Title: GOOD MOOD AND CREATIVITY. THE RECIPE FOR TECHNOLOGICAL INNOVATION

Authors and e-mails of them:
AUTOR 1: Víctor del-Corte-Lora[1]
AUTOR 2: Teresa Martínez-Fernández[1]
AUTOR 3: Teresa Vallet-Bellmunt[1]
AUTOR 4: Norat Roig-Tierno[2,1]

E-mails:
vcorte@uji.es
tmartine@uji.es
vallet@uji.es
norat.roig@esic.edu; norat@uji.es

Department:
Department of Business Administration & Marketing

University:
1. University Jaume I, Castellon, Spain
2. ESIC Business & Marketing School, Valencia, Spain

Subject area: *(please, indicate the subject area which corresponds to the paper)*
S02 – Industrial clusters, dynamism and business strategy

Abstract: *(maximum 300 words)*

An organization's ability to continuously generate innovation is essential to achieve a sustainable competitive advantage in today's highly competitive business environment. The pressure in the current environment to introduce innovations intensifies the need to foster creativity consciously and constantly within organizations.

There is evidence in the literature to support the claim that enhancing the creative climate fosters innovation in firms. Particularly, factors such as motivating employees, developing management skills and allocating the resources in firms judiciously in order to be creative increase the possibility of innovating. Creative ideas potentially stem from all parts of the organization, as well as from the internal interfaces and from outside the organizational boundaries.

In the context of our research, we consider creative climate as a major indicator of innovation. In this context, this study analyse, on the one hand, the causal configurations that allow achieving technological innovations (product or process)

within organizations and, on the other hand, configurations that explain the reasons why organizations introduce non-technological innovations (organization and marketing).

For this purpose, we conduct Qualitative Comparative Analysis (QCA) as a method that combines the advantages of qualitative and quantitative techniques to examine complex causality. Our results show that there is no necessary single condition to lead technological or non-technological innovation. Regarding the analysis of sufficiency, the creative intensity combined with the organizational climate are part of sufficient patterns to introduce technological innovation, while for the introduction of non-technological innovations patterns related with institutions such as technology centers or universities stand out.

Keywords: Creativity; Innovation; Creative Clime; Institutions, QCA
JEL codes:
R11, O32, Q55,

1. Introduction

An organization's ability to continuously generate innovation is essential to achieve a sustainable competitive advantage in today's highly competitive business environment (Lloréns Montes et al., 2004; Subramaniam and Youndt, 2005). The pressure in this environment to introduce innovations intensifies the need to foster creativity consciously and constantly within organizations (Gisbert-López et al., 2014). Consequently, in innovative contexts, creativity has become progressively more valuable for firms (Ahuja, 2000; Amabile, 1998). At the organizational level, creativity is a multidimensional construct and involves the interaction of individuals, groups, and the organization itself.

There is evidence in the literature to support the claim that enhancing a climate of creativity fosters innovation in firms (Amabile et al., 1996; Shalley et al., 2004). Particularly, factors such as motivating employees, developing management skills, and allocating resources in firms judiciously in order to be creative all increase the possibility of innovating (Çokpekin and Knudsen, 2012). Creative ideas potentially stem from all parts of the organization, as well as from the internal interfaces and from outside the organizational boundaries (Björk and Magnusson, 2009). In the context of our research, we consider a creative climate as a major indicator of innovation.

Firm performance is significantly influenced by creativity at all levels, namely individual, team, and organization (Yoon et al., 2010; Bratnicka and Bratnicki, 2013; Gundry et al., 2014). If an organization wants to achieve business excellence, it must create a change-oriented environment where the creativity of the employees is nurtured, developed and sustained through education and training, involvement and teamwork (Eskildsen et al., 1999; Weinzimmer et al., 2011). An enhanced creative climate will also increase the performance of all organizations (Barrett et al., 2005).

Although studying the effect of the creative climate on innovation is not new, an in-depth analysis of this relationship is still necessary for many reasons including, among others, the fact that the multidimensional nature of a creative climate involves a certain degree of complexity (Gisbert-López et al., 2014). In this context, this study analyzes, on the one hand, the causal configurations that allow technological innovations (products or processes) to be accomplished within organizations and, on the other hand, configurations that explain the reasons why organizations introduce non-technological innovations (organization and marketing).

Social science has adopted increasingly sophisticated and powerful methodologies and algorithms. These are geared toward establishing and quantifying causal relationships between

the variables, and underestimate the importance of analyzing the complex interactions produced in social science, which allow for several alternatives to achieve the same end.

In recent years, the adoption of qualitative comparative analysis (QCA), which uses Boolean logic, has been growing and gradually substituting traditional correlation methods to establish causal conditions related to a particular result (Ragin & Fiss, 2008; Ragin, 1987; Ragin, 2000; Ragin, 2008; Vis, 2012; Woodside et al., 2016). Apart from its application to case studies, QCA is currently focused on the analysis of empirical data so as to be able to generalize the analysis, taking into account possible replication in subsequent studies and constructing logical propositions following the qualitative study of the phenomenon in question (Ragin, 1987; Ragin, 2000; Woodside & Zhang, 2012).

Our results show that there is no single necessary condition leading to technological or non-technological innovation. Regarding the analysis of sufficiency, creative intensity combined with the organizational climate are part of the sufficiency patterns to introduce technological innovation, while patterns related to institutions such as technology centers or universities stand out for the introduction of non-technological innovations.

This paper is structured as follows: first, we define the main concepts and then we justify and formulate the propositions, the method is explained, and finally results, conclusions and future research are discussed.

2. Literature Review

2.1. Creativity and creative climate

Across the literature, creativity is viewed as a competitive advantage, a strategic weapon, an embedded philosophy, contributing to employer and employee motivation, problem solving and improved performance (Fillis and Rentschler, 2010). According to Amabile (1988:126), creativity is "the production of novel and useful ideas", and it is the result of a creative process. Thus, creativity can be seen as both a process and an outcome (Shalley and Zhou, 2008).

