Doctoral Thesis

Title Procedures used by industry to establish a first contact with research centers. Multiple case study in Spain.

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Abstract

In the context of University-Industry Collaboration (UIC), the goal of this research project is to understand how and why industries contact research or technological centers with a research objective. The review of the literature, however, yielded little on how industries behave when they encounter a technological related market problem, have no record of previous relationships with University research centers, and decide they need to approach them for the first time.

Following case study methodology, a qualitative multiple case study research was performed around three theoretical propositions in order to assess whether or not a common pattern could be developed. Proposition one states that a firm that approaches a research center for the first time to solve a Technology Related Market Opportunity (TRMO) contacts a technological facilitator who they believe might be able to assist them find the right party. The second proposition is meant to check whether or not members of the firm remember having been visited by a research/technical center intermediary or having done other than externalized research activities with a research/technical center. Finally, proposition three is intended to determine if the firm proactively uses its social capital to obtain assistance to find the right party.

Six companies were found to meet the requirements, and their managers were interviewed. This paper finds a number of evidence concerning the driving factors that trigger said first contacts. Also, this work explores internal behavior when it comes to selecting the right partner. This raises questions on project leadership, project maturity, and trust building between the company and the research center. Following this line of research, this work also proposes a model and compares this with current literature on how to prepare infrastructure to trigger relationships.

Keywords: Technology transfer, University Industry Collaboration, UIC, University Industry Relationship, UIR.

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Introduction

The relationship between universities and industry appears recurrently as a subject for research; most studies analyze the relationship from universities to industry in order to adapt curricula and materials to the needs of a given sector. For example, we can cite the work of Wang et al. (2015), which reflects on the use of industrial simulations to train engineers, or the doctoral thesis of Vallmitjana (2014) which analyses the entrepreneurial activity of universities, particularly in what concerns Chemistry and Chemical Engineering graduates from the IQS (Universitat Ramon Llull), and in which they are discussed and compared with the results published by MIT through a study by Roberts & Eesley (2009). However, the goal of the present work is to attempt to analyze the relationship between industry and university from the standpoint of industry, i.e. how do industries with no previous collaboration with research centers behave when they approach them for the first time. This approach seems to have generated little literature so far, perhaps because it is concerned with the initiative taken by companies. However, the answer to this question could help universities to develop policies to approach industry, thus helping in applied research or by finding solutions to new problems.

To confirm this hypothesis, a preliminary literature search was carried out by scrutinizing several databases using different queries: “Industry University Relationship,” “University Industry Collaboration,” “How Industry meets University,” “How Industry University,” “Industry meeting University,” and “University Industry Partnership.” As expected, we found out that relationships between University and Industry had already been an object of study for years. In particular, a voluminous, multidisciplinary corpus of literature on technology transfer is mentioned (Bozeman, 2009) and the European Union has put emphasized this aspect by measuring the impact of UIC (Healy et al., 2014). Despite the fact that both the business sector, and the higher education institutions make an important contribution in bringing economic growth, and thus to employment and long-term prosperity to society at large (Healy et al., 2014), the problem of how to increase this relationship seems to be as of yet unsolved.

Studies prove that industries that collaborate with universities end up having higher productivity rates compared to those that do not collaborate (Malairaja & Zawdie, 2008). Thus, promoting their mutual collaboration has become a priority for many government institutions. Thus, the traditional missions of university, academia and research have been further increased by the addition of the new one of transferring knowledge to industry in order to speed up its competitiveness (Kyoung-Joo Lee et al., 2010; Etzkowitz & Leydesdorfftz, 2000; Cerych, 1985).

Models have been developed and copied extensively, including their associated laws that are meant to mitigate the difficulties that such relationships might bring (Schofield, 2013; Bauer & Flagg, 2010; Sugandhavanija et al., 2011; Cerych, 1985; David, 1982). However, all relationships must have a start. The necessary link between industries and research centers may have been formed from previous contacts (Thune ,2007), and it may involve the use of a facilitator (Wheatley, 2009).

Accepting that UIC is to be promoted, that the outcome of it is worth overcoming the difficulties that might arise from such a relationship, an interesting question would be: “how does this relationship start?”, and especially what moves industry to get in contact with a university research center for the first time.

Objective

The objective of the present research is to try to understand what triggers the relationship from the point of view of industry. It is intended to help us understand the situation that leads to taking the first step, the procedures set in place, and the behavior of the actors during this first contact. We assume that the reason for the first contact is a market opportunity that requires a technological development or research and that this development or research cannot be solved internally. That is what we will call a Technology Related Market Opportunity (TRMO). In such a situation industry needs external help from a research or technological center.

The present research will use the case study methodology intended to solve the question of:

"How do industries with a Technology Related Market Opportunity (TRMO), who cannot solve it internally and have no record of previous contacts with a research/technological center, contact them for the first time?"

This objective is addressed using three questions, derived from an exhaustive literature review, and which are the backbone of the study design. Considering a firm that approaches a research center for the first time to solve a Technology Related Market Opportunity (TRMO), the questions are:

***1**: Does the firm contact a technological facilitator who it believes might be able to help them find the right party? How do they do it and why?*

***2**: Does the firm remember having been visited by a research/technical center intermediary or having done anything other than externalized research activities with a research/technical center?*

***3**: Does the firm proactively use its social capital to obtain assistance to find the right party? How they do it and why?*

Understanding the motivations a firm has to contact the university research center or technological center for the first time might be interesting as it might help assess what kind of infrastructures are the most suitable to foster University Industry Collaborations (UIC). Furthermore, university research centers might profit from understanding firm behavior by building up a "commercial offer" adapted to meet the real needs and expectations of industry.

Methodology

As far as the methodology is concerned, the first step is to review the literature following the main keywords found, which are four in number, revising the findings within each block one after the other. These blocks are the reasons for University Industry Collaboration (UIC), how to foster UIC, how to organize it, and the consequences of the relationship, which altogether seems to follow a logical path for the establishment of a relationship.

This literature background is important insofar as it shows that little has been found to explain how industries behave for the first time when they decide to approach a research center. In fact, we only found one mention that it could be performed through a facilitator (Wheatley, 2009) or that a majority of collaborations had been formed through the use of previous contacts (Thune, 2007). This seems to be corroborated by more recent studies in the Trieste area (Italy). De Stefano & Zaccarin (2013) studied the innovation networks in a very specific area trying to find the structure of the relationships at the base of the diffusion of knowledge and innovation. The findings show a small world with highly endogenous behavior.

The second step is to decide which methodology suits best the research objective. As we could hardly base the research on literature, it is crucial for us to explore what happens in real world in order to develop a global theory. The research must answer questions on the "how" and the "why" of first contacts carried out by industry. The methodology that allows this exploration and answering such questions in order to establish a theory is the case study.

Once the methodology had been agreed upon, the third step was to design the research, and for this our reference has been Yin (2009). The following step is to find the companies, and associated people that can provide the necessary information on what happened for the first contact. Applying the methodology, a research problem, and a research question have been defined, theoretical propositions have been established, and the results have been analyzed in order to propose a contribution to the state of the art.

The contribution of this research is expected to provide insights into the procedures used in said first contacts and how they are carried out. By understanding the industry behavior and the reasons behind it, a theory might be proposed for the reasoning behind this behavior to explain how and why this contact is carried out. With the numerous efforts made by policy makers to increase the frequency of such relationships, this research might be able to contribute to our understanding of first contacts with such companies. By the time this text was written, the debate was no longer limited to how industry that was already collaborating could intensify its

collaboration, but also on how new "newcomers" can start collaborating. As an example, the bundling of different TTO organizations around Dublin is meant to provide a more suitable service in order to promote first-time collaboration[1].

Doctoral thesis structure

This doctoral thesis is structured as follows:

- Chapter 1 is devoted to the conceptual framework including the research problem, the literature review, and the research question.
- In Chapter 2 the chosen methodology is described, the theoretical propositions are established, and the research design is built up.
- Chapter 3 details the gained evidence and its interpretation according to the theoretical propositions. Other evidence or unexpected findings are also presented.
- Chapter 4 is the discussion of the results compared to the initial propositions, and refines the theoretical propositions along with the other results. All in all a model is proposed with some recommendations, limitations, and future possible research.
- Chapter 5 condenses the conclusions, and final comments on the present work.

A presentation of the present work conclusion was performed at the UIIN Congress in Berlin on June 26th, 2015. The presentation used can be seen in Addendum 16. The corresponding paper has been published in the Congress Proceedings (Addendum 17) and the presentation certificate can be seen in Addendum 18.

Figure 0.1 shows the order we will follow. A reminder on top of the page indicates the chapter the reader is in.

[1] John Keogh (Institute of Technology Tallagh) and David Kirk (Dublin Institute of Technology) joint presentation at UIIN Congress, Berlin, June 25th 2015 “ConnectED: An enhanced online interface for improved engagement between industry and academia.

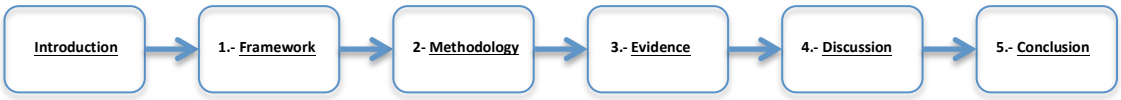

Figure 0.1. Landmark in the text

A scheduler has been created in order pace the work (Addendum 19).

An acronyms list has been included as the last addendum (Addendum 20).

1. Conceptual Framework

This chapter reviews the literature on the constructs that form the conceptual framework in order to address our research questions, and attempts to solve the research problem.

1.1. Research problem

In order to find out if something has already been written on first contacts between Industry, and Research or Technical Centers, a literature review has been conducted. The idea is not only to find out whether or not something has been written, but also to become acquainted with the structure of the literature. To do so, we reviewed some interesting-sounding papers on the topic, and tried to catch a glimpse of the possible structure of the literature. Said structure is the same one that we then followed for the full review.

The next step was to follow a clear, systematic, pertinent, and limited approach to the study of the published research literature. Said approach was systematic insofar as databases such as EBSCO were scrutinized in detail. The aspect of pertinence is determined by the queries used: University Industry Relationship, University Industry Collaboration, How Industry meets University, How Industry University, Industry meeting University, and University Industry Partnership. Following this methodology allowed us not to miss any significant contributions that could be of interest. Finally, concerning its temporal limits, our idea was not to go beyond the year 1980. If anything of interest was found before that date, its presence had to be clearly justified. The reason for that is that the Bayh-Dole Act[2] (1980) may have had an impact on the infrastructures built up to ease relationships. This law changed the rules in assigning the patent rights from the tradition assignation to the inventor to the new assignation to the granted center. This system has been applied in many OECD countries (Mowery & Sampat, 2005) such as Spain[3] or France[4].

[2] https://www.law.cornell.edu/uscode/text/35/part-II/chapter-18 (Based on its content dated May 2015)
[3] Ley Orgánica 6/2001, de 21 de diciembre, de universidades http://www.boe.es/diario_boe/txt.php?id=BOE-A-2001-24515 (based on its content dated May 2015)

1.2. Theoretical background

The review is split between a chapter devoted to clear up the definitions of the main concept used is this work, and a second part for the literature review. The literature review is also separated in sections devoted to each of the main research concepts, which are "reasons for UIC," "consequences of UIC," "how to organize UIC," and "how to foster the UIC."

1.2.1. Definitions

To start the review, the first topic to go through is the definitions of the main constructs that are going to be mentioned in this work. These are: firm, company, private enterprise, Industry, University, academia, technology, technology transfer, research center, research institute, technological center, innovation center, science park, research park, technopole, cluster, relationship, and collaboration.

Firm, company, and enterprise are going to be considered names of a single kind of entity, usually privately-owned, that is involved in the trade of goods, services or both to their customers. Another definition could be an organization that employs productive resources to obtain products or services, which are offered in the market with the aim of making a profit. However firms can also have non-profit aims, and still be firms[5].

"Industry" can have some different definitions. On the one hand an Industry can be defined as the production of a good or service within an economy. Another definition refers to a group of companies that are related in terms of their primary business activities[6]. However in this work Industry will be used as the enterprise that collaborates with the research or technological center in R&D activities.

[4] Loi no 99-587 du 12 juillet 1999 sur l'innovation et la recherche http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000759583&dateTexte=&categorieLien=id (Based on its content dated May 2015)
[5] http://intobusiness.weebly.com/what-is-a-firm.html (Based on its content dated April 2015)
[6] http://www.investopedia.com/terms/i/Industry.asp (Based on its content dated April 2015)

The Collins dictionary provides us two definitions of University[7]:

- An institution of higher education having authority to award bachelors', and higher degrees, usually having research facilities
- The buildings, members, staff, or campus of a University

It is necessary to clarify what higher education is, and for the present work we will say the University (or college for the US) is the school (a place where people learn) immediately following high school or secondary school. Also we will say that a bachelor's degree is also called undergraduate education, and the higher degrees can also be called postgraduate education or professional education.

The interesting part of this definition is that it defines University as a place endowed with research facilities, thus evoking the classical dual mission of teaching and researching provided by Universities. However, this definition misses the mission of transferring this knowledge to society, and especially to business sector (Kyoung-Joo Lee et al., 2010; Etzkowitz & Leydesdorfftz, 2000; Cerych, 1985).

In the Webster dictionary[8] academia is defined as the life, community, or world of teachers, schools, and education. Thus, academia is a term used to describe the students and faculty involved in higher education – University – colleges, research, or even the University system itself. It distinguishes academic professionals from their counterparts in corporate or government positions.

Concerning the definition of technology, we can have a look at the Webster dictionary, which offers three definitions for it:

- The science or study of practical industrial arts
- The terms used in a science, technical terminology
- Applied science

[7] http://dictionary.reference.com/browse/University (Based on its content dated April 2015)
[8] http://www.merriam-webster.com/dictionary/academia (Based on its content dated April 2015)

What "technology" is and especially where are the limits of what can be considered as technology and what cannot seem to be a matter of concern. There also other ways to address its definition:

- Bozeman (2000) focuses that papers on technology transfer see technology as a tool, and maybe its associated knowledge (Sahal, 1981).
- Chandran et al. (2009) focuses on its commercialization, and therefore measures the created revenues as well as the number of jobs created.

For the present work, the reference used has been Bozeman (2000). However, if defining "technology" is already difficult, it is even more difficult to define what "technology transfer" is. To make things worse, defining the impact of technology transfer is extremely difficult. The reasons are that technology transfer can have an impact on many business areas, and that it is difficult to separate from other kinds of impacts within company divisions. The most daunting part is therefore to define technology transfer impact effectiveness.

Works on technology transfer usually refer to technology as something almost physical, a "tool" but not a "study", as it is defined in the dictionary. Therefore, the discussion on technology transfer is approached from the perspective of how to transfer said "tool." Bozeman (2000) mentions that theoretically, technology could be considered as a "set" or "configuration." As a consequence, its transfer could be considered as a transfer of "sets of processes, and/or products." The transfer would not only be the product but also the way of use, and/or application. As if one were buying a new machine, the "product" comes with its "operating instructions." Technology and knowledge come together in a single bundle, and this allows personalization to customer needs either from the perspective of the transferred technology or the associated knowledge.

As for research center and research institutes, the chosen reference has been the Simon Fraser University (SFU), which defines both as follows[9]:

[9] http://www.sfu.ca/policies/gazette/research/r40-01.htm (Based on its content dated April 2015)

- Research centers are non-departmental academic or administrative units established for the purposes of facilitating collaborative research mainly within a faculty.
- Research institutes are created to facilitate collaborative multi-disciplinary research between different faculties, and/or multi-University initiatives, and to provide research-related services to the community.

However, other definitions can also be found. A research center is a building, a place or facility devoted to research, generally on a specific topic, while a research institution is an entity or an establishment endowed for doing research. This latter might have a center, more than one or none, depending on its purpose. It can also be dedicated to basic or applied research. For the purpose of our work we will use this second definition, establishing that a research center is a place and an institution or organization, which seems to be closer to what is more commonly used as definition.

A clear definition for technological center is hard to find. According to the Southern Regional Education Board (SREB), "tech centers, technology centers, technical centers, career centers, and career-technical (CT) centers all have a common purpose: to provide high-quality CT studies to high school students[10]." Another definition can be found when looking at the General Motors Technical Center in Detroit: "*The site offers an advanced technology business atmosphere emphasizing flexibility, efficiency, innovation, quality, safety, and security.*" For Coloradoans, the Denver tech center is an area in downtown Denver where big corporations have their offices[11]. So, for our purposes, we will base our definition on the one of the Collin College National Convergence Technology Center: "*The National CTC leverages the strengths of regional, and national educational institutions, and Industry partners to create of pool of qualified convergence technicians who can design, build,, and troubleshoot communication infrastructure, and devices for enterprise, and home markets*[12]." This means that a technological center is more a place bringing in the necessary technology so as to find technological related solutions for private enterprises or individuals.

[10] http://www.sreb.org/page/1084/technology_centers_that_work.html (Based on its content dated April 2015)
[11] http://www.denver.com/neighborhoods/denver-tech-center (Based on its content dated April 2015)
[12] http://www.collin.edu/academics/ctc/ (Based on its content dated April 2015)

As per the definition of an innovation center, the Innovation Center think tank states that "*The Innovation Center provides resources to speed innovation along, make it more efficient, and weave it into the fabric of your organization's everyday activities*[13]." The term innovation center can mean a number of things – it is a word used to describe office space where there are lots of similar businesses. They normally consist of a mix of open work areas where people can collaborate, and bat ideas around, run networking events, meet venture capitalists, and run an annual conference with lots of awards. There also innovation centers spreading across lots of different industries; from biology to furniture, business, digital media etc. The idea of innovation centers is to bring together like minded individuals to share ideas, and create the future[14]. This is the definition we will use in this work.

"Science parks" as well as "University research parks" and "science and technology parks" are areas meant, designed, and managed so as to promote innovation. They are physical places that support University, Industry, and government collaboration with the aim of creating high technology economic development, and advancing knowledge. There are many approximate synonyms for "University research park," "science park," "technology park," "technopolis," "technopole," and "biopark." The appropriate term typically depends on the type of affiliation the park has with an institution of higher learning, and research, and also perhaps the sort of science, and research in which the park's entities are involved.

Silicon Valley (USA) was a global pioneer in the development of science parks. Originally known as Stanford University Science Park, Silicon Valley dates back to the early 1950s. It was followed by Sophia Antipolis (France) in Europe in the 1960s, and Tsukuba Science City (Japan) in Asia in the early 1970s. This trio represents the oldest, and the most well-known science parks in the world[15].

As far as clusters are concerned, we will define them as geographic concentrations of interconnected companies, and institutions in a particular field (Porter, 1998). This definition is perfectly suited to the present work.

[13] http://www.innovationcenter.org (Based on its content dated April 2015)
[14] http://greenroome.blogspot.fr/2011/04/what-is-innovation-center.html (Based on its content dated April 2015)
[15] http://www.unesco.org/new/en/natural-sciences/science-technology/University-Industry-partnerships/science-parks-around-the-world/ (Based on its content dated April 2015)

According to the Collins English Dictionary, "relationship" as a concept can be defined as[16]:

1. the state of being connected or related

2. association by blood or marriage; kinship

3. the mutual dealings, connections, or feelings that exist between two parties, countries, people, etc: *a business relationship*.

4. an emotional or sexual affair or liaison

5. *logic maths* another name for relation

6. (Mathematics) *logic maths* another name for relation

In order to solve a Technology Related Market Opportunity (TRMO), which is at the base of the present work, the definition that suits best the concept that is going to be used in this work is the third one, establishing that UIC is a kind of deal between two parties, in this case a University research center or a technological center with a particular enterprise for research purposes. The first definition is too general, and may lead to think that an UIC is being connected or related. This might be true in many cases but does not address the real topic of a precise connection with the aim of research.

Looking at the definition of collaboration provides us with two versions[17]:

1. To work together, especially in a joint intellectual effort.
2. To cooperate treasonably, as with an enemy occupation force in one's country.

For our purpose the first definition is the one to choose. But other definitions, more related to business are[18]:

1. General: Cooperative arrangement in which two or more parties (which may or may not have any previous relationship) work jointly towards a common goal.

[16] http://www.thefreedictionary.com/relationship (Based on its content dated April 2015)
[17] http://acronyms.thefreedictionary.com/collaboration (Based on its content dated April 2015)
[18] http://www.aiim.org/What-is-Collaboration (Based on its content dated April 2015)

2. Knowledge management (KM): Effective methodology of transferring 'know how' among individuals, therefore critical to creating, and sustaining a competitive advantage. Collaboration is a key tenet of KM.
3. Negotiations: Conflict resolution strategy that uses both assertiveness, and cooperation to seek solutions advantageous to all parties. It succeeds usually where the participants' goals are compatible, and the interaction among them is important in attaining those goals.

Other precisions on collaboration can be found[19] stating that Collaboration enables individuals to work together to achieve a defined, and common business purpose. It exists in two forms:

- Synchronous, where everyone interacts in real time, as in online meetings, through instant messaging, or via Skype©, and
- Asynchronous, where the interaction can be time-shifted, as when uploading documents or annotations to shared workspaces, or making contributions to a wiki.

All in all, we can classify the types of University-Industry Collaboration into four categories (Kabins, 2011; Perkmann & Walsh, 2009). Type one is defined as *knowledge generation*, and is aimed to focus on academic research projects with Industry participation. Type two is defined as *idea testing*. Initiated by the firm or the academia, this low-cost type of collaboration is meant to explore the commercial possibilities of interesting ideas. Type three strives towards improving or developing a specific technology that might have commercial potential. It is defined as "substantially pursue proprietary *technology development*" (Perkmann & Walsh, 2009). Finally *problem solving* is lead by the firms willing to obtain academic advice on technical problems regarding firm R&D, production, or operations. A Japanese study categorizes the different forms of collaboration into three categories (Kondo, 2010). The first one is defined as joint knowledge creation between academic researchers, and industries. The second, as knowledge transfer to the Industry, which may include continuing professional education (Weimar, 1992), and the third one is starting up new companies based on University knowledge.

[19] http://www.aiim.org/What-is-Collaboration (Based on its content dated April 2015)

1.2.2. Literature review

Once the definitions are over with, next step is to start the review with a short historical overview. A checklist has been created in order to follow a logical order for the literature search (Addendum 1).

For a long time, scientific research was considered to be a good example of what is understood by the expression "in the public interest," that is to say information that is freely available and does not belong to anyone in particular. Scientific discoveries were not linked to the laws governing the economic sector. Two distinct spheres of operation co-existed, and so the situation justified the absence of business in scientific research. In the public sector, scientific research did not generate enough profits to be considered economically worthwhile, and thus the efficiency of the scientific methodology was never questioned. This situation in which two distinct spheres of activity exist is changing. The private sector is investing in scientific research and multidisciplinary hybrid projects may also depend upon both public scientific researchers, and business. There is a major change taking place in the relationship between the scientific and industrial spheres. This change forces the economic sector to reconsider the role of scientific research within businesses. Currently, there are two schools of thought concerning this matter. The first one, a new scientific sub-discipline known as the New Economics of Science Scientific Economy, looks for ways of bringing scientific work into the economic sphere. It also analyzes factors such as ways of optimizing the activity of individual researchers or measuring the efficiency of public research institutions. However, this school of thought can lead to disputes or a denial of the definition of public interest in scientific research. The second school of thought on this matter applies institutional or neo-institutional theories to the scientific-industrial environment relationship in order to identify the conditions which make the passage between the two spheres of activity possible, and in the best conditions. In either case, the question of scientific-industrial relations remains a promising field of research[20].

[20] http://www.cnrs.fr/Cnrspresse/n402/html/en402a03.htm (Based on its content dated April 2015)

1.2.2.1. Reasons for UIC

These two schools of thought are linked to the research on University. The review revealed that universities have traditionally had two basic missions: Academia, and Research. However, more recently, some authors mention the fact that the goals of universities should also include the transfer of their research knowledge to society (Etzkowitz & Leydesdorfftz, 2000; Kyoung-Joo Lee et al., 2010). Said authors argue that strengthening the relationship between universities, and industries can benefit not only the entities involved in the relationship but also society as a whole (Bolton, 1994). In fact, some authors argue that they are both complementary (Kyoung-Joo Lee et al., 2010). However Tartari et al. (2012) mention that a significant number of academics engage in entrepreneurship largely for symbolic reasons. Healy et al. (2014) mention three main reasons for collaboration: the global economic crisis, the emergences of "global challenges" such climate change, and increased competition between universities. Others study which kinds of collaboration accommodate the divergent objectives of firms and academia (Kabins, 2011). However some authors highlight that objective of University should remain different from the ones of firms for the good of society as a whole. If University is transformed into a research institute for Industry, University will not be able to adequately educate future scientists due to an excessive focus on current technology and neglecting that which is yet to be discovered (Kenney, 1987).

Despite the growing imperative for academics to bring Industry funds for academic research centers, much has been written on the commercialization of the research, and the technology transfer. The topic of intellectual property, publication rights, patents, and their licensing is also emphasized (Berman, 2008). This is also the case with the changing role of University, which requires new agreements on the learning provided to Industry professionals (Slotte & Tynjälä, 2003). Additionally, there are a number of publications mentioning problems, either real, perceived or imaginary (Tartari et al., 2012; Lee Y., 1998; Bolton, 1994). Academics might be in favor of close collaboration with Industry but findings say they experience it with deep tension because of two main aspects: the instrumental need for Industry funding, and the intrinsic need to preserve their intellectual freedom and autonomy (Lee Y., 1998). The disclosure time and choice of topics is also especially mentioned (Tartari et al., 2012). A

great number of papers can be found showing the barriers and boundaries that must be overcome to make the relationship successful (Schofield, 2013; Bauer & Flagg, 2010; Sugandhavanija et al., 2011; Cerych, 1985; David, 1982).

Some authors propose some recipes to overcome barriers between University and firms. Schofield's (2013) study concludes on a list of specific enabling factors in order to overcome these specific barriers. These factors and barriers are organized around seven topics: knowledge context, organizational context, decision-making context, individual context, project management, market context, and relational and cultural context. The approach of Wallin et al. (2014) combines three axes, and so builds up three mechanisms. The first one is a tool to facilitate mutual strategic understanding. The second is a methodology meant to manage and facilitate co-creation tactical workshops. The last one is meant to facilitate the operational ideation of prototypes. Tartari et al. (2012) positively correlates the previous collaboration experiences of the scientists and those who trust their Industry partners, while the contrary happens when the scientists face experienced Industry managers, especially when transactional collaboration methodologies are used.

Some publications also explore the levels of engagement activities as an important factor to explain collaboration. In a recent European Union report, Healy et al. (2014) show a graphic with them (figure 1.1).

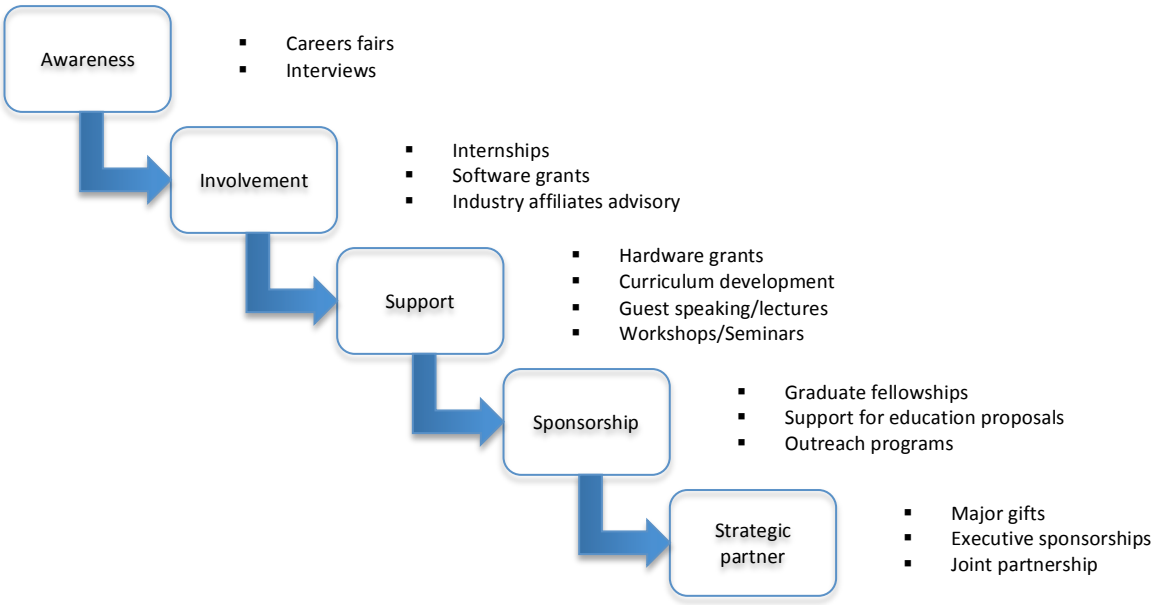

Figure 1.1: Levels of engagement activity (Adapted from Healy et al., 2014)

1.2.2.2. Consequences of UIC

There are a relevant number of publications showing successful UICs (Scott, 2013; Indest et al., 2010; David, 1982; Turk, 2005; Wheatley, 2009; Bernardos & Casar, 2009; Kyoung-Joo Lee et al., 2010; Bolton, 1994, Cerych, 1985). Some papers are essentially meant to brag about said successes. The examples of the MIT (Roberts & Eesley, 2009), the Ohio State University (Indest et al., 2010) or the Johns Hopkins University (Blakeslee, 2012), among others, can be easily found. Other authors propose recipes for successful collaboration. For instance, Pertuzé et al. (2010) offer their own seven keys:

- During the selection process, define the project strategic context.
- Select project managers with boundary-spanning capacities.
- Share with the University team how the project is expected to help the firm.
- Invest in long-term relationships.
- Establish strong communication links with the University team.
- Communicate the project within the firm, and give feedback of project aligned with firm requirements.
- Support internal work *during, and after* the project while it is not exploited.

However, it is also important to agree upon the methodology to measure the meaning or nature of success, and so different ways are proposed to assess it. To begin with, Healy et al. (2014) proposes a simple map to understand the different outputs of the collaboration (figure 1.2).

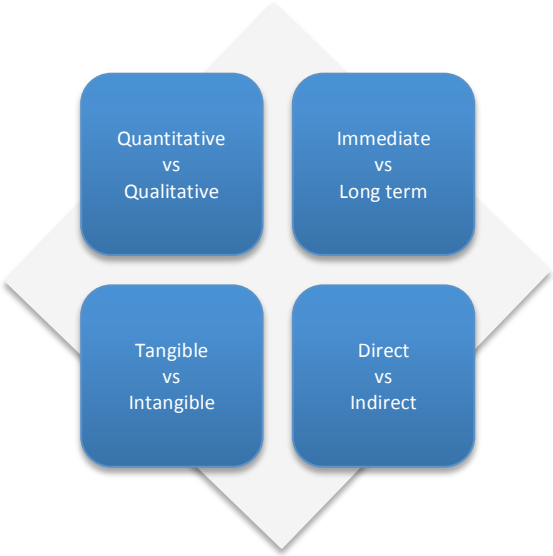

Figure 1.2. Four levels of expected outcome. (Adapted from Healy et al., 2014)

Pertuzé et al. (2010) highlight the fact the collaboration output is not important. What matters is the impact the outcome has in the firm performance. Hanberger & Schild (2004) propose four vectors, the two first being program theory evaluation, and outcome analysis focus more on the program/policy maker point of view. The other two, policy discourse analysis, and qualitative network analysis, tend to be considered non-management oriented points of view. This author analyses the pros and cons of each of them so as to help the reader choose the one that suits him best. Thune (2010) proposes four different approaches split in two groups. To begin, he studies the approaches that privilege the policy/program maker's "management-oriented" point of view. This brings in two sub-approaches: the program theory evaluation that assesses if the "system" or the "relationship" works within the preset parameters, and the outcome analysis where the meeting of objectives is stressed. As a second block of approaches, he incorporates a stance critical towards the management point of view: the policy discourse analysis that differs from political level discourses, and qualitative network analysis that stresses political, and personal informal patterns, and interactions. Going

further, Piva & Rossi-Lamastra (2013) propose the use of a Balanced Scorecard based on six perspectives:

- Competitiveness
- Sustainable development
- Innovation
- Strategic partnership
- Human capital
- Internal business processes

Perkmann et al. (2011) also contribute a four-stage model including inputs, in-process activities, outputs, and outcomes. This helped him develop a success map, which indicates the determinants of alliance success (figure 1.3).

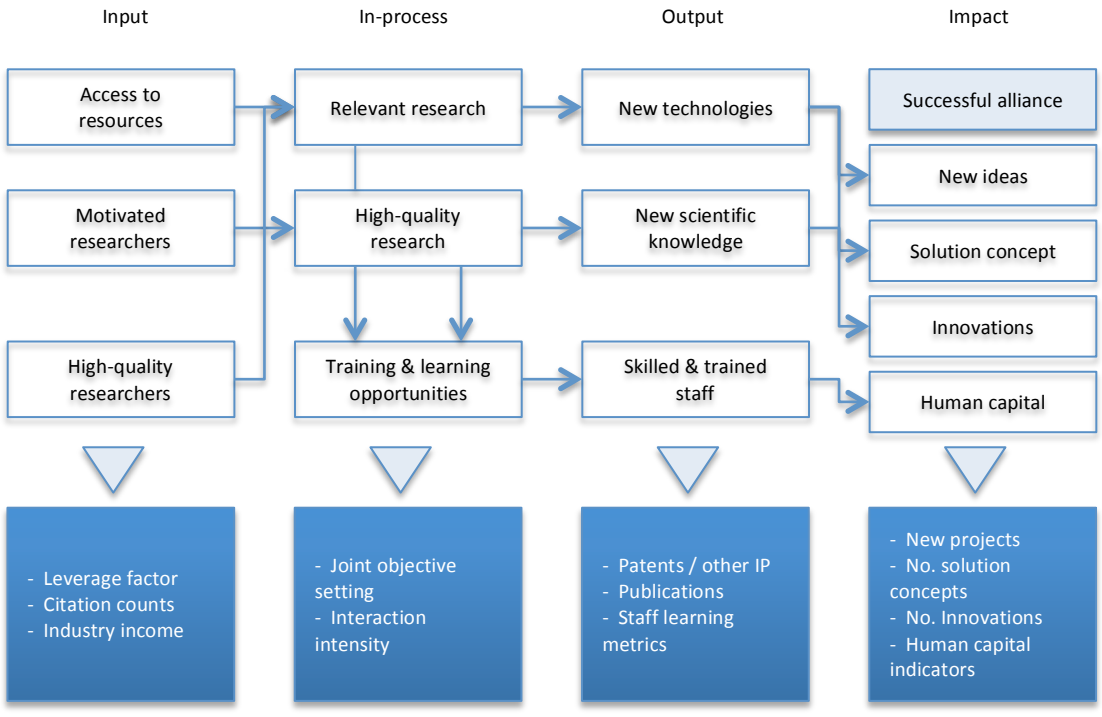

Figure 1.3. Success map with metrics. (Adapted from Perkmann et al., 2011)

Although these ways to organize UIC output are very interesting, some authors directly propose recipes for success (Sugandhavanija et al., 2011). Others explain what kind of knowledge can be more successfully transmitted, drawing a distinction between tacit or explicit knowledge (Santoro & Bierly, 2006). There are also articles showing

which industrial sectors are more successful with UIC (Thune, 2010). These papers show that a significant majority of UICs are linked to the health-bio and engineering sectors (Thune, 2010). Other authors demonstrate that big industries are not the only ones with high success rates in UIC, and some small industries have developed successful relationships with research centers. However Turk (2005) showed that the success factors for successful University-Industry relationships in big faculties cannot be transferred to smaller faculties.

In any case, Thune (2007) noted that nobody has studied the process through which the relationship links are created. That is why he carried out research on the building up of relationships by using semi-structured interviews performed on researchers, and firm R&D managers. Thune (2007) reviews a number of government programs meant to promote a strengthening of ties between universities, and especially SMEs compared to big corporations, and he ends up proposing to focus on "boundary spanners," entrepreneurs with a large network of internal, and external contacts, and on incorporating students in SME structures to ease this relationship.

Though there are different theories on the need of industries to collaborate with academia, some posit that the main shift is due to the increasing importance of communication technologies (Cerych, 1985). Others suggest that increased research costs make it more difficult for industries to be experts in all areas. Access to University knowledge and expertise is considered to be an advantage (Ryan et al., 2008). But this does not directly mean that the Industry must reach an agreement on a research project. The access can be achieved by moving students to the Industry or by training the Industry personnel at the University (García-Aracil & Fernández De Lucio, 2008). Some studies argue that industries do not externalize directly sensitive technology, which they attempt to develop in-house, but rather they do so with non-sensitive or less strategic technology. Other papers focus on what Industry has obtained such as access to unknown technologies or solutions to technological, industrial, or organizational problems (D'Este et al., 2012; Koung-Joo Lee et al., 2010). In any case, some papers show that Industry culture is changing as a consequence of its relationship with universities (Malairaja & Zawdie, 2008; Masayuki, 2010; Van Looy et al., 2003; Leydesdorff, 2012; Carayannis et al., 2012). The implementation of stricter working

norms such as the ISO or GMP, or that work, and studies have to be carried out in an ethically proper way, are partially a consequence of scientific work behavior.

On the other hand, University culture is also influenced by its relationship with Industry (Carayannis & Campbell, 2009). Thanks to reaching agreements with Industry, research centers are able to pursue research in areas they would not be able to research without collaboration with Industry (Kyoung-Joo Lee et al., 2010). However, their behavior is also affected by the Industry aim of reaching clear, practical, and measurable objectives within a specific timeframe (Harryson et al., 2007), which is something universities are not used to. Bolton (1994) studies a number of scenarios in which government grants are used in a distorted way through securing subsidies for Industry internal research that does not profit the University. This is applicable to sensitive sectors such as defense, where grants just pass through the University without leaving anything really profitable or a way to keep the production plants running, and avoid massive layoffs that could harm local political interests.

Despite the fact Glenna et al. (2007) said that there are few studies on Industry evaluation of UIC, Harryson et al. (2007) made a wide screening trying to find the main barriers and drivers industries find for such collaborations. This study shows that what industries find more difficult is, on the one hand, steering collaborative projects towards business objectives, and, on the other, internalizing the resulting consequences for corporate innovation impact. This leads to an organizational dilemma of innovation (figure 1.4), which is also used by Kliknaité (2014) for her study. Other papers focus on the fact that the relationship perception by the researchers is significantly more positive once they have collaborated with Industry than their perception of the collaboration before it (Glenna et al., 2007).

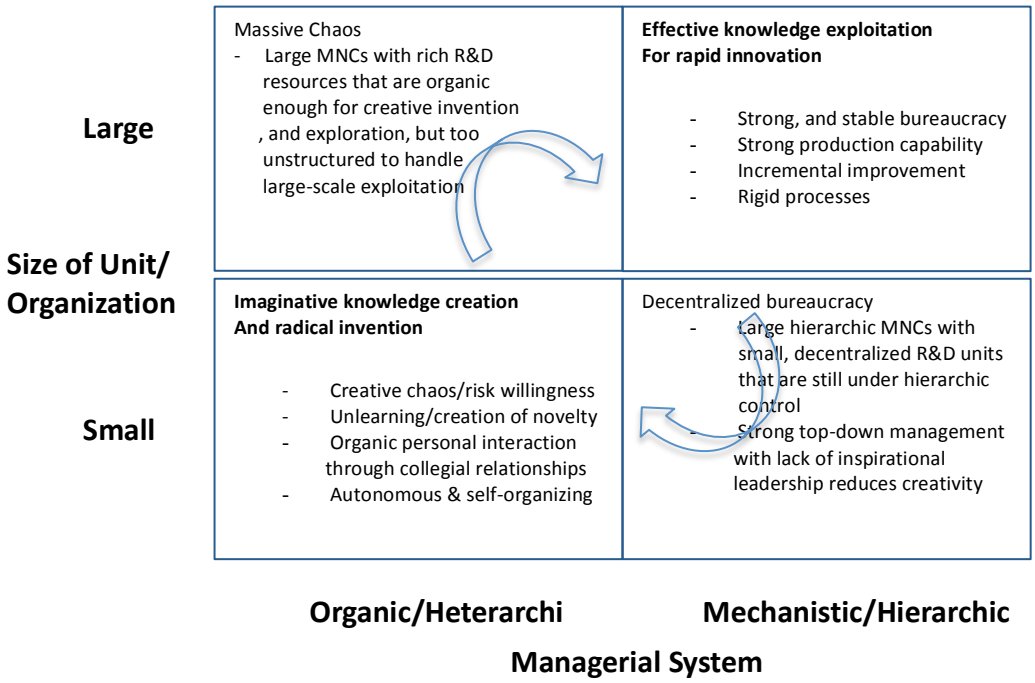

Figure 1.4. The organizational dilemma of innovation. (Adapted from Harryson, 2007)

Harryson et al. (2008) expose an evolution of their findings by proposing the concept of a meta-enabler in the companies who uses his multi-competencies in order to acquire the innovation into the company, and to transform the company into an innovative one (figure 1.5).

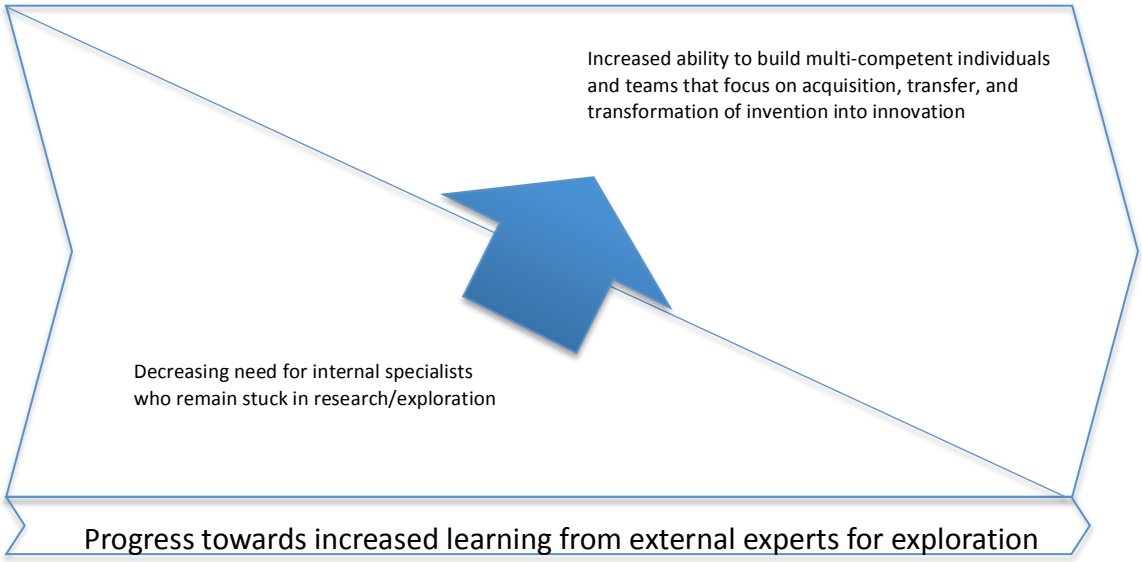

Figure 1.5. Developing multi-competences as a meta-enabler. (Adapted from Harryson et al., 2008)

1.2.2.3. How to organize UIC

A description of different models can be found in the literature. The linear model is the most simplistic one, and can be split into two basic ideas. Either the University has technology, and decides to sell it (supply push) or the Industry has a technology related market need, and goes to the University to solve it (demand pull), as can be seen in figure 1.6.

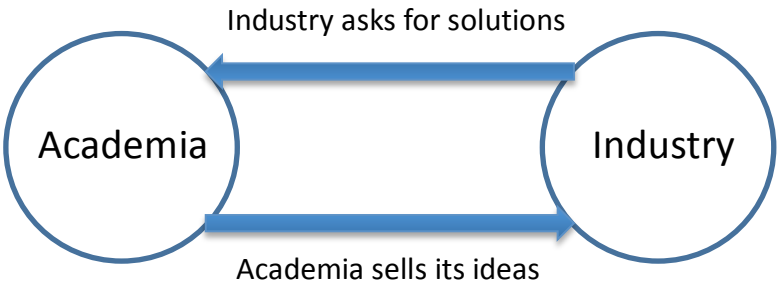

Figure 1.6. Linear model

This linear model can be studied throughout history, and comes in opposition to the mercantilism, which was the economic model until the late 18th Century. Anne-Robert-Jacques Turgot (1766) pushed for freeing commerce under the slogan "laissez faire, laissez passer" and predated Adam Smith (1776) The Wealth of Nations (figure 1.7).

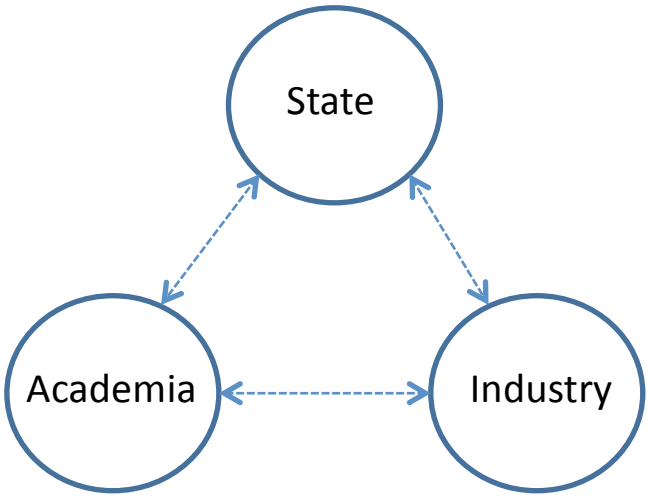

Figure 1.7. State, Academia, and Industry "laissez-faire". (Adapted from Etzkowitz, 2000)

The idea of the Triple Helix Model originated in the late 90's, when it was originally formulated by Etzkowitz and Leydesdorff (1997). It describes the implications of a new social contract between higher education, and society, which gives rise to a new interactive arrangement based on the operation of equivalent, and overlapping institutional spheres with each group sharing responsibilities, and with hybrid organizational structures emerging at the interface (figure 1.8).

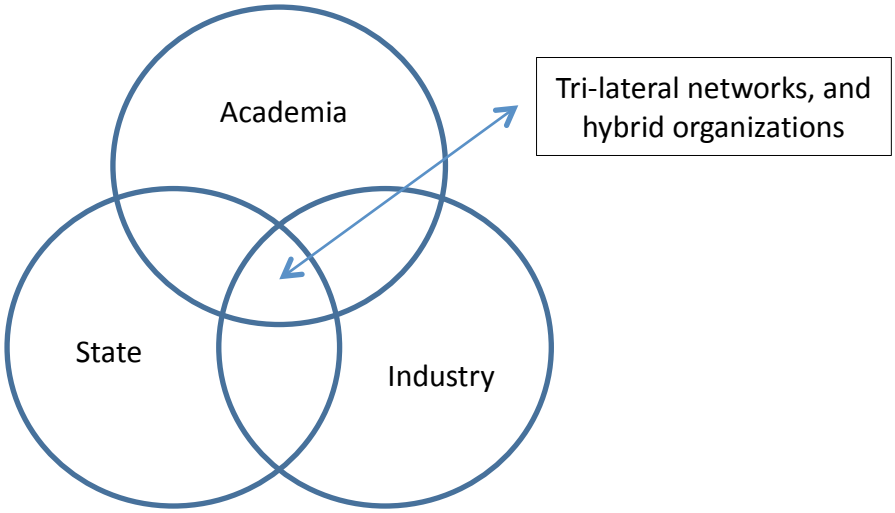

Figure 1.8. The Triple Helix Model. (Adapted from Etzkowitz & Leydesdorff, 2000)

This successful model is used extensively worldwide to support innovative activities. As Etzkowitz, and Leydesdorff (2000) mention, most countries, and regions are presently using or trying to use this model in some capacity. New dimensions have been added to this model, such as media, and culture, leading to the Quadruple Helix model (Carayannis & Campbell, 2009) (figure 1.9).

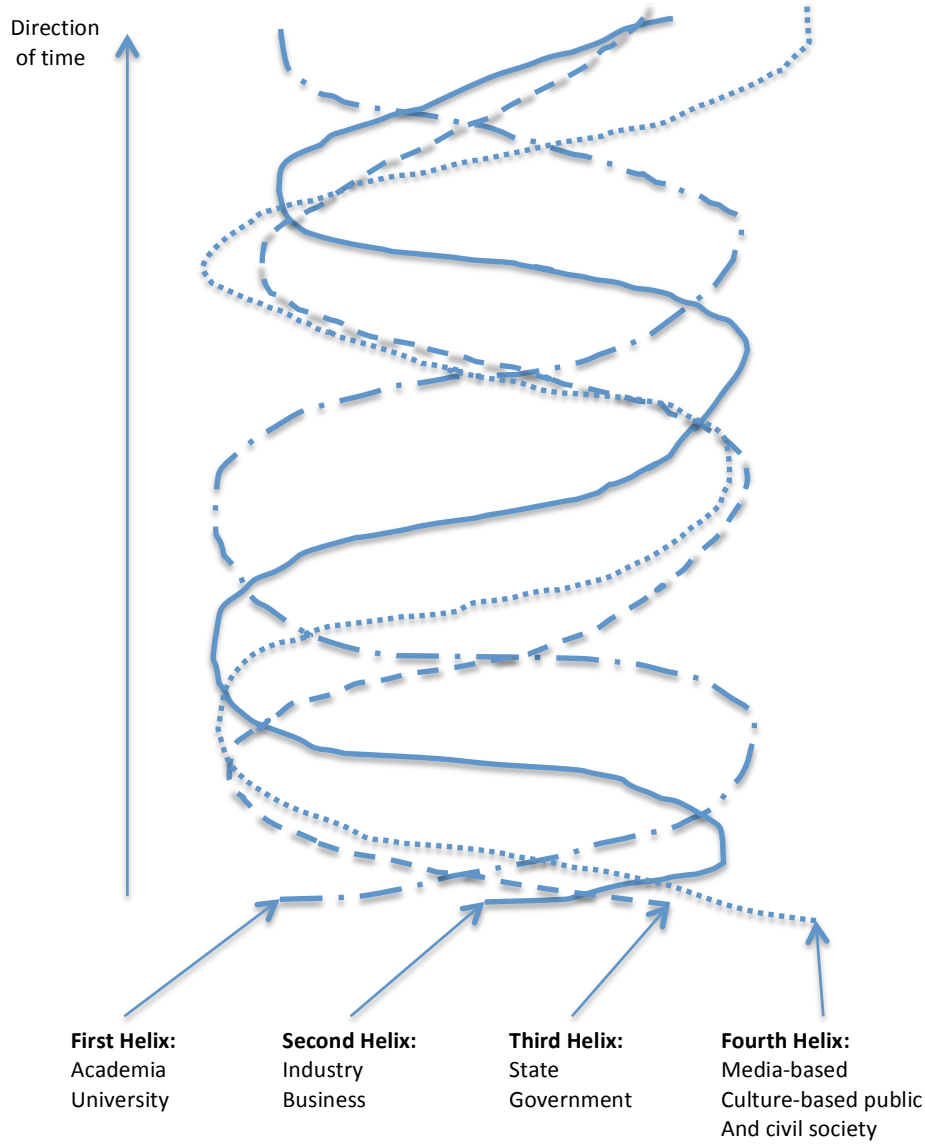

Figure 1.9. The conceptualization of the Quadruple Helix Innovation System. (Adapted from Etzkowitz & Leydesdorff, 2000 and Carayannis, 2012)

This same author clarifies the impact of the society (media, and culture) in the quadruple helix model, and the natural environment in the quintuple helix model (figure 1.10).

