Fearne, A.; García Alvarez-Coque, JM.; Usach Mercedes, TL.; Garcia, S. (2013). Innovative firms and the urban/rural divide: the case of agro-food system. Management Decision. 51(6):1293-1310. doi:10.1108/MD-12-2011-0482.

INNOVATIVE FIRMS AND THE URBAN/RURAL DIVIDE: THE CASE OF AGRO-FOOD SYSTEM

ANDREW FEARNE [1]
Kent Business School

JOSÉ MARÍA GARCÍA ÁLVAREZ-COQUE[2]
Universitat Politècnica de València

TERESA LÓPEZ-GARCÍA USACH[3]
Fundación IVIFA

MERCEDES SÁNCHEZ GARCÍA[4]
Universidad Pública de Navarra

RESUMEN

This paper analyses the capacity of rural and urban spaces to promote innovation in the agro-food firms. The purpose is to determine if the rural/urban division affects the innovative behaviour of agriculture, food processing and food distribution firms. Business data have been obtained for one thousand firms based in the Valencia region, Spain. Out of them, over three hundred declared to have taken part in R&D&i activities, mainly in partnership with public support institutions. The database supplies data of micro and small enterprises, which have been typically underestimated in the Spanish Survey on Technological Innovation in Enterprises. The database also allows to identifying the main location of agrofood business, and the territory is divided in Local Labour Systems (LLS). LLS were in turn classified as rural or urban according to alternative criteria (OECD, national legislation). A logit model has been used in the analyses. The location of enterprises according to the rural/urban divide does not appear relevant concerning innovation, although businesses orientated to the primary sector seem less innovative. Co-op businesses appear to be more innovative and firms' age also has a positive effect on innovation, which suggests a learning process, in particular for small firms.

PALABRAS CLAVE

Innovation, agro-food firms, Local Labor Systems, rural, urban

[1] Centre for value chain research. Kent Busines School. Kent, United Kingdom. A.Fearne@kent.ac.uk
[2] Departamento de Economía y Ciencias Sociales, Universitat Politècnica de València. Camí de Vera, s/n 46022 Valencia, jmgarcia@upvnet.upv.es
[3] Fundación Instituto Valenciano de Investigación y Formación Agroambiental. Marqués de Dos Aigües, 3,1, Valencia telous@upvnet.upv.es
[4] Universidad Pública de Navarra, Campus de Arrosadia, Pamplona mersan@unavarra.es

1. Introduction

This paper provides an assessment of the capacity of rural regions to support innovative firms in the agri-food industry. Rural areas in industrial economies have recently experiencing deep economic and demographic transformations (Pezzini, 2001; OECD, 2006a). Spain's recent period of growth did not entirely embrace rural areas.

Many small communities suffered severe depopulation, including a progressive demographic ageing, and still lag behind urban areas with regard to the access to public services. Rural areas in Spain continued to experience a decline of the agricultural labour force from more than 20% of total employment in 1975 to less than 5% in 2008 (Atance et al, 2010). Nevertheless, positive signs have emerged in terms of a move towards economic diversification outside the primary sector and the development of manufacturing industrial districts (Boix and Galetto, 2008). Improvements in infrastructure and in the transport network suggest a promising future for many rural communities. Agri-food businesses are playing a role in this transformation, boosted by entrepreneurship and innovation, based on local information and resources. The agri-food industry is showing more resilience in the declining economic climate observed since 2008 than other industries (OECD, 2009). In Spain the agri-food sectors play an important role in the economy, contributing 8.7% of its GDP and more than 13.5% of total employment (FIAB, 2010).

National policy makers have shown a growing interest in the influence of spatial factors on innovation (Europe Innova, 2007). Promoting innovative firms is becoming increasingly important for rural areas in the EU. The recent proposals for reforming the Common Agricultural Policy (European Commission, 2011) consider a new package of rural development measures such as knowledge transfer and cooperation, aimed at promoting resource efficiency, productivity, as well as the low emission, climate-friendly and resilient development of agriculture, forestry and rural areas. This should be achieved through greater cooperation between the agri-food economy and research in order to accelerate technological transfer to agricultural practice.

The study of the innovative behaviour of firms across urban and rural areas requires targeted indicators, including the specific influence of adequately identified labour production systems. The present paper aims at (i) investigating the capacity of rural areas to enhance innovation; and (ii) classifying the type of enterprises that show innovative behaviour. Our focus will be on a sample of firms within the agri-food sector, which have a presence in both rural and urban areas. Once innovative firms are identified, the extent to which the rural/urban division matters in supporting innovation can be assessed.

The analysis was carried out in the Autonomous Community of Valencia, where rural and urban areas are spread out across the whole territory. The OECD classifies economic areas according to their degree of rurality (OECD, 1994). However, most analysis neglects the fact that within one region there is a huge diversity of areas with differentiated influences on innovation behaviour. This paper makes use of the concept of local labour systems (LLS) that will be defined below (Topel, 1986; Pischke and Velling, 1997; Moretti, 2010). LLS were classified in this study according to their degree of rurality. This was defined with criteria consistent to the ones proposed by the OECD.

Innovative agri-food businesses were sampled to investigate their comparative behaviour and performance across rural and urban areas in the Autonomous Community of Valencia. The causes of differences in innovation behaviour and performance of innovative firms can be investigated by using business microdata collected from existing surveys.

Measuring innovation cannot be carried out directly per se. Most studies consider innovation-related indicators, the most popular of those being the R&D intensity. This has been calculated in the literature with the help of industrial surveys such as the Community Innovation Survey based on the Oslo manual for OECD countries (see Hansen and Birkinshaw, 2007; Mohnen et al., 2007 for critical analysis of surveys). Such an approach, represented in Spain by the STIE, (Survey on Technological Innovation in Enterprises, Encuesta sobre innovación en las empresas, INE,) , has the shortcoming that it does not allow the exact location of plants to be identified, which prevents the analysis of spatial considerations. Besides, the STIE does not consider firms smaller than 10 workers, a severe restriction

in a region such as Valencia where there are plenty of micro and small firms. In this paper an alternative approach is followed based on the database built by Lopez-Estornell (2010), which incorporates innovative firms defined by related indicators of business participation in R&D&i projects. This database allows a sample of innovative firms which are spatially located in rural and urban LLS to be built up.