While there are varying definitions of creativity, there is general agreement that creativity has novelty and usefulness (Amabile and Gryskiewicz, 1987). Most of the previous research on creativity has emphasized the individual (see Barron & Harrington, 1981, for a review). Recently, there has been a growing interest in the organizational entity and how it can facilitate individual and group creativity (Perry-Smith and Shalley, 2003). This supportive environment of the organization is known as its creative climate (Amabile, 1988; Shalley, 1991; Woodman et

al., 1993). Following Schumpeter (1934), we define creative climate as the work climate or organizational environment that facilitates or inhibits the generation of ideas and ideas applied to practice. These elements affect the organization's capacity to generate new and useful ideas, that is, its creative capacity. Consequently, we have considered the creative climate as an accurate indicator of its creative capacity (Çokpekin and Knudsen, 2012; Baron and Tang, 2011; Mohamed and Rickards, 1996; Dul and Ceylan, 2014; Parry et al., 2009).

A literature review reveals two different creativity models: the interactionist model (Woodman et al., 1993) and the componential model (Amabile, 1988; Amabile, 1997). The first considers that creativity is affected not only by individuals or groups, but also by situational or behavioral actions and the intra-organizational influences that stimulate or reduce creativity. In Amabile's componential model, both individual and organizational creativity are made up of three different components: motivation, resources and techniques, represented as three overlapping circles. The maximum creativity and innovation are generated at the point where they intersect.

Ford and Gioia (2000) call for increased research in the managerial domain. The better managers understand how creative climate influences decisions, the better they can develop and influence performance within organizations. Therefore, creative climate can be viewed as a management-controlled factor (Barrett et al., 2005). Previous research on creativity has suggested that accessing diverse pools of knowledge and developing skills to establish novel linkages among them are important conditions to generate creative outcomes (Simonton, 1999). If diverse knowledge is accessed by connecting to distinct organizational groups that are not interconnected, an individual (or group) positioned in the middle has access to diverse ideas and is thus more likely to generate creative outcomes (Hargadon and Sutton, 1997; Burt, 2004; Rodan and Galunic, 2004; Fleming et al., 2007). The results of Friedman et al. (2003) suggest that a broad, rather than narrow, attentional focus is beneficial for creativity, which is in line with the general notion that creativity benefits from flexibility.

2.2. Creativity and supporting organizations

Creative processes occur thanks to a new association between existing ideas or concepts (Lazzeretti et al., 2008). In general terms, authors have established where, by whom and under what circumstances ideas are generated. Creativity may come from many parts of the organization as well as from both internal interfaces or outside the organizational boundaries (Björk and Magnusson, 2009), including employees, customers, collaborators, partners, and private inventors (Cooper and Edgett, 2007).

Although ideas are obviously generated by individuals, the knowledge of them is a result of being part of a social context, of interacting with other individuals in this specific context (Spender, 1996). Indeed, there is a growing body of research that highlights the importance of social networks for creativity (e.g. Burt, 2004; Kratzer et al., 2004; Leenders et al., 2003; Leenders et al., 2007) and for innovation (von Hippel, 1988; Laursen and Salter, 2006; Brown and Eisenhardt, 1995). In fact, proximity is necessary to have frequent face-to-face interactions, since many ideas are not explicit or well spelled out and much knowledge is tacit.

The inter-organizational network includes not only specialized firms but also a wide range of supporting organizations which assist the whole system. For the purposes of this research, we define supporting organizations as locally-oriented organizations that provide firms with a host of collective support services. Examples of supporting organizations include universities, research institutes, vocational training centers, technical assistance centers, and trade and professional associations. These organizations provide specific knowledge as a consequence of their position as intermediaries (Saad and Zawdie, 2005; Cassingena Harper and Georghiou, 2005).

We have also found many reports in previous research that corroborate the positive effect of supporting organizations on firms (Galaskiewicz, 1985; Baum and Oliver, 1992; Suchman, 1995; McEvily and Zaheer, 1999).

Supporting organizations are in contact with many diverse, external circles and at the same time are close to the firms. As a result, they can explore and transfer new, exclusive information, knowledge and opportunities that are continually refined because of internal redundancy, proximity, and transactional intensity. As intermediaries, supporting organizations also reduce the search costs associated with locating external sources of the knowledge and specialized expertise that is critical for firms. By maintaining an extensive network of ties, these intermediaries generate search economies (Molina-Morales and Martínez-Fernández, 2004).

Because supporting organizations interact with a large number of firms, they are exposed to a wide variety of solutions to organizational challenges. Based on broad experience gained from observing others who have dealt with similar problems, supporting organizations, acting as go-betweens, compile and disseminate summaries about capabilities and routines (Suchman, 1995). Indeed, supporting organizations facilitate managerial innovation by providing access to information and resources, which in turn enable firms to acquire new, and to extend existing, innovation capabilities (McEvily and Zaheer, 1999). In particular, Molina-Morales and Mas-Verdu (2008) tested the statistical significance of a number of specific interactions between supporting organizations and firm innovation.

2.3. Innovation and creativity

Firstly, it is important to distinguish between creativity and innovation. Creativity should be considered as one of the precursors of innovation (Chang and Chiang, 2010; Wilson and Stokes, 2005) and innovation is the successful implementation of the ideas generated by creativity and their acceptance by the stakeholders in the organization (Duxbury, 2012).

The importance of innovation lies in the fact that innovation is one of the key factors in order to create value (Barlett and Ghoshal, 1990; Hitt et al., 1996; Andersson et al., 2002; De Mayer, 1992). Innovation has been defined as the conversion of knowledge and other resources into new or significant changes in products, processes or services that are introduced into the market. Cohen and Levinthal (1990), Kogut and Zander (1992) and Moran and Goshal (1996) posit that new sources of value are generated by the exploitation of a combination of existing and new knowledge resources.

Some authors (Damanpour, 1991; Damanpour, 1996; Damanpour and Evan, 1984; Kimberly and Evanisko, 1981; Knight, 1967; Lam, 2005) differentiate between technological and non-technological (organizational) innovations. Technological innovations are those where technology is applied to create or improve new products, services or processes and would therefore affect the main activities of the company through its technical system. In contrast, organizational innovations are focused on the structure of the organization, on the administrative processes, and on the human resources improving the social structure of the organization. In this vein, the OCDE (2005) classifies technical innovations as innovations in products and processes, while the non-technological ones are those related to marketing and the organizational structure.

