Entrepreneurial ecosystem for the TBFS: resource-based view.

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ABSTRACT:

This research identifies the stages through which an entrepreneurial ecosystem evolves until acquiring the ideal level for triggering the self-sustaining creation of technology-based firms (TBFs), as well as the critical territorial resources necessary for this evolution. The different tangible and intangible territorial assets that affect the creation of TBFs are analysed by means of the resource-based View. The results obtained provide a model in which six entrepreneurial ecosystem stages have been identified; it is also confirmed that the more developed an ecosystem is, the greater the capability to mobilise the territorial resources, create TBFs and reach a greater level of wealth.

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1. INTRODUCTION

For a specific geographic area the qualities of the technology-based firms (TBFs) are numerous as they attract other industries to the region, manufacture high value-added products, have a great potential for exportation and create quality employment (Contreras, 2008; Fernández Doblado, 2008). On account of these facts, the public and private agents show a keen interest in developing such firms, conveying to the academic field the necessity to find out the specific factors that have an influence on and determine the entrepreneurial behaviour in the mid- and high-technology sectors. In this field, the focus has been on identifying the ecosystem's assets of a specific geographic area in which those ventures discover their ideal environment in order to be able to grow and expand.

In this context, the *resource-based View* offers a suitable approach for the analysis of the tangible and intangible assets that play a determining role in venture start-up, providing the basis that permits us to make a clear distinction between those territories that have a differential success level when stimulating the development of such companies (West, Bamford and Marsden, 2008). In particular, it can be noted that the precepts of this theory likewise explain the starting-up of the TBFs, to the point that it is possible to characterise the stages of evolution of the entrepreneurial ecosystem (West and Bamford, 2005). Nevertheless, based on this theory, empirical research has not analysed all the resources available, and in particular, the manner in which it is necessary for those resources to combine and interact so that the TBFs can proliferate. Based on the information presented, the aim of this work is the following**:** *to identify the stages through which an entrepreneurial ecosystem evolves until acquiring the ideal level for impelling the self-sustaining development of the TBFs, as well as the critical resources necessary for this evolution.* In order to answer this, an empirical study is to be carried out in the current research which will look for evidence throughout all the provinces[3] that make up the Spanish territory.

2. THE ENTREPRENEURIAL ECOSYSTEMS FOR THE TBFS

The TBF is a new and independent company whose activity is related to the development of new industries (Shearman and Burell, 1988). From a wider point of view, and based on the definitions of sixteen countries, Storey and Tether (1998) maintain that the TBF is the small or medium (SMEs) new independent owner-managed company operating in high technology sectors. This definition was then at a later date extended to incorporate the SMEs that operate in the high and mid/high technology sectors (Fariñas and López, 2007), with the latter conceptualisation being that which supports the present research due to its general acceptation and for complying to a greater extent to the business situation in Spain.

One of the main characteristics of these TBFs is that they operate in extremely dynamic industries. For this reason the technology must be up-dated, the work force must be highly skilled (Chorev and Anderson, 2006) and furthermore, must be led by highly entrepreneurial individuals (Park, 2005). In the territories where these ventures are established, a high level of competitiveness and economic growth is granted, contributing to the static and dynamic efficiency of the economic system (Colombo and Grilli, 2005). Furthermore, the TBFs are considered to be catalytic factors of the technological change in a territory, as they create social innovation by altering the knowledge and culture of the population and promoting the entrepreneurial culture (Contreras, 2008; Fernández Doblado, 2008).

Venture creation in a specific territory relies on the entrepreneurial ecosystem developed in that area. To be precise, an entrepreneurial ecosystem is defined by Spilling (1996) as the interaction of the economic actors, their roles and the external factors that affect the economic

[3] Form of administrative division of the Spanish national territory, including the autonomous cities of Ceuta and Melilla in North of Africa.

activity and the venture creation of a territory. This ecosystem is a dynamic system, developed in a specific geographic area, characterised due to the fact that the ventures in that area interact, interchanging information, knowledge, services, etc., while at the same time competing with each other. Furthermore, that area provides certain territorial resources which in turn favour the creation of TBFs, amongst which can be found those advanced and specialised in this type of sector. Due to this fact, Neck et al. (2004) state that the ecosystem contains and at the same time supports the business activity. In fact, the considerable amount of TBFs established in the ecosystem not only base their activity on the resources available in the ecosystem, but in addition, represent a centre of attraction for new companies and territorial resources that may profit from its being set up close by. Thus, for example, given that the created companies require venture capital funds or suppliers of technology consumables, they carry out a "pull effect" to all those companies that can provide this. Thus, the ecosystem is integrated by an aggregate of resources and actors that goes beyond the limits of many public or private organisations (Van de Ven, 1993). Considering the efforts carried out by the public agents, it does not seem very likely that such resources can be accumulated, thus making it necessary for the "pull effect" by the established TBFs. Consequently, the importance of the statement by Neck et al. (2004) regarding the transitory evolution necessary so that certain components may interact to form a dynamic system that nurtures the creation of companies, can be understood.

