Relevant Factors Influencing Cognitive Distance in the Performance of Collaborative Research Projects

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Abstract

The research scope of this paper is to reinforce the need to strengthen university-firm relationship. We consider that it is crucial that the interactions between researcher/university and managers/firms should be based on a win-win relationship. In this sense, it is relevant to determine the main drivers behind the success of collaborative research projects, and this study focuses on one of them: cognitive distance. The specific objective of this study is to analyze the main factors that determine the influence of cognitive distance in the individual relationship between researchers and practitioners in collaborative research projects. In the first stage, through a literature review of cognitive distance and collaborative research projects, we identified a list of seven factors that influence cognitive distance and the issues that may provoke in the empirical context. Second, we carried out an empirical study based on semi-structured interviews with coordinators of collaborative research projects managed by the "Chair of Business Volkswagen Navarra – University of Navarra". This permitted us to build guidelines that show the main practical concerns associated with each factor and how they were managed in the analyzed projects. This enriches the cognitive distance literature on individual interactions between researchers and practitioners. We highlight the relevance of previous experience of both agents, the exploitation of projects versus exploratory ones, and the determinant role of support infrastructures to minimize the negative effect of high cognitive distance. Nowadays, there is a trend to develop collaborative research projects with firms, not only agreement collaborations. Therefore, our findings could be useful for analyzing the relationships between researchers and practitioners in action research studies developed inside a doctoral thesis or competitive research project. By considering the effect of cognitive distance when selecting collaborative research projects, it will help to increase the degree of success of these projects.

Keywords

case study, action research, mixed methods, narrative analysis, par - participatory action research

Introduction

In the literature, different approaches are proposed to analyse the relationships between universities and companies, such as motivation/why (Ankrah et al., 2013), support/infrastructure; (Avella & Alfaro, 2014; Bodas Freitas et al., 2013), practices/ how; (Friesike, Widenmayer, Gassmann, & Schildhauer, 2015; Buganza & Verganti, 2009) or factors/barriers that determine the success of this relationship (Bruneel et al., 2010). This study focuses on this specific topic of university-firm relationships (UFR) and a specific factor: cognitive distance (CD). CD is defined as differences in the set of basic values, norms, and

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mental models at work between universities and firms (Muscio & Pozzali, 2013). The aim of this study is to analyze the main factors that determine the influence of CD on the individual relationship between researchers and professionals in collaborative research projects, and how these factors can be managed to increase the positive effects of CD on the success of collaborative research projects while reducing its negative effects.

Skute et al. (2019) analysed the university-industry research field at three interconnected levels: individual, organizational and institutional ones. Our study fits in the first level and analyses the influence of CD in the performance of research projects based on collaborative research projects. To do so, we develop an empirical study framed in the Chair of Business Volkswagen Navarra – University of Navarra. Since 2010, this chair has managed research projects based on collaboration between different departments of VW Navarra and research teams at the University of Navarra.

This study permits the development of a guideline to help both managers and researchers manage the practical concerns that CD provokes in personal interactions.

The main theoretical contribution of this study is a framework for studying CD in the UFR based on seven factors identified through our literature review. From an empirical point of view, the main contribution of this paper is a guideline for managing the main issues related to each of these seven factors to increase the positive effects of CD in the success of university-firm collaborative research projects and to reduce its negative effects.

To achieve this, we developed a qualitative methodology because the data comes from semi-structured interviews. In order to obtain findings, we used lexicographical analysis, which permits us to "quantify" the information and obtain statistical outputs, as shown in Figure 4. This combination of quantitative and qualitative methods is very common in studies where the main source of data is text, such as case studies, interviews, or reporting analysis.

The paper is structured as follows. First, we present the concept of CD and we build a theoretical framework. Next, we describe the methodology used to collect data and how the empirical study was carried out. Then, we present the main findings and we build a guideline of practical concerns that can serve both researchers and practitioners to improve the performance of university-firm collaborative projects. Finally, we present the conclusions, managerial implications and further research.

Background: A Theoretical Framework

Cognitive Distance as a Factor Influencing Collaborative Research Projects

In this section, we conduct a narrative literature review to gain a global understanding of CD and its connection to collaborative research projects. Table 1 displays the five topics that

we have identified and the papers that analyze them. Next, we will describe the main ideas.

The concept of CD is related to the ability to collaborate. This capacity is more difficult to carry out when partners differ significantly in features such as resources, business experience or size (Minshall et al., 2010). Bogers et al. (2017) signalled that the differences between stakeholders are crucial when developing open innovation activities.

CD is usually defined following Nooteboom et al. (2007, p. 107): "the heterogeneity of resources possessed by companies and organizations". The basis of CD is that interaction between people is governed by perceptions and interpretations. Therefore, many factors that may influence each individual's vision: social, educational, labour, cultural environment, etc. However, interaction between groups of people with different knowledge and perspectives could result in new knowledge. Likewise, CD at a broad level can prevent mutual understanding and generate conflicts when collaborating, even affecting communication and the motivation to continue the relationship (Nooteboom, 2000).

The influence of CD as a factor that affects collaboration between two groups of people can be seen both as a barrier and an opportunity. Nooteboom (2000) mentioned that even in the different areas that make up an organization there is CD, since the people who make up each area have different knowledge. Moreover, CD not only implies a difference in intellectual knowledge, but also differences at the sentimental and moral level (Nooteboom, 2006). What all types of organizations must have to achieve adequate performance when interacting with another entity is an organizational approach shared by its members and an optimal absorption capacity. The goal is not for everyone to think the same way, since each person has his or her own judgment, but to share a common approach, beyond individual differences, that encourages people to blend in with each other.

Among the studies that examine the influence of CD in open innovation activities, we can mention Bertin (2019), which explored how startups and large companies organize their collaborations and improve their capability to collaborate. This study shows how geographical proximity reduces CD in the specific context of a high level of decentralization and autonomy when making decisions for both collaborators of startups and large firms. Bertin (2019) used four variables to measure CD: shared values, shared goals, shared culture, and common technological knowledge. These items were taken from Molina-Morales et al. (2014), who explored the relative influence of geographical and cognitive proximity to explain innovation performance in the Spanish footwear industry. This study finds that cognitive proximity, in terms of goals and culture, leads firms belonging to a territorial cluster to achieve knowledge acquisition resulting in relevant innovation. Muscio and Pozzali (2013) assessed the impact of CD on university-industry collaborations. Based on original data from interviews with 197 university departments in Italy, the authors determined that CD is perceived as a barrier to

Table 1. Main topics in the CD literature.

