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One or Two Poles of Attraction in the International Technological Cooperation Process?
¿Uno o Dos Polos de Atracción en el Proceso de Cooperación Tecnológica Internacional?

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Abstract: In recent years, international cooperation processes have become a key mechanism for companies to internationalise their innovative activities, particularly in the case of small businesses whose size reduces their possibilities of developing internationalisation strategies autonomously in the same way as larger companies. In Spain, the existence of two parallel programmes with similar structures oriented towards Europe (EUREKA) and Latin America (IBEROEKA) raises the question as to whether the fact that companies participate in only one (unipolar) or both (bipolar) of these programmes is the result of a selection process, which, in turn, results in the existence of different collectives with different efficiency parameters. The aim of this study is to provide a comparative analysis based on the final reports of Spanish companies that have participated in the EUREKA programme. Two groups of companies were compared: one comprising companies that have only had international experience in Europe (EUREKA); and another formed by companies that have also carried out IBEROEKA projects. The conclusions confirm that the behaviour of both groups of companies differs substantially and reveal the importance of geographical perspective in the analysis of international cooperation in technology. This disparate behaviour is a relevant aspect that must be taken into account when designing policies to promote international technological cooperation.

Keywords: technological cooperation, innovation, internationalisation, Eureka, Iberoeka.

Resumen: La existencia en España de dos programas con estructura similar orientados hacia Europa (Eureka) y América Latina (Iberoeka) permite cuestionarse si el hecho de que las empresas participen en uno de ellos (unipolares) o en ambos (bipolares) conlleva la existencia de colectivos dispares, con distintos parámetros de eficiencia. Este trabajo compara, a partir de los informes finales de las empresas participantes en Eureka, el colectivo de empresas españolas que sólo han participado en Eureka y el de aquellas que también han llevado a cabo proyectos Iberoeka. Las conclusiones obtenidas confirman que el comportamiento de ambos grupos difiere notablemente y destacan la importancia de la perspectiva geográfica en el análisis de la cooperación internacional en innovación. Este dispar comportamiento es un aspecto relevante que debe ser tenido en cuenta en el diseño de políticas de promoción de la cooperación tecnológica internacional.

Palabras clave: cooperación tecnológica, innovación, internacionalización, Eureka, Iberoeka.

1. Introduction

One significant change that has taken place in recent decades has been the growing internationalisation of technological innovation. Indeed, through both increased international exploitation of locally developed innovation and the decentralisation of R&D to other countries or through technological collaboration between firms from different countries, more and more companies no longer limit their technology creation and development activities to their local or national environments (Archibugi and Michie, 1995; Pavitt, 1998; Cantwell and Molero, 2003).

International technological collaboration takes on many forms, such as collaboration that arises spontaneously between companies and collaboration promoted by international cooperation programmes. The former include strategic technological partnerships or alliances, which are mainly used by multinationals that seek to maximise the advantages of a hybrid situation between the mere internal organisation of technological activities and the obtainment of technological resources through technology markets (Hagerdoorn and Narula, 1996; Hagerdoorn *et al.*, 2002).

International collaboration promoted by cooperation programmes has a similar purpose. However, incentives envisaged in such programmes seek to boost cooperation between companies from different countries that would otherwise be expected to develop sub-optimally because market signals would be insufficient. Although large companies and even pu-

blic research centres participate in these programmes, with a view to encouraging public-private collaboration, their most noteworthy feature is that the majority are designed for small or medium-sized companies that would otherwise find it difficult to develop international technological collaboration on their own. In fact, several research projects have analysed the relationship between size and cooperation (Hagerdoorn and Schakenraad, 1994; Cassiman and Veugelers, 1998; Bayona *et al.,* 2001; Fritsch and Lukas, 2001; Tether, 2002).

The relative backwardness characteristic of innovation in the Spanish economy offers companies the opportunity to participate in international programmes as an important alternative for improving their technology creation and development capabilities within such programmes. It is therefore extremely important to evaluate this participation both from an academic standpoint and also for those responsible for designing technology and innovation policies. To date very few studies have evaluated the participation of Spanish companies in international programmes, the most noteworthy being those by Barajas *et al.* (2011) on the European Union's R&D Framework Programme, Bayona and Garcia-Marco (2010) on participation in EUREKA, and Hidalgo and Albors (2004) on participation in IBEROEKA.

This study focuses more on programmes that encourage technological innovation activities relatively close to the market phase, when companies play the leading role. Therefore, the study focuses on analysing the participation of Spanish companies in the EUREKA programme, conceived as an alternative to the European Union's R&D Framework Programmes, which are less oriented to the exploitation of technological results, distinguishing those that have also participated in the IBEROEKA programme.

