Case study

A case study about cooperation between University Research Centres: Knowledge transfer perspective

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ABSTRACT

The aim of this study is to provide a wide-ranging view of the benefits and obstacles of cooperation between University Research Centres. To do so, the four dimensions associated with knowledge transfer, choice of partners, culture and financing were considered. A qualitative approach was adopted, and within this the case study method: the SiNGULAR project. Data were obtained from various in-depth interviews, documentary analysis and the official site of the project. Based on the results obtained, it is concluded that knowledge transfer, choice of partners and finance stimulate this type of cooperation, and that cultural differences between researchers and research centres are a bonus for this cooperation. Several implications for theory and practice are also presented.

Introduction

Research is considered the essence of economic growth. It therefore becomes necessary to understand and cultivate management of the knowledge created, as well as the resources needed for research (Numprasertchai & Igel, 2005).

In this context, universities' main objective is to create and transmit knowledge (Berbegal-Mirabent, Sánchez García, & Ribeiro-Soriano, 2015). To attain their goals, strategies have been implemented to strengthen their capacity for scientific production, despite knowledge mostly being generated in isolation (D'Este & Patel, 2007; Durda & Krajcik, 2016). Therefore, in order to organize and transmit knowledge effectively, universities have created internal structures devoted to research, namely institutes and centres of research that allow the creation of communication channels to transfer the results of research (Rubiano, Rangel, Pacheco, & Hernández, 2015).

University Research Centres were created in response to the need for change in university structures, as well as the desire to join researchers from various origins aiming to solve complex problems of various types (Berbegal-Mirabent et al., 2015; Bozeman & Boardman, 2003).

The literature does not present a clear definition of University Research Centres, or what forms them, possibly due to the heterogeneity of centres and the great diversity of objectives (Geiger, 1990; Sabharwal & Hu, 2013). However, according to Bozeman and Boardman (2003), a research centre is defined as "a formal organizational entity within a university, which exists principally to serve a research mission, being defined beyond the departmental organization and includes researchers from more than one department".

Research centres are the main units for creation of new knowledge (Chataway & Wield, 2000; Sabharwal & Hu, 2013). However, in medium and small-scale research centres, research is carried out by students and researchers under the guidance of a professor, who also teaches (Jain & Triandis, 1990). The situation in large research centres is considerably different. In the latter, there is cooperation between research centres in various universities and countries, thereby allowing a greater exchange of knowledge and resources.

In this scenario, we find the organization of universities and knowledge in global networks (Guan & Liu, 2016; Larner, 2015).

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Scientific cooperation encourages the creation of knowledge and its dissemination. Therefore, researchers and research centres well positioned within a network receive information of greater quality and more quickly (Lamniotte & Panzarasa, 2009).

Management of scientific knowledge is fundamental for the development of research centres in that it makes them more efficient and effective (Numprasertchai & Igel, 2005). Nevertheless, few studies have focused on knowledge management and its contribution to the effectiveness of research centres (Jain & Triandis, 1990). Therefore, this study aims to fill this gap, presenting and explaining the importance of managing and exchanging knowledge between universities, more specifically between University Research Centres, as well as the role firms can play in this type of cooperative relationship.

The problems arising from cooperation are ubiquitous and wide-ranging (Kube, Schaube, Schildberg-Hörisch, & Khachatryan, 2015). The main aim of this study is therefore to provide a broad view of the benefits and obstacles to cooperation between universities, and more specifically between their research centres. Therefore, the following research question is presented: *What factors drive to cooperation between University Research Centres?* This study contributes to the innovation and knowledge literature by assessing the relationship between universities, research centres and firms in the technological transfer process, highlighting the role of cooperation networks.

The structure of this paper is as follows. The next section presents in some detail the advantages and disadvantages provided by cooperation between universities. Section 3 justifies the methodology used, with a description of the case study and the data-collecting instrument. The following sections present and discuss the results, together with the conclusions and implications of the study.

