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Title

Proposal of a contingent model of sustaining strategies in RTOs. The case of Valencian Community and the Basque Country

Authors

Carlos A. Rincón-Díaz, Departamento de Organización de Empresas, Universidad Politécnica de Valencia. Camino de vera s/n, 46022 Valencia, Spain.
E-mail: carrinda@doctor.upv.es

José Albors-Garrigós" Departamento de Organización de Empresas, Universidad Politécnica de Valencia. Camino de vera s/n, 46022 Valencia, Spain.
E-mail: jalbors@omp.upv.es

Abstract
The objectives of this paper are to propose a contingent model linking context, organizational and performance variables, and to identify barriers that Research and Technology Organisations have to overcome to work with companies. Furthermore, there is discussion of the best practices that Research and Technology Organisations carry out in order to develop competitive advantages and adjust to turbulent environments. This research was based on a field study of 14 Research and Technology Organisations in the Valencian Community and 13 Research and Technology Organisations in the Basque Country. The study identifies certain factors which could improve their performance to address properly changes in their environment and become more competitive.

Keywords
Research and technology organisations (RTOs), Innovation strategies, Turbulent environment, RTO challenges.

1. *Introduction and objectives*

European Research and Technology Organisations (RTOs) are undergoing complex institutional reforms, the objective of which is to render them more profitable, competitive and contributors to the SMEs innovation processes (Preissl, 2006). In Spain, budget cuts have posed new requirements on RTOs to reduce their dependence on public resources (FEDIT, 2012).

Regions with different enterprise profiles and their own RTOs models are facing these challenges in different ways. The Valencian Community, made up of 14 RTOs, integrated by the net REDIT, is the autonomous community with the highest accumulated debt. It has reduced its staff over the past year and plans a restructuring of its network under more demanding parameters and performance control (REDIT, 2011c). The Basque Country, however, with 19 RTOs integrated into two technological platforms (TECNALIA and IK4) is, in the short term, developing strategies to fortify networks and to internacionalise the organisations (Comisión Europea, 2011).

Recent research examined the role of RTOs in the emerging economies of Asian countries, which are experiencing a process of change in their National Innovation System (hereafter NIS) (Cho et al. 2011; Intarakumnerd, 2011). These studies contemplated superficially strategic, organisational and performance factors, crucial to understanding what these RTOs are doing to meet the new challenges and changes in their environment. This article seeks to fill this gap, since there is no body of theory that addresses the strategies used by RTOs to survive in dynamic environments.

The objectives of this paper are to propose a contingent model linking context, organisational and performance variables, and identify barriers that RTOs face when looking to cooperate with SMEs. It also highlights the best practices that RTOs adopt to develop competitive advantages and adapt to turbulent environments. This article is organised as follows. First, we review the literature of RTOs to identify variables that support the proposed model. Second, the research hypotheses are proposed supported by the theoretical construct. Third, the methodology research is presented and the results obtained discussed. Finally, we present the conclusions of the study.

2. *State of the art*

2.1 New challenges for RTOs

To respond effectively to changes in the environment, RTOs must overcome certain challenges. They must strengthen their internal capacities integrating diverse technologies and disciplines (Leijten, 2007; Leitner, 2005). They must build networks to cope with reduced funding and

increasing research costs (Loikkanen et al. 2011; Mas-Verdú, 2007). Thus, they must improve their relationships with universities and other innovation actors (Leijten, 2007; Loikkanen et al. 2011; Mrinalini and Nath, 2008). Furthermore, RTOs which are able to overcome these challenges are entering a process of internationalisation with further barriers and challenges.

2.2. RTOs: Their role and innovation strategies

In general, RTOs are set up as non-profit institutions with private and public support (Rush et al. 1996; Santamaría et al. 2002); or they are promoted by groups of companies with common interests (Berger and Hofer, 2011; Leijten, 2007). RTOs are intermediate institutions or interface structures which support and strengthen the innovative activity of enterprises (Albors-Garrigós et al. 2010a; Aström et al. 2008; Intarakumnerd, 2011; Leijten, 2007; Mas-Verdú, 2007) through complementary technology transfer and offer services such as training, information, mediation, expertise, consulting and Research and Development (R&D) or innovation (Hervás et al. 2012b).

