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Higher education needs for the information and communication technology Spanish market

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Abstract

Purpose: The main objective of the paper is to clarify the expectations held in the realm of business and by employers, in relation to the main educational parameters that respond to the employment needs of the Information and Communication Technology (ICT) market in Spain, considering both technical and managerial knowledge. It also assesses whether the Spanish Technical University is providing its graduates with the knowledge currently demanded by the sector.

Design / methodology / approach: The report is based on a survey completed by 43 companies, which constitutes more than 60% of the sector and is representative of the entire range of subsectors that constitute the vast ICT industry in Spain. According to the sample construction, post-stratification has been used for analyzing global results. Responses have been weighted according to the proportion that represents the employees' population of the Spanish ICT sector.

Findings: As a first conclusion of the current research it should be noted that in terms of technological knowledge, the gap between what the industry requires and the skills graduates can offer is, in general, much smaller than the gap relating to business management skills, where differences exceeding 25% have been demonstrated. This would suggest that the Spanish ICT sector needs to improve learning in the subjects related to business management.

Originality/value: Finally, as an innovate factor since there are no previous bibliographic references on this topic, a surprising conclusion is that a significant segment of the Spanish ICT sector, specifically 51,2 % of the companies surveyed, did not distinguish between professional profiles, expressed indifference, and were equally likely to employ graduates as postgraduates. Although when the market was asked about the preferred profile for managerial positions, the results are quite different: 83.7% of respondents preferred a superior engineer qualification; 16.3%

Keywords: telecommunication engineering curriculum, future engineering education, information and communication technologies

Jel Codes: M15

1. Introduction

In the new higher education environment in USA and in Europe, ICT engineers of the future will carry out their work in the Information and Communication Society and therefore in the knowledge society. Consequently, it is essential that engineering curricula are revised, enabling them to contribute to the harmonious development of that society.

Sharing a similar approach, the National Academy of Engineering reflects that “If the United States is to maintain its economic leadership and be able to sustain its share of high-technology jobs, it must prepare for this wave of change”, (Clough, 2004: page 3).

In the same strategic vein in Europe, and within the European Higher Education Area (EHEA), it has been proposed that new degrees could be defined according to the skills, both generic and specific, that students are expected to develop during their training, and the professional experience they are required to gain.

In both instances, a notable feature of the new educational paradigm is the strengthening of relationships between universities and the labour market. Given that in engineering those relationships are particularly important, being essential to ensure specialised work experience, such strong links are already common in the sector (Llorens, Llinas, Ras & Chiaramonte, 2010).

This article is contextualised within a specific working environment, the field of information and communication technology (ICT), which basically refers to telecommunication engineers and computer scientists completing shorter graduate courses and longer postgraduate courses at master's level. The aim of this study is to present the views of a representative sample of 43 companies, which constitute more than two thirds of the workers in the Spanish ICT sector. Such a broad sample allows the authors to ascertain companies' management practices and technological knowledge, in relation to what the industry requires, whilst also highlighting any relevant limitations in recently graduates' skills. In this sense, then, the article assesses whether the University is providing its students with the knowledge the sector really values.

This is achieved by comparing the differences across the broad ICT industry, in relation to the various subsectors and also to the size of organizations surveyed.

Finally, the distinction the market makes in relation to graduates and postgraduates in terms of their current and future employability will be assessed. Since the EHEA has modified the system to differentiate between the two levels of degree and postgraduate studies, certain resistance has arisen in countries such as Spain, France and Germany (Marin-Garcia et al., 2009).

If competitive advantage in Europe and the USA is built on the economy of knowledge, so that technological achievement becomes a real alternative to the exodus of the mass production industry, perhaps the contribution required of future ICT engineers can be more clearly established. This, in turn, could inform how they are trained.

2. Key figures in the ICT sector

The ICT sector is characterized by its enormous diversity of highly technical products and services, and for being a market which is continuously evolving and expanding, mainly due to constant technological advances. It incorporates the following sub-sectors: Telecommunication Services, Information Technologies, Telecommunication Equipment, Consumer Electronics, Electronic Components, Professional Electronics, and part of the Audio-visual sector. Further detail can be found in the DigiWorld report (DigiWorld, 2009), published by IDATE. IDATE is a consortium of the most important consultancy companies in the European ICT sector that has, for eight years, published the "DigiWorld Yearbook", one of the most detailed and prestigious reports on the state of the sector on a global scale.

According to the above mentioned report, ICT contributed directly to 7 % of the global GDP (Gross Domestic Product) in 2008, a percentage which has remained quite stable for some time. However, an apparent deceleration in growth during recent years has led some experts to suggest that the cycle is coming to an end. The contributions of the different sub-sectors that made up the ICT market in 2008 were: the Telecommunication Services with 37%, followed by Software and Computer Services with 24 %, Computer Hardware with 11%, TV Services with 10%, Consumer Electronics with 10%, and Telecommunications Equipment with 8%.

It is interesting to note that, according to the international DigiWorld report (DigiWorld, 2009), on a global level, Europe and America exhibit less buoyancy due to their advanced level of maturity. Despite an expansion of 2.9% in 2008, in terms of its global influence, the U.S. market seems to have fallen by 0.6 points to 30.6%. The European market grew by 3.4% in 2008, but also lost 0.5 points universally, representing 32.9% of the global market.

Although the ICT markets are concentrated in the more advanced economies, those in emerging regions are far more dynamic.

As for the European market, the growth rate has fallen below 5% since 2006, mainly due to the impact of the deceleration of growth in the telecommunications markets and also the inauspicious economic climate.