Cooperation between University Research Centres: literature review

The common characteristic of all University Research Centres, broadly speaking, is the intention to promote collaboration between researchers (Berbegal-Mirabent et al., 2015; Boardman & Corleyb, 2008; Guan & Liu, 2016). The main aim of research centres involves the creation and transmission of knowledge (Chataway & Wield, 2000; Guan & Liu, 2016; Sabharwal & Hu, 2013). These actors have as the common denominator the fact of stimulating research and scientific publication, as well as the intention to cooperate with other researchers and/or research centres (Bozeman & Boardman, 2003).

So research is considered crucial for innovation, since it creates new and differentiated products, thereby promoting technological advantages (Jeong, Choi, & Kim, 2014). In this connection, cooperation, particularly in the context of technology, has increased considerably in recent years, together with international cooperation between researchers and research centres (Czarnitzki, Doherr, Hussinger, Schliessler, & Toole, 2015; Laband & Tollison, 2000).

With the globalization of higher education and IT (Information Technology) support, knowledge transfer becomes more frequent, intensive and rapidly transmittable between universities in different countries. This takes place through various means, namely, books, electronic means, conferences, exchange of researchers and others (Teichler, 2004).

Besides knowledge transfer, scientific productivity, researchers' career prospects, affiliation with important research centres and the commitment to work with older colleagues are factors associated with the productivity of both individuals and research centres (Pezzoni, Sterzi, & Lissoni, 2012). Research productivity

incorporates individual effort to create knowledge and network relationships (Czarnitzki et al., 2015; Su, 2014).

Successful cooperation, therefore, depends also on the right choice of parties to integrate the partnership. Jain and Triandis (1990), and Melin (2009) consider necessary the selection of partners with specific competences or resources (e.g. equipment), to lead to successful completion of the research it is proposed to carry out.

Research centres in universities in developing countries, due to their limited internal resources, should implement cooperation strategies with other centres in developed countries. In this way, they increase their potential and reinforce their research capacity (Numprasertchaia & Igel, 2005).

However, the choice of researcher or research centre for a cooperative relationship, despite being rigorous and following criteria, generally involves some degree of risk (Wildavsky, 2010).

Traditionally, universities are known for having their own particular organizational structure, which dates back to the Middle Ages. However, today universities are faced with European and global developments which question their traditional form of action (Czarnitzki et al., 2015; Wit, 2010).

In response to globalization and the process of regional integration, universities have internationalized. The change in universities' strategy can be observed by the increase in international cooperation between them, namely consortia[1] in higher education (Beerkens & Derwende, 2007), twinning (Knight, 2011; Prem, 2014), alliances, virtual and affiliated campuses (Knight, 2011).

University networks are considered a mechanism for sustained promotion of cross-border collaboration. These networks involve a considerable number of universities and focus on a broader set of activities organized around a given problem or objective (Chapman, Pekol, & Wilson, 2014). Consequently, the internationalization of researchers' labour market is witnessed. Universities have begun to rethink their strategies in order to gain or hold on to competitive advantages (Larner, 2015). In this connection, Numprasertchai and Igel (2005) consider scientific research a fundamental factor in new knowledge creation and thereby sustaining competitive advantages.

The literature suggests that differences in the institutional environment of each university can frustrate cooperation between these agents. This is due to the culture and history of each institution, its structural organization, and to procedures and routines that can conflict with the institutional culture of other universities involved in the cooperation (Beerkens & Derwende, 2007).

University Research Centres are fundamental for strategic use of science and technology, and a way to solve problems (Czarnitzki et al., 2015; Stokols, Hall, Taylor, & Moser, 2008). Consequently, from the 1980s, policy has changed, in terms of budget and fulfilling financing circles (Ponomariov & Boardman, 2010).

Financial incentives stimulate cooperation, particularly international cooperation. This type of cooperation brings higher costs than "traditional" cooperation, due to the distance factor (Bohen & Stiles, 1998). In this context, and since the budget for research is relatively limited, financial incentives encourage the expansion of knowledge abroad and ensure the continuation of important research activities (Jeong et al., 2014).

