	2,76	1,21	.104
	Acquisition of specific knowledge	89	3,33	1,12	.224*
	Opening up other relationship with other actors	89	2,87	1,27	-.119
Item 14, future values	Opening up new perspective	88	3,01	1,24	.136
	Acquisition of specific knowledge	87	3,29	1,21	.254*
	Improving the Company’s recognition	88	2,93	1,33	.078
	Opening up other relationship with other actors	87	3,03	1,38	.060

n = sample size

R = Correlation coefficient

*p < 0,05

**p < 0,01

Table 8 show a significant positive correlation for the value “acquisition of specific knowledge”, both as current value (item 13, $r = .224, p < 0.05$) and as future value (item 14, $r = .254, < 0.05$) with 95% coefficient/confident. However, the correlation coefficient is weak as seen on the R-values in the table above. The below graphs show the correlation with 95% confidence (see figure 2). The correlations for two values in item 13 and 14 are positive and therefore hypothesis 1 is supported.

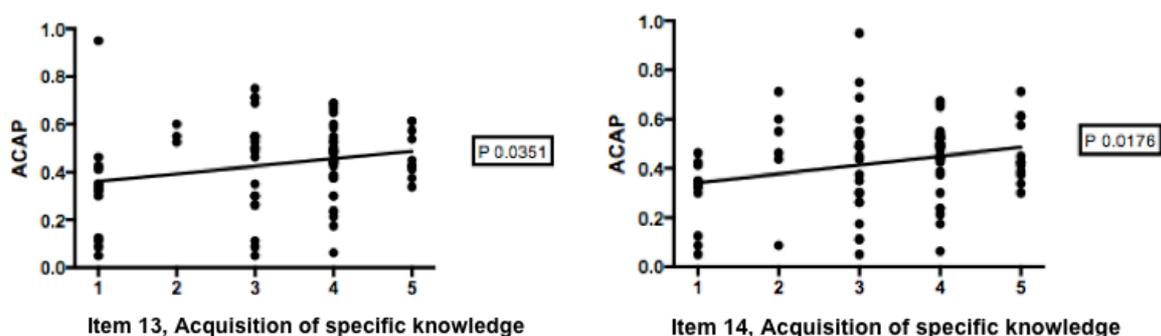


Figure 2 Item 13 and 14. A weak positive correlation with 95% confidence between ACAP and “acquisition of specific knowledge”

4.3 Statistical correlation between ACAP and the barriers

In table 9 this study correlates the four main barriers expressed in item 16; “In your opinion, what is the impact of the following barriers to developing the relationship with universities?” with the companies’ ACAP. Table 9 shows the sample size (n) and the R-value.

Table 9 Correlation between the companies’ ACAP and the four highest scored barriers in average from the standard report

	Barriers for correlation	n	Mean	SD	R-values
The main barriers	Bureaucracy in the university	82	2,7076	1,12	0,038
	Lack of resources and time at the university	82	2,8659	1,19	0,182
	Lack of resources and time at the Company	82	2,7195	1,13	-0,71
	The Company needs quick response, but the university follows a long-term logic	82	2,5610	1,08	0,175

n = sample size

*p < 0,05

**p < 0,01

As seen in table 9 there is no significant correlation. Therefore, hypothesis 2 is rejected.

This results section shows this study's main values and barriers and a statistical test between them and the companies ACAP (One Way Anova test and a Pearson correlation test). The main findings, seen in the tables above, are a 95% significant confident correlation between the companies ACAP and two of the selected values, but it is a weak correlation. There is however no significant correlation between the companies ACAP and the barriers.

5. Discussion

This study had two objectives, first to find out the main values and barriers in I-U relationship and secondly to do a correlation between them and the companies ACAP. This thesis partly confirms previous research concerning the main values and barriers. The results from the correlations show a weak connection between the companies' ACAP and their expected, current and future values in I-U relations. The results show no correlation between ACAP and the barriers experienced by the companies in I-U relations. This is an interesting outcome and needs a deeper discussion. I-U relations are important to both parties, and it is important that this relationship continues to grow and run as smoothly as possible. This section is divided into three smaller sections. The first discusses the expected, current and the future values connected to the correlation between the values and the companies ACAP. The second section focuses on the connection of the organisations differences with the barriers. Last there is a discussion about ACAP and how it is calculated and related to the companies' values and barriers.