EUREKA and IBEROEKA are two public international cooperation initiatives that aim to boost the competitiveness of participating companies by promoting the implementation of projects that seek to develop technological products, processes or services with a clear market orientation. These programmes offer Spanish companies, particularly SMEs, two incentives to develop potential international cooperation opportunities: EUREKA with Europe and IBEROEKA with Latin America. EUREKA is a European initiative created in 1985 to promote cooperation at European level, involving 37 European countries. IBEROEKA innovation projects were launched in 1991 within the CYTED (Science and Technology for Development) programme with support from the Spanish government and the Economic Commission for Latin America (ECLA) and target companies in Spain, Portugal and Latin America. A total of 21 countries participate in this network. Companies from at least two countries in the network must participate in these projects, together with other organisations such as universities, public research centres and technology centres. One interesting feature of these programmes is that they do not provide funding themselves but rather an internationally-recognised «label or stamp» that facilitates access to national public funding.

This paper evaluates the behaviour of the companies that have participated in the EUREKA programme, distinguishing those that have also participated in IBEROEKA projects in order to determine the extent to which companies that have developed internationalisation processes in response to stimuli from two poles of attraction (Europe and Latin America) behave differently when participating in EUREKA from that of companies that have internationalised their operations in a «unipolar» manner focusing only on the European programme.

The hypothesis underpinning this research was that significant differences exist to indicate that companies adopting a dual approach tend to be larger and develop more ambitious and heterogeneous projects. Interestingly, this confrontation between «unipolar» and «bipolar» approaches has been addressed in some studies on foreign trade and direct investment abroad (Alonso and Donoso, 1998), but no studies have focused exclusively on the internationalisation of technology. The rest of the paper is divided into four sections: Section 2 contextualizes the work by analysing the most noteworthy aspects of literature on technological cooperation, focusing in particular on its international sphere; Section 3 outlines the methodology used in the study; Section 4 presents the results obtained; and finally, Section 5 sets forth the main conclusions and recommendations relevant to the design of policies to promote international technological cooperation.

2. An approach to technology cooperation

2.1. Main trends in the study of technological cooperation

Studies on technological cooperation have shown that collaboration in the field of R&D allows com-

panies to achieve economies of scale, combine different resources and diversify financial risks associated with innovation. The ability to cooperate therefore becomes a valuable asset for organisations, enabling them to increase their stock of knowledge and enhance their intellectual capital. Today's technologies are often so complex that companies are unable to develop them on their own. As a result, more and more firms are turning to external sources of knowledge; in this sense, cooperation with other stakeholders becomes the main channel for acquiring the knowledge that companies need and do not possess. Firms can cooperate with competitors, suppliers, customers, universities or research centres. The reasons that drive companies to cooperate with certain stakeholders are diverse and related to different business strategies (Hagerdoorn, 1990; Gemünden *et al.,* 1992; Sorensen and Reve, 1998).

Hagerdoorn *et al.* (2000) define technological cooperation as «the relation between different organisations based on innovation with certain content of R&D». The theoretical bases explaining the existence of cooperation between companies have been postulated from very diverse fields and based on the abovementioned research can be grouped into three main categories: transaction costs theory; the strategic management perspective (including different approaches such as competitive forces, strategic networks, resources and capabilities theory and dynamic capabilities); and industrial organisation theory. The reasons for cooperation may vary. Consequently, the different perspectives must be treated as complementary rather than exclusive (Tsang, 1998).

According to transaction costs theory, cooperation agreements between institutions are seen as an intermediate form between the market and the internationalisation of a company's operations (Williamson, 1996). From this perspective, cooperation allows companies to avoid the high cost of internalising R&D activities while minimising the cost of an incomplete transaction (Hagerdoorn, 2002).

In literature on strategic management, Porter (1986) defines cooperation as an instrument that can improve the competitiveness of companies, allowing them to adapt rapidly to changing market needs. From the perspective of strategic partnerships, it is acknowledged that belonging to technological cooperation networks allows companies to become more efficient, exploiting synergies with other members and exercising more control over their environment. Teece (1986) described cooperation as a means for companies to access the additional resources they need to exploit their own resources and develop their own competitive advantages. In this context, Teece *et al.* (1997) highlighted that interaction with other stakeholders allows companies to learn and strengthen their capacity to deal better with the uncertainty of the technology market.

Industrial organisation theory stems from the conception of scientific knowledge as a public good subject to market failures and considers that the difficulty involved in the commercial exploitation of this knowledge through traditional channels makes joint investments in R&D more attractive. From this perspective, it is recognised that spillovers favour collaboration because in this way they can be internalised within the network of knowledge flows (Cassiman and Veugelers, 2002; Abramovsky *et al*., 2009).