Within the NIS, RTOs have a relevant influence on the economic and technical development of their area of influence (Arnold et al. 2010a; Intarakumnerd, 2011; Preissl, 2006; Sharif and Baark, 2011), and at regional level are considered as the main agent of territorial innovation (Albors-Garrigós et al. 2010a; Barge-Gil and Modrego-Rico, 2008; Martínez et al. 2009; Más-Verdú et al. 2008; Tann et al. 2002; Zubiaurre et al. 2004).

In order for RTOs to play a successful role, they must possess a clear strategic vision in order to contribute adequately to the industry changing innovation needs (Arnold et al. 1998; Leitner, 2005). Therefore, strategic planning is a tool commonly used by RTOs to identify business, generate and articulate their strategic vision and develop basic tasks such as customer management, marketing and development of their scientific relationships, as well as to manage their human resources (Arnold et al. 1998; Aström et al. 2008; Rush et al. 1996).

2.3 Technological environment and competitiveness: Strategies and organisational factors to address turbulence – A contingent approach.

Organisations constantly face the turbulence of the environment, which is the result of the convergence between dynamism, uncertainty and complexity (Tidd, 2001). Some authors (Emery and Trist, 1965; Silverblatt and Korgaonkar, 1987) have stated that deficiencies in internal factors of organisations can contribute to a turbulent environment.

Other researchers believe that environmental turbulence responds to external factors. Demographic changes (Jaworski and Kohli, 1993; McCann and Selsky, 1984), changes in policies regulating markets (Dwyer et al. 1985), changes in economic cycles (Dwyer et al. 1985)

and technological changes (Taylor and Taylor, 2012) all generate technological turbulence and uncertainty associated with the adoption of the technology (Freeman and Soete, 1999).

To address environmental turbulence, contingent theory (Burns and Stalker, 1961; Khandwalla, 1972; Terreberry, 1968) proposes a more flexible or organic organisational structure, which is characterised by a low degree of formalisation, horizontal communication and decentralised decision-making. Reactive companies perceive changes and uncertainty, but do not respond effectively because they have no consistent relationship between organisational structure and strategy. This therefore requires the development of more flexible and proactive strategies (Teece et al. 1997), enabling an RTO to reorient its strategy and adapt to changes in the environment (Gordon et al. 2000).

From a different approach (Lumpkin and Dess, 2001), proactivity is defined as the reaction of the organisations responding to market opportunities and reactivity as the reaction of the organisations against competition and market demand. A dynamic environment characterised by high competition affects the adoption and transfer of technology, and encourages organisations to establish new strategic innovation objectives (Dietrich and Shipley, 2000). RTOs are organisations that develop and transfer technology so they must adapt more quickly to changes in the environment. The success of RTOs depends on their strategic focus and organisational design (Modrego-Rico et al. 2005), in which human resources play a key role (Silva & Ramirez, 2006). For this reason, RTOs should enhance the capabilities of their staff (Mrinalini and Nath, 2008; Nath and Mrinalini, 2000; Rush et al., 1996), and find a fit between the key variables of environment, organisational structure and strategy in order to achieve optimal performance (Deutsch et al. 2009; Rush et al. 1996).

2.4 Funding model

The RTO model generally consists of public capital comprised of government subsidies, funds obtained through competitive European Union projects and private equity derivative strategic projects with client companies (Rush et al. 1996; Santamaría et al. 2002). Currently, it is intended that the RTOs model finds a balance between public and private funding, which is required if they are to reduce their dependence on public resources and to be more involved in competitive projects (Aström et al. 2008; Barge-Gil and Modrego-Rico, 2008; Berger and Hofer, 2011; Cho et al. 2011; Leitner, 2005; Mas-Verdú, 2007; Preissl, 2006).

2.5 Relationships with other innovation agents and served firms. Best practices

RTOs function in the NIS and complement the work of universities and other research organisations (Astrom et al. 2008). RTOs perform applied research, exploiting the knowledge of

industrial innovation and R&D projects (Barge-Gil and Modrego-Rico, 2008), and serve as strategic partners of firms with lower internal capabilities (Roessl et al. 2010), with a clear orientation towards technological development but not research (Barge-Gil and Modrego-Rico, 2008). The relationship between RTOs, universities, other research organisations and industry help to create a channel that facilitates the flow of information (Mrinalini and Nath, 2008), lends further support to the local industry and makes possible mutual benefits, access to greater resources and participation in collaborative international projects in R&D.

