This is an Accepted Manuscript of an article published by Taylor & Francis in *Studies in Continuing Education* on 2018 (2017 first online), vol. 40, issue 4, p. 46-61, available at: https://doi.org/10.1080/0158037X.2017.1343239

Between vocational education and training centres and companies: study of their relations under the regional innovation system approach

Joan Rodríguez-Soler (Corresponding Author)

Centre d'Estudis Sociològics sobre la Vida Quotidiana i el Treball (QUIT), Institut d'Estudis del Treball (IET), Universitat Autònoma de Barcelona, Bellaterra (Cerdanyola del Vallès), Spain

Campus UAB, Av. de l'Eix Central-Edifici B, 08193 Cerdanyola del Vallès (Spain)

Tel (0034) 935813832 Email: joan.rodriguez.soler@uab.cat (corresponding author)

Ignasi Brunet Icart

Grup de recerca Anàlisi Social i Organitzativa, Universitat Rovira i Virgili, Tarragone, Spain

Campus Catalunya, D76, Av. Catalunya, 35, 43002 Tarragone (Spain)

Tel (0034) 977558376 Email: ignasi.brunet@urv.cat

Between vocational education and training centres and companies: study of their relations under the regional innovation system approach

In the current context of economic crisis, the European Union seeks to promote the integration of the vocational education and training system (VET) system and a greater cooperation between this system and enterprises. Education and innovation are part of the answer to achieve this goal. This research asks how the relationship between the VET centres and small and medium-sized enterprises (SMEs) is, and what aspects of that relationship could be improved. Methodologically, it combines the study of cases of VET centres in relation to local SMEs and the exploitation of a survey to SMEs in two industrialized Spanish regions. This aim, under the regional innovation system approach, makes it possible to study how the local environment and the characteristics of local actors are crucial to understanding the level of interaction between the VET system and companies, and the contributions of the former to the innovation system of the regions.

Keywords: vocational education and training, innovation, school business relationship

Introduction

The literature on innovation systems often defines innovation as the result of interaction between actors and factors that may be internal or external to companies in an institutional and cultural environment. These factors include: company relations and internal processes; relations with clients, suppliers and Research and Development (R&D) agents; public policies; the education and training system; the labour relations system; and the financial system (Sharif 2006). Several authors have stressed the importance of the region on the innovation processes of small and medium-sized enterprises (SMEs) in questions such as the knowledge exchange between companies and external agents and the interactive learning (Asheim and Coenen 2005; Kauffmann and Tödtling 2003). These innovation processes take place within an institutional and

cultural environment that comprises the above factors pointed. In other words, the result is a specific model that depends, in part, of the nearest environment (Hillier and Figgis 2011). The regional innovation system (RIS) approach pays attention to this relation between the innovation processes and the contribution of the environment (Asheim and Gertler 2005),

From the RIS approach, the studies of the innovation processes of the SMEs have focused on aspects such as cooperation with clients and suppliers and relationships with R&D agents (Asheim and Coenen 2005; Fritsch 2001). These studies have shown the importance of interactive learning processes with few clients and suppliers and the difficulties involved in relationships with R&D agents such as technology centres and universities. On the other hand, the internal learning processes of SMEs and the relations between these companies and education and training agents have received much less attention. However, the potential role of vocational education and training (VET) centres in regional development has been recognized in more recent studies (Curtain 2004; Moodie 2006; Velluzi 2010). In this sense, the VET system can become an important system that can support and promote the innovation system of regions (CEDEFOP 2009; OECD 2011; Rosenfeld 1998). This discussion is related to several approaches that emphasize the interaction between the business and other external agents with regard to their innovation processes (Chesbrough 2003a; Jensen et al. 2007).

This paper shows the relations between VET centres and companies in order to achieve a greater comprehension of this phenomenon. In Spain there is a long-term gap between the VET system and companies, especially SMEs. This gap contains issues as the mismatches between the educational offer of VET system and the requirements of competences and qualifications from companies, or the need to achieve an effective and

integrated system of orientation and information for Spanish VET (including educational training and labour training) (CES 2009; Homs 2008). Recent reforms of the Spanish VET allow VET centres to develop new functions beyond traditional formal education that can generate new relationships between both systems. The first function is conducting courses of continuing training. The second function is conducting and undertaking innovation and development projects in conjunction with companies[1]. This paper presents a comparative study of these new relations in two Spanish regions (Aragon, and Catalonia) with different degrees of implementation of these new functions of VET centres. The results highlight the difficulties of Spanish VET centres to consolidate these new functions. But, from this analysis we can identify several factors which can improve these relationships. So, this recent scenario can become an opportunity to study the mechanisms of interaction between companies and VET centres beyond the field of traditional formal education.

In Section 1 some theoretical background is discussed, with a special mention to the Spanish VET system and its integration's attempts. In Section 2 the methods and the data are presented. The results are developed in section 3. Finally, this paper presents some concluding remarks that try to contribute to the theoretical debates proposed.

