Presentation

Microeconomic and institutional approaches to vocational education and training

Not many issues of academic economic journals have focused monographically on vocational education and training (VET). VET is studied in various disciplines (education, sociology, economics, law, organisational theory, etc.), which is perhaps why economics in general and the economics of innovation and regional economics in particular, have failed to pay due attention to it.

But this lack of interest in VET and in the institutions that provide it on the part of innovation and regional economic analysts cannot be put down solely to its multi-disciplinary nature. General and university education, which is studied and analysed by the same disciplines, has been able to attract much broader attention in economic and academic literature.

One possible explanation is that analysts tend to focus mainly on studies concerned with the organisations to which they belong, with which they are most familiar and whose functions they consider to be most significant. Most analysts who publish in academic journals are attached to universities or research centres. By contrast, the proportion of staff at VET centres who are engaged in research is practically negligible. What little research they do conduct focuses more on pedagogical or technological innovation than on the role of VET centres and the training that they provide in the context of the economy. This may be why there are few economic analyses of the role of VET and the centres where it is provided in academic journals, and why literature on such organisations has, as outlined below, tended to be produced more by bodies linked to economic development (e.g. the OECD) or by specialised branches of the main international organisations involved in VET (particularly CEDEFOP in the European Union and UNESCO-UNIVOC at the United Nations)[1].

To put things simply, there can be said to be two main approaches to the analysis of VET and the actors who provide it in academic literature, one of which is mainly microeconomic and the other mainly institutional.

Conventional economics deals with vocational training from the perspective of human capital. The theory of human capital put forward by Becker (1964) distinguishes between specific human capital (which is useful only to one employer) and

[1] Rauner & Maclean (2008) refer explicitly to the relatively low level of attention given to VET in academic literature compared to the plethora of studies and reports published by international organisations.

general human capital (which is useful to many employers). According to this theory, individuals invest in training (bearing the costs of the training that they receive and foregoing a wage by not working), but expect that training to bring them higher wages in the future.

Along these lines, numerous publications have sought to analyse whether investment in vocational training is profitable (i.e. whether the wage increases made possible by the higher qualifications acquired through such training actually exceed the spending and opportunity costs involved in the training period) and to compare its profitability with that of a more general or academically oriented education (Johnes & Johnes, 2004); or to compare the profitability of VET obtained at publicly and privately run centres (e.g. Cellini & Turner, 2016).

Also included in these lines are all the studies that deal with the cost of VET and how it should be distributed among the different actors involved (the public administration, students, businesses, etc.). Such studies deal mainly with dual VET or apprenticeships (Hoeckel, 2008; Poulson & Eberhardt, 2016).

From the viewpoint of microeconomic analysis, mention must also be made of the body of literature on the possible gap between supply and demand in qualifications, which is evidenced by, among other things, the difficulties found in covering certain qualified jobs in demand among employers, and by over-qualification among workers for the jobs that they actually do (Lerman, 2015). There are also analyses of whether the effects of technical change result in biases in regard to one type of production factor or another (if they lead to greater substitution of capital or of labour), or one type of qualifications or another (in the context of labour, whether there is increasing demand for workers who are more highly skilled or hold specific skill sets and less demand for others) (Machin, 2004).

In contrast to these microeconomic approaches, there is another set which are more institutional in nature (Wolter & Ryan, 2011). Unlike the approaches taken in conventional economics, where technology is considered as given and a certain demand for labour and skills is derived from it, in institutional approaches the link between knowledge, qualifications and skills on the one hand and the structure of production and innovation on the other is more interactive and cumulative.

Indeed, there is a whole set of links ranging from the structure of production and innovation to certain needs for qualifications. Each stage of the product life-cycle calls for a labour force with different abilities (Tether *et al.*, 2005); similarly, patterns of innovation vary from one sector to another, and with them the type of skills required of the workforce (Pavitt, 1984). There is another type of analysis which maintains that the type of qualifications and skills held by the workforce of a country affects the production specialisation, international trade and patterns of innovation in that country. The article by Westwood included here fits into that line, as it is based on an interpretation of the lack of industrial competitiveness of the United Kingdom as a result of a shortage of workers with sufficient technical qualifications and skills.

