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A CROSS-COUNTRY APPROACH ON THE DRIVERS OF SUCCESS IN INTERNATIONAL R&D NETWORKS

UN ABORDAJE DE LOS DETERMINANTES DE ÉXITO EN REDES INTERNACIONALES DE I+D: UN ANÁLISIS COMPARATIVO ENTRE PAÍSES DE LA UNIÓN EUROPEA

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ABSTRACT

A strategy that plays a central role in the internationalized scenario of innovation is that of R&D collaboration. However, relationships among firms from different national settings increase the complexity of managerial processes, turning it into a relatively unstable organizational structure. To help shedding light on the economic and administrative activities involved in such linkages, our goal in this research lies in assessing simultaneously the influential aspects of firms' results. These are expected to fall under three broad analytical dimensions: *Microeconomic*, *Contextual* and *Macroeconomic*. Logistic regressions were developed in order to identify determinants of success in terms of: a) technological outcomes; b) market achievements; and c) future expected accomplishments. Data is gathered from Eureka's Final Reports (2000-2005) and uses data from Spanish, Italian, French, British, and German firms. Results highlight the core importance of the *Contextual Dimension*. The National Innovation System to which a given firm belongs to has marginal relevance (*Macroeconomic Dimension*), as well as firms' characteristics (*Microeconomic Dimension*).

Key words: R&D cooperation; Eureka Program; European Union; Innovation management.
JEL: M1, O3.

RESUMEN

La innovación es una actividad que presenta características crecientemente internacionales. Una estrategia de fundamental importancia en este escenario es la cooperación internacional en I+D. Sin embargo, las relaciones entre agentes de distintos países añaden complejidad a los procesos gerenciales, lo que pone de manifiesto la necesidad de mejores estructuras de coordinación entre las empresas debido a la presencia de costes de transacción adicionales (idioma, contexto institucional, etc.). La propuesta del artículo se define en identificar los factores determinantes de los logros empresariales basados en tres dimensiones: *Microeconómica*, *Contextual* y *Macroeconómica*. La estrategia metodológica para abordar estos temas está basada en la construcción de modelos regresivos logísticos, buscando verificar los determinantes de éxito en términos tecnológicos y mercadológicos (obtenidos y esperados). Datos para los análisis provienen de los cuestionarios de fin de proyecto del Programa Eureka (2000-2005) para empresas de España, Italia, Francia, Reino Unido y

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Alemania. Los resultados indican la importancia fundamental de la *Dimensión Contextual*. El Sistema Nacional de Innovación tiene una relevancia marginal (*Dimensión Macroeconómica*) así como las características de las empresas.

Palabras claves: cooperación en I+D; programa eureka; unión europea; gestión de la innovación. **JEL:** M1, O3.

1. INTRODUCTION

The systemic perspective of innovation and its related activities relies on a rationale of reinforcement and promotion of existing connections between firms and institutions. As a consequence, we have the creation of a context in which single firms' projects still have importance in terms of RTD policy, but not as much as network-oriented initiatives. Embedded in this scenario is the existence not only of firms' strategies to cooperate in R&D, but also its increasingly international orientation. It is well known that not only for firms, but for innovation systems, this sort of integration can be very beneficial for technological growth and evolution. On the one hand, R&D cooperation functions as a key determinant of competitiveness, while on the other hand it represents an effective way of transferring knowledge between regions (Archibugi and Iammarino, 1999; Suurna and Katel, 2010; Coe and Helpman, 1995; Fernández-Ribas and Shapira, 2009).

Nonetheless, approaches in this regard are somewhat controversial. There still is an important gap in terms of policymaking implications of R&D cooperation initiatives as well as a need for a stronger framework to foster these activities (European Commission, 2011). Much is still unknown regarding the dynamics of such networks, which puzzles both managers and policymakers when designing R&D partnerships. There is a great deal of uncertainty involved, hence raising transaction costs above optimal levels. When cross-border cooperation is included into the analysis further complexity regarding agents' economic behavior is likely to be added.

The scope of this article lies in the analysis of the outcomes from market oriented international R&D cooperation based upon data from European firms. This is justified by the current quest for deeper integration between EU's agents (firms, research institutes, universities, etc.) and the systemic consequences of closer R&D cooperation at the international level. Hence, our goal is to assess firm level data in order to identify determinants of performance (technological and commercial) for companies that participate in international R&D cooperation initiatives. Notwithstanding its geographical focus, our assessment also provides insightful remarks for the scrutinized phenomenon as a whole. The European view, however, is rich in its internal dynamics of economic exchanges at several different levels, thus constituting a valuable case of analysis.

In order to make our analysis operational, data was gathered from Eureka projects (2000-2005) considering participants from Spain, Italy, France, United Kingdom and Germany. The Eureka Program plays a central role in the integration process within the EU in terms of R&D cooperation, and it also acts as a strategic element of the European Research Area given its market-oriented approach and its links with the business environment. In addition, Eureka gathers a substantial amount of data from companies, offering the possibility of drawing a clearer picture of microeconomic phenomena related to international cooperation in R&D.

The main finding of our research points towards the significant impact that managerial quality plays in shaping the outcomes of international R&D networks. This outcome is in line with arguments that highlight the central role of institutional settings in defining rules of governance in interfirm relationships. We can also relate these aspects to the importance of understanding the dynamics of transaction costs in the interaction that takes place among agents when they collaborate in R&D .

The article is structured in the following manner: section 2 sets the theoretical and empirical background for the assessment undertaken, where key concepts of R&D collaboration are presented. We categorize potential determinants of related results under three broad dimensions: Microeconomic, Contextual and Macroeconomic, which define the hypotheses of our research. Section 3 depicts the methodological structure, whereas section 4 contains the results from our empirical assessment. Section 5 concludes with some final remarks.

2. NOTES ON R&D COLLABORATION

History shows that R&D partnerships have gained substantial importance since the 1960s with a noticeable expansion in the 1980s. This is the result of the increased level of complexity of R&D projects in recent decades, higher uncertainty surrounding R&D, higher costs of R&D projects, stronger competition and shortened innovation cycles. Hence, collaboration is understood as an effective strategy in face of an environment with more specialized organizations in terms of knowledge production (Pavitt, 2002; Hagedoorn, 2002; Narula, 2001; Zeng, Xie and Tam, 2010; Katz and Martin, 1997; Jonkers and Castro, 2010; Motta, 1992). As a result, there is a maximization of the added value of a firm through the combination of complementary resources and knowledge between partners (Das and Teng, 2000; Hagedoorn, Link and Vonortas, 2000; Sakakibara, 1997a; Mowery, 1989; Motta, 1992). Veugelers (1998) summarizes this perspective by pointing out that R&D cooperation allows access to new markets, absorption of new skills and technologies, achievement of scale economies and division of costs and risks of innovation projects.