Vocational training, innovation and regional environment

The innovation systems perspective has extended the concept of innovation to include organisational, institutional and cultural aspects (Kauffmann and Tödtling 2003). The

[1] These joint projects are demands of companies to VET centres (under a commercial relation) in order to achieve technical assistance to develop a new product: a mechanical piece, a new fabric, and so on. In this way, VET centres become an external agent of innovation such as technology centres.

interactive model and the literature on RIS have stressed the importance of interaction between a company's internal and external agents (Asheim and Coenen 2005). In this sense, several systems or actors can contribute to the innovation system of a region. Thus, VET centres (as an actor of the VET system of a region) can become an agent that support and promote this innovation system. In this paper, innovation is conceived in a broad meaning. It contains a heterogeneous set of strategies than companies use to improve their business performance. Therefore, innovation can be considered a business strategy to create or improve a new product, an improvement of a business process (the opening of new channels or market relations, the implementation of a new work organisation, a new R&D strategy, etc.). In brief, innovation can be conceived as a dynamic process of learning and implementation of novelties in the companies that allow them to do a better business performance. But, innovation can be developed in several ways. Here, we should recover the contribution of Chesbrough (2003a) about the dichotomy between the closed innovation model and the open innovation model. Chesbrough highlights the benefits of the last model, which lets a set of interactions between the company and different external agents to improve the innovation strategies of companies. In this sense, several authors have identified two modes of innovation: the STI (Science, Technology and Innovation) mode and the DUI or interactive (Doing, Using, Interacting) mode (Jensen et al. 2007). While the STI mode is related to large companies, high-technology sectors and a formal view of innovation, the DUI mode stresses informal and multi-directional bottom-up learning and knowledge-flow processes. Moreover, the interactive mode favours learning and innovation processes of SMEs, often under the form of a network (Kallio and Lappalainen 2015). These local agglomerations have important effects in the interactive dynamics of companies, promoting face-to-face contacts and mutual confidence in business relationships (Scott

and Storper 2003).

Under this interactive and multi-actor approach, several studies have highlighted the important of VET agents for the innovation system of a region (CEDEFOP 2009; Curtain, 2004; Lundvall 2002; Moodie 2006). The ways that VET centres can contribute to this innovation system are diverse. Rosenfeld (1998) suggested that VET centres were better placed than universities to connect to SMEs in order to support this innovation system. Rosenfeld proposed an interesting taxonomy for the missions of these VET centres that ranged from formal education for improving workers' competences and training processes to helping SMEs introduce technology, innovation and inter-company cooperation. This and others studies stress the importance of the role that VET centres can play in innovation systems both locally and regionally (CEDEFOP 2009; OECD 2011). These characteristics are in line with the functions of the Integrated VET Centres (*Centros integrados de FP*) that have been formulated in Spain in the last decade by the Spanish Royal Decree 1558/2005, which regulates the new functions or roles of these centres. These new functions can allow VET centres to better support and promote the innovation system of a region.

The path of the integration into the Spanish VET system

The reform of the Spanish VET system, which began in the 1990s, has gone only a short way to solving problems such as the low level of non-baccalaureate post-compulsory secondary education qualifications, the inadequate connection between vocational education and training and the requirements of industrial companies, the lack of both a national qualifications system and a system for recognising competences, the lack of coordination between the VET system and the workers' training system, and the problems of governance between national and regional authorities (CES 2009; Homs 2008; OECD 2009).

In 1990, the Statutory Act 1/1990 on General Organisation of the Educational System (LOGSE) introduces workplace training programmes in the curriculum. Therefore, learning in the workplace becomes a formal requisite for graduation. According to data of the Ministry of Education, Culture and Sports, Spanish VET has increased in the last decades. Since 2000 the number of VET students has increased in a 45.9%. Nevertheless, the integration of Spanish VET has not been developed at the same level. The current Spanish VET system is developed from the Law 5/2002 of Qualifications and VET[2]. In following laws the Spanish VET system has been expanded, trying to integrate the different subsystems of education and training and providing new functions to VET centres. The subsystems of the Spanish VET are composed by the educational subsystem, characterised by the initial education and training (full-time school-based), and by the labour subsystem, characterised by the occupational training and the continuing training (supply-driven training and demand-driven training). The first one is developed by VET centres. Occupational training is addressed to unemployed, meanwhile continuing training programmes are addressed to employees who want to improve their skills or acquire new skills for retraining. Both programmes are traditionally developed by social partners, and private or public training institutions (private training centres, training services of town councils, etc.). Within the continuing training, there is also the demand-driven training, which is traditionally developed by the own companies or by training agents contracted by companies.

---

[2] In recent years, there have been different general education laws that have modified the educational policy framework in Spain (i.e. LOE in 2006 and LOMCE in 2015).

The Spanish Royal Decree 1558/2005, which regulates the basic requirements of integrated VET centres, describes some of these new functions or roles, already proposed by Rosenfeld (1998). One of these new roles is conducting continuing training and conducting innovation and development projects. Points 1.a) and 2.b) of Article 6 describe these functions:

> To teach courses leading to vocational training qualifications and vocational certificates from the professional family or area that they are authorised for, and other courses that respond to the demands of people and production. (Article 6, Point 1.a, RD 1558/2005, p.43143)

> To drive and undertake innovation and development projects in conjunction with local firms and social interlocutors, and transfer the content and evaluation of the experiences to other centres. (Article 6, Point 2.b, RD 1558/2005, p.43143)

However, there is still a significant distance between the VET system and industrial sector. Continuing training is mainly managed by social partners. On the other hand, for their innovation projects, Spanish SMEs usually contact suppliers or technology centres when they need to innovate, rather than VET centres (Lavia et al. 2011). Nevertheless, VET centres can become an important agent to improve human resources and to contribute on some of these innovation's processes in industrial SMEs. We wonder if the VET system can approach to SMEs with regard to these new functions.