In particular, the literature distinguishes between three major skill training systems: the flexible, internal and occupational labour market models, with the UK, Japan and Germany being archetypal examples of each respective type. Each of these models has different effects on the type and level of VET qualifications, on the participation of direct production workers in innovation and on the type of innovation that emerges. (For more details, see Toner, 2011; Lam & Lundvall, 2006; and Tether *et al.*, 2005).

Another issue closely linked to this classification of labour market models, though different in that it is more specific, is that of the different types of VET system found around the world. As pointed out by Anderson (2012), these systems are the result of past history and reflect the interests and strengths of the different actors in each country. For that reason, key factors in such classifications include the way in which the systems are regulated and the way in which demand is coordinated in terms of the skills offered. The relevant literature distinguishes between three main forms of regulation: the liberal or market system (as found in the US and the UK), the statist system (as found in Asian countries, though the system that prevailed until recently in France also falls into this category) and the corporatist system (as found in central and northern European countries, with Germany as the archetype): see Bosch & Charest, 2008; Ashton *et al.*, 2000; Hanf, 2004; Greinert, 2004; Anderson, 2012.

In any event, some institutional approaches are even more systemic and treat the VET system or labour market as a subsystem which is linked with other subsystems to make up the national (or regional) innovation system (Lam & Lundvall, 2006; Autio, 1998) or a variety of capitalism (Hall & Soskice, 2011).

This monographic issue seeks to analyse and provide an understanding of the role played, or potentially played, by VET in regional and local innovation systems, and in the smart specialisation strategies developed for that purpose. Accordingly, it fits clearly into the institutional approach and thus makes little reference to the types of analysis generally found in microeconomic approaches.

Vocational training within regional innovation systems

A distinction is generally drawn between initial VET and VET for employment (Grubb, 2006; Kuczera & Puuka, 2012). Initial VET includes programmes designed for young people who are starting their careers, generally prior to their joining the job market. VET for employment refers to all other types of VET, including training for those in work and for the unemployed.

In initial VET a distinction is usually drawn between school-based and company-based models. In the past pure training models were widespread, in which young people received training only at school or at a company, but almost all countries now use mixed systems in which students are trained at both types of organisation. What varies from one country or model to another is how their time is distributed between the different organisations and which of them ultimately controls the train-

ing process. The most basic criterion for placing a model in one category or another tends to be the proportion of their time that students spend training at each type of organisation. School-based initial VET models such as that found in Spain contrast with more company-based models such as that of Germany.

As regards VET for employment, leaving aside informal training[2], training for the working population may take the form of training activities organised by the employer, training contracted by private individuals or training offered by the public sector. The first of these types is far more widespread than the other two.

Training organised by companies is generally provided by employers themselves, though they may resort to external of training. Such external providers may take various forms[3]:

- private VET providers whose main activity is providing VET;
- VET schools whose main activity is also the provision of VET, but aimed at young people, with VET for employment as a secondary activity;
- employers' associations and trade unions that provide VET as a secondary activity; and
- capital goods suppliers and service providers who not only sell machinery but also provide training for workers at the firms to which equipment or services are sold.

In the case of training contracted by employees or private individuals or offered by the public sector, the types of provider are similar to those listed above for external actors who provide VET on request from firms.

This monographic issue studies the role of VET in regional innovation systems by focusing on only one of these providers: VET schools. They are the main (and generally the only) providers of VET for young people. Their role in the system of VET for employment is, however, much smaller. Indeed, many VET schools do not provide VET for employment at all, or do so only as an add-on to their main activity of providing initial VET. As mentioned above, the weight of VET for employment provided by VET schools is clearly lower in almost all countries than that provided from other sources (including employers themselves when they train their own workers).

This monographic study therefore focuses on the role of VET schools in regional innovation systems and on smart specialisation strategies designed for them[4].