5.1. Industry's expected, current and future values towards the universities

This study focuses on the main barriers and three types of values in I-U relations. First there are the *obtained values*, which are the values the companies are expecting with their relationship with the universities. Next are the *current values*, these are the values the companies are getting from their relationship. Finally, there are the *future values*, the values the companies' aim to obtain in their future relationships with the universities.

Scholars indicate that the key value creation for the industry is the acquisition of knowledge and technologies (George et al., 2002). Other important values are human capital gaining, retention, contacts and networks (Plewa et al., 2005). This is very similar to this study's findings, opening up new perspective, acquisition of specific and general knowledge, opening

up relationships with other actors and improving the company's recognition. The most selected values were almost the same between expected, current and the future values except for a little difference in how the five values are divided; "opening up new perspective", "acquisition of specific knowledge" and "opening up other relationship with other actors" are included in all the three values (expected, current and future). However, while in current values there is "acquisition of general knowledge", as future values the companies' hope that the relationship with the university will "improve the company's recognition", more than "acquire general knowledge" (see table 5 in section 4).

The significant positive correlations between the companies' ACAP and their values are between ACAP and the "acquisition of specific knowledge" and "improving the company's recognition". The correlation is weak but shows that there is a connection between a higher level of ACAP and how the companies rate some of the values obtained or hoped for in their relation to universities.

In this study's survey the values were given as options and the companies had to rate the importance of the optional values. The author wonders how different the result would be if the companies were interviewed? Would the answers stay the same or would there be more differences in the answers?

5.2. Main barriers and the differences between the two organisations

In Davay's et al.'s, 2011, report, the main barrier to the I-U relationship, from the academic and higher educational institutions viewpoint, is the fundings whereas from the industry viewpoint it is bureaucracy in the universities. Bureaucracy is also one of the main barriers according to this study, and more precisely: "bureaucracy in the university", "lack of resources and time at the university", "lack of resources and time at the company" and "the company needs quick response, but the university follows a long-term logic". These barriers are very similar to the Plewa et al. (2005) research where the identified barriers are; time orientation, adherence to deadlines, lack of market orientations and the organizational bureaucracy and flexibility.

The barriers are at least as important as the values or even more. In fact, Davey et al. (2011) mentioned in their rapport *The State of European University-Business Cooperation* that the barriers are the factors that inhibit or restrict the abilities of industry and university to create relationship. As the author analyse the barriers in this study, similarly to Plewa et al. (2005)

and Bruneel et al. (2010), the main barriers are predominately related to the differences between the two organisations, universities and companies.

The differences between the industry and the universities lie in the organizational environments, in their cultures and the fact that the industry and the universities as organisations have different emphasis. As mentioned in the introduction and in the theoretical review the industry and the university differences are important not only in how they consider their research (and research outcomes) but also in their interaction. Plewa et al. (2005) and Bruneel et al. (2010) indicate that the companies are mainly interested in research outcomes and technological and competitive advantages. The academia however, sees their research outcome as a start for further research and their driving force is to educate and to create new knowledge. The interaction is always on an individual basis and if the interactions are well controlled or operated the key variables, trust and communications, will improve and even get stronger/deeper. Therefore, controlled interaction will provide less risk and lower chance of these variables becoming a large barrier. Barriers can have a larger impact on the I-U relations than the values. In the end controlled barriers can become one of the companies' values.

5.3 ACAP and it's accuracy

The second objective of this study was to perform a correlation analysis between the companies ACAP and their perceived values and barriers. In the beginning the question was, what could possibly affect the company's opinion regarding their relationship with the universities. When searching the literature, ACAP appeared as a prominent concept and was even defined to be the dynamic capacity that allows firms to gain competitive advantages, manage the external knowledge and create values. This indicates that companies with high level of ACAP are more successful then those with a lower level of ACAP. R&D and the connection to ACAP are in previous research the main proxies used to measure ACAP. The founders of the original ACAP theory and other scholars (see theoretical review) discuss the connection of R&D and ACAP. They describe ACAP as to be a by-product of the R&D efforts and that R&D is the key factor in organizational learning. According to this the respected result was that ACAP would have at least some effects on the companies' values and barriers. The impact and the effects of ACAP is also supported by scholars like Laursen and Salter (2004) where they confirmed that companies with higher levels of ACAP are more likely to cooperate with the universities.