Several institutions recommend the need to connect the VET system with the business, regarding to the content of VET studies (i.e. curricula, students competences, etc.) (CEDEFOP 2011; OECD 2011). But also it is so important to focus on the relationship between both systems, beyond the curricula aspects. This kind of relationship can be the provision of continuing training to employees of SMEs and the collaboration in innovation and development projects. A greater understanding of this

issue may allow the design of policies that seek to promote and strengthen these relationships.

Methods

For this research quantitative and qualitative methods were been combined in two Spanish regions. The first method was based on a survey to a sample of SMEs and the second method was based on the case-study method. The selected regions have a high level of industrial activity and a high percentage of VET students, above the Spanish average. The innovation systems of these regions are also worth mentioning, whether for their level of institutionalisation (as in Catalonia) or their potential level of development (as in Aragon) (Table 1). Catalonia is a region with a loss of prominence of industry, but with a VET system with a high tradition of experimental projects on VET's integration with other actors, especially on some regions (Brunet and Rodríguez 2013). Aragon is a typical region of industrial tradition with a recent VET and innovation system but with possibilities to growth (Brunet, Rodríguez, and Puyal 2013). Buesa et al. (2002) define Catalonia as a region of first order, with a highly developed innovation system while Aragon, as a region of second order, has a lower investment in R&D, but with a recent network of R&D agents with a great potential of cooperation, especially between companies and public research institutions. The literature of RIS defines the Catalan innovation system as a locally embedded grassroots system, although for certain emerging sectors located in the metropolis of Barcelona the innovation system is characterised as a regionally networked system (Ahedo 2012).

Place Table 1 about here

In the qualitative phase, we used a case-study method defined by a VET centre, collaborating companies and graduates' VET centre in each case based on semi-structured interviews. These VET centres are singular cases that they have identified in

a previous exploratory phase (cases of good practices in closer relations between the VET system and companies). They were selected because of their importance within each region's VET system in relation of the object of the research: level of collaboration with the local companies, existence of actions beyond traditional formal training (i.e. continuing training, innovation projects), etc. Another difference between both regions must be reported: in Aragon, the studied cases are relatively near to the capital of the region (in fact, some of them are in the capital), while in Catalonia the selected cases are quite far to the dynamics of metropolitan area of Barcelona. Therefore, we can evaluate the role of the environment and the relations in it. The total number of cases is six: three cases by region. For both regions, a total of 30 interviews were carried out between November 2012 and September 2013. The questionnaire comprised questions on level of collaboration between actors (VET centres and companies), provision or use of resources (depending of interviewee's profile), level of innovation of companies, etc. The profile of interviewees was different between VET centres and companies. In the case of VET centres, the profiles were directors, centre-firm coordinators, workplace training or apprenticeship instructors and graduates. In the case of companies, the profiles were CEOs or Human Resources Managers and workplace training instructors. In the quantitative phase, we carried out a computer-assisted telephone survey to industrial companies (CNAE2009[3] 05 to 39) of 10 to 250 workers using stratified random sampling by company size. In total, we conducted 734 surveys, 423 of which were conducted in Catalonia and 311 in Aragon. In both cases, the maximum margin of error was assumed to be 5%, calculated under random assumption, CL95% and p=q. In both regions, the interviews were divided into four categories according to the number

[3] National Classification of Economic Activities from Spanish Statistical Office, according to the NACE Rev.2.

of employees in each company: in Aragon the distribution was proportional to the universe of study but in Catalonia it was non-proportional. In each stratum the companies were selected randomly from the SABI database[4]. The questionnaire comprised 98 questions on general company information; production activities; presence of VET employees; kind of innovation activities, like innovation of products, innovation of processes, improvements in production processes, problem-solving teams (for technical details of sample see Table 2); the relation between employees with VET qualifications and these innovation activities; and VET evaluation from companies. This field work was conducted between 4 December 2013 and 22 January 2014, by a CATI company, and the persons interviewed in the telephone survey were CEOs or Human Resources Managers.

Place Table 2 about here

Vocational education and training system and industrial SMEs: results

Our research analysed the following relationships between VET centres and companies: (i) workplace training programmes (for VET students), (ii) continuing training (for employees), and (iii) the collaboration in innovation projects (for companies). Below we discuss these relationships: firstly the more recent and less consolidated relationships (i.e. continuing training and innovation projects) and then the workplace training programmes as a more traditional and consolidated relationship between VET centres and firms. The aim of this analyse is to show a short overview of the difficulties of VET centres to progress in their relations with companies. But, in addition to these obstacles, we find some factors that can improve these relationships.

---

[4] *Sistema de Análisis de Balances de la Península Ibérica* (Balance Analysis System of the Iberian Peninsula), database with 2.000.000 Spanish and 500.000 Portuguese companies.

Over the last four years workplace training programmes have been the main point of contact between VET centres and firms in both regions (Table 3) (44.7% and 46.6% in Catalonia and Aragon, respectively). Three out of every ten firms have used VET centre job banks to employ staff (30% and 27.8%). New functions as continuing training programmes or the implementation of joint innovation projects are less used by firms. Continuing training (supply-driven and demand-driven) is of little importance, particularly in the case of demand-driven training in Aragon (13.3%). Likewise, neither region is very involved in the implementation of joint innovation projects between VET centres and companies (12.4% in Catalonia and 12.5% in Aragon). This 'picture' shows a low level of relations between SMEs with VET centres. But, can we see any differences within these relations? Or, in other words, which factors can increase this low level of contacts?