3. THEORETICAL BACKGROUND FOR THE STUDY OF THE ENTREPRENEURIAL ECOSYSTEMS FOR TBFS

The *resource-based View* (e.g., Penrose, 1959; Barney, 1991) explains the venture's competitive advantage is based on combining and making use of the resources available or of those that can be developed (Foss et al., 2007). Some authors have partially extended this approach and have argued this in relation with the competitive development of a territory (e.g., Russo and Fouts, 1997; Sánchez Medina et al., 2007). In point of fact, territories develop from unique contexts defined by their industrial, historical and local configurations, as well as the pattern of their resource investments over time (Auerswald and Branscomb, 2003). West, Bamford and Marsden (2008) put the *resource-based View* into use in order to carry out the analysis of the venture growth of an emerging economy, and West and Bamford (2005) utilise this theory to study the differential creation of TBFs. With this theoretical outline it is possible to identify the territorial resources that support the development of the TBFs and, consequently, the economical growth that is intertwined to the territories where those companies proliferate. Based on this theory, West and Bamford (2005) make a relevant contribution in relation to the research carried out on the technology-based entrepreneurial systems. These authors, instead of considering those systems dichotomously –i.e., are they or are they not technology– based entrepreneurial ventures, put forward a theoretical alternative that explains to what extent they are indeed technology-based entrepreneurial systems, or the development stage of the entrepreneurial ecosystem.

3.1. An approximation based on the resources for the study of an entrepreneurial ecosystem for the TBFs

The *resource-based View* explains the advantages of a specific territory in relation with the possession of resources and what path they should follow to acquire or develop resources (Table 1) making it difficult for them to be imitated (Wernerfelt, 1984; Barney, 1991).

Natural resources –e.g., climatology– can be found amongst the specific resources of a territory, as well as the resources created by the community, be it for general use –e.g., roads– or for specialised use –e.g., research institutes– (Porter, 1991). These resources are systematic and can be long-lasting (West and Bamford, 2005). For the level of the venture analysis, Grant (1991) differentiates between the tangible resources –e.g., financial and physical assets–, the intangible resources –e.g., reputation and technology–, and the human resources –e.g., cultural values, training and experience–; Brush, Greene and Hart (2001) differentiate between the human, social, financial, organisational and physical resources and Venkataraman (2004) includes the technological assets

specifically for the companies that operate in this sector. From a territorial point of view, and combining the previous classifications, the following resources stand out:

Table 1. Application of the resource-based View in a territorial level of analysis

Source: Elaborated from West and Bamford (2005) and West, Bamford and Marsden (2008)

Basic suppositions	Application to a territorial level
Generating competitive advantage	The possession of resources defines the capacity of a territory to create TBFs and economic growth.
	There is competitiveness between the territories to see who attracts the TBFs and, with the purpose of being successful attracting these ventures, the territories aim to increase their resources.
	The creation of heterogeneous resources, in combination with the imperfect mobility, imitability, and substitutability of their resource positions can lead some territories to be more successful when creating TBFs.
Resource mobilisation	The competitive advantage of a territory arises from the creation and use of a unique bundle of both tangible and intangible resources, and likewise the manner in which they are used to attract potential entrepreneurial ventures.
Dynamic resource development	Each territory must realistically examine its beginning resource position and then begin to build a valid and attractive infrastructure for the proliferation of TBFs.

Human resources. Literature on entrepreneurship has identified that being young, belonging to a family run business or the level of training a person has all play a decisive role when deciding to create a company (e.g., Colombo and Grilli, 2005; Hayton, 2005). In the case of the TBFs, the fact that the population of an area have higher levels of qualifications in specialised areas related with technology and secondly, rely on trade and marketing skills can be considered determining qualities that sustain the human capital of that specific territory. The social values that promote the entrepreneurial behaviour of a population are likewise incorporated in the human resources category (Lee and Peterson, 2000; Hayton, George and Zahra, 2002; Neck et al., 2004). Expanding on this point, Tominc and Rebernik (2007) state that when the society in which the individuals take part of shares some entrepreneurial values –e.g., having an own business is considered a desirable professional alternative, people respect and admire those who own successful ventures, etc.– entrepreneurial behaviour is promoted.

Social resources. Given the complex and dynamic nature of the technological environment with both the suppliers and the customers, entrepreneurs in the technology-based ventures are especially interested in forming part of social networks (Hagedoorn, 2002), which is in keeping with Jack and Anderson (2002) who defend the contingent value of social embedeness. In such a dynamic context, the necessity to adequately nurture the venture from the technological and commercial resources is a possible justification of the great need to proactively encourage access to the diverse networks that may provide support to the new technology-based firm, therefore making these resources a necessary condition in a territory so that the development of the TBFs proliferates.