2.6 RTOs services. Barriers to work with SMEs

RTOs usually work primarily with SMEs (Astrom et al. 2008; Barge-Gil et al. 2011a; Olazaran et al. 2009; Rialp et al. 2001; Santamaría et al. 2002; Sharif and Baark, 2011; Zubiaurre et al.2004) and one of their main functions is the transfer of technology and knowledge to this collective (Leijten, 2007; Martinez et al. 2009; Mrinalini and Nath, 2008; Tann et al. 2002; Zubiaurre et al. 2004). This process of technology transfer is essential in the SMEs innovation dynamics (Albors-Garrigós et al. 2009). In this direction, RTOs help their partner firms to identify the sources of knowledge required to meet their technology demands (Barge-Gil and Modrego-Rico, 2008) and optimise the interface between the R&D/design and manufacturing phases (Albors-Garrigós et al. 2010).

In undertaking high added value projects with SMEs, RTOs encounter certain barriers (Modrego-Rico et al, 2005). On the one hand, and due to their size and characteristics, SMEs lack the ability to absorb efficiently the knowledge conveyed by RTOs (Barge-Gil et al. 2011a). On the other hand, SMEs do not prioritise to invest in R&D. Consequently, a significant number of SMEs have no contacts with RTOs (Astrom et al. 2008; Olazaran et al. 2009; Roessl et al. 2010). The alternative for RTOs should be to provide technological solutions customised to the needs of SMEs (Zubiaurre et al. 2004) and to help them access project financing sources (Olazaran et al. 2009). However, by combining different disciplines, RTOs have the capacity to generate and apply knowledge in SMEs (Mrinalini and Nath, 2008; Nath and Mrinalini, 2000) and to help them improve their absorptive capacity (Albors-Garrigós et al. 2010a; Hervás et al. 2012b; Intarakumnerd, 2011).

2.7 RTOs' performance and output indicators

Academic literature has pointed out models and indicators which measure the performance of RTOs. Rialp et al. (2001) evaluated the relationship between RTOs and firms. (Modrego-Rico et al. 2005; Silva & Ramirez 2006) suggested organisational, relational and outputs factors as a measure of RTOs' impact. Some authors (FEDIT 2009, in Modrego-Rico et al. 2009; Barge-Gil and Modrego-Rico, 2011) measured RTOs' impact on their area of influence comparing it with

alternative innovation agents, while others (Leitner, 2005; Nath and Mrinalini, 2000) proposed indicators to measure knowledge transfer and innovation in RTOs. Finally, another literature stream (Albors-Garrigós et al. 2010a; Arnold et al. 1998; Aström et al. 2008; Leitner, 2005; Modrego-Rico et al. 2005; Nath and Mrinaline, 2000) suggested turnover per employee as an outcome indicator to compare RTOs' performance.

3. Hypotheses and proposed model

From the previous literature review it can be concluded that the environment affects RTOs just as other organisations and these must adapt to its changes by way of strategic movements and organisational adaptations. To survive in turbulent environments, organisations must develop internal capabilities that allow them to be more flexible and proactive and to interact more effectively with their environment. This leads us to formulate the first hypothesis:

H1: The innovation strategy, organisational structure of the RTO, orientation towards SMEs, and the level of relationship with other innovation agents, are contingent with their environment

As considered earlier, it is expected that with a greater degree of self-financing, RTOs can carry out projects with SMEs and improve their innovation performance. Consequently, the following hypothesis is proposed.

H2: The origin of funding and the barriers that RTOs encounter to work with SMEs, affect their innovative performance.

There is no consensus of academic literature which allows us to establish a positive relationship between the turnover with the innovation output and R&D intensity, as an indicator of performance of RTOs. Thus, the following hypothesis can be proposed.

H3: The innovation output of RTOs are related to their financial performance indicators

In order to understand the relationship among the variables, Figure 1 shows the construct scheme which represents the proposed model.