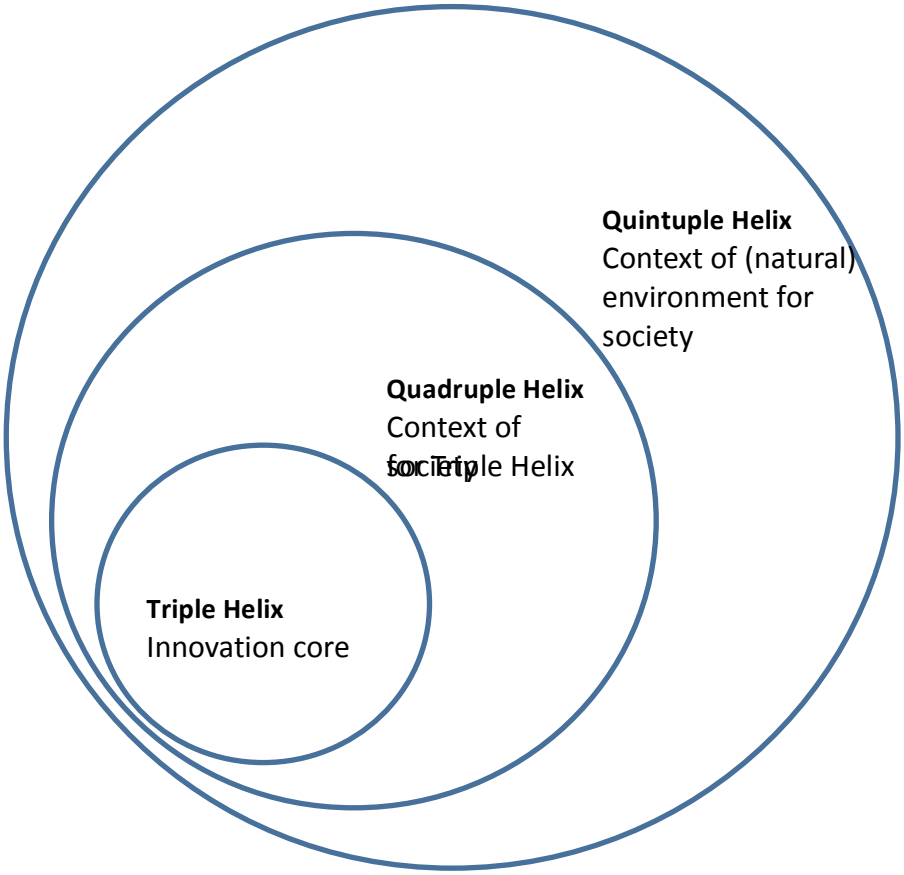

Figure 1.10. Society and environment in the Triple Helix Innovation System. (Adapted from Etzkowitz & Leydesdorff, 2000 and Carayannis, 2012)

However, adding more and more dimensions only makes sense if the specified added dimension adds relevant information within a specific context. Otherwise, the model becomes messy, and may not help explaining what is happening (Leydesdorff, 2012).

Schofield (2013) introduced some changes to the point of view of Carayannis et al. (2012) by adding some other aspects to the mentioned dimensions. With them, she built up a conceptual framework of knowledge transfer dimensions (figure 1.11).

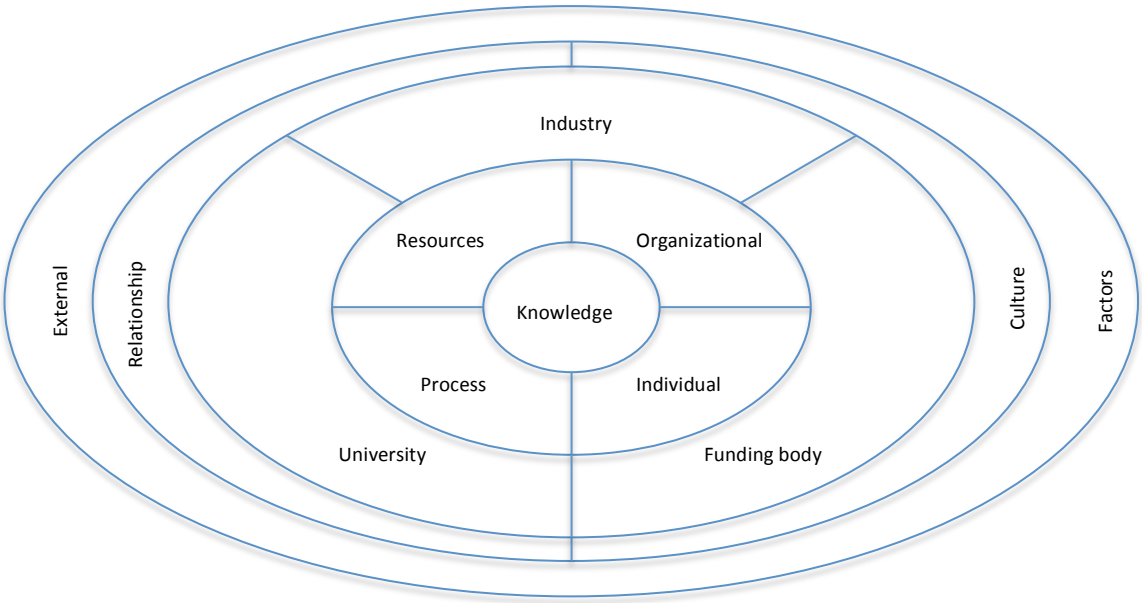

Figure 1.11. Conceptual framework of knowledge transfer dimensions. (Adapted from Schofield, 2013)

But this is not the only valid model to explain the UIC. The idea is that government has to provide a medium in which the Industry, and academia could collaborate. Etzkowitz & Leydesdorff (2000) describes it as seen in figure 1.12.

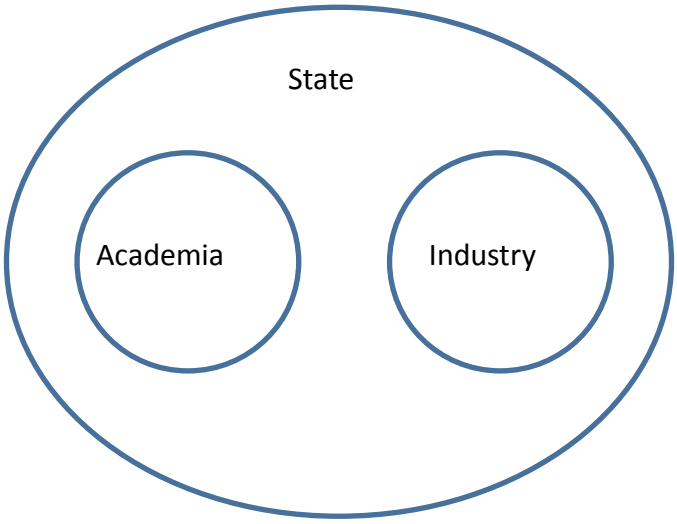

Figure 1.12. State actively interacts with both academia and Industry. (Adapted from Etzkowitz & Leydesdorff, 2000)

Bozeman (2000) proposed the Contingent Effectiveness Model based on the idea of measuring the impact, and effectiveness of relationships between universities, and Industry. It considers five dimensions: the transfer agent, the transfer media, the transfer object, the transfer recipient, and the demand environment (Figure 1.13).

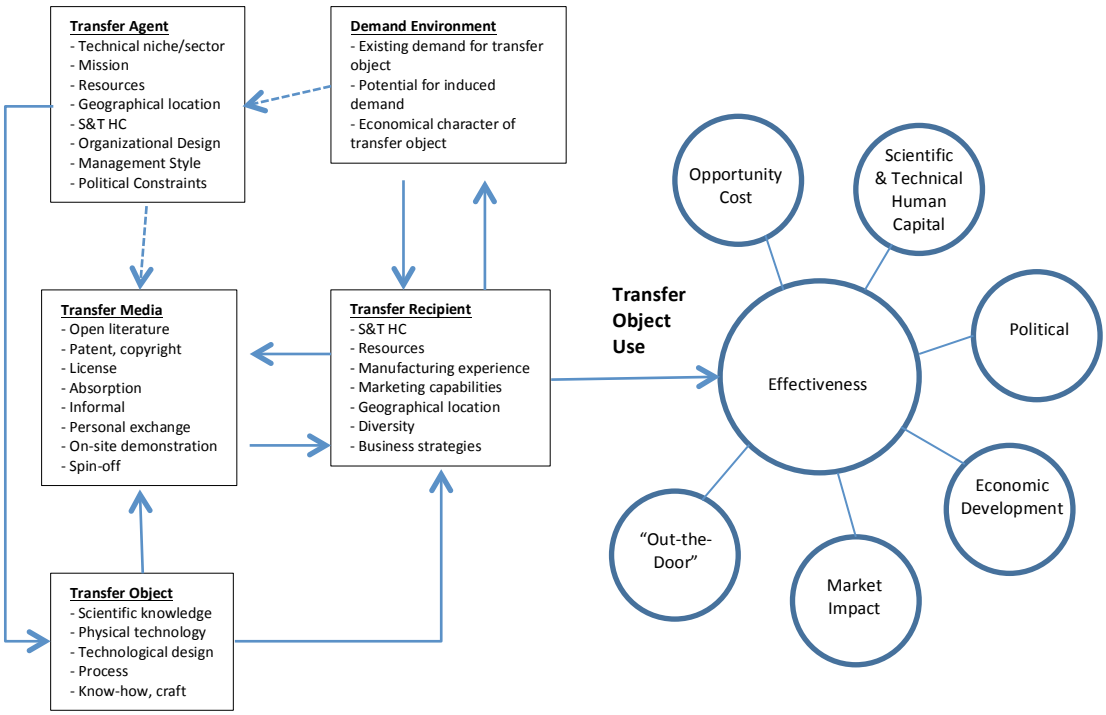

Figure 1.13. Contingent Effectiveness Model. (Adapted from Bozeman, 2000)

Some other models also try to shorten the negotiation time for collaboration setting. One of these models has been developed at UC Berkeley (Burnside & Witkin, 2008) (figure 1.14).

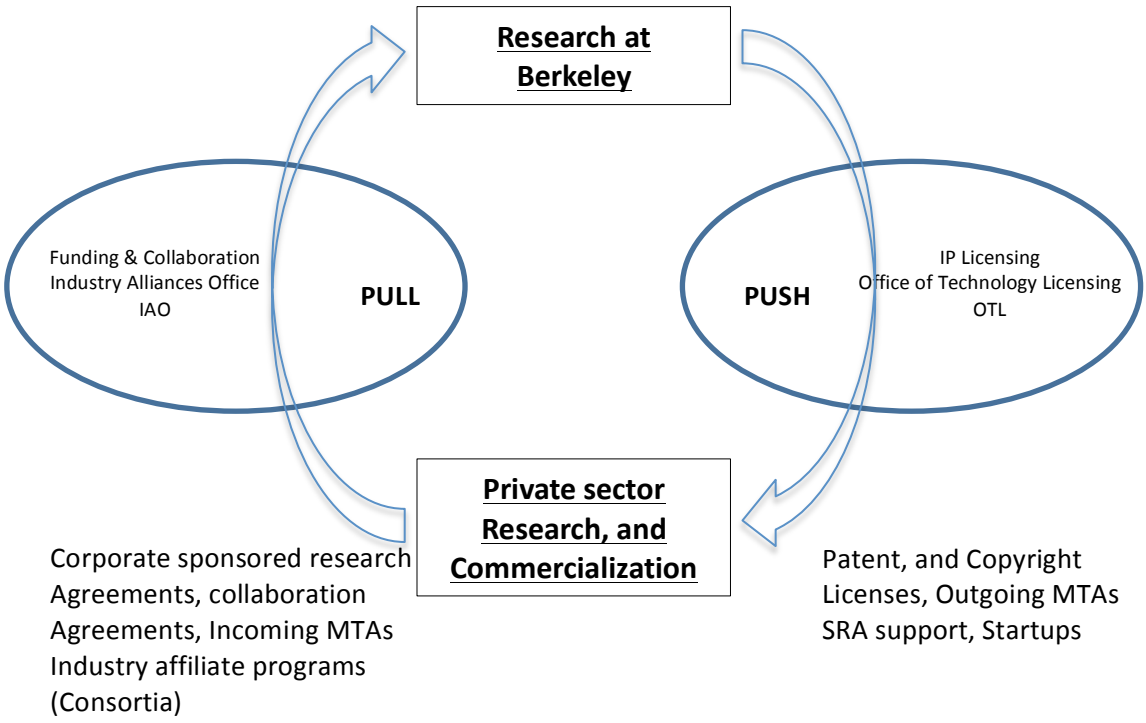

Figure 1.14. "One-stop-shop" Intellectual Property, and Industry Research Alliances Office (IPIRA) at UC Berkeley. (Based on the drawing of Burnside, 2008).

However these models might not apply to all markets and segments. Research and development project in emergent industries are less likely to take place than ones in the mature industries. This has implications for the model and the initiatives governments might put in place to help industries (Bodas Freitas et al. Freitas, 2013). For instance in Japan, there is more focus on differentiating between University and research institutes. Along with Industry they create a triangular relationship in which they feed each other. However, Kondo (2010) goes even further by defining a cross-over interlink that could be seen in figure below 1.15.

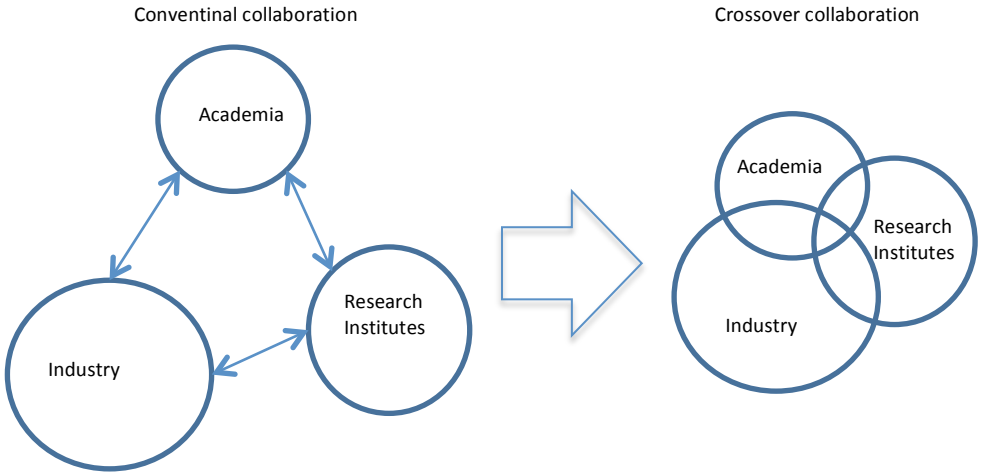

Figure 1.15. From conventional collaboration to crossover collaboration. (Adapted from Kondo, 2010)

To sum up the presentation of the models, after revising the different models set in place in China, US, Japan, and UK, it seems that models that really work must address some key parameters (Lai & Thai, 2010). These are regulation, organization, education, and inducement. His recommendation conveys a creation of an intermediary model in order to push the UIC. It must provide academia and Industry with the necessary fulfillment of their demands and offer needs. This model is then built up on two concepts: “Virtual R&D Organization” (VRO), and “Service Organization” (SO) that are linked to what this author calls Private Enterprise (PE) (figure 1.16). Looking at the details of this model, University institutes need to develop collaboration agreements with VRO. However Philbin (2011) stresses that academia should also, and especially have direct links with other University institution. These cross-institute collaborations are shown to be an essential part of what draws the attention of external bodies, and therefore funding (Philbin, 2011). Anyhow, application of a model would require time to see results on the collaboration side (Slavtchev, 2011).

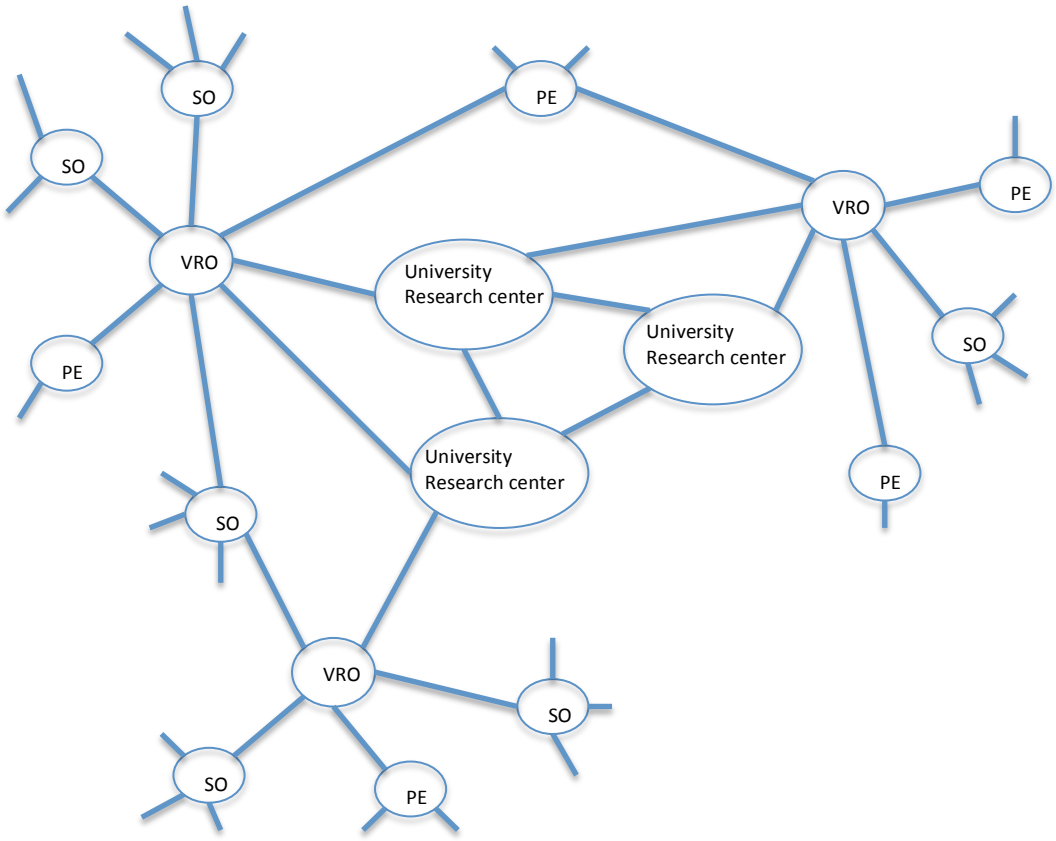

Figure 1.16. The intermediary model. (Adapted from Lai & Thai, 2010)

In another study, Lai (2011) explores the willingness to collaborate between University, Industry, and their intermediaries. It seems that the factors that correlate more with the willingness to collaborate from the point of view of University are "transferor incentive," and the "capability of the transferor." On the side of Industry, the main factors for collaboration are the "capability of the transferee," and the "incentive for establishing technological resources." Finally, on the side of the intermediary, the main factors are the "intermediary's fundamental resources," and the "intermediary's transferring process."

Time is also to be considered in the models (Perkmann & Salter, 2012). This author proposes that firm managers should basically consider two factors before collaborating with University. The first one is clearing the time horizon. Firms can choose short-term, after which the firm must take into account a clear target, and work in alignment with the University, and research modus operandi. They therefore require clear, creative structuring, as the University and the Industry do not usually have the same kind of clock-speed. Firms can also think long-term, something academia is

always trying to promote. This course of action has the advantage of creating a large array of possibilities that can easily sustain firm success for the next 10 years (Perkmann & Salter, 2012). The second dimension considers clearing the degree of disclosure of the partnership output. Firms prefer protection for as long as possible while academia thinks more in terms of open source information, wishing to publish their findings as soon as possible. This ways of thinking brings different solutions to facilitate the collaboration. The "Idea Lab" is more focused towards short-term collaboration while "Deep exploration" is more focused on the long term. In between, Perkmann & Salter (2012) propose two more mid-term solutions, but others can also be put forward.

There is also another time dimension that has a clear impact on firm innovation and collaboration with University. When the Industry sector is evolving very quickly, collaboration with University and other companies is probably the only way to survive. One example of this has been IBM in the eighties. When IBM decided to enter the PC market, in order to keep costs low and reach the market as quickly as possible, the company chose to develop a modular product design with a product modular supply chain, built around major components supplied by two virtually unknown companies: Intel and Microsoft. This structure managed to foster innovation, and after a few years the number of computer generations was already amazing. This innovative structure has since been applied to more traditional industries such as the automobile industry. Nowadays the value of electronics is far above that of steel casting (Fine, 2000). This combination of modular products and modular supply chains is at the base of the double helix supply chain model of vertical integration versus horizontal/modular disintegration (figure 1.17).

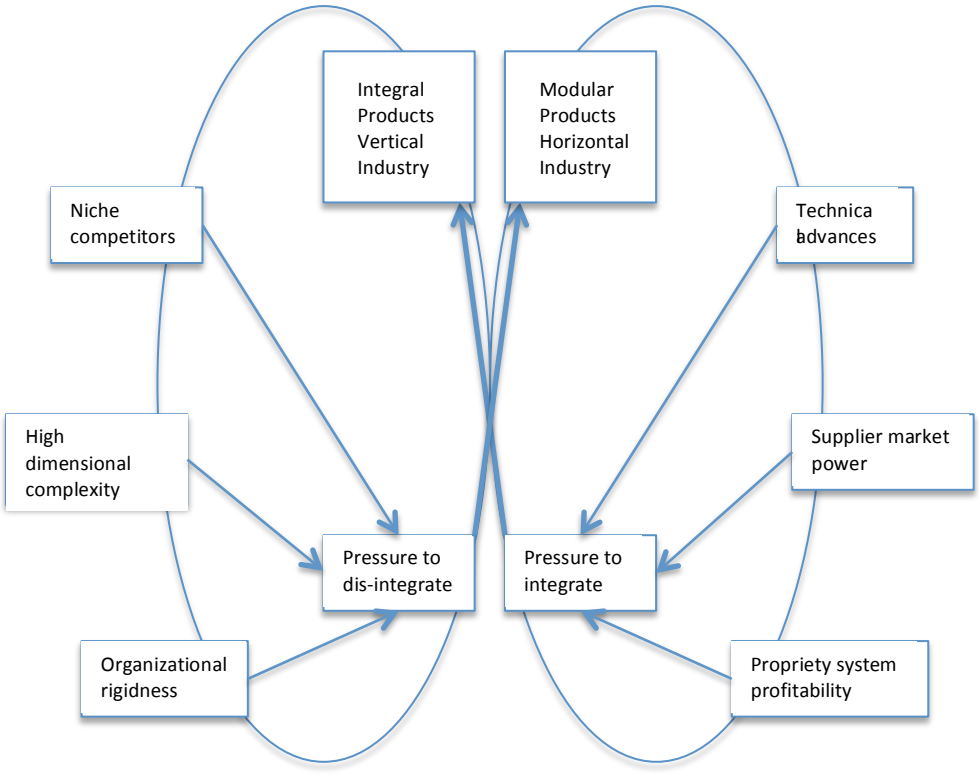

Figure 1.17. Double helix in supply chain oscillation. (Adapted from Fine et al., 2000)

What is important to remember from this supply chain structure (external, and internal) is that following some basic principles allows companies to increase the speed with which their innovations reach the market (Fine et al., 2002), but also that they can apply these same principles to their collaboration with academia in order to stay competitive. Weeks & Feeny (2008) relates outsourcing of IT relationships to innovation outcomes. For some years, the outsourcing of IT was performed on the basis that it would provide innovation to the firm. However, Weeks & Feeny (2008) shows that this is actually true depending on some specific characteristics of the client, the supplier, and the relationship between them. In any case, concerning the supply chain literature, nothing has been found around the use of very common instrument used by the supply chain managers such as the Kraljic portfolio-purchasing matrix (Kraljic, 1983) (figure 1.18).

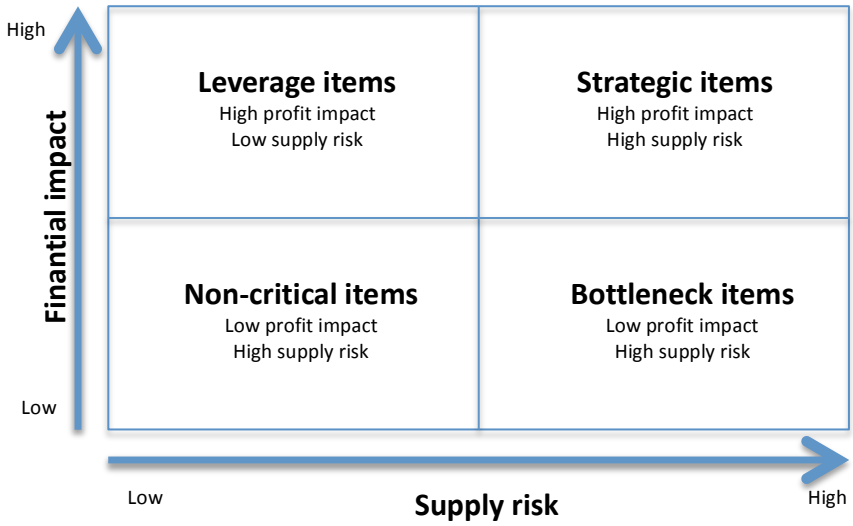

Figure 1.18. Portfolio purchasing model. (Adapted from Kraljic, 1983)

1.2.2.4. How to foster UIC

Concerning the incentives to be set to boost the relationship, Kitagawa & Woolgar (2008) examines the impact on venture business increase after deregulation, and subsidizing policies for R&D in Japan. Others, such as Manjarrés et al. (2009), studied the way to balance UIC promotion as a substitute for public funds to research centers. Bauer & Flagg (2010) proposed to avoid providing grants to universities for technology transfer unless they commit to transmit the generated intellectual property to Industry.

In what concerns technology transfer activities, many authors mention the importance that intermediaries have on fostering collaborations (Kitagawa & Woolgar, 2008). Some models give a foremost role to the importance of stakeholders, and their role in TT. The latter author also exposes the activities, events, stakeholders, and resource providers that take place during technology transfer (figure 1.19).

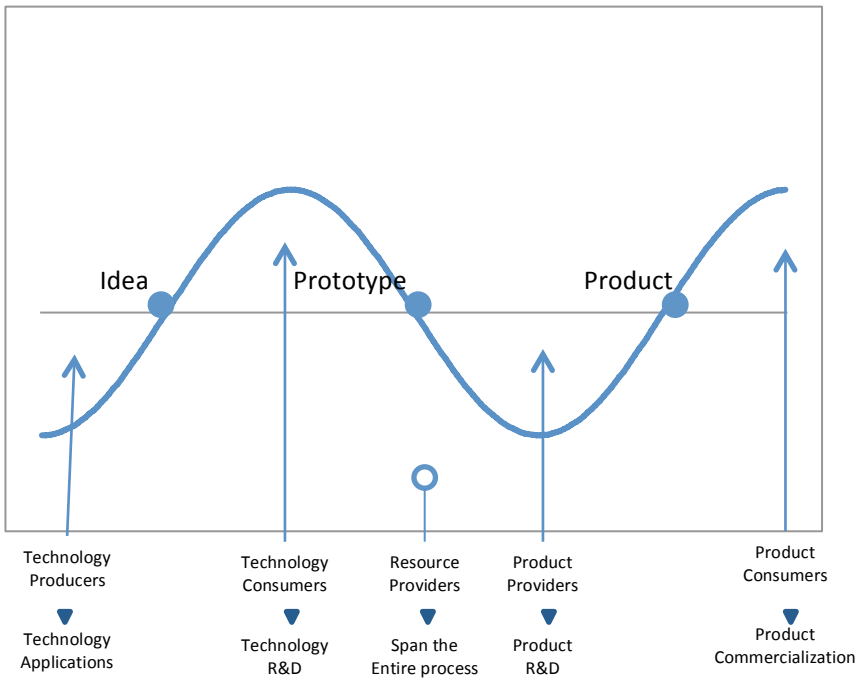

Figure 1.19. Technology transfer model. (Adapted from Lane, 1999)

On the upper part of figure 1.19, the model shows consumer influence on transfer, whereas the bottom part displays how technology basically influences development.

There are two recurrent topics in support of UIC. On one hand, Bauer & Flagg (2010) stresses the fact that the technology transfer has to be driven by market needs, and business interests rather than the more classical research + development + utilization model. On the other hand, authors study TTOs and look for the reasons behind their differing performances. In fact, most inventors, especially serial inventors who have developed their own network of contacts in order to patent or create new ventures, do not use TTOs. For them, this saves time and money (Göktepe-Hultén, 2010). As a consequence, and so in order to increase their success as a bridge between Industry and academia, and it is stressed that TTOs and their liaison officers should not only be experts in intellectual property transfer, license, and patenting but that they should also request marketing, and business expertise (Malairaja & Zawdie, 2008). By using a "survival of the responsive" strategy the TTOs will be able to bring value to the transfer chain between both parties and adapt to customer needs (Göktepe-Hultén, 2010). However, some papers show the TTO actively working to become something like the University "concierge" for the University knowledge transfer. Their activity is

not only focused towards promoting the research activities of the University among industries but also trying to change the University as a whole. The example for that is the Johns Hopkins Technology Transfer Office (Blakeslee, 2012).

Science parks, research parks, technopoles, innovations centers; the names may vary from country to country but the idea remains the same: science parks are a way to bring research centers, and industries together in a close medium in the hopes that they will collaborate. The reason why these clusters exist is because they are meant to create a competitive advantage for the cluster, and the industries placed inside through facilitating innovation and knowledge creation (Gong & Greeven, 2012). Geographic proximity between universities and industries is said to foster relationships and produce more knowledge (Hoba Abd el Hamind, 2012; Petruzzelli, 2011; Slavtchev, 2011; Ponds et al. 2007). Slavtchev (2011) mentions that local social ties between academia and Industry might help overcome mutual distrust and differences. Even more, the increased relationships within a limited area increases the probability of long-distance relationships (Muscio, 2013; Slavtchev, 2011). Following this line of thought, the Japanese government decentralized R&D, expecting that regional research centers would produce technology better adapted to local Industry needs (Kitagawa & Woolgar, 2008). Recently, this author proposed that science parks should be a part of the Triple Helix Culture. Science parks are seen as a link between University research centers and Industry, a place to provide advice, infrastructure for business relationships, and image credibility, especially when it comes to small businesses (Figure 1.20).

Type of resource	Description
University-related	University links, access to University resources, University education, academics, and graduates as skilled manpower
Science park facilities	Business advisory services, venture capital, flexibility of premises, car parking, administrative facilities, science park management
Cluster effects	Image, reputation, and credibility of location, and collective learning

Figure 1.20. Science park as a resource network. (Based on Lowegren, 2001)

However there are also some papers that reveal the limits of science parks. Malairaja & Zawdie (2008) showed that, in spite of the science parks being set up to facilitate the commercialization of developed technology, there is no significant

difference in collaboration between industries located within science parks, and those located outside the parks. Also, Hoba Abd el Hamid (2012) shows that the Egyptian industrial clusters have an impact on UIC increase, especially the most recent ones, but only a mild impact on economic performance in all cases. Laursen et al. (2011) shows that to have collaboration, geographic proximity is not enough. Mitanoski et al. (2013) compares the services and performances to help SMEs of the University of Belgrade with the ones offered by some leading universities: Lomonosov Moscow State University, the University of Edinburgh, the University of Central Florida, and the Monterrey Institute of Technology. Apparently the University of Belgrade offers the same services but lacks providing key support services for SMEs such as incubation services, providing assistance to research, and easing the research process, and innovation activities or creating specialized services for SMEs. Adding to that, Laursen et al. (2011) show the quality of the University is also to be taken into account. For instance, this author proves that being close to a low-tier University reduces the will to collaborate whilst collaborating with a top-tier one. In fact it seems that the University quality seems to be more important than the University proximity, and this is especially important for highly intensive industries or development-intensive ones. This is consistent with findings in which southern Italy University departments have a lower probability to collaborate with firms (Muscio, 2013), and the findings of Slavtchev (2011) showing that the local linkages fail in the absence of appropriate collaborations partners. This is due to the fact that the southern regions are less industrialized or less technologically intensive.

In relatively recent study, Van Looy et al. (2003) study different regional programs and activities, and looks for their critical ingredients that lead to regional innovation and economic success: Leuven, Cambridge, Sophia Antipolis as well as the German Government policy, and Silicon Valley. As a summary it seems that, at least for these kinds of regional projects, the mix of the presence of research institutes (this is the pre-requisite), knowledge-intensive startups along with R&D-intensive incumbents, surrounded by a professional open cultural environment that provides business advice and services are key for their economic success. However, it seems there is no one-size-fits-all pattern to be followed (Gong & Greeven, 2012). Each described region has its own blend of ingredients that makes it unique. For instance, the fact that the climate at

Sophia Antipolis is considered to be an advantage (Van Looy et al., 2003) is not reproducible in Cambridge or Leuven.

This is also shown by Hong & Su (2013) when they studiy the proximity effect, ministry origin, local administration admission, prior collaboration, and University prestige. It is interesting to note the last item. When industries need to solve relatively simple problems that could not be described as cutting-edge, industries attempt to solve the problem using a close, and most probably second-tier University. However, when said local University is not able to solve the problem, and the Industry still needs to find a way out, they take on the added expense and look for the highest prestige University, regardless of distance. That is why Hong & Su (2013) finds that the higher the distance between University and firm, the higher the probability of mutual collaboration (figure 1.21).

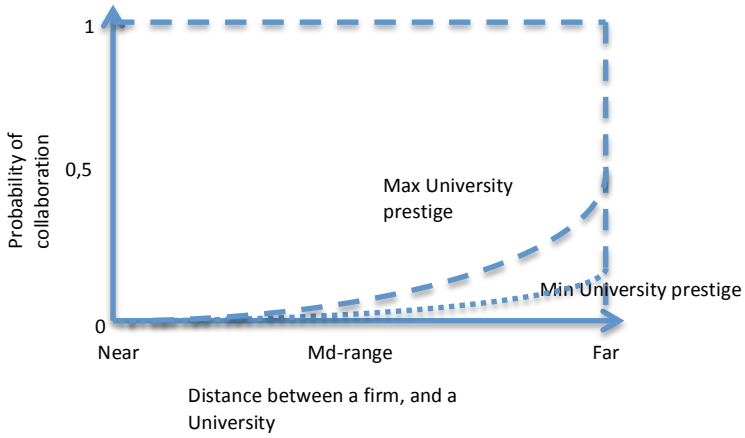

Figure 1.21. The interaction effects of distance and University prestige. (Adapted from Hong & Su, 2013)

The findings of D'Amore et al. (2013) are organized around four topics: an inverse relationship between institutional and spatial distance, basic research networks having larger institutional distances than applied research ones, basic research collaboration being higher at the regional level than at any other level, and there being an inverse relationship between institutional distance and relative collaboration intensity. This is consistent with the findings of Muscio (2013), where the southern Italy University departments, due to their especially weak industrial network area, associated to low-tier universities, found more difficulties in collaborating with Industry.

Translators or facilitators as persons can be either individuals or groups, such as the Federal Laboratory Consortium Locator Service, to which an Industry can submit its technology problem, and get advice about what kind of technology might serve its needs (Bauer & Flagg, 2010). Translators need to be very flexible, and have many fields of expertise (Luna & Velasco, 2003). Other authors directly mention the kind of knowledge they need (Luna & Velasco 2003, Santoro & Bierly 2006): tacit, and explicit, know-how, know-what, and know-why. Strong relationships between individuals, referred to as social connectedness, have been shown to facilitate the flow of knowledge (Santoro & Bierly, 2006). However, it is stressed that developing trust is basic, especially when it comes to the transfer of tacit knowledge (Santoro & Bierly, 2006; Luna & Velasco, 2003; Brannock & Denny, 1998). Santoro & Bierly (2006) also defines facilitators as elements that "facilitate" the knowledge transfer between University, and Industry (figure 1.22).

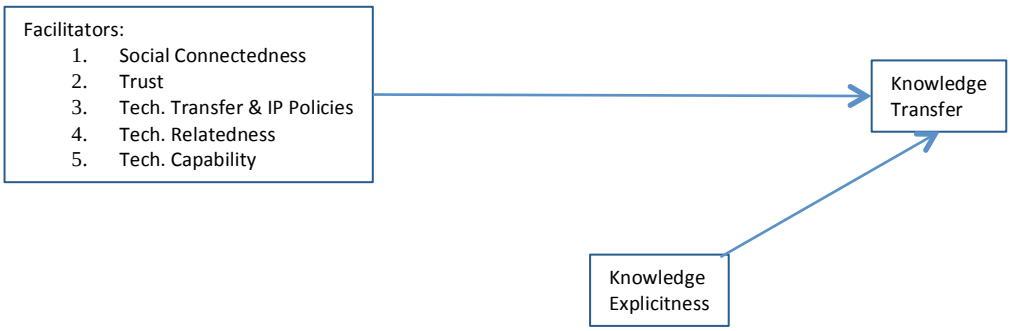

Figure 1.22. Facilitators of knowledge transfer in UIC. (Adapted from Santoro & Bierly, 2006)

Some authors mention conflicts that commonly arise during relationships between University research centers, and Industry. For instance, a lack of understanding of each other's needs, and insufficient rewards for scientists or the administration bureaucracy are mentioned (M. Luna & Velasco, 2003; Santoro & Bierly, 2006). As a solution, these same authors suggest developing networks strong enough to manage the expected conflicts. Others propose the use of "linkage" specialists (Berman, 2008; Wheatley, 2009), or that TTO officials, besides being patent, license, and technical specialists, should also have marketing skills, and entrepreneurial experience (Malairaja & Zawdie, 2008). Also, Malairaja & Zawdie (2008) suggests that University officials should visit science park industries to explain the type of research being carried out at

their research centers, and the available facilities at their disposal. Last but not least, this opens the need for policy initiatives to remove constraints, such as excess bureaucracy, that impede the development of UICs (Malairaja & Zawdie, 2008).

The relationship between American industries, and academia in the 20th century has often been noted as a historical success. A prime example is MIT, which was founded to establish close ties between academia, and Industry, conducted research for a 172.000US$ value (Kenney, 1987). To this end, MIT started a program involving more than 200 companies just after WWI. For a fee, industries had access to state of the art academia, and laboratories, staff, and students who could solve a large variety of research problems. During the academic mobilization to win WWII, MIT developed multi-disciplinary centers, and laboratories (Omenn, 1982). This multi-disciplinary body has been reproduced very often. For example, the Working Education, and Development Services (WLEDS) in Finland coordinated 6 education centers, and related industries (Markkula & Lappalainen, 2009). However the MIT success is been put upfront very often. In 2008, its alumni 25.800 founded, and currently active companies employed almost 3,3 million people, and had an estimated US$2 Trillion in sales. This made the MIT alone the eleventh largest economy of the world (Roberts & Eesley, 2009).

Other authors reinforce this idea by showing that research-intensive universities are developing the cross-fertilization of disciplines by working in a single organization (Scott, 2013; Jones, 2010), or the idea of a one-stop shop regional body for industries looking for access to academic researchers, and advice over available grant funding (Wheatley, 2009). In any case, some authors propose a list of factors to determine the success of the relationship, and have found out that success is a combination of more than just one factor. However, as mentioned before, social connectedness (Santoro & Bierly, 2006), trust development (Slavtchev, 2011; Santoro & Bierly, 2006; Mora-Valentin et al., 2004; Luna & Velasco, 2003; Brannock & Denny, 1998, Davenport et al., 1998), and clearing up topics that might go wrong early in the relationship (Mora-Valentin et al., 2004; Brannock & Denny, 1998) are shown to be important. Failure is also determined by multiple factors (Bernardos & Casar, 2009), such as a technical problem, fund shortages, lack of project definition, and personal relationship problems.

Success in the relationship can also have different solutions depending on its market segment. The so called “science sectors” such as chemistry (Baba et al., 2009) or biotechnology find quick transfer solutions in Industry (Blakeslee, 2012; Baba et al., 2009). However, in other sectors, the transfer is not carried out directly from the University to Industry, but the University needs the feedback of Industry to carry on. This interactive mode of development may be found in sectors such as nanotechnology (Baba et al., 2009). While the one-way system leads to some kind of “star scientist” (Zucker & Darby 2006), the second develops a kind of collaborative system based on a “Pasteur scientist” (Baba et al., 2009) (figure 1.23). The latter acts more as boundary spanner (Thune, 2007) and ends up being more productive for collaborative work. Baba et al. (2010) expand their idea of a “Pasteur scientist” with the concept of a “core scientist” who is involved in paper authoring along with patent application. This author makes said core scientist very involved in project leading in order to push for the commercialization of Industry R&D.

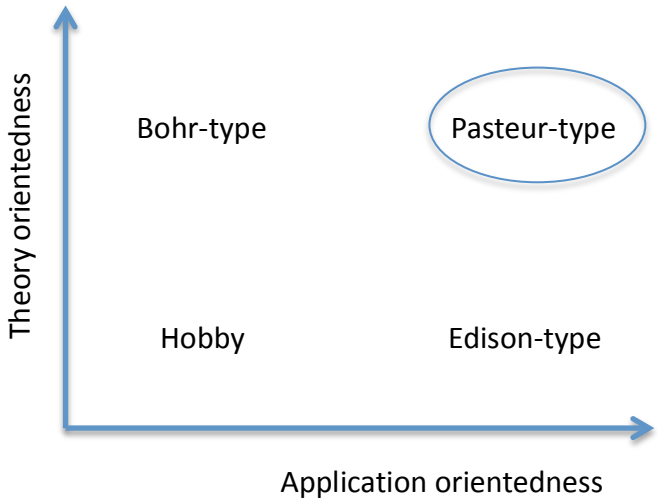

Figure 1.23. Science-Based technology. (Adapted from Kondo, 2010)

In general most of the literature is focused on research commercialization, and technology transfer (Berman, 2008), especially in what regards the biology-health, and engineering sectors (Thune, 2010). Little research is found on Industry perception of the relationship (Berman, 2008).

However, relevant figures in the field of Industry are usually well acquainted with current research programs. This may explain why a majority of University

collaborations were formed through the use of already existing contacts (Thune, 2007), thus revealing the importance of social capital as a way to form collaborative ties. This also explains why there are different ways depending on the community, and the context to negotiate science, why R&D investments can be used for political reasons rather than innovation (David, 1982), or why legislation can be used to judge University TT performance (Bauer & Flagg, 2010).

The question of intellectual property can be split between patents, licenses, consortiums, and grants. Starting with patents, historically, there has been an evolution in the treatment of patents (Kitagawa & Woolgar, 2008). While the example of Wisconsin in 1925 shows that banning universities from filing patents had important consequences that had to be reversed shortly after its enforcement, the right to do so brought funds to justify UICs (Omenn, 1982). In fact, the reasoning is that industries will invest in innovation only if they expect to make attractive profits out of their exploitation (De jong & Von Hippel, 2009). To do so, it is important to clear up that topic early in the relationship (Wheatley, 2009), and also to clear up the lag time for an Industry to say “yes” or “no” to an innovation, and file for a patent.

However, patents are not the only way to measure UIC relationships (D’Este et al., 2012; Manjarrés et al., 2009). Researchers can still profit from their innovations by giving them for free. For instance, a study in the Netherlands showed that 48% of the innovations were given at no fee to high-tech Dutch SMEs, and this proved to provide more profit to society as a whole than a patent based agreement (De jong & Von Hippel, 2009). Other studies couple the patenting and the publishing in the same agreement. For instance, a French study shows that firms and scientists can complement each other in publishing capabilities, and that the best publishing scientists collaborate with the best publishing firms, but substitute each other in patenting skills (Minruta, n/a).

Licensing, though it may bring more funds to the University, also requires skilled personnel to deal with. As licenses have a fixed cost, independently of the number of licenses to be dealt with, it is likely that licensing profits bigger collaborators rather than smaller ones (Turk, 2005). On the other hand, licensing for innovations developed by University fails to account for the greater impact of giving them for free (ratio 24:1) in the private sector,, and especially their benefit to society, and SMEs

(Bauer & Flagg, 2010). It is also important to clear up the distribution of the licensing revenues. Blakeslee (2012) presents the Johns Hopkins University system as an example that is similar to the ones used in many other universities (figure 1.24).

Inventor's personal share	Inventor's research account	Inventor's department	Inventor's school	University administration
35%	15%	15%	30%	5%

Figure 1.24. Johns Hopkins University distribution of licensing revenues

Well-known consortia have led the notion of consortiums to be particularly popular in the field of Industry. It represents a low-cost, low-risk option for everybody, especially for universities, as no Industry has the leverage to exert strong influence on research directions (David, 1982). However, in order to ensure their success, some rules, and guidelines have been proposed to run them (Lewis et al., 2001). Among them, it is especially stressed that user centric consortiums should create win-win situations that are yielded in University real-life cases (Markkula & Lappalainen, 2009).

Among the several Acts voted in the US that are meant to ease the transfer of knowledge (figure 1.25), the Bayh-Dole Act is mentioned several times as a successful landmark for UIC (Turk, 2005). It was created expecting university innovations to flow easily to Industry, whilst generating more funds for u8niversities (Glenna et al., 2007). The idea was to suppress "professor privilege" and make the inventions of academics be owned by their respective universities.

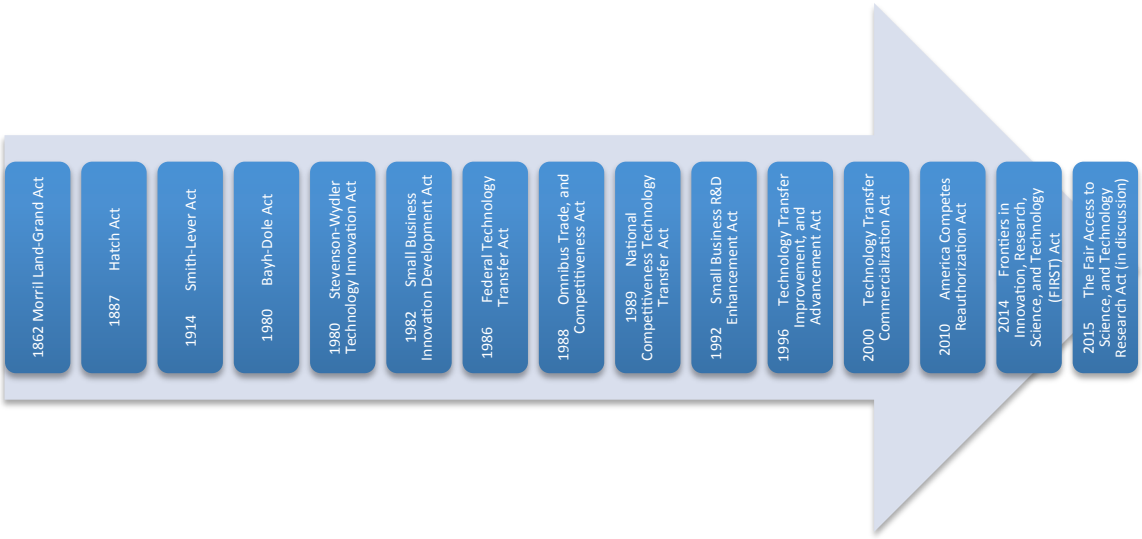

Figure 1.25. List of US Science & Technology related Acts

Also, the Small Business Innovation Development Act describes how Fed Agencies should designate 2.5% of their budget to SME grants (Bauer & Flagg, 2010) but often fail to find appropriate projects. The basics aims of the Act were to let the universities protect their IP, and to facilitate the transfer of technologies from the public to the private sector (Glenna et al., 2007). This maligns any University research that does not translate into IP (Glenna et al., 2007). However, there is no argument on the shifting of University research priorities after the Act was enforced (Turk, 2005). Nevertheless, findings show that the number of collaborations, and the amount of funds have benefited the ones in the top tier rather than the ones in the middle or lower tiers (Turk, 2005). The percentage of private funds was 2.6% in 1970, and increased to 6.9% by 1990 (Bozeman, 2000), but this has been linked to a decline in government funding. Other papers show that the Act itself has not changed the basic trends in patenting. There is no structural break after its enforcement (Mowery & Sampat, 2005), and it is even possible that that law was not really necessary (Mowery, 2011). Copying the Bayh-Dole legislation in other countries (such as Spain, Ireland or Austria) could be counterproductive because it focuses on licensing as the primary channel, and this can have chilling effect on other ones (Mowery & Sampat, 2005). In fact it seems that patenting and licensing might not be the most important when it comes to promoting industrial innovation. Reforms to enhance inter-institutional competition autonomy within national University systems as well as external institutional support to new-firm formation and technology commercialization seem to be more important to foster

University-Industry interaction and technology transfer (Mowery, 2011). Maybe the key to achieve responsible commercialization of research is to balance the Bay-Dole ethos with the traditional meritorian norms of academic research (Kumar, 2010).

Solving the question of ethics versus money is also found in literature (Nellickappilly & Maya, 2009) as something that has to be addressed to foster the UIC. A majority of studies show that UIC threatens research integrity, and may limit the free exchange of information (Glaser & Bero, 2005; Manjarrés et al., 2009). This may tarnish institutional reputations (Lewis et al., 2001) or blur roles (Glenna et al., 2007). Other factors may also have an ethical impact. For instance, developing UIC may undermine the distinction between public-interest, and private-interest research (Glenna et al., 2007) or be too focused on short-term benefits (Mowery & Sampat, 2005). However, research is shown to imply some risks. For instance, the infamous clinical trials conducted by Dr. Huan of John Hopkins University at the regional cancer center Trivandrum in the year 2000 show the need to clarify what is the limit of the public interest as opposed to private interests (Nellickappilly & Maya, 2009). Also, during a gene-transfer test at the Pennsylvania University, a patient died, and a researcher was accused of biasing the results of the test due to his financial ties. It is mentioned that this might be a consequence of the fact that companies manage their relationships taking close stakeholders into account rather than society as a whole (Clarkson, 1995). To overcome this situation Nellickappilly & Maya (2009) propose a model that includes the ethical framework as an essential aspect for collaboration (figure 1.26).

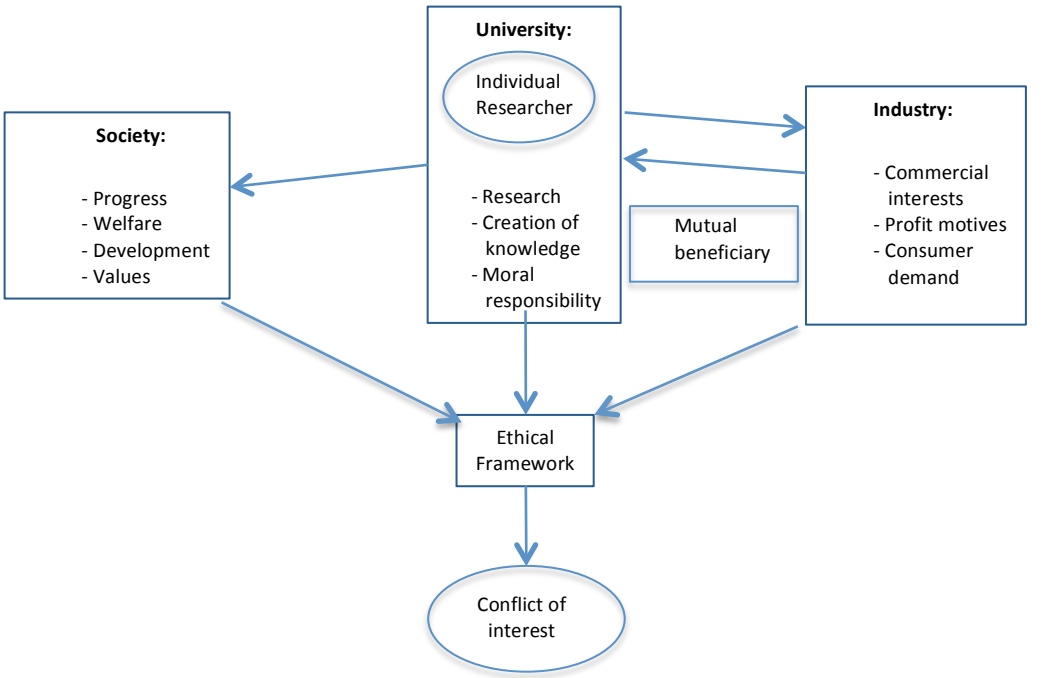

Figure 1.26. Model of creative collaboration including ethics. (Adapted from Nellickappilly & Maya, 2009)

However, previous UICs also have other consequences. Beaudry & Kananian (2013) describe that previous successful collaborations with Industry are positively correlated with becoming an inventor, and thus filing for innovation patents. Also, said positive correlation is found with receiving private funds for research, and having a relatively high level of "cliquishness" (excessive "cliquishness" reduces the positive correlation), high citation rate, and number of claims.

Planning an R&D investment and managing the associated risks is also mentioned in papers. Industry investment decisions are based on planning and forecast. Bond and Houston (2003) have developed a framework to understand and overcome the barriers firms face in order to match technology and market opportunities. This framework not only takes into account the cash flow but also the fact that a given new technology might impact the technology available on the market, and it might also be a source of unexpected, unplanned new market opportunities. Coordination then becomes a matter of concern, and thus needs to be addressed, especially when projects imply multiple disciplines, multiple centers or multiple universities (Cummings & Kiesler, 2005).

Political ideology might also play a role in influencing research (Glenna et al., 2007), and Industry funding creates an incentive to promote positives, and suppress negatives in order to keep on bringing in more funds (Lewis et al., 2001). However, most of the studies describe UIC relationships as positive (Van Looy, 2003; Manjarrés et al., 2009), essentially due to the fact that these relationships bring in more financial resources, have a positive impact on their scientific performance, and have synergistic effects on both parties involved, provided the R&D accounts for a small part of the researcher funding (Manjarrés et al., 2009), and time dedication (Tuunaimen, 2009).