Technological resources. The existence of tech support agents, such as public and private organisms that support entrepreneurship, universities and agents from other sectors such as research centres, advice services, etc., are all determining factors for the entrepreneurs when attempting to identify and exploit new businesses. At this point it is worth mentioning the existence of incubators (Siu and Bao, 2008), which can be carried out by research institutes, public institutes and international or local firms (Suzuki, Kim and Bae, 2002; Ucbasaran, Westhead and Wrigh, 2008). Business *clusters*, technology parks and technology centres, etc. are considered to be among the technological resources, the latter being factors which cause a considerable impact as they carry out significant research activity, in addition to furthering the development of knowledge *spillovers* (Vohora, Wright and Lockett, 2004; Audretsch and Keilbach, 2007), which are proving to be extremely productive when developing new technologies that have the potential to be exploitated in profitable business ventures.

Financial resources. The existence of diverse financial means constitutes a relevant resource which very often conditions the possibility of starting-up new technology-based enterprises. Specifically, the fundamental role carried out by banks, leasing companies, venture capital companies, private investors or regional development funds has been emphasised by authors such as Collinson and Gregson (2003) and Neck et al. (2004).

Physical resources. This is a combination of tangible resources of a territory, some of which being road networks, office space, areas for industrial establishments, etc. (Neck et al., 2004). It is probable that these resources are not basic critical factors essential for fostering the development of an entrepreneurial system in a territory with no prior entrepreneurial tradition, however the lack of this element is an obstacle that restricts entrepreneurial development.

West, Bamford and Marsden (2008) put forward the idea that if there are no intangible resources, such as the knowledge on how to utilize the physical assets to exploit the opportunities, those physical assets are no longer able to support the creation of new ventures. Along the same lines, Venkataraman (2004) states productive entrepreneurship in a territory does not arise from the tangible assets alone. The tangible resources depend on the intangibles and furthermore they must be interrelated. An important factor to be considered is the sustainability of the resources and the advantages or value contributed by those resources to the territory. According to West, Bamford and Marsden (2008), and adapting the original idea of Barney (1991), the assets of a territory have to be rare, inimitable, non-marketable and non-substitutable to lead some communities to be more successful in entrepreneurial economic development than others. Each territory is characterized by a bundle of idiosyncratic resources which support the results in that community as regards the proliferation of the TBFs. Based on the *resource-based View*, it is thus possible to appreciate why some territories who wish to expand by means of the development of TBFs, not only are lacking the resources to do so, but even after analysing the structure and the combination of resources of a model area, are possibly not in a position to imitate them (West and Bamford, 2005).

Based on this approach, various typologies and/or stages have been identified, through which the entrepreneurial ecosystems pass in their consolidation process. Those typologies and/or stages are differentiated according to their specific bundle of territorial resources and the firms established in those areas. Thus, for example, West and Bamford (2005) identify four stages through which a territory evolves when attempting to develop an entrepreneurial system in which TBFs proliferate: economic core, sparse, incipient and critical mass. According to Iammarino and Mccann (2006), no linear or deterministic development path can be established for this kind of development; however it is plausible that idiosyncratic patterns prevail in each territory. Nevertheless, the stages identified are the results of a theoretical analysis, and occasionally result from the direct observation of the researchers. Thus, in the present work, it seems both essential and interesting to carry out empirical studies to identify those stages, their characteristics and the resources mandatory for the development of an entrepreneurial ecosystem. To be more specific, the theoretical basis of the present study can be formulated in three research hypotheses:

H1. For the development of the TBFs, the entrepreneurial ecosystems have to carry out an evolutive process through which the resources and created and consequently attract those technological ventures.

H2. Each stage of the evolution of the entrepreneurial ecosystem is characterised by a combination of human, social, technological, financial, and physical resources.

H3. The greater the development of an entrepreneurial ecosystem for TBFs in a specific territory, the more prosperous that territory becomes.

4. METHODOLOGY

The empirical research is carried out in Spain and the 50 Spanish provinces and the cities of Ceuta and Melilla are the population in this study. The information for carrying out this study was compiled from various international, national and regional databases, and due to this fact, the data

illustrates objective indicators at a provincial level. In accordance with the selected methodological base, the measurement of the heterogeneous variables used is presented.

Provincial economic development. This is measured by means of the GDP (Gross Domestic Product) per capita for the year 2006, a relative term to eliminate the "size effect" of the provinces.