Conceptually, cooperative R&D consists of an arrangement among firms (two or more) that aim at pursuing common objectives, sharing costs and results of an R&D project and can be achieved through R&D contracts, consortia, Research Joint Ventures, licensing contracts or other forms of interaction (Sakakibara, 1997; Archibugi and Iammarino, 1999; Huggins, 2001). The kind of cooperative agreement in which firms engage is largely determined by technological characteristics and sectors of industry, as well transaction costs and information asymmetry between agents (Hagedoorn and Narula, 1996; Zander, 1999; Silipo, 2008). For example, in industries with a rapid rate of technological change, the dynamics favor “softer” forms of collaboration instead of “harder” ones, such as alliances, joint ventures and other contractual agreements (Fernández-Ribas and Shapira, 2009).

Provided this introductory assessment of the R&D collaboration phenomenon, some specific aspects deserve further attention according to the scope of our assessment. These will be approached through three analytical levels in our exploration of the R&D collaboration subject: Microeconomic, Contextual and Macroeconomic. The extension of our focus on each of these three dimensions is presented in the following section. A set of testable propositions is also offered.

2.1 Framework of Analysis and Research Hypotheses

Our emphasis concerning our research hypotheses will lie upon the following three analytical dimensions:

a) Microeconomic dimension - Aspects related to **firms' inherent characteristics** as influential variables in their outcomes;
b) Contextual dimension - Firms' aspects related to their **participation in cooperative settings** (in this case, their participation in a Eureka individual project), as well as the institutional framework represented by RTD policy incentives;
c) Macroeconomic dimension – It represents the general features of the **National Innovation Systems** in which these cooperating firms are embedded.

This perspective does not imply a segmented approach of such dimensions or even the existence of independence among them. The macroeconomic dimension as it is defined is largely determined by microeconomic behavior, but it also exerts some level of influence upon firm aspects. Similarly, the contextual dimension might be affected by both micro and macroeconomic conditions. This arbitrary division is a simplification that allows a workable assessment of the phenomena under scrutiny in this research.

2.1.1 Microeconomic Dimension

Agents must be able to *absorb* knowledge generated elsewhere in order to benefit from collaborative relationships. Therefore, *open innovation strategies* must be followed by a certain level of *absorptive capacity* (Veugelers, 1997; Belderbos, Carree and Lokshin, 2004; Parisi, Schiantarelli and Sembenelli, 2006; Caloghirou, Hondroyiannis and Vonortas, 2003). One significant outcome of this perception is that large companies are likely to capture external knowledge more easily than SMEs, because of an expected higher absorptive capacity (Cohen and Levinthal, 1990). Consequently, larger corporations can become less self-sufficient in their innovative processes (Fritsch and Lukas, 2001; López, 2008; Bayona, García-Marco and Huerta, 2001). Moreover, large firms have a better structure to engage in international cooperation, since they have the capacity to internalize knowledge-intensive activities and the opposite is true for SMEs (Fernández-Ribas and Shapira, 2009; Rammer, Czarnitzki and Spielkamp, 2009; López, 2008; Silipo, 2008), i.e., while large corporations have a greater capacity to engage in such cooperative settings, SMEs might have a greater *necessity* to do so.

But in order to achieve higher levels of absorptive capacity – and thus achieve full benefit of open innovation strategies – firms cannot neglect internal R&D expenditures (López, 2008). Hence, in an environment of deeply specialized players, firms must take an active position, instead of simply relying on knowledge generated elsewhere. Chesbrough (2003) highlights that there is a high level of *complementarity* between external and internal R&D because of the capacities required to make full use of existing knowledge.

Thus, by providing firms with access to capabilities located abroad, international R&D cooperation requires the existence of a certain level of *absorptive capacity* in order to be effective. Furthermore, another suitable approach is to take into account the R&D intensity of a given firm as a potential determinant of cooperative projects' outcomes. Special emphasis should be put on its effects upon the technological results (direct effect), more than on commercial achievements (indirect effect). This relationship is expected because the concept of *absorptive capacity* is technique-oriented. We acknowledge that market results are likely to be influenced by technological development, but not in a linear manner, provided that innovation is inherently a risky process, facing both *technical* and *market* challenges.

H_1: Absorptive capacity has a positive influence on organizational outcomes arising from firms' participation in international R&D cooperation projects,

where this effect is more pronounced on technological outcomes rather than on commercial ones.

H_{1a}: Considering firm size as a proxy for absorptive capacity, large companies achieve better outcomes than SMEs.

H_{1b}: Considering R&D intensity (measured as a percentage of turnover invested in R&D) as a proxy for absorptive capacity, more intensive firms achieve better outcomes, regardless of their size.

2.1.2 Contextual Dimension´s Hypotheses

R&D collaboration poses serious complexity issues when putting together agents of different sizes, types and competences (Georghiou, 1999). As a result, this kind of activity requires intense coordination and information flows for firms (Teece, 1986), which can be attributed to aspects related to transaction costs involved in the relationship. As a result, the quality of coordination and levels of trust in the interfirm relationship are often addressed as main determinants of success in R&D networks (Caloghirou, Hondroyiannis and Vonortas, 2003; Huggins, 2011).

Furthermore, when firms collaborate in R&D they may not be able to monitor the level of effort undertaken by its partner(s), thus creating a *moral hazard problem* (Silipo, 2008). This situation highlights the importance of project management in collaborative settings. But even if properly managed, R&D cooperation carries with it a wide array of *transaction costs* involving *information asymmetry, opportunistic behavior and moral hazard risks* (Veugelers, 1998). Moreover, diffusion of knowledge in an international context does not happen as perfectly as within national borders (Bottazzi and Peri, 2007). In this regard we should approach geography as a proxy for other influent variables in the process, such as cultural background, local market characteristics, language barriers and difficulties involving coordination from long distance.