There is a general consensus that Federal technology laboratories and universities have only modest potential for creating new jobs, and business on their own (Bozeman, 2000). That is why Industry is needed to bring in market requests. However, Industry representatives overwhelmingly support UIC (Glenna et al., 2007). It is stressed that the research outsourcing is mainly used to strengthen their in-house technological capabilities (Kitagawa & Woolgar, 2008), and to avoid the "tunnel vision syndrome," identified as the fact that the internal technological expertise prevents from identifying potential technologies (Kyoung-Joo Lee et al., 2010). That is why the performance of the transfer has been studied especially regarding the technological diversity, and value chain complementarity of the projects as success factors. Some divergent results have been found depending on the industrial sectors, their corresponding collaborative networks (Mora-Valentín, 2004; Petruzzelli, 2011; Von Raesfeld et al., 2012), and the absorptive capacity of the Industry sector (Gong & Greeven, 2012; García-Aracil & Fernández De Lucio, 2008).

A List of the basic revised literature is available in Addendum 2.

1.3. Research question as the research objective

In this literature review we have covered a number of basic topics (figure 1.27).

Chapter	Topic	Main author
1.2.2.1. Reasons why		
	University = academia + research + now transfer	Healy et al., 2014
	Research commercialization raised some topics such as IP or other problems	Tartari et al., 2012
	How to overcome these problems	Wallin et al., 2014
	Levels of engagement as an important factor to understand problems	Healy et al., 2014
1.2.2.2. Consequences of UIC		
	A lot about successes and its keys	Scott, 2013
	Which are UIC outputs	Healy et al., 2014
	Different ways to organize outputs	Piva & Rossi-Lamastra, 2013
	Recipes for success	Sugandhavanija et al., 2011
	How the relationship has started	Thune, 2007
	Need to collaborate and what kind of technology is externalized	D'Este et al., 2012
	Consequences on the culture	Kyoung-Joo Lee, 2010
	Organizational dilemma and researchers perception on the UIC	Kliknaité, 2014
	How the Industry is adapting to acquire the innovation	Harryson et al., 2008
1.2.2.3. How to organize UIC		
	Linear model	Etzkowitz & Leydesdorff, 2000
	"Laissez faire, laisser passer" model	Etzkowitz & Leydesdorff, 2000
	Triple Helix	Etzkowitz & Leydesdorff, 2000
	Quadruple Helix	Carayannis & Campbell, 2009
	Quintuple Helix	Leydesdorff, 2012
	Conceptual framework of knowledge transfer dimensions	Schofield, 2013
	State fixed the medium for collaboration model	Etzkowitz & Leydesdorff, 2000
	Contingent Effectiveness Model	Bozeman, 2000
	Berkeley model	Burnside & Witkin, 2008
	Crossover collaboration model	Bodas Freitas et al. Freitas, 2013
	Summary of models into intermediary model	Philbin, 2011
	Which are the main factors for collaboration willingness	Lai, 2011
	Time as a factor	Perkmann & Salter, 2012
	Speed to the market as a key factor for UIC in some sectors	Fine, 2000
	Outsourcing research as a solution for speeding up the innovation process	Weeks & Feeny, 2008
1.2.2.4. How to foster UIC		
	Incentives	Bauer & Flagg, 2008
	The role of stakeholders	Kitagawa & Woolgar, 2008
	The role of TTO	Blakeslee, 2012
	Science parks, research parks, technopoles, innovation centers = clusters	Muscio, 2013
	The importance of how good the university is to foster UIC	Mitanoski et al., 2013
	Regional projects	Gong & Greeven, 2012
	Proximity effect	Hong & Su, 2013
	The kind of research is more important than the distance	D'Amore et al., 2013
	Translators and facilitators	Santoro & Bierly, 2006
	Solutions to misunderstandings	Wheatley, 2009
	The MIT as an example	Roberts & Eesley, 2009
	Cross-fertilization structures	Scott, 2013
	Boundary spanners and other figures	Blakeslee, 2012
	Developing social capital as a factor	Thune, 2010
	Addressing the IP topics at the beginning	De jong & Von Hippel, 2009
	Think about open innovation as a way to foster	D'Este et al., 2012
	Solving the licensing topic	Blakeslee, 2012
	Consortium	Markkula & Lappalainen, 2009
	Acts meant to foster UIC	Glenna et al., 2007
	Government funding	Mowery, 2011
	Ethics versus risk	Nellickappilly & Maya, 2009
	Planning the R&D investment in order to overcome the problems	Cummings & Kiesler, 2005
	Political ideology might also have to be addressed	Manjarrés et al., 2009
	The Industry bringing their own market requests is especially important	Von Raesfeld et al., 2012

Figure 1.27. List of topics per paragraph of the literature review

To begin, we settled a number of definitions in order to ensure that the reader can have a clear idea of the specific topics discussed in said literature. Most of the literature found was published by management scholars who can be organized in different ways. However, in this paper, the basics topics have been the reasons behind UICs, how they should be fostered, organized, and their consequences. Looking at the motives for this phenomenon, the increased pressure on academia to transfer its knowledge to the private sector has been stressed. This is supported by historical successes, and an exposition of the achievements of universities, and Industry. On the topic of how to foster UIC, different models have been exposed to understand the complexity of the relationship, the different incentives to be put in place, the importance of intermediaries, translators-facilitators, and the experiences with science parks. In the part concerning how UIC is to be organized, we reviewed the patents, licenses, grants, and organization of consortiums. The consequences of UIC reveal a struggle between ethics, and money in academia, and risk vs. profit in Industry. Special emphasis is put the Bayh-Dole Act, and its consequences (figure 1.28).

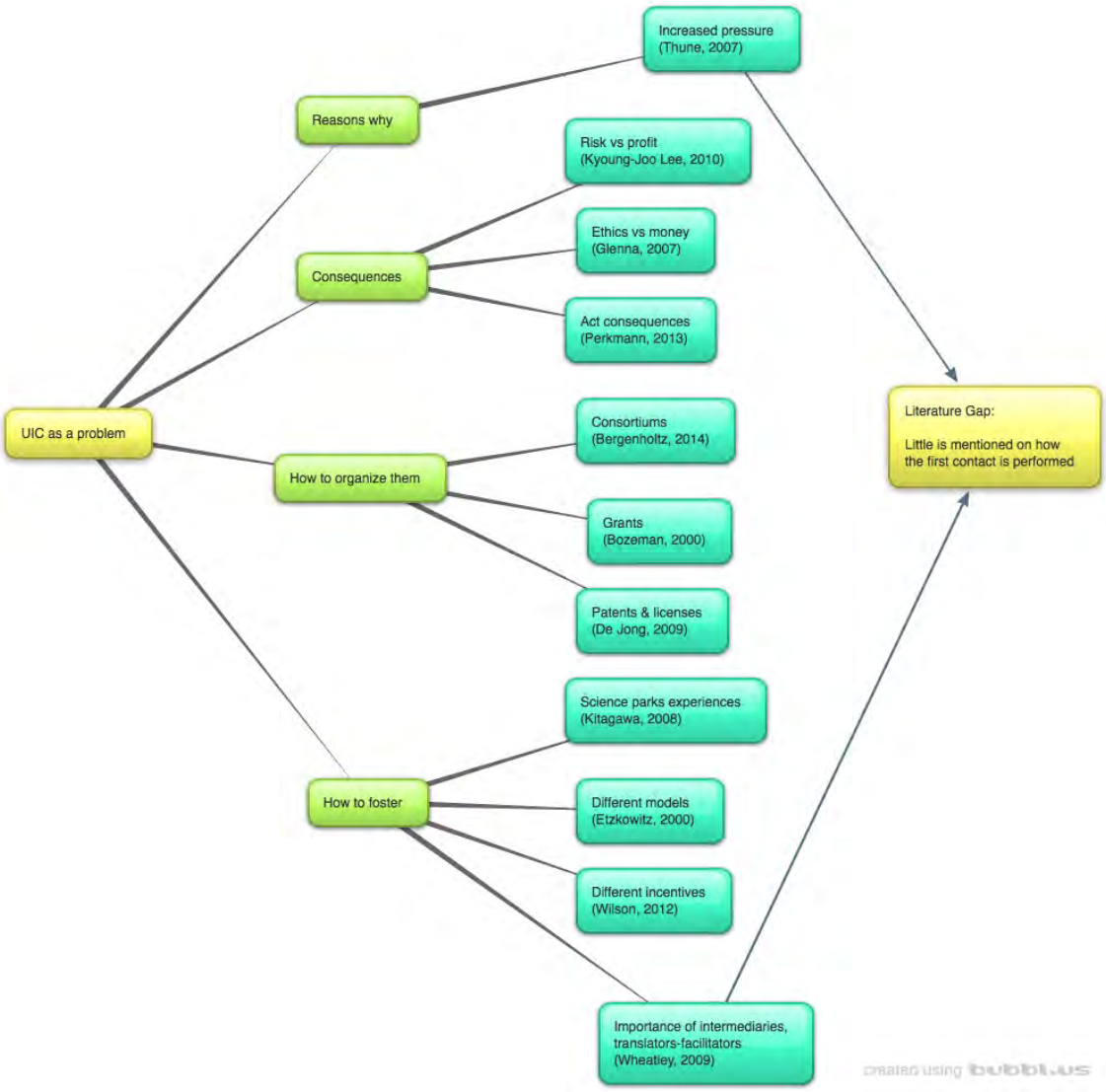

Figure 1.28. Mind Map of literature review

However, despite the idea that research should be directed by the needs of market demand (Bauer & Flagg, 2010), much of the literature on UIC has concentrated on research commercialization, and technology transfer (Berman, 2008). Little has been researched on Industry perception of research links with universities (Berman, 2008).

In general newspapers tend to write a lot about the most spectacular research successes. Velcro[21], and E Ink[22] are among the most publicized. They even talk about how the inventor stumbled upon it, such as in the case of the invention of the

[21] http://inventors.about.com/library/weekly/aa091297.htm (Based on its content dated November 2014)
[22] http://www.eink.com/history.html (Based on its content dated November 2014)

microwave[23]. But these are in fact an absolute minority among the vast amount of research topics being carried out every day. We already mentioned that there is a wide array of literature studying UIC, and that it has to be incentivized. That is why governments are using acts similar to the Bayh-Dole Act, other University reforms, as well as grants, and low interest credits as an incentive for industries to reach agreements with research centers (For instance FP7[24] or H2020[25] for Europe, TRACE[26], INNPACTO[27], Prova't[28] for Spain).

Recent research papers reflect this trend. A common object of study among them is the reasons why the Universities have to seek more Industry collaboration, and studies include historical successes, and the successes Industry has achieved thereby. They also study how to foster UIC from the University point of view including Incentives, TTO, Science parks, "translator-facilitators," success models, how to overcome U-I barriers, etc… They review how University-Industry collaborations should be organized, covering Patents, Licenses, consortiums, and EU FP7-H2020. In some other cases, they study the consequences of University-Industry Collaborations for University (ethics vs. money), and Industry (risk vs. profit), and the consequences of the US Bayh-Dole Act.

So globally, papers study UIC from the University point of view. This can be considered to be the "traditional" way. However, not a single one was found mentioning "how" Industry behaves once it has decided to approach a University or Research Center to solve a technology related market research problem, that is, a technological problem related to a market need that cannot be solved internally in a given company, and thus requires external help. In other words, there is no answer to what industries do to find out "who" has "what" that would allow them to solve a technology related market problem, and how said person is to be reached. Thus, it seems that how industries approach a research center to solve a technology related market opportunity,

[23] http://www.ideafinder.com/history/inventions/microwave.htm (Based on its content dated November 2014)
[24] http://ec.europa.eu/research/fp7/understanding/fp7inbrief/what-is_en.html (Based on its content dated May 2015)
[25] https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020 (Based on its content dated May 2015)
[26] http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=4f1d9349c84b0210VgnVCM1000001034e20aRCRD&lang_choosen=es (Based on its content dated May 2015)
[27] http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=fe6a1b3636297310VgnVCM1000001d04140aRCRD (Based on its content dated May 2015)
[28] http://cerca.cat/en/provat_en/ (Based on its content dated May 2015)

who they approach, and why, at least in what concerns the first time, is an unexplored research venue.

The objective of the present research is then to answer the question of how industries behave once they have decided they need to contact a research center in order to solve a Technology Related Market Opportunity (TRMO).

Thus, the research question will be as follows:

"How do industries with a Technology Related Market Opportunity (TRMO), who cannot solve it internally and have no record of previous contacts with a research/technological center, contact them for the first time?"

When a TRMO is detected in a company, the manager in charge has to decide how to solve it. He or she will have to balance between doing so internally or contacting a third party. Said third party could be a University-related one, an official research center or a private one. For the purpose of our research, only companies that have decided they need a third party to solve a TRMO will be retained.

Our research problem has been addressed by defining TRMO, a "contact," and "research center," setting working hypotheses, checking what has been written in the research literature on Research Centre relationships with Industry in general, and specifically on how the latter contact the former. From this standing point we will try to answer how Industry approaches research centers for the first time, which is the global understanding of the relationship, how Industry finds "who has what to solve my problem?" how Industry reaches the "problem solving" group or person, and why it reaches said group or person rather than another one. In the next chapter the methodology will be addressed in order to solve the abovementioned research problem.

This literature background is important to show that little has been found to explain how industries behave when they decide to approach a research center for the first time. In fact, only the mention that one way to achieve it is through a facilitator (Wheatley, 2009) or that a majority of collaborations were formed through the use of previous contacts (Thune, 2007) was found. As a consequence, it seems there is no

answer as to what industries do to find out "*Who has what to solve a technological market related problem*, and *how should I reach him for the first time*." That is why it could be interesting to study how industries with a technology related market problem, and no record of UICs, behave when they decide that they need a University research center, and approach it for the first time.

However, in order to ensure that this result corresponds to the state of the art, the literature review has been presented at the UIIN Congress in Amsterdam 2013. The presentation that was used can be seen in Addendum 14. A review paper on this same subject was published in the Congress proceedings pages 27-43 (Addendum 15). The Speaker Certificate can be seen at Addendum 16. Also and histogram of the used literature publication year has been included to show there is not an abnormal publication time distribution (figure 1.29).

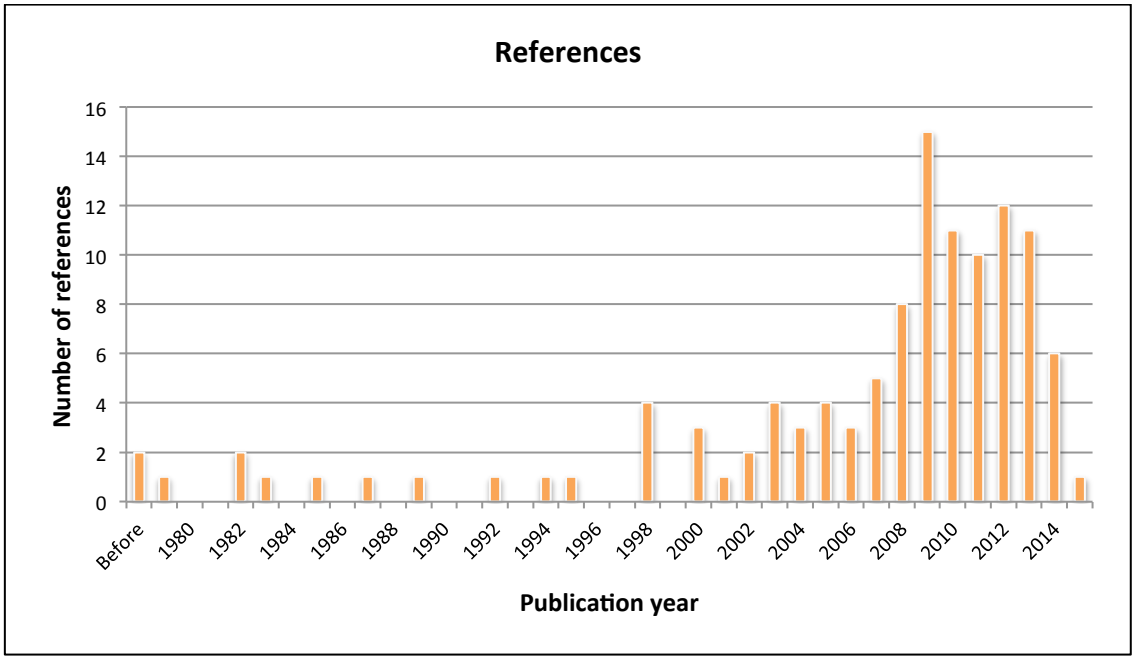

Figure 1.29. Literature publication histogram

As so little has been found on a written way, we need to explore in order to understand what the companies do when they face the need for such a first contact, and how they carry it out. In the next chapter we will discuss the methodology that best suits understanding industry behavior.

The contribution of this research would be to provide insights on the procedures followed, and the way in which said contact is performed. By understanding the behavior (reasons why), a theory might be proposed for the reasoning behind it (how, and why). This is expected to bring a kind of behavioral model that explains what the companies did. With it, we may be able to explain why it is so difficult to make companies, and especially SMEs collaborate with research/technological centers. This might help research centers and policy makers to adapt their offer and bring in more relationships.

2. Methodology

This chapter is intended to show the reasoning that has been used to collect the data, analyze them, and reach conclusions. The methodology that will be used is a consequence of the research problem, literature review, and the research question, which is specified as:

"How do industries with a Technology Related Market Opportunity (TRMO), who cannot solve it internally and have no record of previous contacts with a research/technological center, contact them for the first time?"

As this latter is referred to answer the "How" or "Why" of a specific phenomenon, in this chapter we will demonstrate that the preferred methodology is the case study.

In a global overview of a research, the starting point is the initial research problem, which leads to an exploration of the corresponding literature. This literature exploration ends with a research question. In case little can be extracted from the literature, which is our case, a further field exploration has to be envisioned. This exploration is expected to provide a first glance of a possible explanation on how and why the research question can be answered. That is we get a theory that might be explaining the phenomena. The logical further step is a validation of this theory through a systematic repetition of the phenomena in a significant number of elements in the determined universe. The theory validation allows asserting the reasons for the studied phenomena. The present work is related to the first half of this global workflow (figure 2.1).

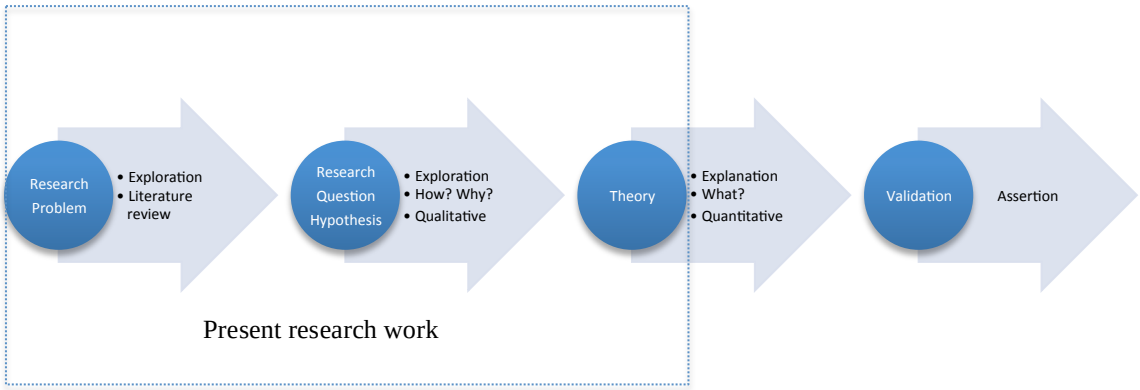

Figure 2.1. Global research workflow and the present research work.

2.1. Case Study Methodology

Science is an enterprise in which there is no "perfect research," and the diversity of beliefs acts as an effective method of checking possible biases or misconceptions. Natural sciences rely on a simple paradigm whose base is undeniable, allowing the accumulation of an impressive amount of material and knowledge. One of its key principles is the ability to explain and predict based on independent theories of context. In this sense, quantitative research aims to fragment and define measurable phenomena in categories that can be applied to all subjects in either similar or different situations. This is based on the paradigm that social facts are an objective reality with variables and measurable facts (Sales & Carenys, 2009).

Mintzberg (1979), referring to organizational theory, which is another kind of social science, and based on purely quantitative studies, considers that we've paid a high price for our obsession for rigor when choosing a methodology. This author also stated that too many results are only statistically significant in the strict sense of the word whilst actually lacking practical value. On the contrary, in order to develop and analyze hypotheses on the causal mechanisms in the context of individual cases in detail, case studies have a number of comparative advantages. Their objective is not to emulate the methodology of the natural sciences, but to gather useful knowledge about people, organizations and society. We seek a different kind of knowledge (Sales & Carenys, 2009).

In short, considering technology transfer as a social science, research methods seek to allow us to gather useful knowledge about people, organizations and society, to analyze problems and possibilities. We aim to solve a particular problem to reach your understanding, or to facilitate decision-making. By analyzing hypotheses on causal mechanisms in the context of individual cases, we seek enlightenment, understanding and extrapolation to similar situations.

The need to understand the context in which technology transfer takes place and the significant changes undergone in this environment, which often give rise to improvements or even the development of innovative tools, requires research strategies that allow us understand the complexity of the phenomena, including the environment as a factor.

The first question to solve when choosing a research methodology is the reason for the choice. There are other methodologies than case study, such as experimental, survey, archival analysis, and history. Each of them has its own specific advantages and disadvantages. In order to assess which is the most suitable one, three basic vectors have been used: the form of research question, if the research requires control on behavioral events, and if the focus is on contemporary events. With these three elements, a table can be created that helps assess the methodology that is most suitable in each case (figure 2.2).

	Form of research question	Requires control of behavioral events?	Focus on contemporary events?
Experimental	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case study	How, why?	No	Yes

Figure 2.2. Relevant situations for different research methods. (Adapted from Yin, 2009)

Case study is the preferred methodology when the research aims to contribute to our knowledge of individual, group, organizational, social, political, and related phenomena. So such a methodology is common in psychology, sociology, political science, anthropology, social work, business, education, nursing, and community planning (Yin, 2009). The aim is to understand complex social phenomena. The methodology retains the holistic and meaningful characteristics of real-life, such as life cycle, small group behavior, and maturation of industries among others.

The case study methodology requires going through some basic steps, starting by a clear and precise planning. This planning allows the study design, which is to be considered the cornerstone of the whole research. The design leads to a preparation, data collection, and analysis. However the collection might imply that the design needs some kind of refining. It is the case when after the preparation a pilot test is performed. This pilot test might imply some changes in order to make sure the results will be

consistent. This feedback could also appear during the analysis. There is also a sharing aspect of the methodology preparation and especially of the analysis/results (figure 2.3).

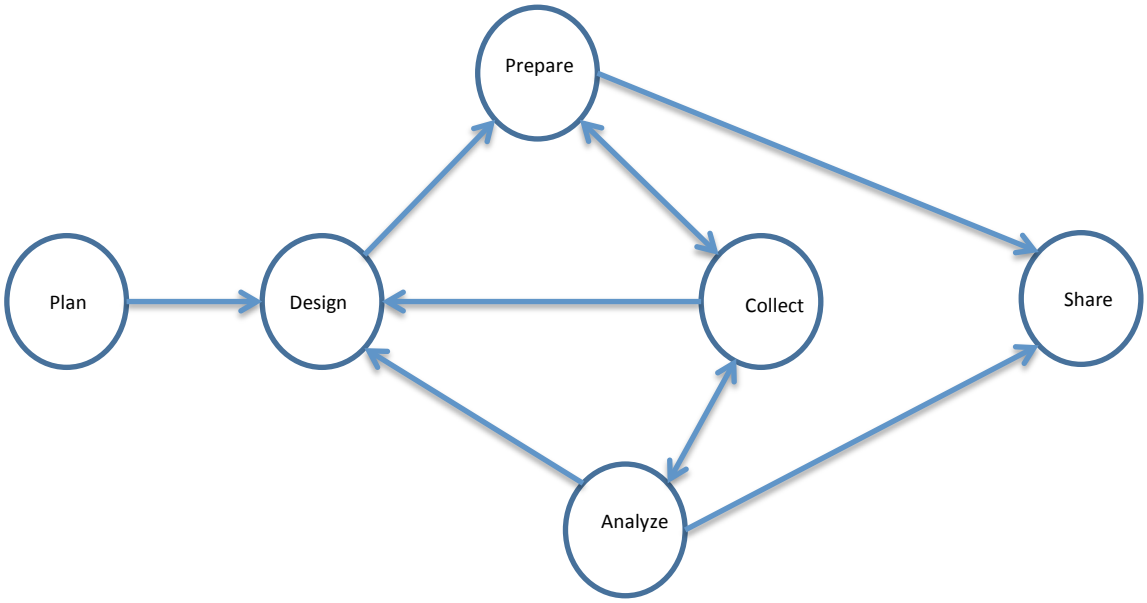

Figure 2.3. Case study general steps. (Adapted from Yin, 2009)

2.2. Research Design

As we saw in the literature review, very little relevant information on our topic was found. As a consequence, we can say that there is relatively little control or access to the relevant information. This implies that we had to rely on the stories told by the parties involved. However, as we expected to meet people who had actively been involved in contact with research centers, we also expected to be able to cross-check their point of view with some other data sources such as emails or other written documents as well as with contacts from the research center in order to verify the acquired information.

As stated previously, our purpose in this research is to construct a theory, and to this end we must proceed inductively, using multiple cases of a focal event, and innovation episodes (Yin, 2009). The use of multiple cases enables a replication logic wherein each case is used to test emerging theoretical insights (Yin, 2009). Such a methodology allowed for a close correspondence between theory and data (Yin, 2009). Theoretical sampling is employed for case selection; cases were selected because they

cast light on the concepts of opportunity identification and exploitation, and facilitated the development of conceptual patterns pertinent to these stages of the innovation process (Yin, 2009). Such sampling is appropriate for inductive theory building, while sampling for representativeness of a population is appropriate for theory-testing research, wherein results are generalized to hold true for that population (Yin, 2009). The use of an inductive approach limits generalization; it would not be appropriate to generalize findings from the study to the broad population of social enterprises. However, such generalization is not the purpose of the research; our purpose is to induce theory from qualitative evidence.

In order to maximize the results of the study, its structure has been built to fulfill four major conditions: construct validity, internal validity, external validity, and reliability (Yin 2009). Thus, in order to start the case study research design we had to follow a logic that would guide us from the questions to be answered to the conclusions extracted from them. This is why we needed to remain aware of the whole work scheme, as in figure 2.4, that should allow us to logically move from the empirical data to the study's initial research questions, and, ultimately, to its conclusions.

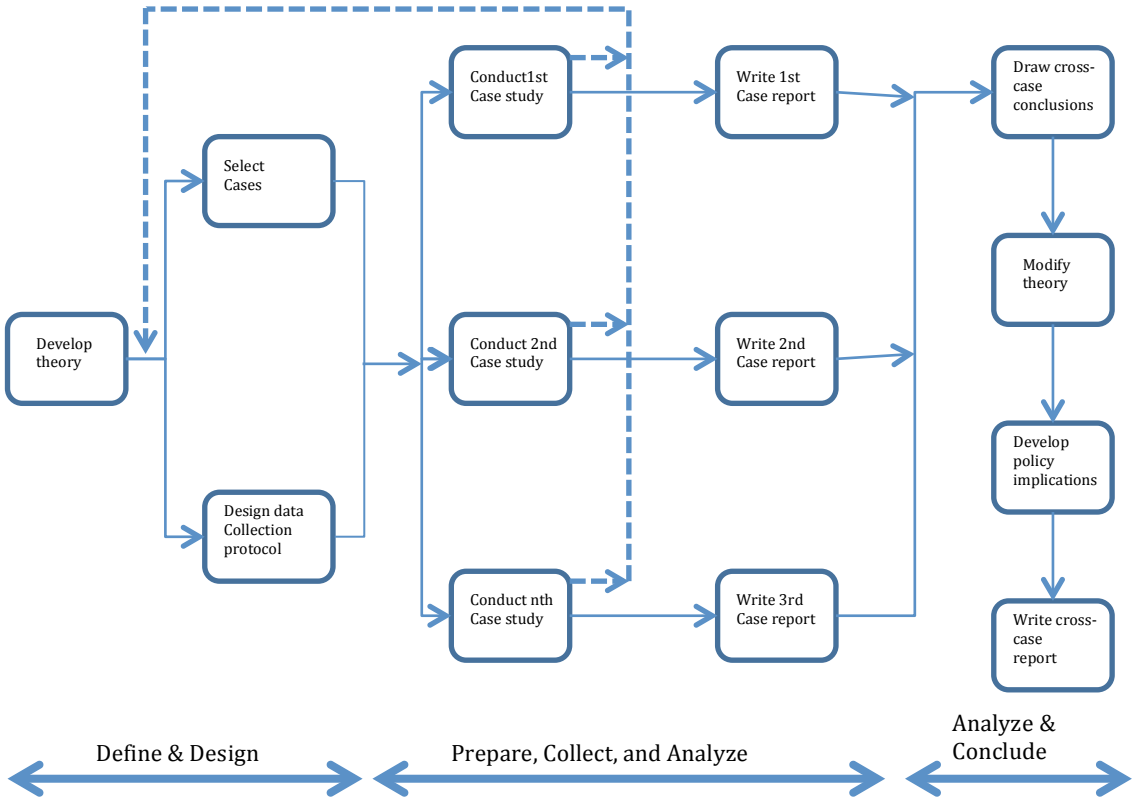

Figure 2.4. Case Study Methodology. (Adapted from Yin, 2009).

Also, the logic of this research design had to include the following components: the research questions, the theoretical propositions, the unit of analysis, the logic linking the data to the propositions, and the criteria to interpret the findings. The research questions are related to the type of question, in our case “How” and “Why”. The theoretical propositions helped us determine the crucial point on which we would focus the research, and hence its purpose. In a certain way we needed to know the rational, and direction that was behind each proposition. In our case, knowing how and why industries contact research centers should help to develop more adapted “products” to improve relationships, allowing them to be more effective and efficient.

The third component is the unit of analysis, which is related to our current subject or that of this specific "case.” This could be an individual or an event/process. In our case, the unit of analysis was industries with no record of previous relationship with research centers that have contacted them. The fourth component is the logic linking data to the propositions, and that was finding the pattern that matched the behavior for all studied units of analysis. That is why it was so important to check for at least two points of view: whether or not the behavior had an “effect” and/or which one explained the phenomena in a more accurate way. In our case, our first guess was to assume that the industries call a friend to start the relationship. Is this a common pattern? This allowed us to create a link between the data we found, and our propositions. We also studied the criteria used to interpret the results. In our case, the idea was to find out how “common” this “common” pattern has been. Unfortunately, a case study only allows proposing of a theory that will have to be validated later in a quantitative study.

With these five components covered, we end up with a theory of the researched topic. In our case, our purpose is to develop a theory that could be stated as follows:

“*The case study shows how and why industries with a market related problem that has to be solved with a technological development, and which have no record of previous contact with a research center, decide to contact one.”*

With this statement, the five basic components for a case study have been covered. The theory that has been developed is a transversal one between individual,

group, organizational, and societal behavior. In order to avoid setting too wide an objective we limited our scope to the substantive theory. This facilitated an analytical generalization, and avoided statistical generalization, even though we would like to go for a multi-case study design later on.

The next step was to check the research design. One of the most common ways to do so is by checking the construct validity, internal validity, external validity, and, finally, its reliability. In what concerns construct validity, the basic idea was to establish correct operational measures for the studied concepts. That is, to select the specific types of changes that are to be studied, and prove that the selected measures of these changes do indeed reflect the specific types of changes that have been selected. To ensure this, we used multiple sources of evidence, established a chain of evidence, and had key informants review the case study draft report in order to avoid "subjective" judgments when collecting data. In our case, the interview findings have been re-validated with documents, emails, or other sources of validation. Also, the study structure has been double checked by asking other professors to read and comment on it.

The external validity should help us determine the domain to which the study can be generalized. This means to be able to say if the findings are generalizable beyond the particular case being studied. As single cases offer little support for generalization, that is, the analogy with samples and universes is incorrect, we relied on analytical generalization. So we strived to generalize some particular results within a broader theory. This theory would then have to be replicated, as with a logic, for the multiple-case studies. As we had more than one case, we used the same logic/theory, behavior, and procedures for each one of the cases. In our case we carefully selected the industries to be studied so that they would all meet the same requirements of not having any record of previous contact with research centers, and of being willing to contact them in order to solve a technology related market problem that cannot be solved internally. Finally, the question of reliability is a matter of proving that the same procedures can be repeated whilst still providing the same outcome. That is why we used the same protocol, documented the procedures, and thus built up a study database of procedures and results.

In what concerns the case study design itself, a decision had to be taken concerning whether this work would be built around one case or multiple cases. One rationale for a single case study is finding a truly representative critical case. Other reasons could be finding an extreme case, a unique one, a representative case, a typical case, a revelatory one (previously inaccessible) or a longitudinal one (studied at two different points in time). Unfortunately, a single case with such characteristics has not been found, and so the study has been carried out on multiple cases.

Whether the cases should to be studied holistically or embedded was another point to be decided. In our case, we only wanted to study the global nature of an organization as a unit, and analyze its behavior. However, the decision to contact a research center might also include knowledge about subunits of the same organization. In such a case, the study had to be considered embedded. In any event, we made sure to include the subunits in the study.

Data collection was also another topic to be approached with care. We obtained our data from six sources: documents, archival records, interviews, direct observation, participant-observation, and physical artifacts. The ones used in a precise case had to be consistent one against each other in order to accept them. That is to say, two or more sources of information had to converge (or not) towards the same evidence so as to validate it. In the event that a divergence was found, the particular case would not be usable for the present research and would therefore be discarded. In sum, the resulting information should be a blend of all the checked sources.

We focused on field interviews with the person who had taken the decision to contact the research center, and did so. In some cases we found out that there were two or more people who carried out this role: one had taken the decision, and a third party carried it out. In such situations we conducted double/multiple interviews.

For the interview we had to be very aware that this technique has some advantages, as it directly targets the case study topic, and allows us to perceive casual inferences. However, poorly constructed questions may bias the result, the answers of the interviewee may also introduce a bias of their own, inaccuracies due to poor memory, or, finally, they could lead to the interviewer hearing what he or she wants to

hear rather than what has to be heard. The way in which interviews must be constructed is by making it feel like a guided conversation rather than structured questioning. This does not mean that we should not have a clear focus and structure during the interview; the point is simply that the interview should flow smoothly, and not be perceived as a rigid topic. There are some advantages to this, as the interviewee should feel more comfortable, explain more on the topic, and direct us to other sources of evidence that will have to be checked afterwards.

To sum up, in order to collect consistent data for our case study, we had to check the information findings from our source with other sources (triangulation principle), create a well organized data base with all the collected information as well as to make sure that any reader of the work would be able to follow and trace the reasoning behind the evidence.

2.3. Research Question

The research question has to reflect different aspects of the research. To start with, it has to include industries as the subject of research. These industries must have been thinking about a solution to a market related problem. In a certain way, the companies must have been aware that there was an uncovered market need. That is that the market was demanding a topic that the company was not addressing properly at the moment. This unaddressed problem needed to have a technological aspect that could not easily be solved internally. In order to address this demand, the companies needed to ask for help outside of their own structure. However, we focused on those companies that had not done so before.

Looking at the research question, it is important to specify what this research question means by “contact.” We intend to go deep into the procedures and behavior that lead a company, and its members, to make the decision to contact some specific person/institution regardless of the result of the contact itself. That is, later output or further movements or a lack thereof will not be taken into account.

We would also like to clarify what "first time contact" means. To have a first contact we decided that there should be no one working in the company at the moment that remembered previously having contacted with anyone on the subject of a technological problem. This could mean there may have been previous contacts with a research/technological center, but the parties involved are no longer in the company, and nobody remembers having had any contacts of this kind before.

It must be mentioned that we accepted industries that had worked with technological centers for reasons other than research. For instance, some technological centers do offer training or analytical test services, recruitment or teaching activities[29]. Such services should not prevent the specific Industry from being a candidate to this study. That means that the TRMO must require some kind of non "standard" service, and so lead to a more systematic and procedure-driven behavior for choosing the right solution to address it.

2.4. Theoretical Propositions

The theoretical propositions are derived from what we have seen in literature. At first it might seem that the most logical ways to make contact for the first time might be linked to what Thune (2007) or Wheatley (2009) mentioned. They should revolve around three basic topics: the use of facilitators, intermediaries, and/or some kind of social connectedness.

In order to clarify what we are talking about, intermediaries are the TTO officials or liaison officers of research or technological centers. The use of this channel assumes a certain passivity of industry, as the role of the TTO is to promote and visit industries so as to show what a given research or technological center has to offer.

Concerning facilitators, we define them as a kind of one-stop shop for industries looking for access to academic researchers, and advice on available grant funding (Wheatley, 2009). These are also known as translators, and they can be either

[29] Dr. Manfred Meier personal presentation as Head of department "University Cooperation" at AutoUni of Volswagen AG, UIIN Congress, Berlin, June 25th 2015 and Dr. Lena Christians personal presentation as Head of Corporate Employer Branding at Henkel AG & Co. KGaA, UIIN Congress, Berlin, June 25th 2015.

individuals or groups, such as the Federal Laboratory Consortium Locator Service, to which industries can submit their technology problems, and get advice about which technologies might serve their needs (Bauer & Flagg, 2010). This way assumes some proactivity from the industry to find out who can solve a given problem for them.

Finally, social connectedness seems to be an important factor (Thune, 2007; Santoro & Bierly, 2006; Luna & Velasco, 2003), which involves using personal networks in order to reach the goal of finding the right person/institution to solve a given problem. We could discuss whether we should have separated personal networks from the ones forged through, by, or for the company, or even draw a distinction between formal, and informal networks. For instance, that would lead us to discuss how to define what a friend is, taking into account how said person was met, either at a person's current job, at a previous one or at an informal event. We will consider this to be out of this discussion, and let the interviewees provide their own definition of friendship.

However the connectedness can come from different sources. Besides the obvious social capital industry employees may have built up, research centers are well known to have their own technology transfer offices, one of whose goals is the promotion of relationships with industry. Some research/technological centers, such as Leitat[30], have even developed a network of salesmen selling services that are not exclusively related to research. They may go from simple testing in pilot plants to providing recruitment of specialists. That is why it would be interesting to separate the impact of the previous contact activities from the more generic social capital ones to induce first contact for research.

As we can deduce from the above choices, our research is somehow reproducing a kind of a model, assessing the push activities of TTO intermediaries, and the pull activities of facilitators against the challenger, which is social capital.

Thus, the theoretical propositions will be (figure 2.5):

[30] www.leitat.org (Based on its content dated May 2015)

***Proposition 1**: A firm that approaches a research center for the first time to solve a technology related market opportunity contacts a technological facilitator whom it believes might know who could solve said problem.*

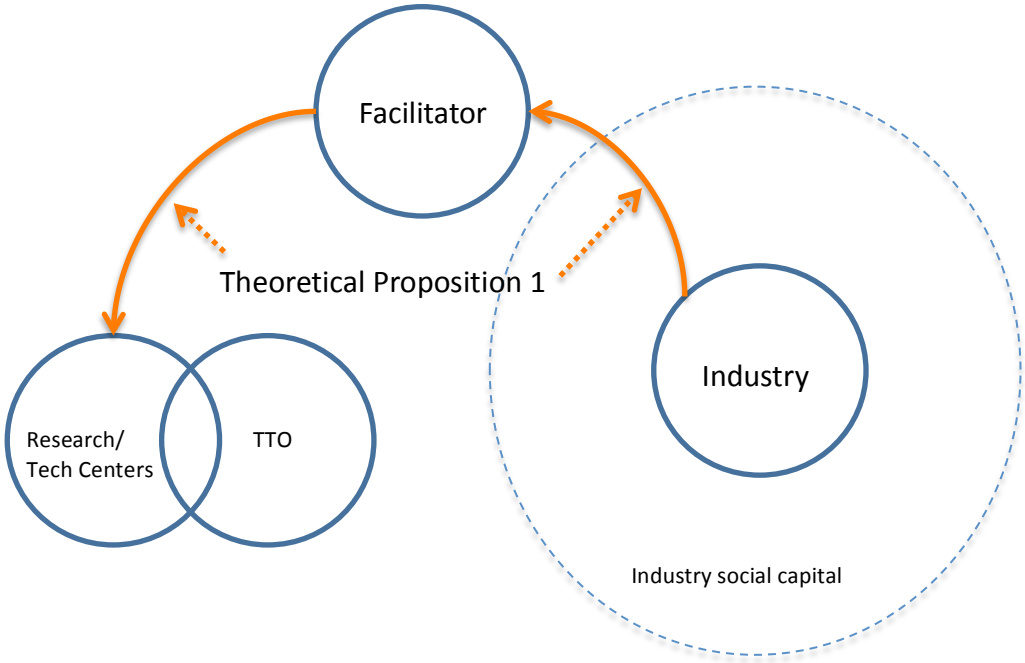

Figure 2.5. Theoretical Proposition 1

This theoretical proposition is intended to check the finding of Wheatley (2009) stating that a facilitator might be a way to contact industry with research/technological centers. There is no restriction on the way said facilitator has been contacted (email, phone, etc…). This person/institution is held to be able to lead to the right partner for the company, but who is not said partner. That is, the facilitator is perceived as a technological expert, and as a bridge to the research/technological partner but is not perceived as the solution in itself. On the contrary, those companies that do not confirm this proposition are those that contact a research/technological center directly.

***Proposition 2**: A firm that approaches a research center for the first time to solve a technology related market opportunity remembers having been visited by a research/technical center intermediary or having done other than externalized research activities with a research/technical center.*

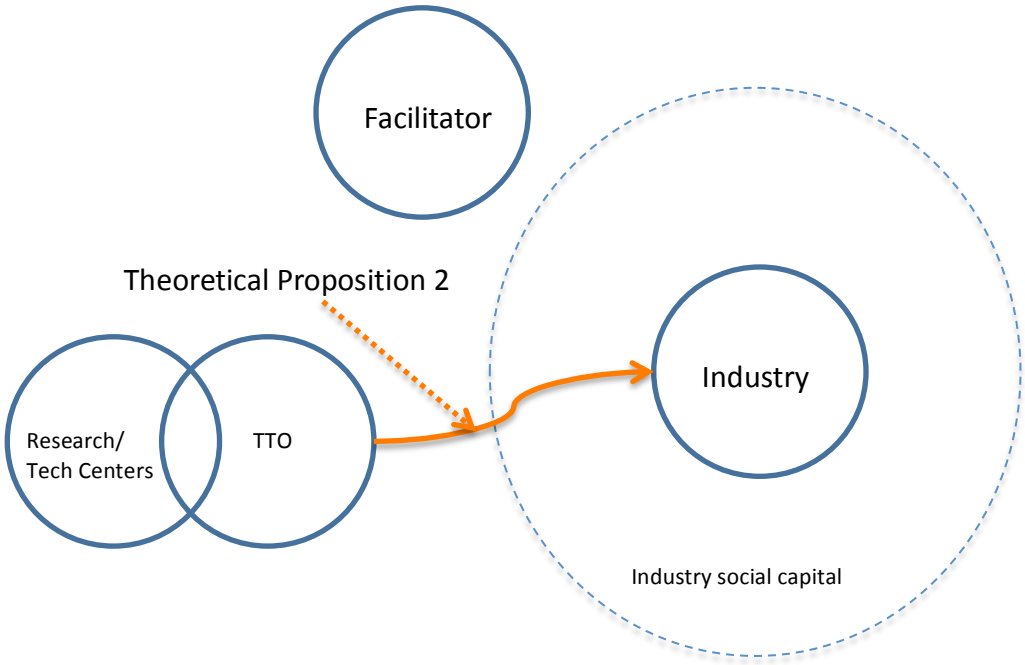

Figure 2.6. Theoretical Proposition 2

This theoretical proposition (figure 2.6) is intended to explore whether what Thune (2007) wrote on the fact that a majority of collaborations have been formed through the use of previous contacts is correct. In this particular case, we would like to assess the activity of the research/technological centers in promoting their R&D activities. The main idea here is that the research center, and specially the technological centers do perform activities research, essentially around teaching and recruitment. Therefore, the key point is to detect contacts for research and to discard contacts for other aims. In this case, the network use is a more formal one created in the melting pot of the company.

***Proposition 3**: A firm that approaches a research center for the first time to solve a technology related market opportunity proactively uses its social capital to find someone who could help.*

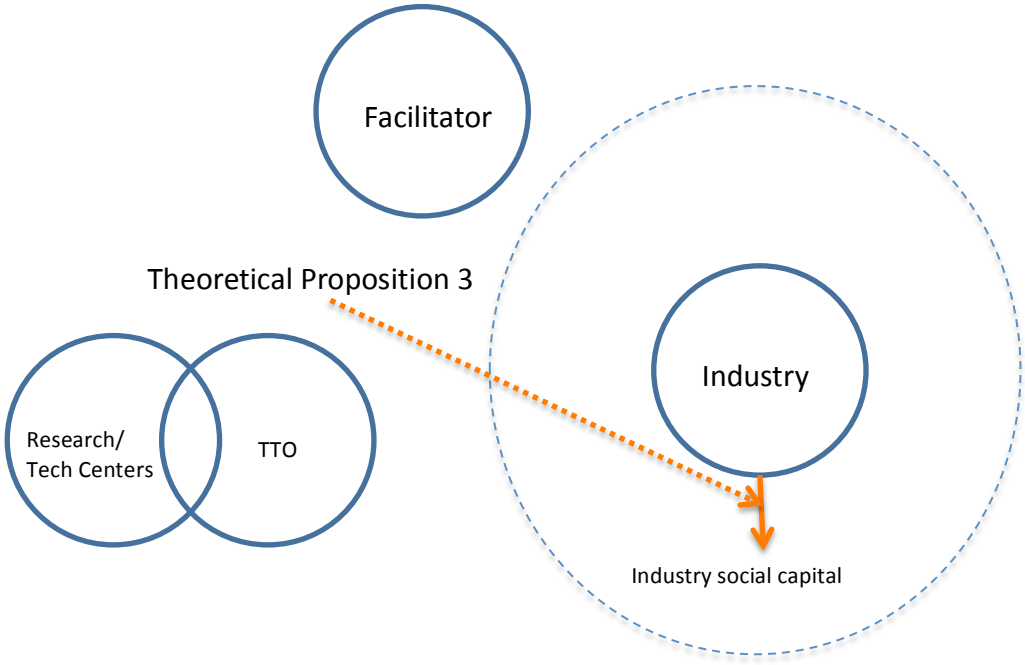

Figure 2.7. Theoretical Proposition 3

This proposition (figure 2.7) is intended to check the use of social capital as a source of finding solutions to an industry problem. Again we are in Thune's (2007) idea of collaboration formed through the use of previous contact, but this time the contacts are not research/technological center promoters. This includes the used social capital formed by the daily work of the company (for instance suppliers), at the university, or through new technology. That is to say, we include formal an informal networks. Maybe social media may be less formal than the legacy media, however, an increasing amount of formal networks are created through social media, leading to a blurring of the boundaries between the above.

To understand the complexity of the sources of evidence we have to take into account that, despite interviews are the basic one, five additional sources can also be taken into account: documentation, archival records, direct observation, participant observation, and physical artifacts.

2.5. Protocol to be followed

The protocol is more than a questionnaire or instrument (Yin, 2009). The protocol includes the procedures/rules, and the instrument to be used for the survey.

This is essential if more than on interviewer is involved. The objective is to ensure that data collection is performed in the same way, thus providing reliability to the research.

In our case, we defined three basic aspects. The first one is how we should present the study objective, and ourselves when faced with the interviewee. This part is what we could call our field procedure. The second one is the interview guide itself, and, finally, the last one is a guide on how to interpret the data collected. The way to present the data is an aspect that is self-defined because it is included in the work, which already has its own rules of presentation.

2.6. Data Collection

Primary and secondary data were collected. Primary data was gathered through semi-structured interviews. The interviews were 60–90 minutes in length, and captured data from key organizational informants. The informants were selected on the basis of their involvement with the innovation episodes in the present study. Secondary data such as email, internal reports, old strategic plans, presentations, and others were required to validate the interview information. However, not all sources could be used in all cases. Emails where almost never available anymore due to computer changes. Apart from the interviews themselves, old plans, and presentations were the easier ones to find.

2.6.1. Primary Data Collection

An interview guide with three sections was used (Yin, 2009). The interview guide is meant to help the interviewer, not the interviewee. The idea is to go through the whole sequence of activities that lead the company to perform the first contact with a research/technological center for research purposes. The guide construction starts on the research question, which has to be interpreted as the basic objective of the exercise. The theoretical propositions are the structures set to analyze the results. So, in order to answer the research question, the guide has to be fed with the topics found in the literature review. The answers of the interviewee will be assigned to these topics and compared to the answers provided by the other companies. A direct assignation of the

topics to the theoretical propositions is not recommendable in our case because it already would introduce a bias in the answer. So the answers of the topics will directly be analyzed through the theoretical propositions (figure 2.8).

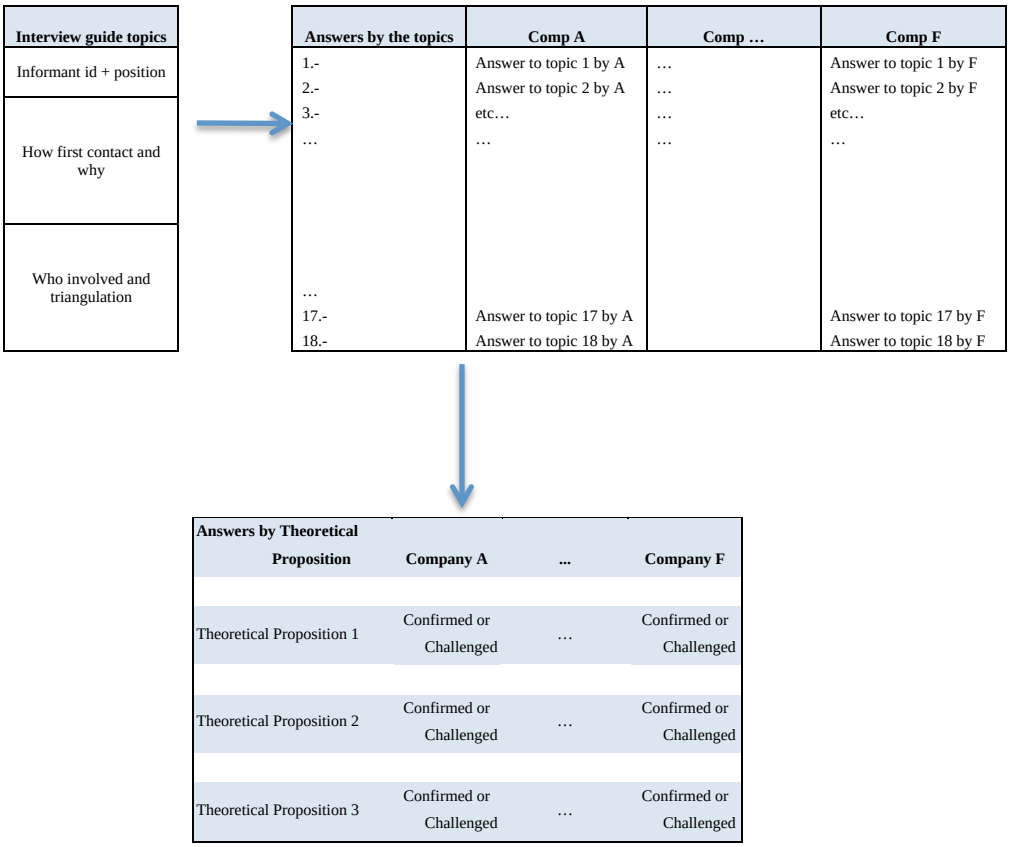

Figure 2.8. Interview guide structure and use

As per the interview itself, informant's identification and position in the organization are the first questions. Second, the informants should be asked to provide a detailed account of the first contact episode they had been intimately involved with. The informants should be encouraged to tell the story of the first contact from their own point of view, although probing questions should be asked to gain further insight into how and why the first contact went as it did. The third section should ask about specific constructs such as other people involved in the first contact episode, benchmarking and other relevant data that could add more details or help the triangulation of the provided information (figure 2.8). We saw these constructs as important for fleshing out a complete understanding of how such constructs had or had not changed across the first

contact episodes examined. All interviews should be digitally recorded and transcribed.

Interview data should be supplemented with field notes that contain information from conversations with non-focal actors such as people involved in the first contact but working in technological or research centers or people inside the companies who promoted or ordered these first contacts.

In order to be sure that the interview guide worked correctly, a test interview was performed in November 2012 with a company that seemed to fulfill the requirements. This interview can be found as addendum 4. The informant was its recently-retired General Manager. The interview showed some flaws in the interview structure that had to be addressed so as to obtain comparable data. For instance, it revealed that finding compliant companies was going to be harder than expected (no secondary data was available for the test case), and that the definitions of some concepts had to be clarified so that all interviewed people would understand the same things. A second interview guide was then proposed (addendum 5).

2.6.2. Secondary Data Collection

Secondary data came from some emails and meeting minutes, some of them handwritten, which complemented the interviews. These documents added rich detail to the episodes of the respective first contacts. Also, these documents were cross-checked with evidence gained through interviews and observations. Whenever possible, archival data was digitalized into text, and added to the database.