Besides the above, financial incentives can have a positive influence on scientific productivity, in terms of both researchers and research centres, through cooperation (Lakitan, Hidayat, & Herlinda, 2012). Nevertheless, that effect may not be immediate, since

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[1] Consortia in higher education can be defined as multi-point groups of higher education institutions, which have a limited number of members and where adhesion is restricted to institutions permitted by the partners (Beerkens, 2002).

some research can take several years to reach applicable results (Daraio & Moed, 2011; Defazio, Lockett, & Wright, 2009).

Research methodology

Type of study

Qualitative methodology occupies the first position among the possible alternatives for studying phenomena that include behaviour with a high degree of subjectivity (Godoy, 1995; Günther, 2006). This approach should be adopted when little is known about the phenomenon to be studied, besides the fact that human sciences sometimes deal with entities that cannot be quantified (Fassinger & Morrow, 2013). Therefore, qualitative methods were used to understand the drivers and obstacles to cooperation between University Research Centres.

Within qualitative research, Yin (2013) considers that the case study is an appropriate research methodology when we seek to understand and explore complex events and contexts in depth. With the case study, the researcher looks for answers to the "how?" and "why?" of interactions between factors giving rise to a given phenomenon. In this specific case, the interactions of cooperation between University Research Centres.

Case selection

To carry out this research, a single case was chosen: the SiNGU-LAR project (**S**mart and Sustainable **In**sular Electricity **G**rids **U**nder **La**rge-Scale **R**enewable Integration). The choice of this particular project/case was due to its great contribution to developing science in the area of renewable energy and reflecting cooperation between research centres from different countries. The aim of this project was to generate forecasts of meteorological information and models to generate alternative energy, combining the technical information necessary to form the construction and parametrization of forecasting services. This project was financed by the European programme, "The European Union's Seventh Framework Programme for research, technological development and demonstration", which lasted three years and ended on 30 November 2015.

The SiNGULAR project was coordinated by the University of Beira Interior (UBI) – Portugal – and involved consortia/partnerships with various European universities and firms, as presented in Table 1.

Although the focus of this research is cooperation between University Research Centres, the firms involved in the project were also studied. This made it possible to obtain a more complete view of cooperation in the scope of the SiNGULAR project.

The international cooperation carried out in this project was very successful, and reflects the commitment and entrepreneurship of all parties involved. Consequently, the output of the project in question was the creation of six new products, fifty-five scientific publications, elaboration of an international questionnaire which served as the basis for scientific research, and various national and international conferences (source: http://www.singular-fp7.eu/home/).

Choosing the case of the SiNGULAR project for this study was therefore due to the success of the partnership between various University Research Centres and firms, and the project's contribution to advancing scientific knowledge.

Data collection and data analysis

Triangulation consists of combining different methods or sources of quantitative and qualitative data collection, such as interviews, questionnaires, documentary analysis and others, besides combining different methods of analysis, such as content analysis, discourse analysis, statistical methods and techniques, among others (Azevedo, Oliveira, Gonzales, & Abdalla, 2013).

Therefore, this study resorted to triangulation of information sources to obtain data about cooperation between universities for the performance of the SiNGULAR project. Namely, the site http://www.singular-fp7.eu/home/, documentary analysis (project application provided by UBI), interviews, in which the questions were about the benefits and barriers found in cooperation. The basic questions asked, supported by theories and hypotheses of interest in the research, had open answers and focused particularly on the cooperation between University Research Centres. The interview script was sent online on 10th April 2016 to the universities and firms involved in this project and responses were received by 9th May 2016.

All the universities involved in the project participated in this research. However, of the firms involved in the project, only six participated: Electricidade dos Açores, SA, Smartwatt – Eficiência Energética e Microgeração, Concepto Sociológico, SL, Intelen Services Limited, Societatea Comerciala de Distributie si Furnizare a Energiei Electrice – Electrica SA and Alstom Grid SAS. The other firms (see Table 1), despite being asked to collaborate in the research, gave no feedback. It should be noted that the firm of Agenzia Nazionale per le Nuove Tecnologie, L'energia e lo Sviluppo Economico Sostenibile did not participate in the research only because it was not directly involved in the project, and

Table 1
Consortia of the SiNGULAR project.