Finally, the taxonomy of Archibugi and Michie (1995), which was a basic reference for this study, attempts to combine these different approaches. The aforementioned authors classified R&D internationalisation activities into three categories: the international exploitation of innovation produced on a national basis; the global generation of innovations; and international technological cooperation involving both companies, on the one hand, and universities and public research centres, on the other, and which can be developed through joint projects, joint ventures or technology transfer agreements.

2.2. International technology cooperation

International technology cooperation is a strategic decision that involves a transfer of technological knowledge between partners located in different countries (Barajas and Huergo, 2006). Interestingly, no theory has been formulated setting out the various aspects involved in the internationalisation of technological cooperation. Moreover, empirical studies are limited by the difficulty in finding technological and economic indicators capable of reflecting the complex multidimensional nature of technological cooperation and the lack of suitable statistics (Veugelers, 1998; Archibugi and Iammarino, 2002).

Existing empirical studies have been based on the theoretical developments of business internationalisation and technology cooperation, and tend to focus on two basic aspects: the reasons influencing the decision to cooperate with foreign partners; and possible models for organising such cooperation (Lunding *et al.,* 2004). Noteworthy reasons for selecting

foreign partners include advances in telecommunications and transportation, the increasing harmonization of regulations, or the conditions of competition in the international sphere (Narula and Hagerdoorn, 1998; Archibugi and Iammarino, 2002; Narula, 2003). Cooperation can be organised either with or without equal participation: the former would include joint ventures, organisational units created by two or more companies, which also tend to be the owners of such ventures (Hagerdoorn, 2002); the latter include networks and joint projects. The most common forms of cooperation in recent years have been non-equity partnerships, which afford greater flexibility in an environment of increasing technological complexity, rapid change and improvements in intellectual property protection regulations (Narula and Hagerdoorn, 1998).

Joint technology projects are a cooperation model often supported by public funds. The theoretical justification for such intervention, as with other policy tools to promote innovation, stems from the existence of market failures related to the very nature of innovation itself: it is expensive, uncertain and the appropriation of its results is flawed (Foray, 1991). Public support for innovation has a number of potential theoretical benefits, namely increases in the stock of knowledge of companies and human capital formation, stimulation of interaction among the different players in the innovation system and the creation of new firms (Gallini and Scotchmer, 2002; Gambardella *et al.,* 2008).

However, from the empirical standpoint there is no consensus on the effectiveness of public intervention and sometimes its limitations must be recognised (Pavitt, 1998). In recent years, different studies have evaluated public programmes that support innovation, such as the European Union's R&D Framework Programme, EUREKA or IBEROEKA, reporting that participation in such programmes generally improves the innovative capacities of participating firms (Lukkonen, 1998, 2000; Georghius and Roessner, 2000; Roediger-Schluga and Barber, 2006, Breschi and Cusmano, 2006). However, no clear direct effect on economic cooperation has been identified (Benfratello and Sembenelli, 2002; Bayonne and Garcia-Marco, 2010; Barajas *et al.,* 2011).

3. Methodology and variables

The empirical basis for this research consisted of data published in the final reports of Spanish companies that participated in the EUREKA programme in the period 2000-2008. This database was developed by EUREKA's Secretariat from the final reports that companies participating in the programme must submit upon completion of their projects. In 2005 significant changes were introduced in the final reports, resulting in a discontinuity between data for the periods 2000-2005 and 2006-2008. For analysis purposes, the period 2000-2005 was chosen since it contained a larger number of companies and therefore more detailed information. The period 2006-2008 was used as a control. Comparisons between the two databases, whenever these were possible, did not reveal any significant differences.

From these data two groups were established for comparative purposes: companies that had only participated in EUREKA projects (hereinafter «unipolar companies»); and companies that had also been involved in IBEROEKA projects (hereinafter «bipolar companies»). This separation was made using information from the Spanish companies that had participated in IBEROEKA during that period. The unit of analysis in this study was companies and not the projects in which they had participated. The main hypothesis to be tested was whether bipolar companies formed a specific group. Another objective was to identify the main factors that determined their specificity.

The empirical analysis was conducted on the number of companies that presented final reports on their activities in the corresponding projects. The total number of companies was 76, of which 60 were unipolar and 16 bipolar. The analysis was divided into the following steps:

a) Firstly, a descriptive analysis was performed of the variables included in the database by means of a frequency analysis, comparing the direct scores of each group of companies. This provided initial information on the similarities and differences between both groups.

b) Secondly, a contingency tables analysis was performed on the three most critical aspects of such projects: initial objectives, results obtained and obstacles encountered by the participating companies. X^2 tests were performed to identify the statistically significant estimated associations in each of the established groups. The differences between the associations of each group provided a detailed insight into the similarities and diffe-

rences in behaviour between companies in both groups.

c) Finally, and in order to draw more robust conclusions, a logistic regression model was estimated to identify which variables determined the inclusion of companies in each group; quantitative and categorical variables were used as explanatory variables.