2.7. Company selection

One of the difficulties to find the companies that were to be included was the request to find those people working or having worked in a firm that had contacted a research/technological center for the first time (to the knowledge of the involved people).

The criteria used for choosing or discarding the companies were:

- Having contacted a research/technological center for the first time with the purpose of research.
- Getting in contact with all the people inside the company so as to be able to re-create the situation at the moment of the decision, and first-time contact with a minimum of at least one research or technological center.
- Carrying out successful semi-structured interviews with all the people involved in said first contact.
- Obtaining sufficient secondary information and/or secondary interviews to confirm the findings from the primary interviews.

In order to find these companies, the research was directed by asking/meeting people around us who might have had some contact with such a company/person:

- Private technological centers such as ASCAMM[31], Leitat[32], CTM[33], and Iris[34].
- Institut Químic de Sarrià (IQS) University technological center Peinusa[35].
- IQS[36], Universitat de Barcelona (UB)[37], and Universitat Politècnica de Catalunya (UPC)[38] professors, Escuela de Organización Industrial (EOI)[39]
- Technology transfer officer of governmental research centers such as Institut Català de Nanotecnologia (ICN)[40], Institut Germans Trias i Pujol (IGTP)[41] or scientists belonging to Consejo Superior de Investigaciones Científicas (CSIC)[42].

2.8. Treatment of the evidence

We followed a sequential protocol for the treatment of gathered evidence. The interview guide is written for the interviewer that is not to be shown to the interviewee. The list of possible answers is simply a series of notes on essential aspects that are not

[31] www.ascamm.com
[32] www.leitat.org
[33] www.ctm.com.es
[34] www.iris.cat
[35] www.peinusa.iqs.edu
[36] www.iqs.edu
[37] www.ub.edu
[38] www.upc.edu
[39] www.eoi.es
[40] www.icn.cat
[41] www.germanstrias.org
[42] www.csic.es

to be forgotten, but the interviewee is left free to answer any other possible questions. The interviews were transcribed. Once this was been done, the transcription was codified following the interview guide topics. That is, the sentences of the interviewee that were related to different topics in the interview guides were assigned to the corresponding topic. Once this was done, results were synthesized through a table containing all the interview topics and a summary of the findings for each of the companies. This method was also followed for the theoretical propositions. Every time the interviewee mentioned something relevant to a theoretical proposition, the finding was codified and assigned to said particular theoretical proposition. Unexpected evidence was added afterwards, followed by a company-by-company and proposition-by-proposition discussion of the results. The global sequence of the case study adapted methodology that has been used can be seen on figure 2.9.

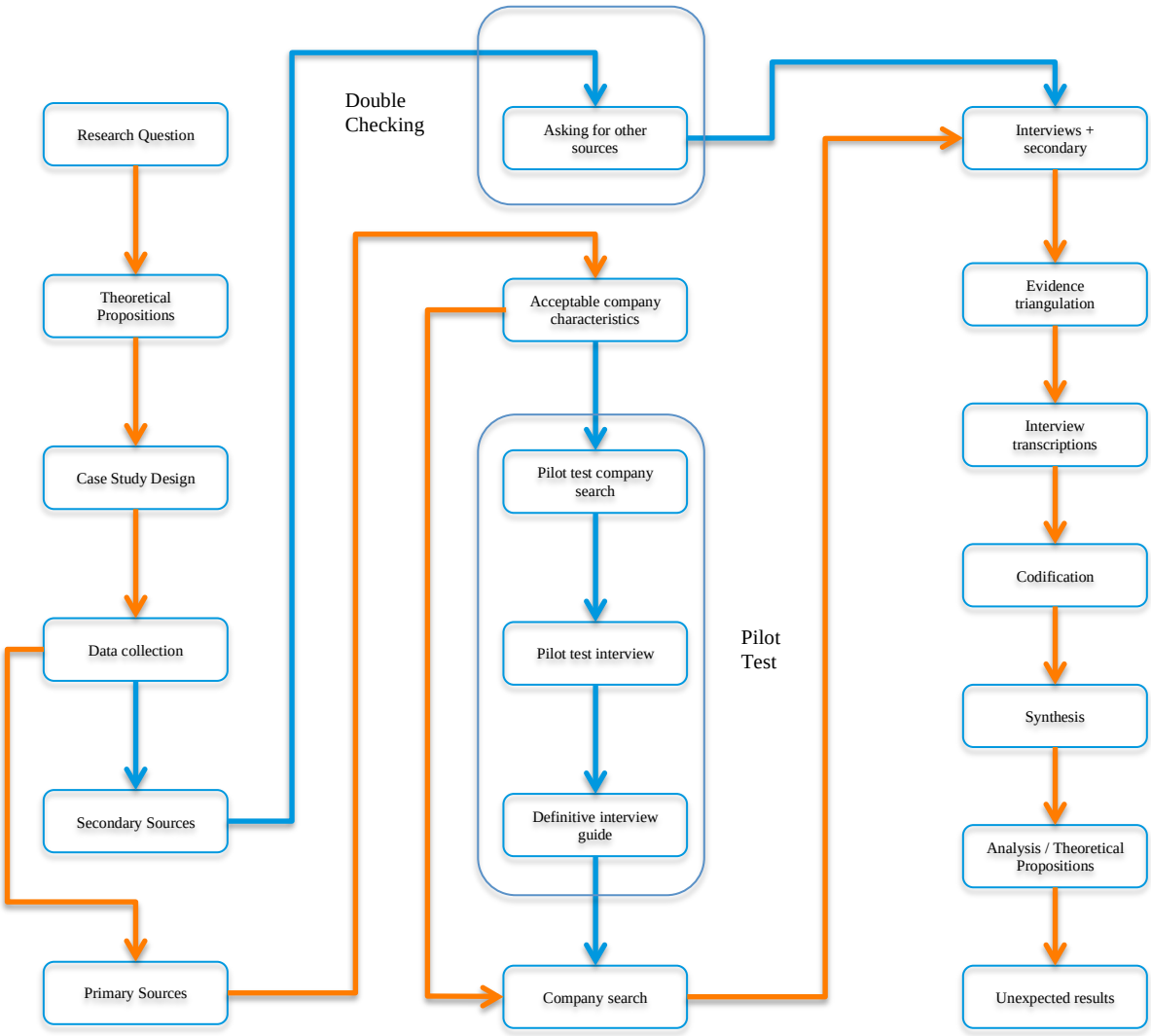

Figure 2.9. Sequence of the case study methodology

3. Case Study Evidence

Having selected the methodology described in the previous chapter, this chapter describes the results of its application. The first step is therefore to establish the protocol to be used and especially the semi-structured interview guide. The second step is to find and chose the companies that will be studied. Finally, evidence is treated through interview transcription, codification, synthesis, and analysis. The data is analyzed on a per-company basis, and within each company the analysis is carried out through the revision of the how and why the contact was performed, and through the theoretical propositions.

3.1 Semi-structured interview and companies

The semi-structured interview keeps the research question in mind and is based on the topics found during the literature review. Its construction must lead the interview but avoiding bias, especially being very careful not to lead the interviewee to tell us what we want to hear. Its structure left some room for the interviewee to explain his points of view on the major topics as way to open up the dialogue on more general topics that could better explain the research question. The interview guide topics, their relationship with the interview guide questions, and the corresponding theoretical propositions can be found in figure 3.1.

Nb	Topic	Related question in interview guide	Related Theoretical Proposition
1	Reasons why the first contact	1	
2	Circumstances	2	
3	Unsatisfied marked	3	
4	How need was identified?	4	
5	Knowledge of available technology	5	
6	Who was involved in the contact decision?	6	
7	Who was involved in choosing the person who should perform the contact?	7	
8	Why that person and not somebody else?	8	
9	Was his technology expertise a prerequisite?	9	
10	Who was involved and how the contact was performed?	14	2 - 3
11	Before contact what was UIC for the company?	10	
12	Which difficulties were foreseen in a UIC relationship?	11	
13	Differences between research and technological centers	12	
14	How was found who has what to solve the problem?	14	2 - 3
15	How to choose the right partner to contact?	13	2
16	How that partner was reached?	14	3
17	How was the contact performed?	14	1 - 2 - 3
18	Was an intermediary used?	14	1
19	Was there any benchmark performed before first contact?	15	

Figure 3.1. Table of guide topics

A first company search was launched in order to find a company that could fulfill the requirements just for testing the interview guide prototype (Addendum 3). A meeting with its company General Manager took place in November 2012, which showed some shortcomings in the semi-structured interview guideline (Addendum 4 and 5), and especially in the interviewee understanding of the definitions we used. In order to address this topic, we had to clarify a number of definitions (refer to chapter 1.2.1).

As a result of the changes, the final semi-structured interview guide was released. Besides the basic information regarding date, name of the interviewee, company name, and company position, the questions were structured as follows (Addendum 13):

3.- Evidence

1) Why did the company approach the research or technological center?
2) In what circumstances?
3) Could you describe the unsatisfied market need the company had?
4) How did the company identify that need?
    a. Marketing / sales requirement
    b. Internal known weakness
    c. Others: specify
5) Once the need was identified, was the company aware of an available technology to satisfy it?
    a. Yes
    b. No
6) Who has been involved in the decision to contact a research or technological center?
    a. Interviewee alone
    b. General management / Board
    c. Technical management / department
    d. Others: specify
7) Who was involved in the choice of the person who had to perform that contact?
    a. Interviewee alone
    b. General management / Board
    c. Technological management /department
    d. Others: specify
8) Why this person and not somebody else?
    a. Technological expertise
    b. Research expertise
    c. Personal relationships
    d. Person in charge of the project
    e. Others: specify
9) Was technological expertise of this person a prerequisite for choosing him?
    a. Yes
    b. No
10) Before contact was made, how did the company understand at the time the relationship between industry and a research or technological center?
    a. Based on partnership
    b. Based on service purchasing
    c. Others: specify
11) Which were the foreseen difficulties in the relationship?
    a. Different cultural behaviors
    b. Different institution objectives
    c. Different working paces
    d. Money-related problems
    e. Technology transfer problems
    f. Patents / royalty problems
    g. Confidentiality

h. Other: specify

12) Were there differences of perception of research centers versus technological centers?
    a. No
    b. Yes. Specify.
13) How did the company choose the one to be contacted and rule out others?
    a. Based on recommendation
    b. Based on reputation
    c. Based on papers / publications
    d. Based on geographical proximity
    e. Based on technological expertise
    f. Other: specify
14) How did the company reach that entity/person?
    a. Calling the standard
    b. Calling an insider (CEO, CTO, etc...)
    c. Calling somebody who knew an insider
    d. General email
    e. Introduced by email to an insider
    f. Going there in person
    g. Social Media contact
    h. Other: specify
15) Did the company benchmark different centers and therefore carry out different contacts before deciding with whom it would work with?
    a. Yes
    b. No
16) Who took the lead to convince the structure to contact a research/technological center?
17) What was the R&D collaboration culture before first contact?
18) How was the interest of grants for research perceived?

Once these changes finished, a new search according to the described methodology for suitable companies was launched, and 8 were found. The meetings took place during the period between January 2013, and April 2013. All 8 companies were visited, and interviewed. However only 6 of them confirmed the final quality requirements for the study (triangulation was not possible with the discarded ones).

3.2 Evidence on the First Contact

As mentioned in the methodology, once the interview guide has been created, tested, the final version validated, and the suitable companies found, the interviews could take place. During them, other sources of evidence were asked for in order to be able to proceed to the planned triangulation. Once the interviews recorded, search for the validation of the sources started. The valid interviews were transcribed, codified and synthetized. The further sections describe the particular events of each valid company.

3.2.1. Company A

Company A was reached through a contact at the CSIC. A Technology Officer at this Spanish official administration knew Company A from having worked with them on projects newer than the first one, which is the object of our research. Thanks to this person, we got in contact with the company General Manager. In order to double-check the information, a scientist from the ICN was also contacted.

Company A is a manufacturer and supplier of biocides, additives, and process chemicals. It originated close to Barcelona (Spain) in 1979 as a group of professionals from the chemical industry with the goal of contributing their experience to the development of sectors that are vital for human progress.

They provide technologically advanced products, highly effective solutions, and expert technical services to a wide variety of industries involved in the production of paints, coating, polymer emulsions, paper, fuel, detergents, personal care products, wastewater treatment, water desalinization, and water purification, among others.

Their products are structured along nine lines plus services. These are: agrochemicals, emulsion and adhesives, fuel, household products, metalworking fluids, paints and coatings, paper, personal care, and water treatment.

Our contacts were the General Manager and one of the company owners. The first time they decided to approach a research center was because they were developing a molecule, and they experienced a certain lack of control on the final result (too much

sulfur). They knew something was happening in the process but they didn't know what to do, when to do it, or how to do it.

The direct informants included:

- The co-founder of the company was involved in production, and was directly involved in finding a solution to the presented problem (semi-structured interviews took place in January 2013). (Addendum 6).
- A Technology Transfer Officer at the CSIC introduced us to Company A by indicating that this company could be a candidate for the research. The meeting with her took place at the UPC campus in November 2012.
- A scientist from ICN helped in double-checking what happened in the case of Company A. This person was a member of the scientific team in the first contacts with company A.

First contact for Company A with a research center took place back in the late 70s. The motive was the development of a molecule whose synthesis the company did not have complete control over. The market required less sulfur residues in the final product than what they were able to provide. This is their TRMO. They knew something was happening during the process but the Research & Development (R&D) manager did not know what to do, when to do it, or how to do it. This is the reason why this company seemed to be interesting to be included in this work.

The R&D referred the problem to general management, asking for permission to ask somebody outside the company for help. They were aware of the fact that this would cost money but, as they were not able to solve it internally, there was no other option. When asked whether they were aware of any available technology that could satisfy this need, the General Manager answered:

> *"No, but we thought somebody had to know it. An IQS final (chemistry) course student was training in the company, so how to access it was obvious. CSIC or other research centers were absolutely unknown to us. In fact, we only learned*

about CSIC 7 years ago[43] *in a research center presentation. Before that we could not even think about contacting any (research center) because they did not exist for us."*

Once the board decided they had to approach a technological center, the:

"IQS was close, and could be reached easily…. The student suggested we could contact the IQS, and that is what we did."

The student suggested that Company A should contact a specific professor at IQS. Company A did not benchmark anyone. However:

"It was easy, close to us, we knew the institution and we perceived it as being trustworthy and serious."

The contact itself was performed first by phone, in order to arrange a meeting. No benchmarking was done. The company did not even envision any other options. After the first meeting, the professor proposed a plan, which was finally followed. It is interesting to note that the expertise of the trainee was not a key factor in the contact.

3.2.2. Company B

An engineer from ASCAMM was one of the very first people involved in the first contact with Company B. As we contacted ASCAMM when looking for suitable cases for our research, this assigned engineer was the one who recommended talking to Company B, and who provided us with their contact details. That is how we met the General Manager of Company B.

Company B is a family-owned company established in 1985 close to Barcelona that resells radiant heat systems. Some years ago, their main supplier was a Dutch company. In 2006, this Dutch company wanted to buy 100% of the shares of Company B. Finally, the owners of Company B decided not to sell, and so acquisition negotiations

[43] Interview took place in 2013. That means that "7 years ago" refers to 2006.

were broken with the Dutch. Expecting the Dutch to find some other company to buy in Spain, and thus to definitively break all commercial relationships with their current partner, in 2007, the CEO of Company B decided to find a substitute, and rebuild the business focus by adding manufacture of products, and premium features to their products.

However, despite knowing what Company B needed, they did not have the knowledge for the production plant (robotic arm), and how to solve the addition of premium products.

The direct informants included:

- The Catalan Association of Family Owned Companies (CAFOO) General Manager (Interviewed March 2013).
- The General Manager, who was the person who pushed hard to change the company focus (Interviewed April 2013). (Addendum 7).
- The specialist engineer from ASCAMM (interviewed April 2013)
- The engineer who implemented the new orientation into the company (Interviewed April 2013).
- The ASCAMM engineer involved people to help Company B to re-orient itself. He helped in double-checking what the company mentioned during the interviews (Interviewed March 2013).

Back in 2004, Company B was a member of CAFOO. The General Manager of CAFOO was also a board member of Company B in 2007, when the need to rebuild the business around the new Italian provider became a must. By that time, Company B was breaking their relationship with their Dutch global supplier because they wanted to change their supplier for an Italian origin one. This latter was not supplying the complete product, as the Dutch were, but just pieces that had to be adapted to the needs of individual customers. Company B wanted to develop its own products based on these Italian original pieces. However, to develop the new Company B radiant systems, the warehouse had to be transformed into an industrial plant including casting, and assembling robots. This is their TRMO. Company B General Manager said:

"In 2006 we had an offer from the Dutch, but their price was too low. They did not take into account 35 years of good relations. Their offer was not attractive. On February 2007 the board decided not to sell, and go for the option of producing their own product lines."

The question of "how" came to the board where the CAFOO General Manager was sitting. The company General Manager remembered:

"We needed to rebuild the business, reach an agreement with the Italians, and build a production capacity in our warehouse."

And the CAFOO General Manager remembered:

"In 2004 I met an engineer (from ASCAMM) by chance during a meeting organized by Catalan Association of Family-Owned Companies. It (for ASCAMM) became a natural choice to contact him for this project."

All the board was involved in the decision. At the beginning the idea was:

"We wanted an industrial adviser. A weak collaboration for the design of the robot. The robot had to be ready for production by Jan 1st 2008."

The CAFOO General Manager knew ASCAMM could help with developing that robotic arm quickly. The reputation of ASCAMM in this field was good, according to him. However, the board had a very different idea. The General Manager of Company B said:

"We saw two options. The main one was to ask the robot supplier, and its subsidiary, ASCAMM… The board thinking was that a technological center does not provide speed."

Despite the fact that the CAFOO General Manager was not an expert on the required technical aspects, the board asked him to contact ASCAMM. He therefore called the engineer he knew from ASCAMM. The conclusion of the phone call was:

"We'll meet at ASCAMM."

On the first meeting, apart from the company General Manager, and the CAFOO General Manager from Company B, the known engineer from ASCAMM, a robotic technology engineer, and a project leader, and casting manager from ASCAMM were also present. The way the company reached the research/technological center makes this company eligible for this present work.

3.2.3. Company C

We requested a professor from the Escuela de Organización Industrial (EOI) whom we had known for a long time to provide us with names of companies that could suit our research. He was the one to ask Company C if they would agree to participate. As a consequence of having this professor as a contact within the company, we got the approval of General Management to meet with the test engineer from Company C.

The basic idea of its system came from the Aeronautical Engineering School of Madrid, where some students developed an initial crank system prototype for bikes in 1995. After the Head of the school approved the project, the University's Manufacturing Department helped with the creation of the prototypes. The designers decided to establish a company to complete the development of this product, and start a business venture.

Some years later, the company wanted to perform some mandatory fatigue tests on new prototypes. They were faced with three basic options. The first one was to buy the machinery to perform them. Another option was to pay for a certified laboratory to perform them for Company C. The last possibility was to subcontract them to a non-certified body.

As the prototypes were not finished goods, the need for a certified laboratory was not a crucial demand. On the other hand, buying the machinery was not an efficient

way to invest company resources. As a consequence, the company preferred to find a non-certified (but still reliable) laboratory. This is their TRMO.

The direct informants included:

- The test engineer involved in product development, and the one who needed some external help to proceed (Interviewed March 2013). (Addendum 8).
- One of the company owners, and the head of the engineering, and innovation departments (Interviewed January 2013)
- A Carlos III University professor who runs the test lab that Company C chose to contact first. He also helped as an opportunity to double-check what was explained by the test engineer (Interviewed April 2013).
- A professor at the Escuela de Organización Industrial who introduced us to Company C (Interviewed December 2012).

Company C, born as a startup from University, has maintained good contacts with it from the beginning. In 2007, the production engineer, and the test engineer needed to perform mandatory European Norm (EN), and other fatigue tests on the new prototypes. The three options were: option 1, to buy the machinery, option 2, to pay for a certified laboratory to perform the tests, and option 3, to subcontract this job to a reliable but non-certified laboratory.

Discussing these possibilities internally, option 1 also implied having to:

"…Develop a (test) bed by ourselves. This would have been very noisy, and suboptimal."

Thus, this option was not retained. Option 2 was the one chosen from the beginning. Company C then started by performing some tests at a certified laboratory for normalized tests. However, after a few months, they realized that:

"We started with option 2 but it is expensive, you lose know-how, and you have to stick to the test protocol."

The latter aspect was a limiting factor for the parameters the company wanted to test. As a producer, Company C also wanted to test some aspects of the prototypes that are not tested during the ones mandated by European Norms. Thus, option 2 was perceived as a restriction by the company.

The test engineer started to think about where he could perform such "special" tests. He knew a professor from days in University. Added to the fact that they were both cyclists, and were therefore acquainted from bicycling together; the professor had therefore learned about Company C through this channel. The test engineer proposed the idea of contacting this professor to his direct supervisor, the managing engineer, and product designer. The idea was:

> *"We wanted to do the test at the University laboratory of this professor. We decided to visit his laboratory, and talk to him."*

Once they had made the decision, the test engineer called him directly on his personal cell phone, and they both decided that:

> *"First, the professor would come to Company C to make a proposal (for the tests) with the University facilities. I would then visit the laboratory (at the University), and start working to adapt the machines/beds."*

This is the reason why this company is an interesting one for the present work. The expertise of the test engineer in this case was key to start this relationship.

3.2.4. Company D

An engineer from ASCAMM suggested that we contact Company D as it seemed to be a suitable candidate for our research. He provided us with the contact details of the chief engineer at Company D.

Ever since Company D began operating in 1975 is specialized in the production of all kinds of manufactured products, derived from the deformation and transformation of metal sheets and tubes, and has brought together mechanical, pneumatic, and

hydraulic parts, bearings, and other components to offer finished industrial products, manufactured to meet each customer's needs.

By 2007, Company D was an industrial subcontractor producing scaffolds and parts for industrial vehicles. When the construction bubble burst, Company D had to change by introducing its own products, and through internationalization. The idea was raised to modify the received plans, specifically for their Dutch airport suitcase logistic carrousel designer to make production simpler, cheaper, and to allow for more customer-friendly maintenance. They knew what to do but some of the knowledge was unavailable inside the Company. This is to be considered their TRMO.

The direct informants included:

- The chief engineer at the company. He knew what happened during the first contact, but had taken place before he joined the company (Interviewed April 2013). (Addendum 9).
- The engineer in charge of the international division development, and who had to find the external help to implement the change in company focus (Interviewed April 2013).
- An engineer from ASCAMM involved in the beginning of the process (Interviewed March 2013).
- The project leader from ASCAMM (Interviewed March 2013).

Until 2007, Company D basically had two lines of business. On the one hand, its main line of work was producing metal tubes for scaffolds for the building industry. On the other hand, Company D was a subcontractor for pieces to be used in other kind of structures. The chief engineer from Company D mentioned:

> *"We received plans to build pieces for industrial vehicles, and also worked for VdL, a Dutch specialist in airport logistics. We produced the carrousel for them."*

With the 2007 construction crisis, sales orders for Company D dropped dramatically. The chief engineer remembered:

"We had to change. We needed own products with high value, and internationalization. We needed own products not related to the construction industry, but rather, to intralogistics, yes!"

The carrousel plans received from VdL were clearly improvable:

"The VdL engineers did not know enough about the production process. The Company D "creator engineers" know it, and could pass it to the plant for assembly and repair."

To this end, Company D created an innovation department, and the international division engineer took this innovation position. Said engineer mentioned the aim at the time:

"We saw that position to look for grants, and organize the innovation process in order to solve the problem of a project that is too large and so to improve customer products."

For instance, improving the VdL carrousel required a project with a budget of 300.000€, a sum Company D could not afford. However, to innovate was not only a matter of better designs. The production plant also needed to be improved, and Company D did not have the knowledge to do everything internally and customers were putting more and more pressure on producing cheaper in order to be competitive.

At that time, a University professor offered to assist Company D in this matter. The international division engineer recalled:

"This Professor wanted to do things but everything was too general. No project was ever put into place. It was too theoretical. There was no…. (feeling)."

Also, Company D had some contacts within the local technological center CTM. He described their relationship:

"We carried out tests at CTM for analysis but it was not for us (for "not the kind of center suited to our needs"). Not for development or know-how…."

By 2008, the international division engineer was introduced to an engineer from ASCAMM at the CECOM metal conference. The international division engineer sent an email to said engineer's personal email address at ASCAMM, and agreed upon a meeting at Company D. Apart from this engineer, a project leader from ASCAMM also attended the meeting. The international division engineer recalled:

"The relation depends on how close the interlocutor is."

This ASCAMM engineer sounded like a good "interlocutor":

"He was close technically, he was knowledgeable, and had worked a lot on the topic, and he was available."

This is the reason why this company is eligible for this present research. This shows the importance of the expertise of the international division engineer to carry out a first contact.

As a benchmark, other technological centers such as Leitat were also considered. However, for this first contact, Leitat was not contacted. A University was also a possibility. The international division engineer did even think about contacting it:

"Company D is very practical. There is no staff to make a connection with the theory of the University. University is too theoretical. It reacts too slowly. We would not get anything from them."

3.2.5. Company E

An engineer, who was working at the ASCAMM technological center at the time, provided us with the name of company E. He asked their CEO if he would agree to participate in the process and that opened the door to contact the chief engineer of Company E.

In 2008, a family-owned company founded in 1925, that we will call FSO, had been producing metallic valves since then. FSO culture was very industry-oriented. The valve market being very mature, the focus was on lowering costs year after year. As a consequence, by 2008, the product portfolio had remained virtually unchanged for 15 years. Furthermore, valve references were being downsized so as to reduce the amount of unprofitable items.

Company E, a Japanese company, acquired FSO in 2008. Very soon, Japan sent a product development engineer with the clear aim to develop local know-how. He requested an R&D department and procedures to be put in place. This is to be considered their particular TRMO. By then, former firm people were not aware there were uncovered market needs, and that there were ways to develop, and provide solutions for them.

The direct informants included:

- The engineer in charge of the engineering department, and the one who has been in charge of contacting external help to re-focus the company towards a more customer-driven one (Interviewed March 2013). (Addendum 10).
- The assigned engineer from ASCAMM, the person Company E contacted first (Interviewed March 2013).
- The chief engineer of ASCAMM, the person who was contacted first (Interviewed March 2013).

In 2008, this family-owned firm, with its portfolio of standard metallic valves unchanged for 15 years, was acquired by the Japanese Company E Corporation. The Japanese immediately started to introduce changes. The chief engineer recalled:

> *"Japan sent a product development engineer who stated that St. A (location of the acquired firm) must develop knowhow, or it's as good as dead… You make a good product and expensive but customers demand a product cheaper and more adapted to their needs."*

Research & Development became a must and that meant a change in the Company pattern. On one hand, the former firm needed to keep its old assortment, but it also had to develop a new one that was adapted to customers. At the time, the company also had some clear technological shortcomings when it came to implementing the new business focus. Finally, company culture did not help with this change. The chief engineer recalled:

> *"If we had decided to do the things like this, it was because this was the correct way. Anyone from outside wanting to change anything inside would be faced with resistance or an unwillingness to listen."*

For a while, splitting the activities into two different companies was envisioned. In this context, contacting a research or technological center was simply unthinkable. For the employees, and even the commercial team, there was no need to do so as the market was not demanding it. The chief engineer mentioned:

> *"We did not know there was a market need. It is very difficult (to know) if there is no technology surveillance… You discover technology by doing R&D."*

But the Japanese wanted to set up an R&D Department, and to obtain a UNE 166002 certification for R&D management. New, more rigorous procedures had to be put in place so as to ensure the survivability of the company. A first group made up by an operation manager, quality, logistics, engineering, and sales was set up to implement this requirement.

It was then discovered that, without external help, it would be very difficult to develop R&D activities and procedures. It was therefore decided to ask for help, but the question was to whom. The operation manager's brother worked in a technological center. Perhaps by asking him, Company E would be able to get a better idea on how to find the right partner. This way of contacting is the reason why this company is interesting to be included in the present work. The answer came with a recommendation to talk to the previously-known engineer from ASCAMM. The chief engineer exchanged some emails with him, explaining the situation and the need to establish this R&D department and procedures. The known engineer from ASCAMM then suggested

that the right man for this specific task inside ASCAMM was the engineer in charge of the innovation, who was finally assigned to the position. The expertise of the operation manager seems to have been crucial to be able to correctly explain what the company needs were in order to enable the interlocutors to assess who could suit Company E better.

From that point, the assigned engineer visited Company E and proposed a plan to set up the R&D department and procedures.

3.2.6. Company F

We asked an engineer from the technological center CTM to suggest names of companies that could be suitable for our research. He provided us with the name of Company F, and that is why we contacted their managing director.

Company F specializes in manufacturing aluminum products for the industrial sector. Their vision for the future and experience allow them to offer products tailored to the needs of each client: to transform ideas into products. The company was first set up in 1965 as an aluminum dye factory. Thanks to the experience acquired, it started to manufacture extrusion presses, and later it continued with the extrusion of profiles for the industry and the construction market.

Some years ago, Company F was in the midst of a general process of strategic re-thinking. To help them in this task they hired a new manager for the board of directors endowed with the required strategic thinking skills. The idea was to refresh the company and introduce innovative future sales products. Meanwhile, some customer requests lead to a need for aluminum welding. Company F had neither the machine nor the expertise within the company. This is the TRMO of this company.

The direct informants included:

- The managing director of the company, who was involved in the new focus that required external help from the beginning (Interviewed March 2013). (Addendum 11).

- The General Manager of Company F, the person in charge of, and the promoter of the global changes (Interviewed April 2013).
- An engineer form CTM, the person the company contacted first (Interviewed April 2013).

Company F has had some prior contacts with technological centers: AIMEN in Vigo (Galicia), CTM (Manresa, Catalonia), FES (Ripoll, Catalonia) or ASCAMM (Cerdanyola del Vallès, Catalonia). However, the reasons why they had contacted them concerned training (CTM, FES), recruitment of specialists (ASCAMM), quick prototype testing (FES), or testing aluminum structures (AIMEN).

During the construction crisis, the board began to reflect globally on the direction the company had to pursue throughout the next years. Some board members attended the innovation groups of the *Forum Carlemany*, an association looking for excellence in management and continuous improvement of its members. In 2009, the outcome of these meetings included innovation as the key point for future survival. Thus, the company developed the idea of boosting innovation among its products.

The board and, in particular, the General Manager of the group had to decide how to implement this innovation strategy, but they were not quite sure about how to go about it. As a matter of fact, the General Manager also had doubts about who could be of help. His experience with the technological centers increased his skepticism:

"The egoism between centers makes you lose time."

The General Manager of Company F insisted:

"They all say they can do it but it is not true. You never know if you are reaching the best candidate to solve your problem. Maybe you have chosen a low-level one."

This shows how important it was for him to be able to assess the actual potential of a technological/research center to help him. His own expertise was therefore a key success factor.

As with the first time, the only possibility was to ask around. Company F General Manager mentioned:

> *"The first contact had to be performed on the basis of geographic proximity or networking. Thanks to the Forum Carlemany we enlarged our vision…Trustworthy networks allow you to avoid wasting time in order to find who could help."*

However, before Company F had the opportunity to contact any technology centers to solve its problem, and in the context of trying to find new customers abroad, managing director of Company F joined a commercial mission to Mexico organized by the Catalan Government. During the long flight hours, he was introduced to the General Manager of ASCAMM, who mentioned the experience of his technology center in aluminum tools. The managing director of Company F thought this center could suit his institution. By that time, Company F was only thinking about tooling innovation rather than implementing and systematizing the innovation process. In fact, Company F was not conscious of the real problems posed by innovation. Its employees had not even thought about what it meant, and how to implement it. In any case, the expertise of ASCAMM managing director was crucial for this first contact. This way of reaching the research/technological center makes this company eligible for this present work.

3.2.7. Summary of the evidence by company

In order to make a summary of the evidence by company we may look at the answer of each company regarding four basic items: how the company was reached, why the company case is interesting for this research, the particular TRMO, and how the contact took place (figure 3.2 and addendum 12).

	Company A	Company B	Company C	Company D	Company E	Company F
TMRO	Too much sulfur	New product/factory	New prototype test	New product creation	New owner	Strategic re-thinking
Behavior	Trainee professor	Through board member	Former professor testing lab	Conference introduction	Call brother	Ask around but stumbled by chance
Reason why	Simple, close, easy	Natural choice	Cycling	Personally and technically close	Trust for good advice	"Trustful networks allows avoid wasting time in finding who could help."
Why company interesting	Something was happening but could not find the reason	Never had production before. Need a robotic arm	Tests at a certified laboratory were not satisfactory	Knew what to do but not how to do it	No R&D performed before	Wanted to implement an innovation strategy but did not know how

Figure 3.2 Summary of the evidence by company

3.3. Evidence by Theoretical Proposition

Following the methodology, the evidence related to each company has been compared to the theoretical propositions. Every time the interviewee mentioned something relevant to a theoretical proposition, the data was assigned to this particular theoretical proposition. This chapter reflects this assignation (figure 3.2).

3.3.1. Theoretical Proposition 1: Contacting a Facilitator Bridge

As a reminder the first theoretical proposition is:

Proposition 1*: A firm that approaches a research center for the first time to solve a technology related market opportunity contacts a technological facilitator whom it believes might know who could solve said problem.*

Now going through each company evidence related to this theoretical proposition:

- Company A: The student did suggest somebody he knew, a professor. It is clear that Company A contacted this professor taking for granted that she could directly be of help. The aim was not to contact her in order to know who could be the right person/center to solve the problem, but rather the idea was that this specific professor could be the solution. Thus, the professor cannot be considered to be one stop-shop or a facilitator. As a consequence, this theoretical proposition is not confirmed (challenged).
- Company B contacted ASCAMM through a board member who knew the General Manager of ASCAMM. However, ASCAMM is a technological center in itself, rather than a facilitator who can provide answers on which center would be most suitable to solve a given problem. In a way, the facilitator was already inside. In any case, this theoretical proposition is challenged.
- In the case of Company C, the test engineer contacted a professor he knew. Again, the idea behind this contact was that said professor would be the solution, rather than a bridge or conduit towards the person or center who could solve the problem. Thus, this theoretical proposition is challenged.
- For Company D, the maturity of the TRMO is a matter of concern. It is not clear whether or not the need was there by the time the professor contacted the company to offer his services. The fact that the company international division engineer says that the offering was too theoretical means that the TRMO was at least not mature enough to consider it to be a first contact with the aim of research. Thus, the option of a real first contact being the professor must be discarded. As a consequence, the first contact took place at the metal CECOM conference, where the test engineer was introduced to an engineer from ASCAMM. The bridge was the person who introduced the engineer from ASCAMM to the company. In light of the above, this theoretical proposition is challenged.
- Company E: rather than a friend, the contacted party was someone's brother who worked at a technological center,, and who redirected the company to the right person. Said person was not the solution, but, rather, a facilitator of sorts. It thus follows that this theoretical proposition can be held to have been confirmed.

- Company F had developed a large array of contacts in diverse technological centers for topics other than research: AIMEN, FES, CTM, or even ASCAMM. In the context of the *Forum Carlemany* they brought up the idea of introducing innovation in their assortment. We shall then consider this forum to be a facilitator that guides the companies towards the right partner to solve their problems, even though the first contact did not come directly from it. However, it is not a facilitator in the sense of the theoretical proposition. So that leads us to say that Company F does not confirm this theoretical proposition.

3.3.2. Theoretical Proposition 2: Contacted a Perceived Solution

As a reminder the second theoretical proposition is:

Proposition 2*: A firm that approaches a research center for the first time to solve a technology related market opportunity remembers having been visited by a research/technical center intermediary or having done other than externalized research activities with a research/technical center.*

Now going through each company evidence related to this theoretical proposition:

- Company A knew the research center they contacted. During the interviews, they had a clear idea of what it was:

  " Close, (good) reputation, easy access."

  On the other hand, the company did have students from this institution as trainees in the company, and this has to be considered another way of learning about the research center whilst having carried out activities other than externalized research with the IQS. All in all, we can consider Company A to have confirmed the requirements of this theoretical proposition.
- Company B directly did not have any previous relationship with ASCAMM. They had never been visited by them or had done any kind of activities other

than research with ASCAMM. Thus, this theoretical proposition does not apply to Company B (theoretical proposition challenged).

- Company C: The fact that the test engineer was a former pupil of the University professor who was contacted leads us to confirm that the test engineer knew of the existence of the professor's laboratory. This was confirmed by test engineer. So again, this theoretical proposition is confirmed.
- Company D remembered CTM as a technological center they had used for tests and analysis. Despite the fact that Company D did not consider CTM to be an appropriate technological center for their research, and development needs, it is a technological center, and Company D remembered it. Therefore this theoretical proposition is confirmed.
- Company E: Throughout the entirety of the reviewed documentation, and during the interviews, no one mentioned having been previously visited by any technological or research center or having done any other kind of activity with one of them. Therefore, this theoretical proposition is challenged.
- Company F had contacts within all of the mentioned technological centers and all of them for topics other than research. Thus, in fact, they knew them from having visited or having been visited by them. This theoretical proposition is therefore confirmed.

3.3.3. Theoretical Proposition 3: Use of Social Capital

As a reminder the third theoretical proposition is:

Proposition 3*: A firm that approaches a research center for the first time to solve a technology related market opportunity proactively uses its social capital to find someone who could help.*

Now going through each company evidence related to this theoretical proposition:

- Company A employees did not know the professor. It was the training student who did. However, since he was a trainee at Company A, he should be held to be a member of Company A because he proposed the contacted person at IQS in

the context of his duties within the company. Thus, Company A confirms this theoretical proposition.

- The CAFOO General Manager met the chief engineer of Company B for the first time during a social activity organized by the CAFOO. It therefore follows that the chief engineer did not call or use directly any known person (direct use of social capital), but was introduced to a person who worked in the technological center at a social event. They did not do anything at the time but, when Company B needed a center to solve their TRMO, the board member remembered him as an option. Though Company B did not use the social capital to check if the center was the most suitable one for them, this theoretical proposition is confirmed.
- Company C: The fact that the test engineers recalled a former professor, probably reinforced by the friendship developed through cycling, is a clear case of using social capital to find a solution. Thus, this theoretical proposition is confirmed.
- The international division engineer at Company D was introduced to an ASCAMM engineer at the metal CECOM conference. Thus, there is not a pro-active use of old social capital to find the right partner. In this case, attending the conference can be considered to be building up new social capital for the company. As with Company B, Company D did not check whether or not the chosen center was suited to their needs with the people they knew with their social capital. Another example is how the professor who proposed his services to Company D, despite the fact that Company D had known him for a long time, was not considered as a possibility. The case of the CTM technological center is equivalent. All in all, we should consider this theoretical proposition confirmed.
- Company E: No one mentioned remembering anyone who could be of help. As said above, the former firm employees, and specifically the ones included in the first team, did not include anyone as a possibility for helping them. Only the operation manager's brother, who had worked in a technological center, was the person to have been contacted. Thus, this theoretical proposition is confirmed.
- Company F specially mentions the use of social media such as Linkedin to search for the right partner. In fact, for the first contact, this was directly useful. However the company validated their "stumbling by chance" through a social media activity. So in both cases, this proposition has to be considered confirmed.

3.3.4. Summary of the evidence by Proposition

In order to summarize the evidence by the theoretical propositions a table has been created in which it is indicated if the particular theoretical is confirmed or not for each of the companies (figure 3.3). A “Yes” in the case, means that the above mentioned theoretical proposition is confirmed. A “No” means it is not confirmed (challenged).

Theoretical propositions	Company A	Company B	Company C	Company D	Company E	Company F
1.- They contacted a facilitator who they think might know something about the subject or a person who can help	No	No	No	No	Yes	No
2.- They remember having been visited by a research/technical center agent or having carried out other than research activities with a research/technical center.	Yes	No	Yes	Yes	No	Yes
3.- The company uses its social capital to find the right partner to help them solve their problem	Yes	Yes	Yes	Yes	Yes	Yes

Figure 3.3 Evidence by Theoretical Proposition

3.4. Other evidence:

The semi-structured interview guide (Addendum 1) included some questions in order to see if other aspects besides the studied theoretical propositions might have any interest. These are questions 10, 11, 12, and 18. The questions provide some extra information that is worth mentioning.

Starting with question 10, which looks for the understanding of the UIC at the time the company had decided to contact the research/technological center for research. Company B was looking for a quick solution was a matter of concern. If speed were not

there, they would have selected a different party to assist them. For Company C, despite the fact that the idea was initially to simply purchase a testing service, the relationship evolved into something more like a partnership. Company D knew a local technological center that provided testing services, but that made them understand that this particular center was not suitable to provide research services to them. For Company E, university is a school that allows you to find a job. Thus, having any kind of relationship with it was ruled out as a possibility. For Company F, research centers are for basic research and they held them to be too distant for their daily needs. They believed a relationship could only be developed if a grant was acquired. Globally, despite the fact that disagreements and fears were also mentioned, it seems that there are two basic points of view on this questions: it can either be seen purely as a matter of purchasing a service, or simply as something so distant from the company that it had never crossed the minds of its employees.

Question 11 was about understanding the difficulties foreseen in a relationship with a research/technological center. Company B mentioned doubts about the red tape such relationship might involve. Their idea was that knowledge is not created at the university but at the firms. Company C also mentions the fear of bureaucratic proceedings, and a concern about disclosures. Company D feared that the research/technological center might be systematic/procedure-driven, and detached from reality. The company was very down to earth, and there was no one to connect with the "theory" of the center. In general, university is far too theoretical, and distant from the needs of companies. If the relationship were to go too slowly, it would not be useful. Company E mentioned the culture gap. At that time the company philosophy was that:

"If we have decided to do it like this, it is because it will be a well done job."

Thus, the company structure was highly resistant to change, and unreceptive towards external ideas. There was a fear that the relationship with a research/technological center might change that, and so we might assume the R&D absorptive capacity (Healy et al., 2014; Perkmann et al., 2013; Piva & Rossi-Lamastra, 2013) of the company structure may have been minimal. According to Company F, the potential problems were cultural differences, the fact that university is too slow, that different working places might lead to lack of communication, and misunderstandings,

and that the relationship could only be built using grants. Therefore, the companies as a whole mention red tape and the culture gap as the most important points. Companies hold themselves to be more practical and quick, and that is what they expect from their research/technological counterpart.

Question 12 is also interesting insofar as it documents the differences in perception between research university centers, and technological centers by the companies. Two companies did not foresee any difference at all. Company C said no difference at the beginning but after thinking it over, mentioned there might be some differences. However, the companies mentioned that universities are more on focused on theory / pure research, and not practical enough while technological centers are seen as closer to the companies. They are a kind of know-how reservoirs that companies can use.

Finally, when it comes to question 18, which attempts to determine if some kind of benchmark was carried out by the companies to decide on the research/technological center they would work with, 4 out of 6 companies performed some kind of benchmark. Among the ones that did so, two (B, and C) looked for two different options at the same time. It is interesting to mention that the benchmark of Company B was carried out between a research center, and a robot supplier, which is not to be considered a research or a technological center. Also, Company F mentioned they were worried about choosing the best center for their needs. The problem comes when centers all state they could do the research job, and that they were the best partner the company could take on for said task. Who the company should believe? Is there one, which has not been contacted, that could do even a better job? These questions seem not to have an answer.

Globally, these questions have raised the topic of a cultural gap between research/technological centers and industry, the image the companies have of the relationship, and of these centers, company fears in terms of practicality, speed, or the right partner, and company behavior in terms of choosing a center.

There are also findings that could be extracted from a transversal listening of the audio recordings. It seems the idea of contacting had to go through different stages before truly being carried out. The stages start with a conscious understanding that a TRMO cannot be solved internally. At that point, said conscious understanding must be

spread within the company. For Company A, it was the industrial engineer who finally acknowledged the fact that he or anyone within his team could find out the way to solve the excess of sulfur. The R&D manager had to find a solution so as to cover commercial demand, and therefore asked the General Management for help. For Company B, the question was that, on the one hand, they never had developed own products, and, on the other, their factory was not prepared for that task either (robotic arm). Consciousness of external help was raised up to the board, and to the CAFOO General Manager. For Company C they saw that using a certified body for research tests was not providing them with the kind of data they needed. Worse, they were slow, and expensive. Thus, another kind of laboratory was needed. The test engineer brought this up to General Management. For Company D, the need to refocus on airport carrousels was not possible to carry out internally as the company needed tremendous changes in behavior, procedures, and plant layout, and this could not be done alone. The company needed external help for that. The General Manager himself proposed to the board to ask for this external help. For Company E, the push came from the new owner to open up an R&D department, and asked the operation manager to do so. For Company F, the R&D experiences explained by other companies at *Forum Carlemany*, led the General Manager to convince the board to open up an R&D department, and he himself took the responsibility to do so.

All in all, we observe that, in all cases, the abovementioned consciousness is brought up to the board, and the board empowers someone to find a solution to the TRMO through external help. This means that, in all cases, two kinds of leaders appear: on the one hand, there is the leader who raises the topic to the board. On the other, there is someone who carries out the contact with the research/technological center. Both roles may be carried out by same person but in any case, an empowered leader is necessary within the company for that first contact to take place.

Another aspect of these replicated findings is that of R&D collaboration culture with external centers. Though this was present in none of the companies prior to the first contact, there was nevertheless an embryo of said culture. For Company A, the trainee knew that collaborating with his former professor was possible. He therefore “sold” the idea that a culture of collaboration was possible to the company. For Company B, the CAFOO General Manager was a board member, and so he was the one

to convince the rest of the board that collaboration was possible, and that this culture could be developed. For Company C, the problems encountered when attempting to fulfill the required fatigue test in a certified laboratory pushed the test engineer to convince the General Manager that this collaboration was possible. For company D, the chief engineer "sold" the idea that the collaboration was possible to the board. For Company E the process of "selling" collaboration was inverted, as it was the new owner who imposed it. In any case there was also a top-down selling. Finally, for Company F, the selling was done at an external forum, and then transferred top-down within the company.

As a conclusion of these findings, breaking the ice, and accepting to study a possible collaboration in R&D with an external center requires someone within the company with a cultural background according to which said collaboration is possible. Said person needs to take the lead, and sell the idea to the board. The acquisition of this culture is always external to the company, as the culture does not exist within it at that precise moment. The acquisition of a culture of collaboration can come from a leader with previous university studies or at management forums. Finally, the same person or another one must be empowered to carry out the contact.

The companies also expressed fears on R&D costs. Though this aspect was not explicitly asked for in the questions, Company F General Manager said:

"No grants, no research."

Two ideas may be derived from the above statement. On the one hand, this means the company knew that research could be carried out with a research center. On the other, this also implies that the company knew there were grants available to pay for that research, and linked the relationship to the existence of the grants. It seems, at first sight, that if the risk is too high industry firms will not finance research. Would grants bounce the relationship without a TRMO? Though the studied companies might be aware that the needed collaboration would cost them money, and effort, this did not prevent them from making contact for the first time. It therefore seems that a TRMO is more important than the existence of grants as a bouncing factor for R&D first

relationships. Grants seem to be more of an excuse than a real factor, at least for a first contact.

3.5. Summary of the evidence:

In order to clear up the evidence by the topics a summary table has been created (figure 3.4).

	Interview analysis By the topics	Theoretical proposition	Analysis
1	Reasons for the first contact		Very diverse: Need for external help that cannot be solved internally, either for a specific project or because of a global change in strategy focus.
2	Circumstances		Most companies did not have any previous relationship. Some did have it either for training or testing but not for research or development.
3	Unsatisfied market		All but one did have market needs or urgencies to cover. One was simply not aware there were uncovered market needs. It fact the company did not even look for them.
4	How was the need identified?		For most, the customer was asking for changes. On two, the strategy was the leading point.
5	Knowledge of technology available		Most answered "Yes" but not all were completely aware of what was available. Company C and Company B knew. The others not really or simply not at all (Company E)
6	Who was involved in choosing the person who should perform the contact?		The board is involved in the decision.
7	Who was involved in the choice of the person who should perform the contact		Top management but also other management positions: production and finance.
8	Why that person and not somebody else?		Mostly because of personal contacts, others because in charge of the innovation or promoters of innovation.
9	Was his technology expertise a prerequisite?		The technical knowledge of the person chosen to lead the contact was mostly (5 out of 6) a prerequisite.
10	Who was involved and how was the contact performed?	2 -3	Some top management supervision is demanded on how the contact will be performed. This seems to tell how important the topic is understood at top level.
11	Before contact what was UIC for the company?		Either is seen as a pure service purchasing topic or it was something too far away for the company to think about.
12	Which difficulties were foreseen in a UIC relationship?		Red tape, different cultural behaviors, and far away from their daily business are some of the difficulties. Companies need more practical things they can understand and speed in answering for their requests.
13	Differences between research and technological centers		2 out of 3 do not see any difference (at first sight). Others see technological centers as more practical and close. Universities are perceived as know-how reservoir, a theoretical research center, and a school to ease job access.
14	How was the question of "who has what to solve the problem" solved?	2 -3	5 out of 6 by personal contacts either direct or through networking. 1 by chance.
15	How to choose the right partner to contact?	2	Very diverse: Could be internal (Company A) or external recommendation (Company F), or knowledge of the person (Company E) or simply the choice was not possible because it was inside (Company B).
16	How was that partner reached?	3	2 out of 6 reached it by a direct visit (Company B and Company D). 3 out of 6 used a phone call. 1 out of 6 did it by email (Company E).
17	How was the contact performed?	1 - 2 - 3	After the first contact, a meeting was scheduled. 4 out of 6 meetings took place at the technological or at the research center.
18	Was an intermediary used?	1	None used a professional technology broker.
19	Was a benchmark performed before first contact?		4 out of 6 did some kind of benchmarking. Out of them, 2 did it with 2 different options (Company C and Company B) and 2 benchmarked similar technological centers. But knowing if they chose the best is still unknown.

Figure 3.4. Summary of answers by topic

Also a summary of the evidence through the theoretical propositions is included in the following table (figure 3.5).

Theoretical propositions	Evidence	Reasons
1.- They contacted a facilitator who they think might know something about the subject or a person who can help	1 confirmed, 5 challenged	1 confirmed but not through a professional one. 5 challenged (no use of a facilitator)
2.- They remember having been visited by a research/technical center agent or having carried out other than research activities with a research/technical center.	4 confirmed, 2 challenged	4 confirmed but the previous relationship did not imply the contact for research. 2 challenged (no remembering)
3.- The company uses its social capital to find the right partner to help them solve their problem	6 confirmed	Social capital is a always used but can be developed or imported for the specific need.

Figure 3.5. Summary of answers by theoretical proposition

Finally a summary table of the unexpected evidence is included in the following table (figure 3.6).

Other evidence	**Analysis**
Contact goes through different stages inside the company before it is carried out.	Either it was perceived as a pure service purchasing topic or too distant for them to be interested in it.
Leadership	It seems an internal leader is necessary to spread the need for first contact. Once the idea is acquired, a leader for the contact is also necessary.
Collaboration culture	It is acquired from outside (trainee, acquisition, university education) and/or internally developed.
Grants	Industries know about their existence, but TRMO is more important than their existence for first contact.

Figure 3.6. Summary of answers for other evidence

4. Discussion

This chapter is intended to discuss the evidence described in the previous chapter. Following the agreed upon methodology, this discussion starts by discussing each theoretical proposition, one by one. Then follows a refining of the theoretical propositions. New theoretical propositions are also proposed. The other evidence are also discussed and the chapter ends with some recommendations, research limitations and proposed future research.

4.1. On the subject of the Theoretical Propositions

Starting the discussion by the theoretical propositions, the goal is to try to reach conclusions on the evidence related to each of the propositions. These conclusions will have to be related to the reviewed literature to see it is consistent with what has been read or there are discrepancies.

4.1.1. Theoretical Proposition 1

Reviewing the first theoretical proposition, which states that the Company has contacted a facilitator who they thought might know something about the subject or a person who can help, we have seen that it was confirmed in only one case. For Company E, the facilitator was someone's brother, and therefore not a professional facilitator, though in this case, he performed such a role. In other cases, the companies did not use a facilitator as defined in the proposition. We did not consider the cases of Companies D and F to have confirmed the theoretical proposition because social events are not a facilitator as defined in the proposition. However, social event, such as the CECOM conference for Company D, and the *Forum Carlemany* for Company F, were used in ways similar to a facilitator or bridge to the solution, albeit not a technological one.

In the other cases, somebody within the companies had worked as a facilitator, answering the question of "who could we call." In Company A, this was the trainee; in

Company B, this was the board member, and in Company C this was the engineer himself. This internal facilitator also shows the need for some kind of leadership to propose, and carry out this first contact. When the contacted facilitator is from outside the company, the leader takes or is entitled to take the lead to contact. When the facilitator is from within it, the leader is in fact the facilitator. In all cases, who carries out the contact does have the minimum technological knowledge to do so, and so acts as a facilitator bridging or routing the company towards a solution.