The inherent complexity of international R&D cooperation stresses the importance of the quality of project management. Risks related to *free riding*, *opportunism,* and *moral hazard* issues, as well as different *modus operandi* of firms - provided their distinct cultural backgrounds - are present in any kind of cooperative engagement. However, when dealing with foreign partners, they are maximized. Cultural ties are likely to differ in a higher degree than it would happen in domestic relationships. Also, monitoring costs of principal-agent relationships also rise significantly. In this sense, we developed the following proposition:

H_2: The management quality of a given cooperative R&D project undertaken at the international level will influence the ultimate corporative outcomes of such project, both at the technological and economic (commercial) levels.

To this we must add the risks of *critical knowledge spillovers*, i.e., unwanted knowledge sharing to other firms/agents involved in the cooperative project. Besides aspects of managerial complexity that are common to networks in general (such as organizational culture, information flows, opportunistic behavior, etc.), we must remind the risks involved in R&D cooperation, which are mainly related to undesired knowledge flows. This implies that vertical networks are easier to manage than horizontal ones (Tao & Wu, 1997), hence potentially leading to better outcomes. While technological and knowledge spillovers are positive in a R&D network, there are severe managerial threats when this “leaking knowledge” can affect agents’ competitiveness.

In collaborative R&D projects there is the risk of the partner imitating the innovator’s technology and competing with him (Teece, 1986), which would represent a case of *free riding*. This is due to the fact that R&D collaboration implies a certain level of potential opportunism because of asymmetric information which might lead to insufficient investments from the parts involved (Socorro, 2007). Therefore:

H_3: R&D cooperation projects involving rival firms are likely to achieve worse overall results than networks formed by non-rival agents.

A next step lies in considering the endogenous impacts of technological achievements on the commercial side of firms' results. Technical outcomes *per se* do not lead to successful *innovation*s, since the marketability of such attainments must be taken into account. Nevertheless, technology is a *necessary* condition in this process (but not *sufficient*). One of the most relevant outcomes from cooperative R&D in companies is the expectation it creates in providing greater innovative capacity. We can attribute this expectation to external knowledge absorption as well as to a greater innovative intensity in collaborating firms.

As a positive body of evidence regarding the relationship between innovative performance and R&D cooperation we can mention the analyses of Faems *et al* (2010) and Zeng, Xie and Tam (2010). These authors report that firms engaging in technological cooperation outperform those that do not in terms of innovative performance. A core aspect to be taken under consideration within this scenario is the timing of the assessment. Sakakibara (1997a) highlights the fact that the commercialization of a given project involving R&D collaboration drives the project's positive or negative evaluation by participants. If further results arise after the evaluation takes place, there is a potential risk of misrepresenting companies' outcomes if returns are not yet being commercialized.

H_4: Technological achievements in an international R&D cooperation project influence positively the commercial achievements of firms.

H_{4a}: Impacts of technological achievements should be regarded not only as those that unfold by the end of a given project, but also as those that are expected to take place after the project's completion.

2.1.3 Macroeconomic Dimension´s Hypthesis

The last aspect to be assessed as an influential determinant regarding international R&D collaboration results makes reference to the geographic and institutional environment in which agents are embedded: National Innovation Systems. Adding this variable into our analysis provides a macro-oriented perspective of the phenomenon under analysis.

As Carlsson (2003) puts it, "*the European Union appears to be the only major supranational scientific and technological block now emerging*". In fact, and in many aspects, the international approximation between EU's member states represents a search for closer interaction, coordination, and, consequently, appropriation of benefits that are expected to arise from large markets (at least from the economic perspective).

Initiatives such as the European Research Area, the Innovation Union, Joint Technological Initiatives, and Eureka/Eurostars represent efforts in this direction. All of them propose support for creating stronger innovative capabilities within Europe *through* the generation of collaboration in innovative activities across the continent, i.e., involving agents belonging to different national settings (National Innovation Systems).

The focus of this approach lies on the capabilities developed by countries in terms of some specific characteristics regarding their performance in terms of innovative *input* and *output*. Thus, we take the dynamics of systems as exogenous for simplicity's sake. To justify this action we must remind that the content of this research is microeconomic-oriented, whereas results can also impact on innovation policy evaluation: the macroeconomic dimension in this case functions as an approximation of the macro environment in which firms are embedded as a control variable in our analysis.

We must consider that the countries being analyzed are of similar economic sizes, as well as of similar levels of development in a global perspective. This is a strong argument not to believe that any of the National Innovation Systems under scrutiny (Spain, Germany, Italy, UK, and France) can be regarded as a "*less-developed Innovation System*". Nonetheless, they differ substantially in terms of several innovation indicators. This validates the perception that their national environments in terms of innovation capabilities may affect their microeconomic structure. In this sense, we propose that laggard Innovation Systems can benefit more in comparative terms from R&D cooperation with foreign Innovation Systems. This hypothesis carries with it an assumption of convergence across Innovation Systems.

> ***H_5: Firms located in relatively laggard Innovation Systems will achieve better outcomes from international R&D cooperation projects than those firms located in leading Innovation Systems, provided that such Systems are above a threshold of development.***

3. A BRIEF OVERVIEW OF COLLABORATIVE INNOVATION IN THE COUNTRIES UNDER ANALYSIS

In this section we offer a brief contextualization of the National Innovation Systems regarding the countries used in our empirical assessment. It is not our intention to develop a thorough and exhaustive review of related aspects[1], but rather to offer a fair context for further analyses.

In the case of Spain, the construction of a modern and efficient innovation system is still a challenge. In the last decades the country has experienced a modernization of its productive structure, which provided an improvement in economic and social indicators (MICINN, 2009). Nonetheless, this situation did not reflect into a strong growth in technologically advanced sectors, keeping the country in a laggard position in comparison to other developed nations in terms of innovation (Molero, 2010; López, 2008). Regarding R&D cooperation, external sources of innovation (such as collaboration agreements and external R&D) play an important role in Spanish innovation (Santamaría, Nieto and Barge-Gil, 2009). Where it could be expected that a process of *catching-up* to more developed capabilities existing abroad would take place, Barge-Gil (2010) finds that cooperation in innovation can be more effective if promotes networking at the *national level*[2]. This is a strong hint of a low level of absorptive capacity regarding advanced technologies and techniques which might be available through interaction with foreign partners[3]. However, this picture seems to be changing as an increasing proportion of Spanish firms devote R&D investment to adopt external technology instead of generate its own (Busom and Fernández-Ribas, 2008).