However, the relationship between creativity and innovation is not always linear and positive for all organizations regardless of their characteristics. According to del-Corte-Lora et al. (2015), the relationship between creativity and innovation might have an inverted U-shape. For Gong et al. (2013), it depends on absorptive capacity, the core knowledge of the employees, the orientation toward risk and the size of the firms. Additionally, larger firms show a stronger relationship with creativity than smaller firms (Sarooghi et al., 2015). Finally, the relationship grows stronger with the level of technology (Lerch et al., 2015).

In this paper we aim to analyze the right configuration in order to generate innovation within the organization. It therefore looks at what conditions we could consider as necessary and which ones could be sufficient. In addition to this, we would also like to know if both kinds of innovations – technological and non-technological – present the same causal configuration.

In accordance with the previous theoretical background, we establish three research propositions that will be analyzed using fuzzy-set QCA (fsQCA).

Research proposition 1: Is high investment in innovation necessary to innovate?

Research proposition 2: Is creative intensity or creative climate a sufficient condition to innovate?

Research proposition 3: Do organizations that introduce technological innovations and those that introduce non-technological innovations present the same causal configurations?

3. Method

Qualitative Comparative Analysis is a method that combines the advantages of qualitative and quantitative techniques to examine complex causality. It was initially developed by Charles Ragin (1987) and its popularity has increased exponentially since the last version of the tool, fuzzy-set QCA, appeared (2000; 2008). Even though it was developed for political science, fsQCA has been applied to a wide range of areas such as sociology, management, criminology, and environmental science (Roig-Tierno et al., 2017). Researchers have argued that QCA in its different variants (csQCA, mvQCA and fsQCA) provide superior applicability in comparison to traditional approaches based on correlation or on the effects of independent variables on the outcome (Thiem, 2016).

FsQCA is employed to analyze cases in order to identify relationships among conditions present or absent in the cases and the outcome of interest (Ragin, 2000; Ragin, 2008). In other words, this method aims to identify the conditions that are necessary or sufficient for the outcome to take place. The results are examined taking consistency and coverage into account. A high membership consistency is paramount because it implies that a condition will not be present both for the presence of the outcome and its absence, for example. Coverage indicates the percentage of cases that are explained by a configuration.

Despite being designed for small-to-medium N, fsQCA has also been successfully applied in studies with a large number of cases (Fiss, 2011; García Álvarez-Coque et al., 2017). Besides its exploratory application, fsQCA has also been used to organize large amounts of qualitative data to draw theoretical assumptions (Verweij and Gerrits, 2013) or to test theories. In addition, fsQCA agrees with the principles of complex causality (conjunction, asymmetry and

equifinality), which is essential in empirical research in the social sciences (Woodside et al., 2016).

3.1. Sample, Data and Calibration

The empirical study is based on a sample of firms belonging to the technological park Espaitec, located at the Universitat Jaume I of Castellón, Spain. Espaitec is a scientific, technological and business park which was promoted by the Universitat Jaume I (UJI) and the Confederación de Empresarios de Castellón (the Castellón Entrepreneurs Association, CEC). It started its activity in 2007 with the aim of contributing to the socio-economic development and the diversification of industry in Castellón in a quantifiable and recognized way.

In order to gather the information, we collected the primary data from the firms belonging to Espaitec in the year 2014. We used questionnaires and interviews addressed to the firms' managers and engineers in charge of R&D activities or the production process. The interviews and the survey were carried out between March 2014 and October 2014. We collected the information from 40 of the 57 firms that belonged to the park at that time.

TABLE 1
Definition of the outcome and conditions.

TYPE	NAME	DESCRIPTION
Outcome	Technological Innovation	Product or Process (OECD, 2005). Product innovations are those that introduce a new or highly improved product in the market. They can be related to the components or materials, characteristics, etc. Process innovations are new or highly improved production processes, supply of services, and improvement in IT systems, etc.
	Non-Technological Innovation	Organizational or Marketing (OECD, 2005) Organizational innovations are related to new methods or organizational practices within the organization or even the relationships with other organizations. Marketing innovations are those that happen when applying new commercialization systems implying changes in the design of the products or the packaging, promotion, placement or the systems for pricing the products or services.
Condition	Creative Intensity	We define the independent variable "creative workforce density" as the relative size of the creative personnel in a firm and measure it as the ratio between the number of patent inventors and the total number of employees. Prior research in the group literature has found evidence to show that characteristics of a creative workforce, such as network structure, size and diversity (Woodman et al., 1993; Nonaka and Takeuchi, 1995; Dugosh et al., 2000; Ofori-Dankwa and Julian, 2002) are critical factors of creative output.
	Creative climate	In order to assess the creative climate, we have followed Moultrie and Young (2009), who produced a questionnaire out of Amabile et al.'s KEYS (1996). (Cronbach's alpha = 0.87)
	Relations with Universities	We measured the intensity of the relations of the firms with universities by means of their frequency. To do so, we used a scale where 1 meant low

		frequency and 3 was high frequency.
	Relation with Technological Centers	We measured the intensity of the relations of the firms with Technological Centers by means of their frequency. To do so, we used a scale where 1 meant low frequency and 3 was high frequency.
	Investment in innovation	We captured the investment in Innovation through the R&D effort by computing R&D expenditure as a percentage of total revenue. This approach has already been used in some previous research conducted by authors like Cohen and Levinthal (1990) or Tsai (2001).
	Size (Employment)	The firm's size was measured by the natural logarithm of the number of employees in the firm. Taking the logarithm reduces the effect of the skewness of the firm size distribution. Following Acs and Audrestch (1991).

The step prior to using fsQCA is to transform the raw data into data sets. This step is known as calibration (Ragin, 2008).

Calibration consists in indicating whether a value belongs to a set or not. An example could be to indicate whether a region with a particular GDP per capita belongs to a rich region, that is, whether it is inside or outside the set of rich regions.