In conclusion, the use of outside facilitators is not general. None of the studied subjects used professional facilitators. There is no common procedure for it. Only in one case, a non-professional facilitator was used. In other two cases, the facilitator was a social event, where companies discuss and share their needs, and obtain feedback about the experiences of other companies, which have gone through similar problems. Furthermore, the selected cases show a kind of common pattern concerning procedures or behaviors for facilitators. The use of social events as a place to exchange, and get information on who could be the right partner is a possibility among companies that use facilitators. This procedure might be significant, though not general, among companies similar to the studied ones.

We should now link these findings with the literature, especially with Wheatley (2009). This author mentions the English network of one-stop shops linking industry with skilled academic researchers as well as providing information and advice on grants, and funding possibilities. He gives a specific successful example with a Japanese multinational corporation, and comments TTO official experiences on UIC. In fact, this author promotes locally-based structures that are close to customers in order to better serve local industry needs. Looking at our interviews, and considering that none of the revised industries used or even mentioned this kind of professional facilitator structures, it seems that these local structures do not exist in Spain or they had not reached the companies in our study.

If we take the definition of facilitator as found in papers such as Santoro & Bierly (2006), that is, as a factor easing the UIC formation, grants were only mentioned by three companies (D, E, and F), but more as an excuse than as a real factor in

contacting. Again, it seems the existence of a TRMO is more determining than the existence of grants for starting a relationship.

4.1.2. Theoretical Proposition 2

When it comes to the second theoretical proposition stating that the Company remembered having been visited by a research/technical center agent or having carried out activities other than research activities with a research/technical center, four of the companies confirmed this theoretical proposition. Company A used a university to recruit a trainee, and, as a consequence, they had carried out activities other than research with it. The test engineer from Company C did remember the laboratory he knew from his times as a university student. Company D used CTM technological capacities for testing. Company F used technological centers for topics other than research such as testing, training, or recruitment. The other reviewed companies, Company B and Company E, did not have any record of having previously used them.

To conclude on the subject of this theoretical proposition, the research or technological centers were well-known among the companies at the time the centers visited them. However, the fact that the visited companies did have some kind of knowledge about the technological centers does not seem to have an important correlation with an increase in relationships based on research. Only Company F, which had previously used the chosen technological center for recruitment, finally contacted it for research. But even in this case, the determination to use a technological center for research came from the existence of a TRMO, and the development of trust created during their first “research” meeting, not because of their previous relationship.

Thus, the common behavior of companies is to make a distinction between research for TRMO, and on other topics. It seems there is no clear link between the “non research activities,” and the “research activities.” Companies have not developed any clear procedure on how to chose or validate the technological center they know from other topics when it comes to research. So maybe, future research may require the incorporation of a new theoretical proposition on the presence or absence of a course of action to validate which research/technological center to contact.

The conclusions of the study of Thune (2007) on the formation of ties show that government policies have little impact on the creation of R&D links with research/technological centers. The reason seems to be the lack of “an explicit demand” for it from the industry. This is shown again in the conclusions on the theoretical proposition. Being known is not sufficient to create an R&D link. The structure, and maybe the grants, have to be there but are not sufficient to induce the relationship. Thus, the findings of Thune (2007), which were related to government structure, are found again when related to research/technological center activities to promote their research activities.

4.1.3. Theoretical Proposition 3

In what concerns the third theoretical proposition, which sets that the company uses its social capital to find the right partner to help them solve their problem, we found that all companies confirm it. The trainee at Company A remembered his old professor at the university, and used this recollection to satisfy the needs of the Company. Company B remembered having met one of the chosen research center engineers. The production engineer from Company C remembered his former professor and his laboratory. Company D found the center in social event whilst building up its social capital. Company E contacted a relative of an employee. Company F found its center at a social event, and used its social media network to validate its choice.

In conclusion, the use of social capital is general. Two companies contacted a former professor. A board member of another company used his address book to contact the technological center. Also, a manager called his brother, who was working in a technological center. Only in two cases had the links been formed while building up social capital at an event. The reason for this building up was TRMO, and did not come from previous experience. Thus, the use of previously developed links, whether at the university, among company suppliers or others, seems to be a common procedure among companies trying to find “research partners.” In this case, the companies lacked previous experience, and building up social capital from scratch seems to be the norm.

It is important to point out that social media such as Linkedin is beginning to play an important role as, in one case, it was used to validate and check whether or not the first contact technological center was the most appropriate one.

The strategic proposals by Thune (2007) to increase the UIC are linked to two aspects. On one hand, there is the idea of the "boundary spanners," a sort of entrepreneurs with a large array of internal, and external contacts. Their capacity to move back and forth between university, and industry allows them to play a central role in the relationship. This boundary spanner is found in Company B, in which a board member was also the General Manager of the Catalan Association of Family-Owned Companies. However, the idea of an entrepreneur is also found in the other companies in the form of a leader who sells the idea of contacting on the inside, and a leader who carries out the contact. For this leader to do his job, he needs to be empowered to carry out both roles. He needs to be confident enough to sell the idea of external help on the inside, and he needs to be empowered to carry out the external contact.

On the other hand, there is the question of students. Thune (2007) also mentions that students are to be considered a key resource in networks between industry and universities. This is the case of Company A, where a trainee was the one to propose who to contact to, and who was finally empowered to do so on behalf of the company. All in all the ideas of Thune (2007) have been validated but they also raise other questions. Whereas government proposals, and student mobility have both been validated, measured, and quantified, how can we measure the amount of capable "boundary spanners" present in the firms? In any case, increasing their numbers will also require time, and the way to "create" them is also a matter of concern.

4.2. Refining of the Theoretical Propositions

With the previous results in mind, in this subchapter we would like to discuss other findings around the theoretical propositions. That is to have a look at the other findings that have been raised and their implications on the theoretical propositions confirmation, challenge, extension and the research itself.

To start with, it seems that there is a certain confidentiality created in a limited circle of people with common aims that helps with the disclosure of some interests, and therefore to share and discuss different possible solutions. That is, the companies, by disclosing some of what they do or how they do it, obtain some interesting information from the experiences of the other assisting companies in return. This then facilitates the flow of information within this circle, and this information is then taken into account in company-level decision-making. That is why social events such as the CECOM metal conference, the *Forum Carlemany*, or commercial missions are to be considered "facilitators." Even taking these social events into account as facilitators, the chosen cases show that only 3 out of 6 have used this way to find the research partner capable of solving the TRMO. That means that the behavior might be significant but does not seem to be general. This might require some clarification, and a broadening of the definition of a facilitator, as well as delving deeper into the hidden wishes of SMEs.

Concerning the second theoretical proposition, looking for companies reminding of having been visited by an intermediary or having purchased services other than research from a research or technological center, 4 out of 6 companies comply with this sentence. However, the previous existence of relationships based on reasons other than research does not necessarily mean that the center has been contacted for research. This is verified in only one case. It seems that companies create their own image of the role each center is able to perform, and is suitable for. If said image does not fit into their research need to solve their TRMO, the center is simply and plainly discarded before first contact. As a consequence, it would be interesting to study these images, and their consequences as capable partners for the needed research.

This idea has two aspects: on the one hand, the image of the center according to company decision makers in charge of the first contact. In some cases, the image of the center makes it ineligible from the start (case of Company D with CTM), perhaps because the decision makers know or foresee its limitations. On the other hand, there is also the image of the center among the people companies ask for advice when moving their social capital. If this image is positive among the people being asked, it may lead to contact (case of Company F with ASCAMM). That means that having previously collaborated for reasons other than research does not make the center directly eligible for research collaboration.

The topic of image is also to be related to suppliers. Two companies did contact at least one of their suppliers in order to solve their TRMO. Company A contacted a supplier of trainees. Company B called their robotic arm supplier as a first choice. However, no one pursued this venue. It would be interesting to know the circumstances in which companies decide to solve their problem with a supplier or via a technological or research center.

These conclusions lead us to the third theoretical proposition, and the importance of social capital to make decisions. Thune (2007) mentioned that building of social capital through personal networks seems to enlarge and facilitate contacts whenever they are needed. 4 out of 6 cases were already acquainted with the center or facilitator they contacted. This can be called the use of already created social capital. But at least two relationships were formed without previous contacts with any technological or research center. Such tie-forming processes can be called need-driven collaborations. That is consistent with Thune (2007).

Globally, the chosen cases show that the use of social capital is a common procedure. However, the quality of the social capital used is rather different from one company to another. The case of Company E using the operation manager's brother, compared to Company D being introduced to a new technological center it knew very little about, may lead to drawing a distinction between weak and strong ties. This is consistent with Bergenholtz & Bjerregaard (2014). However, the kind of strong ties we found among our cases are for some reason not business-related. For Company E, the strong tie stems from family ties, and for Company C the strong tie comes more from cycling, and, perhaps, a mentor-student relationship rather than from a business relationship. As a consequence, the theory of strong ties and weak ties is not clearly validated within the studied cases, simply we do not have real strong business-related ones. In fact, we could even consider that the studied companies do not use clear direct strong ties with the research center to find the one they think might be of help. However, they use strong ties as a hub to reach those who can solve their TRMO. In a way, they use the strong tie as a by-pass to reach the right partner for research (figure 4.1).

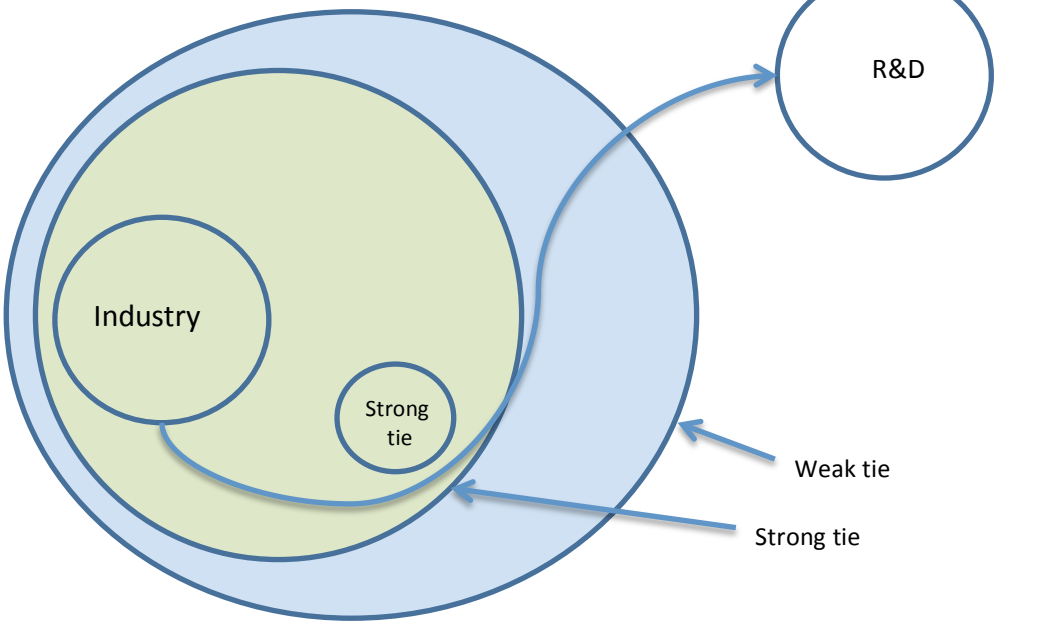

Figure 4.1. Industries use strong ties to reach the right partner

Concerning social media, while social media does not apply to Company A because social media did not exist at the time, the fact that one Company (Company F) already used such media to assess their possibilities may mean that this conduit could explain an increasing number of first contacts in future.

Adding to the theory of strong ties, it is interesting to analyze whether the previous ties were formal or informal. We consider a formal tie to be one that is directly linked to the position the person occupies. Thus, informal ones are those that are not job-related. As examples of informal ties we have Company C (Cycling friend), and Company E (brother). In the other cases, the parties met may have previously been known, but they were always linked to the position the person was occupying. It would be interesting to study the prevalence of contacting an informal contact compared to the formal ones, as well as to study the results of such new relationships.

4.3. Other results discussion

In this section we would like to discuss the results that have not been raised by the theoretical propositions and their link to literature.

Starting with the reasons why a contact is carried out, it seems that the construction crisis that began in 2007 had a significant influence on decisions to contact research/technological centers. This is the case at least for Company B, Company D, and Company F, whose boards of directors did have an urgent need to re-think their business model, and find a successful way to overcome the radical drop in sales. In the case of Company B, the decision to start selling and producing their own products came just prior to the crisis. In the case of Company D and Company F, the crisis forced the re-thinking. In the other cases, the building crisis might not have had an impact, but other critical factors did. For Company A, it was a market requirement of a more purified product (with less residue) that brought up the need for contacting. Company C needed to perform diverse tests on new prototypes, and this was the driving force behind the contact. The need of Company E came from the new owner whose experience showed there was an uncovered need that required applying new technology to their products. So in all the cases, it seems that an external shock was necessary for the companies to contact.

All companies did make an effort to find the right person/institution. To ensure their firm would find the one that suited it best, they all took some aspects for granted. You can either trust a friend for advice, a research/technical center for its competences, trust an old teacher from university, trust a supplier for having proven its knowhow and even trust what you have been told on internet. But in any case, this initial trust seems to be limited to simply “asking, and seeing.” There seems to appear an important aspect here, concerning the act of asking. As soon as you ask for help, you disclose your needs. As no company likes to disclose its own weaknesses, it is then important to disclose to somebody who will not make any use of the information thus disclosed. This might indicate the importance of personal networks in starting a relationship in which trust is a real matter of concern. Gubbins & Dooley (2014) wrote that the strength of ties is sometimes equated to trust, and that there are arguments indicating that trusting relationships lead to greater knowledge exchange. Therefore, trust seems to be required

for sharing important knowledge. As a consequence, trust must be considered a valuable commodity (Gubbins & Dooley, 2014) to make the leap.

Another factor that could be extracted from this work is the question of leadership. In all cases, we found someone raising an internally unsolvable problem, asking for, and taking the lead to find a technological solution outside the Company. This leader could be a manager (Company E, Company D, Company C, Company A) or a board member (Company B, Company F). This person could search and perform the contact himself (Company F, and others), or ask somebody else to do it (Company E, Company A), but in all cases, under board supervision.

As a consequence of these last two findings, one common pattern we found is that industry research/technological center interaction occurs if the market need is there, and if there is leadership or a person in charge of the interaction. To validate this theory, a quantitative explanatory study would be required. Adding to that we could check whether the "feeling," as mentioned in the case of Company D, could have an impact on the decision of who to contact. The "feeling" could be interpreted as the impression of the interviewee that they would not work well together. However, a way of knowing this company "feeling" might be to ask about which selection criteria are used by the companies to select one institution or another.

Finally, on the importance of the fourth, and fifth dimensions introduced by Carayannis & Campbell (2009) in the Triple Helix model, media does not seem to have had any remarkable influence on the decision of SMEs to contact research or technological centers for research. The same happens in civil society. However, a culture of collaboration can be seen in a different way. None of the studied companies had a culture of collaborating with external entities on the topic of research. It seems that companies knew they could collaborate but had had no need to do so until that date. A culture of collaboration for R&D had to be developed, and that took time. However, it seems the person who raises the idea of collaboration has acquired the know-how that this culture of collaboration is possible. Looking at literature, this could be assimilated to the statement of Perkmann et al. (2013) according to which "firms be well equipped to effectively participate in collaboration." It might be because of this person previous studies at the university, because of his previous experience (case of the new owner of

Company F) or because he has heard about previous experiences at a management forum. This case of company acquisition shows that UIC culture is imported top-down into the company by the new owner, and that this import has an influence on the triggering of UIC. This seems to validate the idea of Carayannis & Campbell (2009) on the importance of developing a culture of collaboration, and that this factor might also have an impact on the R&D absorptive capacity of the firm structure (Perkmann et al., 2013; D'Este et al., 2012; Malairaja & Zawdie, 2008; Ponds et al., 2007).

These other results include the existence of an external shock, trust development, the need for a double leadership, and the need for collaborative culture. Taken together, said results warrant further research so as to assess their importance for first contact. Given that we were unaware of these findings prior to our research, we were unable to incorporate them as theoretical propositions after the research question. Now that we got to know of their existence, it is interesting to check if some of them deserve a theoretical proposition on their own.

Starting with the external shock, considering that not all the studied companies experienced such an external shock, this factor might be a candidate for research. It seems not to be a sine qua non condition for raising the need for contacting. A theoretical proposition might try to answer the importance/impact of the external shock and might be stated as follows:

***Proposition 4**: A firm that approaches a research center for the first time to solve a technology related market opportunity has had an external shock that induced the said contact.*

For trust development, though all companies experienced it, it might be interesting to check how this trust was developed and especially if this trust was developed through external recommendations or internal ones. That means this finding deserves a theoretical proposition that could be stated as follows:

***Proposition 5**: A firm that approaches a research center for the first time to solve a technology related market opportunity develops trust through an external recommendation to find who could solve said problem.*

Concerning leadership, this research has confirmed the existence of said leadership. However, the formation of leadership, how it appears, why, and the kind of leaderships necessary in order to reach first contact deserves to be checked further. That would require a new theoretical proposition that would be stated as follows:

***Proposition 6**: A firm that approaches a research center for the first time to solve a technology related market opportunity needs different leaders to contact said center for the first time.*

Finally, concerning the finding on the development of collaborative culture, this is a deep topic that also deserves further research. We have seen in this research that said collaborative culture can be imported, developed, or even imposed for the first contact. However, the fact that this collaborative culture is found to be so important in the most recent papers (Carayannis & Campbell, 2009) and that government policies have incorporated it, makes this aspect a candidate to checked further. The focus would be on how and why companies incorporate collaborative culture to make first contact with a research center. We therefore propose a new theoretical proposition that could be stated as follows:

***Proposition 7**: A firm that approaches a research center for the first time to solve a technology related market opportunity incorporates collaborative culture to contact a said center for the first time.*

4.4. Recommendations

In the present section we would like to wrap-up the discussion with some recommendations. Among the ones, a model is described that seems to explain the found evidence.

One conclusion of this work seems to be the importance of having a real TRMO to start the quest for the right research partner. This is congruent with literature (Thune, 2007). A consequence is that the number of first contacts with research/technological

centers for research purposes can only be increased if there are more TRMOs. As it results from our research, TRMOs are bound to appear when an external shock hits a company, thus requiring it to re-invent itself. Competition, market downturns, or simply acquisitions are ways in which such needs emerge. However, we are not saying that external shock is needed to increase UIC. Our research simply concludes that an external shock is a way to lead to a rethinking of a company's business model, and to exploring other ways to survive. An external shock might be necessary but is not sufficient for first contact. This is where the TRMO appears. The research cases are companies that survived an external shock by using UIC because they detected a TRMO. Thus, for those companies, the external shock led them to think of the TRMO as a solution, after which they initiated contact.

That emphasizes the importance of the maturity of the need for external research help within the company. If the need for research is not there, it seems there is little to be done by the research or technological centers to promote their skills/knowledge in front of the companies. It seems the optimal network characteristics and person choice for success depends on the phase of innovation or maybe the strategic objective of the company. In our case, the companies accepted the external shock, had already identified the TRMO, and knew it could not be solved internally. This brings us towards a somewhat logical sequence, where the external shock is first, followed by the existence of a TRMO, with a third part in which it is made clear that the company cannot solve it internally, making it necessary to look outside, which is the fourth step (figure 4.2). Once this is done, they have entered a further phase of realization during which they use their network to find cognitive distance in order to fill in the gap, and build up new knowledge for the company (Gubbins & Dooley, 2014).

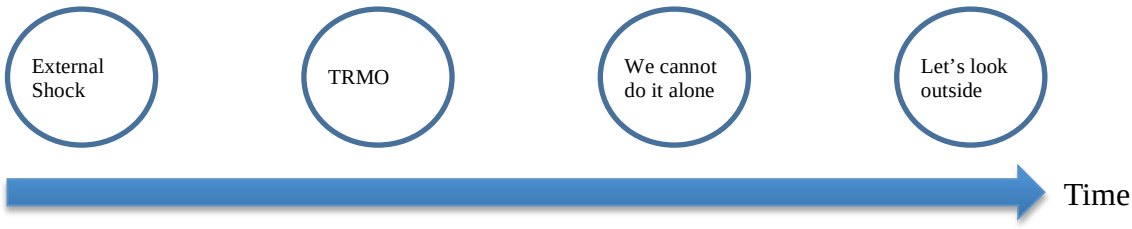

Figure 4.2. Logical sequence to explain industry first contact

Though this logical sequence determines the maturity of the contact, it also has two lacks. On one hand it is not confirmed in some of the cases, for instance, for Company A and Company C. In these two cases, there was not a real external shock that moved towards the TRMO. That is the unique initial point is the TRMO. This is congruent with Thune (2007) that stated that the contact is performed because there is a demand.

On the other hand, this logical sequence is missing some important aspects that make the jump from one stage to the following one, which is internal leadership. In all our cases but for Company E, once the external shock was accepted internally, someone inside the company had to say "we could explore that TRMO." Furthermore, during the next stage, someone had to say "but we cannot do so internally" to the board (this part even for Company E), and, finally, someone has to ask "but who could we ask for help?" These sentences and questions bring us towards two aspects. On one hand the aspect of a maturity process the firm undergoes before the contact is performed. On the other hand, there is a need for leadership. It may or may not be the same actor throughout the entire process, but what is clear in all cases is that the leader has or obtains the empowerment to go on. All in all, in order to understand the company's behavior that triggers the first contact with a research or technological center, requires the presence of three aspects: a kind of external shock that implies setting new rules to survive, a certain TRMO, which someone has "sold" to the board which could both be a solution to the external shock, and cannot be solved internally, as well as a leader empowered to make the contact with a research/technological center. This can be seen in figure 4.3.

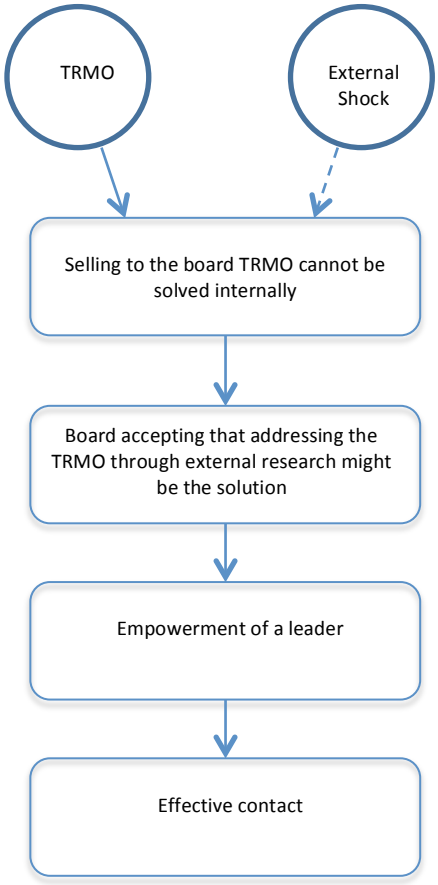

Figure 4.3. Key factors for first contact model

Despite the fact that contacts have been formed through the use of previous contacts (Thune 2007), they did not all begin through weak ties. That does not mean that industries and research/technological centers were disconnected. This is different from Gubbins & Dooley (2014). Some companies did have regular contacts with research/technological centers, but for reasons other than research. However, said previous contacts did not automatically lead to a research contact. This means that the research/technology center strategy of approaching companies with services other than research, expecting that, when the need for research comes, the companies will remember said relationship, and call them, has a very low rate of success. Simply offering products other than research does not systematically create the development of trust for research between industry, and research/technological centers. In a way, this showcases the failure of the current promotion system used by research and technological centers. This is congruent with Santoro & Bierly (2006). In fact, previous contacts that lead to company first contact with research/technological centers may come from very diverse origins, some of which are absolutely not related to research or

technology. This is congruent with the results of Kliknaité (2014) when she states that weak ties are useful for inspiration in exploration, while strong ties are more adequate for research exploitation.

Another result of this work is that subjects of this study did not use professional facilitators to get in contact with research or technological centers. However, this does not mean that they do not use the principle of a facilitator. Somehow, most of the companies found the facilitator profile in other structures, by either calling a relative or using other structures in this capacity. That means there is a real need for a facilitator, something also mentioned by Sugandhavanija et al. (2011). However, as none of the companies had used a professional facilitator, one conclusion is that current facilitators did not have any influence among the studied SMEs. To have an influence, the duty of facilitators must be focused on the origins of the relationship, and trust formation. As trust formation seems to be related to three major factors, strength of ties, reputation/image of research centers, and contractual safeguards (Hemmert et al., 2014), a facilitator must be fully aware of these factors in the minds of industry contacts. As a consequence, it seems this research points to the fact that research/technological centers can hardly increase the TRMO of the companies, at least among the SMEs such as the ones that have been studied.

In order to promote UIC among SMEs, and due to the fact that influence on promoting external shocks is not feasible, it seems that a two-step model can be proposed to policy makers. As a first step, that is, on the short run, the model must cover three aspects. As a principle, it is not a matter of just increasing collaboration but doing it with quality and minimal perspectives of success (Perkmann et al., 2013). Research infrastructure must be there so as, when the companies feel the need, the first contact might take place but not trying to force it when the need is not there. This is congruent with the Triple Helix model (Etzkovitz & Leydesdorff, 2000). It therefore seems clear that, as a first step, research/technological centers have to adapt their offer to what the surrounding industries are able to absorb (Gunasekara, 2006). That means very high top research centers might not be able to increase relationships if the surrounding industries are not able to absorb the high technological output these centers are able to produce. The contrary can also be true if a technological center is not really doing research, and therefore cannot provide truly valuable research services for the

needs of industry. Research/technological centers should be adapted to the surrounding industry environment (Bauer & Flagg, 2010).

As a second aspect, and following the advice of Lai & Thai (2010), an acceptable facilitator structure must be created. The General Manager of Company F insisted during the interview that he was never sure that the contacted center was the right one for him, so why should he take the one he already knows? This same comment can be read in Thune (2007). The facilitator must be the switchman who could say: "trust me, contact this specific center. It is the one that will help you solve your TRMO" (Brannock & Denny, 1998; Luna & Velasco, 2003). Perhaps his personal experience in both industry and academia might be of help (Wheatley, 2009). Anyhow, it seems he should be very flexible, and have many fields of expertise (Tobbias, 1995; Lundvall, 2000; Luna & Velasco, 2003) such as explicit-tacit know-how, know what, and know-why (Luna & Velasco, 2003; Santoro & Bierly, 2006). Some marketing and entrepreneurial experience could also be of help (Siegel, 2003; Malairaja & Zawdie, 2008). It may be assimilated to a kind of champion of innovation (Hemmert et al., 2014), but this has not been proven.

Thus, going further to induce new first contacts, it seems that all reviewed SMEs somehow had a latent TRMO that only cropped up when mature demand was present. However, the question is to find out whether they can detect the maturity of the TRMO, and have a significant effect on it or on the culture of collaboration. From the present research, it seems that, in order to lead to a change in that quest, the facilitator structure needs to fulfill some requirements. The first one is that it must be credible, and known as a system, at least for those SMEs that are the object of this study. That means companies should perceive it as a trustworthy system with no interest other than allowing them to find the best partner according to company needs. A big global system would not be used by SMEs: it would be too big to be intelligible, and too far from their daily lives to be acceptable.

As a consequence for our SMEs, a second requirement of this structure is that it should be both close geographically, and accessible to companies. The cultural closeness should be there. A kind of one-stop shop regional body for industries looking for access to academic researchers, and advice seems to suit that need (Wheatley, 2009)

rather than a national system (Wilson, 2012). Though there is no clear evidence from this research, the promotional strategy that seems most suitable would be to develop some kind of buzz marketing on social media already in use by companies. In a way, the goal would be to reproduce what "*Forum Carlemany*" was for Company F. The government, and local chambers of commerce should be able to be involved in such a structure. It is in their interest to keep local companies competitive and creating jobs.

A third requirement for said proposed facilitator structure is related to company security. By discussing their needs, companies must be sure that disclosed information will not be used against them. The need for effective contractual safeguards is therefore necessary (Hemmert et al., 2014). That would develop a kind of feeling of secrecy or security that could ease disclosure. Perhaps, in the initial stages, posting their needs anonymously would also be a solution. Copying the idea behind Innocentive[44] or Ninesigma[45] could be a solution, but it would have to be managed locally by professional facilitators. This is somehow what the ConnectED project is trying to do around Dublin and Tallagh[46] but their idea is to "sell" the skills available in their group of institutes. Anyhow, the theory could be that the infrastructures created to trigger UIC relationships for SMEs may be based on studies performed with big corporations, and may therefore not be suited to obtaining the same result among SMEs.

In the long run or as a second step, the model should emphasize the culture of collaboration. As we saw in the studied cases, this culture reached the companies through three ways: through people with a background as university students, through the experience of new owners, and through management forums. The second one is difficult to promote, but incorporating collaboration culture with university studies would have an impact in the long run. On the short-term, promoting exchanges of experiences in research collaboration among SMEs might have an impact if the TRMO is already there. On their own, as only one company out of six used a forum as a way to find a center, forums might not have a significant impact (figure 4.4).

[44] www.innocentive.com (Based on its content dated November 2014)
[45] http://www.ninesigma.com (base don its content dated june 2015)
[46] John Keogh (Institute of Technology Tallagh) and David Kirk (Dublin Institute of Technology) joint presentation at UIIN Congress, Berlin, June 25th 2015 "ConnectED: An enhanced online interface for improved engagement between industry and academia.

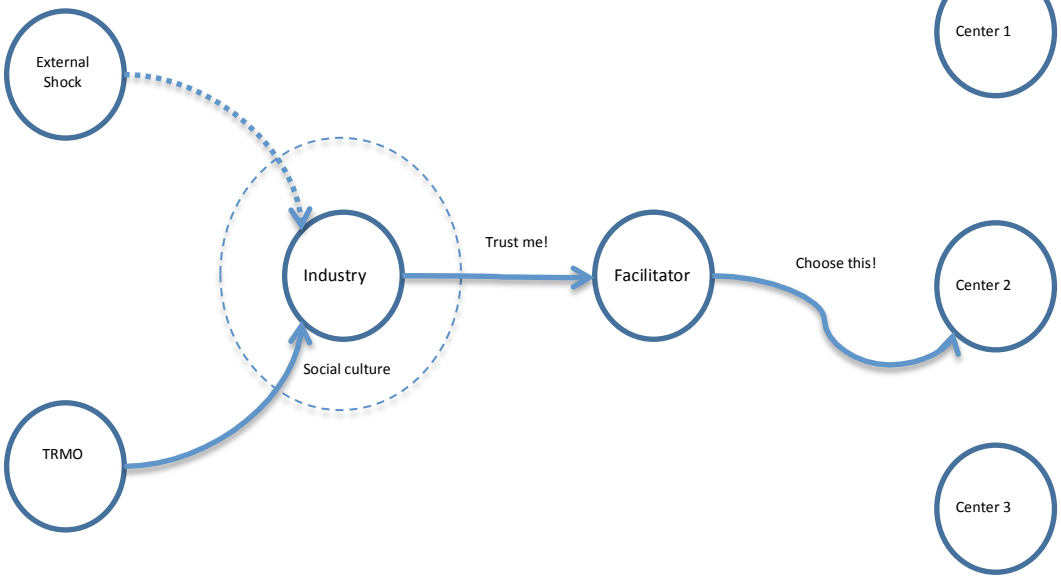

Figure 4.4. Proposed model

4.4. Limitations

First, and foremost, we must set some limits to this work. The work is based on a multiple case study research with the limited number of six studied companies. This is related to the work structure, which was described as exploratory.

The kind of companies is also a limiting factor. It is a known fact that industrial and engineering companies are more prone to be willing to contact research or technological centers (T Thune, 2007; Perkmann et al., 2013). In our case, we have five industries in the field of metal (Company B, Company C, Company D, Company F, and Company E). Company A is not in the field of metal, but of chemistry. Thus, they are all industrial companies producing physical products. That means conclusions can only be applicable to these kinds of companies.

The area where the companies come from is also something to take into account. All six are Spanish companies. Five come from Catalonia, and one from the Madrid area. All six have sales abroad, and some, like Company C, even operate worldwide. Company A is considering to open an operation in Egypt, and the Company F group had just finished building a plant in Canada. Behavior might be different from one area to another. While the US and Europe are relatively well studied, at least in what

concerns the relationships between big corporations and research centers, the behavior of companies in East Asian or other emergent countries have not yet been studied to a sufficiently high standard (Hemmert et al., 2014).

The size of the companies is an important factor. According to the EU definition, they are all SME because they have less than 250 employees, their turnover is under 50 M €, and their balance sheet is under 43 M€. It would be interesting to study big corporations, and perhaps startups with similar patterns, especially in what concerns the importance of the formation of trust, and disclosure resistance between SMEs and big corporations. It might happen that we could obtain similar results to those in countries that attempted to copy and paste the Bayh-Dole Act into their local legislation. A good solution in one country might not apply to others (Mowery & Sampat, 2005). In a way, the infrastructures selected, and set up for big corporations might not work for promoting UIC among SMEs. Thus, the question is to know whether UIC creation needs differ between big corporations and SMEs. If so, the question would be to find out if the surrounding infrastructure suits the two or just one. This doubt arises from the fact that the literature, and hence infrastructure, has been basically built on big corporation needs, and not on those of SMEs. This factor is unknown.

Concerning the ownership of the companies, all but Company E and Company F are single companies. Company E belongs to a Japanese conglomerate, and Company F is part of a small group including Company F, and a couple of small startups. All but Company E are family-owned businesses. This type of ownership may represent a limitation.

4.5. Future research

For further study directions, it would be interesting to check the influence of the open innovation paradigm as a vector inducing first contact. Also another way would be to partially re-do the qualitative research by changing, and adding some of the proposed theoretical propositions four, five, six, and seven. Another theoretical proposition could explore the maturity of a TRMO within a company in order to find out the model

companies follow from the initial “we have to do something” to the acceptance of existence of a TRMO.

Alongside this aspect, it would be interesting to explore which other possibilities target companies assessed besides contacting a research/technological center for research. This would allow us to understand the competitors of contacting a research/technological center for research as well as the decision model that might be behind it. For instance, a study could be carried out on the use or application of the Kraljic (1983) portfolio-purchasing model or any comparable structured way of purchasing services. This can be also linked to other criteria such as firm professionalism, ownership, dimension or age.

Furthermore, other aspects that could be studied further ahead include monitoring of the how research centers have been contacted over the past years. Extending the study to other regions, industrial sectors, or types of companies could provide more insights into the behavior of Company C. However, one topic that would probably bring value would be a comparison of the behavior of comparable companies depending on their different infrastructure or technological/research center environment and behavior. The EU to assess the startup ecosystem already does something similar[47]. This would allow an assessment of the environment that triggers a higher amount of contacts, and to draw a comparison between its results and those of other studies such as Bergenholtz & Bjerregaard (2014). This might assist decision makers to adapt their activities and person profiles to the real aspects that move companies to get in contact with technological or research centers for the first time.

Concerning the abovementioned importance the image research/technological centers might have in the minds of the companies, a further analysis of the images of centers, drawing a distinction between university research centers, and technological centers, could be of interest. This could help understand the “trust conveying capacity” of each when a company approaches them.

[47] blog.startupcompass.co (Based on its content dated April 2015)

We mentioned in the literature review that it might be a good idea to include social culture into the UIC model (Carayannis & Campbell, 2009). From the findings it seems that social media and culture are not at the same level as the other dimensions in the Triple-Helix model. Unless it is imported through a company acquisition, and the new owner already has culture of collaboration, it seems that promoting a culture of collaboration will have an impact in the long run rather than short-term. There is a kind of latency between when the promotion of UIC collaboration, and when it has an impact on the formation of UIC, and cultural acceptance of the same. If we follow the proposal of Carayannis & Campbell (2009) of social context for the Triple Helix model we would end up with figure 4.5. The external shock, and TRMO are the short-term engines that move a firm to contact. Social Media and culture would go next in time, and the natural environment would be the last in time to trigger the relationship. This latency is consistent with Dubina et al. (2012) when they stated that the more advanced the knowledge society is, the more capable of absorbing knowledge it becomes. This also applies to the economy.

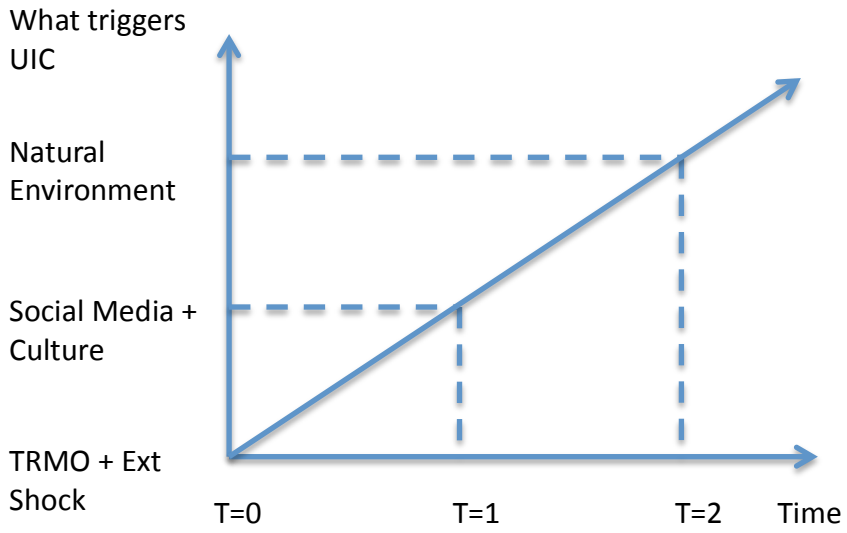

Figure 4.5. UIC triggering factors through time

However, it might be interesting to study the evolution of this cultural / social media factor linked to the environmental change that lead to an increased focus on TRMO. This is, to check if the environmental factor has “triggered” a cultural change in the perception of UIC in Industry, either in full, in part or the other way round. This is a way of checking if the environmental factor is first, and the culture of collaborating

comes afterwards rather than vice-versa. If the environmental factor is first, and culture follows, doubts can be raised that any infrastructure or model is going to be able to increase UIC significantly, at least at the level of the studied SMEs. Conversely, if culture can be changed in order to trigger the UIC, then infrastructure or models have their chance (figure 4.6) in the long run.

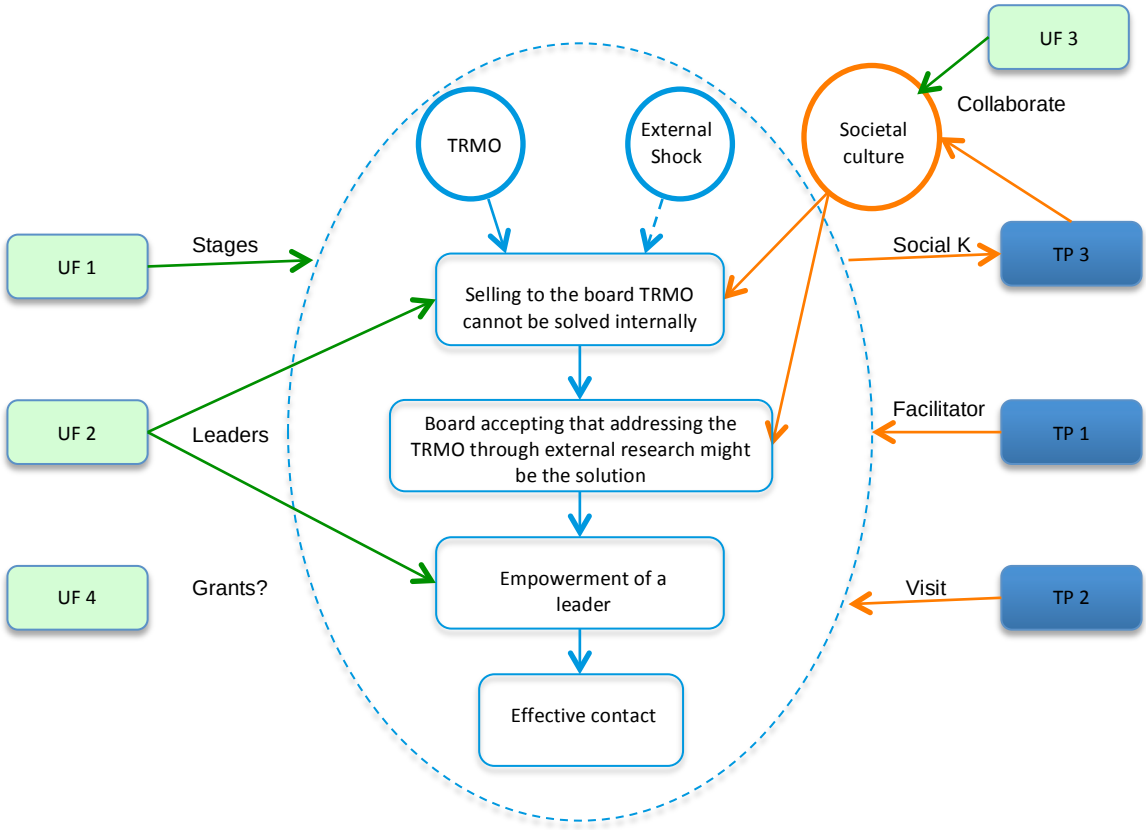

Figure 4.6. Culture influence in the key factors for first contact model

It would also be interesting to study the real impact of grants on the promotion of R&D relationships. Whereas this factor does not seem to be important in the light of the studied cases, the fact that it has been raised at least once might be a good reason to check on it further.

Last but not least, checking the percentage of first contacts driven by strategic decisions, and comparing them with ones that are not directly linked to such behavior is another possible future line of research. In our case, Company F, Company D, and Company E could fall into the category of linking because of strategic decision, but for the other companies, the reason for contacting was solving an important technological

topic but without clear aim to solve a strategic one. A study on the influence this aspect might have on who performs the contact, and how it is done could also help assess the kind of “technological product service” a given company might need, and therefore adapt the “commercial” activities of the technological or research centers, and government efforts to boost UIC.

5. Conclusions

As a summary of what has been done, this work has answered the following research question:

"How do industries with a Technology Related Market Opportunity (TRMO), who cannot solve it internally and have no record of previous contacts with a research/technological center, contact them for the first time?"

In the reviewed literature we only found two general references to this question: Thune (2007) says that a majority of collaborations were formed through the use of previous contacts, and Wheatley (2009) states that one way to achieve contact is through a facilitator.

In order to answer the research question more precisely, we followed the case study methodology (Yin, 2009) and, based on the literature review, we built up to three theoretical propositions. Six cases related to six different companies were studied and allowed us to reach the conclusions explained below.

For proposition 1 *(A firm that approaches a research center for the first time to solve a technology related market opportunity contacts a technological facilitator whom it believes might know who could solve said problem),* we conclude:

(1) Only one company used a facilitator, but the used facilitator cannot be considered to be a professional one. This theoretical proposition is therefore challenged in five out of six cases.
(2) However, the need for a facilitating structure was found. In two cases, this facilitating structure was a social event, where companies discuss and share their needs, and obtain feedback about the experiences of other companies having undergone similar situations. The abovementioned social events were not designed for easing the contact with research centers but they were used for that purpose.

For proposition 2 *(A firm that approaches a research center for the first time to solve a technology related market opportunity remembers having been visited by a research/technical center intermediary or having done other than externalized research activities with a research/technical center)*, we conclude:

(1) This theoretical proposition has been confirmed by evidence of four out of six companies. That is, they had previous contacts with research centers.
(2) However, these previous contacts were not research-driven. It is not confirmed that these previous contacts lead to any posterior contact for research. Being known is not sufficient to create an R&D link, which confirms Thune (2007).

For proposition 3 *(A firm that approaches a research center for the first time to solve a technology related market opportunity proactively uses its social capital to find someone who could help*), we conclude:

(1) The use of social capital has been confirmed in six out of six cases. In two cases, the social capital was built up directly linked to the need of finding the suitable research center. In the other four cases, the use of the already available social capital was used to reach the center. Also the existence of a boundary spanner within the company, who could be a board member, a technical engineer, or even a trainee, is confirmed.

This research, based on a multiple-case study, has provided unexpected findings:

(1) A process of maturing that leads to contact is found in all cases. The need for a contact goes through different stages before it is realized.
(2) It seems that an internal leader is necessary to spread the need for the first contact and convince the board. Once this first contact idea is accepted, this leader or a new one has to be empowered for the contact.
(3) Collaboration culture is acquired from outside the company through different ways and developed internally.
(4) Companies know about the existence of grants, but TRMO is more important than their existence to explain first contact.

(5) These unexpected findings have allowed us to propose a model to understand the key factors, their organization, and the sequence that leads to a first contact. The model is initiated by the TRMO, an external shock may or may not induce this demand. A leader is needed to convince the board that the TRMO cannot be solved internally and that external help is required to address it. Once the board accepts this fact, the model shows the need for an empowered leader who is the one to carry out the effective contact.

As a result of the present research, three basic recommendations have been formulated:

(1) Research or technological centers should adapt their offer to what companies, especially Small and Medium Enterprises (SMEs), really do need.
(2) A centralized facilitator structure might be a solution to create a credible, non-biased assessment redirecting to the most suitable centers. It must be able to detect the latent TRMO, its maturity within a given company, and promote collaboration culture. As it results from the cases of the studied SMEs, this structure must be close, understandable, and have some contractual safeguards for the SMEs. If this centralized facilitator structure is too big, SMEs might be perceived as not suitable to their needs. The structure must be trustable, perceived as fair, and become the link to reach the right center.
(3) Developing collaboration culture at the university, followed by incorporating university students in the SME structures, seems to have a positive long-term impact on developing the R&D collaboration within SMEs.

To wrap it all up, this research has added knowledge to the previous literature. It has added knowledge on how and why SMEs, such as the objects of this study, get in contact with research/technological centers for the first time with the aim of research. Despite the fact that there is still a lot to do to enhance university-industry collaboration, it seems this research has opened new understanding on how to adapt the research offer to the real needs of industry newcomers to university.

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Addendum

Addendum 1. Literature structure checklist

- Reasons why
  - University Industry collaboration
  - Historical successes
  - What industry has obtained
- How to foster UIC
  - UIC
  - Incentives
  - TTO
  - Science parks
  - Facilitators
  - Success models
  - What to do against U-I barriers
  - Others
- How to organize UIC
  - UIC
  - Patents
  - Licenses
  - EU FP7
- Consequences
  - UIC
  - For university: Ethics vs $
  - For industry: Risk vs profit
  - Bayh-Dole

Addendum 2. Basic revised literature

Ordre	Nom	Autors	Data Publi
1	A Broader view of UIR	R. Bolton	1994
2	Basic Guidelines for UIResarch Relationship	Brannock & Denny + Denny	1998
3	Bayh-Dole act and UITT a model for other OECD	Mowery & Sampat	2005
4	Bridging the gap between firms ans Acad	M Luna et al.	2003
5	Facilitators of Know transfer in UIC	M. Santoro et al.	2006
6	Intermingling Academic and Business Activities	Tuunainen + Knuuttila	2009
7	Statement on Corporate Funding of Acad Research		
8	Strategies to Eval UI Know Exch Prgm	Hanberger + Schild	2001
9	Training of Triple Helix Workers	Taran Thune	2010
10	UIC a framework for dialogue	Burrington	1993
11	Uni Admin, Agri Biotech and Academic Kapitalim	Glenna+Lacy+Welsh+Biscotti	2007
12	Etzkowitz Innovation Triple Helix	Etzkowitz & Leydesdorff	2000
13	Etzkowitz Triple Helix	Etzkowitz	2002
14	Tech Transfer and Public policy Bozeman	Bozeman	2000
15	Entrepreneurial Impact The Role of MIT		
16	Measuring User Innovation Dutch High Tech Sme's		
17	Geographical & institutional proximity UIC	Ponds et al	2007
18	New Standards in UIC	Nature	2001
19	Partners to deliver UIC	Malcom Wheatley	2009
20	Science parks and UIC in Malaysia	Malairaja and Zawdie	2008
21	Success Critical Factors for UIC	Bernardos & Casar and Casar	2009
22	UIC in Europe	Cerych	1985
23	UIC Ireland	Ryan et al	2008
24	UIC the network inbeddedness approach	Taran Thune	2007
25	UIC Uni of Tokio case	Kyoung-Joo Lee et al	2010
26	Aalto University	Markkula + Lappalainen	2009
27	Academic attitude towards Ind ties	Glaser + Bero	2005
28	Bridging the devide Perth University	Judith Berman	2008
29	Ind perception of UIR in Biotech	Glenna et al.	2007
30	Re-assessment of UIR assumptions	Weimar	1992
31	Regionalisation of Innovation Japan	Kitagawa + Woolgar	2008
32	Rules for Governing UIR	Lewis et al	2001
33	Striking a Bargain between Ind & Uni	David	1982
34	Tech Transfer Photovoltaic Thailand	Sugandhavanija et al	2010
35	Tech Transfer & Tech Transfer Intermediaries	Bauer & Flagg	2010
36	U-I Collaboration in mid-low performers	Turk-Bicakci and Brint	2005
37	UIR Synergy or Substitution Spain	Manjarrés et al	2009
38	University Challenge (collaboration with Ind)	Ben Jones	2010
39	Uni-Ind Collaboartion	Gilbert Omenn	1982
40	Influence of partner diversity	A Von Raesfeld et al.	2012
41	Outsourcing: From Cost to Innovation	M R Weeks et al.	2008
42	Rapid-Response Capability	C H Fine et al.	2002
43	Clockspeed-Based Strategies for supply	C H Fine et al.	2000
44	A review of Business-University Collaboration	T Wilson DL	2012
45	An investigation of Dev Mgmt of Research Institutes	S P Philbin	2011

Addendum

46	Dilemmas in Regional UIR	C Gunasekara	2006
47	Eval Outcomes of Diff UIC in Comp Science	S Kabins	2011
48	Exploring Geogr Proximity in UIC in UK	K Laursen et al.	2011
49	Forging Successful UIC	B Burnside & Witkin et al.	2008
50	From Interpersonal networks to inter-organizational alliances for UIC in Japan	Kyoung-Joo, Lee	2011
52	Ind-Univ Interactions in Valencia	A Garcí-Aracil et al.	2008
53	Policies to stimulate regional innovation via UIC	B Van Looy et al.	2003
54	Source of succes in innovation: Role of Core Researchers	Yasunori Baba et al. et al.	2010
55	The Ethical Dilemmas of UIC	M Kenney	1987
56	The Role of Collaboration, market ,etc	V G R Chandran Govindaraju et al.	2009
57	The two faces of UIC on Public Research	M Perlmann et al.	2009
58	UIC for Continuing Professional Development	V Slotte et al.	2003
59	UIC some ethical considerations	S Nellickappily et al.	2009
60	Unique collaboration bolsters Ohio	W Indest et al.	2010
61	Willingness to engage in TT in UIC	Wen-Hsiang Lai	2011
62	Energising R&D accumulation and innovation diffusion	Wen-Hsiang Lai et al.	2010
63	Making innovative use of academic knowledge 2007	S Harryson et al.	2007
64	Flexibility in innovation through external learning	S Harryson et al.	2008
65	Crossing the rubicon exploring factor of UIC barriers	V Tartari et al.	2012
66	Licensing, partnering, strategic alliances and university relationships	W D. Blakeslee	2012
67	Industry Academia align in the UK	A Scott	2013
68	Academic engagement and commercialisation	M Perkmann et al.	2013
69	Universities, industrial clusters and economic development in Egypt	Hoba abd el Hamid Ali	2012
70	Effect of institutional proximity	Hong & Su Wei et al	2013
71	Does one size fits all?	Limin Gong & Greeven	2012
72	UIC in new industrialized countries	Bodas Freitas et al. Freitas Isabel Maria	2012
74	Value Creation in University-firm research collaborations	D Mindruta	2013
75	Proximity and the transfer of academic knowledge	V Slavtchev	2010
76	UIC in Turkish SMEs	S Temel et al	2013
77	Shaping the formation UIC	P D'Este et al.	2013
78	Follow the Industry Money	C Beaudry & Kananian	2013
79	Modelling Multiple Interastions	D De Stefano & Zaccarin	2013
80	Research Collaboration networks in Biotech	R D'Amore et al.	2013
81	Systems of indicators to evaluate the performance of UIC	Evila Piva & Rossi-Lamastra	2013
82	Untitled	Tom Wilson	2012
83	University-industry linkages: What are the determinants of distance in collaborations?	Alessandro Muscio	2012
84	Developing SMEs through University Support Centres: a Comparative Analysis	Tijana Mitanoski et al.	2013
85	Critical Success Factors for Knowledge Transfer Collaborations between University and Industry	Tatiana Schofield	2013
86	Barriers to Matching New Technologies and Market opportunities in Established Firms	E U Bond & Houston et al.	2003
87	How institutional conditions impact university–industry search strategies and networks	Bergenholtz & Bjerregaard et al.	2014
88	Exploring Social Network Dynamics Driving Knowledge Management for Innovation	Gubbins C and Dooley L	2014
89	Bridging the Gap Between U&I: 3 mechanisms for innovation efficiency	Johanna Wallin et all	2013
90	Bridging the cultural divide: trust formation	Martin Hemmert et al.	2014
91	Ntuple Helices: Explanatory Model	Loet Leysdesdorff	2011
92	Model 3 Quadruple Helix	Elias G Carayannis et al.	2012
93	The Quintuple Helix innovation model: global warming as a challenge and driver for innovation	Elias G Carayannis et al.	2012

Addendum

D4_2_Final (IRTA_100608)	DIL	2010
El Profesional de la transferencia	ACC10	
Mecasnismos deTT y PI entre OPIS y empresas	EOI Antonio Higalgo	
MIT Inventors guide	MIT	2005
Nano2market	Michelle Grindle Uni Alicante	
NEI Defensa de la PI	ACC10	2009
OMPI Negociación de acuerdos de licencia de tecnologia	Org Mund Propie Intelec	
Plan estrategico TT CSIC 2006-9	CSIC	
Plan Estrategico Univ Valladolid	Univ Valladolid	2006
Presentaciño a CDCs 15 10 2010		
Resumen Modelo TT Univ Viña del Mar		2008
Technology commercialization	Thomas Gering	
TT Cambridge	David Probert	2005
TT Model Mexico	Amezcua et al	2001
TTA Executive Summary EIF		sept-05
TTO UCSD Annualreport 2009	UC San Diego	2009
Getting university-industry relations right	Deutch	1991
Bayh-Dole act and UI TT a model for other OECD	Mowery and Sampat	2005

Addendum 3. Used pilot test interview guide

Questionnaire

Date:
Interviewed name:
Company name:
Company position:

---

19) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
    a. Yes: go on
    b. No: stop.