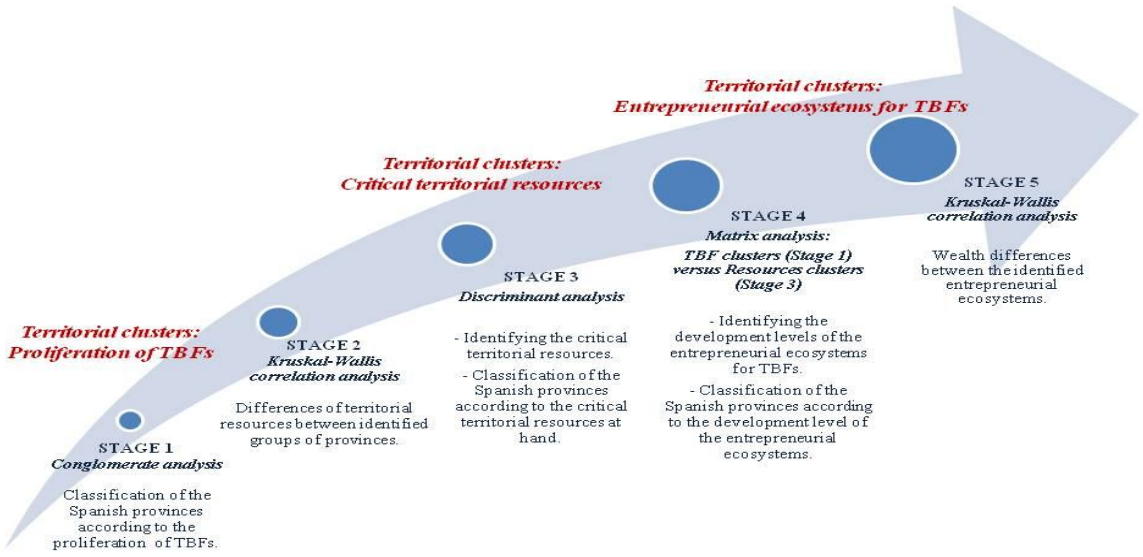
Establishing TBFs by province. To determine the number of small and medium sized TBFs, the criteria of Storey and Tether (1998) and Fariñas and López (2007) are followed. A business venture is regarded as a TBF when: they have fewer than 250 employees, is young (has existed for less than 6 years), is not integrated in a corporate group and functions in sectors of high and mid-high technology –SICs (Standard Industrial Classification) defined by the INE (National Statistical Institute in Spain). Using the SABI database (2008), it was possible to identify a total of 12,799 enterprises that complied with such requirements in Spain in 2006. After carrying out an individual analysis of each of those companies, those whose activity description was unable to be classified as being technological-based were eliminated, leaving a final list of 9,210 TBFs. In relation to these companies, two groups of measures calculated in relative terms to eliminate the impact of the different sizes of the provinces were included: proliferation of TBFs and type of TBFs.

Territorial resources. The measures of the territorial resources were obtained from the year 2001, thus allowing for the structural characteristics that existed in those provincial territories from the start-up of the TBFs included in the study to be analysed. This information was extracted from the following Spanish data sources, to name but a few: National Statistical Institute, Ministry of Commerce, Industry and Tourism; Ministry of Education, Political Science and Sport; Directorate-General of SMEs; Spanish Patent and Trademark Office; and GEM (Global Entrepreneurship Monitor) Project.

5. ANALYSIS OF THE RESULTS

The population under study is composed of the 52 Spanish autonomous territories. On average, these territories own 177 companies that are chiefly specialised in industrial activities and/or services of high technology (58%). Due to the fact that they are newly set-up companies, the average age ranges between 4 and 6 years, and being small in size with an average number of 9 employees. With the aim of contrasting the hypotheses previously stated, the empirical research follows the stages of the process as demonstrated in Figure 1.

Figure1. Stages of the empirical research



5.1. Classification of the territorial provinces according to the proliferation and type of TBFs

By utilising a *cluster* analysis, the groups of Spanish provinces according to their number of established TBFs (Table 2) were identified, and for this the *non-hierarchical algorithm* and the *K-means method* were used. As a result, three groups arise, made up of the 7, 19 and 26 provinces. With the aim of carrying out an in-depth characterisation of these groups, the type of TBFs was also analysed.

Group I can be considered as being the most developed of the three groups, as it owns more larger-sized TBFs, employs a larger proportion of the active population and develops its activity in high-technology sectors, and for these reasons is named *consolidated* group. Group II is situated at an *intermediate* level, although it is in second position as regards the size, number of TBFs and employees. Those companies however prefer to develop their activity in mid-technology sectors. Finally, group III incorporates those provinces that have fewer TBFs, with those being smaller in size, and employing a smaller percentage of the active population, although the proportion of the activity developed in high-technology sectors is greater than in group II (group in *initial* stage).

Table 2. Provincial clusters according to the proliferation of TBFs

Proliferation of TBFs	**Centres of the final conglomerates**			***F***
	Group I	**Group II**	**Group III**	
TBFs /SMEs	0.00390	0.00212	0.00136	48.695***
TBFs /population	0.00030	0.00015	0.00009	53.069***
Employees of TBFs /active population (%)	0.65931	0.29906	0.12902	189.405***
Types of TBFs	***Kruskal-Wallis* test**			
	Mean rank			X^2
Average number of employees in the TBFs	40.14	34.53	16.96	21.302***
High-technology TBFs compared to total number of TBFs	31.71	20.47	29.50	4.853†
Mid-technology TBFs compared to total number of TBFs	22.93	33.97	22.00	7.304*
Mid-technology TBFs/high-technology TBFs	21.79	33.45	22.69	6.315*

†$p<0.1$, *$p<0.05$, ***$p<0.001$.