Specifically, this study has employed the direct calibration method suggested by Ragin (2008). According to this method, there are three thresholds: completely in the set (1), the point of maximum ambiguity (neither in nor out: 0.5), and completely outside the set (0).

Table 2 shows the main descriptive statistics as well as the cutoff points of the calibration.

TABLE 2
Descriptive statistics and calibration points.

	Descriptive statistics			Calibration Anchors		
	Max	Min	Mean (S.D)	Fully in	Crossover point	Fully out
Tech. Innovation	5	1	3.85 (1.39)	5	4	0
Non-Tech. Innovation	8	0	5.73 (2.89)	8	6	0
Creative Intensity	4	1	2.42 (1.08)	3	1.99	1
Creative Climate	175	83	131.25 (22.96)	150	120	90
Rel. Universities	3	0	1.13 (0.88)	2	1.5	0
Rel. Tech. Centers	3	0	1.33 (0.94)	2	1.5	0
Investment Innov.	90	0	22.25 (24.25)	50	15	0
Size	6	1	2.77 (1,56)	6	3	1

Note: As in Crilly et al. (2012), values of 1.99, 2.99, 3.99, 5.99 and 14.99 have been computed as 2, 3, 4, 6 and 15 in the fsQCA software.

4. Results and Discussion

This study analyzes the causal configurations that allow technological innovations (product or process) to be achieved within organizations and the configurations that explain the reasons why organizations introduce non-technological innovations (organization and marketing).

In particular, the models under analysis are the following:

Model 1: Tech. Innovation = f(Creative Intensity, Creative Climate, Rel. Universities, Rel. Tech. Centers, Investment Innov., Size)

Model 2: Non-Tech. Innovation = f(Creative Intensity, Creative Climate, Rel. Universities, Rel. Tech. Centers, Investment Innov., Size)

FsQCA explains complex causality in terms of necessity and sufficiency. On the one hand, a condition is deemed necessary if the outcome cannot occur without this condition. On the other hand, a condition is sufficient if the outcome occurs every time this condition is present (Legewie, 2013).

Necessity and sufficiency analyses have been carried out with the R package developed by (Medzihorsky et al., 2016).

4.1. Necessity Analysis

Table 3 shows the results of the necessity analysis. A condition is necessary if the consistency (Cons.Nec) is higher than 0.9 (Schneider et al., 2010).

In particular, there is no single necessary condition that allows organizations to introduce technological innovations. Similarly, there is no necessary condition for companies to introduce non-technological innovations.

However, we can note that the consistency of creative intensity (0.82) and creative climate (0.81) are close to 0.9 to achieve technological innovation. Furthermore, we can observe that having a high creative intensity or a good creative climate is necessary (consistency higher than 0.9) for the introduction of both technological and non-technological innovation.

4.2. Sufficiency Analysis

Before the sufficiency analysis, the truth table must be generated. The truth table contains all possible logical combinations (Ragin, 2008). Specifically, the size of the truth table for both models is 64 (26), where 6 corresponds to the number of conditions.

Once the truth table has been generated, the minimum consistency value must be set to determine the configurations that will be part of the result. The cutoff point must be over 0.75 (Ragin, 2008). The Quine-McCluskey minimization algorithm is then used to obtain the result (Medzihorsky et al., 2016).

TABLE 3
Necessity analysis for technological and non-technological innovation.

	Tech. Innovation		Non-Tech. Innovation	
	Consistency	Coverage	Consistency	Coverage
Creative Intensity	0.823419	0.631168	0.763938	0.579447
~ Creative Intensity	0.306698	0.743002	0.337581	0.809262
Creative Climate	0.814226	0.655701	0.784729	0.625333
~ Creative Climate	0.375154	0.788782	0.380466	0.791580
Rel. Universities	0.532761	0.795932	0.508070	0.751100
~ Rel. Universities	0.633576	0.604545	0.471928	0.534939

Rel. Tech. Centers	0.677910	0.802830	0.663393	0.777416
~ Rel. Tech. Centers	0.483609	0.553977	0.471928	0.534939
Investment Innov.	0.622699	0.726951	0.633343	0.731639
~ Investment Innov.	0.571315	0.663713	0.515473	0.592573
Size	0.484000	0.746523	0.454082	0.693048
~ Size	0.676357	0.632679	0.676341	0.626044
Creative Intensity + Creative Climate	0.935575	0.614170	0.905424	0.588157

Note: (~) means absence of the condition. The suffix "fz" means that the condition is calibrated. (+) is the logical operator OR.

The solutions shown in Table 4 correspond to the parsimonious and the intermediate solution. The results are presented following the system used by Fiss (2011). The large circles mean core conditions, while a small circle means absence of the conditions. Furthermore, black circles mean that the condition is present and white circles mean that the condition is absent. The solutions present no ambiguity and the expected directions both for Model 1 and Model 2 correspond to the vector (1,1,1,1,1,1) (Baumgartner and Thiem, 2017).

For the model to be valid, consistency must be higher than 0.75 (Ragin, 2008; Fiss, 2011). Specifically, the inclusion values (incl) of our models are 0.91 and 0.92, which are over the theoretical threshold of 0.75.

Table 4 (Model 1) shows four causal configurations or patterns to achieve technological innovations (product and/or process). Patterns 2 and 3 show that a high creative intensity and relations with universities are key conditions to achieve technological innovation. Moreover, as per patterns 1, 2 and 4 a good creative climate contributes to the introduction of technological innovations.

As indicated by Ragin (2008), a causal configuration has a higher empirical relevance while its coverage is higher (unique and raw coverage). Pattern 1 shows that relations with technological centers and the contribution of creative intensity and creative climate lead to technological innovation.

Table 4 shows the results for Model 2 (non-technological innovations). In this case, there are also four causal configurations, but they differ from those in Model 1.

Regarding Model 2, this kind of firm does not have relations with a university but with technological centers. In contrast to the results in Model 1, investment in innovation is a core condition to introduce non-technological innovation.

TABLE 4
Sufficiency analysis.