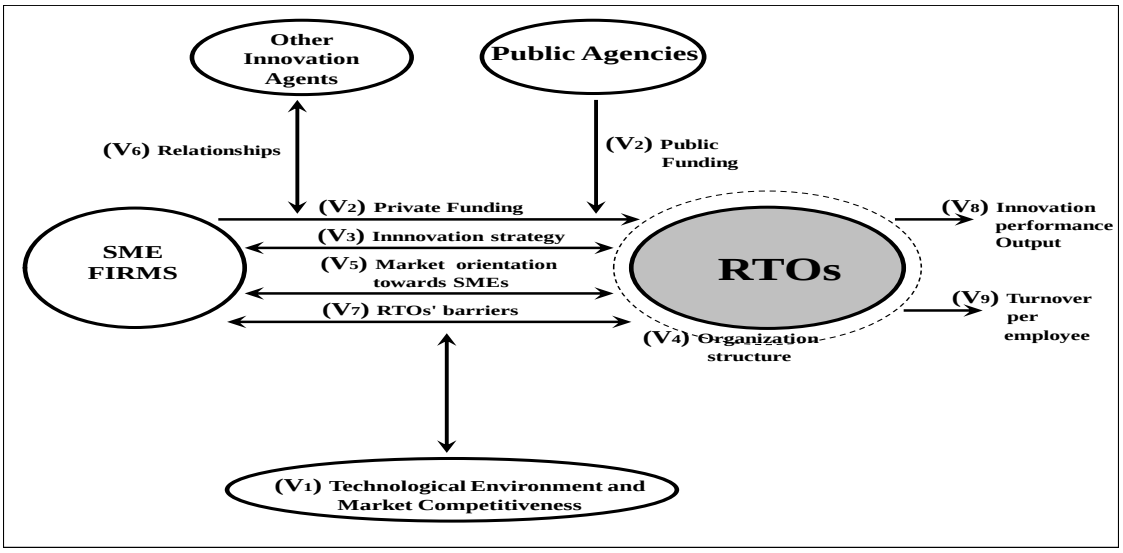

Figure 1. Proposed model to analyse RTOs

The proposed model represents how RTOs cope with a dynamic environment (V1). RTOs must achieve a balance between public funding, competitive and private funds, trying to obtain more resources from competitive projects and depending less on public funding (V2). They also need to develop proactive strategies (V3) and more organic organisational structures (V4), in order to improve their relationship with other innovation agents (V6), work effectively with SMEs (V5) and overcome barriers which hinder their relationships with SMEs (V7). With the combination of these factors RTOs can better adapt to changes in their environment, achieve higher innovation outputs (V8) and improve their economic performance (V9), all of which contribute to their sustainability.

There are examples of European RTOs that through strategic and organisational changes have responded effectively to the dynamism of their environment, thus allowing them to be more competitive and enter into new sectors and foreign markets. In the United Kingdom, (Sharif and Baark, 2011) reported how some RTOs have adapted to meet an increased demand for technology services. Within this process some RTOs have been privatised. Intarakumnerd (2011), furthermore, reported how Portuguese RTOs are developing internal capabilities and hiring consultants specialising in the creation of business networks in order to improve relational capacities with their partners. Finally, other authors have analysed the internationalisation strategies followed by five European RTOs to enter the Asian market through diversification and technology transfer (Berger and Hofer, 2011; Martinez et al. 2009; Mas-Verdú et al. 2008).

4. Research methodology

The field work was based on a survey questionnaire completed during personal interviews carried out with the managers of 14 Valencian RTOs and 13 Basque RTOs. Each interview lasted approximately two hours. In order to obtain the most reliable results possible, the interviewers ensured that the questions were properly understood and fully completed. This information was complemented with secondary data on RTOs' activities such as Annual Reports, web sites and specialised reports.

The questionnaire consisted of 50 questions covering eight areas of the RTOs' operation. With the aim of simplifying the statistical analysis, the study has reduced the variables to seven independent variables: [Technological Environment and Market Competitiveness (V1), Public and Private Funding (V2), Innovation Strategy (V3), Organisational Structure (V4), Market Orientation Towards SMEs (V5), Relationships with Other Innovation Agents (V6), RTOs' Barriers (V7)]; and two dependent variables: [Innovation Performance (V8) and Turnover per Employee (V9)]. Table 1 shows the variables built and how these were constructed from the survey questionnaire.