5.2. Territorial resources in entrepreneurial communities for TBFs

In this section the territorial resources are identified, differentiating the distinctive characteristics in the provinces with a greater number of TBFs established, from those in *intermediate* and *initial* stages (Table 3). Considering the *human resources*, the results indicate that the educational level of the population -population over 16 years of age with completed secondary school studies; number of doctors-, is higher in group I, the so-called *consolidated* group. Consequently, group I is the predominating group due to the general and scientific education of the population. However, the provinces in group I are placed in second position, distanced from group III, as regards students enroled in non-technical studies, an educational specialised area of minor relevance for the activity in technological sectors. However, with reference to the university students enroled in technical studies, group I is almost identical to group II. Nevertheless, work experience of the human resources is likewise significantly higher in group I, whilst the percentage of male employees, a variable that indicates the gender inequality in the labour market, has its lowest value in the provinces with leading TBF development, an indicative factor that the female gender has a broad work experience in these areas. Finally, entrepreneurial knowledge and capability, calculated by the number of SMEs, is similarly greater in group I, although the new ventures that start up out of necessity –i.e. work options are either non-existent or unsatisfactory–, indicating less entrepreneurial vocation and entrepreneurial cognitions in the population, have the lowest value in this group.

Table 3. Territorial resources for the creation of TBFs in the provincial clusters

Resources	*Kruskal-Wallis*[a] test				*eta*	*eta*^{2}
	Mean rank			X^2		
	Group I	Group II	Group III			
Human resources						
Population over 16 years old with completed secondary school studies/population	46.57	25.32	19.50	18.695**	1.000	1.000
University students matriculated in technical studies/total students	22.33	24.82	14.80	6.758*	1.000	1.000
University students matriculated in non-technical studies/total students	15.67	13.18	23.20	6.758*	1.000	1.000
Number of doctors/population	37.43	23.00	26.12	4.839†	0.875	0.766
Number of employees (%)	41.43	26.68	19.92	12.004**	1.000	1.000
Number of male employees (%)	10.71	28.11	27.75	8.380*	1.000	1.000
Number of SMEs for every 100 inhabitants	44.07	26.29	21.92	11.791**	0.971	0.943
Entrepreneurship out of necessity	12.07	31.95	26.40	8.913*	0.785	0.616
Social resources						
Social capital[4] (volume index per capita)	42.86	27.84	18.58	15.818***	1.000	1.000
Social capital (value of the services per capita)	46.14	28.11	17.42	22.024***	1.000	1.000
Number of chambers of commerce/SMEs	10.50	24.29	32.42	12.182**	0.971	0.943
Technological resources						
Technology parks/SMEs	37.43	26.26	23.73	5.725†	0.793	0.629
Agents of the national innovation system/SMEs	44.29	23.21	24.12	11.190**	0.977	0.954
Patent application/SMEs	46.00	23.53	23.42	13.393***	1.000	1.000
Innovation expenses (% GDP)	44.50	29.42	16.85	21.981***	0.846	0.716
Financial resources						
Credit entity offices/100.000 inhabitants	23.29	32.05	20.96	6.330*	1.000	1.000
Number of venture capital firms/SMEs	38.43	23.53	25.46	5.932†	0.781	0.610
Physical resources						
Educational network: non-university education centres/population	12.43	29.21	28.31	7.013*	1.000	1.000
Communication network: kilometres of motorway and dual-carriageway per 1.000 km^2	41.57	21.21	24.21	10.342**	1.000	1.000

Notes:

[a] Only the variables which indicate significant differences between the groups are presented.

$^{\dagger}p<0.1$, $*p<0.05$, $**p<0.01$, $***p<0.001$.

The *social resources* are significantly higher for those provinces included in group I and lower in group III in the *initial* stage of the development of the TBFs, underpinning the significance of the support and the social relations in the development of new technology-based ventures. However, when computing the business networks from the number of chambers of commerce, the highest result was in group III in *initial* stage of development. Due to there being a lack of additional resources that stimulate new ventures, the chambers of commerce represent an associative agent of great importance in order to foster the incipient entrepreneurial development.

When considering the *technological resources*, technological networks (e.g., technology parks and agents of the national innovation system) and activity of the centres for both public and private innovation (patent application and innovation expenses) show significantly higher levels in group I, which includes the provinces in the *consolidation* stage. The above results validate the importance of the function of the technological resources in the configuration of the ecosystems where the TBFs proliferate.

It can be seen from the results of the *financial resources* that although the venture capital is highest in group I, followed by group III, the percent of the financial institutions and banks is

[4] The measurement of social capital included in this paper stems from the research carried out by Pérez *et al*. (2005). To be precise, these authors offer two global value measurements of the social relations- trust and cooperation, especially in the economic field, which have an influence on the success rate. The analysis carried out is focussed on establishing the values of the lasting relations in high uncertainty environments, such as investment markets or the labour market.

highest in group II. Regarding this point, it has to be taken into account that the high-technology TBFs are found to a greater extent in groups I and III, while the mid-technology TBFs are mainly to be found in group II. This fact could clearly justify a larger percent of venture capital in territories where high-risk and growth potential investments are predominant, an occurrence in the high technology ventures. As for the credit entities, they reach out to all the areas where financing is necessary for low-risk projects.