	Tech. Innovation (*Model 1)*				Non-Tech. Innovation *(Model 2)*			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**

Creative Intensity	•	●	●		•	•	•	●
Creative Climate	•	•		•	•	•		●
Rel. Universities		●	●	○	○	○	○	●
Rel. Tech. Centers	●	•		●	●		•	•
Investment Innov.	○		●	•	○	●	●	●
Size			•	●		●	●	
Consistency (incl.)	0.9201	0.9410	0.9527	0.9756	0.9107	0.9123	0.9524	0.9328
Raw Coverage (cov.r)	0.3667	0.3753	0.2785	0.2005	0.2645	0.2220	0.1978	0.3121
Unique Coverage (cov.u)	0.0825	0.0304	0.0233	0.0257	0.1011	0.0410	0.0168	0.1207
Solution coverage:			0.519284				0.497939	
Solution consistency:			0.911173				0.916089	

NOTE: As in Fiss (2011) ● means presence of the condition. ○ means absence of the condition. Large circles mean core condition and small circles mean peripheral condition.
Consistency cutoff: 0.90. Frequency cutoff: 1.00. Calculated as per Medzihorsky et al. (2016). The absence of the outcome was performed but is not included.

Regarding the research propositions established in this work, as can be seen in Table 4: (i*) Is high investment in innovation necessary to innovate?* High investment is not a necessary condition. However, this condition is sufficient to introduce technological innovation when combined with creative intensity and relations with universities (Model 1, pattern 3). Moreover, for non-technological innovations (Model 2) this condition appears in patterns 2, 3, 4; (ii*) Is creative intensity or creative climate a sufficient condition to innovate?* Creative intensity appears in all the patterns (except for pattern 4 Model 1) as a core or peripheral condition to introduce both technological and non-technological innovation; (iii) *Do organizations that introduce technological innovations and those that introduce non-technological innovations present the same causal configurations?* According to the results discussed above, the answer is no. Nevertheless, some similarities do exist. Specifically, creative intensity and creative climate must be in the pattern to introduce both technological and non-technological innovation. Moreover, as seen above, in order to introduce technological innovation, firms establish relationships with universities, while in order to introduce non-technological innovations firms establish relationships with technological centers.

5. Conclusions

In this paper, by using the fsQCA methodology we have been able to measure the complex causality and also to analyze it in terms of sufficiency and necessity based on a small sample,

which would not have been possible with other probabilistic methods. We have confirmed the research propositions stated in section 2:

Investment in R&D is not always necessary to obtain innovations. What is always necessary is either a good creative climate or a high creative intensity. In fact, for the technological innovations, the two models that fit best are those that consider at least having a good creative climate and high creative climate and then having good relationships with universities and/or technical centers. These findings explain better the results found by Laursen and Salter (2006) and del-Corte-Lora et al. (2016).

On the other hand, neither creativity intensity nor creative climate are sufficient conditions to obtain innovations by themselves. In addition to either of them, firms should have good relationships with technological centers or universities, or invest in R&D. We believe that this is due to firms' need to gather novel ideas from the environment that could be applied correctly using the high standards of creativity inside the firms. Therefore, firms would need to have a wide range of sources of knowledge (Laursen and Salter, 2006) to be applied with the creative climate that would act as a catalyst of that knowledge (Amabile et al., 1996; Çokpekin and Knudsen, 2012; Del-Corte-Lora et al., 2015).

Finally, the patterns of the different models (i.e., technological and non-technological innovations) are not equal. Model 1 shows that for the technological innovations, firms need support from both technological centers and universities. Non-technological innovations, on the contrary, only seek the support of technological centers but not universities.

6. Limitations and Future Research

This paper presents a number of limitations, some of them related to the peculiarities of the case analyzed.

First, the sample has been taken only from ESPAITEC, a technological park that was created in the Universitat Jaume I, and so it could easily affect the number of relations between the firms in the park and the university.

Second, the main activities of most of the firms in the park are related to new technologies.

On the other hand, even though the sample was big enough for the methodology that we have used, there is no doubt that a larger sample, or samples taken from some other technological parks, would give us a more accurate result.

Finally, regarding future research, we consider that splitting the different conditions of creativity could give better and more accurate results regarding how different configurations of creative climates could affect the innovation outputs.

7. References

Acs, Z. J. and D. B. Audrestch. (1991). "Innovation and Technological Change: An Overview." In *Innovation and Technological Change: An International Comparison* , edited by Z. J. Acs and , edited by D. B. Audrestch, Ann Arbor, MI. USA, University of Michigan Press, pp. 1–23.

Ahuja, G. (2000). "The Duality of Collaboration: Inducements and Opportunities in the Formation of Interfirm Linkages." *Strategic Management Journal* 21: 317–343. doi:10.2307/3094190.

Amabile, T. M. (1988). "A Model of Creativity and Innovation in Organizations." In *Research in organizational behaviour* , edited by L. Cumings and , edited by S. HM, pp. 123–167.

Amabile, T. M. (1997). "Motivating Creativity in Organizations." *California Management Review* 40: 39–59. doi:10.2307/41165921.

Amabile, T. M. (1998). "How to Kill Creativity." *Harvard Business Review* September-: 77–87.

Amabile, T. M., R. Conti, H. Coon, J. Lazenby and M. Herron. (1996). "Assessing the Work Environment for Creativity." *Academy of management journal* 39 (5): 1154–1184.

Amabile, T. M. and S. S. Gryskiewicz. (1987). *Creativity in the R&D Laboratory*, Greensboro, USA.

Andersson, U., M. Forsgren and U. Holm. (2002). "The Strategic Impact of External Networks: Subsidiary Performance and Competence Development in the Multinational Corporation." *Strategic Management Journal* 23 (11): 979–996. doi:10.1002/smj.267.

Barlett, A. and S. Ghoshal. (1990). "Matrix Management: Not a Structure, a Frame of Mind." *Harvard business review* 68 (4): 138–145.

Baron, R. A. and J. Tang. (2011). "The Role of Entrepreneurs in Firm-Level Innovation: Joint Effects of Positive Affect, Creativity, and Environmental Dynamism." *Journal of Business Venturing* 26 (1): 49–60. doi:10.1016/j.jbusvent.2009.06.002.