This study's results shows a correlation between the companies' ACAP and two of their values but not the barriers they perceive. The correlations with the values are however considered to be weak. Whether ACAP is a good predictor of companies engaging in I-U relations or not, in the end this study demonstrates the discussion of two interesting findings. First that ACAP only weakly explains the variance in the obtained, current and hoped for values for companies in I-U relations. Secondly that companies with both high and low ACAP experience barriers in I-U relations to the same extent. This raises the point of how important the calculation of ACAP really is and that it is done with accuracy for all the companies in the population of this study. A single and universal formula is needed for how to calculate ACAP.

6. Conclusion

The purpose of this study was to find the main values and barriers that companies within the Life Sciences Industry perceive in their collaboration with universities in Sweden. ACAP captured the author's attention first as a widely used concept within the literature where it is used in the concept of the I-U relationship. Secondly it was interesting to understand what ACAP is and why it is used and specially how to calculate this indicator.

There are no prominent differences between this study's main values and barriers when comparing to other similar studies. However it has to be mentioned that there is a lack of literature concerning I-U relationship from the industry perspective. This study finds a weak connection between ACAP and the expected, current and hoped for values. The correlations are mostly related to one value option namely "acquisition of specific knowledge". This could be related to the fact that this value is well known. By cooperating with the universities the industry is gaining access to more specific knowledge. Companies with a higher ability to absorb knowledge and a higher ACAP are more aware of the importance of these types of specific knowledge than companies with lower ACAP. Even though the connection is weak, a higher level of ACAP indicates that the companies give this value a higher score see figure 1 and 2 in section 4.2.

No correlation was however found between ACAP and the barriers. This study argues that the barriers seem to be more related to the differences between the organizations than to the companies' ability to absorb external knowledge and to commercialize. Therefore the level of the firms ACAP is not affecting the companies' view of the barriers. Deeper analysis of the values and barriers from the industry view is suggested for further research.

The lack of research on how to calculate ACAP is also a key issue. The first original model used R&D intensity as the main proxy for ACAP. In this study I argue that this method can be improved and that R&D does not reflect all companies' ACAP. Many companies without R&D are successful and are gaining external knowledge and are commercializing products and processes. This puts into question the results of all the previous research that used R&D intensity as a proxy to calculate ACAP. ACAP is a useful concept but it needs further development and operationalization.

The collected database that this study is based on is full of interesting information for future research of the I-U relationship. The participants in the survey collaborated with Uppsala University, Karolinska Institutet and other selected universities. This study analyzed the

averages of the answers but there is still interesting material in the database yet to be analyzed, enabling correlations especially of the answers connected to each university. Those types of correlation and analysis would give deeper and more detailed information since universities differ and it is interesting to find out their emphasis. It would also be interesting to investigate further the work and the impact of the hybrid organizations mentioned in the introduction. How do those hybrid organizations benefit the industry and what does the industry expect from them. Is there a need for other types of organizations to fulfill the industry requirements or can they serve both parties, universities and companies, equally? This study welcomes future research based on this surveys database as well as other studies related to I-U values and barriers.

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Appendix 1

The main questions in the questionnaire:

What is your educational background?

Degree: _____
Topic: _____

For how many years have you worked within the Life Science field?

Fill in n. of YEARS

Have you previously worked in academia?

- Yes
- No

What is the position you currently occupy in the Company?

For how many years have you occupied this position?

Fill in n. of YEARS

COMPANY CLASSIFICATION

Which is the main business area of the Company?

Tick ONE alternative below

- Pharmaceuticals
- Medical devices & diagnostics
- Equipment & methods for research and production in the Life Sciences
- IT tools for the Life Sciences
- Others, please specify: _____

COMPANY SIZE

What was the total number of employees in the Company, including all of its operating units in Sweden in the year 2011?

Please chose one of the following alternatives:

- 0-5 employees
- 6-10 employees
- 11-20 employees
- 21-50 employees
- 51-100 employees
- 101-200 employees
- 201-500 employees
- 501-1.000 employees
- 1.001-5.000 employees
- >5.001 employees

What was the global turnover for the whole Company, including all of its Swedish units in the year 2011?