Table 1
Variables and measures range used

Variables	*Values*
Company size	0-1
Project total cost	Continuous
Spanish contribution	Continuous
Role in the project	
Project leader	0-1
Producer	0-1
Final user	0-1
Supplier	0-1
Researcher	0-1
Objectives and outcomes	
Product Innovations:	0-1
New products development development	0-1
Existing products improvement	0-1
Process innovations:	0-1
New processes development	0-1
Existing processes improvement	0-1
Demonstration, pilot plants	0-1
New patents	0-1
Publications	0-1
Acquisition or knowledge improvement	0-1
Management and work quality improvement	0-1
New services	0-1
Impact on employment	
Employment growth	0-1
Obstacles	
Technological	0-1
Changes in markets	0-1
Changes in strategies	0-1
Own	0-1
Partners	0-1
Consortium management and organization	0-1
Partners withdrawal	0-1
Communication problems	0-1
Financial obstacles	0-1
Private finance	0-1
Public finance	0-1
Legal obstacles	0-1

Table 1 shows the variables used in the study and their measurements. Most of the study variables were dichotomous except for «cost of the project» and «Spanish contribution». The dichotomous variables, with the exception of «size», were grouped into different categories:

- Role of the company in the project (whether it was the leader or a member and its role as producer, user, supplier and/or researcher).
- Objectives and outcomes, encompassing variables relating to the type of innovation (product or process), demonstrators, patents, improvements in management, etc.
- Impact on employment.
- Obstacles encountered in the development of the project: technological barriers, obstacles relating to changes in the market, strategic, managerial, financial or legal obstacles, etc.

4. Main results of the analysis

4.1. Descriptive analysis

A total of 265 Spanish companies participated in EUREKA projects in the period 2000-2005; 40 of these companies also participated in IBEROEKA projects. The average projects per company indicated greater activity among bipolar companies since, whereas unipolar companies participated in an average of 1.03 projects, bipolar companies participated on average in 1.30 EUREKA projects (Table 2).

Table 2
Firms participating in Eureka projects 2000-2005

	Companies	*Projects*	*Project average by company*
Bipolar	40	51	1.30
Unipolar	225	184	1.03
Total	265	218	1.08

Table 3 shows the main differences observed when comparing the direct scores of the unipolar and bipolar groups. The analysis of these differences revealed that bipolar firms are larger and responsible more often for the leadership of projects, indicating that these companies have greater economic and technical capacity. Similarly, these companies act more frequently as producers and researchers, suggesting that they have greater capacity to create new kno-

wledge. In contrast, the only significant difference observed when analysing the objectives pursued by the companies was the fact that bipolar companies are less active in seeking to develop new processes and focus more on developing new products. Another notable difference is that bipolar companies achieve employment growth more often (62.5% compared with 38.3% in the case of unipolar companies).

Table 3
Frequency analysis: main differences between groups

	Total	*Unipolar*	*Bipolar*
ORGANIZATION			
Large size	36.8	35.0	43.8
Project leader	65.8	58.3	93.8
ROLE IN THE PROJECT			
Producer	60.5	53.3	87.5
Researcher	21.1	16.7	37.5
INITIAL OBJECTIVES			
Improvements in existing products	39.5	41.7	31.3
New processes	42.1	48.3	18.8
IMPACT ON EMPLOYMENT			
Employment growth	43.4	38.3	62.5
REASONS TO JOIN THE PROJECT			
Status of Eureka label	75.0	68.3	100
Costs and risks sharing	42.1	38.3	56.3
MAIN OBSTACLES			
Technological difficulties	50.0	46.7	62.5
Changes on strategies	28.9	30.0	25.0
Differences between partners	17.1	18.3	12.5
Communication problems	11.8	13.3	6.3
Public funds raising	21.1	16.7	37.5

Significant differences were also observed in terms of both the reasons for participating in EUREKA projects and the obstacles to such participation. Bipolar companies more consistently sought the prestige of the EUREKA label, suggesting that they were more capable of or accustomed to managing intangible assets as a competitiveness factor, and more commonly seek to share risks and costs, which is another aspect stemming from the larger average size of projects.

As regards the obstacles identified, the bipolar companies found greater technical difficulties and also more problems in obtaining public funding. In both cases, it would seem that this situation is due to the larger scope and complexity of the projects in which these companies are involved. In contrast, it is significant that companies in this group claimed to have had fewer problems with other partners or in the organisation of partnerships, which may be due to factors such as the greater frequency with which companies in the bipolar group lead projects and their more diversified international experience.