2. The agri-food industry as an innovative sector

The literature classifies the agri-food system as a low R&D intensive sector (Connor and Schiek, 1997; Alfranca et al., 2004; Capitanio et al., 2009), which has also proven to be true in the case of Spain (Garcia and Briz, 2000). The data from the Survey on Technological Innovation in Enterprises indicates low intensity of direct innovation both in the primary sector (sectors 01 to 05, ISIC Rev. 3) and the food industry (sectors 15 and 16, ISIC Rev. 3) in relation to other sectors. At this point two questions arise regarding the generation of technology in the agri-food, a sector that is supposed to be strategic due to its functions of food supply and occupation of territory. The first question is whether the low direct intensity of innovation that is shown in the statistics corresponds as well to a low indirect intensity of innovation in the relationships of agri-food with other sectors. Empirical evidence suggests that inputs from other sectors could represent the main source of R&D incorporation in the agri-food system, like other traditional sectors (Hauknes and Knell, 2009). As Garcia-Martinez and Burns (1999) indicate, national and international suppliers of machinery and equipment contribute considerably to the technological level of the Spanish food and beverages industry. If this were the case the agri-food system would act as an absorber of innovations through the products acquired from sectors that perform direct innovation.

Assuming that technology incorporated in the agri-food sector through acquisition of products from other sectors could be significant, the second question concerns the influence of territory on innovation. This question is especially relevant in the agriculture and agri-food industry because they are considered to be closely linked to the territory. Making use of an input-output framework (Papaconstantinou et al., 1998) García-Alvarez-Coque et al. (2011) investigated the inter-sectoral flows of innovation in the agri-food sector including both agriculture and agri-industry in the Valencia region (see also Alba et al., 2011). They concluded that the weight of inter-sectoral flows in the total innovation effort of the agri-food firms is significant, with marked differences between agriculture and the food industry. In most activities, embodied knowledge in inputs purchased from Spain is greater than embodied knowledge of inputs produced inside the region. However, this analysis does not consider the influence of spatial consideration on business innovation behaviour, in particular how local resources and knowledge can play a role across rural and urban areas.

2.1. Spatial considerations

Michael Porter (2003) distinguishes three broad types of industries, with very different patterns of spatial competition and locational drivers. They are present in the agri-food industry. The first type is local industries. Such industries provide goods and services primarily to the local market, or the region in which the labour force is located. Most of them are in the service sector, which in our sample basically includes local farms and processors that produce for tourism and restaurants. A second type of firm is resource dependent industries, which invest primarily where the needed natural resources are found. This group, which contains most of the agri-food processors, not only serves the local market but also competes with other domestic and international locations. The third type of industries is trading industries that are not resource dependent. Firms in the last group grow beyond the size and the needs of the local market and will not be considered in this paper, as we want to test the influence of spatial considerations and local factors on innovation. Firms in rural economies do not perform better than industries located in the well-communicated urban areas. This also poses the question of the influence of the degree of rurality on innovative firms. In particular, intermediate rural areas, including periurban areas, often offer advantages for local resources as well as access to urban markets. Our sample (see section 3) includes innovative and non-innovative agri-food firms in all types of areas, according to the different classifications of LLS, which affects the type of industry.

A question arises regarding the extent to which innovation can be seen as a local process, based on territorial resources and information (Romanelli and Schoonhoven, 2001). Ideas for innovation are largely related to the immediate environment where enterprises function (Audretsch, 2003; Kalantaridis and Bika, 2006). Firm localization is emerging as a key consideration of the innovation process. This hypothesis falls in lines with the paradigm that spatial externalities play a role on economic performance (Fujita et al., 1999).

Rural areas with innovative firms are able to make use of local resources, based on natural conditions and, at the same time, overcome the challenges of size, distance and access to inputs with embodied technology. Remote rural areas make it difficult for firms to build economies of scale and easy resource supply. Rural locations close to metropolitan areas enjoy better access to services and larger markets. The infrastructure and the transport networks may also affect the knowledge and technological acquisition of agri-food rural firms. Capital markets are also affected by lack of proximity to metropolitan areas, as transaction costs for venture capital access are higher (Henderson, 2002).

Lower skill levels are also a limit on innovation. In most OECD countries the performance of students in the International Student Assessment-PISA (OECD, 2006) shows a significant gap between urban and rural students. Populations in rural areas tend to be older and less well-educated than in metropolitan regions. Likewise, the level of education of rural entrepreneurs is lower than those of their urban counterparts. Rural regions rely on traditional skills with a weak position in skills needed for modern services and the use of advanced technologies. The current business environment in rural regions suffers from weaknesses in the quality of schools, natural amenities, transportation networks, and other infrastructure that make it difficult to attract and retain a workforce with these new skills (OECD, 2009). Hiring human capital from outside the rural areas can be a source of incorporated skills (Webber et al., 2009). However, limited access to public services can hinder the transfer of trained staff.

While there is no general conclusion on the performance of rural areas in the literature on European integration, there is a consensus that the gap with respect to urban areas is widening. However, the picture is complex, as some rural areas in Spain, mainly periurban, are performing considerably well (Regidor, 2008). There appears to be a substantial heterogeneity of economic performance among rural regions. This has been revealed in a number of individual case studies of successful rural regions. Heterogeneity has also led to the development of various classification systems for rural regions that attempt to capture these differences. Such diversity is reflected in the OECD criteria, quoted above, or in the relevant Spanish legislation, illustrated by the LDRS (Law of Sustainable Development of Rural Areas, Ley 45/2007 para el Desarrollo Rural Sostenible del Medio Rural, MAPA 2007), which establishes a typology of rural areas for a better targeting of rural development policies.