Participant	Partner (interviewee Ei)	Country	Type of organization
UBI (coordinator)	Universidade da Beira Interior (E1)	Portugal	University
POLITO	Politecnico di Torino (E2)	Italy	University
UCLM	Universidad de Castilla – La Mancha (E3)	Spain	University
AUTH	Aristotelio Panepistimio Thessalonikis (E4)	Greece	University
UPB	Universitatea Politehnica din Bucuresti (E5)	Romania	University
EDA	Electricidade dos Açores, SA (E6)	Portugal	Enterprise
SMARTWATT	Smartwatt – Eficiência Energética e Microgeração, SA (E7)	Portugal	Enterprise
CS	Concepto Sociológico, SL (E8)	Spain	Enterprise
INTELEN	Intelen Services Limited (E9)	Cyprus	Enterprise
ELECTRICA	Societatea Comerciala de Distributie si Furnizarea Energiei Electrice – Electrica SA (E10)	Romania	Enterprise
ALSTOM	Alstom Grid SAS (E11)	France	Enterprise
ENEA	Agenzia Nazionale per le Nuove Tecnologie, L'energia e lo Sviluppo Economico Sostenibile	Italy	Enterprise
ITC	Instituto Tecnológico de Canarias, S.A.	Spain	Enterprise
W4E	Wave for Energy S.r.L.	Italy	Enterprise
PANTELLERIA	Comune di Pantelleria	Italy	Enterprise
HEDNO	Hellenic Electricity Distribution Operator S.A.	Greece	Enterprise

Source: http://www.singular-fp7.eu/home/and project application.

consequently did not have sufficient knowledge to answer the questions asked (protocol). Between universities and firms, 11 entities out of a total of 16 partners involved in the SiNGULAR project participated in the study.

The empirical data relating to the exploratory study of the SiNGULAR Project were obtained from interviews (primary data), documentary analysis in relation to the project's application and its official site (secondary data). In qualitative studies, in the context of social and human sciences, the interview takes prominence with regard to gathering information (Azevedo et al., 2013).

The interviews were sent online on 10th April 2016 to those in charge of coordinating the SiNGULAR project in all the University Research Centres and firms involved (see Table 1). The questions were about the obstacles and drivers of cooperation, as well as ways of solving possible problems during this process.

The material obtained from the interviews was analyzed and relevant sentences or ideas for this study were transcribed. Additionally, data from the documentary analysis were used, which completed or refuted the information obtained in the interviews. So data triangulation was adopted, allowing better understanding of the phenomenon under study (Azevedo et al., 2013), i.e., the cooperation between University Research Centres, in the scope of the SiNGULAR project.

Results and discussion

For it to be possible to determine the obstacles and drivers regarding the SiNGULAR project, namely, (1) knowledge transfer, (2) choice of partners, (3) institutional culture and (4) importance of financing, the statements of those in charge of coordinating the project in the different institutions (see Table 1) in relation to the topics mentioned are presented below.

Knowledge transfer

Cooperation can take various forms, and highlighted among them are science and technology parks, entrepreneurship and research carried out by students, lecturers and researchers, as well as research centres (Pavlin, 2016). In the domain of cooperation between universities, Veugelers and Cassiman (2005) and Schartinger, Rammer, Fischer, and Fröhlich (2006) consider that innovation and technological development provided by knowledge transfer are the most pertinent factors in this cooperation. The literature states that knowledge transfer between these actors has a positive influence on cooperation (Siegel, Waldman, & Link, 2003; Veugelers & Cassiman, 2005).

In this connection, the coordinator of the SiNGULAR project at UBI gives his opinion on the importance of knowledge transfer between the different research centres involved in the project:

> "*The SiNGULAR project was a successful synergy of various institutions, (industry and universities), in European terms, with the aim of developing proficiently some computer tools, prototypes and other technical solutions, which could help electricity operators in the different aspects of islands' electrical systems*" … "*The exchange of knowledge was crucial, since it was possible to have various models/ideas/methodologies that were developed by countless collaborators (professors, engineers, researchers, …), to solve common problems*" (E1).