Place Table 3 about here

The 'saturated' and rigid market of continuing training

In many Spanish regions, continuing training is a novel opportunity for VET centres, which have been able to provide this training since the introduction of Royal Decree 1558/2005. VET centres have now modified how they operate and how they establish contacts with local companies, seeking to provide training courses for both supply and demand. However, data on continuing training are still low: Table 3 shows that in both regions fewer than 20% of companies receive continuing training from VET centres. It seems that SMEs do not tend to contact VET centres for doing continuing training to their employees.

In both regions, the relations also depend on the size of the firm and its capacity for innovation (Table 4), although not in the same way as for the workplace training programmes as discussed below. In neither case is a positive relation observed between

firm size and greater continuing training. Rather, in both regions there are certain types of firms that do more training than others. This is the case of firms with 150-250 employees and the firms with 50-74 employees in both regions. On the other hand a positive relation is observed between capacity for innovation and greater training. More innovative firms do more continuing training than non-innovative firms[5].

Place Table 4 about here

Several factors emerged from the interviews to explain these data. Firstly, in some VET centres such training initiatives were new and unknown to companies. Moreover, some centres are unaware of the training needs of the workers in their region, so the workplace training programmes can be a powerful mechanism for enabling VET centres to detect these needs. Secondly, VET centres have problems of funding, because the channels to obtain resources on continuing training are often very rigid and not open to new agents as VET centres. Some of them do not have access to general calls for continuing training funds (traditionally targeted to social partners, private training centres, training services of town councils, etc). In Aragon, VET centres have their own budget for applying for continuing training programmes. But this is limited and they need to seek alliances with social partners in order to be able to provide training. In Catalonia, some centres use foundations with which they are associated to acquire funds for continuing training.

> The management of these courses is not as simple as we would like. We do not have the autonomy to say to a firm that we will design a course, organize it,

---

[5] It refers to the perception of companies on their innovation capabilities. In the survey, we have distinguished between 'less innovative companies (or non- innovative companies)' and 'innovative companies'. The first are those who consider themselves equal to or less innovative than their competitors. The second ones are those who consider themselves more innovative than their competitors.

> manage it and put it into practice in two weeks, for example. We do not have this autonomy because we always have to look for funding. We are a public institution so we cannot say that we are going to invest in these courses, and this is where everything always gets complicated in lifelong learning. We have to go through Tripartita [Occupational and Continuing Training Foundation], some sort of trade union entity or organization, or a social agent who can manage the course and find funding. (…) If we want a lifelong learning course, we have to offer it to a social agent: CEPIME and CREA [Regional Employers Organizations], trade unions, etc. and if they manage to get it on their training plan and get it approved, then we can give the course here. They manage it, we provide the premises and the teachers if necessary, and the social agent gets the credit. (Centre-firm Coordinator, Aragon)

> Continuing training is applied for directly by the Foundation. So the institute makes no request at all. (…) As a result of the agreement between them, the institute asks the Foundation to carry out these training courses. Therefore, the institute is given the money, but the courses are managed and taught by the Foundation. (VET centre Director, Catalonia)

The main obstacle, however, is the existence in the region of other consolidated training agents such as private training centres, training centres linked to social partners, and especially suppliers of machinery, software and other types of technology. If these agents exist on the nearest environment, companies tend not to approach VET centres for their continuing training needs.

> Much of what is not internal training is provided by our suppliers. They are one of the biggest sources of training that we have. The field of automation, for example. If the new Siemens PDC thingamajig comes out, in the 2014 range, then the Siemens people come here and they provide the training on site. (Firm Instructor, Catalonia)

> As far as training is concerned, the production areas are most representative of what the institute does and they have considerable internal experience because they provide internal training sometimes. And then, of course, there is the training provided by suppliers. It is so specific that it is given by the manufacturers of the machinery itself or the manufacturers of particular robots. When they sell you the

> equipment, they offer courses and then sell you courses later on. (HR Manager, Catalonia)

In Catalonia, however, some cases have been detected in which VET centres are considered an important agent of training. In one such case, training is organised via a foundation and a training centre, both of which are linked to the VET centre. Both the foundation and the training centre enjoy established relationships and benefits from the joint participation of key actors in the region, such as employers' organisations, companies, trade unions, the town hall, the regional council, and the regional chamber of commerce as well as the VET centre. The existence of this spaces of interaction lets companies to achieve a better knowledge of the training catalogue of VET centres. But, above all, this situation generates a higher level of trust between them. In another case, all the following factors converged: the existence of consolidated relationships between the VET centre and local SMEs, the fact that the centre is a long way from the Barcelona metropolis, and a high degree of social cohesion on the region.

The low collaboration in innovation and development projects

As we pointed out above in the Table 3, the collaboration in innovation and development projects is the lowest relation between SMEs and VET centres. In fact, those firms that collaborate with external agents in innovation projects (Table 5) do so fundamentally with suppliers and/or clients (72.8% in Catalonia and 74% in Aragon) and with technology centres (68.3% in Catalonia and 70.2% in Aragon). By contrast, there is little collaboration with training centres (including VET centres). In both regions, only four of every ten firms collaborate with these agents (40.5% and 40.4%, respectively). These data are lower if we only talk about this collaboration in innovation projects between VET centres and companies (Table 6). Whatever the case may be, the extent of the relation also varies according to the size of firms and their innovation

capacity. In both regions, the smallest SMEs (10-49 employees) have little need for this collaboration. In Aragon, the largest firms (150-250 employees) are the ones that most collaborate with VET centres in innovation projects (42.9%). In Catalonia it is the medium-sized firms (21.1% and 21.3%). As far as innovation capacity is concerned, in both regions there is a positive relation between innovation capacity and a greater collaboration in these projects.