Topics	References
Basic aspects of CD	Nooteboom (2000, 2006) Nooteboom et al. (2007)
CD as an open innovation element	Minshall et al. (2010); Bogers et al. (2017); Bertin (2019)
How to measure CD	Bertin (2019)
Factors influencing the effect of CD on performance	Molina-Morales et al. (2014); Muscio and Pozzali (2013); Nooteboom et al. (2007); March (1991), de wit-de Vries et al. (2019); Alfaro-Tanco et al. (2021)

Source: Own source

university-industry interactions and estimated its effects on the frequency of their collaborations. From the point of view of our study, the work done by Muscio and Pozzali serves as a reference to "quantify" the concept of CD. More specifically, in their study, researchers identified five areas where CD could cause greater influence: (1) Research areas; (2) Research methodology; (3) Typology of results; (4) Types of projects with market access; and (5) Expected results time. Of these five areas investigated, " expected results time" obtained the most striking result over the others, which proves that universities and companies do not follow the same pace and that time is one of the main limitations of UFR.

Universities and firms, by their very nature, face many difficulties, some more complex than others when establishing a relationship and starting to collaborate on different projects. De Wit-de Vries et al. (2019) identify practices to facilitate knowledge transfer in university-industry research partnerships and organize the literature into three themes: cognitive differences, institutional differences, and social capital. They emphasize that ambiguity and absorptive capacity relate to differences in knowledge background.

In Nooteboom et al. (2007), we find that collaboration between organizations can be divided into two groups: exploitation collaboration and exploration collaboration. These types of collaboration were defined by March (1991) in the following way: exploitation collaboration is defined as the expansion of existing knowledge in search of improvements and efficiency. This approach is aimed at practice, and for such collaboration to succeed, the understanding between the parties must be quite broad, as must the dominance of the area and the topic being developed. What would be expected of this relationship is that the CD is smaller, given the specific objectives, as well as the degree of innovation since there would be few relevant developments obtained from existing knowledge.

Exploration collaboration is defined as the search for new knowledge and innovative technology (see also Nooteboom et al., 2007). To exercise this type of collaboration, the parties try to establish relationships with groups that can complement each other; in other words, they look for pairs with which they have sufficient CD so that novelties can emerge. However, if a balance is not found, absorptive capacity may decrease (Nooteboom, 2000). Not all companies have the capacity to do

so, which would cause a stalemate that would nullify any possibility of continuing collaboration.

To find the link between these two types of collaboration and CD, Enkel and Gassmann (2010) is a reference study. They carried out a case study to validate the following hypotheses: "Analogical solutions with a low CD to the adapting problem will have a stronger positive effect on exploitation than on exploration" (p. 258). From now on, the type of pursued results is a factor to be considered when analyzing the influence of CD. It is relevant to emphasize, as Alfaro-Tanco et al. (2021) signaled, that in the context of collaborative agreements, it may work as a moderator of the negative influence of CD.

Theoretical framework

In this section, we develop a framework to define a set of variables that will help us analyze in the empirical study how to manage the influence of CD in collaborative research projects between universities and companies. We have used references to justify our approach, which are listed in the last row of Table 1, as well as new ones that we have incorporated in this section. Figure 1 provides a global view that will serve as a reference for the empirical study we carry out in the following section. More importantly, it will help us identify practical concerns linked to the effects of CD in researcher-practitioner relationships in collaborative projects. Following this, we briefly describe the seven factors we have identified, along with the references from which they come. As we can see, Muscio & Pozzali's (2013) paper is the most referenced as its aim is very similar to ours, even though the methodology and empirical context are very different. Below, we describe the seven identified factors and the references that support them.

F1: Research thematic area. Research thematic areas of interest can have a significant impact on CD in collaborative research projects between universities and companies. This first factor, proposed by Muscio and Pozzali (2013), addresses the differences in the domain of knowledge that interest the researcher and the practitioner. Lee (2000) showed that researchers engaging in research collaboration with firms are primarily driven by the need to advance their own research
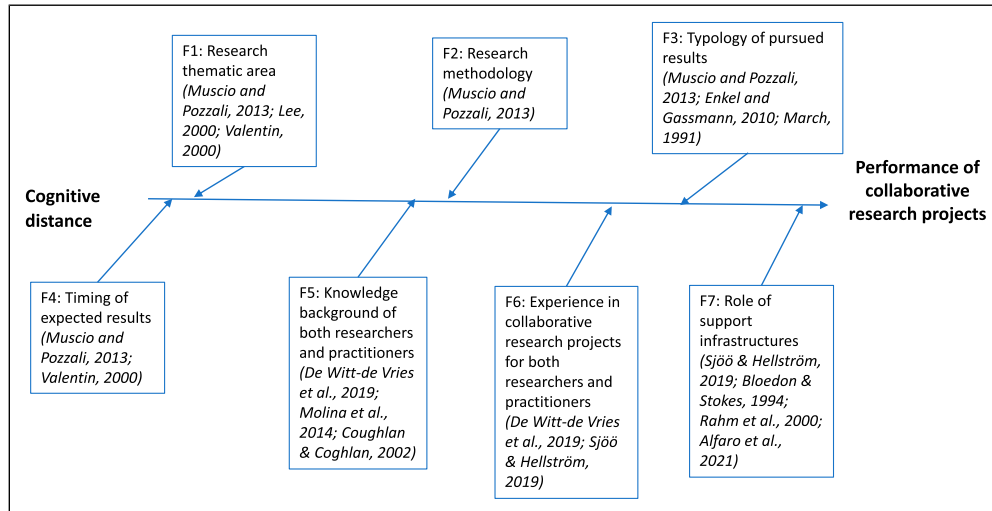
Figure 1. Theoretical framework from UFR and CD literature.

agenda. Generally speaking, from the researchers' point of view, it may be more interesting to cover emerging topics but also "classical" topics where there are literature gaps. These topics are of more interest to them because they will be perceived by their peers as valuable and will increase their chances of publishing in high-impact journals. From the practitioners' point of view, they are likely to choose topics that they perceive as being valuable for the diagnosis of improvement or for solving existing problems in their processes or for the development of innovative products or services. Due to this disparity of interests, researchers usually perceive that practitioners limit the kinds of research topics that the university can carry out. If researchers believe that these restrictions damage knowledge generation, their motivation to collaborate can be seriously damaged (Valentín, 2000).