---

[2] «Informal training» is non-institutionalised training obtained at home, in the workplace or as part of one's day-to-day activities (e.g. what a worker learns by merely watching his/her workmates). For more information on the different degrees of formality in training, see UIS (2006) and UNESCO (2013).

[3] For an outline of the various types of external provider and the weight of each type in different countries, see the survey «*Continuing vocational training in enterprises*» published by EUROSTAT.

[4] Readers interested in learning more about VET for employment and the organisations that provide it in the EU are advised to consult Arulampalam *et al.* (2003), Bassanini *et al.* (2005), Resarch voor Beleid &

What role do VET schools have in the literature on regional innovation systems and smart specialisation strategies?

As stated in this issue by Porto and Doloreux, in the context of academic publications that role has been minimal. Perhaps because, as mentioned above, authors who publish in academic journals tend to be lecturers and researchers at universities and research centres who therefore prioritise activities and functions related more closely to the institutions to which they belong, notable biases can be found in regard to regional innovation systems in mainstream academic publications that combine analyses of innovation and territory (see Navarro, 2009 & 2014):

- they have tended to emphasise the generation of knowledge over its dissemination and use;
- they have also tended to give preference to STI-based models of innovation and learning («*Science, Technology and Innovation*») over DUI («*by Doing, by Using and by Interacting*») models and have therefore prioritised R&D over other types of innovative activities;
- they have focused more on high-technology sectors and large corporations than on traditional sectors (generally thought of as low-technology) and SMEs;
- they have prioritised the study of universities, financial markets and capital markets over the study of the labour force and the job market;
- even in those cases when they have dealt with people, they have focused on a small minority of highly skilled individuals (R&D staff, PhD holders, engineers, scientists, etc.) and neglected medium-level technical specialists;
- similarly, in those cases when they have considered the spatial dimension of innovation systems, they have not broken down their studies further than the regional level and have ignored the various local contexts and ecosystems that may exist within a region.

As pointed out by Toner (2010), VET schools are oriented more towards the dissemination of technology than universities, and are more closely linked to a DUI model and to incremental innovation than to an STI model of radical innovation. Moreover, according to Albizu *et al.* (2017) and Otero *et al.* (in this issue), VET qualification holders are more numerous in smaller firms and in traditional sectors of industry with medium and low levels of technology, among shop-floor workers and middle management than among top management, and at maintenance, assembly and production departments than at engineering and R&D departments. Rosenfeld (1998) maintains that VET schools operate at and are oriented towards more local levels, while universities operate at and are oriented rather towards regional, national or even international levels. In short, there are numerous features that do

---

Plato (2008).

not attract the interest of mainstream economic studies in general, and of studies in the fields of innovation economics, economic geography or regional economics (which deal specifically with links with innovation) in particular.

Even so, studies published by various international organisations such as the OECD, CEDEFOP and UNIVOC and documents of various kinds (academic papers, reports, working documents, etc.) published by a significant number of foreign and Spanish analysts[5] have identified a number of failures or needs which are not sufficiently covered by regional innovation systems:

- the provision of technical job profiles, which according to CEDEFOP (2018) will account for two thirds of the growth in employment up to 2020;
- the provision of technology and innovation services for SMEs, which are the most common type of firm but have less in-house resources and greater shortcomings regarding competitiveness than large firms (Orkestra, 2015), tends to be ignored by conventional science and technology actors (Ranga *et al.*, 2008; Olazaran *et al.*, 2009);
- the lack of connectivity and collaboration between firms (especially between smaller firms) and between businesses and the science and technology actors who provide R&D services (Moodie, 2006; Toner & Woolley, 2016); and
- uneven levels of local development within regional innovation systems and the lack of development strategies and policies adapted to local contexts (Estensoro & Larrea, 2016).

To what extent could VET schools be key actors in remedying these shortcomings and meeting these needs?