20) Why did the company approach the research or technological center?

21) Which were the circumstances?

22) Could you describe the unsatisfied market need the company had?

23) How did the company identify that need?
    a. Marketing / sales requirement
    b. Internal known weakness
    c. Others: specify

24) Once the need identified, was the company aware of an available technology to satisfy it?
    a. Yes
    b. No

25) Who has been involved in the decision to contact a research or technological center?
    a. Interviewed alone
    b. General management / Board
    c. Technical management / department
    d. Others: specify

26) Who has been involved in the decision of the person who had to perform that contact?
    a. Interviewed alone
    b. General management / Board
    c. Technological management /department
    d. Others: specify

27) Why this person and not somebody else?
    a. Technological expertise
    b. Research expertise
    c. Personal relationships
    d. Person in charge of the project
    e. Others: specify

28) Was this person technological expertise a prerequisite for choosing him?
    a. Yes
    b. No

29) Who has been involved in the decision of how this contact would be done?
    a. The chosen person
    b. The General Management / Board
    c. Technological Management
    d. Others: specify

30) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?
    a. Based on partnership
    b. Based on service purchasing
    c. Others: specify

31) Which were the foreseen difficulties in the relationship?
    a. Different cultural behaviors
    b. Different institution objectives
    c. Different working paces

d. Money related problems
e. Technology transfer problems
f. Patents / royalty problems
g. Confidentiality
h. Other: specify

32) Were there differences of perception of research centers versus technological centers?
a. No
b. Yes. Specify.

33) How did the company find who has what to solve our company problem?
a. Intermediary
b. Ask a specialist
c. Social media
d. Old teacher
e. Other: specify

34) How did the company choose the one to be contacted, and discard others?
a. Based on recommendation
b. Based on reputation
c. Based on papers / publications
d. Based on geographical proximity
e. Based on technological expertise
f. Other: specify

35) How did the company reach that entity/person?
a. Phone the standard
b. Phone somebody inside (Gral Manager, tech boss, etc...)
c. Phone somebody who knows somebody inside
d. General email
e. Introduced by email to somebody inside
f. Go there physically
g. Social Media contact
h. Other: specify

36) How was the contact actually performed? Explain

37) Did the company contact an intermediary instead of contacting directly a research or technological center?
    a. Yes
    b. No

38) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?
    a. Yes
    b. No

Addendum 4. Transcribed first prototype interview

ISA Grover → No DIR

Questionnaire

Date:

Interviewed name: Marc Capellades

Company name:

Company position: Centre innovació i transferència

---

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
   a. Yes: go on
   b. No: stop.

2) Why did the company approach the research or technological center?

– Relats (comp. Tèxtil Caldes de Montbui)
↳ fundes per calçat
↳ teixit tècnic
↳ Molt internacionalitzada

3) Which were the circumstances?

↳ Creació de centre tècnic Relats
↳ aglutinament de tots els coneixements del grup.
↳ Pb, el dia a dia et menja la recerca a curt, mig i llarg termini
↳ definir Anàlisi model / estratègic

4) Could you describe the unsatisfied market need the company had?

els de Relats i Grover es coneixien
lligats a F. [illegible]

5) How did the company identify that need?
   a. Marketing / sales requirement
   b. Internal known weakness
   c. Others: specify

el Dir Gral de Relats l'hi explica a en Fèlix

↳ Fèlix pensa que podria ser útil
Ho va explica a en Marc i en Marc va ~~parlar~~ trucar
↳ arrel de una jornada de Formació o club de innovació van contactar amb en Marc Capellades

Addendum

A partir d'aquí va començar

Marc S → interessat en innovació

Felix → Perfil ≠

Viatge Mex OK però a Gràcia

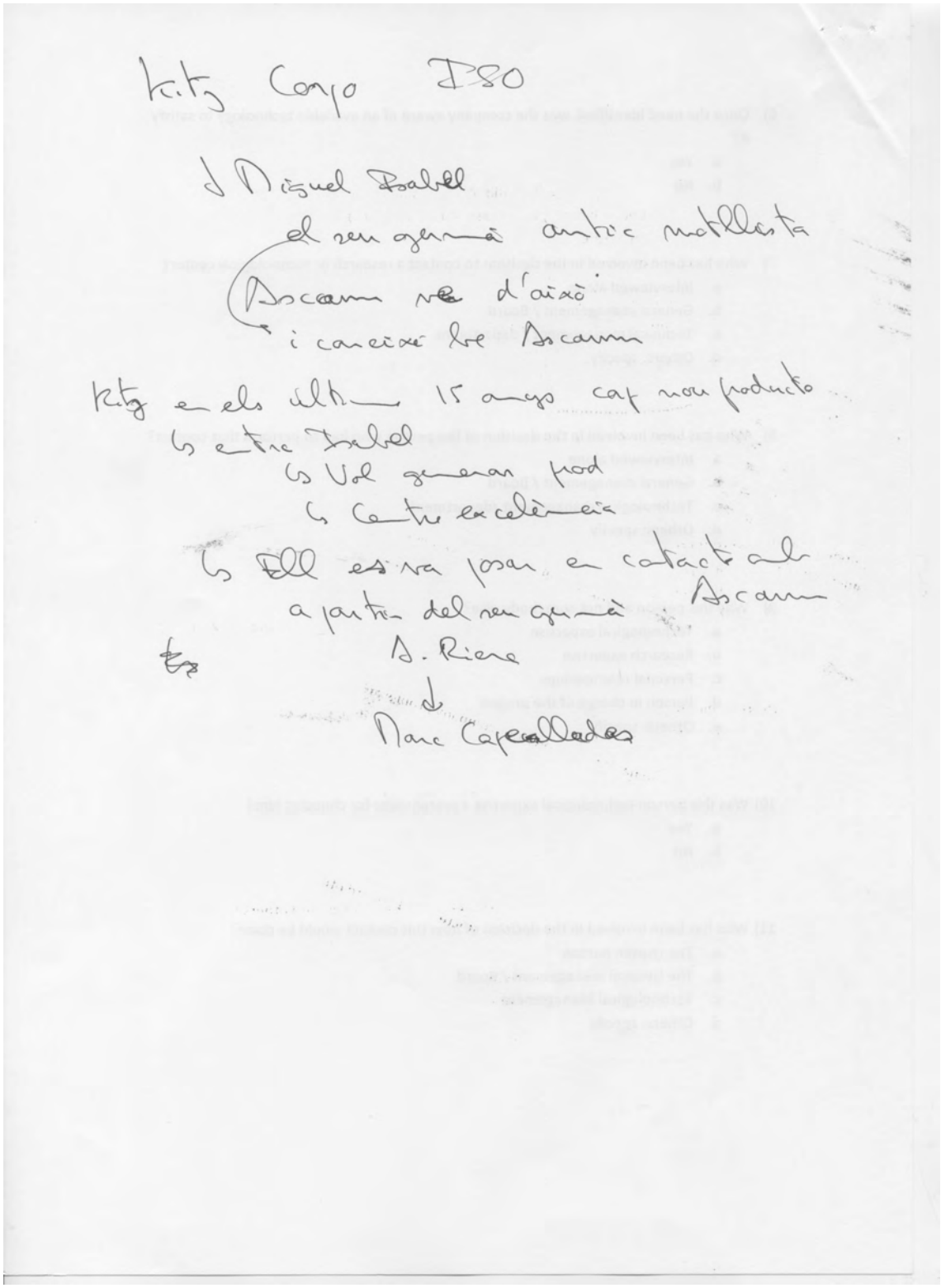
Marc S. truca / coneix a X. López Dtor Gral Ascamm

→ després M. Capellades

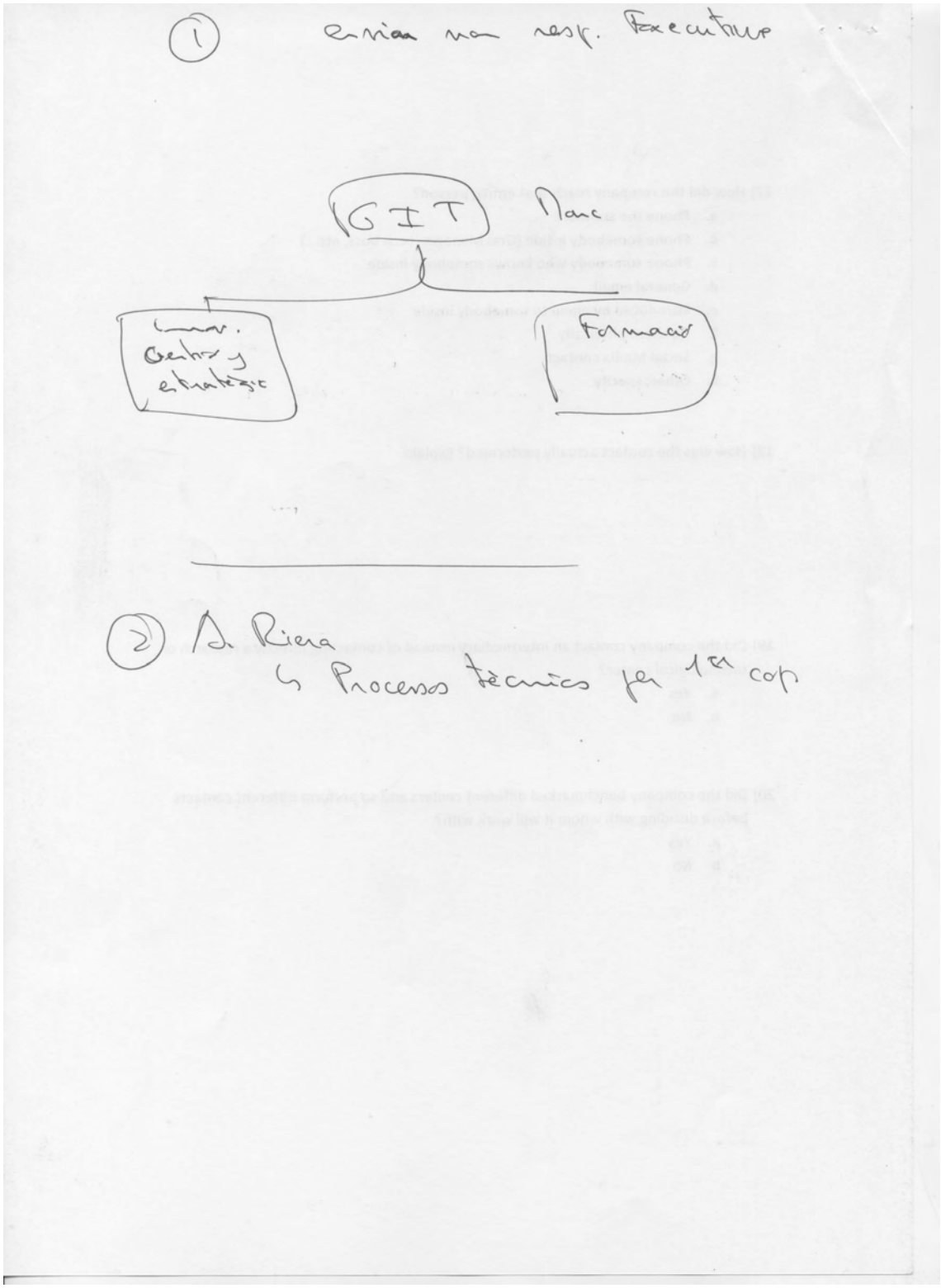
OK V.

Posterior

Addendum


Kitty Congo 1980
J Miquel Isabel
el seu germà antic matllista
Ascaso va d'això
i carcixi hre Ascaso
Kitty en els últims 15 anys cap nou producte
Entre Isabel
Vol generar prod
Centre excel·lència
Ell està posar en contacte amb
a partir del seu germà Ascaso
A. Riera
Marc Capdevila

Addendum



Addendum 5. Second transcribed interview guide prototype

Questionnaire

Date: April 5th
Name: Eduard Senties
Company: Retired CEO of Vivesa
Responsibility in the company: ex-CEO

39) Have you ever needed to approach a research center to solve a technological problem?
    a. Yes, several times
40) For what reason did you decide to approach a research center?
    a. To find people with knowledge, training and skills that the company did not have in house.
    b. They had some know-how but in specific moments and specific areas the company needed more prepared people or they needed a lab with skilled people they did not have.
    c. The problem is not to invest in R+D but the need of knowledge and skills in peripherical areas of the company that were not present.
41) Which were the circumstances when you decided to find a research center?
    a. We had an idea: we wanted to develop a product that needed skill not present in the company. That led them to approach the most appropriate research center for the development.
42) Could you describe the unsatisfied need you had?
43) How did you indentify that need?
    a. In the developed project, the needs, skills, labs and machines were laid down and so we knew which were available internally and which the ones to fetch outside were.
44) Was your personal and professional experience relevant for its identification?
    a. As responsible of the team, the answer is yes
    b. In any case, it was the sum of the contributions of all member team during the scheduled meetings
45) Was it a prerequisite?
    a. Of course, if not we would not be able to fulfill the needed specifications to obtain the required output.
46) Once the need identified, were you aware of an available technology to satisfy it?
    a. We knew the big ideas to be followed but we did not know the track to reach the milestones.
47) Before approaching a research center, what was your perception of a UIC?
    a. Positive perception but not a previews experience
    b. But we had a very clear idea of what we wanted, very clear prerequisites and clear project. This is basic since the beginning.

   c. This was clear because, by the time, I was responsible for R+D and in that job I always wanted to have clear objectives, tasks and projects (gantt and others).
   d. That helped me determinate what resources and helps I needed

48) Once decided to approach one, what did you do to reach the one who could solve your problem?
49) Did you have an intuition about to whom you should address?
50) Who did you finally contact first?
   a. We looked for assessment on the project at the UPC: There were the ones who re-directed us towards to the CSIC research center
   b.
51) Why him/them and not others?
   a. We knew the UPC guy previously
   b. Once contacted I saw that this person was appropriated for our needs
   c. What is clear is that the same service can be delivered by different universities but the different teams they have (people and material resources) specially in textile industry (Terrassa)
   d. We looked for the best team but we could not go to Shanghai or MIT but we felt that the UPC seemed appropriate. We could go to Lyon or other in the US but UPC was closer (és a tocar) and simpler to deal with. Better dialogue, better communication that at 1996 this was more sensible
52) What is the duty of these people you contacted? (centres recerca, profes, intermediaris, agències govern, etc…)
53) How did you contact that people? (tenia el telèfon, xarxa social, web, etc…)
   a. Telephone + visit
54) Did they suggest directly a solution to your problem or to contact another research center?
   a. We were re-directed to the CSIC teams
55) Did you benchmark different research centers?
   a. No
56) How did you take the decision to take a specific research center? (si han de triar, es clar)
   a. We started to do it but finally did not finish it. It is not a matter to find out which is the best but the most appropriate for us.
   b. The key is to know what you want: the objective is to be very clear. You must be able to ask: I want that and not anything else.
57) Why did you choose that research center and not another one?
   a. It was the most appropriate
58) Was it a University related one?
   a. The final one was not.

Others:

El primer projecte és el que marca el camí?

No. El que marca el camí és aceptar-ho. Si fracasses en el primer, quedes resentit.

The problem in Spain is that companies

- Do not know the investigation possibilities we have around
- What they have to investigate: I know that I have to investigate but I do not know how much they have to spend on it or how to do it

So the key point to succeed is to have some clear ideas

- To know what can be done
- The cost
- R+D is just part of the solution

Addendum 6. Transcribed interview with Company A

Questionnaire

Date: April 7th
Name: E B
Company: A
Responsibility in the company: CEO

1) Have you ever needed to approach a research center to solve a technological problem?
    a. Yes, first time in late 70s
2) For what reason did you decide to approach a research center?
    a. We were developing a molecule and we had some miscontrol on the final result (too much sulphur). We knew something was happening in the process but we did not know neither what to do, when to do nor how to do it.
3) Which were the circumstances when you decided to find a research center?
    a. While developing a new molecule we needed external help in the control of its production.
4) Could you describe the unsatisfied need you had?
    a. We were unable to provide a solution to the too high amount of residue (3%)
    b. The product production was a three phase one. But we did not know where the problem lied nor how to solve it.
5) How did you indentify that need?
    a. The residue was in the final product
6) Was your personal and professional experience relevant for its identification?
    a. No. This was the topic of the R+D department boss
7) Was it a prerequisite?
8) Once the need identified, were you aware of an available technology to satisfy it?
    a. No but we thought somebody had to know it.
9) Before approaching a research center, what was your perception of a UIC?
    a. IQS was close and could be reached easily. There a final course student training in the company so its access was obvious.
    b. CSIC or other research centers were absolutely unknown. In fact we got to know about CSIC only 7 years ago in a research center presentation. Before that we could even think about contacting any because they did not exist for us.
    c. Now we are working with other research center (Valencia) that was chosen because of its better competences regarding the specific project.
10) Once decided to approach one, what did you do to reach the one who could solve your problem?

a. The training student suggested that we should contact the IQS and that is what we did.

11) Did you have an intuition about to whom you should address?
    a. Not at the beginning
12) Who did you finally contact first?
    a. The professor (a lady) the student found the most appropriate
13) Why him/them and not others?
    a. It was easy, close, we knew the institution, it provided trust and seriousness.
14) What is the duty of these people you contacted?
    a. Professor at IQS
15) How did you contact that people?
    a. Phone call and meeting
16) Did they suggest directly a solution to your problem or to contact another research center?
    a. Yes, after the meeting the professor proposed a working plan
17) Did you benchmark different research centers?
    a. No, not at all
18) How did you take the decision to take a specific research center?
    a. No choice.
19) Why did you choose that research center and not another one?
    a. Close, reputation, easy access (the student)
20) Was it a University related one?
    a. Yes.

Addendum 7. Transcribed interview with B

Questionnaire

Date: 12-4-2013

Interviewed name: Jordi Latorre

Company name: ALB

Company position:

Comentar, Marc Capellades estudiant pràct procés internacionalització per Global!!

email recordatori gestió per altres caves

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?

   (a.) Yes: go on

   b. No: stop.

ALB empresa familiar al 1985

95 fundada ↳ Cornellà de Llob.

2000 ↳ Sta Clara

⇒ No prod ⇒ Si sistema ↳ Ctal compra/venda

2003 ↳ + entre gammes ↳ Consell d'admin

2004 ↳ especialitat

Mktg Mgmt ↓ Xavier Lopez dir. gral Ascamm

2) Why did the company approach the research or technological center?

Casualitat amb Ascam 2004 → Vicenç Bosch dir. Gral Ascamm Cat empresa familiar

conaix K. Lopez (ASCAMM) (Alfred)

3) Which were the circumstances?

2006 → Germà Jordi abandona la empresa

2006 Empresa Holandesa proposa comprar 100% Però no venen i tenen amb els holandesos

4) Could you describe the unsatisfied market need the company had?

↳ Cal reconstruir tot el negoci ↳ acord amb italians que subministrava una cartera de prod

2007 ↳ Prod ALB Sist → + plantes indus. ↳ entra en joc ASCAMM

5) How did the company identify that need?

   a. Marketing / sales requirement

   b. Internal known weakness

   c. Others: specify

Planta ↳ Motllos ↳ robots

↳ Panell radiant amb recobriment alumini ↳ Prod estrella actual

Crisi ▽ 60% venda

6) Once the need identified, was the company aware of an available technology to satisfy it?
   a. Yes
   b. No

Prod: Substituir el prod Holandes

Això els ha salvat per la crisi

7) Who has been involved in the decision to contact a research or technological center?
   a. Interviewed alone
   b. General management / Board
   c. Technical management / department
   d. Others: specify

tot el consell

↳

1a: redacció pla estrat 2006-08
↳ Volen desenvolupar Sant ACB

8) Who has been involved in the decision of the person who had to perform that contact?
   a. Interviewed alone
   b. General management / Board
   c. Technological management /department
   d. Others: specify

2a: 2006 → oferta Hol
↳ el preu ofertat és baix
↳ 35 anys l'operació no era atractiva

9) Why this person and not somebody else?
   a. Technological expertise
   b. Research expertise
   c. Personal relationships
   d. Person in charge of the project
   e. Others: specify

3a Febr 2007 → nosaltres
↳ opció fabricar
↳ accord de consell
↳ Sandr K. Lopez
↓
enginyer industrial per col·laboració Light
↳ disseny robot
Velocitat!!

10) Was this person technological expertise a prerequisite for choosing him?
   a. Yes
   b. No

11) Who has been involved in the decision of how this contact would be done?
   a. The chosen person
   b. The General Management / Board
   c. Technological Management
   d. Others: specify

1r gener 2008
Ja està al mercat!!

ASCAMM → centre tec
no dona velocitat

Addendum

12) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?

a. Based on partnership
b. Based on service purchasing → aquest → es veia necessitat → sabia voluntat → ni no servia, un altre
c. Others: specify

13) Which were the foreseen difficulties in the relationship?

a. Different cultural behaviors
b. Different institution objectives
c. Different working paces
d. Money related problems
e. Technology transfer problems
f. Patents / royalty problems
g. Confidentiality
h. Other: specify

↳ no el veia algu molt llunya estructural burocràtic dubtes que la tech. el coneixement NO es genera a la uni ni a les empreses

14) Were there differences of perception of research centers versus technological centers?

a. No
b. Yes. Specify.

15) How did the company find who has what to solve our company problem?

a. Intermediary
b. Ask a specialist
c. Social media
d. Old teacher
e. Other: specify

16) How did the company choose the one to be contacted, and discard others?

a. Based on recommendation
b. Based on reputation
c. Based on papers / publications
d. Based on geographical proximity
e. Based on technological expertise
f. Other: specify

Addendum

17) How did the company reach that entity/person?

a. Phone the standard
b. Phone somebody inside (Gral Manager, tech boss, etc...)
c. Phone somebody who knows somebody inside
d. General email
e. Introduced by email to somebody inside
f. Go there physically
g. Social Media contact
h. Other: specify

18) How was the contact actually performed? Explain

Vs X. Lopez → Vbem-nos a ASCAMM
→ 1ª reunió Jordi Ribatallada (Robòtica)
D. Caballero (Projects)
(Villos)

19) Did the company contact an intermediary instead of contacting directly a research or technological center?

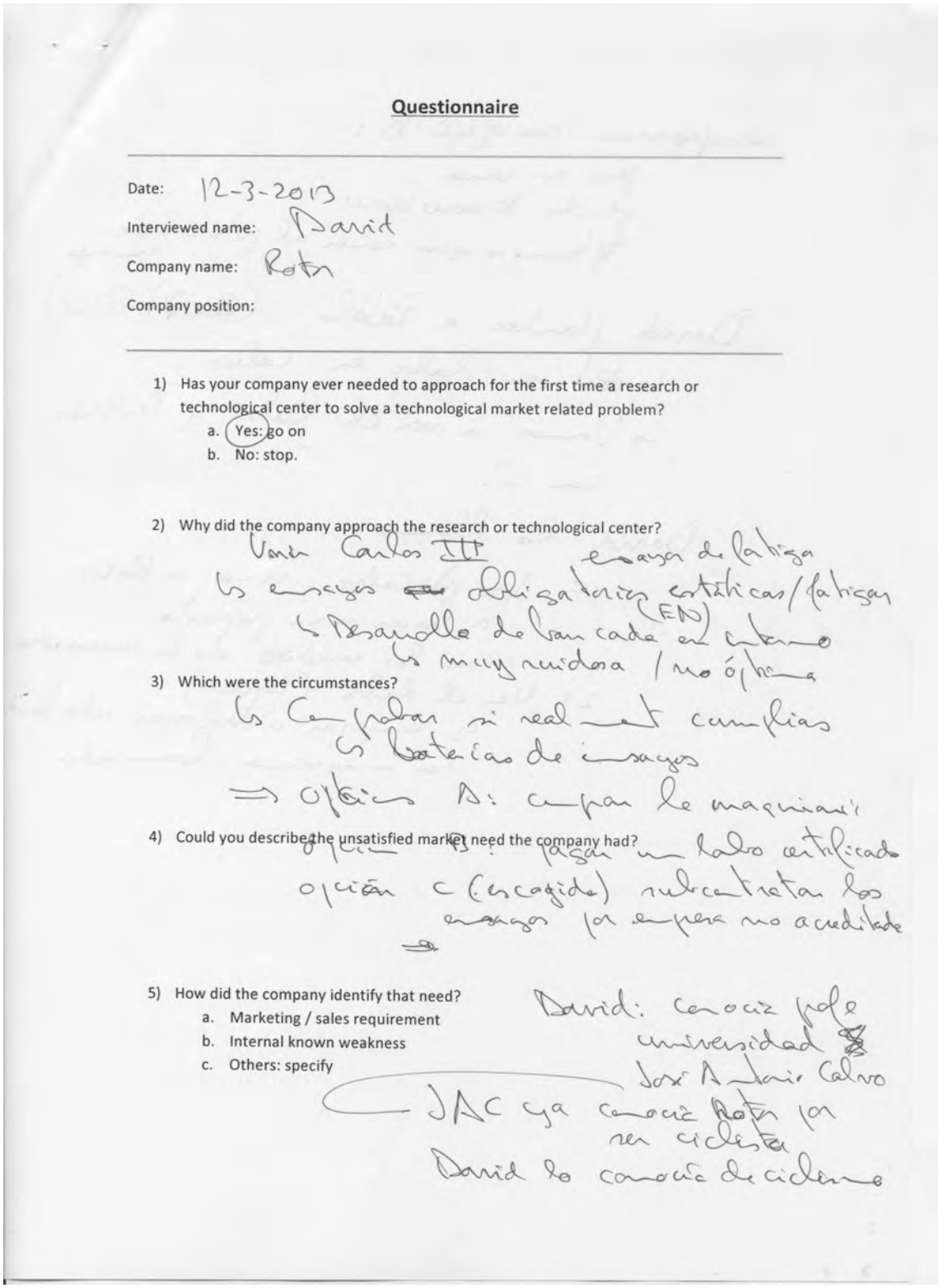
a. Yes
b. No

→ van venir 2 opcions subsidiàries Vs Asc CATM
Prof Vs Industrial (el fabricant del robot)

20) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?

a. Yes
b. No

Addendum 8. Transcribed interview with C



Questionnaire

Date: 12-3-2013

Interviewed name: David

Company name: Rotn

Company position:

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
   a. (Yes: go on)
   b. No: stop.

2) Why did the company approach the research or technological center?

Juan Carlos III ensayos de fatiga
los ensayos obligatorios estáticos/fatiga
Desarrollo de barcada en interno (FEM)
muy sencilla / no ópima

3) Which were the circumstances?

Comprobar si realmente cumplías
baterías de ensayos
⇒ opción A: comprar la maquinaria

4) Could you describe the unsatisfied market need the company had?

opción B: pasar un kabo entrelicado
opción C (escogida) subcontrata los
ensayos por empresa no acreditada
⇒

5) How did the company identify that need?
   a. Marketing / sales requirement
   b. Internal known weakness
   c. Others: specify

David: conoce gente universidad & Jose Antonio Calvo
JAC ya conoce Rotn por ser ciclista
David lo conoce de ciclismo

Addendum

empezaron con aquí B:
no es cara
pierden know how
tuvimos que ceñirnos al protocolo de ensayo

David plantea a Pablo (2007-2008)
- test en labro en Calvo
- Vamos a ver el labro y hablar con él.

David lo llamó
1º: José D Calvo vino a Rota a hacer una propuesta con los medios de la universidad
2º: Ver el labro (David) y empezar a trabajar adaptado las máquinas/brocados

6) Once the need identified, was the company aware of an available technology to satisfy it?
   a. Yes
   b. No

7) Who has been involved in the decision to contact a research or technological center?
   a. Interviewed alone
   b. General management / Board
   c. Technical management / department
   d. Others: specify

8) Who has been involved in the decision of the person who had to perform that contact?
   a. Interviewed alone
   b. General management / Board
   c. Technological management /department
   d. Others: specify

Pablo + dirección
Dirección + ingeniería

9) Why this person and not somebody else?
   a. Technological expertise
   b. Research expertise
   c. Personal relationships
   d. Person in charge of the project
   e. Others: specify

10) Was this person technological expertise a prerequisite for choosing him?
   a. Yes
   b. No

11) Who has been involved in the decision of how this contact would be done?
   a. The chosen person
   b. The General Management / Board
   c. Technological Management
   d. Others: specify

12) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?
   a. Based on partnership
   b. Based on service purchasing → cliente proveedor antes
   c. Others: specify

↳ luego cambió porque los ensayos los hace [illegible] y define el ensayo

13) Which were the foreseen difficulties in the relationship? Pb:
   a. Different cultural behaviors
   b. Different institution objectives → Burocracia
   c. Different working paces
   d. Money related problems → nada más por el
   e. Technology transfer problems hecho de conocer a JAC
   f. Patents / royalty problems
   g. Confidentiality → sí [illegible] CDA
   h. Other: specify

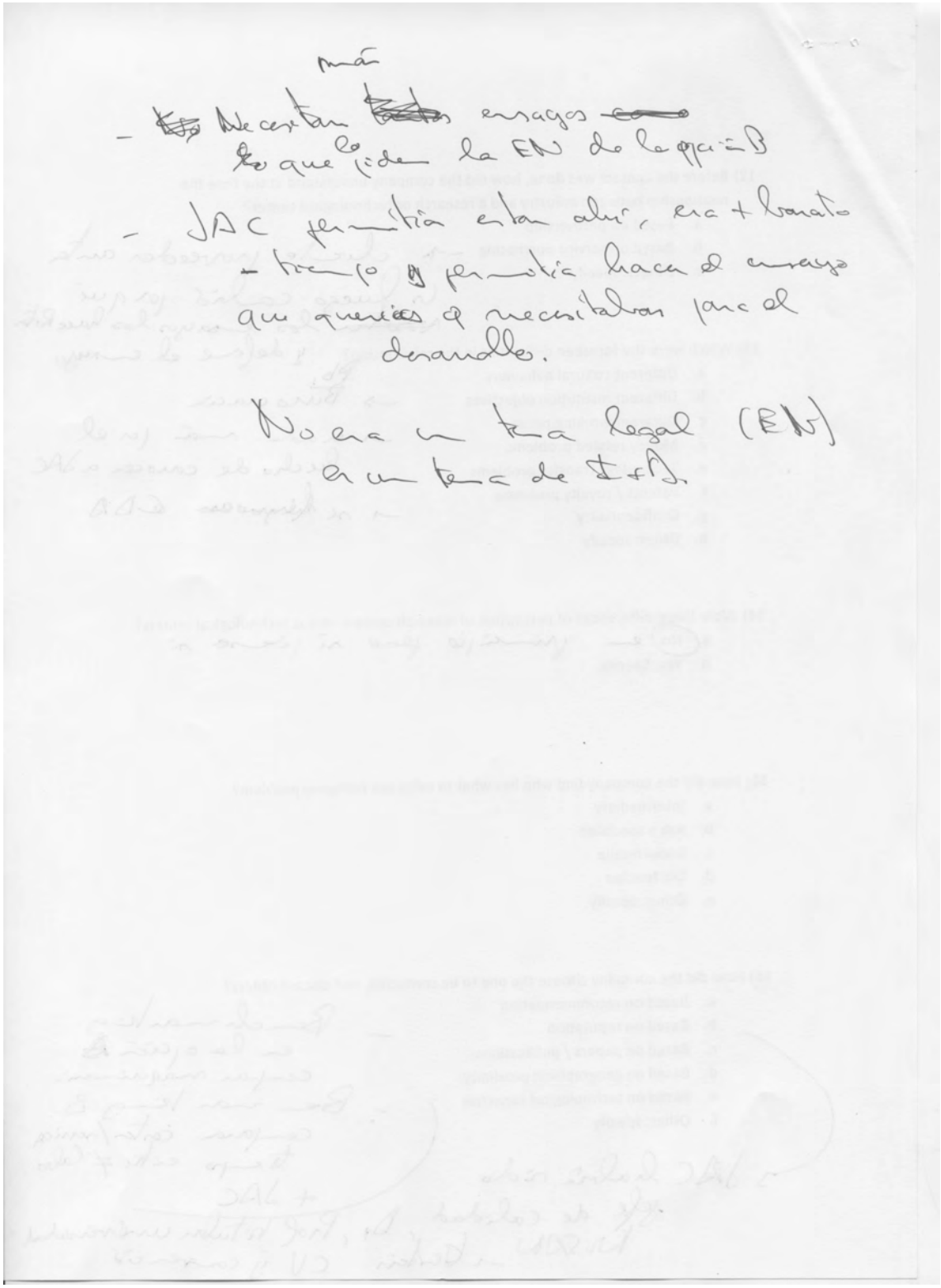
14) Were there differences of perception of research centers versus technological centers?
   a. (No) en principio pero sí piensa sí
   b. Yes. Specify.

15) How did the company find who has what to solve our company problem?
   a. Intermediary
   b. Ask a specialist
   c. Social media
   d. Old teacher
   e. Other: specify

16) How did the company choose the one to be contacted, and discard others?
   a. Based on recommendation
   b. Based on reputation – Benchmarking
   c. Based on papers / publications en la opción A
   d. Based on geographical proximity comprar maquinaria
   e. Based on technological expertise – Benchmarking B
   f. Other: specify compara coste/servicio
   tiempo entre ≠ labo
   + JAC

→ JAC habría sido
jefe de calidad Dr, Prof titular universidad
NISSAN → Martín CV y conocencia

Addendum


más
- Necesitan ensayos
lo que pide la EN de la aparato
- JAC permitía estar ahí, era + barato
- tiempo y permitía hacer el ensayo
que querías o necesitaban para el
desarrollo.
No era un tema legal (EN)
era un tema de I+D.

17) How did the company reach that entity/person?
   a. Phone the standard
   b. Phone somebody inside (Gral Manager, tech boss, etc...)
   c. Phone somebody who knows somebody inside
   d. General email
   e. Introduced by email to somebody inside
   f. Go there physically
   g. Social Media contact
   h. Other: specify phone but direct

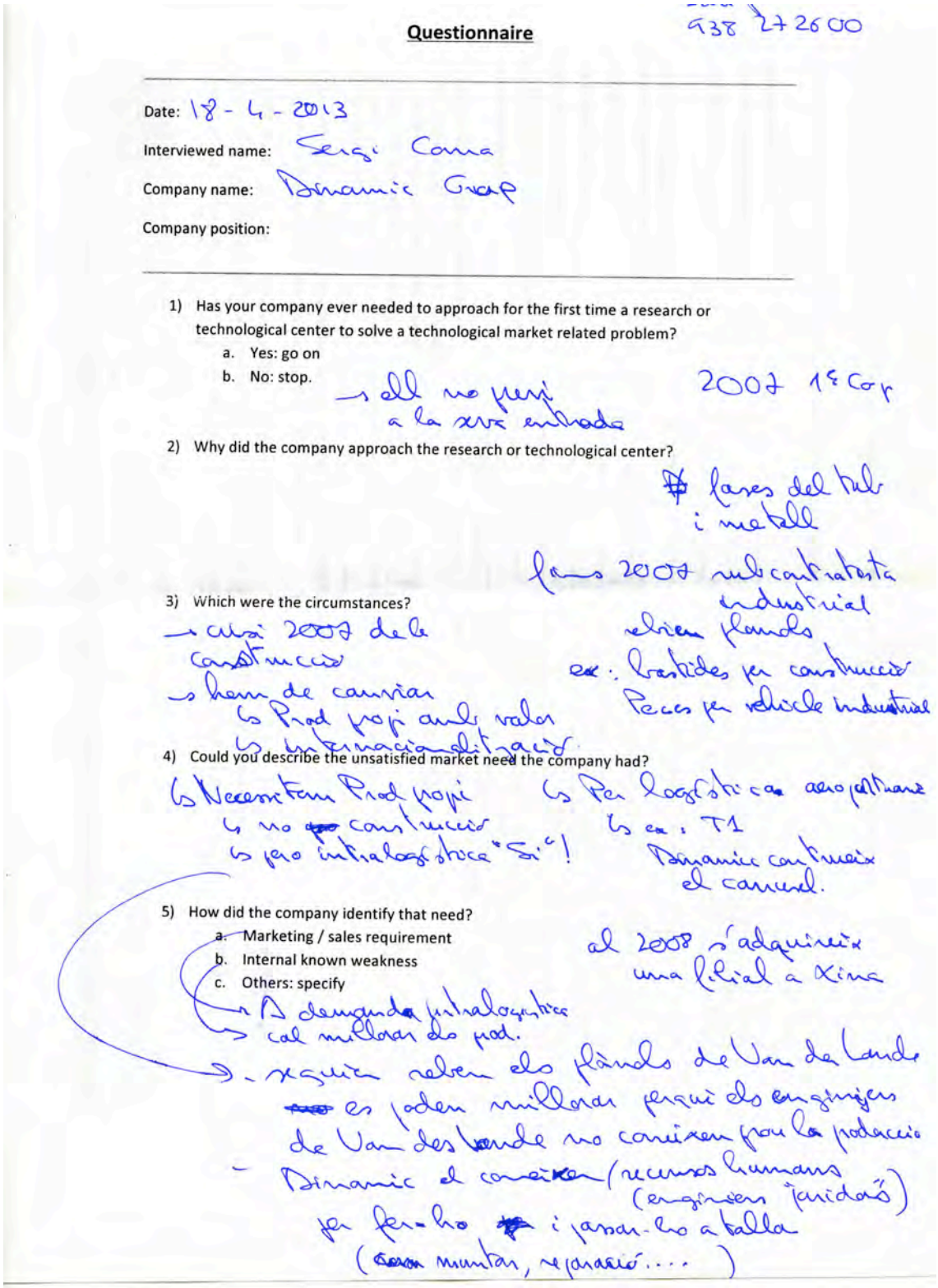
18) How was the contact actually performed? Explain

19) Did the company contact an intermediary instead of contacting directly a research or technological center?
   a. Yes
   b. No

20) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?
   a. Yes
   b. No

Addendum 9. Transcribed interviews with D

First interview



Questionnaire

938 27 26 00

Date: 18 - 4 - 2013

Interviewed name: Sergi Coma

Company name: Dinamic Group

Company position:

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
   a. Yes: go on
   b. No: stop.

→ sí no però a la seva entrada

2007 1ª Cop

2) Why did the company approach the research or technological center?

fases del tub i metall

fins 2007 subcontratista industrial

3) Which were the circumstances?

→ cap a 2007 de la construcció

→ han de canviar
- Prod propi amb valor
- internacionalització

ex.: bastides per construcció
Peces per vehicle industrial

4) Could you describe the unsatisfied market need the company had?

- Necessitem Prod propi
- no construcció
- pero intralogística "Sí"!

- Per logística aeroportuària
- ex.: T1

Dinamic continuarà el carrusel.

5) How did the company identify that need?
   a. Marketing / sales requirement
   b. Internal known weakness
   c. Others: specify

al 2008 s'adquireix una filial a Xina

→ Δ demanda intralogística
→ cal millorar els prod.

- aquests van ser els fàbrics de Van der Lande
- es poden millorar perquè els enginyers de Van der Lande no coneixen prou la producció
- Dinamic sí coneix (recursos humans (enginyers "jardins"))

per fer-ho i passar-ho a taller

(muntar, reparació....)

6) Once the need identified, was the company aware of an available technology to satisfy it?
   a. Yes → cat fab : el fab és de enginyeria
   b. No

7) Who has been involved in the decision to contact a research or technological center?
   a. Interviewed alone
   b. General management / Board
   c. Technical management / department
   d. Others: specify

8) Who has been involved in the decision of the person who had to perform that contact?
   a. Interviewed alone
   b. General management / Board
   c. Technological management /department
   d. Others: specify

9) Why this person and not somebody else?
   a. Technological expertise
   b. Research expertise
   c. Personal relationships
   d. Person in charge of the project
   e. Others: specify

10) Was this person technological expertise a prerequisite for choosing him?
   a. Yes
   b. No

11) Who has been involved in the decision of how this contact would be done?
   a. The chosen person
   b. The General Management / Board
   c. Technological Management
   d. Others: specify

12) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?
   a. Based on partnership
   b. Based on service purchasing
   c. Others: specify

13) Which were the foreseen difficulties in the relationship?
   a. Different cultural behaviors
   b. Different institution objectives
   c. Different working paces
   d. Money related problems
   e. Technology transfer problems
   f. Patents / royalty problems
   g. Confidentiality
   h. Other: specify

14) Were there differences of perception of research centers versus technological centers?
   a. No
   b. Yes. Specify.

15) How did the company find who has what to solve our company problem?
   a. Intermediary
   b. Ask a specialist
   c. Social media
   d. Old teacher
   e. Other: specify

ASCAMM
o centre tec de Manresa

16) How did the company choose the one to be contacted, and discard others?
   a. Based on recommendation
   b. Based on reputation
   c. Based on papers / publications
   d. Based on geographical proximity
   e. Based on technological expertise
   f. Other: specify

17) How did the company reach that entity/person?
    a. Phone the standard
    b. Phone somebody inside (Gral Manager, tech boss, etc...)
    c. Phone somebody who knows somebody inside
    d. General email
    e. Introduced by email to somebody inside
    f. Go there physically
    g. Social Media contact
    h. Other: specify

18) How was the contact actually performed? Explain

19) Did the company contact an intermediary instead of contacting directly a research or technological center?
    a. Yes
    b. No

20) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?
    a. Yes
    b. No

Addendum

Second interview

Questionnaire

Date: 29-4-2013

Interviewed name: Joan Cos

Company name: Dinamic Group / Rinea 3

Company position:

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
   a. Yes: go on (circled)
   b. No: stop.

2) Why did the company approach the research or technological center?

TTo: Subcontractistes de procés

des de 2007 càrrec innovació
ho veien com
→ cerca millores
→ organitzar el procés
↳ fons [illegible]

3) Which were the circumstances?

T1: Proj. de complicat
↳ resoldre pb
ex: T1 (≈ 300000 €)
↳ contracten enginyeria

2007 entrad. Cos

↳ p.b. pb de projecte molt greus
↳ o bé millorar un producte de client
⇒ Pel liderat del propietari
↳ va cap a l'innovació
↳ productes propis
↳ millores en tallers que no poden fer en intern

4) Could you describe the unsatisfied market need the company had?

T2: Client demana fer això però + barat
↳ millora de producte
↳ empresa

demanda que ~~[illegible]~~ a contactar Centre Tec

5) How did the company identify that need?
   a. Marketing / sales requirement
   b. Internal known weakness
   c. Others: specify

↳ consciència de innovació
↳ pot desenvolupar sense tanta dependència dels pas clients
⇓
trànsit comercial complicat

T3: Producte propi
↳ ho ha fet tant bé que això és meu, no ten
↳ Patentar

6) Once the need identified, was the company aware of an available technology to satisfy it?
   a. Yes
   b. No

7) Who has been involved in the decision to contact a research or technological center?
   a. Interviewed alone
   b. General management / Board
   c. Technical management / department
   d. Others: specify

8) Who has been involved in the decision of the person who had to perform that contact?
   a. Interviewed alone
   b. General management / Board
   c. Technological management /department
   d. Others: specify

9) Why this person and not somebody else?
   a. Technological expertise
   b. Research expertise
   c. Personal relationships
   d. Person in charge of the project
   e. Others: specify

10) Was this person technological expertise a prerequisite for choosing him?
   a. Yes
   b. No

11) Who has been involved in the decision of how this contact would be done?
   a. The chosen person
   b. The General Management / Board
   c. Technological Management
   d. Others: specify

Abans ASCAMM Catedràtic Univ.
"Rare" vàlids fer coses
però es quedava en un estat general
→ no varen saber concreta
no hi havia... sense resposta

12) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?

   a. Based on partnership
   b. Based on service purchasing
   c. Others: specify

es feia CTM per anàlisi + test
però no era el "nostre"
no per desenvolupament
mi knowhow

13) Which were the foreseen difficulties in the relationship?

   a. Different cultural behaviors
   b. Different institution objectives
   c. Different working paces
   d. Money related problems
   e. Technology transfer problems
   f. Patents / royalty problems
   g. Confidentiality
   h. Other: specify

- tenim 1 projecte ajuda
- lo "adequat" que segui el catedràtic
→ Jordi Gabaldà
→ Dinàmic és molt pràctica
→ no hi ha personal per la empresa amb la "teoria" de la universitat
"Universitat massa teòric"
→ massa lents
→ "no ens han entès"

14) Were there differences of perception of research centers versus technological centers?

   a. No
   b. Yes. Specify.

→ ASCAMM va encaixar per la practicitat - rapidesa de resposta

15) How did the company find who has what to solve our company problem?

   a. Intermediary
   b. Ask a specialist
   c. Social media
   d. Old teacher
   e. Other: specify

→ posar una persona
- propera tècnicament
- saps si ho ha cursat
- disponibilitat

16) How did the company choose the one to be contacted, and discard others?

   a. Based on recommendation
   b. Based on reputation
   c. Based on papers / publications
   d. Based on geographical proximity
   e. Based on technological expertise
   f. Other: specify

17) How did the company reach that entity/person?

   a. Phone the standard
   b. Phone somebody inside (Gral Manager, tech boss, etc...)
   c. Phone somebody who knows somebody inside
   d. General email
   e. Introduced by email to somebody inside
   f. Go there physically
   g. Social Media contact
   h. Other: specify

mail personal (targeta de (ECOM)

18) How was the contact actually performed? Explain

19) Did the company contact an intermediary instead of contacting directly a research or technological center?

   a. Yes
   b. No

20) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?

   a. Yes → no formal, no estructurada
   b. No

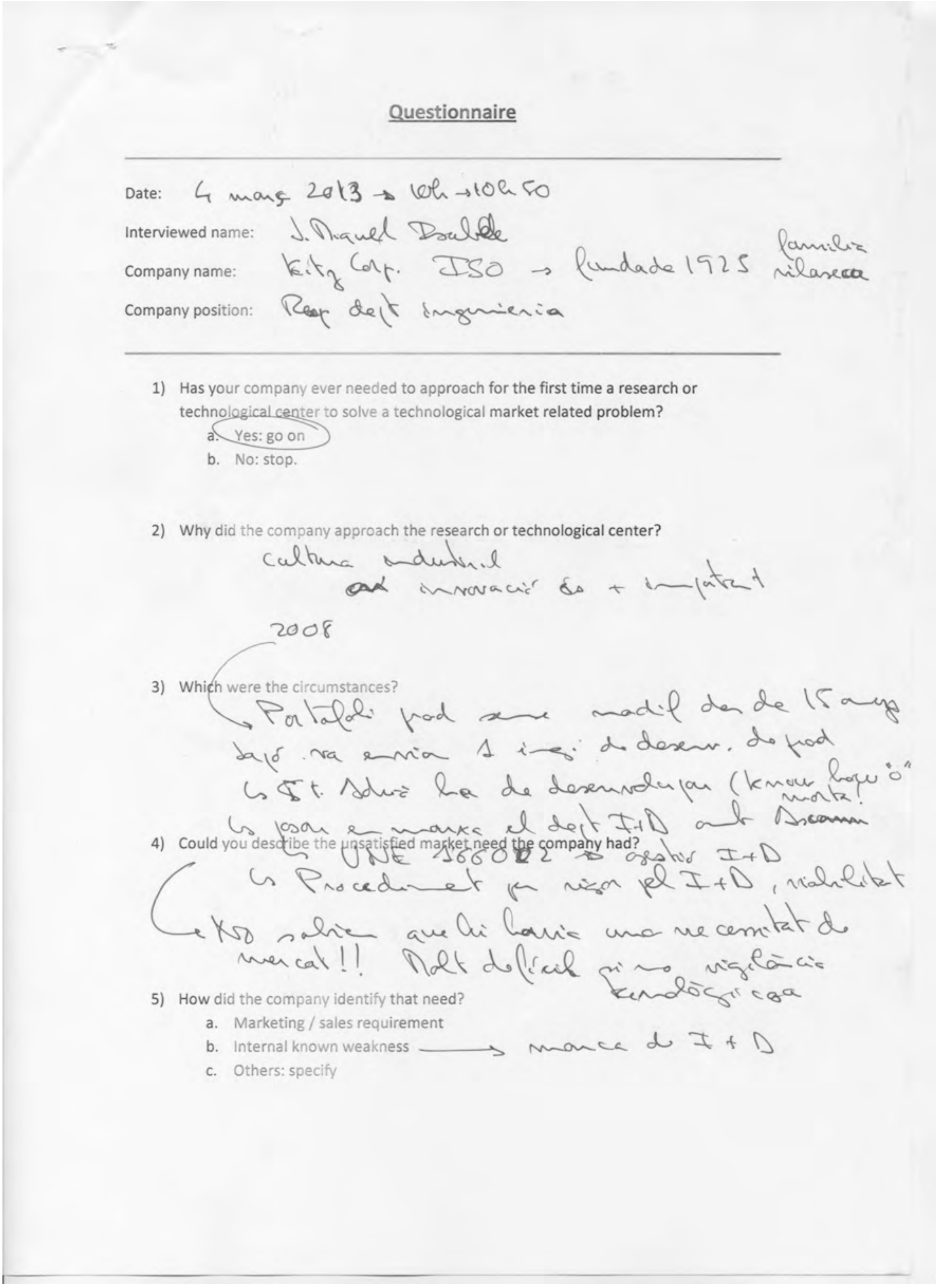
abans CTM, Leitat, Roure, ASCAMM

Leitat: J.C. els coneixia
↳ música pertenece a ASCAMM

CTM: J.C. no els tenia ben posicionats
↳ no els vaig contactar per això
↳ no es tenia al cap pel que necessitava

↳ Contacta J. Guasch

Addendum 10. Transcribed interview with E



Questionnaire

Date: 4 maig 2013 → 10h → 10h 50

Interviewed name: J. Miquel [illegible]

Company name: Kitz Corp. ISO → fundada 1925 família vilaseca

Company position: Resp dept Ingenieria

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
   a. Yes: go on
   b. No: stop.

2) Why did the company approach the research or technological center?

   cultura industrial
   innovació és + important

   2008

3) Which were the circumstances?

   → Portafoli prod sense model des de 15 anys
   però va entrar 1 eng. de desenv. de prod
   → S.T. Advisor ha de desenvolupar (know how molta!)
   → però es marca el dept I+D amb Ascamm
   UNE 166002 → gestió I+D

4) Could you describe the unsatisfied market need the company had?