Place Table 5 about here

Place Table 6 about here

For this collaboration in innovation projects, VET centres provide facilities and instructors for companies' minor innovation and development projects such as the testing of certain compounds or the mechanization of small pieces under the demand of companies.

> An innovation service is set up for two main reasons: to improve the competitiveness of local firms, particularly micro- and small enterprises, and to become a knowledge hub. We seek to become a point of reference for certain technologies and processes, taking advantage of the fact that some firms spend a lot of time thinking up projects of all sorts that are never actually carried out, either because of the strain of coping with the daily grind or because their experts are lacking the knowledge they need to put it into practice or because they would have to invest so much time to get it up and running that it is not cost effective. (VET Instructor, Catalonia)

The interviews revealed significant differences between Aragon and Catalonia in the relations between VET centres and companies. In Aragon, these relations appear to the result of personal and sporadic contacts and, therefore, they seem to be less consolidated (though they are gradually becoming more so). In Catalonia, on the other hand, they appear to be more consolidated and more stable, especially in those cases with a high

tradition of contact between the different agents of local environment (VET centres, social partners, the town hall, the chamber of commerce, etc.). In this case, firms also seem to make greater use of the resources of VET centres when there has been some sort of consolidated relationship.

> Our experience has always been very good. We've had a very good relationship with VET centres because we have people there who are trying their best to make them work. They come here, they say that they want two of their students to come and do some work experience here, they ask about our research so that they can get involved or involve their students. But when it comes down to it, it's all about one person. (CEO, Aragon)

> We've always argued that there should be a course that is more focused on plastic injection because there's a sort of a cluster here. And we've always been listened to and in the last few months they've said yes. They've been given permission to open up a vocational course in plastic injection or other techniques for transforming plastic. And we were asked for our opinion, we were given the syllabus, we were asked what we thought…. We played a big role in it, we attended some meetings, we were asked to provide content and we gave our opinion. (Firm Instructor, Catalonia)

Workplace training programmes as a catalyst of relationships

Under the Statutory Act 1/1990 (LOGSE), work experience programmes became workplace training programmes, and, therefore, they are a part of the compulsory training curriculum of each VET student. This change means that VET centres have to create an enduring portfolio of companies that are willing to train students on site. Table 3 shows that workplace training programmes are the main point of contact between VET centres and SMEs. This higher contact is obvious because VET centres are obliged to seek collaborating companies. Nevertheless, for both regions, this contact depends on the size of the firms and their capacity for innovation (Table 7). A positive relationship is observed between the size and the extent of the collaboration with VET centres. The

larger the firm, the more likely it is that it will have students on workplace training programmes in Catalonia and Aragon. The same positive relationship can be seen for the capacity for innovation of firms. More innovative firms have more students on workplace training programmes than less innovative firms, particularly in the case of Catalonia.

Place Table 7 about here

From the interviews conducted we have identified two main features of these programmes: 1) workplace training programmes can be a strong instrument of job intermediation, and 2) workplace training programmes can become the main setting and catalyst for establishing relationships between VET centres and companies. Firstly, workplace training programmes provide a setting for job intermediation, which enables companies to get to know students and evaluate them as a trial period. This evaluation is not limited to the students' training competences but extends to less tangible aspects such as the future worker's personality and character. If the company then decides to employ the student, the contracting process is implemented more quickly. Nevertheless, the current economic recession has drastically diminished the recruitment capacity of companies. In this context, the immediate objective of SMEs is not contracting new people but establishing a critical mass of trained personnel in specific subsectors that can be recruited in the near future.

> We are not very work intensive here. We provide very few new contracts and rotation is very low so we don't need new contracts to, for example, renew the staff. It's more a question of creating a market in our area of production. We note down the students who have been here. And when we do have something special that has to be done, we know where to ring. (HR Manager, Catalonia)

> You can put an advert on a website for finding work like *Infojobs* [Job search website]. It may work but you still have to look at their CV, do an interview and,

> even then, you don't know whether the person is going to function. It's very different from getting in touch with someone who has already been here and who you know. The chances of things working out right increase by five. (CEO, Catalonia)

Secondly, and especially, workplace training programmes are the most important setting for the relationships between VET centres and companies both in terms of volume and intensity. In some cases this setting provides a way in which companies that have traditionally been isolated from VET centres can establish contact and rapport with them. Where such relationships already appear to be solid, workplace training programmes enable the establishment of other types of relationships and collaboration between them. On the one hand, workplace training programmes can provide an 'adjustment mechanism' for the training programme, since meetings and relationships between VET instructors of workplace training programmes and companies can serve to highlight shortcomings in the programmes and make recommendations for their improvement. On the other hand, workplace training programmes also provide a means for mutually transferring knowledge from one actor to the other. Workplace training programmes enable VET centres to identify companies' requirements regarding technologies, training and innovation and to promote their own training activities. At the same time, though to a lesser extent, workplace training programmes give companies the opportunity to acquire greater knowledge of the range of training activities that VET centres can provide. Workplace training programmes therefore become a setting in which VET centres can detect companies' requirements and promote their training resources and technical services.