First and foremost it must be pointed out, as highlighted by Navarro and Retegi in this issue, that there is more than one type of VET school. All VET schools provide vocational training for young people. However, the demand for VET varies considerably from one place to another[6], as does the way in which it is organised, so the weight, make up and operation of initial VET also tend to differ widely from one territory to another. This makes for very different conditions at different schools when it comes then to tackling the provision of additional functions such as VET for employment, technical services for SMEs, brokering and bridging services and support and encouragement for local development strategies.

---

[5] Non-Spanish authors who can be mentioned include Bailey, Cellini, Grubb, Moodie, Powell, Rabit, Rosenfeld and Toner, and Spanish authors include those appearing here, plus Alonso, Brunet and Rodríguez-Soler.

[6] As mentioned above, it is worth remembering the link between specialisation of production and patterns of innovation in a territory on the one hand and the demand for certain qualifications and skills among workers on the other.

Looking only at the cases analysed in this issue, it can clearly be seen that there are substantial differences between VET schools in the US (studied by Rosenfeld) and those in the UK (Westwood), Germany (Koschatzky & Heijs), the Basque Country (Mujika & Intxausti, Egaña *et al.* and Estensoro) and Navarre (Navarro & Retegi): they therefore start from different points when it comes to developing other, non-conventional functions, which are always more discretionary in nature.

Nor is there the same level of need or systemic failure in all economies. This may be because different characteristics (e.g. a lower proportion of small firms) result in different levels of demand for VET or because there are other actors already meeting that demand satisfactorily, so there is no need for VET schools to do so (Rodríguez-.Soler & Brunet, 2017). As a result, there is no need for schools everywhere to engage in all these other functions.

Indeed, as pointed out by Navarro and Retegi in their article, there is substantial variation in the type of additional functions provided by schools in different places. This applies not only to schools in different countries but also within the same country. Thus, for instance, the regulations on integrated schools in Spain (Royal Decrees 1558/2005 and 564/2010) were intended to encourage the setting up of schools of this type in all the country's autonomous regions, with the idea that they would engage in numerous additional functions over and above the provision of initial VET (i.e. that they should be multi-functional schools), but the current situation is anything but homogeneous. In the region of La Rioja, for instance, the proportion of integrated schools is very small, but in the neighbouring regions of Navarre and the Basque Country almost all publicly-run VET schools are integrated schools. Moreover, the integrated schools in Navarre provide practically no additional functions over and above initial VET (see Navarro and Retegi), while those in the Basque Country are heavily involved in providing VET for employment, providing technical services, encouraging entrepreneurship and even, in some cases, encouraging local development strategies (see Mujika & Intxausti, Egaña *et al.* and Estensoro in this issue).

The articles in this issue

This issue comprises 11 research articles which all deal with the role of VET schools in innovation systems, but from different perspectives.

The first two articles, by Navarro & Retegi and Porto & Doloreux, are more technical presentations. Navarro & Retegi provide a critical review of the literature and the policies of regional innovation systems (RIS), smart specialisation strategies and the role of VET schools in regard to them, then go on to set out the various functions that these schools can perform within such systems. They discuss the debate in the literature on VET concerning whether schools should be single-function (i.e. specialising solely in providing VET for young people) or multi-function. As a case study for their analysis they look at the Regional Community of Navarre, considering what functions are provided by VET schools there and what factors are in-

volved. The article by Porto & Doloreux uses a bibliometric analysis to examine the extent of the presence of the various potential actors in an RIS (including VET schools) in academic articles concerned with the relevant field published in Scopus-indexed journals and how that presence has changed over time.