Table1. Construct variables and their meaning

V_1	Technological Environment and Market Competitiveness	Technology uncertainty, market competitiveness, technology life cycle (Stable versus turbulent environment).	Barge-Gil and Modrego-Rico. (2008); Leijten. (2007); Leitner. (2005); Modrego-Rico et al. (2005); Rush et al. (1996)
V_2	Public and Private Funding	Origin and percentage of funding. (Public - Private, competitive - noncompetitive)	Aström et al. (2008); Barge-Gil and Modrego-Rico. 2008; Berger and Hofer. (2011); Cho et al. 2011; Leitner. (2005); Loikkanen et al. (2011); Mas-Verdú. (2007); Preissl. 2006; Rush et al. (1996); Santamaría et al. (2002)
V_3	Innovation Strategy	Motivation for the RTOs establishment, R&D activity, risk assumption policies, research freedom, pioneering. (Proactive versus Reactive)	Arnold et al. (1998);Aström et al. (2008); Cho et al (2001); Intarakumnerd. (2011); Leitner. (2005); Nath and Mrinilini. (2000); Rush et al. (1996).)
V_4	Organizational Structure	Hierarchy levels, organization structure, staff stability, working groups, decision making, personnel selection criteria, professional careers, salary policies. (Mechanical versus organic structures)	Mrinilini and Nath. (2008); Modrego et al. (2005); Nath and Mrinilini. (2000); Rush et al. (1996); Silva y Ramírez. (2006)
V_5	Market orientation towards SMEs	Percentage of the main firm customers size	Albors-Garrigós et al. (2010a); Aström et al. (2008); Barge-Gil and Modrego-Rico. (2008), Barge-Gil et al. (2011a); Leijten. (2007); Martínez et al. (2009); Mrinilini and Nath. (2008); Rialp et al. (2001); Roessl et al. (2010); Olazaran et al. (2009); Santamaría et al. (2002); Sharif and Baark. 2011; Tann et al. (2002); Zubiaurre et al. (2004)
V_6	Relationships with other innovation agents	Level and frequency of collaboration with other innovation agents (Regional, Spain and Europe)	Aström et al. (2008); Barge-Gil and Modrego-Rico. (2008); Leijten. (2007); Loikkanen et al. (2011); Mrinilini and Nath. (2008); Roessl et al. (2010)
V_7	RTOs' barriers	The main barriers that RTOs find to work with SMEs: (Financial, innovative culture and SMEs technology absorptive capacity)	Albors-Garrigós et al. (2010a); Aström et al. (2008); Barge-Gil et al. (2011a); Hervás et al. (2012b); Intarakumnerd. (2011); Lyne. (2007); Martínez et al. (2009); Mas-Verdú et al. (2008); Mrinilini and Nath. (2008); Modrego-Rico et al. (2005); Nath and Mrinilini. (2000); Olazaran et al. (2009); Roessl et al. (2010); Silva y Ramírez. (2006); Zubiaurre et al. (2004).
V_8	Innovation performance Output	Obtained results by RTOs (Patents, spin-offs, scientific publications, new generated jobs and new clients).	Albors-Garrigós et al. (2010a); Aström et al. (2008); Barge-Gil and modrego-Rico. (2011); Leitner. (2005); Modrego-Rico et al. (2005); Modrego-Rico et al. (2009); Silva y Ramírez. (2006)
V_9	Turnover per employee	Turnover per employee without public support	Albors et al. (2010a); Arnold et al. (1998); Aström et al. (2008); Leitner. (2005); Modrego-Rico et al. (2005); Nath and Mrinaline. (2000)

The final values assigned to the variables were 1 to 5 in a Likert scale, based on a standardisation of the values of each variable.

5. Results

Table 2 shows the interpretation of the survey results. It must be pointed out that RTOs numbered 1 to 14 belong to the Valencian Region, whereas RTOs (1 to 9) are sectorial[1] and RTOs (10 to 14) are multisectoral.[2] The RTOs (15 to 24) belong to the Basque Country and are all multisectoral.

