Agència
per a la Qualitat
del Sistema Universitari
de Catalunya

EMPLOYERS

THE OPINION OF EMPLOYERS REGARDING THE EDUCATION RECEIVED BY GRADUATES IN ICTs

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08007 Barcelona

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With the cooperation from the sector of

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INTRODUCTION

The primary goal of Agència per a la Qualitat del Sistema Universitari (AQU Catalunya) is to **contribute to the improvement of university study programmes in the Catalan university system**. To achieve this, it is essential to benefit from evidence and data making it possible to assess the functioning of each study programme with the aim of making it easier for decisions to be made by the officials in charge of the universities and study programmes and by politicians responsible for universities.

Evidence-based proposals for improving study programmes

This report sets out evidence regarding the implementation and delivery of study programmes in the field of ICTs gleaned from the results of the **2018 survey on employers in this sector. Two education sub-fields are distinguished: the first is linked to study programmes in Telecommunications;[1] the second is linked to study programmes in Computer Science.[2]**

The survey strives to gain an acquaintance of the opinion of companies regarding the education received by the recently graduated individuals in the field of ICTs they have recruited, particularly with regard to cross-disciplinary and specific skills which bear substantial margin for improvement.

In addition to these results, the report incorporates an initial section with **contextual information on the study programmes in ICTs**, setting out **basic data on the study programmes** and the main results of the **surveys on the satisfaction of individuals who have recently graduated from these study programmes, as well as the results of the survey on their access to the labour market**.

Figure 1. Databases for improving study programmes

[1] This includes the following study programmes: Telecommunication Systems Engineering, Electronic Systems Engineering, Telematics Engineering, Telecommunication Technologies and Services Engineering, Engineering in the Management of ICTs, and Audiovisual Systems Engineering.

[2] This includes the following study programmes: Computer Engineering, ICT Systems Engineering, Multimedia Engineering, Geoinformation and Geomatics Engineering, and Bioinformatics.

INDICATORS ON THE STUDY PROGRAMMES IN ICTs

Basic data on the study programmes

The basic data on the study programmes involves **administrative data taken from the UNEIX information system.**

Figure 2. Indicators on the implementation and delivery of study programmes in the sub-field of Telecommunications (2017-2018 academic year)

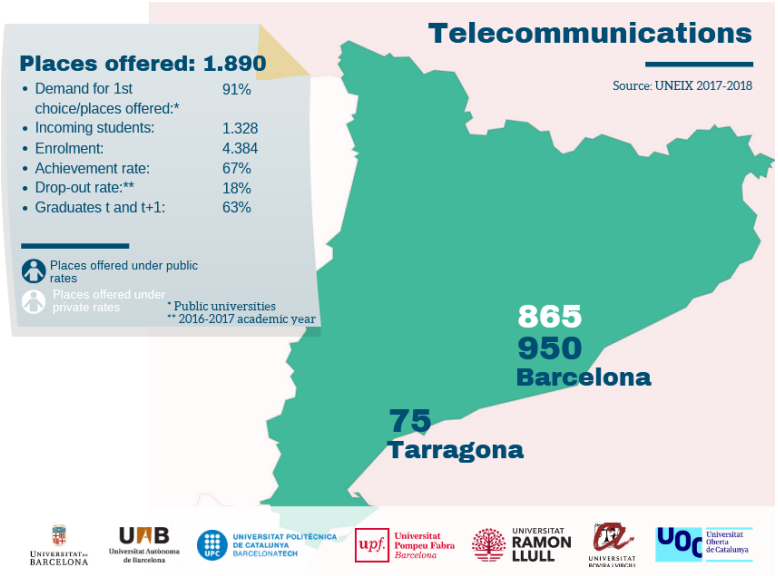


Figure 3. Indicators on the implementation and delivery of study programmes in the sub-field of Computer Science (2017-2018 academic year)