Besides including researchers from different countries and backgrounds, the SiNGULAR project was considerably productive in relation to scientific publications in the context of renewable energy (source: http://www.singular-fp7.eu/home/).

In this scenario, the project coordinator at POLITO (E2) states that, "*with our cooperation, we had the possibility of learning new*

contents belonging to the expertise of different research groups, working together and producing an impressive amount of research articles containing the results of our very fruitful collaboration*".

The knowledge transfer allowed by the cooperative relationship formed leads to greater researcher commitment, in that they are able to achieve the objectives proposed in the cooperation, more efficiently and quickly (Arvanitis, Kubli, & Woerter, 2008). Accordingly the project coordinator at UCLM highlights that, "*since this allowed to have exchanges of students among the project members. The benefits were related to new publications, co-direction of theses, etc*" (E3).

Cooperation between research centres from different countries allows more efficient and quicker knowledge transfer (Teichler, 2004). Agreeing with this, the project coordinator at AUTH also considers that, "*the SiNGULAR project favored the exchange and development of knowledge relevant to my research. Main benefits of cooperation were (a) numerous joint journal and conference papers (b) fruitful exchange of research ideas and (c) cooperation in development of specific applications software*" (E4). Similarly, the project coordinator at UPB considers that, "*The knowledge shared in our research activities addressed power systems operation optimization and price signals of island electrical power systems*" (E5).

The literature on cooperation between universities and industry also mentions the importance of knowledge transfer between these agents, in order to meet market needs through the creation of new technology developed at universities (Franco & Haase, 2015; Franco, Haase, & Fernandes, 2014).

In this context, among the firms involved in the project, the opinion is also unanimous regarding the importance of knowledge transfer. All the firms studied here and involved in the SiNGULAR project consider knowledge transfer fundamental for the cooperation's success. However, the person in charge of project coordination at the firm of EDA goes further, by saying that cooperation is beneficial for both parties:

> "*The cooperation between these two types of institutions is very important. Both have a lot to gain from this cooperation. Enterprises give indications to universities about their needs, concerns and difficulties about the operation of the systems which leads to the topics and subjects for universities to study and investigate. On the other hand, universities receive from enterprises real data and knowledge about the practical operation of the systems and in the end they can supply ideas and solutions for enterprises to cope with their needs, concerns and difficulties. It is a profitable exchange relationship*" (E6).

Universities provide firms with several benefits, directly or indirectly. Research carried out in universities will, in the long-term, provide improved technology in industry, knowledge produced can be directly applicable to industrial production (prototypes and new processes) and they supply a qualified workforce, training actions and researcher mobility from universities to firms (Schartinger et al., 2006).

In this connection, according to the project coordinator at Swartwatt (E7), "*there is no doubt about benefits in the interaction between SME and Universities. The SME have clear ideas about the problems to solve and about the results/products that must be obtained, this is something that is not so clear for academics. On other side the academics have knowledge to drive from the problem to the result/product. And have a more open mind about the solutions beyond the state of the art*". This empirical evidence shows the ease of knowledge transfer allows cooperation.

Choice of partners

Choice of the right partners is a determinant factor of the cooperation's success (Jain & Triandis, 1990; Jones, Wuchty, & Uzzi, 2008;

Melin, 2009), as well as mutual trust between the parties involved (Le Roy, Robert, & Lasch, 2016). A partnership should be formed of researchers with the same background, but also of University Research Centres that complement each other, in order to meet the needs arising from the research in question (Jones et al., 2008).

In agreement with what is claimed by the authors quoted above, the coordinator of the SiNGULAR project at UBI says that:

"*The right choice of partners influenced the success of the SiNGU-LAR project, and this is reflected in the great success aimed for and approved by the European Commission in January 2016, approving conclusion of the project with a score of 97.22%, that is, 19,44 points out of a possible 20, which in itself is remarkable*" . . .