Table2. Variable values based on questionnaire responses

RTOs	V1	V2	V3	V4	V5	V6	V7	V8	V9
1	2,10	2,12	2,20	1,85	4,20	1,85	4,69	1,70	2,00
2	2,32	3,25	2,10	1,99	4,30	2,05	4,06	2,50	1,50
3	3,02	3,48	2,89	1,75	4,15	2,32	3,75	2,32	2,20
4	2,99	3,32	2,85	1,92	4,05	2,89	3,13	2,65	2,90
5	4,15	4,53	3,75	3,85	3,20	4,65	3,75	4,75	2,80
6	3,15	2,58	2,75	2,20	3,75	2,96	3,44	3,15	4,10
7	3,02	2,60	2,83	2,90	3,99	3,51	3,75	3,05	4,10
8	3,69	2,03	3,05	2,95	3,50	2,85	4,38	3,25	3,50
9	3,12	1,09	2,99	2,80	2,60	2,50	3,75	2,95	1,00
10	3,52	4,38	3,65	2,95	4,10	3,95	4,38	3,25	4,50
11	3,25	2,03	2,84	2,40	3,60	3,05	3,75	2,65	3,00
12	4,55	0,25	4,25	4,05	3,50	4,19	4,69	4,55	2,30
13	4,85	0,63	4,20	3,95	3,90	4,01	4,06	4,22	5,00
14	4,92	0,49	3,99	3,85	3,50	3,85	4,06	4,10	3,20
15	1,90	3,51	2,00	3,20	4,10	2,56	2,81	1,00	3,85
16	3,80	1,09	3,30	3,17	3,50	3,96	3,13	3,63	4,56
17	3,00	3,08	3,20	3,00	1,85	2,98	4,06	2,13	3,65
18	3,70	3,08	3,20	3,10	2,40	3,30	3,44	3,58	1,59
19	1,90	3,95	2,70	3,10	4,90	3,92	3,75	1,97	0,70
20	3,75	2,54	3,30	3,84	1,55	3,41	4,69	4,08	3,15
21	3,50	2,41	3,55	3,91	4,30	4,57	3,75	3,26	5,00
22	3,70	3,35	3,45	3,73	2,10	3,24	3,13	1,36	3,14
23	3,74	1,99	3,25	3,93	2,20	2,36	2,81	3,16	2,23
24	3,95	1,70	4,70	3,85	2,10	4,86	4,06	3,62	1,76
25	3,76	2,89	4,10	4,16	2,15	3,98	3,44	1,93	3,83
26	3,38	0,20	3,80	4,14	3,58	4,14	4,06	3,54	2,26
27	3,70	5,00	3,50	4,20	1,55	4,20	3,13	1,17	3,32

The data analysis based on a correlation analysis indicated the relationship between the input and output variables. Although the sample size is too small, the representativeness is 100%. However, the results must be interpreted with caution.

Table3. Bivariate correlations between the dependent and independent variables

Kendall's Tau-b	V1	V2	V3	V4	V5	V6	V7	V8	V9
V1	1	**-0,326(*§)**	**0,662(**)**	**0,483(**)**	**-0,408(**§)**	**0,459(**)**	0,074	**0,576(**)**	0,173
Bilateral significance		0,018	0,000	0,000	0,003	0,001	0,609	0,000	0,210
V2		1	-0,244	-0,193	0,087	-0,069	-0,266	**-0,430(**§)**	-0,011
Bilateral significance			0,076	0,162	0,530	0,617	0,067	0,002	0,933
V3			1	**0,576(**)**	**-0,362(**§)**	**0,574(**)**	0,170	**0,456(**)**	0,152
Bilateral significance				0,000	0,009	0,000	0,242	0,001	0,269
V4				1	**-0,344(*§)**	**0,551(**)**	-0,062	0,268	0,144
Bilateral significance					0,014	0,000	0,670	0,052	0,296
V5					1	-0,211	0,078	-0,130	0,003
Bilateral significance						0,127	0,594	0,347	0,983
V6						1	0,083	**0,357(**)**	0,237
Bilateral significance							0,566	0,009	0,083
V7							1	**0,296(*)**	-0,071
Bilateral significance								0,041	0,625
V8								1	0,095
Bilateral significance									0,491
V9									1
Bilateral significance									

Correlation significant at ** p < 0.01; * p < 0.05 (Bilateral)