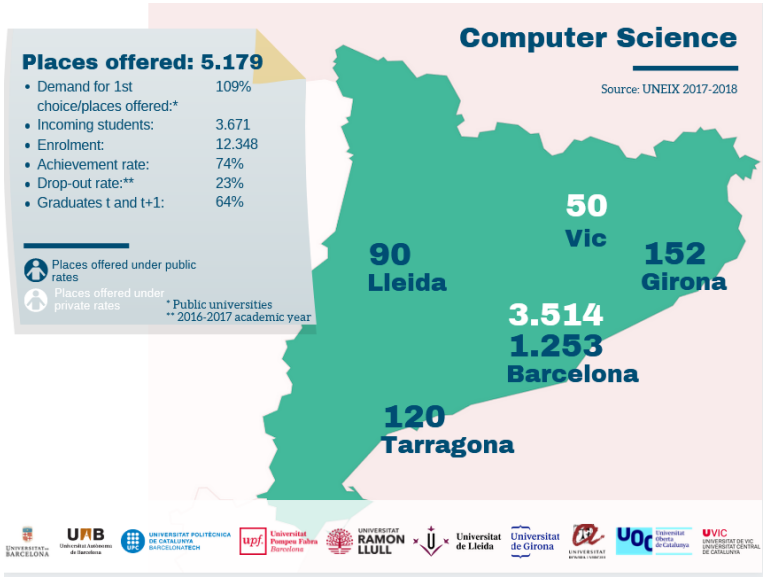
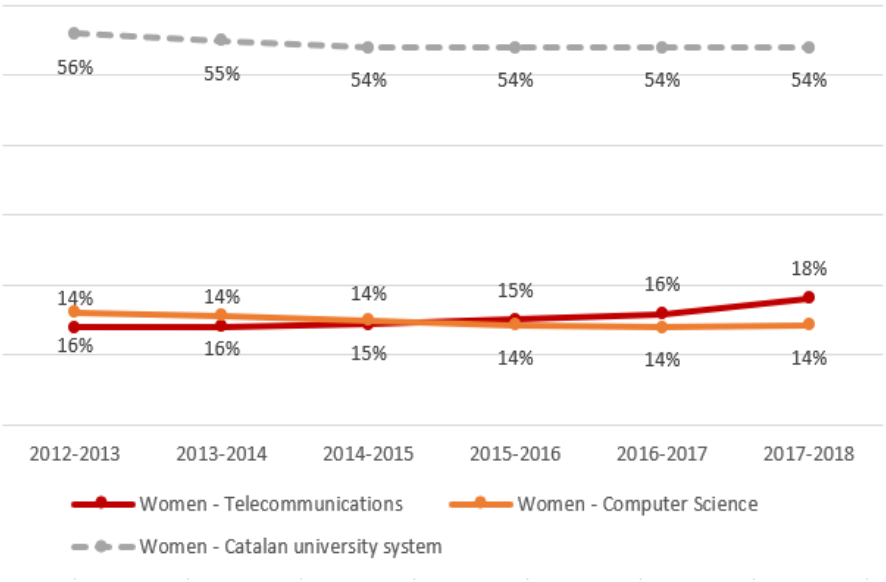


Figure 4. Trend in the percentage of women enrolling on study programmes in the sub-fields of ICTs



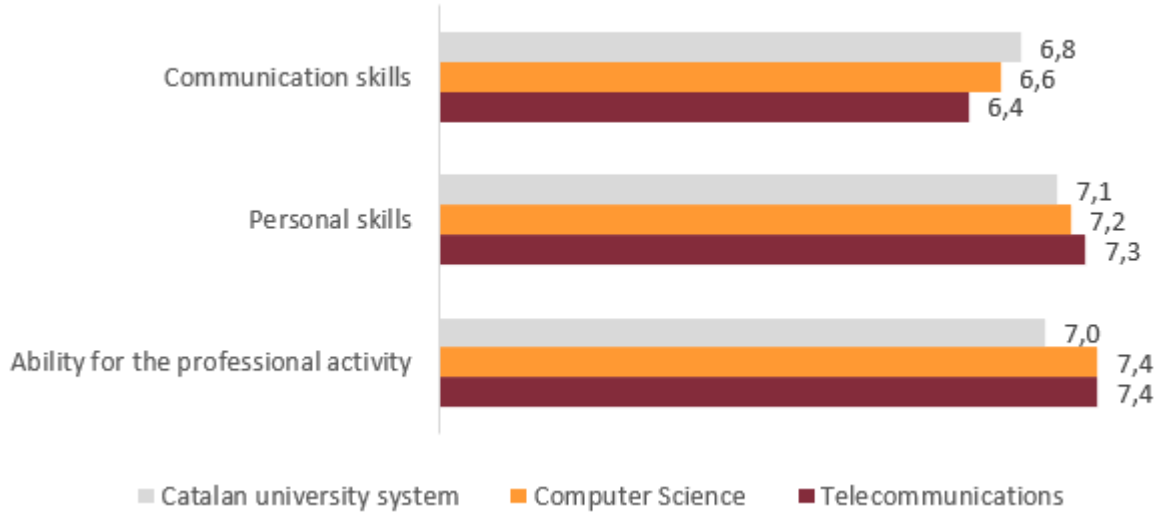
The study programmes in both sub-fields of ICTs are evidently male-dominated

The proportion of women enrolled on the Bachelor's degrees in this sub-field was below 20% in the 2017-2018 academic year, far below the average for the study programmes in the Catalan university system.