F2: Research methodology. Following Muscio and Pozzali (2013), this factor "refers to differences in the way in which specific problems are targeted, framed, and solved" (*p.* 493). Therefore, it is related to the fact that, depending on the knowledge domain, the way in which university researchers transmit academic rigor may not align with the way practitioners make decisions based on their experience. As a result, companies may perceive this academic methodology negatively because it delays obtaining results, which may impact the role of CD (Muscio & Pozzali, 2013).

F3: Typology of pursued results. Typology of pursued results relates to the level of applicability of the research developed in the project (Muscio & Pozzali, 2013). Typically, academic researchers are more inclined to solve basic research questions, whose potential application for the industry, at least in the short run, is small (basic research) but that offer them the opportunity to achieve academically valuable results such as

academic publications. This type of research coincides in its description with the concept of exploration as proposed by March (1991) and analysed empirically in Enkel and Gassmann (2010), which entails search, variation, and experimentation efforts to generate novel recombinations of knowledge.

F4: Timing of expected results. This factor is linked to differences in what is considered an acceptable period to reach the goals of each partner (Muscio & Pozzali, 2013). Differences between 'open science' and private sector norms are a source of conflict in this area. When researchers obtain the results of their research, the university culture encourages them to publish their findings. However, companies may prefer to maintain a high level of secrecy to gain a competitive advantage over their competitors. These delays can make it difficult for researchers to gain priority among their peers when publishing their results, which can be damaging to their careers (Valentín, 2000).

F5: Knowledge background of both researchers and practitioners. The knowledge background factor relates to prior knowledge and technological competence that can help to understand and integrate new knowledge (De Witt-de Vries et al., 2019). This factor generates differences in 'language' and different logics regarding what methods should be used. Molina-Morales et al. (2014) used shared culture to measure cognitive proximity among firms. In this way, this factor could be a proxy of the cultural distance between researchers and practitioners. This factor is usually cited as relevant in action research projects, which are one of the collaborative research methodologies. One of the benchmark papers, Coughlan and Coghlan (2006), emphasized that the professional profile of both researchers

and practitioners is a relevant factor for the success of collaborative projects.

F6: Previous experience in collaborative research projects. This factor focuses on the experience with academic engagement in general and the specific partner in particular. This factor can build understanding for the needs of industry and can increase trust in confidentiality (De Wit-de Vries et al., 2019).

Among researchers it was found that prior collaborative experience among researchers and firms was positively related to the likelihood and success of collaboration. When it comes to firms, previous experience matters as well. Prior experience in collaboration with university is such a strong predictor that even previous collaboration deemed unsuccessful by practitioners was shown to be positively associated with the probability of interacting with universities again (Sjöö & Hellström, 2019).

F7: Role of support infrastructures. Many papers in the literature emphasize the importance of support infrastructures in overcoming barriers to collaboration between universities and companies, such as excessive bureaucracy or conflicts of interests among parties (Sjöö & Hellström, 2019). Bloedon and Stokes (1994) and Rahm et al. (2000) highlight the virtues of an 'agent' whose job is overall administration, management, and monitoring of collaborative research between universities and companies.

As cited in Alfaro-Tanco et al. (2021), "these support infrastructures permit practitioners to participate, interact and be more proactive and they can get continuous feedback during the process. Likewise, managers can use their experiential knowledge to reframe their understanding of situations they are close to".

Empirical Study

The objective of this empirical study is to contrast the theoretical framework proposed in the previous section (see Figure 1) by analyzing seven collaboration projects between VW Navarra and the University of Navarra, under the so-called "Chair of Business VW-Navarra-University of Navarra."

This section includes the following contents: First, we present the context of this empirical study, the Chair of Business VW Navarra-University of Navarra, and its role in the research collaboration between these two entities. Second, we explain the process of selection and management of collaborative research projects supported by this Chair. Third, we explain how the selection of the projects included in this empirical study was made and we summarize the main characteristics of these projects. Fourth, we describe how the questionnaires were designed, and the interviews were conducted. Finally, we detail the analysis methodology applied in this empirical study.

Context: Chair of Business VW Navarra – University of Navarra

The Chair of Business is a tool that guides the relationship between the University of Navarra and Volkswagen Navarra. The objective of this chair is to promote collaborative research projects between the University of Navarra and Volkswagen Navarra. To this end, the Chair manages and finances research projects developed by professors from different faculties and schools of the University of Navarra in collaboration with professionals from various areas of Volkswagen Navarra.

What motivated them at the time to establish a relationship has now translated into benefits for both organizations. Each party has its own criteria for assessing what the Chair represents and how they have benefited. To elaborate on this section, face-to-face interviews were conducted with the coordinators of the Chair from the University of Navarra and Volkswagen Navarra, respectively. Additionally, documents such as the Web site and annual reports describing the projects, achievements, and objectives to be met in the future were also analyzed.

The Chair of Business was established in 2010, with the Chair Committee serving as the main management tool. This Committee is comprised of executives from Volkswagen Navarra and professors from the Schools of Business/ Economics and Engineering. Its primary function has always been to ensure the proper functioning of the Chair and to promote its activities.

The geographical context of this chair encompasses two regions of Spain where the University of Navarra has two of its campuses. The first is Navarra, where both the production plant of the Volkswagen group, known as Volkswagen Navarra, and the main campus of the University of Navarra are located. The second is the Basque Country, where the Engineering School of the University of Navarra is located on the campus in the city of San Sebastián.

The process of selection and management of collaborative research projects

To understand the effect of CD in the empirical study, it is relevant to understand the stages associated with the analyzed research projects. Figure 2 represents the process of selection and management of research projects.