> When we need something, we get in touch with 'VET centre' [Anonymised name]. If we need a mechanic, we get in touch with the mechanics tutor. He comes here and we tell him what we need. When it comes down to it, it's a small region and everybody knows everybody else. I've known the tutor from 'VET centre'

> [Anonymised name] for years. He knows us and is familiar with what we need. And we ask him about the subjects they teach there and the ones that they don't. (Firm Instructor, Catalonia)

> You talk about several things. You make the most of the visit and you talk about the lifelong learning and occupational training you have done, or any innovation projects you have been involved in, etc. And sometimes you get the chance to talk about two or three students who have been there at some time. You talk about a bit of everything. The meetings are more informal than formal. (VET Instructor, Catalonia)

In this sense, Table 8 shows that those firms with students on workplace training programmes do tend to have greater contact with VET centres. In both regions, those firms with students on workplace training programmes collaborate significantly more than firms without. Having students on workplace training programmes involves contact with VET centres (via instructors, centre-firm coordinators, etc.) that firms with no students do not have. This contact gives firms greater knowledge of the resources these centres have at their disposal and their mutual needs which, in turn, brings them together and generates greater and more diverse collaboration. One particular example of this collaboration is employing staff from job banks (41.7 points higher in Catalonia and 35.3 points higher in Aragon) and giving supply-driven training courses (21 and 16 points higher, respectively). Collaboration in innovation, although still higher for firms that have students on workplace training programmes, continues to be of little importance (16.9% and 14.6%).

Place Table 8 about here

Concluding remarks

The results show that in both regions the relationships between VET centres and SMEs are weak, especially with regard to the new functions of the former. This picture does

not differ to the Spanish general context (CES 2009). Nevertheless, we have identified several factors that improve this relational weakness.

These findings contribute to the theoretical debate on learning innovation or interactive mode of innovation, especially the idea of the conception of these interactions under the form of a network. SMEs become the core nodes of their network, and the other nodes would be the different agents than can contribute to the innovation of the company. As we seen above, these agents can be suppliers, technology centres, even other companies (in this case, each company would have its own network, which could interact with the networks of other companies, extending the network indefinitely). Under the approach of the DUI or interactive mode of innovation, VET centres could be a key node in the network of these SMEs (Jensen at al. 2007; Moodie 2006). The findings show the obstacles of VET centres to consolidate themselves in the network of the SMEs. But VET centres have a "card up one's sleeve". We have seen the potential of workplace programmes as a catalyst of relations. In fact, we argue that these programmes could be conceived as a weak tie but with strong results on the creation (or consolidation) of several contacts between VET centres and SMEs (Granovetter 1973).

Another debate is reported by the findings of this study. These findings show the existence of different models of interaction according to the profile of the SMEs. These differences are partially related to the dichotomy argued by Chesbrough (2003a, 200b). According to the typology of Chesbrough, companies can develop a closed innovation model or an open innovation model (2003b). In this paper we have seen that those companies with a more open profile (i.e. more innovative companies, with more contacts with external agents, etc.) tend to a greater collaboration with VET centres. These companies are more related to the open innovation model, which "the boundary

between the company and its surrounding environment is porous" (Cherbrough 2003b, 37).

This question is related to the debate of RIS approach, where the nearest environment is crucial to understand the dynamics of innovation systems. According to this approach, the findings of this study point to some elements that go beyond the specific innovation profile of SMEs. Geographical proximity (or, on the contrary, the remoteness to the metropolitan dynamic of the capital) is crucial to achieve some level of contacts between SMEs and VET centres of the region. But also it is interesting to highlight the question of 'common spaces' in the region, through the existence of consolidated or formal alliances in some of the cases studied. The case studies allow us to shed light on some of these issues. The case of Aragon shows the weakness of a still recent system (often based on personal or informal relations) and too near of the capital of the region. The case of Catalonia shows some possible alternatives and some best practices that can improve these relations. Among other issues, it stresses the importance of territory and alliances between VET centres and other local institutions, where the companies are involved in them. The distance from the capital of the region generates the need to contact between them, with a high level of mutual confidence (Luo et al. 2017).

The debate is not closed. The contributions of VET centres to the innovation system are still low, especially with regard to their relations with companies. Institutionally mechanisms such as workplace training programmes help bring together VET centres and companies in a networked innovation model. Future research should focus on the mechanisms which can enhance the relation between both them. This focus can allow us to study how increase the level of interaction with those SMEs with an

open or interactive profile of innovation, but also how break up the 'boundaries' of those companies that not tend to interact to their nearest environment.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Ahedo, M. 2012. "Repensando los estudios de sistemas de innovación. El sistema catalán de innovación como caso estratégico de innovación [Rethinking the Innovation Systems Studies: The Catalan System of Innovation as Strategic Research Case]." *Arbor. Ciencia, Pensamiento y Cultura* 188 (753): 49-62. doi:10.3989/arbor.2012.753n1004.

Asheim, B.T., and L. Coenen. 2005. "Knowledge Bases and Regional Innovation Systems: Comparing Nordic Clusters." *Research Policy* 34 (8): 173-190. doi:10.1016/j.respol.2005.03.013.

Asheim, B., and M. Gertler. 2005. "The Geography of Innovation: Regional Innovation Systems". In *The Oxford Handbook of Innovation,* edited by J. Fageberg, D. Mowery and R. Nelson, 291-317. Oxford: Oxford University Press.