Satisfaction of graduates with the university education received

The data regarding satisfaction with the education received stems from the **satisfaction survey** drawn up by AQU Catalunya. It sets out information on graduates' satisfaction with various characteristics of the education delivered in the university study programme they followed. It is an online survey conducted yearly on all the individuals who graduated one year earlier. The results shown are the averages for 2016, 2017 and 2018 in the respective sub-fields and for the Catalan university system as a whole.

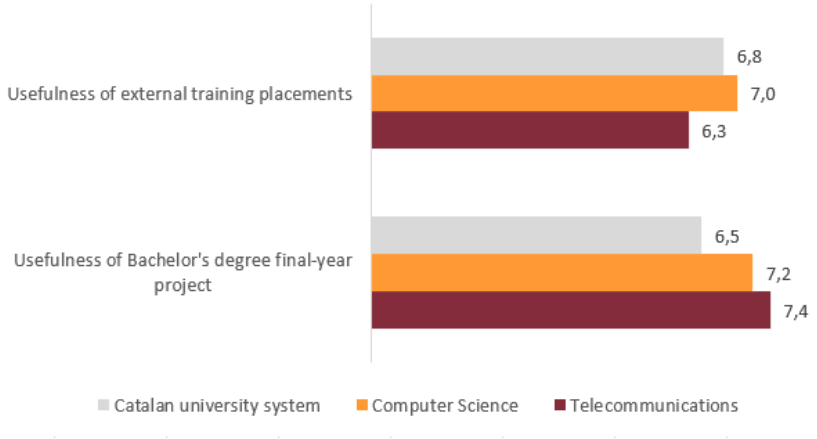
Figure 5. Assessment of several aspects of the education delivered (from 0 to 10)



Satisfaction among graduates of ICTs with the improvement in personal skills and ability for the professional activity is substantial

On the other hand, their satisfaction with the improvement delivered in terms of communication skills is lower than the study programme average in the Catalan university system.

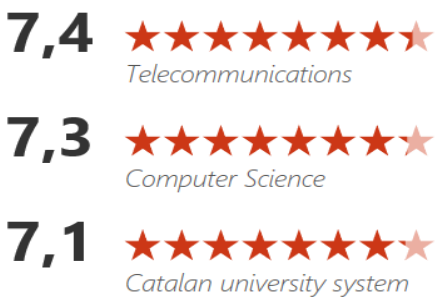
Figure 6. Usefulness of external training placements and Bachelor's degree final-year projects (from 0 to 10)



Students who qualify in the sub-field of Telecommunications place greater value on the usefulness of the Bachelor's degree final-year project, while those qualifying in Computer Science highlight the usefulness of external training placements

Satisfaction with the usefulness of the Bachelor's degree final-year project is above the average for the study programmes in the Catalan university system (7.2 in Computer Science and 7.4 in Telecommunications compared to 6.5 for the Catalan university system overall). In the case of external training placements, the assessment given is substantially higher for Computer Science (7.0) than for Telecommunications (6.3), for which the rating reported even falls below the Catalan university system average (6.8).

Figure 7. Overall satisfaction with the study programme (from 0 to 10)



Overall satisfaction with the education in ICTs is above the Catalan university system average

Access to the labour market for graduates

The survey on access to the labour market is conducted every three years with the aim of finding out what the experience of graduates is when it comes to access to the labour market three years after completing their university programmes. The results shown relate to the most recent survey from 2017 and are broken down according to university and study programme. The results for the Catalan university system as a whole show the average for all degree programmes taught in Catalonia.[3]