Finally, one perspective that complements the comparison was obtained by calculating a rank correlation between the different project objectives and the outcomes achieved. The most striking feature to emerge from this correlation was that it was lower in the bipolar group than in the unipolar group (respective ratios of 0.78 and 0.96). This result may be interpreted as an indication that unipolar companies develop lower risk projects and are therefore more likely to achieve the intended outcomes.

4.2. Contingency tables analysis

This stage of the analysis compared the behaviour of the companies in relation to three groups of aspects: the objectives of their participation in the programme, outcomes achieved and obstacles encountered. Contingency tables analysis allows the Chi-square statistic to be used to test the significance of associations between objectives-outcomes, objectives-obstacles and outcomes-obstacles for both the total sample of participating companies and for the unipolar and bipolar groups. Pearson's Chi-square statistic is used to analyse the degree of association between categorical variables. The null hypothesis is that the variables are independent (no association). With small samples, some authors recommend using the Yates continuity correction to improve the fit of the Chi-square statistic to distribution probabilities.

The results show that most of the significant associations were found between initial objectives and outcomes obtained, the number of significant associations being much lower in the other two groups of correlations. The results obtained are analysed below.

1. Project objectives and outcomes

The data in Table 4 show that most of the relationships between initial objectives and outcomes for all the companies participating in EUREKA projects were positive and significant for the same variable. However, the analysis of statistically significant associations between variables of different groups of questions was more relevant because it revealed interactions of various factors. In this regard, the following significant associations were observed:

Table 4
Relationship between initial objectives and outcomes in all companies

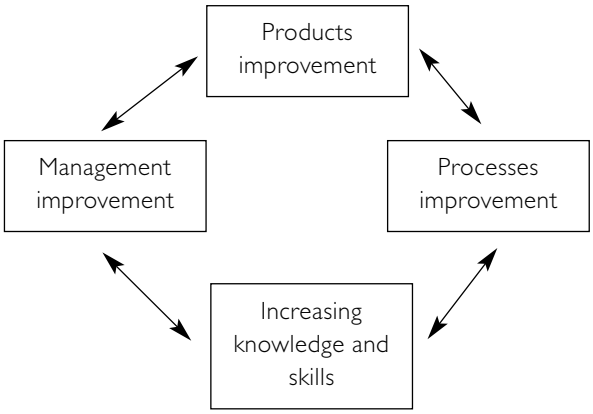
	Chi- square		*Continuity correction*	
	Value	*Sig. (bilat.)*	*Value*	*Sig. (bilat.)*
New products				
New products	19.981	0.000	17.966	0.000
Improvements in existing products				
Improvements in existing products	36.133	0.000	33.633	0.000
New processes	4.837	0.028	3.833	0.050
Improvements in existing processes	9.163	0.002	7.780	0.005
Management and work quality improvement	4.787	0.029	3.692	0.055
New industrial alliances or enhance existing	4.723	0.030	3.208	0.073
New processes				
New products	3.949	0.047	3.077	0.079
Improvements in existing products	5.076	0.024	4.082	0.043
New processes	26.628	0.000	24.217	0.000
Improvements in existing processes	4.537	0.033	3.590	0.058
Management and work quality improvement	5.836	0.016	4.631	0.031
Improvements in existing processes				
Improvements in existing products	4.085	0.043	3.172	0.075
Improvements in existing processes	43.790	0.000	40.636	0.000
Management and work quality improvement	7.098	0.008	5.722	0.017
New knowledge and skills improvement	12.982	0.000	11.265	0.001
Demonstrators or prototypes				
Demonstrators or prototypes	37.999	0.000	35.160	0.000
New licenses				
New products	4.946	0.026	2.920	0.088
New licenses	23.617	0.000	12.537	0.000
New knowledge and skills improvement	6.843	0.009	4.356	0.037
New patents				
Improvements in existing processes	4.738	0.030	3.048	0.081
New patents	15.882	0.000	10.218	0.000
Publications				
Publications	23.787	0.000	20.450	0.000
New services	4.191	0.041	2.737	0.098
New knowledge and skills improvement				
Improvements in existing processes	5.706	0.017	4.632	0.031
New knowledge and skills improvement	23.884	0.000	21.593	0.000
Management and work quality improvement				
New processes	6.934	0.008	5.614	0.018
Management and work quality improvement	30.456	0.000	27.326	0.000
New knowledge and skills improvement	7.008	0.008	5.680	0.017
New industrial alliances or enhance existing	5.436	0.020	3.662	0.056
New services				
Demonstrators or prototypes	3.806	0.051	2.704	0.100
New services	30.051	0.000	25.780	0.000

Chi-square & Continuity correction, Sign. (bilat.)<0.1

- Product improvements as an objective and process improvements as an outcome.
- Process improvements as an objective and managerial improvements and quality work as outcomes.
- Efforts to improve company knowledge as an objective and the achievement of improvements in processes as an outcome.
- Improvements in management and quality of work as objectives and improvements in knowledge of the company and new processes as outcomes.

This analysis revealed a virtuous circularity or «diamond-shaped relationships» between the objectives and outcomes of improvements in products and processes, increases in the knowledge and skills of companies and improvements in management (Figure 1).

Figure 1
Relationship between objectives and outcomes



The next step consisted in analysing the extent to which these associations were maintained or changed when the group was divided into two sub-samples: bipolar and unipolar companies (Table 5). The most significant aspect of the analysis was that far fewer significant associations were identified in the group of bipolar companies than in the unipolar group. Only three associations were significant and only one exceeded the confidence level of 95% (relationships between improvements in existing processes as an objective and as an outcome), while the other two exceeded 90% (new processes as an objective and an outcome, and publications as an objective and strategic alliances as an outcome). In contrast, the number of significant associations in the unipolar group was much higher and applied to all the objectives set by the companies at the start of the projects.

The causes of these differences can be explained by the fact that outcomes may differ more with respect to initial objectives in bipolar companies due to their larger size and tendency to take more risks (as already shown in the rank correlation between objectives and outcomes).

2. Initial objectives and obstacles encountered

The most striking result of the analysis of all the companies was the small number of significant relationships identified between objectives and obstacles (Table 6). The withdrawal of partners was one of the main obstacles to both the improvement of existing products and the generation of new processes or services, while legal problems represented a major obstacle in the development of new or improved industrial partnerships. Also, changes in the strategies of both companies and their partners were obstacles to improvements in project management.

The analysis of the situation of the two groups analyzed revealed no significant association with a confidence level below 10% in the bipolar group. In contrast, various significant associations were observed in the unipolar group: improvements to new/existing products and difficulties in obtaining public funding; development of new processes and communication problems; new patents and organisation of the partnership; and acquisition or improvement of knowledge and legal problems (Table 7). The interpretation of these results suggests that a relationship exists in unipolar companies between objectives and obstacles, while in bipolar companies obstacles may be more random and are not uniquely associated with initial objectives.

3. Project outcomes and obstacles encountered

For all the companies, a larger number of significant associations were observed between outcomes and obstacles than between objectives and obstacles (Table 8). The withdrawal of partners or changes in strategy were still important for the development of new processes or the improvement of existing ones, while technological difficulties were more important in the generation of new technological products.

Table 5
Relationship between initial objectives and outcomes in bipolar and unipolar companies

	Chi- square		*Continuity correction*	
	Value	*Sig. (bilat.)*	*Value*	*Sig. (bilat.)*
New products				
New products	19.981	0.000	17.966	0.000
Improvements in existing products				
Improvements in existing products	36.133	0.000	33.633	0.000
New processes	4.837	0.028	3.833	0.050
Improvements in existing processes	9.163	0.002	7.780	0.005
Management and work quality improvement	4.787	0.029	3.692	0.055
New industrial alliances or enhance existing	4.723	0.030	3.208	0.073
New processes				
New products	3.949	0.047	3.077	0.079
Improvements in existing products	5.076	0.024	4.082	0.043
New processes	26.628	0.000	24.217	0.000
Improvements in existing processes	4.537	0.033	3.590	0.058
Management and work quality improvement	5.836	0.016	4.631	0.031
Improvements in existing processes				
Improvements in existing products	4.085	0.043	3.172	0.075
Improvements in existing processes	43.790	0.000	40.636	0.000
Management and work quality improvement	7.098	0.008	5.722	0.017
New knowledge and skills improvement	12.982	0.000	11.265	0.001
Demonstrators or prototypes				
Demonstrators or prototypes	37.999	0.000	35.160	0.000
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New products	4.946	0.026	2.920	0.088
New licenses	23.617	0.000	12.537	0.000
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New patents				
Improvements in existing processes	4.738	0.030	3.048	0.081
New patents	15.882	0.000	10.218	0.000
Publications				
Publications	23.787	0.000	20.450	0.000
New services	4.191	0.041	2.737	0.098
New knowledge and skills improvement				
Improvements in existing processes	5.706	0.017	4.632	0.031
New knowledge and skills improvement	23.884	0.000	21.593	0.000
Management and work quality improvement				
New processes	6.934	0.008	5.614	0.018
Management and work quality improvement	30.456	0.000	27.326	0.000
New knowledge and skills improvement	7.008	0.008	5.680	0.017
New industrial alliances or enhance existing	5.436	0.020	3.662	0.056
New services				
Demonstrators or prototypes	3.806	0.051	2.704	0.100
New services	30.051	0.000	25.780	0.000

Chi-square & Continuity correction, Sign. (bilat.)<0.1

Table 6
Relationship between initial objectives and obstacles in all companies

	Chi- square		*Continuity correction*	
	Value	*Sig. (bilat.)*	*Value*	*Sig. (bilat.)*
Enhances in existing products				
Partners withdrawal	6.630	0.010	5.122	.0.024
New processes				
Partners withdrawal	7.619	0.006	6.011	0.014
Management and work quality improvements				
Changes in own strategies	9.016	0.003	7.087	0.008
Changes in partners strategies	8.253	0.004	6.708	0.010
New industrial alliances or enhance existing				
Legal problems	7.703	0.006	3.597	0.058
New services				
Partners withdrawal	5.044	0.025	3.391	0.066

Chi-square & Continuity correction, Sign. (bilat.)<0.1

Table 7
Relationship between initial objectives and obstacles in unipolar companies

	Chi- square		*Continuity correction*	
	Value	*Sig. (bilat.)*	*Value*	*Sig. (bilat.)*
Improvements in existing products				
Public funding of its share	5.939	0.015	4.364	0.037
New processes				
Communication problems	5.67	0.017	4.005	0.045
New patents				
Consortium management and organization	10.28	0.001	6.346	0.012
Acquisition or knowledge improvements				
Legal problems	6.429	0.011	4.029	0.045

Chi-square & Continuity correction, Sign. (bilat.)<0.1

An analysis of each group revealed no significant associations in the bipolar group, except for the development of new patents and problems in obtaining public funding, but with a significance level of 0.10. In contrast, the situation faced by unipolar companies was very different and nine significant associations were identified: between the development of new products and difficulties resulting from changes in the market; between the obtainment of new licenses and participants' funding problems; between the development of new patents and changes in partners' strategies, financing and management of the partnership; between publications and changes in partners' strategies; between problems in acquiring or improving knowledge and legal and organisational problems; and between the generation of new services and changes in strategies.

4.3. Logistic regression

The last phase of the analytical study consisted in the estimation of a logistic regression in order to confirm which variables best explained the inclusion of the companies in each group (unipolar and bipolar). This analysis aimed to provide more robust results to the initial question of whether, in fact, both groups of companies behaved differently in statistical significance terms when participating in EUREKA.

The dependent variable reflected participation or non-participation in the IBEROEKA programme and the explanatory variables included were categorical and continuous variables drawn from the final reports. A bivariate analysis was performed to determine which study variables could be truly predictive,

Table 8
Relationship between initial objectives and obstacles

	Chi- square		*Continuity correction*	
	Value	*Sig. (bilat.)*	*Value*	*Sig. (bilat.)*
ALL COMPANIES				
New products				
Technological difficulties	6.408	0.011	5.296	0.021
New processes				
Partner withdrawal	6.168	0.013	4.709	0.030
Improvements in existing products				
Changes in partners strategies	4.770	0.029	3.716	0.054
Demonstrators or prototypes				
Partner withdrawal	6.571	0.010	5.095	0.024
Lack of synchronization in partners financing	4.727	0.030	3.577	0.059
Publications				
Changes in partners strategies	5.109	0.024	3.591	0.058
Lack of synchronization in partners financing	8.911	0.003	7.009	0.008
Management and work quality improvement				
Changes in own strategies	6130	0.013	4.537	0.033
BIPOLAR COMPANIES				
New patents				
Public funding of its shares	6.154	0.013	3.309	0.069
UNIPOLAR COMPANIES				
New products development				
Market changes	6.048	0.014	4.517	0.034
New license				
Private funding of its shares	19.322	0.000	4.335	0.037
New patents				
Changes in partners strategies	7.368	0.007	4.277	0.039
Consortium management and organization	7.773	0.005	3.674	0.055
Private funding of its shares	19.322	0.000	4.335	0.037
Publications				
Changes in own strategies	5.346	0.021	3.896	0.048
Acquisition or knowledge improvements				
Legal problems	6.894	0.009	4.383	0.036
Consortium management and organization	5.25	0.022	3.613	0.057
New services				
Changes in own strategies	5.455	0.02	3.68	0.055

Chi-square & Continuity correction, Sign. (bilat.)<0.1

i.e. the relationships between the dependent variable and each independent variable were analysed (the Chi-square test to compare categorical variables and ANOVA for continuous variables). As shown in Table 9, most of the selected variables were related to categorical responses in relation to an activity performed or outcome achieved. These were accompanied by two quantitative variables relating to the cost of the project and Spanish participation.

Different regressions were performed with very stable results. The complete regression is shown in Table 10. The global parameters of the model indicated that it fitted well and had a significant predictive

validity, confirmed by the fact that the percentages of correctly classified cases were relatively high: 92.1% for all companies, 96.7% for the unipolar group and 75.0% for the bipolar group.