"*Some of the factors that were essential for selection of the different partners were the interest in collaborating in islands' electricity systems, their location in areas of the study, the availability of data for the necessary starting points, the prestige of some partners in the academic and business world, and also the opportunity to introduce new pilot systems for electricity management or production developed in the scope of the SiNGULAR*" project (E1).

The complementarity between research centres and researchers is also highlighted by the project coordinator at POLITO, confirming what is argued by Jain and Triandis (1990); Melin (2009):

"*The choice of partners was based on complementary skills of the research groups. At the moment of starting the project, the coordinators of the research groups did not work together on a regular basis. During the project, a strong and extremely fruitful collaboration was established, leading to extraordinary results (the EU Reviewers themselves graded some results as "overperforming"*" (E2).

Researchers' background is a factor influencing the choice of researchers and research centres (Santoro & Gopalakrishnan, 2000). Here, the project coordinator at UCLM considers that, "*Since we worked in similar but complementary problems before. The selection was based on existing research works and previous collaboration*" (E3).

Research centres with prestige in the academic field is also a crucial factor in partner selection. The literature states that research centres in less developed countries should choose partnerships with those located in more developed ones, since various types of problems are avoided in cooperation (Numprasertchaia & Igel, 2005). In this context, interviewee E4 says that, "the basic criterion was academic excellence", and the person in charge of the project at UPB (E5) reveals that, "*The criterion used was research proficiency*".

From the firm perspective, the choice of partners in the SiNGU-LAR project was appropriate, as this was done according to common and complementary objectives among the various parties:

"*the selection of partners is important. It must be a complementary relationship, if there are no common interests the relationship doesn't work. On the other side situations where the partners compete directly in the same markets could be a problem for the project, creating natural barriers for a constructive work environment. The criteria must be complementarity, technical complementarity, problem/solution complementarity, geographic complementarity*" (E7). In the same line of thought, interviewee E9 says that, "basic criteria are that the partners should be complementary to each other in terms of technologies and research areas".

Thus, the choice of partners has a positive influence on cooperation.

Institutional culture

Cultural differences between research centres can be an obstacle to cooperation (Beerkens & Derwende, 2007). Particular aspects of teaching institutions, such as historical, geographical, cultural and linguistic factors are of great importance for cooperation between different entities (Beerkens, 2002).

In this connection, all those in charge of coordinating the SiNGU-LAR project in research centres consider that cultural diversity was not revealed to be a problem for the cooperation. The coordinator at UBI considers that:

"*The cultural question made it possible for us to get to know each other, since not only was there a "share" of cultures and customs in European terms, but also with countries from different continents. In the case of UBI it was possible to have numerous researchers from different countries. Namely, Spain, Ethiopia, Greece, Moldova, Turkey, Venezuela, and of course, Portugal. The cultural exchange was a bonus, since it was possible to create new bonds, expand our horizons of knowledge, in both the academic and industrial world, and it was also possible to show a bit of our country to the researchers of other nationalities*" (E1).

Similarly, the person in charge of coordinating the SiNGULAR project at POLITO says that, "*we did not find any problem. The transnational and trans-cultural nature of our collaborators was wide, as they came from different countries, also outside Europe, and created a well-focused and friendly team*" (E2). However, Huisman and Van der Wende (2005) and Pavlin (2016) consider that cultural heterogeneity can emerge as an obstacle or disincentive to cooperation.

Following the same reasoning as the universities, all the firms studied in this research consider that cultural diversity among research centres does not hinder cooperation. The coordinator at EDA considers that, "*given the good exchange of experiences and ideas between institutions of different countries. Maybe the language issue, but that is an insignificant factor nowadays*" (E6).

Therefore, national culture influences cooperation, is controversial, as the literature and empirical evidence contradict each other. While the literature suggests that cultural differences are an obstacle to cooperation, this case study revealed precisely the opposite. Cultural differences were found to be a bonus for this cooperation.

Financial incentives

Government policies in relation to structural finance for the research done by research centres has been diminishing and substituted by funding according to the merit of the projects presented. With this, the intention is that researchers should become dynamic and entrepreneurial (Geuna, 2001). Besides that funding, the European Union also subsidizes projects in various scientific areas based on the quality of the projects presented. In this context, researchers are encouraged to cooperate, so as obtain finance for their research (Bozeman & Gaughan, 2007).