***Excess of outliers* (§)**

Applying Kendall's Tau-b coefficient for non-parametric data [-1 + 1], table 3 shows the bilateral correlations at acceptable significant level (α) of 0,05. In those cases of acceptable

[1] They serve primarily a specialised industry sector (i.e., furniture, shoes, textiles, food, etc.).
[2] They serve many industries regardless of their specialisation.

correlation coefficient, as mentioned, table 3 shows a positive relationship between the technological environment and market competitiveness (V1) and its innovation strategy (V3), organisational structure (V4), relationship level with other innovation agents (V6) and innovation performance (V8). The RTO innovation strategy (V3) has a positive relationship with its organisational structure (V4), relationship level with other innovation agents (V6) and innovative performance (V8). The organisational structure (V4) of the RTOs is positively related to their relationship level with other innovation agents (V6). Finally, the RTO relationship level with other innovation agents (V6) is positively related to its innovative performance (V8).

Although table 3 shows certain correlation coefficients between the origin of RTOs' funding (V2) and the SME focus of the RTOs (V4) with other variables – generally of negative signs – an excessive number of outliers impede drawing clear conclusions. It is also noted that there is no correlation between the RTOs' turnover per employee (V9) with the other study variables.

The interpretation shows that there is a positive correlation between the industrial environment (V1), innovation strategy (V3), and organisational structure of the RTOs (V4). It could be concluded from the previous results that those RTOs in more turbulent industrial environments, and which have high technological rotation, follow strategies more proactively and show more organic organisational structures, compared with RTOs that work in mature sectors with little innovating industries and low technological levels. These RTOs assume more reactive innovation strategies.

There also are differences between the type of client company (V5) and relationship skills with other innovation agents (V6) of RTOs in both communities. Valencian RTOs work more with medium and low technological level SMEs. These RTOs have high collaboration levels with groups, associations and other RTOs both regionally and nationally; however, only multisectorial RTOs are more linked to other RTOs and European research organisations. Basque RTOs are focused on medium and large companies of medium and high technology. Compared with Valencian RTOs, they relate better to universities and other national and European innovation agents.

The origin and percentage of funding of RTOs (V2) was estimated from secondary information.[3] From these data we can see a negative correlation with innovation output of RTOs (V8) in both communities. Valencian RTOs have a higher percentage of non-competitive public

[3] Financial data on RTOs were scarce and managers reluctant to disclose this type of information during the interviews.

funding, while the percentage of private and competitive funding for Basque RTOs is higher. The barriers that RTOs encounter in working with SMEs (V7) as identified in the literature are, for all RTO respondents, important, and they agree that these have influence on their performance. Valencian RTOs give more importance to financial barriers and the innovative culture of SMEs, but consider less relevant the absorptive capacity of firms. Basque RTOs state that the financial barriers of the companies represent major obstacles.

Overall, the Basque RTOs have higher innovation outputs (V8) than Valencian RTOs in terms of the number of patents, creation of spin-offs, scientific publications and new jobs created. However, some Basque RTOs which work in turbulent environments have a lower ratio of outputs, since they have comparatively fewer scientific publications, fewer jobs created and new customers in the last year. The results of innovative performance of Valencian RTOs reveal that their percentage of new customers tripled the Basque RTOs' results in the last year. Such a difference increases the final result of this variable. Finally, the empirical analysis shows that there is no correlation between financial performance indicators expressed in turnover per employee of RTOs (V8) and their innovative performance (V9).

6. Conclusions

The objectives of this study were to examine the strategies adopted by Valencian and Basque Country RTOs in turbulent environments. Moreover, it was identified the barriers they faced and the best practices used to adapt and become more competitive. The research also examined independent variables and dependent variables that affect RTOs' performance.

The analysis of the context variables, like the technological and market competitiveness, the origin of funding, its innovation strategy, level of relationship with other innovation agents and the barriers encountered when working with SMEs, affect the efficiency of RTOs, measured by their innovative performance. In relation to the hypotheses, the conclusions that can be drawn from the data analysis are summarised below.

Firstly, the proposed model supports empirically a contingent relationship between technological environment, innovation strategy and organisational structure, following the premise of a number of studies (Burns and Stalker, 1961; Gordon et al. 2000; Khandwalla, 1972; Teece et al. 1997; Terreberry, 1968), that in order to respond efficiently to changes in the environment, RTOs should look for congruency among key variables such as environment, structure and strategy to achieve optimal performance and become more competitive.