Some agri-food industries are the core of local clusters or industrial districts in the Autonomous Community of Valencia, as is the case of food and beverage industry in some local production systems (Boix and Galleto, 2008). The concentration of competing firms in industrial districts stimulates the development of unique pools of specialized skills and the formation or attraction of specialized suppliers (Beccatini et al., 2003). Clusters enhance innovation in three ways. First, they improve productivity because firms have easy access to specialized suppliers, skills, information, training and techniques in a demanding competitive environment. Second, clusters allow firms to perceive opportunities for new products and new processes. Third, clusters lower transaction costs and the barriers to entry of new firms, expertise and credit. Empirical evidence shows that economic performance in rural areas with industrial districts has been better than rural areas without industrial districts. Lopez-Estornell (2010) identifies three industrial districts in the Autonomous Community of Valencia based on food processing (Ybarra et al., 2008 and Boix, 2008). Lopez-Estornell also finds 10 LLS with relatively high specialization in the primary production of agricultural products. These areas may show a local cluster effect, as they provide local resources for agri-food industries.Texto independiente

2.2. Local labour systems and rural economies

The features of an economy cannot be totally understood without taking into account its territorial organization, especially in local systems characterized by many small and medium sized enterprises (Giusti and Grassini, 2007). In the 1990s, the Italian National Statistical Institute (ISTAT) proposed the use of a geographical unit called local labour systems in order to reflect the productive and social structure of a territory, that is, the area in which a group of people lives and works. A LLS is defined as a community of firms and people, a territory, where the productivity and social structure have strong interaction. More precisely, a LLS is an area characterized by internal commuting patterns that produce a self-contained labour market. LLSs are defined using information regarding enterprises and commuters, more precisely data on daily commuting to work contained in the population census. LLSs are delimited using the Sforzi algorithm that can be summarized in two steps: first, agglomeration points (those that attract flows of workers from neighborhoods) are identified. Second, neighboring municipalities from which work flows originate are aggregated to the agglomeration points (Ciccone and Cingano, 2003). Boix and Galetto (2005) used the ISTAT methodology in order to delimit LLSs in Spain using data from the 2001 Spanish population census and data from the DIRCE (Central Directory of Firms, Directorio Central de Empresas) (see also Boix and Galetto, 2008). Spain is divided into 806 LLSs, 83 of them located in the Autonomous Community of Valencia.

Once the LLSs were identified they were classified according to their degree of rurality, which allows for determining possible relations between innovation and rural territories. Two criteria of classification were used in our study. Firstly, the OECD classification for rural and urban territories, this allows for international comparisons. Secondly, the Spanish classification of rural territories included in the LDRS.

The OECD classifies municipalities according to the density of population (OECD, 1994). A municipality is considered urban if the population density is higher than 150 inhabitants per square kilometer. Below that level a community is considered to be rural. Three types of regions are defined: predominantly rural (PR), if more than 50% of the population lives in rural municipalities, intermediate areas (IN), if between 15 and 50% of the population lives in rural municipalities and predominantly urban (PU), less than 15% of the population lives in rural municipalities. Following the OECD criteria there are 40 LLSs that are predominantly urban, 8 intermediate and 35 predominantly rural in the Autonomous Community of Valencia (Table 1).

An alternative classification is given by the LDRS, which establishes the criteria for the classification of Spanish territory based on six main factors: population density, population trends (flows of population and ageing), rate of employment in agriculture, industry and services, income, isolation versus proximity to urban municipalities or high densely populated areas, and location in hilly areas. The law provides a list for each Autonomous Community in Spain where rural municipalities are classified in three categories: periurban, intermediate, and areas “to be revitalized”. Municipalities not included in the list are considered urban. If more than 50% of population in an area lives in periurban municipalities, that area is considered periurban, and so on for intermediate areas and areas “to be revitalized”. Following this classification in the Autonomous Community of Valencia there are 41 urban LLSs, 33 periurban LLSs, 6 intermediate LLSs and 3 LLS “to be revitalized” (Table 1).

TABLE 1
Rural/Urban classification of LLS in the Valencia region according to different criteria

LLS classification according to OECD					
	Predominantly urban	Intermediate		Predominantly rural	Total
Number of LLS	39	8		36	83
Population (% of total)	84%	2%		13%	100%
Surface (% of total)	42%	8%		50%	100%
LLS classification according to LDRS					
	Urban	Periurban	Intermediate	To revitalize	Total

Number of LLS	41	33	6	3	83
Population (% of total)	84,3%	14,3%	1,1%	0,4%	100%
Surface (% of total)	44,5%	39,8%	5,3%	10,4%	100%

Source: Authors' calculations based on Boix and Galetto (2005); OECD (1994), MAPA (2007) and Instituto Nacional de Estadística.

3. Innovative enterprises database

Analysis such as the *EU Regional Innovation Scoreboard* involves the collection and comparison of innovation-related indicators across regions in order to rank them (Hollanders, 2007). More recently, a number of studies have collected indicators that reflect the socio-economic characteristics of the EU regions, including productivity structure, population, education and human resources, R&D expenditure and patent intensity (Navarro *et al*., 2008; Wintjes and Hollanders, 2010; Ajmone-Marsan and Maguire, 2011). The present research makes use of a regional database of innovating enterprises, which allows us to locate firms in local labour systems. This database, developed by Lopez-Estornell (2010), attempts to overcome some of the limitations of the STIE, which the quoted author summarises in three points: (i) the anonymity of official sources does not allow for an identification of the surveyed firms, in particular, their location; (ii) the results of the STIC are more representative of a typical Spanish firm, so it is less relevant for investigating business behaviour at a sub-national levels of analysis; and (iii) no results are reported in the STIE for companies with less than 10 workers, which are predominant in most Autonomous Communities, like the Valencia one.