Brunet, I., and J. Rodríguez. 2013. "Cataluña [Catalonia]." In *Entorno regional y formación profe- sional: los casos de Asturias, Aragón, Cataluña, Navarra y País Vasco* [Regional Environment and Vocational Training: The Cases of Asturias, Aragon, Catalonia, Navarre and Basque Country], edited by M. Olazarán and I. Brunet, 87–128. Tarragona: Publicacions de la URV/UPV-EHU Servicio de Publicaciones.

Brunet, I., J. Rodríguez, and E. Puyal. 2013. "Comunidad de Aragón [Community of Aragon]." In *Entorno regional y formación profesional: los casos de Asturias, Aragón, Cataluña, Navarra y País Vasco* [Regional Environment and Vocational Training: The Cases of Asturias, Aragon, Catalonia, Navarre and Basque Country], edited by M. Olazarán and I. Brunet, 21–53. Tarragona: Publicacions de la URV/UPV-EHU Servicio de Publicaciones.

Buesa, M., M. Martínez, J. Heijs, and Th. Baumert. 2002. "Los sistemas regionales de innovación en España. Una tipología basada en indicadores económicos e institucionales [Regional Innovation Systems in Spain. A Typology based on

Economic and Institutional Iindicators].” *Economía Industrial* 347: 15-32.

CEDEFOP (European Centre for the Development of Vocational Training). 2009. *Modernising Vocational Education and Training. Fourth Report on Vocational Education and Training Research in Europe: Synthesis Report*. Luxembourg: Publications Office of the European Union. Retrieved from http://www.cedefop.europa.eu/fr/node/11622

CEDEFOP 2011. *The Benefits of Vocational Education and Training*. Luxembourg: Publications Office of the European Union. doi:10.2801/43027.

CES (Consejo Económico y Social). 2009. *Sistema Educativo y Capital Humano* [Educational System and Human Capital]. Madrid: CES. Retrieved from http://www.ces.es/documents/10180/18510/Inf0109

Chesbrough, H. W. 2003a. *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, Massachusetts: Harvard Business School Press.

Chesbrough, H. W. 2003b. “The Era of Open Innovation.” *MIT Sloan Management Review* 44 (3): 35-41

Curtain, R. 2004. “Innovation and Vocational Education and Training”. In *Vocational Education and Training and Innovation: Research Readings,* edited by S Dawe, 42-58. Adelaide, SA: National Centre for Vocational Education Research (NCVER), Adelaide, SA.

Fritsch, M. 2001. “Co-operation in Regional Innovation Systems.” *Regional Studies* 35 (4): 297-307. doi:10.1080/00343400124434.

Granovetter, M. 1973. “The Strength of Weak Ties.” *American Journal of Sociology* 78 (6): 1360-1380.

Hillier, Y., and J. Figgis. 2011. “Innovation in VET: Networks and Niggles.” *Studies in Continuing Education* 33 (3): 251-271. doi:10.1080/0158037X.2010.547465.

Homs, O. 2008. *La Formación profesional en España. Hacia la sociedad del conocimiento* [Vocational Training in Spain: Towards the Knowledge Society]. Barcelona: Fundación “La Caixa”.

Huerta, E., ed. 2003. *Los desafíos de la competitividad. La innovación organizativa y tecnológica en la empresa española* [The Challenges of Competitiveness: The Organizational and Technological Innovation in the Spanish Company]. Bilbao: Fundación BBVA.

Kallio, K., and I. Lappalainen. 2015. “Organizational Learning in an Innovation

Network: Enhancing the Agency of Public Service Organizations." *Journal of Service Theory and Practice* 25 (2): 140-161. doi:10.1108/JSTP-09-2013-0198.

Kaufmann, A., and F. Tödtling. 2003. "Innovation Pattern of SMEs". In *Regional Innovation Policy and Small-medium Enterprises,* edited by B. Asheim, A. Isaksen, C. Nauwelaers and F. Tödtling, 78-115. Cheltenham: Edward Elgar.

Jensen, M.B., B. Johnson, E. Lorenz, and B.A. Lundvall. 2007. "Forms of Knowledge and Modes of Innovation." *Research Policy* 36 (5): 680-693. doi:10.1016/j.respol.2007.01.006.

Lavia, C., B. Otero, M. Olazarán, and E. Albizu. 2011. "Innovación y territorio: Una encuesta a pymes industriales [Innovation and Territory: A Survey of Industrial Small and Medium Enterprises]." *Revista Internacional de Sociología* 69 (2): 461-486. doi:10.3989/ris.2009.11.06.

Lundvall, B.A. 2002. *Innovation, Growth and Social Cohesion: the Danish Model.* Cheltenham: Edward Elgar.

Luo, L., X. Gu, Q. Wei, and H. Li. 2017. "On Interactive Learning and Mutual Trust within the Innovation Network." *Advances in Intelligent Systems and Computing* 502: 25-36. doi: 10.1007/978-981-10-1837-4_3.

Moodie, G. 2006. "Vocational Education Institutions' Role in National Innovation." *Research in Post-compulsory Education* 11 (2): 131-140. doi:10.1080/13596740600768901.

OECD. 2009. *Education at a Glance 2009: OECD Indicators* Paris: OECD. doi:10.1787/eag-2009-en.

OECD. 2011. *Regions and Innovation Policy*. OECD Reviews of Regional Innovation, OECD Publishing. doi:10.1787/9789264097803-en.

Rosenfeld, S. 1998. "Technical Colleges, Technology Ceployment and Regional Development." Paper presented at OECD conference on Building Competitive Regional Economies, Modena, May 28-29.