In the present study the *physical resources* have been analysed by means of both the non-university educational network and the road communication network. The results indicate that the latter can be seen to a greater extent in the provinces in group I, a fact which without a doubt represents a decisive factor for entrepreneurial development in general. Notwithstanding, the results of the non-university educational network in this group are lower than in the other groups, which could be partly due to the fact that a larger effort has been carried out from the public agents to improve the educational offer in those provinces with a lower level of non-university education.

As a result of this study, it can be seen that in the provinces with a larger creation of TBFs, there is an higher level of development in almost all the resources analysed in this study, compared to those in the *initial* and *intermediate* stages, and at the same time, it has been confirmed that the three groups do not rely on the same level of resources.

The critical resources of a territory for the technology-based entrepreneurship

A *discriminant analysis* was carried out with the aim of identifying the critical resources and reclassifying the provinces depending on how many resources they possess. In order to do this, the most significant variable according to the *eta* and eta^2 statistics was selected from each group of resources, and in the case of a coincidence occurring, the variable with the highest result in the *Kruskal-Wallis* test, that is: population with completed secondary school studies, social capital, patents, credit entities and road network.

The results obtained demonstrate two discriminant functions, where the first one explains 91% of the variation and contributes better coefficients for the quality indicators for evaluating a discriminant function (autovalue=2.523; canonical correlation=0.846; Wilks' Lambda=0.227; Chi-squared=66.640, p=0.000); the second function only explains the remaining 9% (autovalue=0.248; canonical correlation=0.446; Wilks' Lambda=0.801; Chi-squared=9.976, p=0.041). When considering the territorial resources in the two functions, it can be emphasised that the human, social, technological and financial resources have higher structural coefficients in the first function, whereas the physical resources to a large extend support the second function. It can thus be affirmed that the physical resources represent territorial assets that are less relevant for stimulating the development of TBFs, agreeing with West, Bamford and Marsden (2008).

The global percentage of correctly classified provinces obtained with the discriminant function of the highest discriminant power is 76%, with the new groups now being composed of 6, 17 and 27 provinces respectively. To be precise, the discriminant function classifies 85.7% of the provinces that were initially included in the *consolidated* group according to the proliferation of TBFs, 63.2% of the *intermediate* group and 83.3% of the *initial* group.

5.3. Entrepreneurial ecosystems: proliferation of TBFs versus critical territorial resources

Based on the previous results, a combined analysis was carried out from the two classifications obtained from: (1) groups of provinces according to the TBFs developed in those provinces, and (2) groups of provinces according to the critical territorial resources. From this combined analysis, that includes the two sets of variables that define the entrepreneurial ecosystem –i.e., established TBFs and territorial resources– the development stage can be identified, and consequently, the capacity of the ecosystem in attracting new TBFs. Five stages of entrepreneurial ecosystems have been identified in Spain: critical mass, advanced development, intermediate development, sparse development and incipient development (Table 4).

Table 4. Stages of the entrepreneurial ecosystems

Cluster analysis: proliferation of TBFs	Discriminant analysis: critical territorial resources for TBFS	Development of entrepreneurial ecosystems for TBFs	Provinces
Group I	Group 1	Critical Mass	Álava, Barcelona, Guipúzcoa, Madrid, Navarre, Biscay.
Group I	Group 2	Advanced development	Zaragoza.
Group II	Group 2		Burgos, Castellón, Gerona, Guadalajara, Huesca, La Rioja, Lérida, Palencia, Soria, Teruel, Valencia, Valladolid.
Group III	Group 2	Intermediate development	Balearic Islands, Salamanca, Segovia, Tarragona.
Group II	Group 3	Sparse development	Albacete, Asturias, Ciudad Real, Cuenca, Pontevedra, Seville, Toledo.
Grupo III	Grupo 3	Incipient development	Alicante, Almería, Ávila, Badajoz, Cáceres, Cádiz, Cantabria, Córdoba, Granada, Huelva, Jaén, Corunna, Las Palmas, León, Lugo, Málaga, Murcia, Orense, Santa Cruz de Tenerife, Zamora.