Thus, instead of resorting to the use of the STIC, use was made of information residing in public archives, mainly reflecting partnership collaboration between scientific and technological institutions and firms. Such an approach has also been taken by studies defining labour local markets (Boix, 2008; Sforzi and Lorenzini, 2002) and conducting benchmarking analysis (Hollanders, 2009) that seek to establish the position and evolution of various national and regional systems of innovation (Braczyk *et al*., 1998).

The database constructed makes it possible to analyse the performance of innovative companies in the local labour systems (see previous section). The database elaborates a directory of innovative enterprises, which fulfil at least one of the following criteria:

- To have been granted public aid to innovation projects by the IMPIVA (Small and Medium Enterprise Institute in Valencia, Instituto de la Pequeña y Mediana Industria de la Generalitat Valenciana) during the period 2000-2006.
- To have been granted public aid to innovation projects by the CDTI (Technological Industry Development Centre, Centro para el Desarrollo Tecnológico Industrial) during the period 2003-2006.
- To have applied for a patent in the OEPM (Spanish Office of Patents and Trademarks, Oficina Española de Patentes y Marcas) during the period 2000-2006.
- To have applied for a utility model in the OEPM during the period 2000-2008.
- To have had a contractual relation with a Valencian public institute during the period 1999-2003 (INGENIO database).
- To have published a scientific journal paper (at least one of the authors should be part of the firm's staff) during the period 1995-2006 (INGENIO database).
- To be member of a technological institute, formed by industry members in the Autonomous Community of Valencia. Data were collected from the 14 technological institutes of Autonomous Community of Valencia.
- To have been a partner of the European Centre of Enterprises and Innovation (CEEI):

- To be a spin-off from the universities or research institutes in Valencia.
- To be classify as CNAEi-73 (R&D services) in the SABI database.

The database constructed for innovative firms contains about 6.000 enterprises, whose data can be crossed with those from the SABI (Iberian System of Balance Sheet Analysis, Sistema de Análisis de Balances Ibéricos) database. This dataset is the Spanish branch of AMADEUS family of databases and is generated by the private firms INFORMA and Bureau Van Dyck. The innovative firms' database containing SABI indicators represents a powerful tool for economic and financial analysis of innovative firms that can be compared with data of other firms.

In our case, the focus was on the innovative firms belonging to agri-food economic branches, which were compared with other firms belonging to the same branches. As for the agri-food branches, they include primary agricultural products (NACE 01) and food processing and drinks (NACE 10, 11). The database was subjected to a thorough checking in order to eliminate repetitions, complete the information available and correct mistakes. This operation led to a database of 247 enterprises in the agri-food branches (see tables 2a and 2b). The sample was classified according to the activity sector (NACE), labour local market (as explained above) and size, according to the number of employees: micro-enterprise and small from 1 to 49 employees; medium from 50 to 250 employees and large enterprise, more than 250 employees. Other basic variables, such as the legal status and age of the enterprise were also taken into account.

For a comparative assessment, a list of agri-food firms not fulfilling any of the aforementioned innovation criteria was collected from the SABI for the year 2006. A first selection contained 2,494 enterprises (see table 2a and 2b, SABI database, August, 2011). The results of the query were carefully checked in order to detect abnormalities such as enterprises classified in the selected NACE but whose activity description was inconsistent or did not show the number of workers registered. Such filtering operations led to a set of "non- innovative" agri-food enterprises in the Autonomous Community of Valencia.

Enterprises' bases were localised by selecting those with their headquarters in the Autonomous Community of Valencia. Those companies with headquarters in another Spanish region were not considered in the sample. This led to a certain loss of information with limited impact on the basis of the results provided by the STIC, which highlights low levels of innovation efforts made in Valencia by these companies. The approach taken in this paper assumes that the values of the financial information of a company based in Valencia were charged in full to the territory of the latter and, in particular, the municipality and local labour market where it is established. We considered that, given the widespread presence of SMEs in Valencia, we could reasonably assume that most of the innovative activity of Valencia based firms is carried out close to their headquarters. This conclusion is also reached by observing that in 2007 only 0.96% of spending on business innovation was made outside the region.

TABLE 2A

Innovative and other firms. Regional distribution according to OECD criterion

Innovative Firms		OECD (%)			Total
		Rural	Intermediate	Urban	
Size	Micro&Small	83,3	83,3	74,9	190
	Medium&large	16,7	16,7	25,1	57
Total		54	6	187	247
Other Firms		OECD (%)			Total
		Rural	Intermediate	Urban	
Size	Micro&Small	97,3	97,6	96,3	2.404
	Medium&large	2,7	2,4	3,7	90

Total	477	84	1.933	2.494

Source: Author's elaboration extracted from Lopez-Estornell database (Lopez-Estornell, 2010) and SABI database.

TABLE 2B
Innovative and other firms. Regional distribution according to LDRS criterion

Innovative Firms		LDRE (%)				Total
		To revitalize	Intermediate	Periurban	Urban	
Size	Micro&Small	100,0	100,0	79,3	75,3	190
	Medium&large	0,0	0,0	20,7	24,7	57
Total		5	2	58	182	247
Other Firms		LDRE (%)				Total
		To revitalize	Intermediate	Periurban	Urban	
Size	Micro&Small	100,0	100,0	97,7	96,0	2.404
	Medium&big	0,0	0,0	2,3	4,0	90
Total		48	55	524	1.867	2.494

Source: Author's elaboration extracted from Lopez-Estornell database (Lopez-Estornell, 2010) and SABI database.

4. Empirical estimation

To determine the probability of a firm being innovative, according to the different characteristics and local situation of the enterprise, alternative Logit Models were developed. The dependent variable takes the value 1 if the firm is classified as innovative, and takes the value 0 if the firm is not considered to be innovative according to the innovation alternatives proposed in the paper.