Scott, A., and M. Storper. 2003. "Regions, Globalization, Development." *Regional Studies* 37 (6-7): 579-593. doi:10.1080/0034340032000108697a.

Sharif, N. 2006. "Emergence and Development of the National Innovation Systems concept." *Research Policy* 35(5): 745-766. doi: 10.1016/j.respol.2006.04.001.

Velluzi, N.D. 2010. "Community Colleges, Clusters and Competition: A Case from Washington Wine Country." *Regional Studies* 44 (2): 201-214. doi:10.1080/00343400903167888

Table 1. Socioeconomic indicators (2013).

	Aragon	**Catalonia**	**Spain**
% Spanish population	2.9	16.0	100.0
% Total Spanish GDP	3.2	18.8	100.0
GDP per capita / national average (= 100)	111.0	119.7	100.0
% GVA Industrial / regional GDP	20.2	19.1	15.9
% High and medium-high technology manufacturing sectors (2012)	33.4	32.8	26
Unemployment rate	21.39	23.12	26.09
% People with VET in employed population	23.5	22.8	21.4
Expenditure on R&D to GDP (%) (2012)	0.93	1.51	1.30
% Spanish R&D expenditure (2012)	2.3	22.3	100.0

Source: INE & IVIE.

Table 2. Technical Data about CATI Survey.

Aragon		**Number of employees**				
		10-49	50-74	75-149	150-250	TOTAL
Theoretical sample	n	260	23	15	7	305
Valid interviews[a]	n	261	23	20	7	311
	%	100,4	100	133,3	100	102
Full interviews[b]	n	226	22	19	7	274
	%	86,9	95,7	126,7	100	89,8

Catalonia		**Number of employees**				
		10-49	50-74	75-149	150-250	TOTAL
Theoretical sample	n	259	37	37	37	370
Valid interviews[a]	n	309	39	47	28	423
	%	119,3	105,4	127	75,7	114,3
Full interviews[b]	n	259	38	47	27	371
	%	100	102,7	127	73	100,3

a Interviews correctly finished, regardless of whether they were companies that had employees with VET studies.

b Interviews to companies that have VET employees.

Table 3. Firms' relationships with VET centres (last 4 years) (in percentages).

	Catalonia	Aragon
Workplace training programmes	44.7	47.6
Contracts given through job banks	30.0	27.8
Supply-driven training	20.1	18.1
Demand-driven training	16.0	13.3
Innovation projects	12.4	12.5

Note: Only the percentage of affirmative responses has been noted.

Table 4. Continuing training by firm size and innovation capacity (in percentages).

	Catalonia		**Aragon**	
	Supply-driven training	**Demand-driven training**	**Supply-driven training**	**Demand-driven training**
Total	20.1	16.0	18.1	13.3
Number of employees				
10–49	16.3	13.6	14.3	12.1
50–74	26.3	21.6	40.9	13.6
75–149	25.5	21.3	27.8	22.2
150–250	38.5	22.2	42.9	28.6
Innovation capacity				
No innovation	20.8	15.0	16.7[a]	14.1 [a]
Innovation	24.3	20.6	26.3 [a]	17.1 [a]

[a] The percentages vary respect to the total due to the greater number of missing values to the question regarding innovation capacity.

Note: Only the percentage of affirmative responses has been noted.

Table 5. Firms' cooperation with external agents in innovation projects (in percentages)

	Catalonia	**Aragon**
Technology centres	68.3	70.2
Universities and others	41.6	50
Training centres (including VET centres)	40.5	40.4
Competitors/firms	47.2	35.3
Suppliers/clients	72.8	74

Note: Only the percentage of affirmative responses has been noted.

Table 6. Collaboration with VET centres in innovation projects by firm size and innovation capacity (in percentages).

	Catalonia	**Aragón**
Total	12.4	12.5
Number of employees		
10–49	8.9	10.7
50–74	21.1	18.2
75–149	21.3	16.7
150–250	18.5	42.9
Innovation capacity		
No innovation	10.4	13.5[a]
Innovation	17.8	15.4[a]

[a] The percentages vary respect to the total due to the greater number of missing values to the question regarding innovation capacity.

Note: Only the percentage of affirmative responses has been noted.

Table 7. Firms with workplace training programmes by firm size and innovation capacity[a] (in percentages).

	Catalonia	**Aragon**
Total	44.7	47.6
Number of employees		
10–49	35.1	44.0
50– 74	63.2	63.6
75– 149	70.2	63.2
150– 250	66.7	71.4
Innovation capacity		
No innovation	41.4	51.0[b]
Innovation	55.1	51.9[b]

[a] Perception of innovation capacity versus their competitors: No innovation: Companies who consider themselves equal or less innovative than their competitors. Innovation: Companies who consider themselves more innovative than their competitors.

[b] The percentages vary respect to the total due to the greater number of missing values to the question regarding innovation capacity.

Note: Only the percentage of affirmative responses has been noted.

Table 8. Contacts with VET centres of firms with students workplace training programmes (in percentages).

	Catalonia			**Aragon**		
		Workplace training programmes			**Workplace training programmes**	
	Total	**Yes**	**No**	**Total**	**Yes**	**No**
Employment of staff through job banks	30.0	53.0	11.3	27.8	46.5	11.2
Supply-driven training	20.1	31.7	10.7	18.1	26.6	10.6
Demand-driven training	16.0	22.6	10.8	13.3	19.7	7.7
Innovation projects	12.4	16.9	8.8	12.5	14.6	10.6

Note: Only the percentage of affirmative responses has been noted.