In the opinion of the project coordinator at UBI, European financing was decisive for the successful cooperation which took place in the SiNGULAR project:

"*The financial incentives were sufficient to be able to encourage the sharing of information and ideas between institutions, and also for being able to spread those ideas in the academic world and industry. As can be understood, those funds were also essential for hiring specialists and researchers in the area of study/analysis. Besides this, with those same financial incentives, it was possible to develop responses able to help the island electricity-producing system considering the objectives of Horizonte 20/20/20*" (E1).

Indeed, the finance attributed to universities is an incentive to the exchange of knowledge and researchers between different research centres, and encourages them to cooperate with other entities (Muscio, Quaglione, & Vallanti, 2013). Here, the person in charge of Project coordination at the Politécnico di Torino

Table 2
Summary of the key ideas of university project coordinators.

Universities	Knowledge transfer	Choice of partners	Culture	Financial incentives
Universidade da Beira Interior (UBI)	- The exchange of knowledge allowed various methodologies developed to be tested -Finding solutions to common problems	-Partners with interest in the field of developing island electricity systems	- Cultural exchange	- Hiring researchers and acquiring new equipment
Politécnico di Torino (POLITO)	- Exchange of knowledge between research centres about renewable energy	Complementarity of researchers' backgrounds	- Cultural differences united researchers	-Mobility of researchers between different universities
Universidad de Castilla – La Mancha (UCLM)	- Exchange of researchers -Production of more scientific knowledge	- Successful cooperation carried out in the past - Researchers with similar and at the same time complementary knowledge	- Cultural differences became constructive	- Universities would manage to cooperate
Aristotelio Panepistimio Thessalonikis (AUTH)	- Building new scientific knowledge	- Excellence of the universities involved in the project	-No obstacle to cooperation	- Incentive to cooperate - Maintaining a team of researchers of a high academic level - Being able to attend both national and international conferences
Universitatea Politehnica din Bucuresti (UPB)	- Optimizing research	- Scientific research capacity	- No problems found due to cultural differences	- Spread of information

considers that, "*the financial support was essential. We had the possibility of activating mobilities among Universities, sending our young research collaborators to work for a period with the research groups at other Universities. This exchange is a clear benefit for professional and personal growth of the young researchers*" (E2).

According to Bozeman and Gaughan (2007), finance incentivizes cooperation, and in agreement, interviewee E3 also considers that, "*Having financial support was key to allow the mentioned exchanges and fostered cooperation. Otherwise, our universities would not have funds for that*". The project coordinator at AUTH also says that, "*Financial support was a major incentive to cooperation. The main benefit was the ability to support a highly competent research team of post-docs and PhD students (a total of six young scientists) over the course of the project. Other benefits were the coverage of travel expenses for the project meetings and international conferences*" (E4).

From the firms' point of view, the European financial incentives awarded to the SiNGULAR project encouraged cooperation between the entities involved. According to the project coordinator at EDA, "*financial support is important. Anyway, from the beginning we were available to cooperate with the project consortium even without that financial support. But I have to say that the financial support leads to a better and larger commitment with the overall objectives and tasks of the project*" (E6).

Financing provides the necessary conditions to enable the development of a wider range of products. Therefore, financing stimulates researchers' innovation (Auranen & Nieminen, 2010). Following this line of thought, the coordinator of the SiNGULAR project at SMARTWATT, mentions that, "*The benefit is a more wide variety of products for the SME, innovative products that don't have a market yet*" (E7).

Consequently, the innovation allowed by financing leads to problem-solving (Wonglimpiyarat, 2016). And according to the coordinator at the ELECTRICA firm, financing, "*stimulated the concern of employees for research and innovation by becoming aware of new theoretical concepts in solving technical problems encountered with the integration of renewable energy sources*" (E10).

In this circumstance, financial incentives have a favourable influence on cooperation.