The independent variables selected can be divided into three types: a) food economic activity sector using two classifications: the first one based on NACE activities classification (agricultural and food processing) and the second one distinguishing between agricultural specialized LLS and food processing industrial district; b) rural classification of LLS using both OECD or LDRS criteria; and c) other firm characteristics such as age and whether it has the legal status of a co-op in the region analysed.

Tables 3 and 4 show the results obtained considering two types of firm according to its size. Table 3 includes the results for the micro and small enterprises and Table 4 presents the values obtained for medium and large firms. Previously some authors have found differences in innovative behaviour depending on the firm's size (Verhees and Meulenberg, 2004; De Noronha et al., 2006; Salavou and Avlonitis, 2008). Two different classifications of local labour systems have been used. Thus Models 1 and 3 select OECD criteria to classify LLSs according to their degree of rurality, and Models 2 and 4 follow the criteria of the LDRS. Models 1 and 2 use the NACE classification to classify enterprises, and Models 3 and 4 employ the concept of district to identify the activity sector (the difference between Models 1 and 2, and Models 3 and 4 is the consideration of local labour system).

The results indicate good levels of reliability in all models. With regard to micro and small firms, the primary sector seems to be less innovative than food processing activities, independently of its measure as NACE or district alternative. None of the models suggest that food processing districts have an influence on the probability of incorporating innovative activities. Additionally, the local labour system has no significant influence on innovative behaviour. Thus it is worth underlining this result in the sense that the spatial situation does not significantly influence the innovative nature of the enterprises in the sample. Finally, firms' age does not affect propensity to innovate and the co-op businesses seem to be more innovative in all models developed.

The results are similar for the medium and large firms (Table 4). Again the condition of agriculture negatively affects the likelihood of an enterprise being innovative. There is no influence of the spatial location of the firm in its innovation character. And the business being a co-op positively affects its innovative behaviour. As in the case of smaller enterprises the firm's age does not affect its innovative impulse.

TABLE 3
Logit models for Micro and Small Firms

Variables	Model 1	Variables	Model 2	Variables	Model 3	Variables	Model 4
Constant	-2.27*** (2.3.57)	Constant	-2.39 *** (17.26)	Constant	-2.79*** (35.5)	Constant	-2.26*** (16.36)
Activity Sector Agriculture	-2.53 *** (92.8)	Activity Sector Agriculture	-2.53 *** (92.54)	Activity Sector District_Agriculture Spec. District_Food Processing	-0.6* (2.98) 0.31 (1.36)	Activity Sector District_Agriculture Spec. District_Food Processing	-0.64 * (2.82) 0.32 (1.47)
Local Labor System OECD_Urban OECD_Rural	0.26 (0.29) 0.18 (0.128)	Local Labor System LDRS_Urban LDRS_Rural LDRS_Intermediate	0.374 (0.416) 0.371 (0.391) -0.61 (0.40)	Local Labor System OECD_Urban OECD_Rural	0.12 (0.06) 0.23 (0.21)	Local Labor System LDRS_Urban LDRS_Periurban LDRS_intermediate	-0.39 (0.5) -0.37 (0.41) -1.25 (1.9)
Other characteristics Firm's age Co-op business	0.001 (0.144) 2.36 *** (98.43)	Other characteristics Firm's age Co-op business	0.001 (0.15) 2.39 *** (100.2)	Other characteristics Firm's age Co-op business	-0.001 (0.96) 1.98*** (92.94)	Other characteristics Firm's age Co-op business	-0.001 (1.01) 1.99*** (94.3)
Number of observations X^2 Log-Likehood R^2 Nagelkerke Correct classification	2393 238.5 *** -1,088.47 0.223 92.1%	Number of observations X^2 Log-Likehood R^2 Nagelkerke Correct classification	2393 240.49 *** -1,086,48 0.225 92.1%	Number of observations X^2 Log-Likehood R^2 Nagelkerke Correct Classification	2392 85.69 *** -1241.58 0.10 92.1%	Number of observations X^2 Log-Likehood R^2 Nagelkerke Correct Classification	2392 87.54*** -1239.43 0.10 92.1%

Note: ***p<0.01; **p<0.05; *p<0.10

TABLE 4
Logit models for Medium and Large Firms

Variables	Model 1	Variables	Model 2	Variables	Model 3	Variables	Model 4
Constant	1.57	Constant	-0.93	Constant	-1.94	Constant	-0.96
	(0.01)		(1.82)		(1.26)		(2)
Activity Sector		Activity Sector		Activity Sector		Activity Sector	
Agriculture	-4.1 ***	Agriculture	-3.62 ***	District_Agriculture Spec.	-2.33*	District_Agriculture Spec.	-2.27 *
	(9.96)		(9,88)		(2.98)		(2.9)
				District_Food Processing	-0.21	District_Food Processing	-0.22
					(0.06)		(0.07)
Labor Local System		Labor Local System		Labor Local System		Labor Local System	
OECD_Urban	-2.1	LDRS_Urban	0.046	OECD_Urban	1.34	LDRS_Urban	0.30
	(0.77)		(0.46)		(0.61)		(0.22)
OECD_Rural	-2.77			OECD_Rural	0.89		
	(1.32)				(0.25)		
Other characteristics		Other characteristics		Other characteristics		Other characteristics	
Firm's age	-0.008	Firm's age	-0.008	Firm's age	-0.01	Firm's age	-0.012
	(0.31)		(0.34)		(0.88)		(0.76)
Co-op business	4.65 ***	Co-op business	4.62 ***	Co-op business	2.64***	Co-op business	3.6 ***
	(17.8)		(18.2)		(27.4)		(27.28)
Number of observations	141	Number of observations	141	Number of observations	141	Number of observations	141
X^2	76 ***	X^2	74.51 ***	X^2	57.88 ***	X^2	57.04 ***
Log-Likehood	-114.26	Log-Likehood	-115.76	Log-Likehood	-132	Log-Likehood	-133.3
R^2 Nagelkerke	0.56	R^2 Nagelkerke	0.554	R^2 Nagelkerke	0.46	R^2 Nagelkerke	0.45
Correct classification	59.6%	Correct classification	59.6%	Correct Classification	59.6%	Correct Classification	59.6%