A second group of three articles looks at the situation of VET in the context of the US & UK models (Rosenfeld writes about the former and Westwood about the latter) and the German model (Koschatzky y Heijs). These three articles do not focus on the prevailing types of school in the relevant countries but rather on new developments there. Thus, the article by Rosenfeld deals with «career and technical education» (the term of art for VET in the US, where «*vocational education and training*» tends to have negative connotations) and focuses not on the well-known «*community colleges*» of further education but on reforms in VET at publicly-run secondary schools. Nor does the article by Westwood focus on the UK's well-known colleges of further education but rather on a new type of further education establishment known as «institutes of technology», which is currently being promoted in the field of VET there. The idea is to emulate the post-secondary VET schools that have been set up in the past few decades in numerous European countries to provide higher-level VET plus applied research and innovation activities. Finally, the article by Koschatzky & Heijs does not deal with the conventional German dual VET or the schools that provide it, but with technology transfer and particularly how technology is transferred to small firms from leading post-secondary VET schools in Germany, known as «applied science universities» (*fachhochschules*).

The articles in the next block analyse two key aspects of VET in Spain. Echeverría & Martínez examine the attempt to implement dual VET in Spain in response to the problems arising from the labour market and employability crisis in the country, and the contrastingly excellent performance of the German labour market over the same years, which is attributed in part to Germany's dual VET system. For their part, Chacón & Moso-Díez look at what factors influence the preference shown by young people in Spain for general education (upper secondary schooling) rather than VET, which has led to Spain having one of the lowest VET enrolment rates at upper secondary level in Europe, in spite of the evidence that VET qualification holders find it easier to find work.

The remaining articles analyse VET from a regional or local perspective, tackling different aspects of what is without a doubt Spain's most advanced regional VET system. Mujika & Intxausti, both of whom have held various high-responsibility posts in the Basque VET system, reflect on the changes as it shifts towards a multi-functional system integrated into the Basque competitiveness strategy. They seek to determine what main areas have been affected by those changes, what the main stages of change have been and what factors underlie the progress made in various areas. The article by Egaña, Egurbide & Valdaliso presents the history and functions of the Elgoibar Machine-Tool Institute (IMH), which is perhaps one of the best examples of an integrat-

ed or multi-functional VET school anywhere in Spain, and what factors have influenced its development over time. The article by Estensoro looks at what role VET centres can play as facilitators of local development, taking as an illustrative case study one of the most advanced VET schools in this regard: the Goierri Eskola in the Goierri district of Gipuzkoa in the Basque Country. Finally, the article by Otero, Olazaran, Albizu & Lavía analyses the proportion of workers with VET qualifications at Basque industrial SMEs, concentrating on an issue about which the literature on VET has had a great deal to say in spite of a shortage of empirical evidence: the contribution of such workers to the competitive position of their firms.

After this general presentation, we now outline the main conclusions and contributions to the literature of each article.

Mikel Navarro & **Javier Retegi** add to the few academic papers that uphold the idea of a capital role for VET schools in the literature on RIS. A unique feature is that this is the first academic article to stress the decisive role that these schools can have on all three basic levels of a territorial smart specialisation strategy: horizontal priorities, vertical priorities and governance.

The bibliometric analysis of Scopus-indexed articles on RIS presented by **Igone Porto** and **David Doloreux** confirms the qualitative assessments conducted by numerous authors as regards the bias in favour of certain actors within the system (basically universities and research centres) and the marginalisation of others.

Stuart Rosenfeld, one of the best-known US analysts of VET, outlines some of the main differences between the US system and those in Europe, then discusses two situations that must be tackled by the reforms to be undertaken. One is the lack of reputation and the poor image of VET and the other concerns the structural and technological changes that are taking place in the economy and in society and the changes in the values and expectations of young people, who are calling for a new kind of VET.

The article by **Andrew Westwood** centres on a point that has been brought up repeatedly by analysts and recognised by successive UK governments for many years but not yet resolved: the lack of competitiveness of British industry. This is due largely to the low skill levels of its labour force, which in turn can be attributed to a lack of consideration and development of the country's VET system. This idea has been taken up again by the government of Theresa May, who has linked it to Brexit and proclaimed the need for a new industrial policy in the UK, based largely on a reform of the VET system. To that end, following the example of Europe's leading economies in terms of industrial competitiveness, it is considered necessary to develop a group of new centres that can offer advanced technical training at further education level and provide firms with R&D&i services. These centres would stand between conventional UK further education colleges and universities.