   → Procediment per regir el I+D, viabilitat
   → No sabien que hi havia una necessitat de mercat!! Molt difícil sense vigilància tecnològica

5) How did the company identify that need?
   a. Marketing / sales requirement
   b. Internal known weakness → manca de I+D
   c. Others: specify

Addendum

6) Once the need identified, was the company aware of an available technology to satisfy it?
   a. Yes
   b. No

7) Who has been involved in the decision to contact a research or technological center?
   a. Interviewed alone
   b. General management / Board
   c. Technical management / department
   d. Others: specify

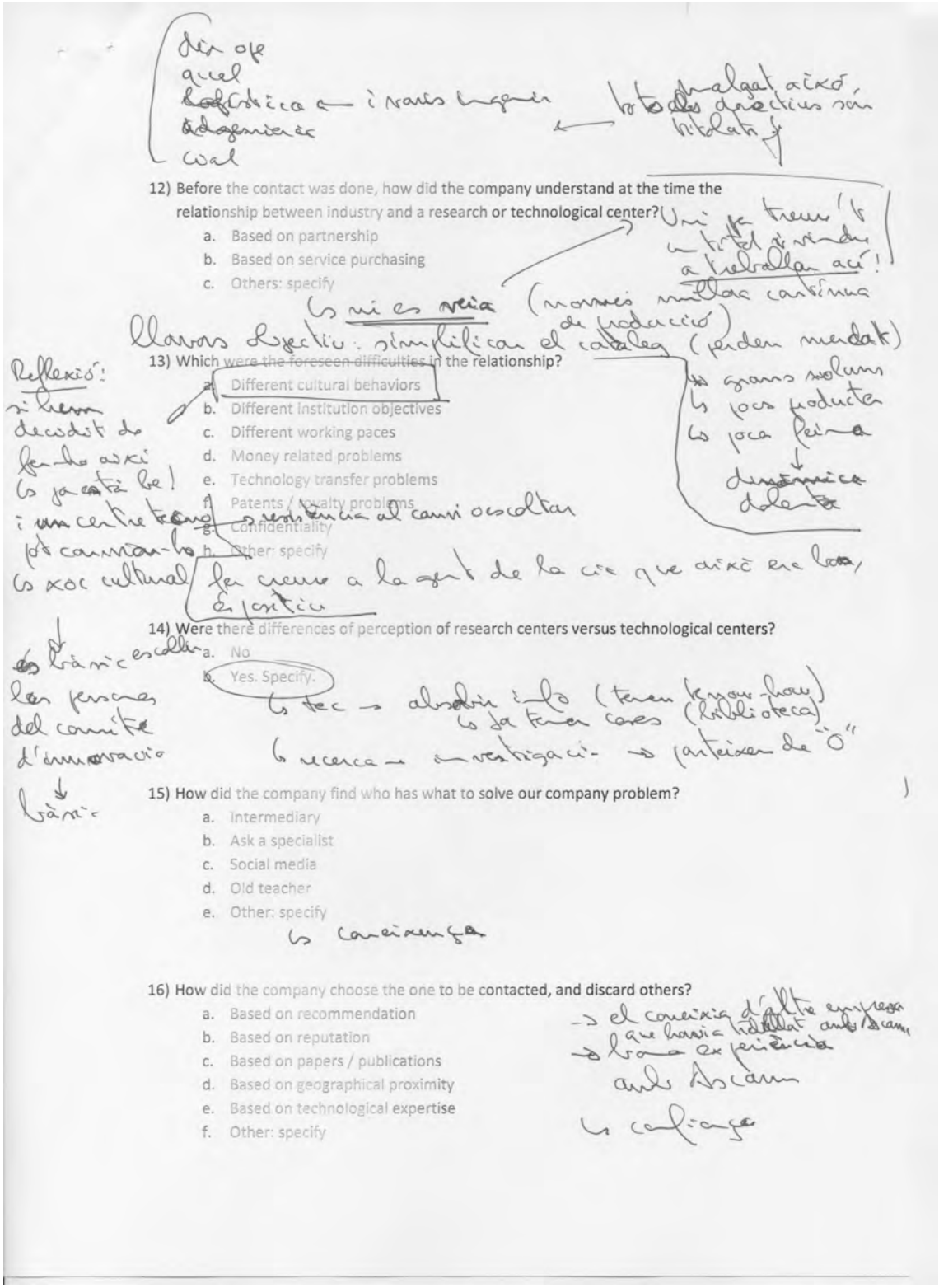
8) Who has been involved in the decision of the person who had to perform that contact?
   a. Interviewed alone
   b. General management / Board
   c. Technological management /department
   d. Others: specify

9) Why this person and not somebody else?
   a. Technological expertise
   b. Research expertise
   c. Personal relationships
   d. Person in charge of the project
   e. Others: specify

10) Was this person technological expertise a prerequisite for choosing him?
   a. Yes
   b. No

11) Who has been involved in the decision of how this contact would be done?
   a. The chosen person
   b. The General Management / Board
   c. Technological Management
   d. Others: specify

Addendum



12) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?

a. Based on partnership
b. Based on service purchasing
c. Others: specify

13) Which were the foreseen difficulties in the relationship?

a. Different cultural behaviors
b. Different institution objectives
c. Different working paces
d. Money related problems
e. Technology transfer problems
f. Patents / loyalty problems
g. Confidentiality
h. Other: specify

14) Were there differences of perception of research centers versus technological centers?

a. No
b. Yes. Specify.

15) How did the company find who has what to solve our company problem?

a. Intermediary
b. Ask a specialist
c. Social media
d. Old teacher
e. Other: specify

16) How did the company choose the one to be contacted, and discard others?

a. Based on recommendation
b. Based on reputation
c. Based on papers / publications
d. Based on geographical proximity
e. Based on technological expertise
f. Other: specify

Addendum

17) How did the company reach that entity/person?
   a. Phone the standard
   b. Phone somebody inside (Gral Manager, tech boss, etc...)
   c. Phone somebody who knows somebody inside
   d. General email
   e. Introduced by email to somebody inside
   f. Go there physically
   g. Social Media contact
   h. Other: specify

el seu gendre treballa [illegible] de la fundació Ascamm
ls [illegible] va parlar amb ell del tema i li va demanar amb qui d'Ascamm. email amb el nom d'Albert Riera.

18) How was the contact actually performed? Explain

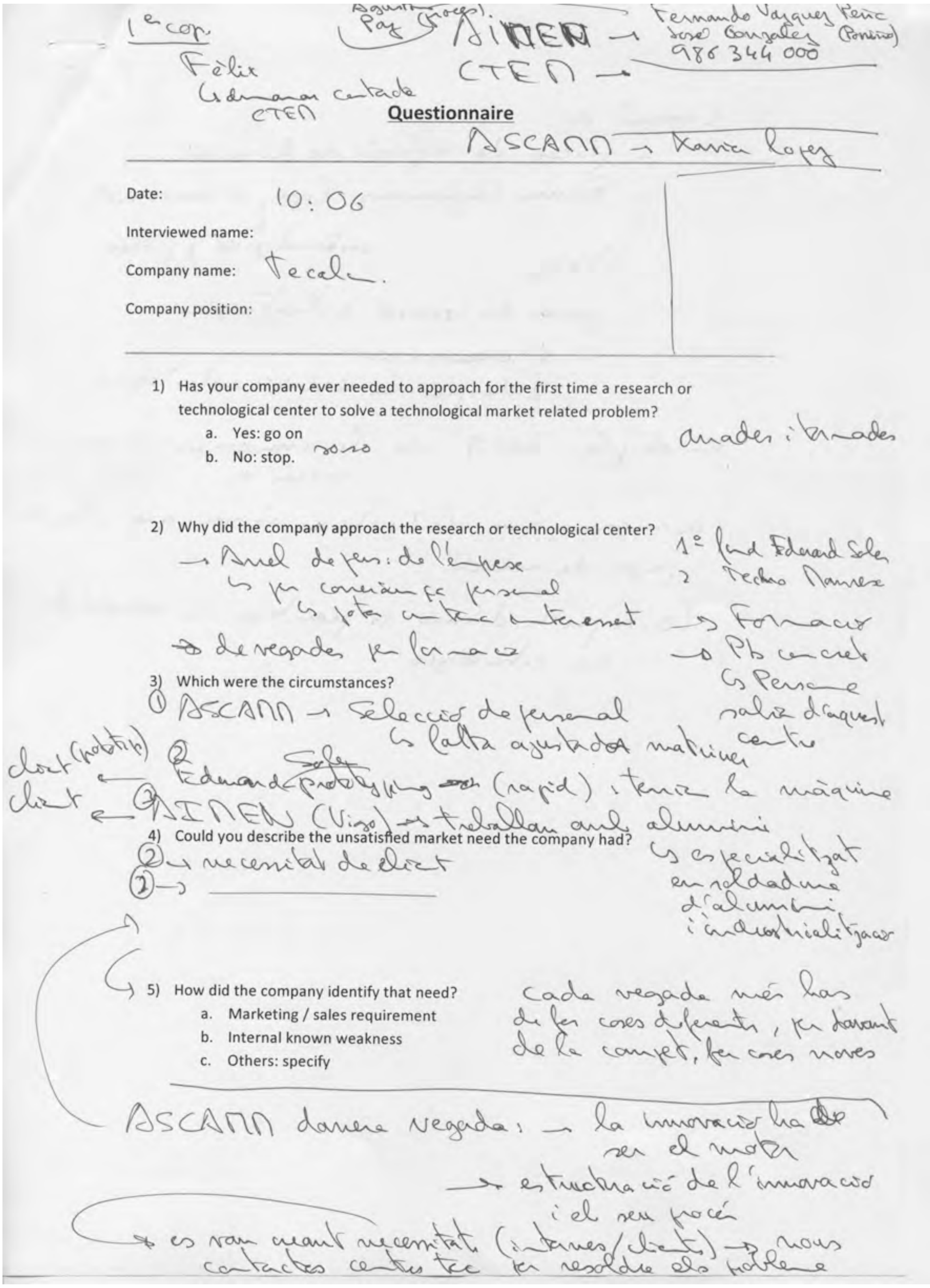
ls email d'A. Riera amb Scentroni de kitz i idea de muntar el dept de I+D.
ls A. Riera va posar en contacte amb en Marc Capdevila (resp innov d'Ascamm.)

19) Did the company contact an intermediary instead of contacting directly a research or technological center?
   a. Yes – qui és
   b. No

20) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?
   a. Yes
   b. No

ls flamingo va posar en marxa el dept de I+D.

Addendum 11. Transcribed interview with F


1ª cop.
Fèlix
AIMEN → Fernando Vazquez Perez
José Gonzalez (Porriño)
986 344 000
CTEM →

Questionnaire

ASCAMM → Xavier Lopez

Date: 10:06

Interviewed name:

Company name: Tecale.

Company position:

1) Has your company ever needed to approach for the first time a research or technological center to solve a technological market related problem?
   a. Yes: go on
   b. No: stop.

2) Why did the company approach the research or technological center?

3) Which were the circumstances?
① ASCAMM → Selecció de personal
② Eduard Soler prototyping (rapid)
③ AIMEN (Vigo) → treballen amb alumini

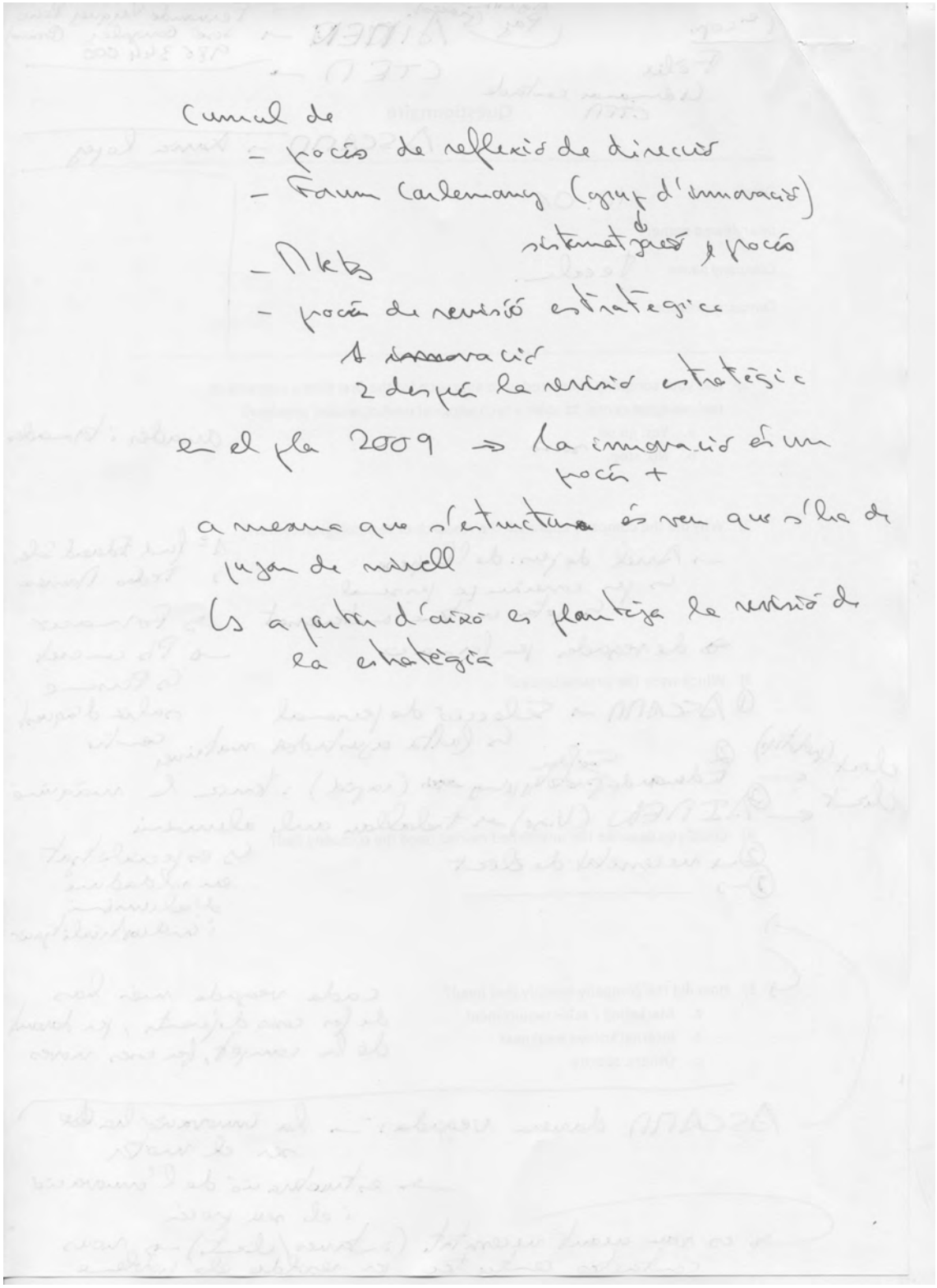
4) Could you describe the unsatisfied market need the company had?

5) How did the company identify that need?
   a. Marketing / sales requirement
   b. Internal known weakness
   c. Others: specify

Cada vegada més has de fer coses diferents, per davant de la compet., fer coses noves

ASCAMM darrera vegada: → la innovació ha de ser el motor
→ estructuració de l'innovació i el seu procés

Addendum


Canvi de
- procés de reflexió de direcció
- Fòrum Cardemany (grup d'innovació)
- Nkbs
- procés de revisió estratègica
  1 innovació
  2 després la revisió estratègica

el gla 2009 → la innovació és un procés +

a mesura que s'estructura és veu que s'ha de jugar de nivell

Es a partir d'això es plantija la revisió de la estratègia

Addendum

6) Once the need identified, was the company aware of an available technology to satisfy it?
   a. Yes
   b. No

→ ens dirigim a 1 persones que coneixes → lluita entre centre tec. Sembla que s'ajuden però són egoistes i potser no són els millors → pot acabar donant volta

7) Who has been involved in the decision to contact a research or technological center?
   a. Interviewed alone
   b. General management / Board
   c. Technical management / department
   d. Others: specify

alvaro | Entre Felix (Dir Gral)
ana | Qualsevol resp de 1era nivell bo podria fer

8) Who has been involved in the decision of the person who had to perform that contact?
   a. Interviewed alone
   b. General management / Board
   c. Technological management /department
   d. Others: specify

idem.
ana: la persona amb el pb la que contacta, Felix i Marc catalitzadors i no fan les decisions.

9) Why this person and not somebody else?
   a. Technological expertise
   b. Research expertise
   c. Personal relationships
   d. Person in charge of the project
   e. Others: specify

10) Was this person technological expertise a prerequisite for choosing him?
   a. Yes
   b. ~~No~~

→ sí però la milloren molt amb els projectes

11) Who has been involved in the decision of how this contact would be done?
   a. The chosen person
   b. The General Management / Board
   c. Technological Management
   d. Others: specify

| Acaben treballant també com a conectors entre empreses amb capacitats molt interessants

12) Before the contact was done, how did the company understand at the time the relationship between industry and a research or technological center?

a. Based on partnership
b. Based on service purchasing
c. Others: specify

imprescindible relacionar-se
→ associat a recerca de base
→ menys a vol de subvencions
1es → compra venda de serveis

13) Which were the foreseen difficulties in the relationship?

~~a~~. Different cultural behaviors
b. Different institution objectives
~~c~~. Different working paces
~~d~~. Money related problems
e. Technology transfer problems
f. Patents / royalty problems
g. Confidentiality
h. Other: specify

ara: internacional
cosa llunyana
allunyats del dia a dia
menys si subvencions
temps: la unió molt lenta entre tec menys així (AIMEN)

14) Were there differences of perception of research centers versus technological centers?

a. No
b. Yes. Specify.

① ②
② + pràctics, ràpids, més semblant a l'empresa
① lligats a dinàmiques d'universitat per ells s'escapa

15) How did the company find who has what to solve our company problem?

a. Intermediary
b. Ask a specialist
c. Social media
d. Old teacher
e. Other: specify

per el centre tec cal ajut cap a la univ. ! !
l'agents dels centres ~~s~~ fan perdre temps a l'empresa i al país per trobar la persona adequada

16) How did the company choose the one to be contacted, and discard others?

a. Based on recommendation
b. Based on reputation
c. Based on papers / publications
d. Based on geographical proximity
e. Based on technological expertise
f. Other: specify

1a contacte per proximitat geogr.
o networking
a través de Fora Catalunya
Ampliar la visió
Però de vegades no arriben a qui té la millor (potser és de baix nivell)

17) How did the company reach that entity/person?
   a. Phone the standard
   b. Phone somebody inside (Gral Manager, tech boss, etc...)
   c. Phone somebody who knows somebody inside
   d. General email
   e. Introduced by email to somebody inside
   f. Go there physically
   g. Social Media contact linkedin
   h. Other: specify

Truquen / correu ~~linkedin~~ a una ~~persona~~ que penses que lot ajudar-te ...

Cuidar aquestes relacions

18) How was the contact actually performed? Explain

Eduard Soler: contacte d'una persona que hi coneixia d'abans i tenia

AIMEN: Presentació d'ells prèvia. (entre nosaltres i amics)
↳ Quan van tenir la necessitat, el truquen
↳ Tenien capacitat mental de recordar-ho

19) Did the company contact an intermediary instead of contacting directly a research or technological center?
   a. Yes
   b. No (circled)

20) Did the company benchmarked different centers and so perform different contacts before deciding with whom it will work with?
   a. Yes (circled)
   b. No

La clau és estructurar el procés d'innovació

⇒ Ajudar per les empreses que no ho fan.
↳ voluntat i visió (ni a la mediàtica s'ha menjat) mentalitat oberta

Les xarxes de confiança permet d'evitar de perdre temps per trobar qui t'ajudarà.

Addendum

Felix

2' Primer cop

Felix coneixia ASCAMM
↳ va contactar i els la fer venir
en aquell moment ASC. estaven ~~aut~~ posant-se
al campus de l'Uni Gir.
↳ OK preguntat

1ª vegada
· Viatge de la Gene a Mèxic (Maragall + Huguet)
↳ barreja Cultura i Empresa
A l'altre empresa de joieria text sic empresa a Mèxic
Pb no conscient! ↳ Va conèixer X. López ASCAMM (moltes hores)
↳ experiència de matriceria
↳ podria ser vàlid
Joieria certs contactes amb especialista
ASCAMM especialistes a posar en marxa
comitè innovació (sistematització)

ASCAMM propi empresa
↳ cultura
↳ en casella
↳ sí no molt vàlid

Club Innovació ASCAMM
que ofereix capacitat sobre d'empreses associades.

Addendum 12. Interview analysis: answers by questions

Interview analysis

By the Questions

		Company A	Company B	Company C	Company D
2	Reason why	Miscontrol in a molecule production	Business re-orientation need: -60% sales!	To verify if prototypes comply to what they are expected to	Need to develop a complex technological problem w/o the needed ressources
3	Circumstances	Need external help to solve the problem	Ascamm CEO X Lopez already board member	Lots of prototypes but using internal machines is not optimal/noisy	Change in the company focus towards new products not depending too much on the Dutch
4	Unsatisfied market	The market wanted a product with lower residue	Radiant panel with AL panel similar to Dutch needs to be produced with Italian parts	Need for new products	Cheaper and improved carrousel
5	How need identified	The amount of residue	Break of relationship with Dutch supplier who intented to buy ALB at very low price	It was part of the strate	The Dutch designer asked for it
6	Knowledge of technology available	Supposed yes	Yes	Yes	Yes but not up to what was reached
7	Who involved in the contact decision	The production manager and the board mager	All the board	The interviewed + the development manager (Pablo)	The board
8	Who involved in the person who should perform the contact	The production mager	The board	Interviewed and Dev manager	The Fin manager and the interviewed The CEO knew but not on top of it
9	Why that person and not somebody else	IQS training student proposed to contact IQS = easy and quick	CEO of tech center Ascamm	The interviewed knew the person to contact (bike fellow)	In charge of innovation
10	Was his tech expertise a prerequisite?	Not for the trainee	Not him	Yes	Yes
11	Who involved on how the contact?	The prod mager and the training student	The board	Interviewed and Dev manager	Interviewed
12	Before contact what was UIC?	-	Based on service purchasing	Based on service purchasing	Just for test and analysis at tech center CTM
13	Which foreseen difficulties in relationship	-	Not seen Something very far away	Bureaucracy CDA	The relationship should be very practical Speed to answer
14	Differences between research and tech centers	-	No	Not at first sight but thinking about it Yes	Universities are too much on theory not practical enough
15	How was found who has what to solve	The student proposed the professor to contact	Ascamm CEO was already a board member	Personal contact	By chance
16	How to choose the one	The student did it	The choice was already in	No choice in the person but choice between different options to solve the problem	Comparison with the test and analysis tech center
17	How that person was reached	Through the student	Already in the board	Direct phone call	By chance at a metal sector conference
18	How was the contact really performed	Phone call and meeting at IQS	Ascamm CEO proposed a meeting at Ascamm	Direct phone call At University	At a sector conference the interviewed met J. Guasch and decide to meet later at Dinamic
19	Was an intermediary used	The training student	No	No	No
20	Was there any benchmark before?	No	Yes the robot provider	Yes (buy or externalize)	Yes between CTM and Ascamm Ascamm

Addendum

Interview analysis

By the Questions

		Company E	Company F	Conclusions
2	Reason why	Acquisition by Japanese	Need to innovate, to be upfront competitors	Very diverse: Need for external help that cannot be solved internally Either for a specific project or because or a global change in strategy focus
3	Circumstances	From a pure industrial company to an innovative one	Change in the focus need to struture innova tion process	Most companies did not have any previous relationship Some did have it either for training or testing but not for research o development
4	Unsatisfied market	By then the company was not even aware of unsatisfied market need	Customers ask for more different products and new ones	All but one did have market needs or urgencies to cover One was simply not aware there were uncovered market needs. It fact the company did not even look for them.
5	How need identified	Japanese impose it	Customers ask for it	For most, the customer was asking for changes. On two, the strategy was the leading point.
6	Knowledge of technology available	No. The technology is discovered by doing R&D…	Yes and No	Most said Yes but were not all were completely aware of what was available Rotor and ALB knew. The others not really or simply no (Kitz)
7	Who involved in the contact decision	The board	CEO and Mgm Dir	The board is involved in the decision
8	Who involved in the person who should perform the contact	The board	CEO and Mgm Dir	Top management but also other management positions: production and finance
9	Why that person and not somebody else	Personal relationships	CEO was the promoter of the change	Mostly because of personal contacts, others because in charge of the innovatio or promoters of innovation
10	Was his tech expertise a prerequisite?	Yes	Yes	The technical knowledge of the person chosen to lead the contact was mostly (5 out of 6) a prerequisite
11	Who involved on how the contact?	The interviewed	CEO	Some top management supervision is demanded on how the contact will be performed. This seems to tell how important the topic is understood at top level.
12	Before contact what was UIC?	University is a school to let you find a job	Unthinkable for Tecalum Idea related to research	Either is seen as a pure service purchasing topic or it was something too far away for the company to think about.
13	Which foreseen difficulties in relationship	Different cult behaviors	Diff cultural behaviors no grants no research far from day to day Univers too slow	Bureaucracy, different cultural behaviors and far way from their daily business are some of the difficulties. Companies need more practical things they can understand and speed in answering their requests.
14	Differences between research and tech centers	Yes. Tech to absorb info Are know-how reservoir Universities = research	Tech are more practical close to companies Univers was far away	2/3 do not see any difference (at least at first sight) Others see tech center as more practical and close. A know-how reservoir Universities are for research = theory + school to get a job
15	How was found who has what to solve	Personal contact	Networking, contacts	5/6 by personal contacts either direct or through networking 1 by chance
16	How to choose the one	Knew the person from previous company = trust + good experience	Recommendations direct or via social media	Very diverse: Could be internal (Chemipol) or external (Tecal) recommendation or knowledge of the person (Kitz) or simply the choice was not possible because it was inside (ALB)
17	How that person was reached	His brother works in a tech center and directed him to the person via email	phone call + email	2/6 direct visit (ALB + Dinamic) 3/6 phone call 1/6 email (Kitz)
18	How was the contact really performed	email to the person + meeting at Kitz	phone call + email + a meeting at Tech Center	After the first contact a meeting was scheduled 4/6 meeting at the tech/research center
19	Was an intermediary used	Not a professional one (his brother)	No but recommendations	None used a professional tech broker
20	Was there any benchmark before?	No	Yes diverse. They were afraid of not taking the best (all say they can do it but it not always true)	4/6 did some kind of benchmarking Out of them, 2 did it with two different options (Rotor Buy machines or do it externally and ALB between robot provider or tech center) and two did it comparing similar tech centers

Addendum 13. UIIN 2013 Congress Amsterdam Presentation

"Do you remember the first time?"

(or how Industries behave to approach Research Centers for the first time once they have decided they need them.)

May 28th 2013

Martorell Gérard

PERSONA CIÈNCIA EMPRESA
Universitat Ramon Llull

0.- Title and Objectives

Title:

How Industries

- with no previous collaboration with research centers
- but with a market problem that has to be addressed through external research
- behave to approach research centers for the first time?

0.- Title and Objectives

What do you think companies do?

0 Title and Objectives
1 Method
2 Difficulties and solutions
3 Comments and Discussion

1.- Method

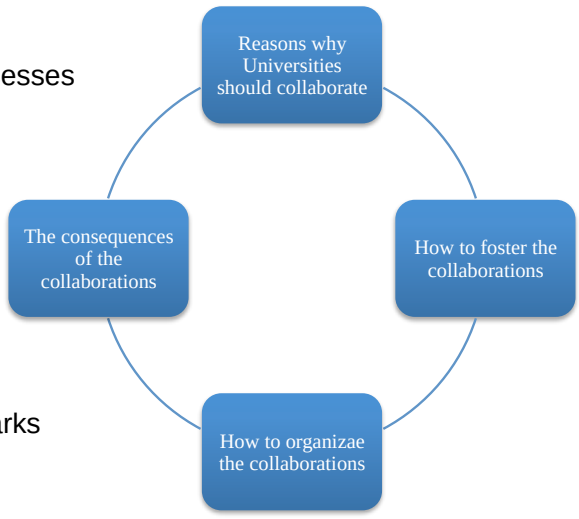
What have we found in papers?

Historical successes

Grants

Ethics

Science parks



Patents

TTO

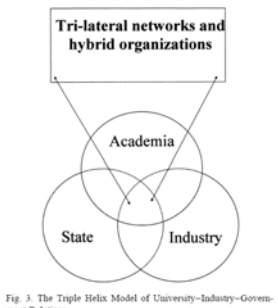


Fig. 3. The Triple Helix Model of University–Industry–Government Relations.

1.- Method

Conclusions of the literature:

- A small bunch of papers treat how industries behave to contact research centers

- None has been found for industries with no previous records of collaboration

Why?

1.- Method

How are we going to study the proposed topic?

Qualitative Quantitative

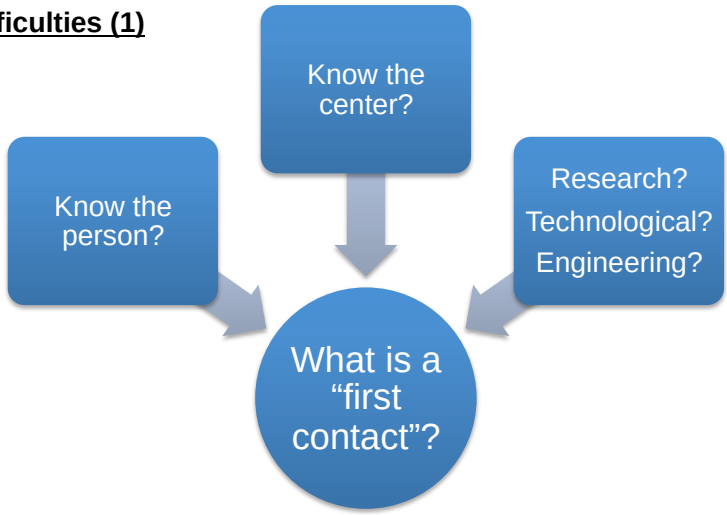
1.- Method

How are we going to study the proposed topic?

- A qualitative study consisting on some interviews with industries that meet the parameters have taken place.
- The aim is to find out if any common pattern could be developed.
- Understanding the industry behavior (reasons why), a theory should be proposed for the reasoning behind it (how and why).

3.- Difficulties and Solutions

Difficulties (1)



3.- Difficulties and Solutions

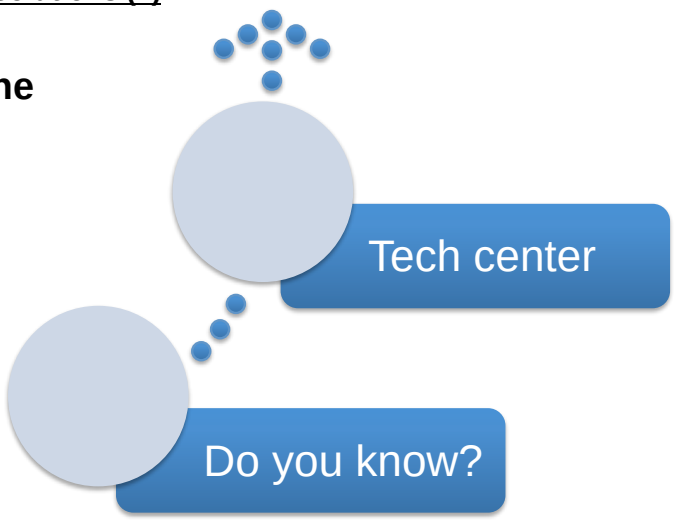
Solutions (1)

- A "first contact" with research or technological center is defined as being
  - "new to the company" regardless if someone already contacted or knew them because of his private or previous experiences.
  - "new to the company" if, despite the technological center / research center has already collaborated in other areas than research or technology transfer, the contact is done with the aim of research or technology transfer.
  - Engineering companies are not going to be classified as technological centers because they do not perform research in house.

3.- Difficulties and Solutions

Difficulties and solutions (2)

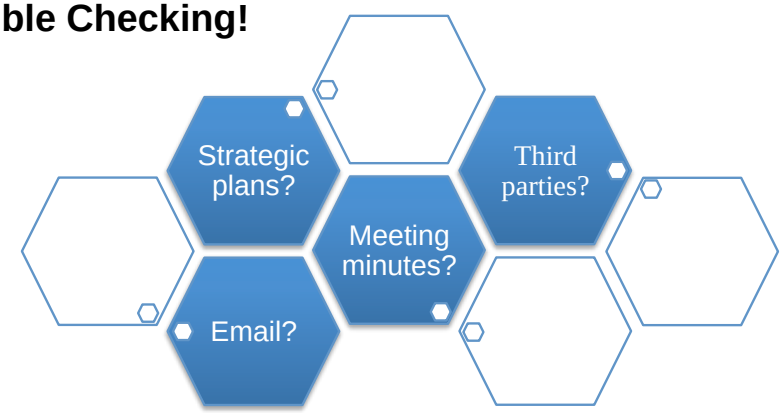
How to reach the companies



3.- Difficulties and Solutions

Difficulties and solutions (3)

Double Checking!



4.- Comments and Discussion

What have we found (preliminary results) (1)

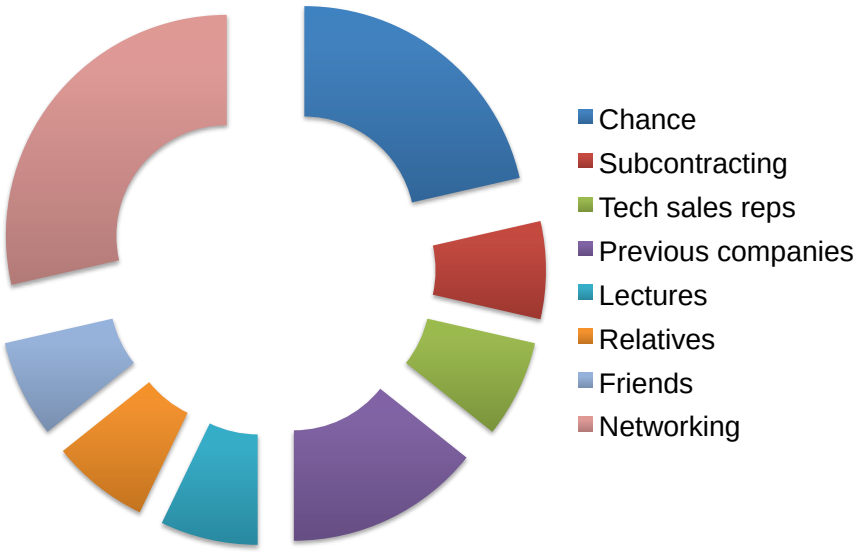
- Ways:
  - By chance
  - Previous job experiences in other companies
  - Any lectures/training/teaching by the center.
  - Relatives
  - Friends
  - Networking
  - Subcontracting
  - Tech center sales reps

- The same company could have 2 or more explanatory first contacts
  - E.g.: Chance can be coupled with previous job experiences

4.- Comments and Discussion

What have we found (preliminary results) (2)

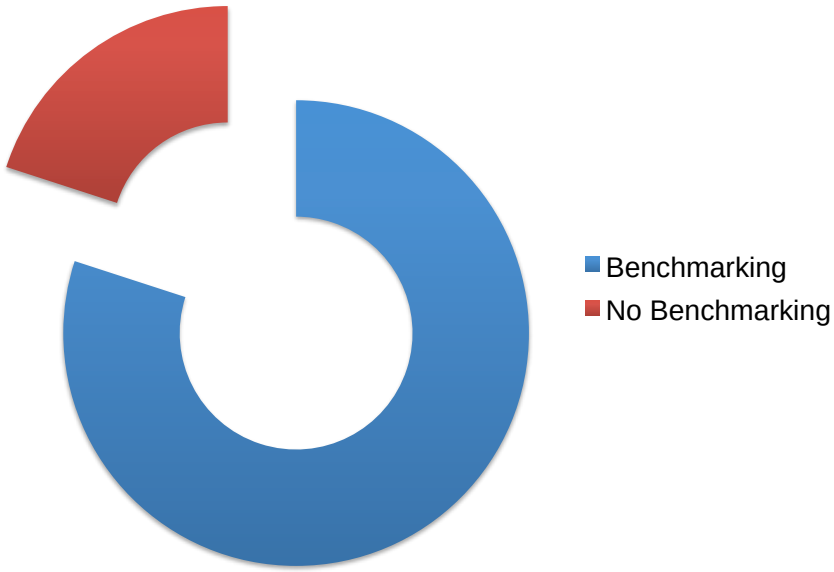
- There is not a single way to explain the behavior



4.- Comments and Discussion

What have we found (preliminary results) (3)

- Most companies perform previous benchmarking before contact



4.- Comments and Discussion

What have we found (preliminary results) (4)

No need = No contact!

Viva the quantitative!

"We do not know what we do not know"
and a kind of paralysis sets in,
where it becomes easier to do nothing.
Weathley 2009

Addendum

Addendum 14. UIIN 2013 Congress Amsterdam Paper (Proceedings pages 27-43)

HOW INDUSTRIES WITH NO PREVIOUS COLLABORATION WITH RESEARCH CENTERS BEHAVE TO APPROACH THEM FOR THE FIRST TIME?

A review

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Abstract: This paper explores the latest contributions in the University Industry Collaboration (UIC) literature on how industries behave when they have a technological related market problem, no record of previous relationships with university research centers and decide they need to approach them for the first time. What has been found is related to the reasons to justify the collaboration, what can be done to foster these relationships, how the collaboration has to be organized and which are the consequences of it. Among the papers found we would like to review how many and in what sense they talk about the proposed topic.

Keywords: Technology transfer, University Industry Collaboration, UIC, University Industry Relationship, UIR.

I. INTRODUCTION

Relationships between University and Industries have been studied since years. Bozeman (2000) mentions there is a "voluminous, multidisciplinary literature on technology transfer". In this relative high amount of documentation, authors tend to give different names to concepts that could be assimilated as close-by or even identical. For instance, the name "firm" instead of "industry" is often used, or "collaboration" instead of "relationship" could be found in many papers.

Our method is to check what has been written in the last years and especially after the Bozeman (2000) revision mentioned before. The Databases such as EBSCO were deeply scrutinized through different questions: University Industry Relationship, University Industry Collaboration, How industry meets University, How Industry University, Industry meeting university and University Industry partnership. Reviewing the papers found and especially the interesting ones, it has been observed that some authors were repeatedly mentioned. So next step has been to find out why these authors were mentioned and extract from the database their main contribution papers. This is the case for the Bozeman (2000) or Etzkowitz (2000 and 2002). Adding to that some main laws have been found to have had an impact on the Academia Industry relationship and this is the case for instance of the Bayh-Dole Act (1980).

In order to leave things clearer and avoid controversies, Cambridge Academic Dictionary is used to find out the key words definitions this paper is going to be using all along. "Research" is defined

as “a detailed study of a subject, especially in order to discover (new) information or reach a (new) understanding”. “Research center” is “a place where research is performed”. “University” is “a college or collection of colleges at which people study for a degree”. As a comment in the case of the university, the mentioned definition shows a clear focus on academia. There is a common understanding by many authors that, besides academia, university objective should include research. “Industry is defined as “the companies and activities involved in the production of goods”. Also as a comment, as per industry, the names “company” or “firm” are going to be considered equivalents for this paper. “Collaboration” is “the act of working together with other people or organizations to create or achieve something”. “UIC” is the acronym of “University Industry Collaboration”. In some cases, UIC becomes UIR, where “R” is “Relationship”.

“Technology” has two main definitions. The first one is “The use of scientific knowledge or processes in business, industry, manufacturing”. The second one is “New machinery and equipment that has been developed using scientific knowledge or processes”. Sahal (1982) argues that the applied science as a “tool” is not to be separated to the “knowledge”. Both are linked together. This means that the “tool” is transferred with its use and application. To simplify the concept, the “tool” comes with its “instructions” of “how to use”.

Once the definitions are clear, the next question before exploring the literature is to have a look on the different points of view the UIC has been reviewed. Globally, the greatest number of publications on technology transfer has been published by management scholars. These can be organized in different technology topics to be transferred. The first one overlooks the production or design related technology or the “good” or service that is transferred (Lake, 1979; Teese, 1976). The second block mentions the relationship between the technology transfer and the company strategy (Laamanen and Autio, 1996; Lambe and Spekman, 1997). And the last one reviews the technology transfer within the same industry segment (Chiesa and Manzini, 1996; Rabino, 1989) or the impact of alliances in the technology transfer (Mowery, 1996).

It is also important to note that besides Universities and Industries, the governments, other administrative organizations and the surrounding society with its particular cultural behaviors play a significant role in the UICs. The policy paradigm, enforced acts and helps (grants or others) do also have an impact on the relationship. The models are going to be reviewed later on.

So the objective of this paper would be to check the available literature about the question of how industries with no previous collaboration with research centers behave to approach them for the first time.

To facilitate the understanding of the research, we decided to use the same block structure we found in the literature and so divide it into 4 major blocks, revising the finding within each block one after the other. These block are the reasons why of the UIC, how to foster the UIC, how to organize it and the consequences of the relationship, which altogether seems to follow a logical path for the establishment of a relationship.

II. Literature Review

This bloc will be reviewed in three parts.

II.1. The reasons:

Universities have traditionally had two basic missions: Academia and Research. However, more recently, some authors mention the fact that university objectives should also include the transfer of their research knowledge to the society (Etzkowitz, 2000; Kyoung-Joo Lee, 2010; Perkmann Markus, 2013). The argument is that strengthening the relationship between universities and industries can benefit not only the entities involved in the relationship but also the society as a whole (Bolton, 1994). In fact, some authors argue both are complementary (Kyoung-Joo Lee, 2010).

Despite the growing imperative for academics to bring in the academia research centers industry funds for research, much has been written on the commercialization of the research and the transfer of its technology. The topic of intellectual property, publication rights, the patents and their licensing is also emphasized (Berman, 2008; Perkmann, 2013).

Additionally, there are a number of publications mentioning problems, real or imagined (Bolton, 1994), barriers and boundaries to be overcome to make the relationship successful (Bauer, 2010; Sugandhavanija, 2010; David, 1982).

Perkmann et al. (2013) have recently published an article exploring the university engagement with firms and the commercialization one. Engagement is shown as being more the involvement in relationships with the industries and so might not conclude in any specific commercialization typical items such as patents or licensing. Also the reasons for one or the other are shown to be different and have different outputs.

II.2. The historical successes:

There are a relevant number of publications showing successful UICs (David, 1982; Bolton, 1994; Turk, 2005; Wheatley, 2009; Bernardos, 2009; Kyoung-Joo Lee, 2010; Scott, 2013). However, it is also important to agree upon the method how to measure what success is or means. In order to assess how successful a UIC might be, Thune (2010) proposes four different approaches split in two groups. To start with, he approaches privileging the policy/program maker's "management-oriented" point of view. This brings in two sub-approaches: the program theory evaluation that assesses if the "system" or the "relationship" works within the preset parameters and the outcome analysis where the meeting of the objectives is stressed. As a second block of approaches, he incorporates a critical stance to the management point of view: the policy discourse analysis that differs from political level discourses and qualitative network analysis that stress the political and personal informal patterns and interactions.

Although the theory mentioned by Thune (2010) is very interesting, some authors directly propose recipes for success (Sugandhavanija, 2010). Others explain what kind of knowledge is more successful to be transmitted: splitting between tacit or explicit knowledge (M. Santoro, 2006). There are also publications showing which industrial sectors are more successful with UIC (Thune, 2010). These papers show that a significant majority of the UIC are linked to the Health-Bio and engineering sectors (Thune, 2010; Perkmann, 2013). Other authors demonstrate that big industries are not the only ones with high success rates in the UIC and some small industries have developed successful relationship with research centers. However Turk (2006) showed that the success factors for successful university industry relationships in big faculties are not to be copied to the smaller faculties.

In any case, Thune (2007) noted that nobody has studied the process of creation of the links necessary to start the relationship.

II.3. What Universities and industries have obtained

Increased research costs make it more difficult for industries to be experts in all areas and access to university knowledge and expertise is considered to be an advantage (Ryan, 2008). Some studies argue that industries do not externalize directly sensitive technology, which they try to develop in house, but rather the non-sensitive or less strategic technologies. Other papers focus on what the industry has obtained such as access to unknown technologies or solutions to technological, industrial or organizational problems (Lee, 2000; Santoro, 2002; Rasmussen, 2006; D'Este, 2007; Koung-Joo Lee, 2010). In any case, some publications show that the industry culture is changing as a consequence of their relationship with universities (Varma, 2000). The implementation of stricter working norms such as the ISO or GMP, or that the work and studies have to be ethically well done, are partially a consequence of the scientific work behavior.

On the other hand, university culture is also influenced by their relationship with industry. Thanks to reaching agreements with the industry, the research center is able to pursue research in areas they would not be able to research without industries collaboration (Lee, 2000; Santoro, 2002; Kyoung-Joo Lee, 2010). However their behavior is also affected by the industry aim of reaching clear, practical and measurable objectives within a specified timeframe, which is something universities are not used to. Bolton (1994) has a look at some distorted ways to use the government grants via getting subsidies for industry internal research that does not profit the university. This is applicable to sensitive sectors such as defense, where grants just pass through the university

without leaving anything really profitable or a way to keep the production plants running and avoiding massive layoff that could harm the local political interest.

Despite the fact Glenna (2007) said that there are few studies on industry evaluation of the UIC, it is shown in other papers that the relationship perception by the researchers is significantly more positive once they have collaborated with the industry than their perception of the collaboration before the collaboration.

III. How to foster the UIC

III.1. In order to understand the UIC, some models have been proposed:

The Linear model is the most simplistic one and can be split in two basic ideas. Either the university has a technology and decides to sell it (supply push) or the industry has a technological related market need and goes to the university to solve it (demand pull). This linear model can be studied through history. Some authors propose historical structure evolutions:

- First phase till WWII: As Etzkowitz (2000) mentions, state, academia and industry had globally little interaction (see Fig. 1).

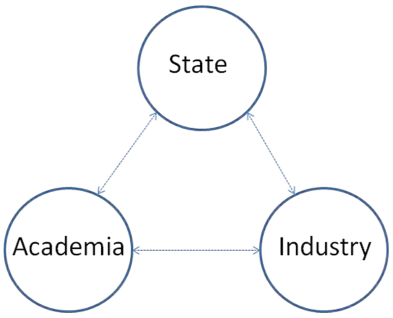

Fig. 1. State, Academia and Industry "laissez-faire"
Adapted from Etzkowitz (2000)

- Second phase: The idea is that State had to provide a medium in which the industry and academia could collaborate. Etzkowitz (2000) describes it as seen in Figure 2.

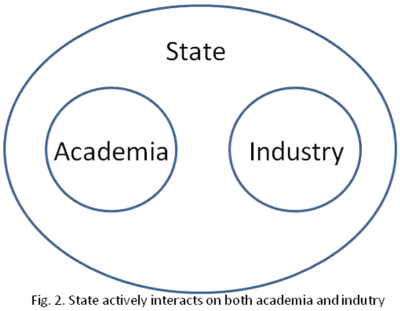

Fig. 2. State actively interacts on both academia and indutry
Adapted from Etzkowitz (2000)

In late 90s', the idea of the Triple Helix Model originated, originally formulated by Etzkowitz and Leydesdorff (1997), it describes the implication of a new social contract between higher education and society, which gives rise to a new interactive arrangement based on the operation of equivalent and overlapping institutional spheres with each group sharing responsibilities and with hybrid organizational structures emerging at the interface. See Figure 3.

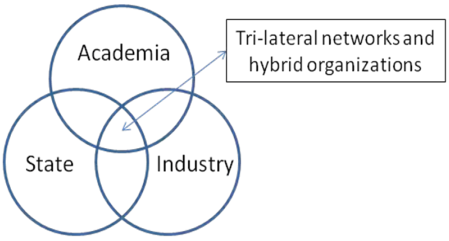

Fig. 3. The Triple Helix Model
Adapted from Etzkowitz (2000)

This successful model is used extensively worldwide to support innovative activities. As Etzkowitz and Leydesdorff (2000) mention, most countries and regions are presently using or trying to use this model in some sort.

However this is not the only valid model to explain the UIC. Bozeman in 2000 proposed the Contingent Effectiveness Model based on the idea of measuring the impact and effectiveness of the relationship between universities and industry. It considers five dimensions: the transfer agent, the transfer media, the transfer object, the transfer recipient and the demand environment (Figure 4).

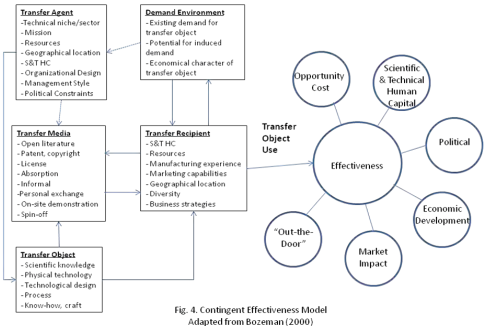

Fig. 4. Contingent Effectiveness Model
Adapted from Bozeman (2000)

III.2. In order to foster the relationships between research centers and industry some authors analyze the incentives to be put in place.

For instance, Kitagawa (2008) examines the impact on venture business increase after de-regulations and subsidizing policies for R&D in Japan. Others, such as Manjarrés (2009), studied the way to balance the UIC promotion as a substitute of public funds to the research centers. Bauer (2010) proposed to avoid providing grants to Universities for technology transfer unless they do not commit to transmit the generated intellectual property to the industry.

III.3. In relation to the technology transfer activities, many authors mention the importance that the intermediaries have on fostering collaborations (Kitagawa, 2008). Some models, putting upfront the importance of the stakeholders in their role in the TT are explained. Lane (1999) exposes the activities, events, stakeholders and resource providers that take place during the technology transfer (Figure 5).

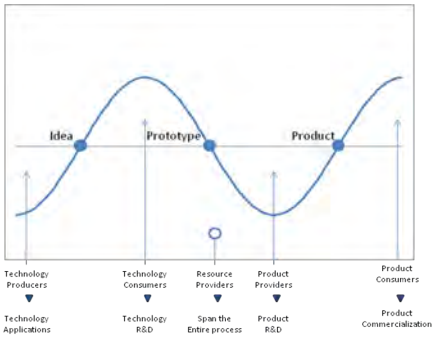

Fig. 5. Technology transfer model. Adapted from Lane (1999)

On the upper part of the figure 5, the model shows the consumer influence on the transfer while on the bottom part the technology is the one to basically influence the development.

Two topics recur in support of the UIC. On one hand, Bauer (2010) stresses the fact that the technology transfer has to be driven by the market need and the business interest instead of the more classical research + development + utilization model. On the other hand, authors also stress that the TTO and their liaison officers should not only be experts in intellectual property transfer, license and patenting but also request marketing and business expertise (Siegel, 2003; Malairaja, 2008).

III.4. Science parks, Research Parks, Technopoles, Innovations centers:

The names can be different from country to country but the idea is the same: Science parks are a way to bring in together research centers and industries into a close medium expecting that they will collaborate. A geographic proximity between universities and industries is known to foster relationships and produce more knowledge (Jaffe 1989 - 1993, Audretsh 1996, Feldman 1999, Van Oort 2004, Ponds 2007). Using the same reasoning, the Japanese government de-centralized the R&D expecting that regional research centers would produce technology better adapted to the local industry needs (Kitagawa, 2008). Recently Saad (2005) proposed the science parks to be part of the Triple Helix Culture.

Science parks are seen as a place for linking University research centers and industries, to provide advice, infrastructure for the business relationships and image credibility to especially small businesses (Lowegren, 2001; Figure 6)

Science park asa a resource network

Type of resource	Description
University-related	University links, access to university resources, university education, academics and graduates as skilled manpower
Science park facilities	Business advisory services, venture capital, flexibility of premises, car parking, administrative facilities, science park management
Cluster effects	Image, reputation and credibility of location and collective learning

Fig. 6 based on Lowegren (2001)

However there also some papers showing the limits of the science parks. Malairaja (2008) showed that, despite the science parks being set up to facilitate the commercialization of the developed technologies, there is no significant difference in collaboration between industries located within science parks and those located outside the parks.

III.5. The translators- Facilitators

The translators or facilitators can be either an individual or a group, such as the Federal Laboratory Consortium Locator Service, to which an industry can submit their technology problem and get advice about which techologies might serve their needs (Bauer, 2010. The translator needs to be very flexible and have many fields of expertise (Tobbias, 1995; Lundvall, 2000; M. Luna, 2003). Other authors directly mention the kind of knowledge they need (M. Luna 2003, Santoro 2006): tacit and explicit, know-how, know-what and know-why.

The strong relationships between individuals, referred to as social connectedness, have shown to facilitate the knowledge flow (Santoro, 2006). However it is stressed that developing trust is basic, especially for tacit knowledge transfer (Santoro, 2006; Luna, 2003; Brannock, 2006). See Figure 7.

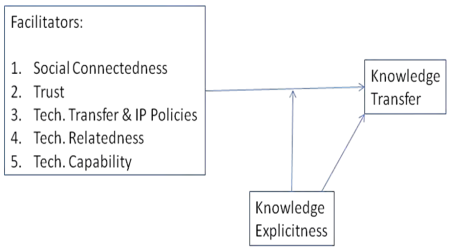

Fig. 7. Facilitators of knowledge transfer in UIC. Adapted from Santoro (2006)

III.6. The "what to dos" against U-I barriers

To begin some authors mention conflicts that can commonly arise during the relationship between the University research center and the industry. For instance a lack of understanding of each other's needs, and insufficient rewards for scientists or the administration bureaucracy is mentioned (Messner, 1999; Siegel, 2003; M. Luna, 2003; Santoro, 2006).