Please chose one of the following alternatives:

- 0-1 million SEK
- 1-5 million SEK
- 6-10 million SEK
- 11-20 million SEK
- 21-50 million SEK
- 51-100 million SEK
- 101-500 million SEK
- 501 million-1 billion SEK
- 1-5 billion SEK
- >5 billion SEK

COMPANY STAGE

Which of the following stages has the Company as a whole reached in 2012?

Tick one alternative below, considering the products/services that are closest to sales.

- Research (= the Company is still pursuing basic research)
- Development (= the Company has started developing a product/service)
- Pre-market launch (= the Company is ready to launch a product/service)
- Sales (= the Company is currently selling products/services on the market)

COMPANY STAGE

Can you please indicate the number of products/services that the company currently has on the market? _____

Fill in n. of PRODUCTS/SERVICES... _____

How many years ago did the Company launch its first _____

product/services?
Fill in n. of YEARS...

COMPANY'S RESEARCH INTENSITY

	0-20	21-40	41-60	61-80	81-100
	%	%	%	%	%

Can you please indicate the percentage of R&D personnel in the Company over the total workforce in the year 2011?

Can you please indicate the percentage of the Company's R&D budget over its turnover for the year 2011?

GEOGRAPHY OF THE COMPANY

	Yes	No
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Is the headquarters of the Company located in Sweden?

Does the Company have any operating sites (e.g., for R&D, production, sales etc.) abroad?

Was the Company established as a branch/subsidiary of a foreign (non-Swedish) multinational firm?

How many operating sites (e.g., for R&D, production, sales etc.) does the Company have in Sweden?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- More than 10

THE R&D COOPERATIONS OF THE COMPANY

How many R&D projects that involved external partners did the Company have in the past 5 years?

- 0

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- More than 20

How do you evaluate the importance of the following actors as cooperation partners in the Company's R&D?

Tick for each actor on a 5-point scale: 1: totally unimportant, 3: neither or, 5: extremely important

	Totally unimportant			Extremely important	
	1	2	3	4	5
Customers	<input type="checkbox"/>				
Suppliers	<input type="checkbox"/>				
Competitors	<input type="checkbox"/>				
Universities, including university hospitals	<input type="checkbox"/>				
Private research Institutes	<input type="checkbox"/>				

RELATIONSHIPS WITH UNIVERSITIES

Does the Company currently have collaborative relationships with any university in Sweden?

- Yes
- No

Can you please indicate why your company has no relationships to universities in Sweden?

Tick ONE or MORE alternatives below

- We have relationships with foreign universities instead
- We consider relationships with universities as not valuable enough
- We encountered too strong barriers to entertain such relationships
- Other reasons, please specify: _____

How many universities (Swedish and foreign) does the Company currently have collaborative relationships with?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- More than 20

Geographical closeness to the collaborating University

Tick on a 5-point scale: 1: totally unimportant, 3: neither or, 5: extremely important

	Totally unimportant		Extremely important		
	1	2	3	4	5
How important is it for the Company to have its operating units geographically close to the collaborating University?	<input type="checkbox"/>				

Does the Company currently have a collaborative relationship with:

	Yes	No
Uppsala University?	<input type="checkbox"/>	<input type="checkbox"/>
Karolinska Institutet?	<input type="checkbox"/>	<input type="checkbox"/>

Does the Company currently have a collaborative relationship with:

Please select your most important relationship among the following alternatives:

- Göteborgs universitet
- Stockholms universitet
- Umeå universitet
- Linköpings universitet
- Kungliga tekniska högskolan
- Chalmers tekniska högskolan
- Luleå tekniska universitet
- Karlstads universitet
- Linnéuniversitetet
- Örebro universitet
- Mittuniversitetet
- Sveriges lantbruksuniversitet
- Blekinge tekniska högskola
- Malmö högskola
- Mälardalens högskola
- Högskolan i Halmstad
- Södertörns högskola
- Högskolan i Borås
- Högskolan Dalarna
- Högskolan på Gotland
- Högskolan i Gävle
- Högskolan i Halmstad
- Högskolan Kristianstad
- Högskolan i Skövde
- Högskolan Väst
- Högskolan i Jönköping

PREFERRED INNOVATION STRATEGY OF UNIVERSITIES

Can you please express your opinion about the two following types of innovation strategies of universities?