Barrett, H., J. L. Balloun and A. Weinstein. (2005). "The Impact of Creativity on Performance in Non-Profits." *International Journal of Nonprofit and Voluntary Sector Marketing* 10 (4): 213–223. doi:10.1002/nvsm.25.

Barron, F. and D. M. Harrington. (1981). "CREATIVITY, INTELLIGENCE, AND PERSONALITY." *Annual Review of Psychology* 32: 439–476.

doi:10.1146/annurev.ps.32.020181.002255.

Baum, J. A. C. and C. Oliver. (1992). "Institutional Embeddedness and the Dynamics of Organizational Populations." *American Sociological Review* 57 (4): 540–559.

Baumgartner, M. and A. Thiem. (2017). *Model Ambiguities in Configurational Comparative Research*, 46.

Björk, J. and M. Magnusson. (2009). "Where Do Good Innovation Ideas Come From? Exploring the Influence of Network Connectivity on Innovation Idea Quality." *Journal of Product Innovation Management* 26: 662–670. doi:10.1111/j.1540-5885.2009.00691.x.

Bratnicka, K. and M. Bratnicki. (2013). "Linking Two Dimensions of Organizational Creativity to Firm Performance: The Mediating Role of Corporate Entrepreneurship and the Moderating Role of Environment." *Advances in Business-Related Scientific Research Journal* 4 (2): 153–163.

Brown, S. L. and K. M. Eisenhardt. (1995). "Product Development: Past Research, Present Findings, and Fu." *The Academy of Management Review* 20 (2): 343–378. doi:10.2307/258850.

Burt, R. S. (2004). "Structural Holes and Good Ideas." *American journal of sociology* 110 (2): 349–399.

Cassingena Harper, J. and L. Georghiou. (2005). "Foresight in Innovation Policy: Shared Visions for a Science Park and Business-University Links in a City Region." *Technology Analysis and Strategic Management* 17 (2): 147–160. doi:10.1080/09537320500088716.

Chang, W. C. and Z. H. Chiang. (2010). "A Study on How to Elevate Organisational Creativity in Taiwanese Design Organisation." *International Journal of Innovation Management* 12 (4): 699.

Cohen, W. M. and D. A. Levinthal. (1990). "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarterly* 35 (1): 128–152.

Çokpekin, O. and M. P. Knudsen. (2012). "Does Organizing for Creativity Really Lead to Innovation?." *Creativity and Innovation Management* 21 (3): 304–314. doi:10.1111/j.1467-8691.2012.00649.x.

Cooper, R. G. and S. J. Edgett. (2007). *Generating Breakthrough New Product Ideas: Feeding the Innovation Funnel*, Ancaster, Product Development institute.

Damanpour, F. (1991). "Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators." *Academy of Management Journal* 34 (3): 555–590.

doi:10.2307/256406.

Damanpour, F. (1996). "Organizational Complexity and Innovation: Developing and Testing Multiple Contingency Models." *Management Science* 42: 693–716. doi:10.1287/mnsc.42.5.693.

Damanpour, F. and W. M. Evan. (1984). "Organizational Innovation and Performance: The Problem of" Organizational Lag"." *Administrative science quarterly* 29: 392–409. doi:10.2307/2393031.

Del-Corte-Lora, V., F. X. Molina-Morales and T. M. Vallet-Bellmunt. (2016). "Mediating Effect of Creativity between Breadth of Knowledge and Innovation." *Technology Analysis and Strategic Management* 28 (7): 768–782. doi:10.1080/09537325.2016.1142075.

Del-Corte-Lora, V., T. Vallet-Bellmunt and F. X. Molina-Morales. (2015). "Be Creative but Not so Much Decreasing Benefits of Creativity in Clustered Firms." *Entrepreneurship and Regional Development* 27 (February): 1–27. doi:10.1080/08985626.2014.995722.

Dugosh, K. L., P. B. Paulus, E. J. Roland and H. C. Yang. (2000). "Cognitive Stimulation in Brainstorming." *Journal of Personality and Social Psychology* 79 (5): 722–735. doi:10.1037/0022-3514.79.5.722.

Dul, J. and C. Ceylan. (2014). "The Impact of a Creativity-Supporting Work Environment on a Firm's Product Innovation Performance." *Journal of Product Innovation Management* 31 (6): 124–1267. doi:10.1111/jpim.12149.

Duxbury, T. (2012). "Creativity: Linking Theory and Practice for Entrepreneurs." *Technology Innovation Management Review* (August): 10–15.

Eskildsen, J. K., J. J. Dahlgaard and A. Norgaard. (1999). "The Impact of Creativity and Learning on Business Excellence." *Total Quality Management* 10 (4–5): 523–530. doi:10.1080/0954412997488.

Fillis, I. and R. Rentschler. (2010). "The Role of Creativity in Entrepreneurship." *Journal of Enterprising Culture* 18 (01): 49–81. doi:10.1142/S0218495810000501.

Fiss, P. C. (2011). "Building Better Causal Theories: A Fuzzy Set Approach to Typologies in Organization Research." *Academy of Management Journal* 54 (2): 393–420. doi:10.5465/AMJ.2011.60263120.

Fleming, L., S. Mingo and D. Chen. (2007). "Collaborative Brokerage, Generative Creativity, and Creative Success." *Administrative Science Quarterly* 52: 443–475.

Ford, C. M. and D. A. Gioia. (2000). "Factors In Uencing Creativity in the Domain of

Managerial Decision Making." *Journal of Management* 26 (4): 705–732.

Friedman, R., A. Fishbach, J. Forster and L. Werth. (2003). "Attentional Priming Effects on Creativity." *Creativity Research Journal* 15 (2): 277–286. doi:10.1207/S15326934CRJ152&3_18.

Galaskiewicz, J. (1985). "Interorganizational Relations." *Annual Review of Psychology* 11 (1): 281–304.

García Álvarez-Coque, J. M., F. Mas-Verdú and N. Roig-Tierno. (2017). "Technological Innovation versus Non-Technological Innovation: Different Conditions in Different Regional Contexts?." *Quality and Quantity* 51 (5): 1955–1967. doi:10.1007/s11135-016-0394-2.