In the case of Italy, the Ministry of University and Research gives strong emphasis to participation in European collaborative projects, such as ERA-NETs, Framework Programme's projects and Joint Technological Initiatives, while the "Industria 2015" is an example of a national project in Italy that aims at fostering large cooperative projects (Potí and Reale, 2011).

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[1] The literature on the National Systems of Innovation is vast, including a large body of theoretical and empirical assessments regarding a broad set of dimensions and variables of interest.

[2] Nonetheless, the Spanish economy lacks the existence of a critical mass of large domestic or multinational firms that can effectively promote the generation of RTD networks (Heijs, 2011).

[3] Heijs (2009) believes that this is partly due to the Spanish low level of English language skills, which hampers the opportunities for interaction with other members of the ERA and makes it more difficult to absorb knowledge generated abroad.

Rammer (2011), in an assessment of Germany's innovation system, points out that the achievement of improvements in the science-industry relationship is a key element of German innovation policies. Furthermore, RTD programs in this country are open to participants from other countries, setting the stage for incentives in terms of international R&D collaboration. Germany currently has over 200 bilateral and multilateral agreements of technological and scientific exchange and cooperation (with stronger emphasis on the European context).

In France, innovation policy is strongly oriented towards SMEs, while domestic collaboration aims at enforcing public-private linkages through cluster support (Zaparucha and Muths, 2011). The internationalization of this specific innovation system relies in governmental subsidies to local SMEs to engage in international (mainly European) networks related to FP's initiatives and other sorts of technological partnerships (though the latter is diffused across a myriad of programs, each receiving only marginal support when compared to FP activities).

The British innovation policy framework follows a different pattern, where it does not address domestic RTD collaboration explicitly, and incentives to international cooperation seem limited to participation in European initiatives (Eureka, FP, ERA-NETs), characterizing a low level of intervention in this particular field (Cunningham, Sveinsdottir and Gok, 2011). UK innovation measures are also widely closed for foreign participation.

In table 1 we offer a summary of R&D cooperation for the countries under scrutiny using data from the Community Innovation Surveys (waves 4, 5, and 6). As it can be noticed, Spanish innovative firms cooperate moderately in manufacturing, while this behavior plays a marginal role in services. Nonetheless, its profile varies significantly between national and international R&D cooperation, especially in the case of collaboration with partners located outside of the European Region. Even though this pattern repeats itself in the other 4 countries, in the Spanish case it is particularly pronounced. French companies show a much more cooperative pattern than its peers, followed by British counterparts (at least in the manufacturing sector case, since data for services is not available for both UK and Germany). It is interesting to highlight this cooperative behavior of British firms even in the absence of specific national-level policies that aim at fostering this sort of behavior. Nonetheless, this perception is based upon scarce data, which might hide some interesting features of cooperative strategies from UK's firms. As per Germany, national or international R&D cooperation appears to be somewhat less relevant than for France.

Furthermore, innovation-oriented cooperation seems to be more strongly related to tangible industrial activities, whereas the picture for services shows weaker signs of collaboration as an important strategy when firms innovate. In terms of trends developing over time, French firms are the sole ones to show a declining figure from the 5th to the 6th wave of the Community Innovation Survey, where Spain shows a stagnant proportion in manufacturing. Data for the remaining countries highlight a growing weight of *open innovation* activities in their overall composition.

TABLE 1. SUMMARY OF COOPERATIVE BEHAVIOR IN INNOVATIVE ACTIVITIES (COMMUNITY INNOVATION SURVEY – WAVES 4, 5, AND 6) FOR SELECTED COUNTRIES. MANUFACTURES AND SERVICES

SUMMARY OF COOPERATIVE BEHAVIOR IN INNOVATIVE ACTIVITIES – MANUFACTURING

	Total Cooperation in Innovation (% of Innovative Firms)			Cooperation in Innovation at the National Level (% of Innovative Firms)			Cooperation in Innovation at the European Level (% of Innovative Firms) - excluding National cooperation			Cooperation in Innovation with Countries outside the European Region (% of Innovative Firms)		
	CIS4	CIS5	CIS6	CIS4	CIS5	CIS6	CIS4	CIS5	CIS6	CIS4	CIS5	CIS6
Germany	19.2%	21.3%	22.9%	18.1%	na	22.1%	6.6%	na	7.3%	3.8%	na	4.9%
Spain	18.6%	18.1%	18.8%	17.5%	16.8%	17.7%	4.6%	4.7%	4.8%	1.5%	1.7%	2.0%
France	38.8%	48.3%	43.9%	36.2%	43.8%	40.5%	17.5%	25.2%	17.9%	10.0%	13.5%	10.2%
Italy	11.0%	11.3%	13.6%	10.5%	na	12.4%	2.3%	na	3.5%	0.9%	na	1.8%
UK	28.9%	30.8%	na	na	na	na	na	na	na	na	na	na

SUMMARY OF COOPERATIVE BEHAVIOR IN INNOVATIVE ACTIVITIES - SERVICES

	Total Cooperation in Innovation (% of Innovative Firms)			Cooperation in Innovation at the National Level (% of Innovative Firms)			Cooperation in Innovation at the European Level (% of Innovative Firms) - excluding National cooperation			Cooperation in Innovation with Countries outside the European Region (% of Innovative Firms)		
	CIS4	CIS5	CIS6	CIS4	CIS5	CIS6	CIS4	CIS5	CIS6	CIS4	CIS5	CIS6
Germany	na	na	na	na	na	na	na	na	na	na	na	na
Spain	12.7%	11.6%	15.5%	12.1%	11.0%	15.0%	2.9%	2.3%	3.1%	0.6%	1.3%	1.6%
France	37.7%	na	38.1%	35.8%	na	36.0%	11.2%	na	11.0%	7.6%	na	8.5%
Italy	15.9%	13.3%	18.9%	15.6%	na	17.6%	2.4%	na	5.3%	1.1%	na	2.5%
UK	na	na	na	na	na	na	na	na	na	na	na	na

Source: Eurostat

4. METHODOLOGICAL APPROACH

Data for this research comes exclusively from Eureka individual projects' dataset of final reports, which was provided by the Eureka Secretariat. Such reports are structured as questionnaires, containing several questions on different aspects. For the purposes of this particular assessment, the information is particularly rich in terms of what we defined as the *Contextual Dimension*. The Eureka Programme was created aiming at enhancing collaboration between companies in a market oriented, non-bureaucratic, bottom-up approach promoting cooperative projects for national funding (Georghiou, 2001; Marín and Siotis, 2008). Eureka is present in 38 countries and does not act through financial support, but providing projects with a seal of approval that facilitates access to governmental funds in the national level (Georghiou and Roessner, 2000). Its focus is on improving European competitiveness and productivity through an enhanced cooperation between companies from different Member Countries (international collaboration) and research centers in high-tech areas. Under Eureka, cooperation often consists of occasional meetings between firms at which information is shared, but more formal ways of cooperation also take place (Fölster, 1995).