The ecosystems developed in the provinces of Álava, Barcelona, Guipúzcoa, Madrid, Navarre and Byscay are to be found in the *critical mass* stage. On account of the high level of TBF proliferation and the critical territorial resources available, these geographical areas are classified in Group I. The combined effect of both assets in the territory will be sufficient to support the sustained growth of the number of TBFs without it being necessary for the development of promotional actions on behalf of the public agents. The ecosystems with an *advanced development* level correspond to territories with an average number TBFs established and a relevant development level of the territorial resources. This group, as well as including Zaragoza, also encompasses twelve of the nineteen provinces initially classified in Group II according to the number TBFs, which likewise take second position after analysing the critical resources present in their territories. In these provinces a great attempt has to be made to reach the critical mass, a task where the efforts of attracting the high technology business ventures have to be even more enhanced, as in this group the mid-technology companies are more dominant, resulting in them being somewhat distanced from the key characteristics and benefits associated with the start-up of TBFs. On the other hand, the ecosystems to be found in the group of intermediate development are those ecosystems that rely on a significant level of critical territorial resources for the development of the TBFs. However, they have only been able to establish a low number of those companies. Four Spanish provinces are to be found in this stage: Balearic Islands, Salamanca, Segovia and Tarragona. As regards these territories, it is worth highlighting the fact that their commitment in the development of some critical territorial resources in order to attract TBFs, has made possible that those successfully established, although few in number, mainly deal with the high-technology sectors, thus establishing a basis for the evolution towards more advanced ecosystems.

In the *sparse development* stage of the entrepreneurial ecosystems, although the provinces are those from group II because of the TBFs established, the discriminant analysis indicates that their critical resources are not very adequate for the stimulation of TBFs. Territories that offer certain benefit for companies operating in mid-technology sectors have been included here, although there are still significant uncertainties in the public administration to encourage and foster the development of those territorial resources needed by those ventures. As a result, the entrepreneurial ecosystem is not sufficiently developed to attract new TBFs and, more notably, nor is it sufficiently developed to attract those that operate in high-technology sectors. Finally, in Spain, entrepreneurial ecosystems in the *incipient development* stage have been identified, where not only the number of established TBFs is limited but also the critical territorial resources necessary. To be precise, twenty Spanish provinces (40%) are located in this inferior level. Thus, this group includes

the Spanish provinces that take on a larger challenge so that they can advance in the development of the ecosystems that give rise to these companies being attracted.

In light of what has been previously stated, the first two hypotheses in the current research paper can be agreed upon. To be precise, the analyses carried out allowed us to confirm, firstly, that in order for the TBFs to develop, the entrepreneurial ecosystems must likewise go through an evolutive process by means of which they are provided with major resources and at the same time are successful in establishing a larger percent of these business ventures (*H1*). Secondly, these results corroborate the fact that each stage in the development of the entrepreneurial ecosystem is characterised by a bundle of human, social, technological, financial and physical resources (*H2*).

Entrepreneurial ecosystems for the TBFs and wealth of the provincial territory

The entrepreneurial ecosystems for the TBFs have been highlighted in literature for their capacity to create a more competitive economic system and consequently for increasing the wealth and prosperity of a geographic area. Taking this into account, the last stage of this research studies the levels of wealth in the different groups of provinces identified in this work. On categorising the 50 Spanish provinces according to the development level of their entrepreneurial ecosystems for TBFs, the analysis shows the existence of statistically significant differences between the levels of wealth in those provinces (Table 5).

Table 5. Entrepreneurial ecosystems for TBFs and provincial wealth

Economic growth	***Kruskal-Wallis* test**							
	Mean rank					X^2	***eta***	eta^2
	Incipient development	**Sparse development**	**Intermediate development**	**Advanced development**	**Critical mass**			
GDP per capita	15.35	13.29	33.50	34.75	47.33	34.976***	0.879	0.773

***$p<0.001$.

To be precise, the provinces with more developed ecosystems, to be found in the *critical mass* stage, have higher levels of wealth. Furthermore, there is a great difference in the GDP per capita of this group compared to the group in the previous stage. Based on these results, the third hypothesis stated in the current research can be confirmed, that is, the greater the development of an entrepreneurial ecosystem for TBFs in a specific territory, the more prosperous that territory becomes.

6. DISCUSSION AND CONCLUSIONS

West and Bamford (2005) theoretically differentiate between the existence of four stages in the development of the entrepreneurial ecosystems for the TBFs: from the basic economy to the critical mass stage. In this work, and recognising the existence of the initial stage characterized by economies dominated by industries that are in no way related to the TBFs, five stages have been identified and each with a different level of creation of TBFs and different territorial resources. That is to say, the ecosystems considered in this study are to be found in the initial, sparse, intermediate, advanced and critical mass development stage, thus identifying four stages of development between the basic economy stage and the critical mass stage, increasing in number those identified by West and Bamford (2005).

The results obtained confirm that in the most developed stage of an ecosystem, the so-called critical mass level, the long-term goal of having a level of entrepreneurial activity that is self-sustaining has been fulfilled in the territory (Ginsberg, Larsen and Lomo, 2001). In Spain, only six provinces can claim to be at this high level of development. For this level of ecosystem development, the entrepreneurial activity self-generates greater advanced and specialised resources, exceeding those provided by the investments of the public agents (West and Bamford, 2005). This is due to the fact that new business ventures and territorial resources –e.g., TBFs, venture capital firms, etc.– see the increased number of technological business enterprises already established as a focal point of attraction for starting-up their own business nearby (Neck et al., 2004). Thus, according to the resource-based View, the current paper explains why the territories with

ecosystems at the critical mass level have a greater capacity for successfully stimulating the development of new TBFs.