Knut Koschatzky & **Joost Heijs** analyse technology transfer from applied science universities (the German equivalent of the institutes of technology analysed by

Westwood) and from research campuses to businesses. These two transfer processes are completely different: the latter is based on basic research conducted in cooperation, with the businesses involved being mainly large firms. However, it is the former which is of most interest for the purposes of this issue, as it rests on more applied research and the combination with existing knowledge, and is aimed more at SMEs. This transfer of technology towards SMEs is the second major remit of institutes of technology, the first being the provision of training services. The case of Germany shows that technology can ultimately be transferred in three different ways: by centres themselves, by institutions created by and dependent on those centres (*An-Institutes*) and by autonomous centres that operate under market criteria (*Steinbeis* centres).

Benito Echeverría & **Pilar Martínez** begin by stressing that the components of one country's VET system cannot merely be replicated in another: there must be an «intelligent transfer of adapted elements». They go on to propose a number of structural improvements to facilitate such intelligent transfers in a dual VET model.

In an effort to understand what factors underlie the strong preference shown by Spanish youngsters for upper secondary school studies rather than VET, **Mercedes Chacón** & **Mónica Moso-Díez** examine a survey conducted on over 10,000 Spanish students aged between 16 and 19. The results are clear: their choice is influenced by both individual factors (they tend to choose either upper secondary schooling or VET depending on their academic performance and gender) and social factors (the education level and occupational status of their parents). In other words, VET continues to be linked to lower school results and gender stereotypes. And career guidance and information services in Spain are not proving effective.

Moving on to the articles that deal with the Basque VET system, **Iñaki Mujika** & **Kike Intxausti** clearly illustrate progress towards multi-functionality not just by individual centres but by the Basque VET system as a whole. Their article reveals two issues: transforming a VET system is a long process involving various stages in which the number of functions handled by the system and the way in which it performs those functions increase; and the functions gradually incorporated into the system are mutually reinforcing rather than mutually exclusive, thus confirming the advantages of multi-functionality.

The article by **Joxean Egaña**, **Ixaka Egurbide** & **Jesús M. Valdaliso** also deals with the shift towards multi-functionality, but at a specific centre: the IMH in Elgoibar. Again, it emerges that the change is a long process that takes place by stages, and the authors state that the new functions incorporated «at no time had a negative effect on VET for younger students, but rather supplemented and enhanced it». The authors highlight the importance for the success enjoyed by the centre and its transformation into a multi-functional centre of the structure or type of centre created (a specific, public/private centre with considerable emphasis on the further education

level, etc.), of internal factors (especially the management team and teaching staff) and of external factors (specialisation in the district, education policies and support from the regional, provincial and municipal authorities).

Miren Estensoro looks in her article at the potential framework of functions that can be performed by a VET centre and at the internal and external factors that can influence the process, and then applies her findings to the case of the Goierri Eskola centre in Gipuzkoa. She outlines the trend in these functions over time at the centre, but focuses mainly on the function of facilitating local development strategies and processes and on the elements involved in that function. She shows that the deployment of multi-functionality is not merely a matter of cumulative, linear progress but that there are cases in which some functions decrease in relative terms as others are set up and provided on a specialist basis (e.g. the provision of technical services and support for local development). However, even in these cases those functions are not entirely withdrawn; instead, the centre returns to and focuses on those aspects that new actors do not cover, or where cooperation is required.

Finally, the article by **Beatriz Otero**, **Mikel Olazaran**, **Eneka Albizu** & **Cristina Lavía** confirms that sector and size are the two main discriminating variables in the general distribution of job profiles in regard to the presence of VET qualification holders at Basque industrial firms. The highest proportion of VET qualification holders is found at smaller firms in the metal/mechanical industry (sectors with a medium-to-low technology level). The main contribution of this article is that it provides empirical evidence of the contribution of workers with VET qualifications to innovation and competitiveness at firms. It states that their contribution is highly valued, particularly when higher level VET qualification holders are involved and when employees with VET are more involved in innovation-related activities.