Source: Own calculation

5. Findings and discussion

There are two general approaches to innovation, and they are often combined (Europe Innova, 2007). One is to promote innovation through enhanced cooperation and exchange between firms (Más-Verdu et al., 2011). The other is to enhance partnership between the business sector and public support services in R&D activities. This is the kind of cooperation captured in the innovative firms database used in the present paper. This criteria for innovation does not reject the fact that many of the firms other than the ones qualified here as innovative are also innovating in many ways. This consideration obliges us to interpret our findings with caution. However, those businesses included in the database can be clearly considered as innovative, as they proved to have activated mechanisms connected to public service delivery and private-public partnership for innovation activities. Moreover, what interests us in our paper is the relationship between location and innovative behaviour, and in particular, whether or not rural areas imply a constraint for innovation. We focused on agri-food firms, which are scattered across rural and urban regions.

As the empirical exercise carried out over one thousand firms in the Autonomous Community of Valencia indicates, innovative behaviour is not particularly restricted in predominantly rural LLSs with respect to intermediate and predominantly urban LLSs. This result does not change whichever criteria are used to classify rural areas (OECD or Spanish LDRS). In this context, in spite of their spatial handicaps, rural areas do not pose a handicap for firms to undertake innovative actions. Rural businesses were found to be as innovative as their urban counterparts. This is also consistent with results of qualitative surveys of rural economic performance (Courtney et al, 2004) that show that peripherality is not perceived to be a significant constraint on economic performance by individual entrepreneurs. The quoted study clarifies that knowledge and skills were important factors in determining rural area economic performance, but, significantly, this influence had less to do with the skills of the resident rural population and is more concerned with the ability of an area to attract knowledge and skills into the area. Acquisition of knowledge and skills for highly innovative firms seems to be possible in the Autonomous Community of Valencia, where transport and knowledge networks facilitate their attraction to rural areas and commuting to a city with population of over 50,000 inhabitants does not take more than 45 minutes.

This does not mean that low educational levels of residents have no influence on innovation. This can be the case of those businesses sourced more from local resources, such as agriculture, which seemed to be less innovative. Agricultural firms can be considered supply-dominated businesses, which have been associated with low technological intensities and lower rates of entrepreneurship (Alba et al., 2011).

In fact, rural development in Spain has been found to be associated with an increasing diversification of rural economies, marked by an increase in employment in manufacturing and services, and the progressive decline of employment in the agricultural sector (OECD, 2009). This is consistent with the negative influence of the primary sector on the presence of innovative firms found in our previous tests. Results support the argument that there is no exact correspondence between rural development and agricultural sector development, as the first can lead to innovative processes not directly linked to primary activities. This puts the subsidy-based agricultural policy approach in doubt given that it has not proved to be very effective in promoting innovative firms. The positive role of food processing is also consistent with the results of previous studies, which characterise the food manufacturing as an industry with relatively high technological intensities in the Autonomous Community of Valencia (Garcia-Alvarez-Coque et al, 2011).

The presence of innovative firms is significant in co-ops. This supports findings in rural economics literature showing the potential of co-ops for organizational advantages with respect to investment and innovation activity (Giannakas and Fulton, 2005). Co-ops can have a tendency to take part in the kind of private-public partnerships that define an enterprise as innovative according to the Lopez-Estornell criteria. This can also be the case for micro-small enterprises where younger firms don’t show a particularly significant innovative behaviour. New firm creation is not necessarily connected with

innovation, as there might appear a learning process that leads to the private-public collaboration for implementing innovations.

A question of increasing relevance for regional analysis and regional policy in this regard is the identification of the factors (locational or other) that determine the spatial distribution of innovative firms for regional development. There are some other variables with effects on the innovation process that will be the focus of future research, such as access to capital (bank financing, savings), past growth (and/or expected future growth), intangible assets, among others. This comprehensive analysis is beyond the scope of this paper. It would also help to test the hypothesis that innovation can emerge not only in core but also in peripheral areas if the basic elements of synergetic regional interaction networks exist. Our study supports that vision, and results are robust for various firm sizes, reflecting the fact that innovative behaviour is also observed in micro and small firms. As for the spatial considerations related to the degree of rurality, they do not seem to be a constraint, apart from the impact of primary activities and the social and political aspects related to.

Open innovation and other collaborative strategies can be used by agri-food firms to innovate. These strategies are suitable for a sector where SMEs are predominant (Weaver, 2008, Dahlander and Gann, 2010, Acosta et al., 2011) and because of its structure in food value chains (Künhe et al., 2010).

6. Conclusions

The present paper has investigated some spatial and internal characteristics of firms that display innovative behaviour. A database was constructed for the Autonomous Community of Valencia including enterprises that undertook partnership and collaboration with public institutions linked to R&D&i activities. The added value of the database used in this paper is the possibility to take into account spatial considerations, and the rural/urban division could be controlled to test its influence on the innovative character of agri-food firms. The empirical analysis allowed for investigation of the differential characteristics of a sample of 247 innovative firms within an overall sample of over two thousand enterprises. A Logit test confirmed the argument that agri-food processors display more innovative behaviour than primary producers. These results apply to both groups of studied enterprises (micro-small and medium-large). Innovation appears to be strengthened in co-ops, which seem to be more willing to collaborate with public support services. As suggested by Alba et al (2011) age and new firm creation are not necessarily linked to innovation behaviour in supply based traditional sectors. What is more, such findings do not depend on spatial considerations and rurality does not seem to be per se a handicap for innovative firms, independently of the criteria used to measure rurality (OECD, LDRS).