The competitive advantage of a territory for luring TBFs not only lies in the resources at hand and the ability to attract new resources, but also how adept one is at being able to sufficiently mobilise the combination of both the available tangible and intangible resources. For example, in the territories at the critical mass stage, a large percentage of the population with a scientific education supports the multitudinous technology parks and agents of innovation systems already set up in those territories. This population represents the great artifices that manage the large venture capital funds available and the numerous investments in innovation giving rise to the start-up of TBFs with innovative products and processes that create quality employment. As a result of being able to successfully mobilise those advanced and specialised territorial resources, those geographical areas benefit from significant competitive advantages that create a greater level of wealth in comparison with the other areas that are not in possession of such a set of resources and/or the capability to mobilise them.

In particular, the critical territorial resources compulsory for the development of entrepreneurial ecosystems for TBFs have been determined in this research. These are mainly intangible resources, for example the educational level of the population (human resources), the social capital (social resources) and the patents (technological resources), classified in order of importance and are followed by the tangible financial resources. In the current study, the physical resources have not been established as critical, a result that is in keeping with West, Bamford and Marsden (2008).

In accordance with the resource-based View, it can likewise be asserted that those assets established as critical represent the competitive advantages of the territories with ecosystems in the critical mass stage. Due to the fact that it is not easy for other territories to acquire, imitate or substitute these advantages, they are idiosyncratic to a specific territory and have a long-term sustainability. To be precise, the advanced specialised nature of most of the critical resources, together with the complexity of the interaction between them, is exactly what protects the ecosystem from the mobility, imitation and substitutability of those resources. For example, it is worth mentioning the multiple interactions between the economic actors and the social networks in the ecosystem, the diverse roles they perform and the synergy produced due to the extension to the growth *spillover* effect between the actors –i.e., interconnections and multidisciplinary knowledge flows that strengthen the creative and innovative capacity.

Even after having analysed the structure and bundle of resources of a model area, the failure of certain public initiatives in the development of entrepreneurial ecosystems can be justified when one takes into consideration the necessity for the adequate bundle of the advanced and specialised intangible resources, their correct mobilisation by means of establishing heterogeneous interaction between them, and the difficulty that their acquisition, imitation and substitutability entails (West and Bamford, 2005). It is thus highly unlikely that the territory with the ecosystem at the critical mass stage is a result of mere political investments undertaken by public agents. An evolutive and gradual process is a fundamental condition for the entrepreneurial ecosystems for TBFs to be successful in their development and accomplish self-sustainability (Neck et al., 2004; West and Bamford, 2005). In view of this, each territory should analyse its existing bundle of resources and, based on them, establish a long-term goal for acquiring new resources or ones that complement the already existing assets and ensure that they have a special appeal for establishing certain type of TBFs. Thus, a territory could only gradually develop its own entrepreneurial ecosystem supported by its idiosyncratic advantages (West, Bamford and Marsden, 2008). With reference to this point, Iammarino and Mccann (2006) state that no linear or deterministic development path can necessarily be established, and for this reason each territory should develop its own growth pattern.

This research suffers from a number of limitations. The first concerns the number of cases, which is limited to 52 territories, allowing only for a non-parametric statistical analysis. Likewise,

the research carried out is based on transversal data for a specific moment in time. Then, future studies could engage in research-that extends to multi-country territorial areas and then the use of more robust statistical analysis methods could be utilised. On account of these studies it would thus be possible to carry out *cross-national* comparisons related to the development stages of the entrepreneurial ecosystems in each country. Furthermore, the development of studies with longitudinal samples is of importance due to the interest associated in the search for the critical territorial resources in each stage of the process.

Finally, it is worth highlighting how usuful this research could prove useful to public agents. First, this study places each Spanish province at their specific stage according to the development level of their entrepreneurial ecosystems for the TBFs, as well as indicating where efforts have to be focussed, always taking into consideration their current position and idiosyncrasies. In this research, what stands out is the fact that 40% of the territories analysed are to be found in the incipient stage and are faced with a significant challenge. Second, the results distinguish numerous relevant resources as a means of attracting TBFs and consequently should be seriously considered by the public agents when establishing their paths of entrepreneurial economic development. Nevertheless, if resource investments are not accompanied by the TBFs being established progressively, highly developed ecosystems will never be attained. In order to attract these technological ventures, the public institutions have to provide economic incentives, such as tax breaks, goverment financing, amongst other promotional actions. On the other hand, due to the fact that a large number of the territorial resources are particularly hard to imitate, commercialise or substitute for other resources on a short-term basis, the public agents must endeavour to focus on fostering the endogenous development of those resources rather than relying on external support. Due to this, the public agents have to be aware of the fact that the results of the investments and efforts carried out are not always obtained in the short term.

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