The Committee is responsible for managing the entire process. In this new stage, the Chair of Business intends to promote various projects that cover different areas of the company and faculties. The objective is to achieve relevant results from both academic and business perspectives. One limitation of the Chair is its inability to finance numerous projects. As a result, only five to seven projects are carried out each year. Therefore, the Committee selects projects that are most closely aligned with the objectives of the Chair. However, the selected projects must also receive final approval from Volkswagen executives and the boards of the Faculties of the University. From 2011 to 2019, four calls for proposals
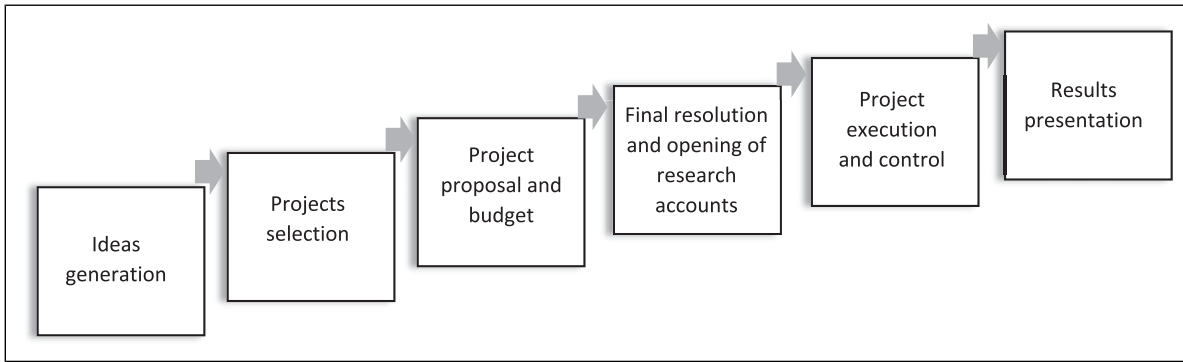
Figure 2. Process of selection and management of research projects.

Table 2. Details of analysed research projects.

#	Project	Time Frame	VW Navarra Department	Research Group – UNAV
1	Identification of critical points in the tightening of screws in the production line of VW navarra	2016–2017	IT systems	Management
2	Design and development of a wearable glove customized by 3D printing to measure the pressure exerted by operators in clipping operations	2016–2017	Prevention	Design
3	Reducing the CO2 footprint by optimizing long-haul material supply routes	2016–2017	Logistics	Operations research
4	Changes in the daily mobility of VW navarra workers	2016–2017	Environment	Geography
5	Analysis of the communication area in open innovation processes: The case of VW navarra	2018–2019	Communication	Communication
6	Analysis of the communication area in open innovation processes: The case of VW navarra	2018–2019	Environment	Chemistry
7	Application of the design of experiments in body elements	2018–2019	Manufacturing	Quality

A detailed description of each project is available in Spanish at the following URL: https://www.unav.edu/web/catedra-empresa-volkswagen/investigacion

were made (2011–2013, 2014–2016, 2016–2017, and 2018–2019), and three different procedures were implemented to select and manage the projects

Selected projects usually last between 9 months and 1 year, but this does not prevent some projects from going on for longer. A clear example is when a project is linked to a doctoral thesis, in which case the project extends from one call to another. Regarding funds, the main researchers manage the funds provided to finance the work, in addition to reporting progress to the Committee.

After the completion of the projects, a presentation event is organized for the research groups to showcase their results, usually held at the Volkswagen plant. The researchers are required to prepare a presentation that highlights the quantitative results and academic contributions. This event provides visibility to the benefits generated by the research for all parties involved.

Selected projects typically last between 9 months and 1 year, although some may continue for a longer duration. For example, if a project is related to a doctoral thesis, it may extend beyond one funding cycle. The primary researchers are

responsible for managing the funds provided to finance the project and reporting progress to the Committee.

Project Selection for the Empirical Study

The next step in our methodology was to select the research projects for this study. We included all the projects developed in the Chair of Business between 2016 and 2019. Table 2 displays the project titles, time frames, and the respective research groups and departments from Volkswagen Navarra (VW) and the University of Navarra (UNAV) involved in each project.

Questionnaire Design and Interviews

Based on the theoretical framework proposed, we designed two different semi-structured questionnaires as a guide for the interviews, one for project leaders from the university and another for project leaders from the company. The table in Annex one displays the link between the factors in our
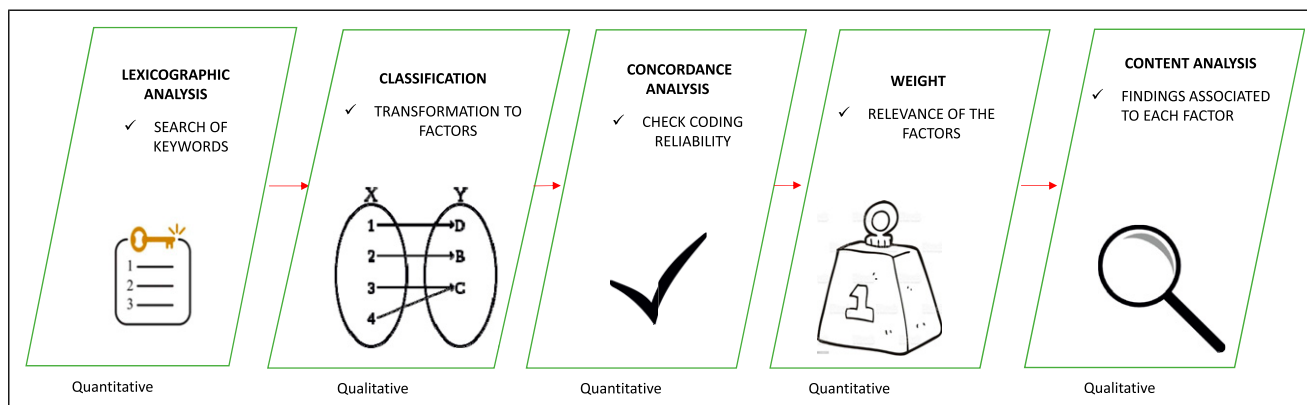
Figure 3. Stages in the interview analysis.

framework and the questions in the two questionnaires. As shown in the table, questions Q1, Q2, Q3, Q8, Q11, Q14, Q15, Q16, Q17, and Q18 are common to both profiles. However, questions Q4–Q7 and Q9–Q13 are formulated differently depending on the interviewee's profile.

Semi-structured interviews were conducted with project leaders from both the university and the company for the selected projects. The interviews, which lasted an average of 20 minutes, were digitally recorded and transcribed by the researchers. This strategy enabled the researchers to participate in the analysis of all the transcriptions.

Analysis Methodology

The methodology applied for this purpose, which we will explain in the following sections, is summarized in Figure 3.

As represented in Figure 3, our analysis methodology is a mixed methodology in which qualitative and quantitative methods were used in a complementary way. Quantitative methods, supported by the use of the Sketch Engine tool, allowed us to obtain three results:

- Identify keywords for content analysis.
- Ensure that the coding performed by two different researchers to associate each keyword with the seven factors associated with CD had a high level of concordance.
- Analyze the frequency of appearance of each factor associated with CD to measure the relevance of each factor for the two profiles of interview participants: university researchers and company practitioners.