Gisbert-López, M. C., A. Verdú-Jover and J. M. Gómez-Gras. (2014). "The Moderating Effect of Relationship Conflict on the Creative Climate–Innovation Association: The Case of Traditional Sectors in Spain." *The International Journal of Human Resource Management* 25 (1): 47–67.

Gong, Y., J. Zhou and S. Chang. (2013). "Core Knowledge Employee Creativity and Firm Performance: The Moderating Role of Riskiness Orientation, Firm Size, and Realized Absorptive Capacity." *Personnel Psychology* 66 (2): 443–482. doi:10.1111/peps.12024.

Gundry, L. K., L. F. Ofstein and J. R. Kickul. (2014). "Seeing around Corners: How Creativity Skills in Entrepreneurship Education Influence Innovation in Business." *International Journal of Management Education* 12 (3): 529–538. doi:10.1016/j.ijme.2014.03.002.

Hargadon, A. and R. I. Sutton. (1997). "Technology Brokering and Innovation in a Product Development Firm." *Administrative Science Quarterly* 42 (4): 716–749.

von Hippel, E. (1988). "Cooperation Between Rivals: The Informal Trading of Technical Know-How." In *The Sources of Innovation*, pp. 76–92.

Hitt, M. A., R. Duane and R. Hoskisson. (1996). *Strategic Management: Competitiveness and Globalization*, St. Paul, West Publishing Company.

Kimberly, J. R. and M. J. Evanisko. (1981). "Organizational Innovation: The Influence of Individual, Organizational, and Contextual Factors on Hospital Adoption of Technological and Administrative Innovations." *Academy of Management Journal* 24: 689–713. doi:10.2307/256170.

Knight, K. E. (1967). "A Descriptive Model of the Intra-Firm Innovation Process." *The Journal of Business* 40: 478. doi:10.1086/295013.

Kogut, B. and U. Zander. (1992). "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology." *Organization Science* 3 (3): 383–397. doi:10.1287/orsc.3.3.383.

Kratzer, J., R. T. A. J. Leenders and J. M. L. van Engelen. (2004). "Stimulating the Potential: Creative Performance and Communication in Innovation Teams." *Creativity and Innovation Management* 13: 63–72. doi:10.1111/j.1467-8691.2004.00294.x.

Lam, A. (2005). "Organizational Innovation." In *The Oxford Handbook on Innovations* , edited by J. Fagerberg, , edited by D. C. Mowery, and , edited by R. R. Nelson, Oxford. UK, Oxford Univ Press, pp. 115–47.

Laursen, K. and A. Salter. (2006). "Open for Innovation: The Role of Openness in Explaining Innovation Performance among UK Manufacturing Firms." *Strategic Management Journal* 27 (2): 131–150. doi:10.1002/smj.507.

Lazzeretti, L., R. Boix and F. Capone. (2008). "Do Creative Industries Cluster? Mapping Creative Local Production Systems in Italy and Spain." *Industry and Innovation* 15 (5): 549–567.

Leenders, R. T. A. J., J. M. L. Van Engelen and J. Kratzer. (2003). "Virtuality, Communication, and New Product Team Creativity: A Social Network Perspective." *Journal of Engineering and Technology Management - JET-M* 20 (1–2 SPEC.): 69–92. doi:10.1016/S0923-4748(03)00005-5.

Leenders, R. T. A. J., J. M. L. Van Engelen and J. Kratzer. (2007). "Systematic Design Methods and the Creative Performance of New Product Teams: Do They Contradict or Complement Each Other?." *Journal of Product Innovation Management* 24 (2): 166–179. doi:10.1111/j.1540-5885.2007.00241.x.

Legewie, N. (2013). "An Introduction to Applied Data Analysis with Qualitative Comparative Analysis." In *Forum Qualitative Sozialforschung/Forum*, Qualitative Social Research.

Lerch, C., M. Thi Thanh Thai, V. Puhakka and T. Burger-Helmchen. (2015). "General Presentation." *Journal of Innovation Economics* 3 (18): 3–23. doi:10.3917/jie.018.0003.

Lloréns Montes, F. J., A. Ruiz Moreno and L. M. Molina Fernández. (2004). "Assessing the Organizational Climate and Contractual Relationship for Perceptions of Support for Innovation." *International Journal of Manpower* 25 (2): 167–180. doi:10.1108/01437720410535972.

López-Estornell, M., F. Mas-Verdú and F. X. Molina-Morales. (2008). "Política Tecnológica Aplicada a Los Distritos Industriales." *Mediterráneo Económico* 13: 435–458.

De Mayer, A. (1992). "Management of International R&D Operations." In *Technology Management and International Business* , edited by O. Granstrand, , edited by L. Hakanson, and , edited by S. Sjölander, Chichester, UK, Wiley, pp. 163–179.

McEvily, B. and A. Zaheer. (1999). "Bridging Ties: A Source of Firm Heterogeneity in Competitive Capabilities." *Strategic Management Journal* 20: 1133–1156. doi:10.1002/(SICI)1097-0266(199912)20:12<1133::AID-SMJ74>3.0.CO;2-7.

Medzihorsky, J., I. Oana, M. Quaranta and C. Q. Schneider. (2016). "SetMethods: Functions for Set-Theoretic Multi-Method Research and Advanced QCA R Package Version 21.".

Mohamed, M. Z. and T. Rickards. (1996). "Assessing and Comparing the Innovativeness and Creative Climate of Firms." *Scandinavian Journal of Management* 12 (2): 109–121. doi:10.1016/0956-5221(96)00003-6.

Molina-Morales, F. X. and M. T. Martínez-Fernández. (2004). "How Much Difference Is There between Industrial District Firms? A Net Value Creation Approach." *Research Policy* 33: 473–476. doi:10.1016/j.respol.2003.10.004.

Moran, P. and S. Ghoshal. (1996). "Value Creation by Firms." *Academy of Management Proceedings* 1996 (1): 41–45.

Moultrie, J. and A. Young. (2009). "Exploratory Study of Organizational Creativity in Creative Organizations." *Creativity and innovation Management* 18 (4): 299–314.

Nonaka, I. and H. Takeuchi. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, New York, USA, Oxford Univ Press.