Tick on a 5-point scale: 1: I totally disagree, 3: neither or, 5: I totally agree

	I totally disagr ee	1	2	3	4	5	I totally agree
A university's strategy focussing on commercializing their discoveries via spin-offs and licensing is beneficial for our company?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A university's strategy focussing on building long term relationships with companies in order to mutually define current and future cooperation possibilities is beneficial for our company?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BARRIERS TO DEVELOPING THE RELATIONSHIP

In your opinion, what is the impact of the following barriers to developing relationships with Swedish universities?

Tick for each barrier on a 5-point scale: 1: no impact at all, 3: somewhat strong impact, 5: extremely strong impact

	No impact at all	1	2	3	4	5	Extremely strong impact
Bureaucracy in the university	<input type="checkbox"/>						
Bureaucracy in the Company	<input type="checkbox"/>						
Lack of resources and time at the university	<input type="checkbox"/>						
Lack of resources and time at the Company	<input type="checkbox"/>						
Lack of interest by the researchers at the university	<input type="checkbox"/>						
Cultural differences between the university & the Company	<input type="checkbox"/>						
The Company needs quick response, but the university follows a long-term logic	<input type="checkbox"/>						
Intellectual property problems: e.g., risk of confidentiality breach despite non-disclosure agreements	<input type="checkbox"/>						
The teacher's exemption (Iararundantaget = university researchers owning the rights to their discoveries)	<input type="checkbox"/>						
The commercial orientation of the university	<input type="checkbox"/>						

towards pushing spin-offs and licences

Other barriers, please specify:

QUESTIONNAIRE CONFIDENTIALITY POLICY

- | | Ye | No |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Do you consent that we include your Company in the official list of companies that answered the questionnaire? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you consent that we mention the answers that you provided for your Company in the questionnaire (mention only anonymously)? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you consent that we mention your answers with full reference to your Company? | <input type="checkbox"/> | <input type="checkbox"/> |

Appendix 2

Example of questions: The companies answered this questions for each universities they are in a collaboration with, Karolinska Institutet, Uppsala University and/or other universities.

1. How important were the following reasons for the Company's choice to collaborate specifically with Karolinska Institutet?

Tick for each reason on a 5-point scale: 1: completely unimportant, 3: neither or, 5: extremely important

	Completely unimportant			Extremely important	
	1	2	3	4	5
Geographic proximity to the University	<input type="checkbox"/>				
The University's specific technical/scientific knowledge	<input type="checkbox"/>				
Personal relationship	<input type="checkbox"/>				

Other reasons:

2. How valuable do you consider this relationship to be now for the Company?

Tick on a 5-point scale: 1: not valuable at all, 5: extremely valuable

Not valuable at all					Extremely valuable
	1	2	3	4	5
	<input type="checkbox"/>				

3. How valuable do you expect that this relationship will become in the future for the Company?

Tick on a 5-point scale: -2: much less valuable, 0: as valuable as now, +2: much more valuable

-2: much less valuable	-1	0: as valuable as now	+1	+2: much more valuable
<input type="checkbox"/>				

4. FEATURES OF THE RELATIONSHIP WITH KAROLINSKA INSTITUTET

For how many years has the Company had a collaborative relationship with Karolinska Institutet?

- 1 year
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- 7 years
- 8 years
- 9 years
- 10 years
- 11 years
- 12 years
- 13 years
- 14 years
- 15 years
- 16 years
- 17 years
- 18 years
- 19 years
- 20 years
- 20 years or more

5. How many collaboration projects did the Company conduct with Karolinska Institutet in the last 5 years?

- 1 project
- 2 projects
- 3 projects
- 4 projects
- 5 projects
- 6 projects
- 7 projects
- 8 projects
- 9 projects
- 10 projects
- 11 projects
- 12 projects
- 13 projects
- 14 projects
- 15 projects
- 16 projects
- 17 projects
- 18 projects
- 19 projects
- 20 projects or more

6. How important are the following elements for the good functioning of this relationship?

Tick for both alternatives on a 5-point scale: 1: completely unimportant, 3: neither or, 5: extremely important

	Completely unimportant			Extremely important	
	1	2	3	4	5
Formal contracts and regulations	<input type="checkbox"/>				
Informal contacts, friendships and personal connections	<input type="checkbox"/>				

7. To what extent does the Company involve researchers from Karolinska Institutet in making its own technology-related decisions?