The Other Contributions section contains an article by **Elisa Sainz de Murieta, Luis María Abadie** and **Ibon Galarraga** in which they estimate the expected rise in sea level at eleven locations along the Basque coastline under three IPCC climate change scenarios using sto-chastic modelling. This information is highly relevant for the drawing up of policies for adap-tation to climate change. Moreover, working with probability distributions is essential if more sophisticated methods are to be applied for analysing investments, estimating economic and environmental impacts and prioritising in decision-making.

BIBLIOGRAPHIC REFERENCES

Albizu, E.; Olazaran, M.; Lavia, C.; Otero, B. (2017): Making visible the role of vocational education and training in firm innovation: evidence from Spanish SMEs. European Planning Studies 25 (11): 2057-2075.

Anderson, F. (2012): *The Construction of Professionalism in Vocational Education and Training in Ireland: A mixed methods study of trainers' roles and professional development in the workplace*. Dublin City University.

Arulampalam, W.; Booth, A.L.; Bryan, M.L. (2003): Training in Europe. *IZA Discusssion Paper* No. 933, November 2003.

Ashton, D.; Sung, J.; Turbin, J. (2000): Towards a framework for the comparative analysis of national systems of skill formation. *International journal of Training and Development* 4 (1): 8-25

Autio, E. (1998): Evaluation of RTD in regional systems of innovation. *European Planning Studies*, 6: 131–140.

Bassanini, A.; Boolth, A.; Brunello, G.; De Paula, M.; Leuven, E. (2005): Workplace training in Europe. *IZA Discussion Paper* No. 1640.

Becker, G.S. (1964): *Human Capital: A Theoretical and Empirical Analysis*. New York: Columbia Univ. Press.

Bosch, G.; Charest, J. (2008): Vocational training and the labour market in liberal and coordinated economies. *Industrial Relations Journal* 39 (5): 428–447.

Cedefop (2018): *Insights into skill shortages and skills mismatch: learning from Cedefop's European skills and job survey*. Luxembourg: Publications Office. Cedefop reference series; No 106.

Cellini, A.R.; Turner, N. (2016): Gainfully Employed? Assessing the Employment and Earnings of For-Profit College Students Using Administrative Data. *NBER Working Paper* No. 22287.

Greinert, W-D. (2004): European vocational training systems: the theoretical context of historical development. In Greinert, W-D. y Hanf, G. (eds.) *Towards a history of vocational education and training (VET) in Europe in a comparative perspective*. Proceedings of the first international conference October 2002, Florence. Volume I: The rise of national VET systems in a comparative perspective. (pp. 17-27).

Estensoro, M.; Larrea, M. (2016): Overcoming Implementation Problems in Smart Specialization Strategies: Engaging sub-regional governments. *European Planning Studies*, 24 (7): 1319-1335.

Grubb, W.N. (2006): *Vocational Education and Training: Issues for a Thematic Review*. Paris: OECD.

Hall, P.A.; Soskice, D. (ed.) (2001): *Varieties of Capitalism. The Institutional Foundations of Comparative Advantage*. New York: Oxford University Press.

Hanf, G. (2004): Introduction. In Greinert, W-D. y Hanf, G. (eds.) *Towards a history of vocational education and training (VET) in Europe in a comparative perspective*. Proceedings of the first international conference October 2002, Florence. Volume I: The rise of national VET systems in a comparative perspective. (pp. 11-15)

Hoeckel, K. (2008): Costs and Benefits in Vocation Education and Training. *EDU/EDPC/CERI(2008)3*. OECD.

johnes, g.; johnes, j. (2004): *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar.

Kuczera, M.; Puuka, J. (2012): Overview of post-secondary vocational education and training. In Puukka, J. (ed.) (2012). *Post-Secondary Vocational Education and Training: Pathways and Partnerships*. Paris: OECD. (pp. 17-35).