As a solution, these same authors propose to develop networks strong enough to manage the expected conflicts. Others propose the use of "linkage" specialists (Berman, 2008; Weathley, 2009), or that the TTO officials, besides being patent, license and technical specialists, should have marketing skills and entrepreneurial experience (Siegel, 2003; Malairaja, 2008). Also, Malairaja (2008) proposes that the University officials visit the science park industries to explain the type of research being performed at the research centers and the available facilities at disposal for them. Last but not least, this opens the need for policy initiatives to remove constraints, such as excess bureaucracy, that impede the development of the UICs (Saad, 2005; Malairaja, 2008).

III.7. The success models

The American Industries' relationship with academia in the 20th century has often been noted as an historical success (citation here). A prime example is MIT, which was founded to establish close ties between academia and industry.

For this, MIT started a program just after WWI involving more than 200 companies. For a fee, industries had access to state of the art academia and laboratories, staff and students who could solve a large variety of research problems. During the academic mobilization to win WWII, MIT developed multi-disciplinary centers and laboratories (G Omenn, 1982).

This multi-disciplinary body is been reproduced very. For example, the Working Education and Development Services (WLEDS) in Finland coordinated 6 education centers and related industries (Markkula, 2009). Other authors re-enforce this idea by showing that research-intensive universities are developing the cross-fertilization of disciplines by working in a single organization (Jones, 2010). Or the idea of a one—stop shop regional body for industries looking for access to academic researchers and advice over grant available funding (Wheatley, 2009). This is proven by some private owned research companies that have developed doing just this, for example the Irish IRIS (www.iris.cat) or LEiTAT (www.leitat.org).

In any case, some authors propose a list of factors to determine the relationship success and found out that success is a combination of more than just one factor. However, as mentioned before, social connectedness (Santoro, 2006), trust development (Santoro, 2006; Luna, 2003; Brannock, 2006) and clearing up topics that might go wrong early in the relationship (Brannock, 1998) are shown to be important. Failure is also determined by multiple factors (Bernardos, 2009) such as a technical problem, fund shortage, lack of definition and relationship problem.

III.8. Others

In general most of the literature is concentrated on research commercialization and technology transfer (Casey, 2005; Fulop, 2006; Kruss, 2006; Meagher, 2006; Severson, 2003; Thompson, 2003; Berman, 2008) and especially concerning Biology-Health and engineering sectors (Thune, 2010). Little research is found on industry perception of the relationship (Berman, 2008).

However industry people who really matter have a pretty good idea of the current research programs (Burringtion, 1993). This may explain why a majority of the university collaborations have been formed through the use of already existing contacts (Thune, 2007) and so shows the importance of social capital as a way to form collaborative ties. This also explains why there are different ways depending on the community and the context to negotiate science (Kleimman, 2003), why the R&D investment can be used for political reasons instead of innovation (David, 1982) or why legislation can be used to judge the university TT performance (Bauer, 2010).

IV. HOW TO ORGANIZE THE UIC

IV.1. The Intellectual property (IP) problem

IV.1.1. Patents:

Historically there has been an evolution in the treatment of the patent (Kitagawa, 2008). While the Wisconsin example in 1925 shows that prohibiting the University to patent has had important consequences that had to be reverted soon after its enforcement, the possibility to do so has brought funds to justify the UICs (Omenn, 1982). In fact, the reasoning is that industries will invest in innovation only if they expect to make attractive profits out of their exploitation (Jong, 2009). To do so, it is important to clear up that topic early in the relationship (Wheatley, 2009) and also to clear up the lag time for an industry to say “yes” or “no” to an innovation and file for a patent.

However, patents are not the only way to measure UIC relationships (D’Este, 2005; Cohen, 2002; Manjarrés, 2009). Researchers can still profit from their innovation by giving it for free. For instance, a study in the Nederland’s showed that 48% of the innovations were given at no fee to high tech Dutch SMEs and this proved to provide more profit to the whole society that a patent based agreement (Jong, 2009).

IV.1.2. Licenses:

Licensing, though it may bring more funds to the university, also requires skilled personnel to deal with. As these have a fix cost, independently of the number of licenses they have to deal with, it is likely that licensing profits more bigger collaborators than smaller ones (Turk, 2005).

On the other hand, licensing for innovations developed by the university, fails to account the greater impact of giving it for free (ratio 24:1) in the private sector and especially the benefit to the society and SMEs (Bauer, 2010).

IV.2. The consortiums

Historically well-known consortia have led the consortium notion to have a clearly popular position within industry. It represents a low-cost, low-risk option for everybody, especially for the university because no industry has the leverage to exert strong influence on research directions (David, 1982).

However in order to be successful some rules and guidelines are proposed to run them (Lewis, 2001), it is especially stressed that user centric consortiums create win-win situations that yield the university real-life cases (Markkula, 2009).

IV.3. The grants

The Bayh-Dole Act is mentioned several times as a success land mark for the UIC (Turk-Brint, 2005). It was created expecting the University innovation to flow easily to the industry, while generating more funds to the Universities (Glenna, 2007). Also, the Small Business Innovation Development Act describes how Fed Agencies should designate 2.5% of their budget to SME grants (Bauer, 2010) but often fail to find appropriate projects.

V. THE CONSEQUENCES OF THE UIC

V.1. For the Universities: Ethics vs. Money

A majority of studies show that UIC threatens research integrity and may limit the free exchange of information (Glaser, 2005; Florida, 1999; Manjarrés, 2009). This may tarnish the institutional reputations (Lewis, 2001) or blur roles (Powell, 1998; Kleimman, 2001; Glenna, 2007).

Other factors have an ethical impact. For instance, developing UIC may undermine to distinct public-interest and private-interest research (Kleiman, krimsky, lacy, Mc Sherry, 2001; Powell, 1998; Glenna, 2007) or be too short term lead (Mowery, 2005; AFT, 2001). Political ideology might also play a role in influencing research (Glenna, 2007) and the industry funding creates an incentive to promote the positive and suppress the negative in order to keep on bringing in more funds (Lewis, 2001; Martin, 2000).

However most of the studies qualify the UIC relationships as positive (Landry, 1996; Gullbrandsen, 2005; Stephan, 2007; Calderini, 2004; Azoulay, 2006; Breschi, 2007; Van Looy, 2004; Godin, 2000; Manjarrés, 2009) because basically these relationships bring in more financial resources, impact positively on their scientific performance and have synergistic effects on both, provided the R&D accounts for a small part of the researcher funding (Manjarrés, 2009) and time dedication (Tuunaimen, 2009).

V.2. For the industries: Risk vs. Profit

There is a general consensus that fed technology labs and university have only modest potential for creating new jobs and business on their own (Bozeman, 2000). That is why the industry is needed to bring in the market requests.

However, industry representatives overwhelmingly support UIR (Glenna, 2007). It is stressed that the research outsourcing is mainly used at strengthening their in-house technological capabilities (Kitagawa, 2008) and to avoid the "tunnel – vision syndrome", identified as the fact that the internal technological expertise prevents from indentifying potential technologies (Kyoung-Joo Lee, 2010).

V.3. The Act consequences: The Bayh-Dole example

The basics aims of the Act were to let the universities protect their IP and to facilitate the transfer of technologies from public to private sector (Glenna, 2007; Slaughter, 2004).

This maligns any university research that does not translate into IP (Glenna, 2007; Somers, 2005). However there is no argument of shifting the university research priorities after the act enforcement (Cote, 1993; Turk, 2005). But findings show that the number of collaborations and the amount of funds have benefited the top ones and not the mid or low ones (Turk, 2005). The percentage of private funds was 2.6% in 1970 and increased to 6.9% by 1990 (Cohen, 1993; Bozeman, 2000) but this has been linked to the decline in government funding. Other papers show that the Act itself has not changed the basic trends in patenting. There is no structural break after its enforcement (Mowery, 2005).

Copying the Bayh-Dole legislation in other countries (such as Spain, Ireland or Austria) could be counterproductive because it focuses on licensing as primary channel and this can have chilling effect on other ones (Mowery, 2005).

VI. CONCLUSIONS AND RECOMMENDATIONS

In this literature revision some basic topics have been reviewed. To start with some definitions have been settled down so as everyone understands the specific topics the literature is talking about. Most

of the literature that has been found has been published by management scholars who can be organized in different ways. However in this paper the basics topics have been the reasons behind UICs, how to foster them, how to organize them and their consequences.

Looking at the reasons why, the increased pressure on academia to transfer its knowledge to the private sector has been stressed. This is supported by historical successes and the exposure of what universities and industries have obtained. On the topic of how to foster the UIC, different models have been exposed to understand the complexity of the relationship, the different incentives to be put in place, the importance of the intermediaries, translators- facilitators and the experiences with science parks.

In the how to foster the UIC part, the patents, licenses, grants and consortiums organization is reviewed. The consequences of the UIC show the fight between ethics and money in the academia and the risk vs. profit in the industry. Especial emphasis is put the Bayh-Dole Act and its consequences.

However, despite the idea that the research should be directed by market demand needs (Bauer, 2010), much of the literature on UIC has concentrated on research commercialization and technology transfer (Casey, 2005; Fulop, 2006; Kruss, 2006; Meagher, 2006; Severson, 2003; Thompson, 2003; Berman, 2008). Little is been researched on industry perception of the research links with universities (Berman, 2008).

This literature background is important to show that little has been found to explain how industries behave for the first time when they decide to approach a research center. In fact, only the mention that a facilitator can be a way (Weathley, 2009) or that a majority of collaborations have been formed through the use of previous contacts (Thune, 2007) has been found.

As a consequence, it seems there is no answer to know what industries do to find out "*Who has what to solve a technological market related problem and how I reach him for the first time*".

That is why it could be interesting to study how industries with a technological market related problem and no record of UICs, once they have decided they need a university research center, behave to approach them for the first time.

The contribution of this research would be to provide the insights of the procedures used and the way to perform this contact. By understanding the behavior (reasons why), a theory might be proposed for the reasoning behind it (how and why). The conclusions of a quantitative study might even help adapt the developed instruments to foster the UIC, especially among the ones that do not use it.

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Addendum 15. UIIN 2013 Congress Amsterdam Certificate

Addendum 16. UIIN 2015 Congress Berlin Presentation

Procedures used by the Industry to establish first contact with research centers. Case study in Spain.

June 26th 2015

Martorell Gérard

0	Title and Objectives
1	Methodology
2	Evidence finding
3	Comments and Discussion

0.- Title and Objectives

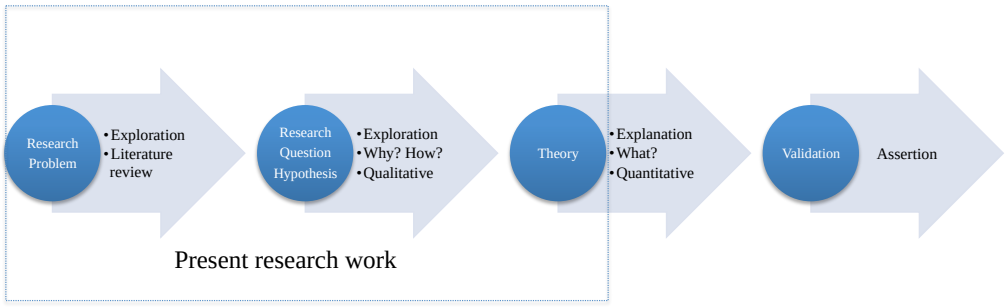
Title:

How Industries

- with no previous collaboration with research centers
- but with a market problem that has to be addressed through external research
- behave to approach research centers for the first time?

0.- Title and Objectives

Objectives



0 Title and Objectives
1 Methodology
2 Evidence finding
3 Comments and Discussion

1.- Method

What have we found in papers?

Historical successes

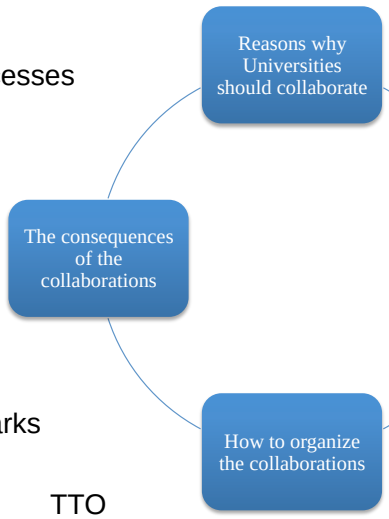
Grants

IP

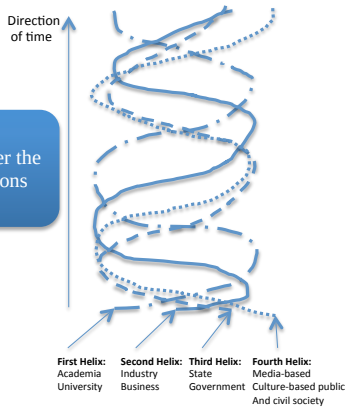
Ethics

Science parks

TTO



Models



1.- Method

Conclusions of the literature:

- A small bunch of papers treat how industries behave to contact research centers (Thune, 2007; Wheatley, 2009)
- None does it for industries with no previous records of collaboration

Research Question:

"How industries, with a Technology Market Related Opportunity (TRMO), who cannot solve it internally, and have no record of previous contacts with research/technological center, connect with them for the first time."

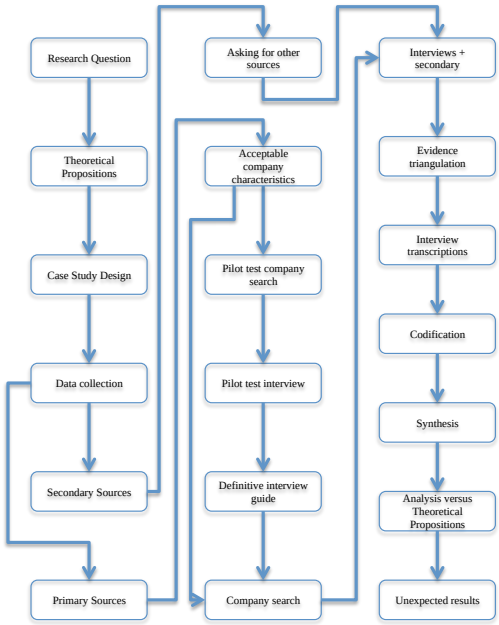
1.- Method

Which methodology have we used?

	Form of Research Question	Requires control of behavioral events?	Focus on contemporary Events?
Experimental	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case Study	How, why?	No	Yes

1.- Method

How to implement?



3.- Evidence finding

Theoretical propositions

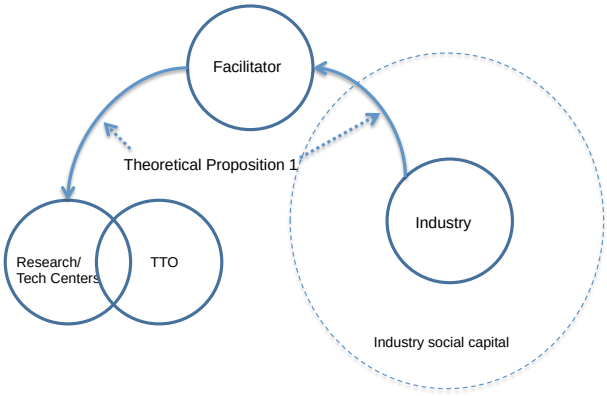


Figure 2.5. Theoretical Proposition 1

3.- Evidence finding

Theoretical propositions

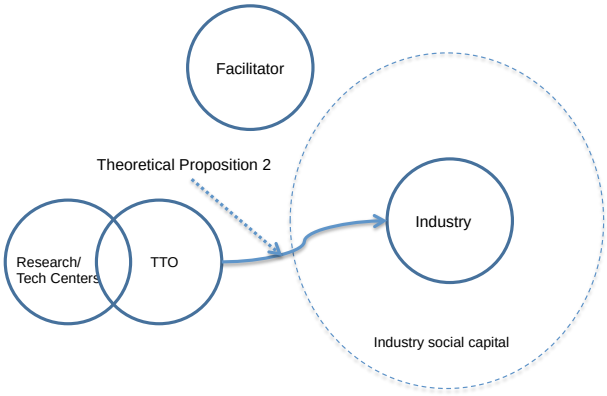


Figure 2.6. Theoretical Proposition 2

3.- Evidence finding

Theoretical propositions

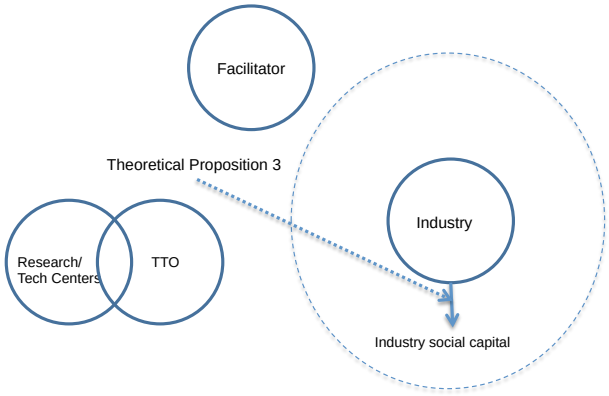


Figure 2.7. Theoretical Proposition 3

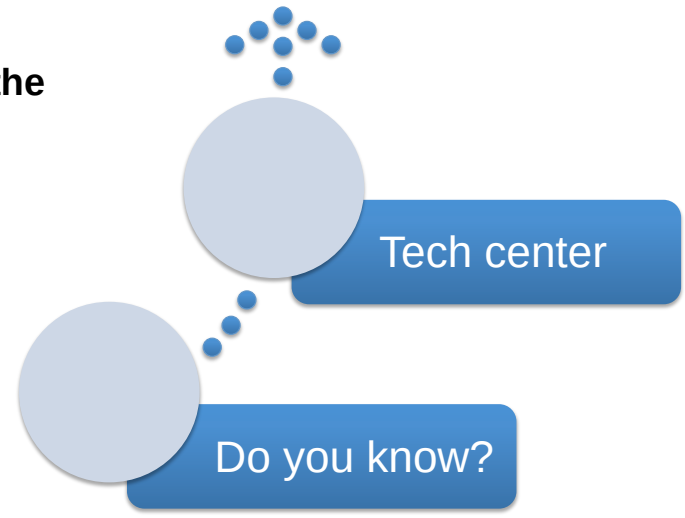
3.- Evidence finding

Interview guide

Nb	Topic	Related question in interview guide	Related Theoretical Proposition
1	Reasons why the first contact	1	
2	Circumstances	2	
3	Unsatisfied marked	3	
4	How need was identified?	4	
5	Knowledge of available technology	5	
6	Who was involved in the contact decision?	6	
7	Who was involved in choosing the person who should perform the contact?	7	
8	Why that person and not somebody else?	8	
9	Was his technology expertise a prerequisite?	9	
10	Who was involved and how the contact was performed?	14	2 - 3
11	Before contact what was UIC for the company?	10	
12	Which difficulties were foreseen in a UIC relationship?	11	
13	Differences between research and technological centers	12	
14	How was found who has what to solve the problem?	14	2 - 3
15	How to choose the right partner to contact?	13	2
16	How that partner was reached?	14	3
17	How was the contact performed?	14	1 - 2 - 3
18	Was an intermediary used?	14	1
19	Was there any benchmark performed before first contact?	15	

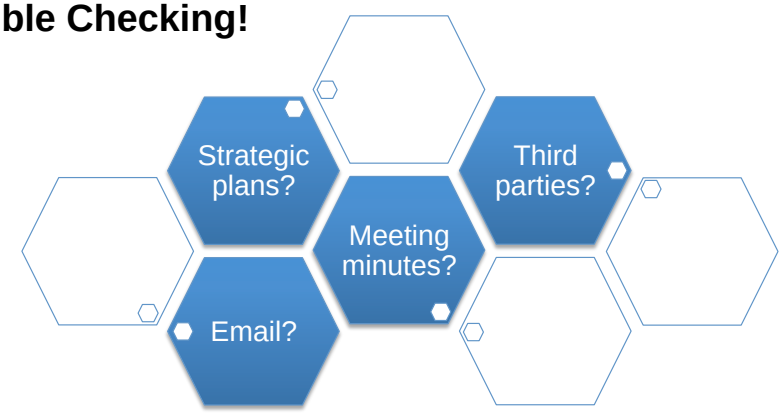
3.- Evidence finding

How to reach the companies



3.- Evidence finding

Double Checking!



3.- Comments and Discussion

Theoretical propositions	Evidence	Reasons
1.- They contacted a facilitator who they think might know something about the subject or a person who can help	1 confirmed, 5 challenged	1 confirmed but not through a professional one. 5 challenged (no use of a facilitator)
2.- They remember having been visited by a research/ technical center agent or having carried out other than research activities with a research/technical center.	4 confirmed, 2 challenged	4 confirmed but the previous relationship did not imply the contact for research. 2 challenged (no remembering)
3.- The company uses its social capital to find the right partner to help them solve their problem	6 confirmed	Social capital is a always used but can be developed or imported for the specific need.

3.- Comments and Discussion

Other evidence	Analysis
Contact goes through different stages inside the company before it is carried out.	Either it was perceived as a pure service purchasing topic or too distant for them to be interested in it.
Leadership	It seems an internal leader is necessary to spread the need for first contact. Once the idea is acquired, a leader for the contact is also necessary.
Collaboration culture	It is acquired from outside (trainee, acquisition, university education) and/or internally developed.
Grants	Industries know about their existence, but TRMO is more important than their existence for first contact.

3.- Comments and Discussion

Model

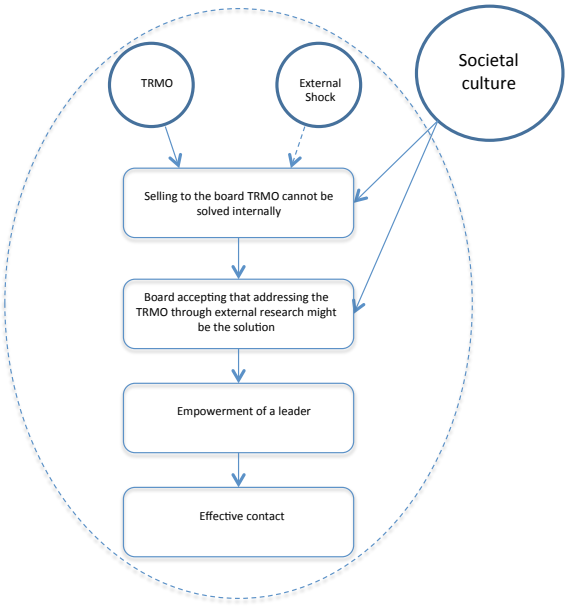


Figure 4.6. Culture influence in the key factors for first contact model

3.- Comments and Discussion

Comments

Create infrastructure adapted for first contact!

Practical, simple, quick!

With a regionally centralized intermediary

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Martorell Gérard, PhD Student

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Procedures used by the industry to establish first contact with research centers. Case study in Spain.

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Abstract

In the context of University-Industry Collaboration (UIC) the paper starts by reviewing the latest contributions to the UIC literature especially on the beginning of the relationship. The Databases were deeply scrutinized using different queries: University-Industry Relationship, University-Industry Collaboration, How Industry meets University, How Industry University, Industry meeting University and University-Industry partnership. The search, however, yielded little literature related to this topic. In fact, nothing has been found on how industries behave when they encounter a technological related market problem, have no record of previous relationships with university research centers and decide they need to approach them for the first time.

Following case study methodology, a qualitative multiple case study research was performed around three theoretical propositions in order to assess whether or not a common pattern could be developed. Proposition one states that a firm that approached a research center for the first time to solve a technology-related market opportunity (TRMO) contacts a technological facilitator who they believe might be able to assist them find the right party. Second proposition checks if the firm remembers having been visited by a research/technical center intermediary or having done other than externalized research activities with a research/technical center. Finally proposition three wants to see if the firm pro-actively uses its social capital obtain assistance to find the right party.

Six companies were found to meet the requirements and their managers were interviewed and recorded. This paper reaches a number of conclusions concerning the different factors as driving forces that trigger said first contacts. For instance, this work raises the question of professionalism when it comes to selecting the right partner, project leadership and trust building up between the company and the research center. Following this line of research, the work also reaches conclusions on the way the first contact is carried out, proposes a model and compares this with current literature on how to prepare infrastructure to trigger relationships.

Keywords

Include 5-6 keywords. The first keywords should be taken from the title. Please separate keyword by comma.

Introduction

The investigation started by scrutinizing databases such as EBSCO using different queries: University Industry Relationship, University Industry Collaboration, How industry meets University, How Industry University, Industry meeting university and University Industry partnership. As expected the author found out that relationships between University and Industries had already been an object of study for years. Bozeman (2000) mentions that there is a "voluminous, multidisciplinary literature on technology transfer". Throughout this relatively rich body of documentation, authors tend to give different names to concepts that could be assimilated as close-by or even identical. For instance, the name "firm" is often used instead of "industry", or "collaboration" instead of "relationship", as could be seen in many papers.

It is also mentioned that both the business sector and the higher education institutions make an important contribution in bringing economic growth and so employment and long term prosperity to the surrounding society (Healy, 2014). Studies prove that industry collaborating with the universities end up having higher productivity rates than comparable ones that do not collaborate (Malairaja, 2008). So promoting their mutual collaboration is been put upfront by many government institutions. This has the implication of adding to the traditional university objectives of academia and research the new one of transferring the knowledge to the industry in order to speed up its competitiveness (Kyoung-Joo Lee, 2010; Etzkowitz, 2000; Cerych, 1985).

This trend has attracted many authors researching how this relationship can be fostered and publishing their results (Bolton, 1994). This has lead study past successes and try to explain the reasons for their success (Roberts, 2009). New models have been developed and copied all around including their associated laws that are meant to mitigate the difficulties of such a relationship might bring (Schofield, 2013; Bauer, 2010; Sugandhavanija, 2011; Cerych, 1985; David, 1982). However all relationships need to have a start and Thune (2007) mentions that this link has been formed from previous contacts and maybe a facilitator can also be used (Wheatley, 2009).

Accepting that such relationship is to be promoted, that the outcome is worth overcoming the inherent different objectives both institutions, an interesting question might be: how this relationship starts? And especially what moves the industry to get in contact with a university research center for the first time. Understanding the motivations to contact the university research center or technological center for the first time might be interesting as it might help assess the nowadays created infrastructures that are meant to foster the university industry collaborations.

As far as the method is concerned the first step has been to revise the literature following the main keywords found, which were four, revising the finding within each block one after the other. These blocks are the reasons why of the University Industry Collaboration (UIC), how to foster the UIC, how to organize it and the consequences of the relationship, which altogether seems to follow a logical path for the establishment of a relationship.

This literature background is important to show that little has been found to explain how industries behave when they decide to approach a research center for the first time. In fact, only the mention that one way to achieve it is through a facilitator (Wheatley, 2009) or that a majority of collaborations were formed through the use of previous contacts (Thune, 2007) was found. As a consequence, it seems there is no answer as to what industries do to find out "*Who has what to solve a technological market related problem and how should I reach him for the first time*". That is why it could be interesting to study how industries with a technology-related market problem and no record of UICs, behave when they decide that they need a university research center and approach it for the first time.

The second step has been to learn how to use the case study method and for this the reference has been Yin (2009). Once the method has been understood and learned the following step has been finding the companies and associated people that could provide the necessary information on what happened for the first contact. Applying the learned methodology, a research problem and research question was defined, theoretical proposition were established and the results were analyzed in order to propose a contribution to the state of the art.

The contribution of this research would be to provide insights on the procedures followed and the way in which said contact is performed. By understanding the behavior (reasons why), a theory might be proposed for the reasoning behind it (how and why). This is expected to bring a kind of behavioral model that explains what the companies did. With it, we may be able to explain why it is so difficult to make the companies and especially the SMEs collaborate with the research/technological centers. This might help research centers and policy makers adapt their offer and bring in more relationships.

Methodology

In order to maximize the results of the study, a case study structure has been built to fulfill 4 major conditions: the validity of its construction, its internal validity, its external validity and its reliability (Yin 2009). Thus, in order to start the case study research design we had to follow a logic that would guide us from the questions to be answered to the conclusions extracted from them.

The research will then try to find out an answer to the question of how industries behave once they have decided they need to contact a research centre in order to solve a Technology-Related Market Opportunity (TRMO). The research question has to reflect different aspects of the research. To start with, it has to include industries as the subject of research. These industries must have been thinking about a solution to a market related problem. In a certain way, the companies must have been aware that there was an uncovered market need. That is that the market was demanding a topic that the company was not addressing properly at the moment. This unaddressed problem needed to have a technological aspect that could not easily be solved internally. In order to address this

demand, the companies needed to ask for help outside of their own structure. However, we focused on those companies that had not done so before.

Thus, the research question will be as follows: “how industries, with a technological market related problem that cannot be solved internally and which have no record of previous contacts with research/technological center, contact them for the first time.”

Thus, the Theoretical Propositions will be:

Proposition 1*: A firm that approaches a research center for the first time to solve a technological related market opportunity contacts a technological facilitator whom it believes might know who could solve said problem.*

Proposition 2*: A firm that approaches a research center for the first time to solve a technology-related market opportunity remembers having been visited by a research/technical center intermediary or having done other than externalized research activities with a research/technical center.*

Proposition 3*: A firm that approaches a research center for the first time to solve a technological related market opportunity pro-actively uses its social capital to find someone who could help.*

Primary and secondary data was collected. Primary data was gathered through semi-structured interviews. The interviews were 60–90 minutes in length and captured data from key organizational informants. The informants were selected on the basis of their involvement with the innovation episodes in the present study. Secondary data such as email, internal reports, old strategic plans, presentations and others were required to validate the interview information. Six companies were found to comply with the necessary requirements. Their names are hidden for this publication, as we did not get the authorization to disclose them in all cases. So the names are summarized as Company A, Company B, etc..

Case Study evidence

Reviewing the first theoretical proposition stating that the Company has contacted a facilitator who they thought might know the right person who can help, we have seen that it was validated in only one case. For Company E, the facilitator was someone's brother and therefore not a professional facilitator, though in this case, he performed such a role. In other cases, the companies did not use a facilitator as defined in the proposition. We did not consider the cases of Companies D and F to have validated the theoretical proposition because social events are not a facilitator as defined in the proposition. That means that the rival theoretical proposition is the one that has been validated. However, the social event, such as the CECOM conference for Company D and the *Forum Carlemany* firm forum for Company F, were used in ways similar to a facilitator or bridge to the solution, albeit not a technological one.

In the other cases, somebody within the companies had worked as a facilitator, answering the question of “who could we call”. In Company A, this was the trainee. In Com-

pany B, this was the board member and in Company C this was the engineer himself. This internal facilitator also shows the need for some kind of leadership to propose and carry out this first contact. When the contacted facilitator is outside the company, the leader takes or is entitled to take the lead to contact. When the facilitator is within it, the leader is in fact the facilitator. In all cases, he who carries out the contact does have the minimum technological knowledge to do so and so acts as a facilitator bridging or routing the company towards a solution.

In conclusion, the use of outside facilitators is not general. None of the studied subjects used professional facilitators. There is no common procedure for it. Only in one case, a non-professional one was used. In other two cases, the facilitator was a social event, where companies discuss and share their needs and obtain feedback about the experiences of other companies, which have gone through similar problems. Furthermore, the selected cases show a kind of common pattern concerning procedures or behaviors for facilitators. The use of social events as a place to exchange and get information on who could be the right partner is a possibility among companies that use facilitators. This procedure might be significant, though not general, among companies similar to the studied ones.

When it comes to the second theoretical proposition stating that the Company remembered having been visited by an agent from a research/technical center or having carried out activities other than research with a research/technical center, four of the companies validated this theoretical proposition. Company A used a university to recruit the trainee and, as a consequence, they had carried out activities other than research with it. The test engineer from Company C did remember the laboratory he knew from his times as a university student. Company D used CTM technological capacities for testing. Company F used technological centers for topics other than research such as testing, training or recruitment. The other reviewed companies, Company B and Company E did not have any record of having previously used them.

For the third theoretical proposition, which sets that the company uses its social capital to find the right partner to help them solve their problem, we found that all companies fulfill it. The trainee at Company A remembered his old professor at the university and used this recollection to satisfy the needs of the Company. Company B remembered having met one of the chosen research center engineers. The production engineer from Company C remembered his former professor and his laboratory. Company D found the center in social event whilst building up its social capital. Company E contacted a relative of an employee. Company F found its center at a social event and used its social media network to validate its choice.

The results by the theoretical propositions are shown on Table 1.

Results by the Theoretical Propositions						
Company	Company A	Company B	Company C	Company D	Company E	Company F
They contacted a bridge to the solution	No	No	No	No	Yes	No
Remember having been contacted by a research/technological center for other than research activities.	Yes	No	Yes	Yes	No	Yes
Use social capital to find the solution	Yes	Yes	Yes	Yes	Yes	Yes

Table 1 Results by the Theoretical Propositions

Other results

Starting with the reasons why contact is carried out, it seems that the building crisis that began in 2007 had a significant influence on decisions to contact research/technological centers. This is the case at least for Company B, Company D and Company F, whose boards of directors did have an urgent need to re-think their business model and find a successful way to overcome the radical drop in sales. The need of Company E came from the new owner whose experience showed there was an uncovered need that required applying new technology to their products. So in all the cases, it seems that an external shock was necessary for the companies to contact.

All companies did make an effort to find the right person/institution but no systematic pattern such a kind of supply chain Kraljic (1983) one could be observed. To ensure the firm finds the one that suits them best, they all took some aspects for granted. You can either trust a friend for advice, a research/technical center for its competences, trust an old teacher from university, trust a supplier for having proven its knowhow, and even trust what you have been told on internet. But in any case, this initial trust seems to be limited to simply “asking and seeing”. There seems to appear an important aspect here, concerning the act of asking. As soon as you ask for help, you disclose your needs. As no company likes to disclose its own weaknesses, it is then important to disclose to somebody who will not make any use of the information thus disclosed. This might indicate the importance of personal networks in starting a relationship in which trust is a real matter of concern. Gubbins (2014) wrote that the strength of ties is sometimes

equated to trust, and that there are arguments indicating that trusting relationships lead to greater knowledge exchange. Therefore, trust seems to be required for sharing important knowledge. As a consequence, trust must be considered a valuable commodity (Gubbins, 2014) to make the leap.

Another factor that could be extracted from this work is the question of leadership. In all cases, we found someone raising an internally unsolvable problem, asking for and taking the lead to find a technological solution outside the Company. This person could search and perform the contact himself (Company F and others) or ask somebody else to do it (Company E, Company A) but in all cases, under board supervision.

As a consequence of these last two findings, one found common pattern is that industry research/technological center interaction occurs if the market need is there and if there is leadership or a person in charge of the interaction. To validate this theory, a quantitative explanatory study would be required. Adding to that we could check whether the "feeling", as mentioned in the case of Company D, could have an impact on the decision of who to contact. The "feeling" could be interpreted as the impression of the interviewee that they would not work well together. However, a way of knowing this company "feeling" might be to ask about which selection criteria are used by the companies to select one institution or another.

Finally, on the importance of the 4th and 5th dimensions introduced by Carayannis (2009) in the Triple Helix model, media does not seem to have had any remarkable influence on the decision of SMEs to contact research or technological centers for research. The same happens in civil society. However, a culture of collaboration can be seen in a different way. None of the studied companies had a culture of collaborating with external entities on the topic of research. It seems that companies knew they could collaborate but had had no need to do so until that date. A cultural of collaboration for R&D had to be developed, and that took time. However, it seems the person who raises the idea of collaboration has acquired the know-how that this culture of collaboration is possible. Looking at literature, this could be assimilated to what Perkmann (2013) mentions as the "firms be well equipped to effectively participate in collaboration". This seems to validate the idea of Carayannis (2009) on the importance of developing a culture of collaboration and that this factor might also have an impact on the R&D absorptive capacity of the firm structure (Perkmann, 2013; D'Este, 2012; Malairaja, 2008; Ponds, 2007).

Discussion

One contribution of this work seems to be the importance of having a real TRMO to start the quest for the right research partner. This is congruent with literature (Thune 2007). A consequence is that the number of first contacts with research/technological center for research purposes can only be increased is there are more TRMOs. We have seen in the research that TRMOs specially appear when an external shock hits a company, thus requiring it to re-invent itself. Competition, market downturns or simply acquisitions are ways in which such needs emerge. However, we are not saying that external

shock is needed to increase UIC. Our research simply concludes that an external shock is a way to lead to a rethinking of a company's business model and exploring other ways to survive. External shock is necessary but is not sufficient for first contact. This is where the TRMO appears. The research cases are companies that survived an external shock by using UIC because they detected a TRMO. So for these companies, the external shock lead them think about the TRMO as a solution and then initiate the contact.

That emphasizes the importance of the maturity of the need for external research help within the company. If the need for research is not there, it seems there is little to be done by the research or technological center to promote their skills/knowledge in front of the companies. In all our cases a leadership for contact had to be developped. It may or not be the same actor throughout the entire process, but what is clear in all cases is that the leader has or obtains the empowerment to go on. All in all, to understand the company behavior that triggers the first contact with a research or technological center, three aspects must be present: A kind of external shock that implies setting new rules to survive, a certain TRMO, which someone has “sold” to the board and which could both be a solution to the external shock and which cannot be solved internally, and a leader empowered to make the contact with a research/technological center.

Another result of this work is that professional facilitators have not been used to get in contact with research or technological centers. However, this does not mean that they do not use the principle of a facilitator. Somehow, a majority of the companies find the facilitator profile in other structures, by either calling a relative or using other structures in this capacity. That means there is a real need for a facilitator, something also mentioned by Sugandhavanija (2011). However, as none of the companies had used a professional facilitator, one conclusion is that current facilitators did not have any influence among the studied SMEs. To have an influence, the duty of facilitators must be focused on the origins of the relationship and trust formation. As trust formation seems to be related to three major factors, strength of ties, reputation/image of research centers and contractual safeguards (Hemmert, 2014), a facilitator must be fully aware of these factors in the minds of industry contacts. As a consequence, it seems this research points to the fact that research/technological centers can hardly increase the TRMO of the companies, at least among the SMEs such as the ones that have been studied.

In order to promote UIC among SMEs and due to the fact that influence on promoting external shocks is not feasible, it seems that a two-step model can be proposed to policy makers. As a first step, that is, on the short run, the model must cover 3 aspects. As a principle, it is not a matter of just increasing collaboration but doing it with quality and minimal perspectives of success (Perkmann, 2013). Research infrastructure must be there so as, when the companies feel the need, the first contact might take place but not trying to force it when the need is not there. This is congruent with the Triple Helix model (Etzkovitz, 2000). It therefore seems clear that, as a first step, research/technological centers have to adapt their offer to what the surrounding industries are able to absorb (Gunasekara, 2006). That means very high top research centers might not be able to to increase relationships if the surrounding industries are not able to ab-

sorb the high technological output these centers are able to produce. The contrary can also be true if a technological center is not really doing research and so cannot provide a real valuable research services for the needs industry is demanding. Research/technological centers should be adapted to the surrounding industry environment (Bauer, 2010).

As a second aspect, and following Lai (2010) advice, an acceptable facilitator structure must be created. The general manager of Company F insisted during the interview that he was never sure that the contacted center was the right one for him, so why should he take the one he already knows? This same comment can be read in Thune (2007). The facilitator must be the switchman who could say: "trust me, contact this specific center. It is the one that will help you solve your TRMO" (Brannock 1998, M. Luna 2003). Perhaps his personal experience on both sides industry and academia might be of help (Wheatley 2009). Anyhow, it seems he should be very flexible and have many fields of expertise (Tobbias 1995, Lundvall 2000, M. Luna 2003) such as explicit-tacit know-how, know what and know-why (M. Luna 2003, Santoro 2006). Some marketing and entrepreneurial experience could also be of help (Siegel 2003, Malairaja 2008). It may be assimilated to a kind of champion of innovation (Hemmert, 2014), but this has not been proven.

Thus, going further to induce new first contacts, it seems that all reviewed SMEs somehow had a latent TRMO that only crop up when an external shock was present. However, the question is to know if they can detect and have a significant effect on the maturity of the TRMO or the culture of collaboration. From the present research, it seems that, to lead to a change in that quest, the facilitator structure needs to fulfill some requirements. The first one is that it must be credible and known as a system, at least for those SMEs that are the object of this study. That means companies should perceive it as a trustworthy system with no interest other than finding the best partner according to the company needs. A big global system would not be used by SMEs: it would be too big to be understandable and too far from their daily lives to be acceptable.

As a consequence for our SMEs, a second requirement of this structure is that it should be both close geographically and understandable by the companies. The cultural closeness should be there. A kind of one-stop shop regional body for industries looking for access to academic researchers and advice seems to suit that need (Wheatley, 2009) rather than a national system (Wilson, 2012). Though there is no clear evidence from this research, the promotional strategy that seems most suitable would be to develop some kind of buzz marketing on social media companies already use in order to open eyes when need appears. In a way, the goal would be to reproduce what "*Forum Carlemany*" was for Company F. The government and local chambers of commerce should be able to be involved in such a structure. It is in their interest to keep local companies competitive and demanding workforce.

A third requirement for said proposed facilitator structure is related to company security. By discussing their needs, companies must be sure that disclosed information will

not be used against them. The need for effective contractual safeguards is therefore necessary (Hemmert, 2014). That would develop a kind of feeling of secrecy or security that could ease disclosure. Perhaps, in the initial stages, posting their needs anonymously would also be a solution. Copying the idea behind Innocentive (www.innocentive.com) could be a solution, but it would have to be managed locally by professional facilitators. Anyhow, the theory could be that the infrastructures created to trigger UIC relationships for SMEs may be based on studies performed with big corporations and may therefore not be suited to obtaining the same result among SMEs.

In the long run or as a second step, the model should emphasize the culture of collaboration. As we saw in the studied cases, this culture reached the companies through 3 ways: through people with a background as university students, through the experience of new owners and through management forums. The second one is difficult to promote but incorporating collaboration culture with university studies would have an impact in the long run. On the short-term, promoting exchanges of experiences in research collaboration among SMEs might have an impact if the TRMO is already there. On its own, as only one company out of six used a forum as a way to find a center, forums might not have a significant impact. See Figure 1.

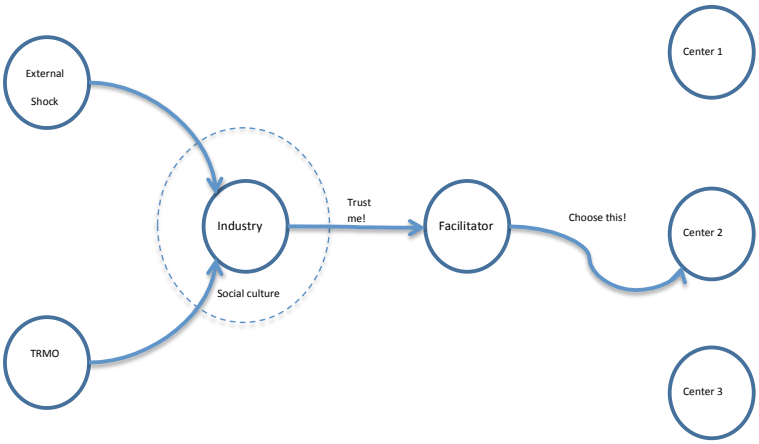

Fig. 1. Proposed Model

Limitations

First and foremost, we must set some limits to this work. The work is based on a multiple case study research with the limited number of six reviewed companies. This is related to the work structure that has been described as exploratory. The kind of companies is also a limiting factor. It is a known fact that industrial and engineering companies are more prone to be wiling to contact research or technological centers (T Thune, 2007; Perkmann, 2013). The area where the companies come from is also something to take into account. All six are Spanish companies. Five come from Catalonia and one

from the Madrid area. All six have sales abroad; some like Company C even operate worldwide. The size of the companies is an important factor. As per the EU definition, they are all SME. It would be interesting to study big corporations, and perhaps startups with similar patterns, especially in what concerns the importance of the formation of trust and disclosure resistance between SMEs and big corporations. It might happen that we could obtain similar results to those in countries that attempted to copy and paste the Bayh-Dole Act into their local legislation. A good solution in one country might not apply to others (Mowery, 2005). In a way, the infrastructures selected and set up for big corporations might not work for promoting UIC among SMEs. Thus, the question is to know if UIC creation needs differ between big corporations and SMEs. If so, the question would be to find out if the surrounding infrastructure suits the two or just one. This doubt arises from the fact that the literature, and hence infrastructure, has been basically built on big corporation needs and not on those of SMEs. This factor is unknown. Concerning the ownership of the companies, the majority of the studied companies are family owned ones. This type of ownership may represent a limitation.

Future research

For further study directions, it would be interesting to partially re-do the qualitative research by changing and adding some of the theoretical propositions. Alongside this aspect, it would be interesting to explore which other possibilities target companies assessed besides contacting a research/technological center for research. This would allow us to understand the competitors of contacting the research/technological center for research as well as the decision model that might be behind it. One topic that would probably bring value would be a comparison of the behavior of comparable companies depending on their different infrastructure or technological/research center environment and behavior. Something similar is already done by the EU to assess the startup ecosystem (blog.startcompass.co) This would allow an assessment of the environment that triggers a higher amount of contacts and comparing the results with other studies such as Bergenholtz (2014). This might assist decision makers to adapt their activities and person profiles to the real aspects that move companies to get in contact with technological or research centers for the first time.

We mentioned that it might be a good idea to include the social culture into the UIC model (Carayannis, 2009). From the findings it seems that social media and culture are not at the same level as the other dimensions in the Triple-Helix model. Unless it is imported in a company acquisition and the new owner already has culture of collaboration, it seems that promoting a culture of collaboration will have an impact in the long run rather than short-term. There is a kind of latency between when the promotion of UIC collaboration and when it has an impact on the formation of UIC and cultural acceptance of the same. If we follow the proposal of Carayannis (2009) of society context for the Triple Helix model we would end up with Figure 2. The external shock and TRMO are the short-term engines that move a firm to contact. Social Media and culture would go next in time, and the natural environment would be the last in time to trigger the relationship.

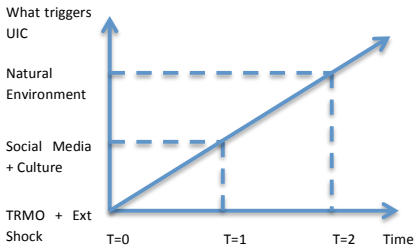

Fig. 2. UIC triggering factors through time

However, it might be interesting to study the evolution of this cultural / social media factor linked to the environmental change that lead to focus on the TRMO. This is, to check if the environmental factor has "triggered" a cultural change in the perception of UIC in industry, either in full, in part or the other way round. This is a way of checking if the environmental factor is first and the culture of collaborating comes afterwards rather than vice-versa. If the environmental factor is first and culture follows, doubts can be raised that any infrastructure or model is going to be able to increase UIC significantly, at least at the level of the studied SMEs. Conversely, if culture can be changed in order to trigger the UIC, then infrastructure or models have their chance in the long run.

Conclusions

To start with, we carried out a literature review, checking what has been written on how companies behave on their first contact with research/technological center in order to solve a technology-related market opportunity. Only one (Thune, 2007) clear reference was found on the topic. So, in order to understand the behavior and check if a model could be applicable, we performed a case study with semi-structured interviews. The research question was defined as follows: "how industries, with a technological market related problem that cannot be solved internally and which have no record of previous contacts with research/technological center, contact them for the first time." From this question, three theoretical propositions were proposed. Six companies were found to comply with the prerequisites of a minimal amount of people available to re-create a situation of first contact. Said people were interviewed with a semi-structured interview, and their statements were cross-checked through secondary sources or other interviews with other parties involved.

In what regards the theoretical propositions, this work seems to show that SMEs such as the studied ones systematically use some kind of facilitator to take the leap to contact research/technological centers for the first time. Said facilitator was never a professional one. Rather, they used their social capital to find what companies think might be the right partner. That leads to the importance of the image of any given center, as some of the studied companies already had had contacts with research/technological centers for

reasons other than research. The image of the center, not only in the minds of the company but also in the minds of their strong ties, is a key factor in the approach.

Concerning other results, it seems that a sort of external shock along with a TRMO are necessary so as to push the company to make contact, that trust is a key factor in said behavior, and that companies therefore chose strong ties to take the first step to approach a research/technological center. Furthermore, a project leader is necessary in each step of decision-making within the company. A culture of collaboration is also a topic that has to be developed to make collaboration possible. Some important limitations to our work have been mentioned, such as the kind of company, the geographic area and the market segment they are active in.

With respect to the revised literature, it seems that idea of a boundary spanner (Thune, 2007) does exist. Furthermore, the use of students as a way to ease contact has also been validated. This same author mentions the importance of having a demand to start the relationship. However, this work seems to emphasize the importance of a combination of factors to force a first contact. These are an external shock, which could have the form of a crisis, an acquisition or other, and a TRMO that cannot be solved internally. There is no evidence that any of them could induce the contact in isolation. Through necessary leadership at the head of the company board, these two factors induce the awareness of external need to solve a TRMO as a possible solution to an external shock, empowering a leader with boundary spanning capabilities and the leader carrying out the effective contact. Also, the importance of the social culture of UIC is found to be critical (Carayannis, 2009), but it is shown that it can be imported, provided there is a strong will for that from the company board, thus working as a boundary spanner. This implies a kind of dual timing environment. While an external shock and TRMO require immediate solutions, a culture of UIC needs a far longer period of time to penetrate SME structures.

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Addendum 18. UIIN 2015 Congress Berlin Certificate

Addendum 19. Research Scheduler

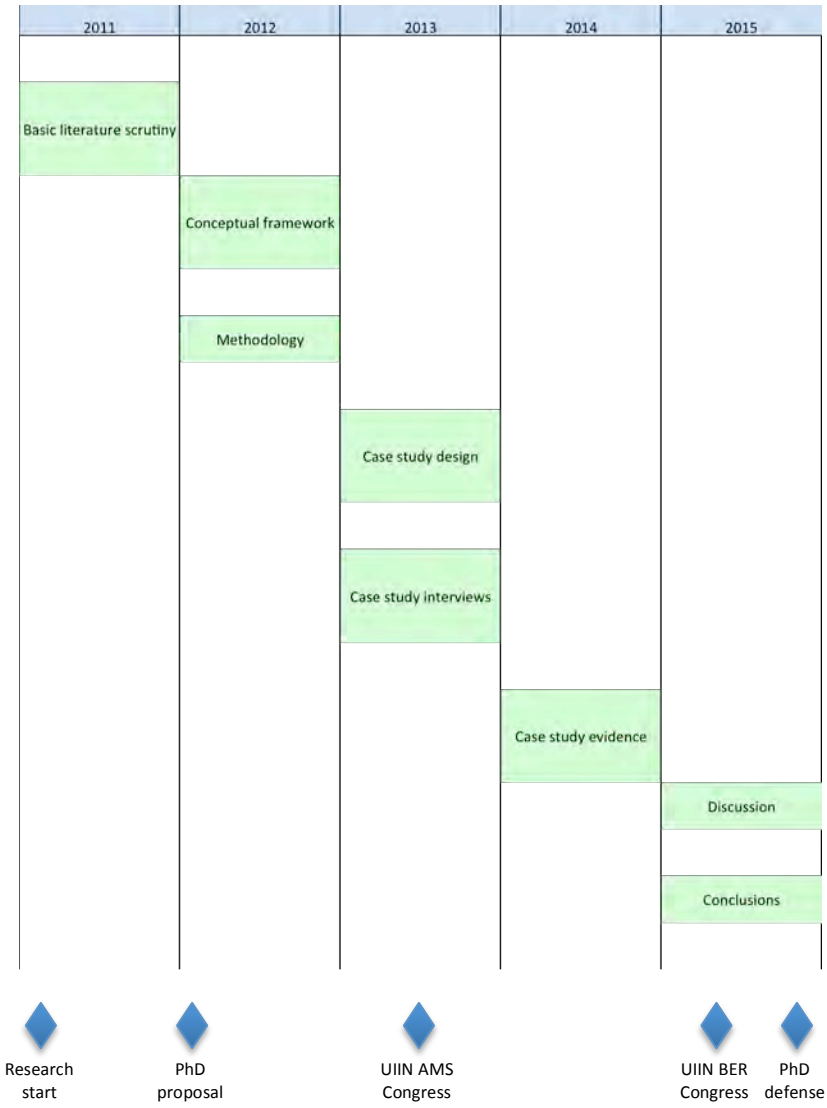

Figure 0.2. Work schedule and time frame.
Legend:
UIIN: University Industry Innovation Network Congress
AMS: Amsterdam
BER: Berlin

Addendum 20. Acronyms

ASCAMM: Name of a technological center

CAFOO: Catalan Association of Family Owned Companies

CT: Carreer-Technical centers

EBSCO: Elton B. Stephens Co. Information supplier company

KM: Knowledge Management

OECD: Organisation for Economic Co-operation and Development

R&D: Research and Development

TP: Theoretical Proposition

TRMO: Technology Related Market Opportunity

TTO: Technology Transfer Officer

SME: Small and Medium Enterprises

VdL: A Dutch specialist in airport logistics

UF: Unexpected Finding

UIC: University Industry Collaboration

UIR: University Industry Relationship