This finding supports the approach of EU rural development policies in favour of promoting the economic diversification of rural areas and seems to confirm the effectiveness of such approach. It could also support the CAP measures to encourage efficiency of producer organisations due to its positive impact on innovation. Our study finds evidences that innovation is possible in rural areas, and that targeted policies enhancing innovation in the agri-food sector are still needed, in particular to remove existing constraints in the primary sector.

This research is not free of limitations, which open the gate to future research. First, the available database would permit to a deeper classification of businesses according to their innovative behaviour, as enterprises could be ranked according the number of criteria of partnership with R&D services fulfilled. Consequently, the analysis could be improved by classifying firms according to their degree of innovation. Second, local labour systems are classified by a number of variables, such as proximity to technological centres, training institutions, levels of education, etc. Thus innovative behaviour could be related to territorial variables, beyond the rural/urban classification. Finally, different measures of productivity can be obtained in the SABI database, making easy the association between productivity, innovation and local systems' variables.

Referencias bibliográficas

Acosta, M., Coronado, D., Toribio, M.R. (2011),"The use of scientific knowledge by Spanish agrofood firms". Food Policy, 36, 507-516.

Ajmone Marsan, G. and Maguire, K. (2011), "Categorization of OECD Regions Using Innovation-Related Variables", OECD Regional Development Working Papers, 2011/03, OECD Publishing.

Alba, M., Mas F., García-Alvarez-Coque, J.M. (2011), "New firm creation and innovation: industrial patterns and inter-sectoral linkages", International Entrepreneurship and Management Journal (DOI 10.1007/s11365-011-0210-3).

Alfranca, O., Rama, R., von Tunzelmann, N. (2004), "Innovation spells in the multinational agri-food sector". Technovation, Vol. 24, pp. 599-614.

Atance, I. García Corral, A., Martínez Jávega, M.T., Pujol, R., Urruela, J. (2010), "La población rural en España: un enfoque a escala municipal", Economía Agraria y Recursos Naturales, Vol. 10 No. 1, pp. 35-57.

Audretsch D. B. (2003), "Innovation and spatial externalities", International Regional Science Review Vol. 26, pp. 167-174.

Becattini, G., Bellandi, M., dei Ottati, G. and Sforzi, F. (2003), "From Industrial Districts to Local development. An Itinerary of Research", Chetelham, Elward Elgar.

Boix, R. (2008), "Los distritos industriales en la Europa Mediterránea. Los mapas de Italia y España", Mediterráneo Económico nº 13, Almería, Cajamar.

Boix, R. and Galletto, V. (2005), "Identificación de sistemas locales de trabajo y distritos industriales en España". Dirección General de Política de la Pequeña y Mediana Empresa.

Boix, R. and Galletto, V. (2008), "Marshallian Industrial districts in Spain", Scienze Regionali, Vol. 7 No. 3, pp. 29-52.

Braczyk, H.J., Cooke, P. and Heidereich, M. (1998), Regional Innovation Systems. The

Role of Governances in a Globalized World. London: UCL Press.

Capitanio, F., Coppola, A. and Pascucci, S. (2009), "Indications for drivers of innovation in the food sector". British Food Journal, Vol. 111 No.8, pp. 820-838.

Ciccone, A. and Cingano, F. (2003), "Skills and clusters", in Bröcker, J.; Dohse, D.; Soltwedel, R. (Ed). Innovation clusters and interregional competition. Springer.

Connor, J. and Schiek, W. (1997), Food processing: an industrial powerhouse in transition, 2nd ed. John Wiley & Sons, NY.

Courtney, P., Agarwal, S., Errington, A., Moseley, M. and Rahman, S. (2004) Determinants of Relative Economic Performance of Rural Areas. Final Research Report prepared for DEFRA, July, University of Plymouth and Countryside and Community Research Unit, Cheltenham.

Dahlander, L. and Gann, D.L. (2010), "How open is innovation?", Research Policy, Vol. 39 No. 6, pp. 699-709.

De Noronha, T., Morgan, E.J. and Nijkamp, P. (2006). The new European rurality: strategies for small firms. Ashgate. Aldershot. England.

Europe Innova (2007), "Innovation Clusters in Europe. A Statistical Analysis and Overview of Current Policy Support", PRO INNO Europe paper N° 5 DG Enterprise and Industry report.

European Commission (2011), "Proposal for a Regulation of the European Parliament and of the Council on Support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD)", Brussels, 19.10.2011 COM(2011) 627 final/2.

FIAB (2010) Available at http://www.fiab.es/es/industria/industria.asp (accessed 14 November 2011).

Fujita, M, Krugman, P. and Venables, A. (1999), The Spatial Economy: Cities, Regions and International Trade, MIT Press, Cambridge, MA.

García-Alvarez-Coque, J.M., Alba, M and López-García Usach, T. (2011) "Innovation and sectoral linkages in the agri-food system in the Valencian Community", Spanish Journal of Agricultural Research (forthcoming).

Garcia-Martinez, M. and Briz, J. (2000), "Innovation in the Spanish food and drink industry", International Food Agribusiness Management Review Vol. 3 No. 2, pp. 155-176.

Garcia-Martinez, M. and Burns, J. (1999), "Sources of technological development in the Spanish food and drink industry. A supplier-dominant industry", Agribusiness Vol. 15 No. 4, pp. 431-448.

Giannakas, K. and Fulton. M. (2005), "Process Innovation Activity in a Mixed Oligopoly: The Role of Cooperatives", American Journal of Agricultural Economics Vol. 87, pp. 406-422.

Giusti, A. and Grassini, L. (2007), "Local labor systems and agricultural activities: The case of Tuscany", International Advances in Economic Research, Vol. 13 No.4, pp. 475-487. doi:10.1007/s11294-007-9112-0

Hansen, M. and Birkinshaw, J.M. (2007), "The Innovation Value Chain", Harvard Business Review, Vol. 85 No. 6, pp. 121-131.

Hauknes, J. and Knell, M. (2009), “Embodied knowledge and sectoral linkages: An input-output approach to the interaction of high- and low-tech industries”, Research Policy Vol. 38, pp. 459-469.