On the other hand, the content analysis qualitative method allowed us to obtain two main results:

- Code the relation of each keyword with the seven factors associated with CD.
- Infer the findings of this research work.

Stage 1: Lexicographic analysis. The text analysis of the interviews was carried out with the researcher/university and the managers/firms in collaborative research projects. They were separated by the type of project: exploitation (interviews number 3, 4, 6, and 7) and exploration (interviews 1, 2, and 5), which made it possible to identify a set of keywords in the transcribed semi-structured interviews. These keywords were associated with the seven factors defined in the theoretical framework that we built from studies on the factors influencing UFR. The program used for this analysis was The Sketch Engine, a leading corpus tool for the lexicographical study (Kilgarriff et al., 2004). The program works by dividing the total number of characters of the text or corpus into K parts. This partition is the result of dividing the number of times a word of interest appears in the text by the number of characters. The division of K parts will subsequently lead to calculating a relative measure of how many times the word of interest appears between the resulting number of parts in which the text has been divided. In our analysis, it was the program itself that searched the text for keywords or words of interest. The frequency of appearance of these will account for the relative importance of the factors both for managers/firms and the researcher/university.

Stage 2: Classification analysis. With the set of keywords found by the program, we proceeded to classify them, associating each keyword with the seven factors of interest in the study. We carried out a double classification by two of the researchers of this work who acted as encoders. This double classification was performed for both collaborative agents in the relationship (managers/firms and researcher/university) separately.

Stage 3: Concordance analysis. We then performed a concordance analysis of the classification by both encoders. Concordance analysis adds rigor to qualitative analysis by checking if both encoders produce similar results in the coding task.

The concordance analysis between the two coders was almost exact, with a Kappa statistic value of .854*** for factors classified for researcher/university and a statistic of
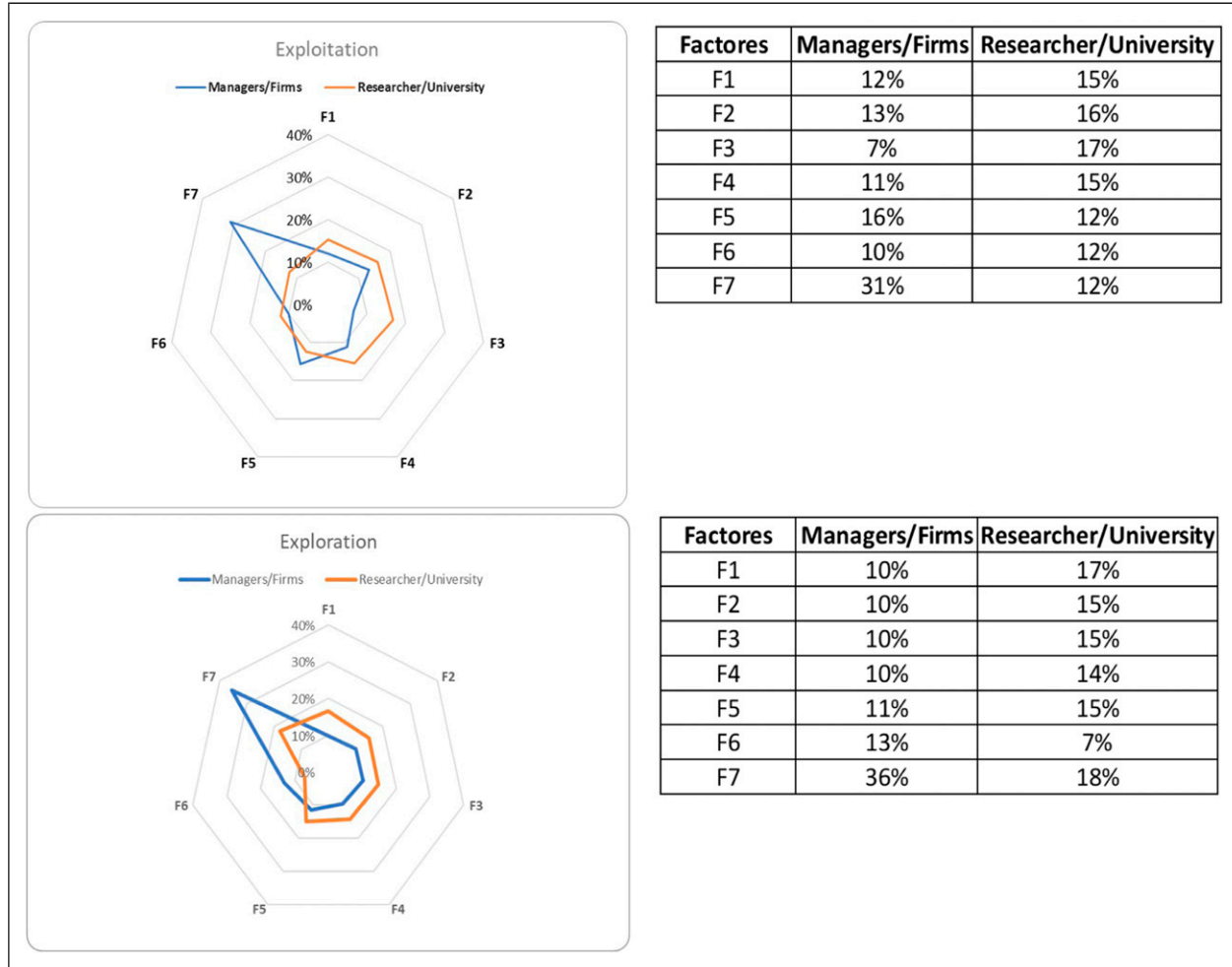
Factores	Managers/Firms	Researcher/University
F1	12%	15%
F2	13%	16%
F3	7%	17%
F4	11%	15%
F5	16%	12%
F6	10%	12%
F7	31%	12%

Factores	Managers/Firms	Researcher/University
F1	10%	17%
F2	10%	15%
F3	10%	15%
F4	10%	14%
F5	11%	15%
F6	13%	7%
F7	36%	18%

Figure 4. Analysis of factors in terms of exploitation versus exploration projects.

.918*** for managers/firms (both significant at 1% with a *p*-value of .000).