Comparative analysis

In summary form, Tables 2 and 3 present the main ideas put forward by the SiNGULAR project coordinators in the different institutions collaborating in this research.

Similarly, the most relevant ideas of the SiNGULAR project coordinators in the different firms are also presented, in relation to the four dimensions considered in this research.

Conclusions and implications

The main objective of this study was to provide a wide-ranging view of the benefits and obstacles to cooperation between University Research Centres. To do so, the dimensions of knowledge transfer, choice of partners, institutional culture and financial incentives were considered. The empirical evidence obtained about the SiNGULAR project lets us conclude that knowledge transfer, choice of partners and financial incentives are factors favouring successful cooperation between these entities. However, cultural diversity, mentioned in the literature as an obstacle to cooperation, is considered a bonus by the coordinators of this project.

Knowledge transfer gives research centres quicker access to knowledge held by researchers in other such centres, and so together they find solutions to common problems. From the firm point of view, knowledge transfer let them meet market needs, through the creation of new products or technology developed by the researchers.

Although beneficial for both sides, some problems can emerge in the cooperation process. Industry may fear that results coming from research centres will be unviable, since these agents are too theoretical and rather impractical, whereas industry's focus is on immediate solutions to practical problems.

Table 3
Summary of key ideas of project coordinators in firms.

Firms	Knowledge transfer	Choice of partners	Culture	Financial incentives
Electricidade dos Açores, SA (EDA)	- It was beneficial - Problems solved and the universities had access to practical guidelines and real data about the problems to be solved		- Exchange of ideas and experiences between researchers from different universities	- Greater commitment to the project's objectives
Smartwatt – Eficiência Energética e Microgeração, SA	- Universities have the necessary knowledge to solve firms' problems	- Common interests - Technically and geographically complementary	- Universities are more prepared for international cooperation than firms - Adapting to different problems and diverse contexts	- Greater variety of products developed by the firm
Concepto Sociológico	- Problem-solving	- Coherence and balance between partners	- Cultural differences were enriching	- More finance for better exploration of new technologies
Intelen, Inc.	- Incremental innovation	Complementarity and in terms of technology and areas of research	- Cultural differences were no obstacle to cooperation	- Paying researchers and to incorporate new technology in products developed by the firm
Societatea Energetica "ELECTRICA, SA"	- Development of more effective electrical systems	- Test models and software proposed by the universities	No problems were observed regarding cultural differences	- Greater commitment of those involved to solve technical problems
Alstom	- Practical application of theoretical knowledge developed by the universities	- Good balance between academia and industry	Cultural differences did not cause disagreements between researchers	- Partnerships between a high number of universities and firms

According to the empirical evidence obtained from academia, no problems were registered in this cooperation. Despite being generally positive, firms mention some problems in cooperating with research centres, namely the lack of market orientation and the excessively theoretical nature of researchers.

Therefore, the results obtained let us identify some implications for both theory and practice. Regarding contributions to the former, this research enhances knowledge of this subject, identifying four dimensions that influence cooperation between research centres. Both universities and firms are unanimous about the importance of knowledge transfer, choice of complementary partners and financing for the success of cooperation between the various agents involved in the SiNGULAR project.

However, contrary to the literature, the entities interviewed consider that the cultural differences between the various actors are no barrier to cooperation. On the contrary, they are a bonus, and enhanced the cooperation in this project.

As for practice, this research identified weaknesses in cooperation between research centres and industry, and possible ways of solving them. From the firm perspective, the situation of researchers being too theoretical and little concerned about seeking markets can be overcome, if research centres' teams include firm employees concerned more with practice, to solve problems and identify market needs quickly. According to firms, this closer relationship between universities and industry would remedy that weakness.

Concerning the limitations of this study, they are related to the methodology used. Resorting to the case study means the conclusions cannot be generalized and there is the problem of subjectivity in interpreting the answers.

It is suggested that future studies should include other dimensions influencing cooperation, besides knowledge transfer, choice of partners, cultural differences and financial incentives, to complement the study presented here. It would also be fruitful to carry out similar studies but applied to other geographical regions and in various fields, to be able to make comparative studies.

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