The work of AETIC serves to illustrate the Spanish ICT market. AETIC, the Association of Spanish Information and Communication Technology Companies, is the result of a merger between the National Association of Electronic and Telecommunication Industries (ANIEL) and the Spanish Association of Information Technology Companies (SEDISI). It publishes an annual report of the Spanish electronic information technology and telecommunication sector.

According to the 2008 AETIC report (AETIC & the Ministry of Industry, Tourism and Trade, 2009), approximately 102.668 million Euros were generated, so it maintained the same value with regard to the previous year. The market shares were as follows: Telecommunication Services with 44%, Information Technologies with 17%, Automobile Electronics and E-commerce with 15%, Telecommunication Industries with 5%, Consumer Electronics with 4%, Electronics Equipment with 3%, Professional Electronics with 2% and Digital Content with 10%.

In terms of growth in the Spanish ICT sector, a definite deceleration has taken place, with growth dropping from 10% in 2005, to 6% in 2006, 5% in 2007, and then falling to 1% in 2008. Nevertheless, this is for good a sector which employs professionals, creates jobs and generates wealth for other sectors.

Despite it already being a consolidated employment sector, the last five years have seen a growing demand for professionals in the Spanish ICT industry, especially in Research and Development, currently reaching the point of a perceived deficit in the availability of engineers and technical engineers qualified in telecommunications and computer sciences. One of the main causes of this deficit is a decline in the number of university entrants inclined to pursue scientific or technological studies, particularly in courses focusing on ICT.

An important issue this article seeks to emphasize regarding the Spanish ICT sector is that only 57.5% of employees working in it are graduates, the remaining 42.5% do not have university qualifications (AETIC & the Ministry of Industry, Tourism and Trade, 2008).

Of all the graduates employed in ICT, it is the computer scientists who dominate the sector, making up 28.9% of the total. Telecommunication engineers follow with 21.5%, then graduates in economics and business studies with 10.3%. It is notable that almost the 50% of graduates who work in the ICT sector come from these two branches of engineering (AETIC & the Ministry of Industry, Tourism and Trade, 2009).

3. Studies relating to ICT requirements

The range of parameters that respond to the employment needs of the ICT market in Spain that a professional can bring to the workplace varies widely. For this reason, we felt it necessary to establish an initial list, based on the relevant conclusions provided by the literature. We present the main report on this matter next.

Of the different studies relating to Spain, one of the foremost is PAFET (Dueñas, Burillo & Ruiz, 2005). One of the most important national studies in relation to the qualification and profile requirements for professionals in computer sciences, electronics and communications companies is the study called PAFET: Proposal of Activities for Training Electronics, Computer and Telecommunication Engineers. It is promoted by COIT (Official College of Telecommunication Engineers); AETIC

(Association of Spanish Electronics and Information Communication Technology Companies); and AEIT (Spanish Association of Telecommunication Engineers).

A further indispensable work relating to Spain is known as the PESIT report. Published by the Official College of Telecommunication Engineers and the Spanish Association of Telecommunication Engineers (first published in 1984, and then subsequently every 4 years), the reports illustrate the socio-professional position of engineers. The most recent version, "PESIT VI", reflects the survey conducted in 2004 and published 2005 (Carranza & Segovia, 2005).

Another equally important reference that was taken into consideration when defining which personal skills are most valued by engineers concentrated in the Spanish ICT sector is known as the "White Book of the Computer Sciences" (Casanovas, Colom, Morlán, Pont & Ribera, 2004), chapter 9, funded by ANECA (Spanish National Agency of Quality, Evaluation and Accreditation). As well as dealing with other occupations, it sets out generic skills in relation to the professional profiles relative to management, and the development of information technologies.

A project by ANECA, presented by 46 schools from 36 universities relating to the "The Design of Course Outlines and Official Qualifications in Engineering and Telecommunication Adapted by the EHEA" (which resulted in the "The White Book on Telecommunication Engineering: final document of the Telecommunication Engineering Project" (ANECA, 2004; ANECA, 2005) was also a valuable point of reference.

At a European level, another useful source of information was the study on "Profiles of Professional Skills Generic to ICT" (Career Space, 2001) conducted by the Career Space consortium. This work had the same objectives as the PAFET study, but was conducted on a European scale.

The Tuning Project or "Tuning Educational Structures in Europe", also known as "Refining Educational Structures in Europe", is a project addressing the academic world, which seeks to offer a standardized approach that makes the application of the Bologna process possible in higher education institutions across many academic subjects. Although this project includes universities specializing in a wide range of disciplines (business administration, geology, history, mathematics, physics, chemistry and education) no school of engineering participated. Nevertheless, had the work of ECET (European Computing Education and Training), the Socrates-

Erasmus network, been taken into consideration, the Tuning methodology could have been applied to computer sciences.

Another source of information taken into account was the “Dublin descriptors” (Joint Quality Initiative, 2004) which aims to set out general criteria relative to the development of the skills that must be demonstrated for qualifications at the end of each Bologna cycle.

At international level, the ABET (Accreditation Board for Engineering and Technology) criteria relative to engineering qualifications, acknowledged by CHEA (Council for Higher Education Accreditation) in the United States, were born in mind - particularly the recommendations concerning the various computer sciences curricula defined by the IEEE/ACM (*Institute of Electrical and Electronics Engineers* / Association for Computing Machinery: Curricula Recommendations).

4. Objectives

Using a representative sample of companies in the Spanish ICT sector, field work was conducted to clarify the expectations held in the realm of business and by employers in relation to the principal educational parameters that respond to the employment needs of the ICT market in Spain, considering both technical and managerial knowledge.