Stage 4: Relative importance of the weights of the factors. With the frequency of appearance of the different factors through their keywords with which they are reflected in the conversations, we calculated the average frequency of appearance of each of the seven factors. Next, the percentages that each of these average frequencies appear over the total were obtained to measure the relative weight of each factor over the total set of seven.

We calculated the average frequency of appearance of each of the seven factors by analyzing the frequency with which they appeared in conversations through their respective keywords. Next, we obtained the percentages for each of these average frequencies in order to measure the relative weight of each factor in the total set of seven.

We used this methodology to analyze the relative importance that researchers and practitioners give to each factor in both types of projects (exploitation and exploration). This can help us determine whether there is proof of CD. Figure 4

summarizes the results, showing that F7 is crucial for managers, and that there are larger differences in F3, F6, and F7.

Stage 5: Content analysis. In this final stage, we inferred findings of this research work through making sense of the similarities and differences of the relevance of each factor for the two different profiles of stakeholders (researcher and practitioner) and two different types of projects (exploration or exploitation).

The coded segments of the transcribed interviews were systematically compared and discussed in relation to the literature references of our theoretical framework. This was a particularly useful strategy for linking data with concepts, as it allowed cross-case exploration of the concepts.

Findings

In this section, we first present the findings of the project analysis related to each factor associated with CD that can influence the results of a collaborative research project between university and enterprise.

Choice of Research Thematic Areas (F1) - Priority for Each Part

This factor is related to the first steps in defining the project. Both parties must share their interests, agree on the project content and formulate its objectives. The first stage of the process of the Chair of Business starts with specific challenges identified by Volkswagen Navarra at its plant. The Committee distributes these challenges among research groups, which have research lines that could address the proposed challenges. Then the Chair of Business starts a matchmaking process in which the responsible person from the company department and his team and the university research group discuss the possibilities of applying their knowledge domain and interests to identify a specific research topic for the project.

First, according to the results of the analysis described before, we can observe that the differences among the relevance given to this factor by both profiles, company managers and university researchers, are low both in exploration and exploitation projects.

Next, thanks to the qualitative analysis of the answers of both profiles to the questionnaires, we found that the higher the difference of domain of knowledge and interests of the parties (researchers and practitioner), the higher the CD and that this higher CD has negative effects on the results of the collaborative research project. The first negative effect identified is an unbalanced level of commitment to the project by the two parts, which usually translates into disparity of interests when making decisions and delays in the project development.

Research Methodology (F2)

This second factor refers to differences in the way in which specific problems are targeted, framed and solved by the two coordinators. First, according to the results of the analysis described before, we can observe that the relevance given to this second factor by both profiles and in both types of projects (exploration and exploitation) is very similar.

Then, through the answers from both profiles to the questionnaires, we found that the higher the relevance of the research methodology to obtain relevant information, the higher the difference of CD. Related to this factor we found that the main source of conflict was the different methodological approach of the two parts. On the one hand, the university follows the scientific method; this approach ensures validity and repeatability of their results to achieve scientific rigor, essential to for academic exploitation of the results in the form of publications. On the other hand, the company's way of working is completely different; based on a trial-and-error strategy, they try to solve specific problems as soon as possible and not aware of the importance of following the scientific method to ensure the rigor of the results.

This higher CD has one main negative effect in the collaborative research project: it generates tension between the parties due to the difficulty in publication because of the lack of rigor on the part of the researcher or due to time pressure from the bosses of practitioners to achieve results. Contrary to findings in the literature, such as Bruneel et al. (2010), in our research we did not identify any negative effects related to the confidentiality of the data. The practitioners demonstrated complete confidence in the researchers to provide them with the data they needed to advance the research. In fact, only in P1 did the parties sign a confidentiality agreement. The findings related to this factor show the importance of making the practitioners aware of the scientific research method and the rigor concept to reduce its negative effects. Once they understand the importance of rigor, it would be easier to achieve their commitment to invest the needed time to do data collection in the right conditions. This measure could be easily implemented by identifying in the project selection phase those projects that involve the collection of a large amount of quantitative data.

Typology of Pursued Results (F3)

The first relevant finding in relation to this factor is that the impact on the level of involvement of the practitioners is determined by whether it is an exploration or exploitation project. Projects P1, P2 and P5 analysed in this research work are exploration projects. These projects are focused on exploring emerging technologies for Volkswagen Navarra, such as big data, wearables, etc., and developing pilot projects. These pilot projects help different departments in the company to understand the potential of applying these technologies in their scope and to identify barriers that must be considered when looking for a more massive application in their processes. In exploration projects the university contributes with its knowledge, methodologies and tools, usually involving PhD students (this is possible because they are generating novel knowledge according with the state of the art) and their thesis directors and has the opportunity to use company facilities and resources to test the performance of these emerging technologies in industrial applications.

Projects P3, P4, P6 and P7 analysed in this research work are exploitation projects. These projects are focused on solving specific problems raised by the company. These are usually problems that the company has not been able to solve internally and for which they seek new approaches from a "less contaminated" point of view. These projects are normally linked to specific objectives and key performance indicators (KPIs) of a department or area; they can be, for example, economic savings, environmental improvements or reduction of defectives. The results of the quantitative analysis show that university researchers give greater relevance to this factor than company practitioners in both exploitation and exploration projects.

As for how to reduce these negative effects of CD in exploration projects, a suitable strategy could be to suggest to the company from the very beginning the idea of exploration projects as stage-based projects. A first explorative stage can be framed in the first stages of a doctoral thesis, where both parties explore the potential application of a technology/tool. This first stage output for the company will be focused on learning about the technology/tool and actively work on identifying potential applications and barriers. After the first stage, both parties analyse the results and agree on whether to launch a second stage in which a pilot application of this technology/tool for the company can be proposed. This second stage could serve as part of the validation of the doctoral thesis for the researcher and include specific KPIs to measure the impact of the project for the company. This approach would also respond to the need for a longer period for the development of this type of project than the chair's current 1-year period.

Timing of Expected Results (F4)

While researchers look for publishing their results to gain priority among their peers, firms have a preference to keep secrets and control a resource that is not available to their competitors (Muscio & Pozzali, 2013). In the qualitative analysis, we did not find that this factor, understood in this way, has a direct effect on CD. Some researchers explain the difficulties that they found in publishing project results in academic journals because 1 year, the typical duration of the project of the Chair of Business is a short amount of time to manage with their teaching activities, answering the pace of the project and at the same time being able to write the research article. In fact, in reviewing the academic publications derived from these seven projects, collected in the annual results report of the Volkswagen Chair, we see a considerable delay between the date of completion of the projects and the date of publication of these articles. Nevertheless, in none of the projects analysed is this difficulty in publishing the results associated with a discrepancy or demand for confidentiality on the part of the company.