Lam, A.; Lundvall, B-Å (2006): The Learning Organization and National Systems of Competence Building and Innovation. In Lorenz, N. and Lundvall, B-Å (eds), *How Europe's Economies Learn: Coordinating Competing Models*. Oxford: Oxford University Press. (pp. 110-139)

Lerman, R.I. (2015): Are Employers Providing Enough Training? Theory, Evidence and Policy Implications. Prepared for the Committee

on the Supply-Chain for Middle-Skill Jobs, NASEM. http://nas.edu/SkilledTechnicalWorkforce (accedido el 14 de mayo de 2018).

Machin, S. (2004): Skill-biased technical change and educational outcomes. En Johnes, G. y Johnes, J. (eds.). *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar. (pp. 189-210)

Moodie, G. (2006): Vocational education institutions' role in national innovation. *Research in Post-Compulsory Education* 11 (2): 131–140.

Navarro, M. (2009): Los sistemas regionales de innovación. Una revisión crítica. *Ekonomiaz* nº 70: 24-59.

Olazarán, M.; Albizu, E.; Otero, B. (2009): Technology Transfer between Technology Centres and SMEs: Evidence from the Basque Country. *European Planning Studies* 17 (3): 345-363.

Orkestra (2015): *Cuadernos del Informe de Competitividad del País Vasco 2015. Número 2: Factores empresariales*. Bilbao: Publicaciones Deusto.

Pavitt, K. (1984): Sectoral patterns of technical change: towards a theory and a taxonomy. *Research Policy* 13, 343–373.

Poulsen, B.; Eberhardt, C. (2016): Approaching Apprenticeship Systems from a European Perspective. *BIBB Discussion Papers* Nº 171.

Ranga, L.M.; Miedema, J.; Jorna, R. (2008): Enhancing the innovative capacity of small firms through triple helix interactions: challenges and opportunities. *Technology Analysis & Strategic Management* 20 (6): 697–716.

Rauner, F.; Maclean, R. (2008): *Handbook of Technical and Vocational Education and Training Research*. Bremen-Bonn: Springer.

Research voor Beleid; Plato (2008): *VET trainers in public and private training institutions*. Final Report. Project number B3237, financed by the European Commission.

Rodríguez-Soler, J.; Brunet, I. (2017): Between vocational education and training centres and companies: study of their relations under the regional innovation system approach. *Studies in continuing education*. https://doi.org/10.1080/0158037X.2017.1343239

Rosenfeld, S. (1998): *Technical colleges, technology deployment and regional development*, Modena: OECD. Accedido el 02/05/2018 en: https://files.eric.ed.gov/fulltext/ED463800.pdf

Tether, B.; Mina, A.; Consoli, D.; Gagliardi, D. (2005): *A Literature Review on Skills and Innovation. How Does Successful Innovation Impact on the Demand of Skills and How Do Skills Drive Innovation?*. Manchester: ESRC Centre for Research on Innovation and Competition (CRIC), University of Manchester.

Toner, P. (2010): Innovation and Vocational Education. *The Economic and Labour Relations Review* 21 (2) 75–98.

—(2011): Workforce skills and innovation: an overview of major themes in the literature. *OECD, STI working paper series SG/INNOV(2011)1.*

Toner, P.; Woolley, R. (2016): Perspectives and Debates on Vocational Education and Training, Skills and the Prospects for Innovation. *Revista Española de Sociología* (RES) 25 (3): 319-342.

Uis (unesco institute for statistics) (2006): *Participation in formal technical and vocational education and training programmes worldwide. An initial statistical study*. Bonn: UNESCO-UNEVOC.

Unesco (2013): *Clasificación Internacional Normalizada de la Educación CINE 2011*. Montreal: Instituto de Estadística de la Unesco.

Wolter, S.; Ryan, P. (2011): Apprenticeship (pp. 521-576). En Hanushek, E.A., Machin, S. y Ludger Woessmann, L. (eds.) *Handbook of the Economics of Education*, Volume 3. North-Holland: Elservier.