TABLE 2. INDEPENDENT VARIABLES OF ANALYSIS

Code	Description	Structure 2000-2005
TOT_COST	Total cost of project(s) carried out by firms. Source: Eureka	Millions of euros
DURATION	Duration of project(s). Source: Eureka.	Months
ORG_TYPE	Firm size. Source: Eureka	1 = Large company 0 = SME
NIS*	Consists of countries' categories to which firms belong, i.e., Spain, Germany, France, UK, and Italy. It functions as a proxy for National Innovation Systems' characteristics.	1 = Spain 2 = Italy; United Kingdom; France (Intermediate) 3 = Germany (Leader)
RATIO_RD	Ratio between R&D expenditure and total turnover. Source: Eureka	1 = <2% 2 = 2 to 10% 3 = >10%
COMPETITOR	Existence of at least one competitor among participants of the project. Source: Eureka	1 = Yes 0 = No
IND_EXP	Industrial exploitation of results by the company at the end of the project. Source: Eureka	1 = Yes 0 = No
FUNCTIONING**	Evaluation of functioning's quality of project's participants. Source: Eureka	1 = Excellent 2 = Good 3 = Weak/Bad

* Methodological note I: Countries' codes are assigned according to their relative position in terms of the stage of development of their National Innovation Systems. The higher the rank, the more developed. Furthermore, they were grouped in three categories, where Spain is referred to as a laggard Innovation System; Italy, UK and France are classified as intermediate Innovation Systems (including, thus, lower intermediate, Italy, intermediate, France, and upper intermediate, UK); and Germany is regarded as the leading nation in terms of IS capacities. This categorization follows a relatively similar structure to that found in the Innovation Union Scoreboard (European Commission, 2011a).

** Methodological note II: Categories 3 and 4 (Weak and Bad Functioning, respectively) were merged in order to have analyzable data, since observations in category 4 were scarce.

The timeframe used refers to projects concluded within the 2000-2005 period. In geographical terms, we assessed data for five European countries: Spain, Italy, UK, France and Germany. These can be regarded as highly representative of the European situation, gathering data for the largest economies and which face different stages of development in terms of their innovation systems. The resulting structure of the datasets comprehended: 77 Spanish firms; 60 German firms; 34 French firms; 27 Italian firms; 17 British firms (N = 215).

TABLE 3. DEPENDENT VARIABLES OF ANALYSIS

Code	Description	STRUCTURE 2000-2005 Original	Binary
TECHACHIEV*	Evaluation of Overall technological achievements in the project. Source: Eureka	1 = Excellent 2 = Good	*Positive Results (1)*
		3 = Weak 4 = Bad	*Negative Results (0)*
COMMACHIEV*	Evaluation of commercial achievements as a results of the project. Source: Eureka	1 = Excellent 2 = Good	*Positive Results (1)*
		3 = Weak 4 = Bad 5 = Nil	*Negative Results (0)*
EXP_IMPACT*	Expected future impact of results from the project. Source: Eureka	1 = Very Large 2 = Large 3 = Medium	*Positive Results (1)*
		4 = Small 5 = Nil	*Negative Results (0)*

* Methodological note: The original categories of these variables were dichotomized in order to produce significant numbers of observations for categories. The underlying rationale in this procedure is one of grouping positive perceptions on the one hand, and negative perceptions on the other. Preliminary attempts showed that original structures of variables did not fit adequately in multinomial or ordinal regressions.

Unfortunately, sectoral data (NACE classification) was not available in the database. As companies' names were censored for confidentiality issues, any attempt to overcome this matter was not feasible. While such samples are not quantitatively meaningful in the broad environment of international R&D cooperation, they provide important information on projects' development. The evaluation of such information through statistical techniques will contribute to the subject of analysis on suggestive terms, rather providing consistent conclusions.

4.1 Analytical Models

In this section we present the binary logit models built according to data contained in the dataset. Even though the original structures of the dependent variables (TECHACHIEV, COMMACHIEV, EXP_IMPACT) are multinomial (table 2), the number of observations per category represented a risk for models' stabilities. As preliminary assessments revealed, the use of Multinomial (or Ordinal) Logit Models could potentially lead to interpretation issues in regressions' validity (such assessments suggested a need for merging categories). Therefore, in order to achieve statistically representative results, we resorted to data transformation in order to apply the binary models. For the purposes of this research, the required data transformation did not affect the logical arrangement of statistical analyses performed. This procedure also helps reducing disturbances caused by subjectivity of answers and scale sensitivity.

A first operational assessment considers TECHACHIEV, i.e., companies' perception of overall technological achievements, as the dependent variable. The resulting equation will, thus, assume the following structure:

$$\boldsymbol{TECHACHIEV_i = \beta_1 + \beta_2 ORG\_TYPE_i + \beta_3 RATIO\_RD_i + \beta_4 COMPETITOR_j + \beta_5 FUNCTIONING_j + \beta_6 TOT\_COST_j + \beta_7 NIS_i + \varepsilon}$$

Equation 1

Where:

- "i" refers to variables inherently related to firms.
- "j" refers to variables related to cooperative projects.
- β_1 is the intercept.
- ***Microeconomic Dimension*** is represented by ORG_TYPE and RATIO_RD;
- ***Contextual Dimension*** is represented by COMPETITOR and FUNCTIONING; TOT_COST is added as a proxy for project size in terms of R&D invested in project "j".
- ***Macroeconomic Dimension*** is represented by NIS.
- ε: Error term.

This assessment produces estimates for the parameters of variables that represent hypotheses 1-5. Nonetheless, even *technological* innovation cannot be regarded by only technical outcomes. Technological advancements might not qualify as innovation *per se* if they provide no economic impacts on firms. For this reason, we complement the approach described in Equation 1 with a *market-oriented* perspective, as depicted in Equation 2.

$$\boldsymbol{COMMACHIEV_i = \beta_1 + \beta_2 ORG\_TYPE_i + \beta_3 COMPETITOR_j + \beta_4 TECHACHIEV_i + \beta_5 IND\_EXP_i + \beta_6 FUNCTIONING_J + \beta_7 DURATION_J + \beta_8 NIS_i + \varepsilon}$$

Equation 2

Where:

- "i" refers to variables inherently related to firms.
- "j" refers to variables related to cooperative projects.
- β_1 is the intercept.
- ***Microeconomic Dimension*** is represented by ORG_TYPE. RATIO_RD was dropped in this analysis, given its technical characteristic: while it is expected that it might lead to better technological outcomes, we do not foresee a direct relationship with commercial achievements;
- ***Contextual Dimension*** is represented by COMPETITOR, FUNCTIONING, TECHACHIEV, and IND_EXP. In this case, it should be noticed that TECHACHIEV performs the role of independent variable, since technical outcomes from innovation projects are expected to influence the market dimension. DURATION of project "j" was added as a control variable, where its expected influence regards the idea that the longer a project is, the more likely it is to produce marketable outcomes before it comes to an end;
- ***Macroeconomic Dimension*** is represented by NIS.
- ε: Error term.

Lastly, we present Equation 3, which deals with the idea of future developments resulting from firms' participation in international R&D cooperation. This is a rough approximation of results that might arise after a projects' completion, since it is based on expectations rather than on objective facts. Nonetheless, it is assumed that such prospects can represent not only firms' confidence (or lack of it), but they may also reveal the existence or not of achievements that are on their way to reach markets..

$$\boldsymbol{EXP\_IMPACT_i = \beta_1 + \beta_2 ORG\_TYPE_i + \beta_3 COMPETITOR_j + \beta_4 TECHACHIEV_i + \beta_5 FUNCTIONING_J + \beta_6 NIS_i + \varepsilon}$$

Equation 3

Where:

- "i" refers to variables inherently related to firms.
- "j" refers to variables related to cooperative projects.
- β_1 is the intercept.
- ***Microeconomic Dimension*** is represented by ORG_TYPE;
- ***Contextual Dimension*** is represented by COMPETITOR, FUNCTIONING, TECHACHIEV. As IND_EXP represents the existence of industrial exploitation of results by the end of the project, its impacts on future developments are not necessarily related, therefore the variable was dropped from this model.
- ***Macroeconomic Dimension*** is represented by NIS.
- ε: Error term.

5. RESULTS AND DISCUSSION

Table 4 presents the results for equations 1-3 in the 2000-2005 period. Results for the multivariate binary logistic regressions corresponding to equation 1 perform consistently and the model is significant as a whole, according to the Hosmer-Lemeshow Test for goodness-of-fit. However, both Nagelkerke R^2 and the evaluation of the model's correct predictions in comparison to an intercept only assessment show a weak explanatory power. Even though FUNCTIONING is not significant at 5 por 100 in Equation 1, an Excellent rate of functioning has an Adjusted Odds-Ratio that represents a positive influence on technological attainments at a level of significance of 10 por 100. On the other hand, this does not hold for "good" functioning (it is slightly above 10 por 100). Nevertheless this result provides an indication of the importance of such aspect in determining technical outcomes in international R&D projects, controlling for the set of theoretically grounded variables included in this equation.

Other variables in this estimation fail in correctly predicting the technical outcomes of Eureka projects. This is particularly surprising for the case of RATIO_RD, which functions as a measure of firms' innovative intensity. However, the fragility of this estimation is likely to be related to the measure of technological achievements in descriptive terms, where 91.1 por 100 of the sample rated TECHACHIEV as "successful" (*excellent* or *good* ratings)**[4]**. Such feature destabilizes statistical relationships for a binary dependent variable.

In equation 2, more robust results are found. Hosmer-Lemeshow exceeds the statistical threshold at 1 por 100, 5 por 100, and 10 por 100 of model's validity. Nagelkerke's R^2 and the difference between the percentages of correct predictions with predictors *versus* the intercept only estimation indicate a fair explanatory capacity of this regression. It is interesting to remind that projects' functioning already performed significantly in the TECHACHIEV model (especially for the Excellent Functioning instrument). FUNCTIONING is significant at both Excellent and Good levels, since both exceed the value assigned to the Reference Category (Weak/Bad). This is in accordance to results found for Equation 1, supporting the idea that partners' capacity of properly managing an international R&D cooperation project is a relevant determinant of ultimate success (in both technical and commercial dimensions). This contextual feature of projects seems to lie at the heart of networks' success, providing H_2 with robust support from empirical data. It should also be noticed that this variable has a stronger impact on commercial results than TECHACHIEV and IND_EXP, which puts emphasis on the managerial role (more than technical) in determining networks' success.

Technological achievements (TECHACHIEV) appear as an important predictor of market success, which puts this feature as a necessary condition for appropriation of innovations in the economic realm. The capacity of having industrial exploitation of results (IND_EXP) by the end of projects is also a significant factor of success. An additional aspect related to IND_EXP is its theoretical relationship with TECHACHIEV, which provides

[4] Descriptive statistics of the sample are available upon request.

further support for the supposition that technical aspects are a necessary, but not sufficient, condition for market performance.

TABLE 4. BINARY LOGISTIC ESTIMATIONS FOR EQUATIONS 1-3 (2000-2005)

Independent Variable		**Adjusted Odds Ratio - Exp (B) Sig. in parentheses**		
		Equation 1	**Equation 2**	**Equation 3**
ORG_TYPE	Large Company (1)	.696 (.555)	.910 (.780)	.432 (.028)
	SME (0)	0[a]	0[a]	0[a]
COMPETITOR	Yes (1)	1.412 (.667)	.626 (.215)	.955 (.915)
	No (0)	0[a]	0[a]	0[a]
FUNCTIONING	Excellent (1)	5.634 (.063)	18.455 (.009)	6.544 (.011)
	Good (2)	3.616 (.105)	12.921 (.019)	1.072 (.922)
	Weak/Bad (3 - Ref. Cat.)	0[a]	0[a]	0[a]
RATIO_RD	<2% (1)	.745 (.764)	-	-
	2-10% (2)	.726 (.670)		
	>10% (3 - Ref. Cat.)	0[a]		
NIS	Laggard IS (1)	.597 (.511)	1.296 (.515)	3.209 (.019)
	Intermediate ISs (2)	.593 (.484)	1.067 (.871)	3.023 (.027)
	Leader IS (3 - Ref. Cat.)	0[a]	0[a]	0[a]
IND_EXP	Yes (1)	-	13.828 (.000)	-
	No (0)		0[a]	
TECHACHIEV	Success (1)	-	8.329 (.007)	1.449 (.602)
	Failure (0)		0[a]	0[a]
DURATION	Months	-	1.002 (.828)	-
TOT_COST	Million Euro	.987 (.335)	-	-
Hosmer-Lemeshow Test		.980	.636	.231
Nagelkerke R sq.		.077	.326	.243
% of Correct Predictions (Intercept Only)		91%	52.6%	74.2%
% of Correct Predictions		91%	73.2%	75.1%

a: This parameter is set to zero because it is redundant

In both cases (equations 1 and 2), the Macroeconomic Dimension can be disregarded as an influential factor. Not only its related instruments are not significant, but values are close to the benchmark set for the Reference Category, thus not indicating any relevant information for the model. For the Microeconomic dimension, represented in these equations by the variable ORG_TYPE, results are not significant, even though the coefficient suggests a weak relationship between SMEs and better commercial achievements. In the Contextual dimension, besides TECHACHIEV, IND_EXP, and FUNCTIONING, the existence of rival firms in the network (COMPETITOR) and its duration (DURATION) did not show any evidence of statistical significance.

In the results of equation 3, we deal with the variable EXP_IMPACT as the dependent element in regressive estimations. This particular item deals with relatively higher levels of subjectivity, since it is based on perceptions of future returns arising from international R&D cooperation projects. Nonetheless, *expectations* are known to play a decisive role in economic behavior, shaping today's behavior in face of envisaged scenarios. Considering this logic, such results can be considered as valid instruments for our evaluation. Furthermore, future impacts (or *expected* future impacts) represent an important feature of innovative projects, since time-to-market for products, process, or services is often not immediate.

In this case, TECHACHIEV does not come out as a relevant determinant of future success. This gives a hint on the systemic role played by Eureka in increasing firms' competitiveness in the longer run. Thus, such projects might actually increase participants' competitiveness, even when they are not regarded as "successful" by the time of their completion. On its turn, the instrument "Excellent" from the variable FUNCTIONING is also significant, and its adjusted-odds ratio indicates that projects having an outstanding level of coordination are more likely to be related to *positive* future returns. However, projects with "good" functioning do not perform significantly.

On the Microeconomic dimension, it is valid to affirm that SMEs expect better outcomes in the future (arising as a result of their participation in such projects) than Large Companies. This leads us towards the conclusion that such firms increase their absorptive capacity through participation in international R&D networks, thus benefitting from these activities in the long run, while results for Large Firms are not expected to have such a relevant impact. COMPETITOR is not significant in this analysis, maintaining its characteristic of being a weak predictor of success in international R&D collaboration. On the Macroeconomic dimension, instruments of the variable NIS perform significantly, and according to theoretical expectations (further discussions on the relationships between empirical results and theoretically grounded hypotheses are offered below). Spanish firms (Laggard IS) are more likely than those from intermediate Innovation Systems to foresee positive outcomes, whereas those from intermediate ISs are more likely than those from the Leader IS to expect good results in the future. This indicates some level of convergence in the long run, where firms from relatively laggard systems benefit more from international R&D networks than those firms from Innovation Systems that are in a relatively better position.

5.1 Research Hypotheses' Overview

ORG_TYPE is a variable that is directly related to hypothesis ***H1a***, which predicts that ***Large Companies are capable of achieving better results than SMEs thanks to their higher absorptive capacity in terms of R&D***. This is expected to be relevant in technical (TECHACHIEV, Equation 1) and economic aspects (COMMACHIEV, Equation 2; EXP_IMPACT, Equation 3). However, the set of outcomes points in the opposite direction. Therefore, ***H1a is rejected***. Nonetheless, the lack of statistical significance of the ORG_TYPE variable does not allow us to conclude that there are relevant differences in terms of technical and commercial results between large companies and SMEs.

The following analysis seeks to assess the role played by R&D intensity in firms' ultimate technological and commercial outcomes arising from their participation in international R&D cooperation. H1b is approached as a microeconomic hypothesis, but its assessment takes place through the use of three variables, namely: RATIO_RD (Microeconomic Dimension), TOT_COST (Contextual Dimension), and DURATION

(Contextual Dimension). The use of the two latter variables functions as a complementary way of understanding firm behavior through project-specific engagement, thus the use of projects' costs and their respective duration. Such aspects help to verify the innovative intensity of firms in specific projects. As variables used in this assessment represent inconsistent outcomes (without statistical relevance), H1b is also rejected.

Nonetheless, firm behavior is filled with contingencies, where no firm is equal to another. Hence, firms' generic characteristics, such as size or R&D intensity, may not be representative of impacts since the perception of such influence is likely to vary among a sample of companies. In this scenario, firms' static features can actually be expected *not to* be related to their tactical and strategic goals, which are deemed to be case-specific. In this case, it is not surprising to achieve results that correspond to the rejection of ***H1***.

Nonetheless, even considering that results are evaluated taking into consideration individual goals, one would argue that firms that are better capable of capturing results from networks would be better positioned to find their strategic goals satisfied. Our results suggest, on the other hand, that this situation does not hold for the samples under scrutiny. A possible explanation for such finding lies in the imperfectness of the variables used for such estimations, where organizational capabilities might not be well represented by R&D investment, firm size, or amount of funds dedicated to a given project, but rather on the quality of human resources, organizational culture, etc. This can be especially relevant when we consider market-oriented outcomes, provided that other abilities can be referred as more pertinent than the usual instruments of absorptive capacity.

The second hypothesis to be verified already falls entirely under the Contextual Dimension, and makes reference to ***the management quality of cooperative R&D projects as a determinant of technical and commercial outcomes (H2)***. The assessment of this hypothesis is done via the variable FUNCTIONING. This variable shows a stable and significant influence on firms' results for all levels of analysis, i.e., technological (Equation 1), commercial (at the end of the project, Equation 2), and expected future impacts (Equation 3). This is true especially for commercial impacts, since instruments (Excellent, and Good, plus the Reference Category: Weak/Bad) in this case are all positive (above 1 as expected) and significant. The predictive strength found in this variable allows us to ***accept H2***.

The relevance of the variable FUNCTIONING regarding its role as a determinant of TECHACHIEV, COMMACHIEV, and EXP_IMPACT may be related to an optimistic view of the managing process in the face of positive outcomes, i.e., the respondent of Eureka's Final Report may be biased in evaluating the quality of a given project's functioning in face of successful outcomes, thus minimizing issues that may have happened during collaboration's development.

Nonetheless, innovation is a manageable process, not a result of chaotic forces acting by chance. Many authors have recognized through case studies and econometric analyses the central role played by organizational structure in fostering innovation. In this regard, the chain-linked model of innovation (Kline and Rosenberg, 1986) is an important framework of analysis, where proper coordination among different departments is of utmost importance in defining firms' innovative capacities. Hence, in a cooperative context, it is not surprising that inter-firm management plays a leading role in defining effectiveness of processes and outcomes. What is more important, however, is that the required managerial competences most likely differ from standard intra-firm administrative tasks, as hierarchical and departmental structures take more complex forms (often interdisciplinary when it comes to innovation), redefining the landscape for efficient coordination.

The third hypothesis to be confronted with empirical data from regressive estimations makes reference to the ***absence of competing firms in a network as a relevant factor in determining its success - H3***. This approach also belongs to the Contextual Dimension of analysis and is centered on the variable COMPETITOR. Regarding statistical merits, COMPETITOR is not significantly related to any of the three dependent variables in the abovementioned equations (TECHACHIEV, COMMACHIEV, and EXP_IMPACT). Nonetheless, it is important to remind that resorting solely to statistical significance shall provide a narrow view of the phenomena, especially considering the size of the sample. This can be influenced by a non-direct form of competition, since this analysis deals with R&D cooperation between firms from different nations, thus rivalry risks are likely to be somewhat minimized. This is reflected in the positive (non significant) association of the presence of rival firms and successful technological achievements. However, when we turn to commercial achievements, a more sensitive area of innovation when it comes to projects involving competitors, there is an indication of a *negative* association with better results. This scenario does not allow us to fully accept ***H3***, but to reject this hypothesis could be an error of judgment in face of empirical results. Therefore, ***H3 is partially accepted***.

The following proposition is that technological achievements arising from firms' participation in international R&D cooperation projects represent a necessary condition (but not sufficient) in determining market outcomes (achieved and expected) - H4 and H4b. To make this aspect operational, we used the variable TECHACHIEV. Results consistently point towards the hypotheses' relevance, where they are always positive (above 1), and significant for commercial achievements (2000-2005), and expected impacts (2006-2008). In face of these estimates, H4 and H4a are accepted.

The last hypothesis to be tested represents an approximation of the effects that National Innovation Systems might have as a determinant of firms' results in international R&D networks (H5). Empirical results are somewhat controversial. For the technological dimension, 2000-2005 projects from laggard and intermediate ISs are actually outperformed by those projects in which German firms were involved. In the evaluation of commercial achievements, adjusted odds-ratio vary between periods for the Spanish case, while they hold constantly positive (above 1) for intermediate ISs' firms. However, such results are not only non-significant, but they also range near the reference value of 1. Therefore, it is not safe to assume that such values are representative of valid trends in samples. In Equation 3, on the other hand, the picture is clearer for the Spanish case, where results are well above the benchmark threshold. The situation of intermediate innovation systems is somewhat distinct, since they represent the expected behavior (above 1, significant, and below Spain). The conclusion in this case is in favor of a ***partial acceptance*** of ***H5***, with special emphasis on the case of the laggard innovation system, i.e., Spain, where its firms seem to benefit more from international R&D networks than its peers in more developed innovation systems.

6. CONCLUDING REMARKS

Overall results of our research highlight the relevance of H2 which states that "The management quality of a given cooperative R&D project undertaken at the international level will influence the ultimate corporative outcomes of such project, both at the technological and economic (commercial) levels". The formation of networks of innovation implies that good coordination must be present within and between agents involved in such activities. It is not surprising then that the rate of functioning works as a strong determinant factor in terms of both technology and market outcomes by firms. In an international context, such dimension is even more critical, provided that companies share distinct institutional environments, cultures, languages, and are geographically apart from each other. This particular result provides striking evidence in favor of a transaction cost perspective of R&D networks, where network management faces a wide array of constraints (outlined in our literature review) that largely shape innovative activity (with impacts comparable to those caused by purely technical developments). A direct implication of this finding regards the role played by alliance managers in setting the stage for effective interactions among firms. Ireland, Hitt and Vaidyanath (2002) refer to this viewpoint as the managerial imperative, which states that transaction costs represent core aspects in the definition of alliances' dynamics.

A policy implication related to this finding is one of efficiency of allocated resources. Much is argued about the need for improvement in the amount of financing for innovative activities. Nonetheless, the dynamics of these resources are likely to be affected not only by the institutional environment, but, as we have shown, they are also a function of companies' managerial capabilities. Therefore, establishing behavioral patterns for the economic transaction that take place within these networks can be desirable in order to provide the dedicated funds with increased probabilities of generating optimal returns for firms. Hence, Eureka is likely to have an important role to play in monitoring the activities undertaken by its networks. In summary, investing *more* in innovation cannot be as beneficial for society as investing *better*. As the management of innovative activities lies at the core of the definition of "*better*", improving the quality of coordination in R&D networks is of utmost importance.

Furthermore, it is important to notice the relatively low level of importance of the *Microeconomic* and *Macroeconomic Dimensions*. Organizations are similar in pursuing individual benefits (*through innovation* for a good contextualization in the terms of this research), but their strategies and tactics to achieve firm-specific goals are highly ***idiosyncratic***.

Some additional limitations exist regarding the appropriation of outcomes of this research, as outlined throughout most of our empirical assessment and methodological definitions. Analytical variables offer meager conclusions regarding their overall explanatory power. In-depth case studies may be recommended in order to design other aspects regarding Eureka's Final Reports so they can gather more contributive information, especially regarding detailed aspects of managerial activities that take place in networks, since our results streamline the relative importance of coordination in shaping ultimate results. Identifying the existence of previous ties among agents, kind of cooperative agreement (governance modes), evaluation of specific cases of transaction costs are examples of dimensions that can be usefully included in these questionnaires. Moreover, other limitations of our assessment regard barriers regularly faced by R&D cooperation researchers (for an example, see Gallié and Roux, 2010): selection bias, lack of partners' information, and single data cross section, which does not allow the control of firms' evolution over time, thus limiting the reach of our findings.

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