However, we found that when participants are asked about the differences in timing of expected results, they refer to the different paces of project development between researchers and practitioners. The perception of what is an adequate pace of development of the project varies significantly between the two profiles and if this is not managed properly, it can lead to increased CD. It is also important to note that the lack of temporal synchronization was not always due to a slower pace at the university. In some projects, the company team interrupts the flow of data and communication due to internal production problems whose resolution has absolute priority and consequently delays the progress of the project. According to the results of the quantitative analysis, we can observe that the differences among the relevance given to this factor by both profiles, by managers of the firm and

researchers from the university, are low both in exploration and exploitation projects.

Finally, two different strategies could help to minimize the negative effects of this factor on the projects. The development stage of the life cycle of the projects of the Chair could finish with an internal dissemination of the results achieved by the company. These projects could include a later phase of academic dissemination allowing the financing of dissemination activities by researchers such as attendance at congresses or expenses for editing and publishing articles.

Professional Background (F5)

According to the literature, a different professional training of both parties causes a greater CD due to differences in 'language' and different logics regarding methods to be used (De Witt-de Vries et al., 2019). In this research, the participants did not report professional background as a cause of higher CD. The results of the quantitative analysis show that the differences among the relevance given to this factor by both profiles, by managers of the firm and university researchers, are low both in exploration and exploitation projects.

The following quotes explained this from the point of view of both parties. The project coordinator of the university in project 1 explained: "Yes, the experience and profile of our partners in the project was different. I think it did not have a lot of influence because even though we had different professional profiles, they were very sure of what they wanted, so even though we professionally do very different things, we have developed a common language quite easily in this case." The project coordinator of the company in project 2 explained: "Our training and experience was complementary, and this is one of the positive parts and transmits the theoretical point of view of those who come from the university and our practical point of view, in what is production in a case of the automobile industry such as ours. I see it as something positive."

These differences are seen more as a contribution to enriching points of view when dealing with projects than as a source of problems. Also relevant in relation to this factor are the references to the fact that the professional prestige of both institutions generates a positive predisposition on both sides, which overcomes the differences that may exist at the background level between researchers and practitioners. Regarding this factor, we can also highlight that the geographical proximity of the participants may also be caused by cultural proximity that reduces the effect of this factor on CD.

Previous Experience in Collaborative Research Projects (F6)

This sixth factor focuses on the experience with academic engagement in general and the specific partner in particular. The literature references related this factor to an easier understanding of the needs of companies from the university participants' side and to a higher trust in confidentiality of the

Table 3. Guideline of practical concerns and how to manage them.

Factors	Main Issues Related to CD for Each Factor	How to Manage the Issues to Reduce CD in Collaborative Research Projects
F1: Choice of research thematic area///degree of priority	Different expectations about the relevance of results provoke problems with attitude and conflicts among coordinators. This implies an increase of CD.	Critical step: choice of projects and assure the interest and the commitment of both parties. Closely monitor of the project. Relevance of integrating the projects in teaching programs, such as master's and doctoral theses
F2: Research methodology//data collection and analysis	Different ways of collecting and analysing data imply conflicts among the parties. This is critical for researchers because if the data collecting process is not adequate, the data cannot be analysed statistically. It was often necessary to invest much time in "cleaning" the data	Invest time in letting the practitioner know the relevance of following a rigorous methodology in the collection and analysis of information. Relevant role of the committee
F3: Typology of pursued results	Exploitation versus exploration projects: Relevant differences in terms of CD. Higher CD in exploration projects: Results are not expressed in quantitative and short-term KPIs: Less involvement for the firm	Prepare personalized outputs for the firm in the case of exploration results: Diagnosis reports, visibility actions, further exploitation projects
F4: Timing of expected results	The more different the expectations, the higher the CD and possibilities of conflicts. The firm's outputs must be obtained in the short term and researcher's outputs in the long term	Organize an event at the end of each academic course to show practitioner's results. Extend the life of the project to obtain funds to research outputs: Attendance to conferences, editing papers
F5: Professional background	Different backgrounds implied different skills and knowledge, but this was more a positive than a negative aspect to enrich the performance of the project: Transversal projects enrich the process and the results	It is crucial not to change the coordinators during the process. Geographical closeness helps: Both researcher and practitioner live in the same city and it is easy to find personal ties
F6: Previous experience in collaborative projects	The previous experience in collaborative research projects is crucial for empathy. Lack of experience implies distrust among the parties	Take care in the choice of coordinators is crucial: Most of the problems come from the existence of "bad feelings" among researchers and practitioners. Know-how is crucial
F7: Role of support infrastructures	Crucial for conducting the projects. If the coordinators do not feel supported by the institutions, conflicts are very difficult to solve. Solving problems quickly encourages the coordinators: The more bureaucracy, the more relevant the CD.	The role of the chair committee is very well valued by coordinators. It is crucial that there is a "reference person" in both the university and the firm so that in case of a problem, the coordinators may ask for help

university from the company participants' point of view (De Wit-de Vries et al., 2019).

In the sixth of the seven analysed projects, we found that at least one of the coordinators, either from the university, from the company or both in only one case, had a previous experience of collaboration in research projects with the other party. In two cases, they had participated in previous research projects with the same partner but as participants, not coordinators. In the only project in which none of them had this previous experience, the coordinator of the project from the company side had completed his doctorate at the university, so he had direct experience in university research activities, which allowed him to understand his counterpart very well.

The success of these projects can indicate that previous experience of at least one of the coordinators in collaborative projects between university and companies reduces the CD and has a positive effect on project success. The results show that while in the exploitation projects both researchers and

practitioners, give a very similar relevance to this factor, while in the exploration projects the relevance assigned by the managers of the company to this factor practically doubles that given by the university researchers. This difference may be related to the fact that practitioners feel more comfortable collaborating with researchers who had previous experiences of collaborating with companies, specifically in exploration projects in which the CD is greater and therefore they need the expert in the field to make this new knowledge more accessible to them.