Tick on a 5-point scale: 1: never, 3: sometimes, 5: always

Never					Always
1	2	3	4	5	
<input type="checkbox"/>					

8. How many researchers from the Company and how many people from Karolinska Institutet are actively engaged in this relationship?

	1-23-56-1011-2021-40	41-100	More than 100
Company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Karolinska Institutet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. CONTENTS OF THE RELATIONSHIP WITH KAROLINSKA INSTITUTET

	Ye	No
	s	s
Is the Company a spin-off from Karolinska Institutet?	<input type="checkbox"/>	<input type="checkbox"/>
Does the basic technology of the Company originate from Karolinska Institutet?	<input type="checkbox"/>	<input type="checkbox"/>
Is Karolinska Institutet directly or indirectly, a shareholder in the company?	<input type="checkbox"/>	<input type="checkbox"/>

10. To what extent is the Company currently engaged in the following activities in its relationship with Karolinska Institutet?

Tick for each activity on a 5-point scale: 1: not at all, 3: somewhat, 5: to a very large extent

	Not at all			To a very large extent	
	1	2	3	4	5
Access to laboratory and special equipment	<input type="checkbox"/>				
General technology testing	<input type="checkbox"/>				
Beta-user testing: the university tests our products and provides feedback	<input type="checkbox"/>				
The university purchases our products	<input type="checkbox"/>				
Licensing in the university's technologies	<input type="checkbox"/>				
Clinical trials	<input type="checkbox"/>				
Contract research paid for by the Company	<input type="checkbox"/>				
Involving students for degree projects (examensarbete)	<input type="checkbox"/>				
Recruiting students permanently	<input type="checkbox"/>				
Employing personnel jointly with the university / industrial PhDs	<input type="checkbox"/>				
Consulting from the university's researchers	<input type="checkbox"/>				
Joint research projects financed by both the university and the company	<input type="checkbox"/>				
Joint projects financed by a third party (e.g., VINNOVA, Tillväxtverket)	<input type="checkbox"/>				
Engaging university researchers in joint boards and committees (e.g., scientific advisory boards)	<input type="checkbox"/>				

11. To what extent do you expect the Company will engage in the following activities in its relationship with Karolinska Institutet in the future ?

Tick for each activity on a 5-point scale: 1: not at all, 3: somewhat, 5: to a very large extent

	Not at all			To a very large extent	
	1	2	3	4	5
Access to laboratory and special equipment	<input type="checkbox"/>				
General technology testing	<input type="checkbox"/>				
Beta-user testing: the university tests our	<input type="checkbox"/>				

products and provides feedback	<input type="checkbox"/>				
The university purchases our products	<input type="checkbox"/>				
Licensing in the university's technologies	<input type="checkbox"/>				
Clinical trials	<input type="checkbox"/>				
Contract research paid for by the Company	<input type="checkbox"/>				
Involving students for degree projects (examensarbete)	<input type="checkbox"/>				
Recruiting students permanently	<input type="checkbox"/>				
Employing personnel jointly with the university / industrial PhDs	<input type="checkbox"/>				
Consulting from the university's researchers	<input type="checkbox"/>				
Joint research projects financed by both the university and the company	<input type="checkbox"/>				
Joint projects financed by a third party (e.g., VINNOVA, Tillväxtverket)	<input type="checkbox"/>				
Engaging university researchers in joint boards and committees (e.g., scientific advisory boards)	<input type="checkbox"/>				

VALUES AND EFFECTS OF THE RELATIONSHIP

12. Which of the following advantages did the Company expect to obtain from the relationship with Karolinska Institutet before starting it ?

	Ye s	No	I don't know
Opening up new perspective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acquisition of general knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acquisition of specific knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Access to unique valuable equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solving concrete technical problem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speeding up the Company's R&D processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speeding up market launch of its products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improving other internal processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recruiting qualified personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improving the Company's recognition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opening up other relationships with other actors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gaining new customers and sales by using this university as a reference	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

OTHER ADVANTAGES, please specify

13. To what extent can the Company exploit its current relationship with Karolinska Institutet to obtain the following advantages?