At the same time, and as an innovate factor since there are no previous bibliographic references on this topic, a further objective was to determine whether there are significant differences between the market expectation from graduate level engineering degrees in the Spanish ICT sector and that which is sought at postgraduate level from students with master degrees.

In order to reflect upon and evaluate the current performance of the academic world, the article also seeks to explore whether the sector believes that universities are providing the necessary training.

A further matter to be explored is whether any differences between sector demands and the demands of different sized of companies can be distinguished.

5. Methodology and technical data

This report is based on a survey completed by 43 companies. Regarding the suitability of the sample, it should be pointed out that the structure of this economic sector in Spain is extremely unbalanced: 98% companies are small (i.e.

less than 50 employees), whereas the remaining 2% employ more than 70% of people in this industry (AETIC & the Ministry of Industry, Tourism and Trade, 2009). The selected sample represents more than 60 % (in number of employees).

The study focuses on the opinions of employers and managers when recruiting their technical staff, so stratified sampling was rejected because small companies neither have structured organizations, nor employ many graduates. The sample included 25 big companies (i.e. more than 250 employees) which represents 60.37% of the sector global population; 11 small companies (0.26%) and 7 medium sized companies (0.12%). Thus, the sample is very suitable for the big companies' stratum, but may misrepresent medium and small companies. In fact, this is not a problem, as the study focuses on the opinions of employers and managers when recruiting their technical staff.

According to the sample construction, post-stratification has been used for analyzing global results: responses have been weighted according to the proportion that big, medium and small companies in the survey represent on the employees population of the Spanish ICT sector.

From a statistical point of view, the approach is quite qualitative and usually we show graphical representations instead of more technical issues, such as ANOVA tables. We believe that this choice is more adequate to the scope of this report and to the sample characteristics. However, references to ANOVA are also included when this method is suitable according to the data available.

The survey was conducted by email, and then a follow-up telephone call was made if necessary. The findings of the survey can be substantiated as the respondents held strategic or middle management positions within their organizations. According to Mintzberg's model (Mintzberg, 1984) this meant that they were therefore suitably knowledgeable and had a deep understanding of their companies. Table 1 shows the respondents' profiles.

Managing director, manager, president or chief executive	51.16%
Operational or technical manager	23.26%
HR manager or HR specialist	13.95%
Commercial or marketing manager	6.98%
Engineer	4.65%

Table 1. Profile of respondents

As can be seen in Table 2, the sample includes the entire range of subsectors that make up the vast ICT sector, although it should be pointed out that conventional categories are becoming increasingly obsolete, given the difficulties of establishing

clear distinctions which unequivocally determine the grouping of different activities involved in the diverse ICT industry. Table 3 shows that the sample was well-balanced, including companies of different sizes.

	Sample
Telecommunication services	44.19%
Information technologies	20.93%
Telecommunication equipment	16.28%
Professional electronics	6.98%
Consumer electronics	4.65%
Audiovisual	4.65%
Electronic components	2.32%

Table 2. Description of the sample according to the ICT subsector

	Sample
Large companies	58.14%
Medium companies	16.28%
Small companies	25.58%

Table 3. Description of the sample according to company size

As some subsectors within the sample are not so well-represented, those of "Professional electronics", "Consumer electronics" and "Electronic components" have been merged into a class called "Electronics". Figure 1 shows the structure of the sample, according to the ICT subsector classification and the size of the companies.

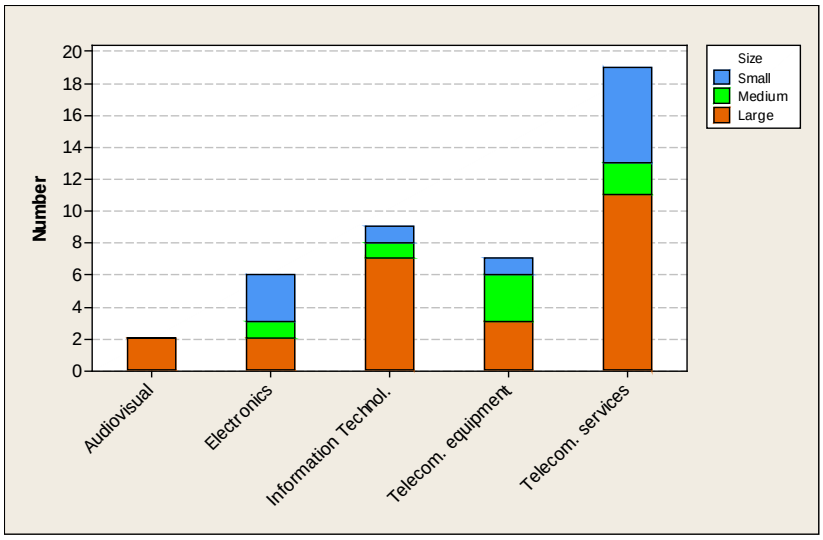

Figure 1. Sample structure

6. Results

Graduates' characteristics: requirements and limitations, from technological and business perspectives

The results illustrated in Figure 2 show the main sector requirements, and the main limitations that recently graduates in computer sciences and telecommunications have, in terms of technological knowledge.

Vertical scale in Figure 2 shows weighted number of responses. As pointed out before, weight corresponds to the proportion that big, medium and small companies in the survey represent on the employees population of the ICT sector. This kind of statistical post stratification gives a more accurate portrait of the whole sector, assuming that big companies, collecting more than 90% of employees, should set the pattern.

It is evident that knowledge about telecommunication networks and information processing, followed by programming languages and internet technologies are the main requirements demanded by the sector. Conversely, the most common limitations identified during the study are telecommunication networks, internet technologies and programming languages.

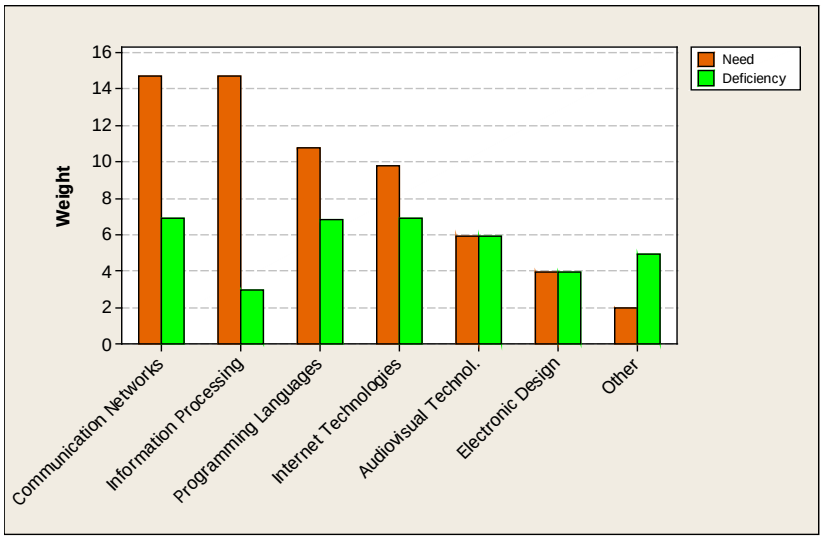

Figure 2. Requirements and limitations: technological knowledge

The results illustrated in Figure 3 show the main sector requirements, and the main limitations recently graduates in computer sciences and telecommunications have, in terms of business knowledge.

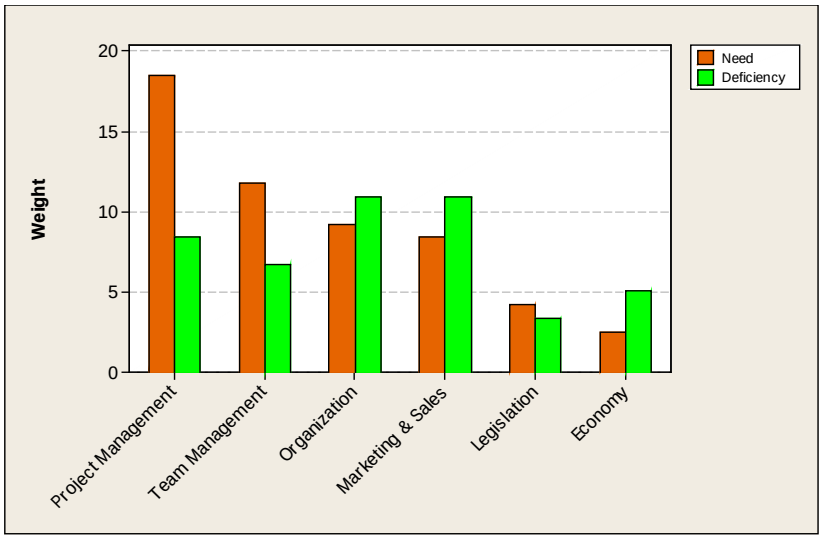

Figure 3. Requirements and limitations: business knowledge

In this case, project management, team management and organization and marketing & sales are identified as the most important requirements for the sector. However, the most notable limitations are marketing & and business organization.

It is interesting to examine how these requirements and limitations relate to the different subsectors. To explore these issues ANOVA statistical testing was applied.

A priori, it might be suspected that deficiencies were neither dependent on size nor on sector, for example, weaknesses might be the result of poor training rather than being related to the expectations of the industry. This is generally reflected in the analysis, although there are some exceptions: audiovisual technologies, information processing and business organization. As may be expected, every company in the audiovisual sector detected a shortage of skills in audiovisual technologies, whereas this deficiency was not reported by other sectors:

Source	DF	SS	MS	F	p
Sector	4	1,6062	0,4016	4,37	0,005
Error	38	3,4890	0,0918		
Total	42				
Level			**Mean**		**StDev**
Telecom. equipment			0,1420		0,3756
Telecom. services			0,1049		0,3132
Information technologies			0,1109		0,3311
Electronics			0		0
Audiovisual			0,9937		0,0000

Table 4. ANOVA for deficiencies in audiovisual technologies

Similarly, and more surprisingly, companies in both the electronics and audiovisual arenas claimed a considerable shortfall in information processing:

Source	DF	SS	MS	F	p

Sector	4	0,5036	0,1259	2,13	0,096
Error	38	2,2504	0,0592		
Total	42	2,754			
Level				Mean	StDev
Telecom. equipment				0,0006	0,0016
Telecom. services				0,0525	0,2279
Information technologies				0	0
Electronics				0,1663	0,4054
Audiovisual				0,4969	0,7027

Table 5. ANOVA for deficiencies in information processing

In contrast to this, some significant differences appear when observing the requirements for technological knowledge throughout the ICT subsectors. The most relevant case is electronic design, which is a very important requirement in the electronics and audiovisual industries (Table 6). A similar and quite obvious situation appears with audiovisual technologies and audiovisual companies (Table 7).

Source	DF	SS	MS	F	p
Sector	4	0,8971	0,2243	3,18	0,024
Error	38	2,6827	0,0706		
Total	42	3,5798			
Level				Mean	StDev
Telecom. equipment				0,0003	0,0007
Telecom. services				0,0002	0,001
Information technologies				0,1104	0,3312
Electronics				0,3326	0,5121
Audiovisual				0,4969	0,7027

Table 6. ANOVA for need in electronic design

Source	DF	SS	MS	F	p
Sector	4	1,9204	0,4801	5,75	0,001
Error	38	3,1753	0,0836		
Total	42	5,0957			
Level				Mean	StDev
Telecom. equipment				0,2845	0,4845
Telecom. services				0,1046	0,3133
Information technologies				0	0
Electronics				0,0007	0,0018
Audiovisual				0,9937	0,0000

Table 7. ANOVA for need in audiovisual technologies

There is also a remarkable difference of opinions with respect to business organization skills: companies belonging to the information technologies and, mostly, audiovisual sector detected more deficiencies and needs in organization and, partially, in project management (see Table 8):

Source	DF	SS	MS	F	p
Sector	4	2,301	0,575	3,29	0,021
Error	38	6,645	0,175		
Total	42	8,946			
Level				Mean	StDev
Telecom. equipment				0	0
Telecom. services				0,2619	0,4493
Information technologies				0,5525	0,5232

Electronics	0,1663	0,4054
Audiovisual	0,9937	0,0000

Table 8. ANOVA for deficiencies in organization

In terms of evaluating the relevance of university training, it would be desirable those organizations' major requirements are satisfied, and that there are few omissions in graduates' skill sets. Therefore the ideal outcome (graduates are adequately trained in this important skill) and the less-appealing outcome (graduates do not have sufficient skills in this key area) have been plotted in Figures 4 and 5.

The results are generally positive for technological knowledge, as the key needs are satisfied in five out of six cases. However, the results relating to business skills show a very different situation. Respondents reported significant gaps in the graduates' skills sets, particularly in the areas of organization, marketing and sales, economics and team management. This deficit echoes a well-known trend in engineering education in Spain, where undergraduates show little interest in business skills and the curricula tend not to include the topic.

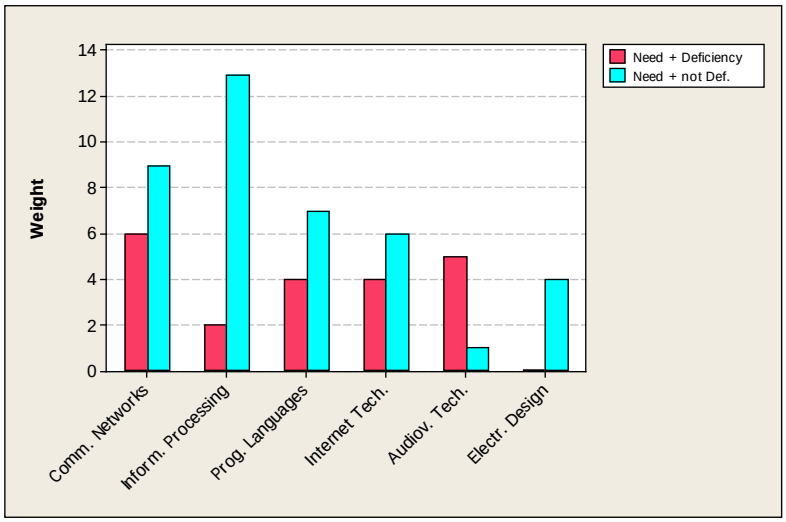

Figure 4. Training outcomes, technological skills

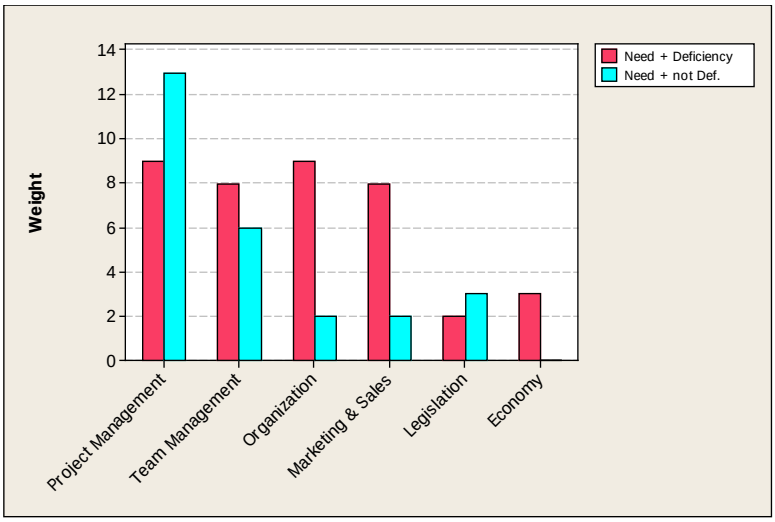

Figure 5. Training outcomes, business skills

Differences from the Perspective of Employers at Graduate and Postgraduate or Master's level

Employers were asked about their preferences when hiring. As there are two main levels of qualification in the Spanish university system, "technical engineer" (which compares to a degree level) and "superior engineer" (which compares to a postgraduate level), the response categories included four options:

- We generally employ technical engineers,
- We generally employ superior engineers,
- We employ the same proportion of technical and superior engineers,
- We are indifferent as to the employee's level of qualification

The responses are presented in Figure 6: in most cases (41.9%), there is no preference between the levels of qualification and, when a preference is specified, superior engineers are preferred (37.2%).

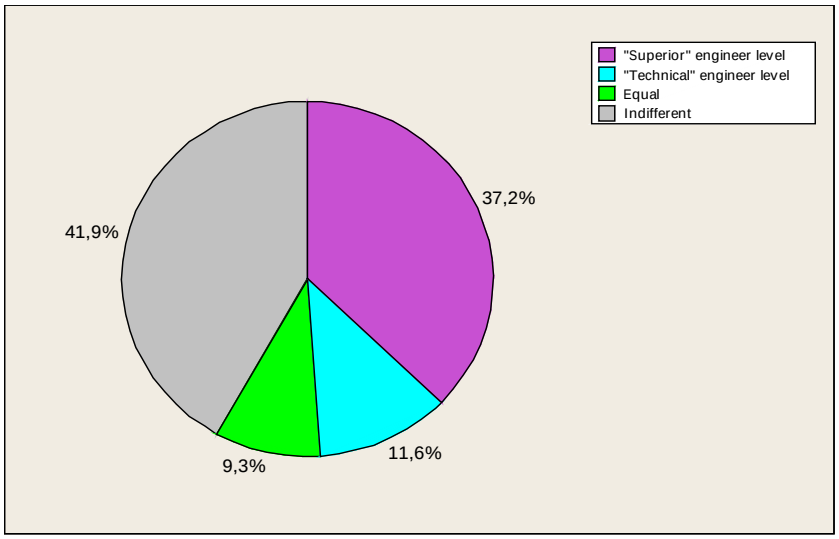

Figure 6. Preferences when hiring

The possibility of differences in recruitment preferences according to sector or the size of the company was further examined. The findings are illustrated below. Although from a statistical point of view (as ANOVA, for instance, will demonstrate), there are few notable differences (Figure 7), it is evident that employers in the Information Technologies sector tend to hire superior engineers. With regard to company size, Figure 8 shows that large companies tend to be either indifferent or employ superior engineers; medium-sized enterprises clearly prefer to employ superior engineers level staff, and the small companies display a relatively equal balance between technical and superior engineers (in the two later cases statistical significance, is difficult to determine because there are so few in the sample).

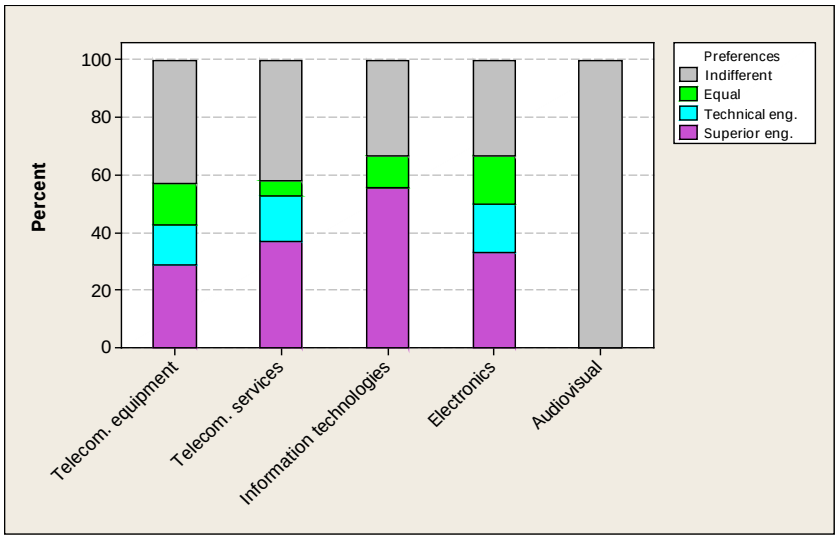

Figure 7. Preferences when hiring, by sector

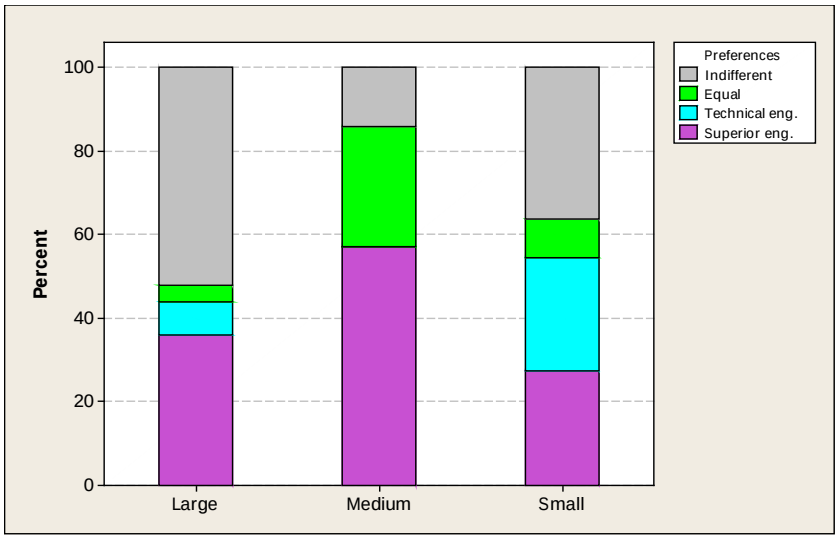

Figure 8. Preferences when hiring, by company size

To develop a more in-depth understanding of this theme, the survey included other questions, asking if postgraduate level training (what was called in Spain, superior engineers) brings added value when filling new positions. The analysis distinguished between new employees with experience and those without experience. As may be expected, affirmative responses were obtained in more than 60% of cases. However, when the person they wanted to employ already had experience, the level of their qualification was not so important (Figure 9).

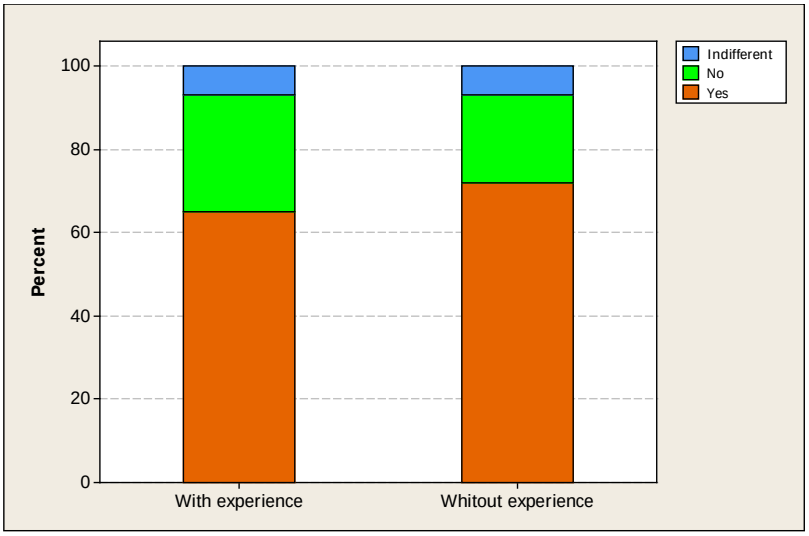

Figure 9. Added value provided by superior engineers

As with the previous topics, the potential influence of sector and the size of the company were considered. Figures 10 and 11 show the results according to those factors.

Less than half of the smaller companies predicted added value as a result of longer training, whereas most of the medium-sized organizations expected that benefit (Figure 10).

When the same characteristic is observed through sector clustering, the most striking fact is that when considering staff without experience, Electronics enterprises did not anticipate much added value from superior level training (Figure 11). As pointed out previously, the results in the audiovisual sector are not significant because very little data was collected for this category.

Figure 10. Added value provided by superior engineers, by company size

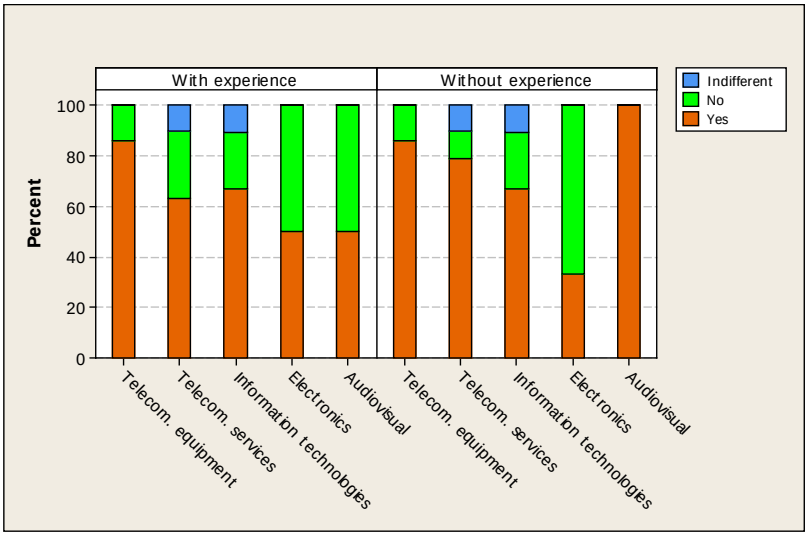

Figure 11. Added value provided by superior engineers, by sector

The final question dealt with the preferred profile for managerial positions. The results are quite clear: 83.7% of respondents preferred a superior engineer qualification; 16.3% were indifferent; and no one opted for the technical engineer level.

Clustering by size (Figure 12) does not show significant differences between the different sized companies, although, the larger the company is, the more likely they are to demand superior qualifications for managerial appointments. Neither were there significant differences when the various sectors were considered; the only fact worth mentioning was that higher level training for managers seemed less important in the Telecommunication Services (Figure 13).

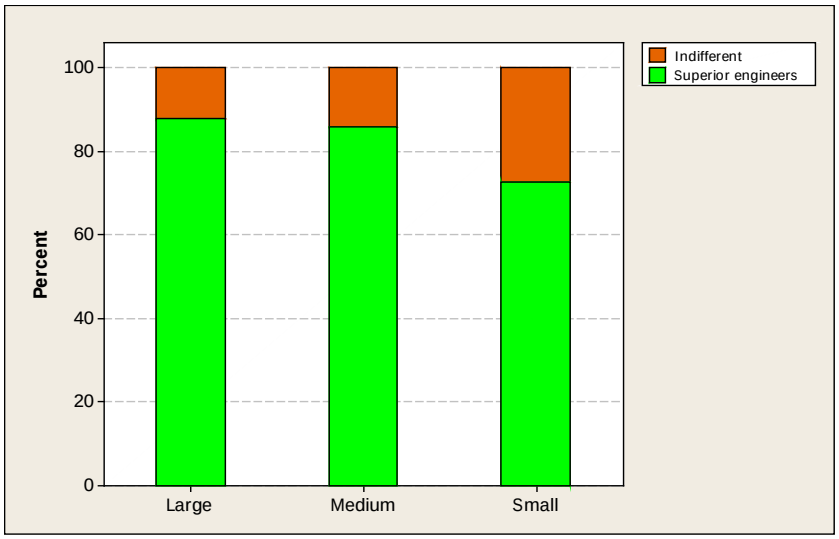

Figure 12. Managerial positions, by company size

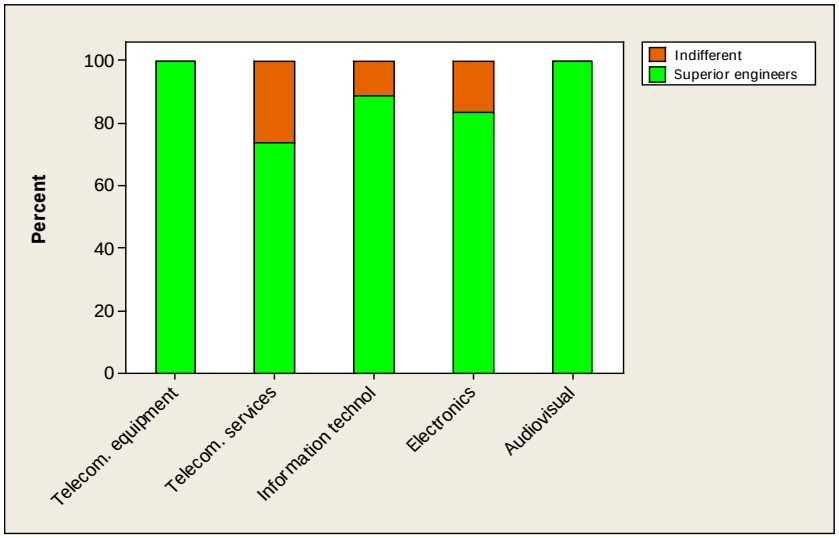

Figure 13. Managerial positions, by sector

7. Conclusions and limitations

As a first conclusion of the current research it should be noted that in terms of technological knowledge, the gap between what the industry requires and the skills graduates can offer is, in general, much smaller than the gap relating to business management skills, where differences exceeding 25% have been demonstrated. This would suggest that the Spanish ICT sector needs to improve learning in the subjects related to business management.

More specifically, it can be seen that the ICT sector highlights the necessity for expertise in telecommunication networks and Internet technologies, while the results indicate an underperformance by graduates in both subject areas. Similarly, in terms of business management skills, the sector requirements include project management, marketing and sales, and business organization, all of which have been stressed as areas where graduates have most weakness.

It is therefore important to reconsider how the University should respond to these "gaps" in knowledge, whether the gaps could be eliminated or at least reduced, and also how the first generation of graduates from the EHEA should be assessed.

By examining the results of this study in terms of the sector preferences relating to employing engineers, there are some very interesting conclusions regarding the level of qualifications. Firstly, the ICT sector expected to contract more graduates than postgraduates, which initially made sense. Small companies have a stronger tendency towards this employment practice.

Finally, a more surprising conclusion is that a significant segment of the Spanish ICT sector, specifically 51.2% of the companies surveyed, did not distinguish between professional profiles, expressed indifference, and were equally likely to employ graduates as postgraduates.

Also in the same vein, in most cases, the added value that the company expects to gain through the recruitment of postgraduate level engineers, telecommunication engineers and computer scientists, is less than at graduate level.

Lastly, the limitations of this research should be pointed out. As explained in the methodology section, this paper has presented results and conclusions which are specifically representative of the ICT sector in Spain. Furthermore, the time frame in which it was carried out coincided with closing stages, or perhaps the final phase, of an educational paradigm. Also, it should be pointed out that sample was rather

small in some sub cases and for this reason sometimes we have made a qualitative study instead a deep statistical analysis.

This article, therefore, is a timely reflection of the reality of higher education in the field of telecommunication engineering and computer sciences; a field that is perhaps no longer applicable, and fast becoming obsolete. However, it cannot be neglected, because it serves as a platform to determine and evaluate the true magnitude of the changes taking place in the Technical University of Spain and Catalonia, led by the introduction of the common European model and the implementation of the new pedagogical model associated with it. The assessment of this new system will be a research topic of the future.

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Appendix A

Tic Questionnaire:

Name :

Job :

Company :

Date :

1. If we think about the recently graduated ICT engineers' technical knowledge, what are the most important needs?

Electronic Design	
Programming languages	
Telecommunication Networks	
Internet technologies	
Audiovisual and multimedia technologies	
Information processing	
Other (indicate):	

2. If we think about the recently graduated ICT engineers' technical knowledge, what are the most important lacks?

Electronic Design	
Programming languages	
Telecommunication Networks	
Internet technologies	
Audiovisual and multimedia technologies	
Information processing	
Other (indicate):	

3. If we think about the recently graduated ICT engineers' business knowledge, what are the most important needs?

Marketing - Commercial	
Workgroup Management	
Project Management	
Interpreting legal rules	
Economy	
Business organization	
Other (indicate):	

4. If we think about the recently graduated ICT engineers' business knowledge, what are the most important lacks?

Marketing - Commercial	
Workgroup Management	
Project Management	
Interpreting legal rules	
Economy	
Business organization	
Other (indicate):	

5. If your company was to hire recently graduated ICT engineers, which would be, approximately, the proportion of superior engineers (5 years of training) and technical engineers (3 years of training)?

More superior engineers (5 years) than technical engineers	
More technical engineers (3 years) than superior engineers	
Indifferent	

6. Do you consider that the training received in superior engineering degrees, compared to the training in technical engineering, adds value to the company when hiring 'recent' graduates in the ICT sector?

Yes	
No	

7. Do you consider the training received in the superior engineering degrees, compared to technical engineering, add value to the company when hiring 'experienced' graduates in the ICT sector?

Yes	
No	

8. If we talk about managerial positions, what would be the best profile?

Superior Engineers (5 years):	
Technical Engineers (3 years):	
Indifferent or you do not care:	

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