Table 9
Variables used in logistic regression

Variables	*Values*
Project total cost	Continue
Spanish contribution	Continue
Project leader	0-1
Project role: Producer	0-1
Project role: Researcher	0-1
Product innovations	0-1
Employment growth	0-1
Technological obstacles	0-1

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When analysing the significant variables for explaining the differences between the groups, the results presented in the descriptive analysis and contingency tables were confirmed. In this sense, the following observations may be made:

- Firstly, the role of companies in international cooperation projects is essential since the possibilities of belonging to a bipolar group increased significantly if the company had played the role of «researcher» (significance 0.01), «producer» or «leader» (significance 0.1). In other words, the

Table 10
Logistic regression: model summary and classification table.

Step	*-2 log*	*R square of Cox y Snell*	*R square of Nagelkerke*
1	49.574a	0.314	0.489

Observed			*Predicted*		
			If Iberoeka		
			0	*1*	*Right percentage*
Step 1	If Iberoeka	0	58	2	96.7
		1	4	12	75.0
		Global percentage			92.1

The cut-off value is ,500

	B	*E.T.*	*Wald*	*gl*	*Sig.*	*Exp(B)*
Project leader	-3.691	1.920	3.697	1	0.055	0.025
Producer role	-1.754	.998	3.092	1	0.079	0.173
Researcher role	-2.709	.974	7.729	1	0.005	0.067
Project total cost	.288	.119	5.842	1	0.016	1.333
Spanish contribution	.033	.037	.773	1	0.379	1.033
Product innovations	-1.523	1.134	1.806	1	0.179	0.218
Employment growth	-1.024	.790	1.683	1	0.195	0.359
Technological obstacles	-2.365	.949	6.213	1	0.013	0.094
Constant	.770	2.492	.095	1	0.757	2.159

companies with experience in diversified international cooperation programmes had played a greater technological role in projects (as researchers, producers) and in management (as project leaders). This also indicated that their involvement was much more complex and that they also played a more active role.

- Secondly, bipolar companies encountered more difficult technical obstacles. Although at first glance this may seem contradictory taking into account the superior technical and economic capacity of companies in this group, it reveals the greater complexity of the projects in which these companies were involved. A logical interpretation is that, due to the more ambitious nature of the projects undertaken and the fact that they these companies assume more risks in technology and management, they are more likely to have to deal with unforeseen obstacles.

- Thirdly, the higher cost of the projects in which bipolar companies participate simply confirms the foregoing. The greater ambition and complexity of these projects is reflected in their significantly higher cost.

- Fourthly, mention must be made of two other variables, which, in spite of their lower confidence levels, reveal two other aspects that must be borne in mind: firstly, bipolar companies obtain more public funding in Spain, which is consistent with the larger size of the projects in question; and secondly, the outcomes results in terms of job creation were superior in this group, revealing the greater economic impact of such projects.

5. Conclusions and recommendations

The results of this study confirm the importance of analysing international technology cooperation from a geographic perspective, depending on whether partners are selected in a single area (in this case Europe through the EUREKA programme) or by means of a more geographically diverse participation strategy (in this case, companies participating in EUREKA projects that had also participated in IBEROEKA projects in Latin America).

The general behaviour of the groups of companies revealed significant differences between both groups, mainly when associating responses according to initial objectives, outcomes and obstacles. The unipolar companies generally had more consistent profiles, meaning that they displayed important significant relationships between responses. In contrast, the response profile of the bipolar companies was much more random, with very few significant associations being observed; this was conditioned by the fact that the projects undertaken by these companies were more complex and riskier.

The bipolar companies developed more complex, ambitious and costly EUREKA projects. Their participation in such projects entailed a greater technological risk and higher costs. Consequently, they experienced greater technological difficulties and created more jobs. These coordinates were complemented by data that showed that the broader international outlook and greater ambitious of the projects meant that there was less similarity between what was initially planned when bipolar companies applied to participate in a EUREKA project and the actual results they obtained than in the case of unipolar companies participating in less complex projects. In contrast, the less risky and ambitious nature of projects involving unipolar companies increased the predictability of results and reduced the likelihood that they would face risks during the execution of the projects.

The results obtained enabled the identification of actions design to improve policies developed to promote international technological cooperation. The main lesson that can be drawn from this is that there is a "trade off" between guaranteeing results and the ambition of projects. Mechanisms must therefore be introduced in international technological cooperation programmes to promote greater opening up and diversification of innovative companies and the development of more ambitious projects and greater participation of companies, which would help them overcome the main negative factors associated with such projects: higher risk and fewer guarantees of success. This would also help companies to achieve greater technological and economic returns and increase job creation.

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