Tick for each advantage on a 5 -point scale: 1: not at all, 3: somewhat, 5: to a very large extent

	Not at all			To a very large extent	
	1	2	3	4	5
Opening up new perspective	<input type="checkbox"/>				
Acquisition of general knowledge	<input type="checkbox"/>				
Acquisition of specific knowledge	<input type="checkbox"/>				
Access to unique valuable equipment	<input type="checkbox"/>				
Solving concrete technical problem	<input type="checkbox"/>				
Speeding up the Company's R&D processes	<input type="checkbox"/>				
Speeding up market launch of its products	<input type="checkbox"/>				
Improving other internal processes	<input type="checkbox"/>				
Recruiting qualified personnel	<input type="checkbox"/>				
Improving the Company's recognition	<input type="checkbox"/>				
Opening up other relationships with other actors	<input type="checkbox"/>				
Gaining new customers and sales by using this university as a reference	<input type="checkbox"/>				

14. To what extent do you expect that the Company will exploit its relationship with Karolinska Institutet to obtain the following advantages in the future ?

Tick for each advantage on a 5 -point scale: 1: not at all, 3: somewhat, 5: to a very large extent

	Not at all			To a very large extent	
	1	2	3	4	5
Opening up new perspective	<input type="checkbox"/>				
Acquisition of general knowledge	<input type="checkbox"/>				
Acquisition of specific knowledge	<input type="checkbox"/>				

Access to unique valuable equipment	<input type="checkbox"/>				
Solving concrete technical problem	<input type="checkbox"/>				
Speeding up the Company's R&D processes	<input type="checkbox"/>				
Speeding up market launch of its products	<input type="checkbox"/>				
Improving other internal processes	<input type="checkbox"/>				
Recruiting qualified personnel	<input type="checkbox"/>				
Improving the Company's recognition	<input type="checkbox"/>				
Opening up other relationships with other actors	<input type="checkbox"/>				
Gaining new customers and sales by using this university as a reference	<input type="checkbox"/>				

15. PERCEIVED INNOVATION STRATEGY OF KAROLINSKA INSTITUTET

Swedish universities have two major alternatives available for stimulating the industrial use of their science:

(a) to promote patents on their discoveries, which can later be either licensed to existing firms or become the basis to build a new "spin-off" firm that will commercialize the discovery.

(b) to build relationships with existing firms irrespective of a specific discovery or patent, that is, simply as a way to jointly find out future ways to exploit the university's science base.

This question asks if You experience that Karolinska Institutet applies one of these two alternative more than the other.

Tick on a 5-point scale: 1: I totally disagree, 3: neither or, 5: I totally agree or "I do not know"

	I				I	
	totally				totally	
	disagr				agree	
	ee					
	1	2	3	4	5	I
						do
						not
						kno
						w
According to your experience of the relationship with Karolinska Institutet do you think that the	<input type="checkbox"/>					

university focuses on commercializing their patented discoveries via spin-offs and licensing?
 Do you think that Karolinska Institutet focuses on building long term relationships with companies in order to mutually define current and future cooperation possibilities?

16. BARRIERS TO DEVELOPING THE RELATIONSHIP

In your opinion, what is the impact of the following barriers to developing the relationships with Karolinska Institutet?

Tick for each barrier on a 5-point scale: 1: no impact at all, 3: somewhat strong impact, 5: extremely strong impact

	No impact at all			Extremely strong impact	
	1	2	3	4	5
Bureaucracy in the university	<input type="checkbox"/>				
Bureaucracy in the Company	<input type="checkbox"/>				
Lack of resources and time at the university	<input type="checkbox"/>				
Lack of resources and time at the Company	<input type="checkbox"/>				
Lack of interest by the researchers at the university	<input type="checkbox"/>				
Cultural differences between the university & the Company	<input type="checkbox"/>				
The Company needs quick response, but the university follows a long-term logic	<input type="checkbox"/>				
Intellectual property problems: e.g., risk of confidentiality breach despite non-disclosure agreements	<input type="checkbox"/>				
The teacher's exemption (Iararundantaget = university researchers owning the rights to their discoveries)	<input type="checkbox"/>				
The commercial orientation of the university towards pushing spin-offs and licences	<input type="checkbox"/>				

Other barriers, please specify:
