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Innovation projects performance: Analyzing the impact of organizational characteristics☆

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ABSTRACT

This study analyzes the effect of organizational characteristics on the innovation project performance. This research applies fuzzy set Qualitative Comparative Analysis (fsQCA) to a large sample of Spanish firms appearing in the Community Innovation survey (CIS). The results show that the combination of organizational innovation, firm size and cooperation with national and, especially, international firms is a sufficient condition for the success of innovation projects within the organization. Evidence also suggests that variables such as the investment on R&D per employee or the seniority of the company do not affect the success of innovation projects. These findings help complement some results in previous studies on innovation projects performance.

1. Introduction

A discussion exists among academics and practitioners about the importance of studying the factors of success and failure of projects exist (Balachandra & Friar, 1997; Dvir et al., 1998; Ika et al., 2012; Pinto & Mantel, 1990; Scott-Young & Samson, 2008). Firms design, develop and implement different projects, both internal and external, and their success directly affects significant economic benefits, economic and intellectual growth for its employees, and important loses that can lead to failure.

In the literature, two blocks of investigation aim at highlighting the factors of success and failure of projects within an organization. On one side, some investigations exist about management methodologies using own elaboration surveys as research methods for specific sectors or geographical regions (Bloom & Van Reenen, 2010; Motohashi, 2005). On the other side, some investigations focus on success and failure of projects, building on specific case studies and success criteria about management (Cooke-Davies, 2002; Dilts & Pence, 2006). In addition, several studies analyze in detail the factors that improve organizational innovation (Crossan & Apaydin, 2010; Damanpour & Aravind, 2012; Ganter & Hecker, 2014; García-Vega & López, 2010), but do not link the effect of these factors on the success of innovation projects.

According to several authors (Belso Martínez et al. 2013; Cantner et al., 2011), a greater number of successful innovation projects leads to higher incomes for shareholders and higher learning for their employees. Linking innovation with project-based organizations, this study demonstrates the effect of certain organizational characteristics in the success of innovation projects a firm develops.

This study introduces fuzzy set Qualitative Comparative Analysis (fsQCA) to the research on innovation projects and applies this approach to a large representative sample of 10,163 Spanish firms. FsQCA is suitable for exploring complex relationships among several factors influencing an expected outcome (Cheng et al., 2013; Fiss, 2011; Ragin, 2006). By facilitating that analysis, this approach presents a practical way to organize several interdependent cause-effect relationships into a framework explaining variance in performance of innovation projects. Implications to a bigger population are therefore feasible using fsQCA (Woodside, 2013).

The results suggest that no single organizational characteristic is key for ensuring the success of innovation projects, and no particular causal path leads to that outcome. Because of significant interdependencies, the main contributing organizational characteristics to the success of innovation projects within the company relate to organizational innovation, national and international cooperation, firm size, and holding firm membership.

Following this introduction, Section 2 contains the theoretical framework. Section 3 describes the method. Section 4 presents research findings. Section 5 offers conclusions and further research.

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2. Literature review

Many diverse factors contribute to success on innovation projects performance. According to Lovallo and Kahneman (2003) more than 70% of new manufacturing plants in North America close during its first decade of operation. Debacles like that staged the governments of Britain, Germany, Italy and Spain when they announced the joint construction of advanced military jets, are very common in business. The project starts in the 80s and even though the deadline was the year 1997, in 2003 the project was still in process with a budget increase from 20 to 45 trillion dollars. Likewise, Whittaker, B. (1999) explains the failure rate of projects of Information Technology; a 2008 study in the US finds that customers cancel 31% of projects software before their completion. More than half of the projects cost on average a 189% of its original estimate, 250 billion dollars of expenses each year in the United States in developing IT applications.

According to Ika et al. (2012), underperforming projects and the disappointment of stakeholders, especially final consumers, is the rule rather than the exception nowadays. According to World Bank statistics, failure of projects exceeds 50%, whereas a study of the IEG (Independent Evaluation Group) states a failure rate of 39% of World Bank projects around the world in 2010.

According to Matta and Ashkenas (2003), economic theory could easily help to explain why firms, despite knowing that a high risk of failure exists in performing them, agree to design and implement innovation projects. The benefits in the long term of successful projects are higher than the losses of failed projects. Project efficiency explains the profitability of having failed projects despite having other projects in the firm's portfolio Having a greater number of successful projects results in higher incomes for shareholders and greater learning for their employees.

Considering Matta and Ashkenas' (2003) results, this study aims to identify the organizational characteristics that make a firm successful in their innovation projects in Spain during the period 2008–2010 using the Spanish Community Innovation Survey (CIS).

Within the literature on variables for the analysis of success and failure of innovation projects, the use of the CIS is common because the CIS provides information on a large number of firms with different characteristics for different countries.

Because all these surveys are conducted under the same methodology proposed by the OECD, is possible to compare the results of studies based on these surveys for different countries.

Faria and Lima (2009) conduct an investigation about the two types of strategy that a firm can implement to their innovation projects: focusing on product and on process. Using data from the Portugal CIS in the period 1998–2000 and applying a Logit model to a sample of 821 firms, the authors conclude that organizational innovation leads firms to improve the performance of their innovation projects.

Polder et al. (2010) conduct a study on innovation's effect on productivity, claiming that productivity increases process and organizational innovation. Likewise, Battisti and Stoneman (2010) conduct a research with UK CIS in 2004 and a sample of 16,383 companies seeking the complementarities between the two major types of innovation: organizational and technological (comprising product innovation, process, machines, market, organization, management, and strategy). The authors clarify that these two groups are complementary but not substitutes and suggest that technological innovation in the absence of organizational innovation cannot create competitiveness. Other authors find that this innovation capacity in firms tends to persist over time and that differences in levels of innovation among firms owe partially to the way firms address these differences (Mas-Verdú et al., 2015).

Another significant research variable under study is the cooperation with different stakeholders participating in a project: partners, customers, suppliers, etc. On this subject, Belderbos et al. (2004)conduct an investigation in Dutch companies using data from the CIS from 1996 and 1998 with data from 2056 companies. The authors determine whether different types of cooperative R&D affect business growth in added value per employee and growth in sales of new products on the market per employee. Their results show that cooperation with suppliers and partners has a significant effect on the growth of added value per employee. In this sense, Lhuillery and Pfister (2009) identify the characteristics contributing to 'failure of cooperation'.

The literature review shows that there exists a lack of analysis about the impact of organizational characteristics on the success of innovation projects. Several researches using CIS as the main data source conclude that organizational innovation is complementary to other types of innovation and generally increases the likelihood of successful innovation.

To maintain consistency with previous investigations, the authors of this research work upon: the studies of Battisti and Stoneman (2010), Faria and Lima (2009) and Fiss (2011); and the formal structure of the Community Innovation Survey regarding selection and definitions of variables influencing the performance of innovation projects.

Hypothesis. Organizational innovation, degree of cooperation (with national and international partners), education level of employees, firm size, firm seniority, membership to a holding company and R&D investment impact on performance of innovation projects.

3. Data and method

3.1. Data

This research uses data from the database Technology Innovation Panel (PITEC), including information since 2003, and aims to provide additional information to databases on innovation activities in Spanish firms. This data panel builds on the Community Innovation Survey (CIS), which covers the time span between 2008 and 2010. The Spanish gross sample consists of 31,636 firms. The data gathering process considered the organizational innovation variable to collect the questionnaires in those firms. This measure leaves a final sample of n = 10,163 firms observations. Thus, for this study the researchers consider the study of Greckhamer et al. (2013), who apply fsQCA to large data samples. These are the definitions of variables:

Organizational innovation, variable reflecting the implementation of organizational innovation during the period considered. 1 if the firm adopted at least one organizational innovation (knowledge management, workplace organization, or external relation) between 2008 and 2010. *Degree of cooperation with national partners*, variable reflecting the firm cooperation with other national firms/partners. *Degree of cooperation with international partners*, variable reflecting the firm cooperation with international firms/partners. *Education*, the share of employees with a doctoral degree (within the firm working in R&D projects) operationalizes the education level of the workforce. *Firm size*, continuous variable specifying the number of employees in 2010. *Firm seniority*, continuous variable specifying the seniority of a firm designing, developing and delivering innovation projects. *Holding company*, variable indicating if firms belong to a holding company. R&D investment, continuous variable measuring the total investment in R&D per employee.

3.2. FsQCA in innovation research

The fsQCA approach is an appropriate methodology to analyze complex nonlinear relationships between variables (Ragin, 2008; Woodside, 2013). This type of analysis conceptualizes variables as combinations of attributes. By comparing cases, fsQCA allows a comprehensive understanding of how the various causes combine to produce a particular outcome that suits causal complexity levels and identifies, in this case, the necessary and sufficient conditions of innovation project performance. This approach offers a practical way to organize the complex and interdependent relations of cause–effect that can explain the variation in the innovative behavior of firms (Fiss, 2011; Short et al., 2008).

Analyzing the causal relationships in terms of set-theoretic relations involves a number of new explanatory features that facilitate a better understanding of innovation processes and their effects on a firm. FsQCA identifies different configurations to achieve the same behavior innovation. This method also accounts for equifinality, allowing multiple causal pathways that lead to the same outcome of interest (e.g., the performance of the innovation project). Therefore, fsQCA helps to differentiate between necessary and sufficient causal conditions for success in the performance of innovation projects (Fiss, 2011). Whereas necessary conditions are attributes that every firm considered in the study shows, sufficient conditions describe combinations of attributes leading for themselves to the outcome of interest.

FsQCA works by progressing through several steps (Ganter & Hecker, 2014). First, building a truth table. Second, reducing the number of rows in the truth table. Ragin (2006) recommends a minimum consistency of 0.80. Establishing necessary conditions should highlight cases that lead to the outcome. Conversely, cases where the outcome is not present are irrelevant, and are thus absent when testing propositions. Third, following a review of the truth table, an algorithm simplifies combinations and minimizes solutions. The researcher must then determine how to handle logical remainders, implementing one of three alternative techniques. First, the parsimonious solution involves all simplifying assumptions, regardless of whether they include easy or difficult counterfactuals. Second, intermediate solution involves simplifying assumptions by including easy counterfactuals. Third, complex solution includes neither easy nor difficult counterfactuals.

The next step is to analyze if causal conditions belong to the core or to the peripheral configurations (parsimonious and intermediate solutions). Core conditions are part of both parsimonious and intermediate solutions. Parsimonious solutions exclude peripheral conditions, which only appear in the intermediate solution. Outcome and conditions correspond to the description and codification in Table 1. The outcome (i.e., projsucc) is a dichotomous variable distinguishing if a firm has completed all the innovation projects launched in the period 2008–2010.

4. Research findings

This section presents the results from the analysis, explaining which conditions lead firms to the outcome (i.e., success in innovation project performance). The model for analysis is:

$Projsucc = f(orginn, coop, coopint, educ, size, senior, holding, R\&D)$.

The first step is to examine the conditions necessary for the outcome. Consistency does not exceed 0.8 for any condition (Table 2). Thus, no condition on its own assures success in innovation project performance. FsQCA method allows for analyzing combinations of conditions (causal configurations). Table 3 presents the results of the intermediate solution. This solution minimizes the combination, assuming that the conditions of firm size, cooperation (with national and international partners) and holding company membership use lead to success in innovation projects. As Table 3 shows, analysis consistency is 0.81, which indicates a sufficient relation between success in innovation project performance and a certain subset of conditions.

Table 2
Analysis of necessary conditions for success in innovation projects.

	Consistency	Coverage
Orginn	0.52	0.72
Coop	0.46	0.69
Coopint	0.41	0.69
Educ	0.33	0.56
Size	0.72	0.84
Senior	0.31	0.42
Holding	0.31	0.43
R&D	0.36	0.56

The discussion of the results examines three solutions resulting from the analysis. These solutions appear in Table 3. Ragin (2008) recommends a consistency threshold of 0.80 (all configurations comply with this threshold). Filled circles indicate above-threshold levels of the respective condition. Empty circles indicate below-threshold levels. Blank cells indicate 'don't care' conditions.

The first configuration shows that a combination of organizational innovation, cooperation with international partners, and a large firm size is a sufficient condition for success in innovation project performance. The second configuration implies that the combination of organizational innovation, cooperation with national partners, a large firm size, and holding company membership is also a sufficient condition for success in innovation project performance. The third configuration shows that a sufficient condition for success in innovation projects' performance is the combination of organizational innovation and both national and international cooperation when the firm size is not large.

The results of this investigation align to other studies using CIS as data source (UK, Portugal, Netherlands, Germany), and confirm Faria and Lima (2009) conclusion about the relevance and impact of organizational innovation on innovation projects, even for those projects focusing on product development and on processes. Just as Polder et al. (2010) state, a firm's competitiveness does not improve if technological innovation does not align with organizational innovation. This study confirms that investing in collaboration with different national and international partners in the absence of organizational innovation cannot ensure the success of a project. Cooperative relationships with other partners have a significant effect on the growth of added value (Belderbos et al., 2004), but this cooperation should appear together with other variables such as firm size, a holding company membership, and components of organizational innovation, such as knowledge management and workplace organization. These configurations can improve firm performance through the optimal performance of firms' innovation projects, and can guide the management board towards the establishment of strategic relationships with partners that meet certain characteristics to ensure the operational and strategic objectives of the firm.

5. Conclusion

This study examines organizational characteristics that affect innovation projects' performance. The analysis uses fsQCA to identify

Table 1
Outcome conditions, description and codification.

Outcome conditions	Description	Codification
Outcome: Projsucc	Variable indicating if firms have completed all innovation projects during the period	Project success 1 Did not success 0
Orginn	Variable reflecting the implementation of organizational innovation during the period	Adopted org. Inn. 1 Did not adopt org. Inn. 0
Coop	Variable reflecting the firm cooperation with national firms/partners	Cooperation 1 No cooperation 0
Coopint	Variable reflecting the firm cooperation with international firms/partners	Int. cooperation 1 No int. cooperation 0
Educ	Continuous variable identifying the number of PhD within the firm working in R&D projects	Fuzzy variable
Size	Continuous variable specifying the number of employees	Fuzzy variable
Senior	Continuous variable specifying the seniority of a firm developing innovation projects	Fuzzy variable
Holding	Variable indicating if firms belong to a holding company	Holding 1 No holding 0
R&D	Continuous variable measuring the total investment in R&D per employee	Fuzzy variable

Table 3
Configuration explaining organizational and business characteristics for success in innovation projects.

Solution	Causal conditions								Raw coverage	Unique coverage	Consistency	Solution coverage	Solution consistency
	Orginn	Coop	Coopint	Educ	Size	Senior	Holding	R&D					
1	●		●		●				0.15	0.05	0.82	0.64	0.81
2	●	●			●		●		0.19	0.08	0.80		
3	●	●	●		○				0.26	0.06	0.81		

Filled circles indicate above-threshold levels of the respective condition. Empty circles indicate below-threshold levels. Blank cells indicate 'don't care' conditions. n = 10,163.

combinations of causes that lead to success in innovation projects performance for Spanish firms. Organizational innovation, when the size of the firm is large and appears in combination with some kind of national or international cooperation, has an important effect on the success of innovation projects. Furthermore, this study also demonstrates the effect of organizational innovation in the ultimate success of the projects, even when firms do not have a large size but combine both types of cooperation with other firms and partners. Thus, firms belonging to national and international networks facilitate performance and ultimate success of innovation projects in Spanish companies confirming that organizational innovation (as an adoption of knowledge management, workplace organization, or external relation) is key and facilitates successful completion of the innovation projects.

Variables such as level of education of employees, expenditure on R&D per employee, or the age of the firm have no direct effect on the success of innovation projects in Spanish companies.

A main implication of this study for practitioners is that practitioners can clearly identify the keys to success in planning, development, and launch of an innovation project. This ability can help firms, in the early stages of any innovation project, to identify the type of partner with whom to ally, to improve the management of human resources of the firm, and to determine to what extent the firm should invest in organizational innovation.

This research has certain limitations, which may create opportunities for future investigations. For example, the research only addresses performance on innovation projects. Current research aims to obtain results for different types of projects (organizational, consulting, engineering, business development), for different business sectors, even comparing same firms in different European regions.

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