Role of Support Infrastructures (F7)

Support infrastructures build bridges between the parties, acting as intermediaries between the researchers and the practitioners to solve issues that can arise throughout in the research process (De Witt-de Vries et al., 2019). The responses to the questionnaire from both parties clearly

reflect the positive impact of the Chair as a support infrastructure or intermediary that reduces the CD between the parties in three fundamental areas. One of these areas, the role as mediator in conflicts, is already presented in the previous literature, but the other two are new contributions from this research work.

The first area refers to the advantage of having a clear framework for the first stages of the projects. The second area is related to the follow-up of each project with periodic meetings. This follow-up promotes periodic and fluid communication between the parties and avoids a higher CD due to being trapped by their day-to-day activities. The third area, already presented in the literature, refers to the work of the Chair as a mediator in situations in which conflicts arise between the parties, as reflected in the quote from the project 5 company coordinator: "The role of the Chair is perfectly made visible here at Volkswagen and we know that if there are problems there are people who help us."

The results of the qualitative analysis show that support infrastructures are more relevant for practitioners than for university researchers. While for university researchers the development of research projects in cooperation with external partners is part of their day-to-day tasks and they have areas and departments at their institutions that largely relieve them of some management tasks typical of this activity; for practitioners these activities are not part of their day-to-day activities.

Guideline of Practical Concerns

The analysis of the interviews has allowed us to determine how the factors identified in the literature influence CD (see Figure 1) in the process of collaborative research projects. The main contribution of this study is Table 3, which provides a guideline for both managers and researchers to identify the main practical concerns for each factor during the collaborative process. Most importantly, the accumulated experience has enabled the Chair to manage these concerns so that they take advantage of the positive effects of CD. Table 3 may serve as a guideline to improve the management of collaborative research projects and to enrich the field of university-firm relationships. The experience described in this study shows that the main issues related to CD are problems with attitude, possible conflicts among coordinators related to different expectations and priorities in terms of time and results, and differences in methodology for collecting data. Distrust is also relevant when there is no previous experience in this type of project. What is more relevant, however, is the role of the Committee as a "reference point" to solve any problems that may arise.

Conclusions

This study makes it possible to analyse how CD can be influenced in the specific context of individual relationships in collaborating research projects. First, through

studies such as Muscio and Pozzali (2013), De Witt-de Vries et al., 2019 and Muscio & Pozzali (2013) we delimited the scope of the study and built a framework that identified seven relevant factors that influence the performance of collaborative research projects. Our empirical study is based on determining the issues that these factors imply in the influence of CD and how they can manage so that the positive effects of CD increase and the negative ones are less relevant. We observed that most relevant aspects we consider crucial in the influence of CD are the type of projects (exploitation vs. explorations projects), as found in Nooteboom et al. (2007). It is also relevant to see that the findings do not depend on the field of knowledge. Thus, we have analysed projects focused on urban geography, chemistry, ergonomics and communication, among others. To link projects to doctoral studies and master's degree programmes is also crucial to manage better CD; and the same happens with previous experiences from both researchers and practitioners. Finally, the role of support infrastructure to manage all the issues provoke that CD is not a negative variable if not an enriching one. This has permitted us to develop a specified framework based on collaborative research projects that are carried out in the context of a formal agreement and where there is a standardized process to develop these projects.

Managerial Implications

This study enriches the literature on CD, but we also consider that this paper has relevant managerial implications. The guideline described in Table 3 can become a relevant instrument for managers who are in charge of supervising collaborative research projects. While our study's scope is based on university-firm relationships, which means that our findings cannot be extrapolated to collaborative relationships between firms or organizations, there is a trend to develop collaborative research projects with firms, not only agreement collaborations. Therefore, our findings could be useful for analyzing the relationships between researchers and practitioners in action research studies developed inside a doctoral thesis (Zuber-Skerritt & Fletcher, 2007) or competitive research projects (Coghlan & Coughlan, 2006). By considering the effect of CD when selecting research projects where the degree of interactions between researchers and practitioners is high, it will help to increase the degree of success of these projects.

Further Research

Further research with a larger sample of projects coming from different countries would enable cross-country comparisons and generalisation of the results. The use of surveys to collect data would be a relevant option for further studies and to make comparative analysis with studies such as Muscio & Pozzali (2013).

Appendix

ANNEX 1: Relation Between Semi-structured Questionnaires and Factors of the New Framework.

Factors	Questions	Profile of the Interviewees
F1: Research thematic area	Q1: Did you initiate this project, and was it a priority within your research line?	Project leader of the university and of the company
	Q2: Did the difference in work priorities between both parties influence the project?	Project leader of the university and of the company
F2: Research methodology	Q3: Did your working methods clash with how you worked with your "partner"? If so, how?	Project leader of the university and of the company
	Q4: Did you perceive any distrust in obtaining data for the project from the company? If so, in what sense? (Confidentiality, difficulty, etc.)	Project leader of the university
	Q5: Did the way the researcher obtain the data cause any problems or conflicts? If so, in what sense? Confidentiality, difficulty in obtaining the data, others?	Project leader of the company
F3: Typology of pursued results	Q6: What were the desired results of the research projects? (Publications, funding, networks, future projects ideas, consolidating research lines, etc.)	Project leader of the university
	Q7: What type of results were you aiming for? (Specific solutions, diagnostic analysis, improvement proposals, etc.)	Project leader of the company
	Q8: Were there any discrepancies in the expected results that affected the project or the relationship between the researchers?	Project leader of the university and of the company
F4: Timing of expected results	Q9: What were your expectations for obtaining results, and how did they differ from the company? Did they affect the project's development?	Project leader of the university
	Q10: What were your expectations for obtaining results, and how did they differ from the university's? Did they affect the project's development?	Project leader of the company
F5: Knowledge background of both researchers and practitioners	Q11: What is your professional profile (university studies, type of training)?	Project leader of the university and of the company
F6: Previous experience in collaborative research projects	Q12: Do you have experience developing projects with companies?	Project leader of the university
	Q13: Do you have experience developing projects with universities?	Project leader of the company
	Q14: Is this the first time you have carried out projects for the chair?	Project leader of the university and of the company
	Q15: Regarding your "partner" in the chair project, did you notice that the experience and professional profile were very different?	Project leader of the university and of the company
	Q16: Did this fact influence the different stages of the project? How?	Project leader of the university and of the company
F7: Role of support infrastructures	Q17: How would you describe the role that the chair has played in the preparation, development and exploitation of this research project?	Project leader of the university and of the company
	Q18: What, in your opinion, are the benefits and/or advantages that it brings to these projects?	Project leader of the university and of the company

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