Henderson, J. (2002) “Building Rural Economy with High-Growth Entrepreneurs”, Economic Review, Federal Reserve Bank of Kansas City, December 2002, pp. 45-70.

Hollanders, H. (2007), European Regional Innovation Scoreboard (2006 RIS) Maastricht Economic Research Institute of Innovation and Technology, Maastricht, The Netherlands.

Hollanders, H. (2009), “Measuring innovation: the European Innovation Scoreboard”, in Villalba E. (Ed.), Measuring Creativity, Proceedings from the conference, 'Can creativity be measured?', Luxembourg: Publications Office of the European Union.

INE (several years) Encuesta sobre innovación de las empresas. Instituto Nacional de Estadísticas, Madrid.

Kalantaridis, Ch. and Bika, Z. (2006), “Local embeddedness and rural entrepreneurship: case-study evidence from Cumbria, England”, Environment and Planning, Vol. 38, pp.1561-1579.

Künhe, B., Vanhonacker, F., Gellynck, X. and Verbeke, W. (2010), ”Innovation in traditional food products in Europe: Do sector innovation activities match consumers’acceptance?”, Food Quality and Preference, Vol. 21 No. 6, pp, 629-638.

López-Estornell, M. (2010), Empresa Innovadora, Conocimiento y Distrito industrial, Ph. D. Dissertation; Universitat Politècnica de València.

MAPA (2007) Ley 45/2007 para el Desarrollo Rural Sostenible del Medio Rural (Law on Sustainable Development of Rural Areas), Ministerio de Agricultura, Pesca y Alimentación, 13 December 2007, Madrid. Programa de Desarrollo Rural Sostenible (2010-2014). Aplicación Ley 45/2014

Más-Verdú, F., Wensley, A., Alba, M. and García Álvarez-Coque, J.M. (2011), “How much does KIBS contribute to the generation and diffusion of innovation?”, Service Business, Vol. 5 No 3, pp. 195-212.

Mohnen, P.; Mairesse, J.and Dagenais, M. (2007), “ Innovativity: A comparison across seven European countries”, Economics of Innovation and New Technologies, Vol. 15 No. 4/5, pp. 391-413.

Moretti, E. (2010) “Local Labor Markets, Handbook of Labor Economics”, Handbooks in Economics, Elsevier B.V Chapter 14. Vol. 4, Part B, pp. 1237-1313.

Navarro, M., Gibaja, J.J., Aguado, R. and Bilbao, B. (2008), “Pattern of Innovation in the EU-25 Regions: a Typology and Policy Recommendations”, Orkestra Working Papers Series in Territorial Competitiveness, Number 2008-04, Deusto Foundation, Donostia/San Sebastian.

OECD (1994) Creating Rural Indicators for Shaping Territorial Policies, OECD Publishing, Paris.

OECD (2006a) OECD Rural Policy Reviews: The New Rural Paradigm: Policies and Governance, OECD Publishing, Paris.

OECD (2006b) OECD PISA evaluation 2006, OECD Publishing, Paris.

OECD (2009) OECD Rural Policy Reviews: Spain, OECD Publishing, Paris.

Papaconstantinou, G., Sakurai, N.and Wyckoff, A. (1998) “Domestic and international product embodied R&D diffusion”, Research Policy Vol. 27, pp. 301-314.

Pezzini, M. (2001) “Rural Policy Lessons from OECD Countries”, International Regional Science Review, January 2001, Vol. 24 No. 1, 134-145.

Pischke, J.S. and Velling, J. (1997) "Employment Effects Of Immigration To Germany: An Analysis Based On Local Labor Markets," The Review of Economics and Statistics, Vol. 79 No. 4, pp. 594-604.

Porter, M.E. (2003) “The Economic Performance of Regions”, Regional Studies, Vol. 37, pp. 549-578.

Regidor, J. (2008): Desarrollo Rural Sostenible: un Nuevo desafío, Ministerio de Medio Ambiente, Medio Rural y Marino, Mundiprensa, Madrid.

Romanelli, E. and Schoonhoven, B. (Eds) (2001) “The local origins of new firms", in The Entrepreneurship Dynamic: Origins of Entrepreneurship and the Evolution of Industries, Stanford University Press, Stanford, pp. 40-67.

Salavou, H. and Avlonitis, G. (2008). “Product innovativeness and performance: a focus on SMEs”, Management Decision, Vol. 46 No. 7, pp. 969-985.

Sforzi, F. and Lorenzini, F. (2002), I distretti industriali; en VVAA: L’esperienza Italiana dei Distretti Industriali. Istituto per la Promozione Industriale (IPI).

Topel, R. H. (1986) "Local Labor Markets," Journal of Political Economy, Vol. 94, No. 3, pp. 111-43.

Ybarra Pérez, J. A., Santa María Beneyto, M. J., Giner Pérez, J. M.and Fuster Olivares, A. (2008): Mapa de áreas de cambio e innovación en la Comunidad Valenciana, San Vicente (Alicante), Universidad de Alicante.

Verhees, R.J.H.M. and Meulenberg, M.T.G. (2004), "Market orientation, innovativeness, product innovation and performance in small firms", Journal of Small Business Management, Vol. 42 No. 2, pp. 134-154.

Weaver, R.D. (2008), "Collaborative pull innovation: origins and adoption in the new economy", Agribusiness, Vol. 24 No 3, pp. 388-402.

Webber, D., Curry, N. and Plumridge, A. (2009), "Business Productivity and Area Productivity in Rural England", Regional Studies, Vol. 43, pp.661-675.

Wintjes, R. and Hollanders, H. (2010), "The Regional Impact of Technological Change in 2020", Report to the European Commission, Directorate General for Regional Policy, on behalf of the network for European Techno-Economic Policy Support (ETEPS AISBL)

http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/2010_technological_change.pdf

[i] National Classification of Economic Activities