The Basque Country region is characterised by a more dynamic and innovative industrial environment. Its RTOs show rather organic organisational structures and follow more

proactive innovation strategies, with the exception of RTOs 15 and 19, which serve low-tech sectors. The Valencian RTOs embedded in turbulent environments (RTOs 5, 10, 12, 13 and 14) have, as well, higher levels of organic organisational structure and show more proactive strategies. In contrast with the Basque Country, there are more Valencian RTOs involved in low-technology industries (numbers 1, 2, 3, 4, 6, 7, 8, 9 and 11). These RTOs must work with mature sectors and show more mechanical structures and reactive innovation strategies. The differences between the two regional RTOs, both in their strategic approach to SMEs and their skills to interact with other innovation agents, have an effect on how RTOs respond to their environment, so we concluded that the first hypothesis can be partially validated.

Secondly, we considered the differences between the funding models used by RTOs in both communities. The estimated data shows a negative correlation between funding and innovation outputs of RTOs. Valencian RTOs have greater reliance on public funding and are involved less in competitive projects, while Basque RTOs are better endowed to self-finance, and obtain resources from competitive projects and private funding. The results show a correlation with innovative performance but, as it has been pointed out, such data were based on secondary information and, again, must be interpreted with caution. With respect to the barriers that RTOs have to overcome to work with SMEs, these are related to innovative performance. However, it cannot be established which ones influence more or less their performance, and we must conclude that hypothesis 2 cannot be validated.

Thirdly, the economic results expressed in the ratio of turnover per employee (V9) and innovative performances of RTOs (V8) are uncorrelated. Despite being a good indicator of performance, no conclusion can be inferred from the difference of values between RTOs with higher innovation outputs. We conclude that hypothesis 3 cannot be validated either.

The analysis of the variables also allows us to identify the best practices of RTOs. Valencian RTOs point out the following: analyse the needs of their SMEs market, conform to mixed teams composed of employees from RTOs and partner SMES' clients during the project's development and disseminate the results properly. For Basque RTOs, some best practices are essential such as knowledge of SMEs' strategy, defining mechanisms for project tracking, conforming to mixed work teams, planning marketing activities and meeting with partner firms to identify their needs. For all respondent RTOs those best practices have a high impact on the SMEs' competitiveness.

According to the theoretical construct, it can be concluded that, from a contingency approach, RTOs can cope with the environmental turbulence through a contingent relationship between organisational structure and strategy. In both communities RTOs with proactive

strategies and organic structures can confront new challenges due to their better capacity to research in new technology areas and identify the needs of enterprises, as well as the best means to collaborate with other innovation agents, which allows them to achieve higher innovation performance. RTOs with mechanical organisational structures have more difficulty dealing with changes in the environment because they are conditioned primarily by the characteristics of the low-tech sectors with which they work. To survive, these RTOs must develop their internal capabilities and find ways to enter into new sectors through the integration of new technologies and networking with other RTOs.

The particular context of Basque Country industry and its RTO model, integrated on two technology platforms, enables Basque RTOs to reach a critical mass, to become more competitive and to support their internationalisation strategies. Only a few RTOs belonging to less innovative mature sectors have more obstacles to respond to environmental changes.

The high dependency of valencian RTOs on public funding makes them vulnerable, but does not imply a lack of capacity to adapt and survive. To survive and be more competitive Valencian RTOs must strengthen and redirect their strategy to improve their relationship with universities and other knowledge sources, increase their critical mass, organise their technology offer and generate synergies which reduce duplication considering that there are RTOs that currently offer services in the same areas.

The search for new financing sources and the process of internationalisation are necessary, as long as RTOs do not deviate from their main goals as non-profit organisations to support the innovating activity of SMEs with lower capacities. In order to face new challenges, be more competitive and respond efficiently to the changing environment, RTOs need the clearer support of public technology policies. This means public policies adapted to each regional characteristics.

The conclusions of this study should be interpreted with caution. It is an exploratory study which compares two different communities with their own RTOs models. Further research should be carried out with a larger population and more diverse contexts.

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