OECD. (2005). *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data: Oslo Manual*, Paris, France.

Ofori-Dankwa, J. C. and S. D. Julian. (2002). "Toward Diversity and Similarity Curves: Implications for Theory, Research and Practice." *Human Relations* 55 (2): 199–224. doi:10.1177/0018726702055002183.

Parry, M. E., M. Song, P. C. de Weerd-Nederhof and K. Visscher. (2009). "The Impact of NPD Strategy, Product Strategy, and NPD Processes on Perceived Cycle Time." *Journal of Product Innovation Management* 26 (6): 627–639. doi:10.1111/j.1540-5885.2009.00688.x.

Perry-Smith, J. E. and C. E. Shalley. (2003). "The Social Side of Creativity: A Static and Dynamic Social Network Perspective." *The Academy of Management Review* 28 (1): 89–106.

Ragin, C. C. (1987). *The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies*, Berkely (CA), University of California Pres.

Ragin, C. C. (2000). *Fuzzy Set Social Science*, Chicago (IL), Chicago University Press.

Ragin, C. C. (2008). *Redesigning Social Inquiry: Fuzzy Sets and Beyond*, Chicago (IL), Chicago University Press.

Rodan, S. and C. Galunic. (2004). "More than Network Structure: How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness." *Strategic Management Journal* 25 (6): 541–562. doi:10.1002/smj.398.

Roig-Tierno, N., T. F. Gonzalez-Cruz and J. Llopis-Martinez. (2017). "An Overview of Qualitative Comparative Analysis: A Bibliometric Analysis." *Journal of Innovation & Knowledge* 2 (1): 15–23. doi:10.1016/j.jik.2016.12.002.

Saad, M. and G. Zawdie. (2005). "From Technology Transfer to the Emergence of a Triple Helix Culture: The Experience of Algeria in Innovation and Technological Capability Development." *Technology Analysis and Strategic Management* 17 (1): 89–103. doi:10.1080/09537320500044750.

Sarooghi, H., D. Libaers and A. Burkemper. (2015). "Examining the Relationship between Creativity and Innovation: A Meta-Analysis of Organizational, Cultural, and Environmental Factors." *Journal of Business Venturing* 30 (5): 714–731. doi:10.1016/j.jbusvent.2014.12.003.

Schneider, M. R., C. Schulze-Bentrop and M. Paunescu. (2010). "Mapping the Institutional Capital of High-Tech Firms: A Fuzzy-Set Analysis of Capitalist Variety and Export Performance." *Journal of International Business Studies* 41 (2): 246–266. doi:10.1057/jibs.2009.36.

Schumpeter, J. (1934). *Theory of Economic Development*, Cambridge, USA, Harvard Univ Pr.

Shalley, C. E. (1991). "Effects of Productivity Goals, Creativity Goals, and Personal Discretion on Individual Creativity." *Journal of Applied Psychology* 76 (2): 179–185. doi:10.1037/0021-9010.76.2.179.

Shalley, C. E. and J. Zhou. (2008). "Organizational Creativity Research." In *Handbook of Organizational Creativity* , edited by J. Zhou and , edited by C. E. Shalley, New York, USA, Psychology Press, pp. 3–31.

Shalley, C. E., J. Zhou and G. R. Oldham. (2004). "The Effects of Personal and Contextual Characteristics on Creativity: Where Should We Go from Here?." *Journal of management* 30 (6): 933–958.

Simonton, D. K. (1999). *Origins of Genius: Darwinian Perspectives on Creativity*, New York, USA, Oxford Univ Press.

Spender, J. C. (1996). "Making Knowledge the Basis of a Dynamic Theory of the Firm." *Strategic Management Journal* 17 (S2): 45–62. doi:10.1002/smj.4250171106.

Subramaniam, M. and M. A. Youndt. (2005). "The Influence of Intellectual Capital on the Types of Innovative Capabilities." *Academy of Management Journal* 48 (3): 450–463. doi:10.5465/AMJ.2005.17407911.

Suchman, M. C. (1995). *On Advice of Counsel: Law Firms and Venture Capital Funds as Information Intermediaries in the Structuration of Silicon Valley*, Stanford University.

Thiem, A. (2016). "Analyzing Multilevel Data with QCA: Yet Another Straightforward Procedure." *Quality and Quantity* 50 (1): 121–128. doi:10.1007/s11135-014-0140-6.

Tsai, W. (2001). "Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance." *Academy of Management Journal* 44 (5): 996–1004. doi:10.2307/3069443.

Verweij, S. and L. M. Gerrits. (2013). "Understanding and Researching Complexity with Qualitative Comparative Analysis: Evaluating Transportation Infrastructure Projects." *Evaluation* 19 (1): 40–55. doi:10.1177/1356389012470682.

Weinzimmer, L. G., E. J. Michel and J. L. Franczak. (2011). "Creativity and Firm-Level Performance: The Mediating Effects of Action Orientation." *Journal of Managerial Issues* 23 (1): 62–82. doi:10.2307/25822538.

Wilson, N. . and D. Stokes. (2005). "Managing Creativity and Innovation The Challenge for Cultural Entrepreneurs." *Journal of Small Business and Enterprise Development* 12 (3): 366–378.

Woodman, R. W., J. E. Sawyer and R. W. Griffin. (1993). "Toward a Theory of Organizational Creativity." *The Academy of Management Review* 18 (2): 293. doi:10.2307/258761.

Woodside, A. G., P. M. Bernal and A. Coduras. (2016). "The General Theory of

Culture, Entrepreneurship, Innovation, and Quality-of-Life: Comparing Nurturing versus Thwarting Enterprise Start-Ups in BRIC, Denmark, Germany, and the United States." *Industrial Marketing Management* 53: 136–159. doi:10.1016/j.indmarman.2015.11.003.

Yoon, S. W., J. H. Song, D. H. Lim and B. K. Joo. (2010). "Structural Determinants of Team Performance: The Mutual Influences of Learning Culture, Creativity, and Knowledge." *Human Resource Development International* 13 (3): 249–264. doi:10.1080/13678868.2010.483815.