Figure 8. Employment status of graduates in 2017

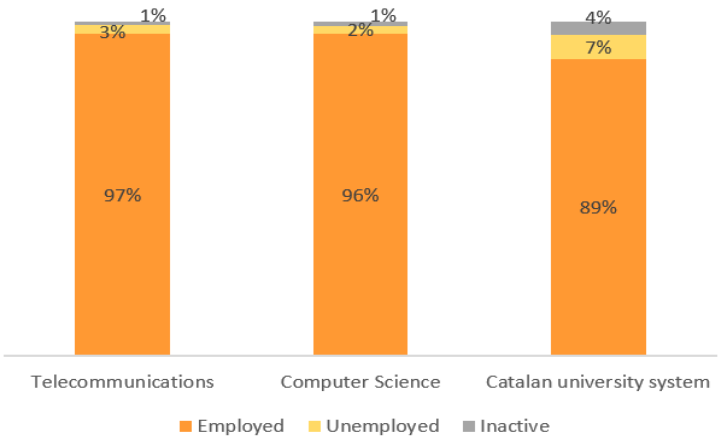
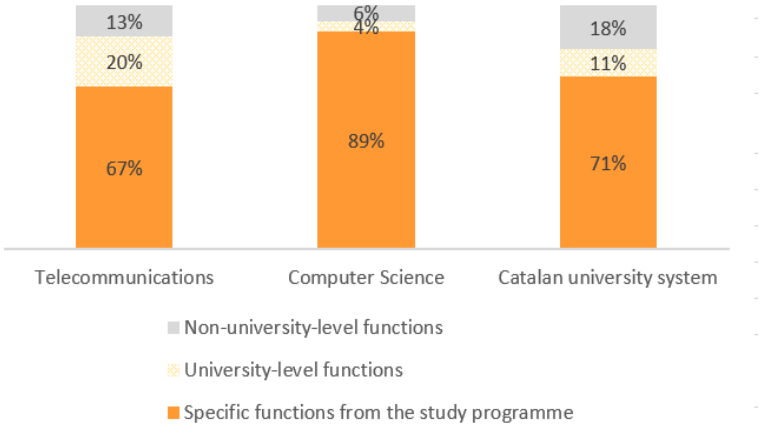


Figure 9. Functions performed at work in 2017



Almost all graduates of ICTs are in work three years after completing their education, although big differences are reported in terms of the proportion performing functions specific to their study programme

The percentage of employment among graduates of study programmes in ICTs is higher than the Catalan university system average.

On the other hand, significant variations are noted in the percentage of graduates in ICTs performing functions specific to the study programme: while for Computer Science 89% report doing so, the percentage falls to 67% for Telecommunications, which is below the average in the Catalan university system (71%).

[3] At classroom-based universities. The results are weighted by a factor that corrects possible proportional variations in the sample.

Figure 10. Contract type in 2017

	Telecommunications	Computer Science	Catalan university system
Permanent	76%	73%	50%
Temporary	17%	13%	35%
Self-employed	5%	11%	11%
Others	2%	3%	4%
Total	100%	100%	100%

Figure 11. Monthly gross earnings (only those in full-time work) in 2017 (€)

High salaries and employment stability are the most frequently reported elements among graduates of ICTs

Companies employing graduates of ICTs provide excellent employment conditions to ensure retention: almost 3 in every 4 are on a permanent contract, while the average stability figure for the Catalan university system overall stands at 2 in every 4. With respect to income, most are earning above €24,000 (as reported by 78% of Telecommunications graduates and 69% of Computer Science graduates), percentages that are far higher than the Catalan university system average.

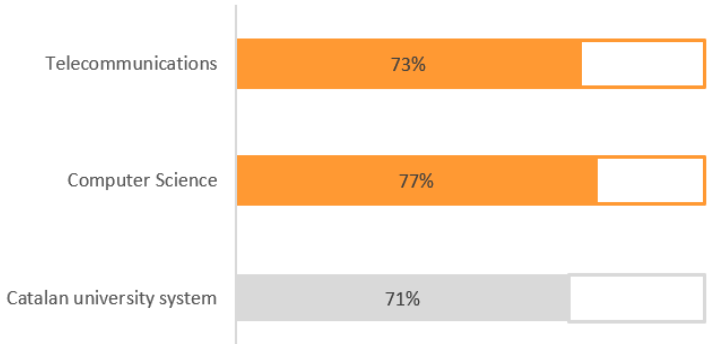
Figure 12. Level of education received according to skill in 2017 (from 0 to 10)

Skills level	Telecommunications	Computer Science	Catalan university system
Theoretical training	7.1	6.9	6.8
Practical training	5.9	6.4	5,6
Oral expression	5.0	5.3	5.9
Written expression	5.1	5.4	6.3
Team work	7.1	7.0	6.8
Leadership	4.7	4.7	5.0
Problem solving	7.5	7.3	6.1
Decision-making	6.1	6.1	5.8
Creativity	5.0	5.3	5.2
Critical thought	5.9	6.1	6.5
Management	5.2	5.7	5.4
IT skills	7.1	7.9	5.0
Languages	3.9	3.7	3.7
Documentary skills	5.9	5.9	5.9

Problem solving, team work and IT are the most highly rated skills in study programmes in ICTs

In addition, the level of education reported for these three skills is above the average for the Catalan university system. As with other study programmes in the system, however, languages still show the greatest room for improvement.

Figure 13. Percentage of graduates willing to take the same study programme 3 years later



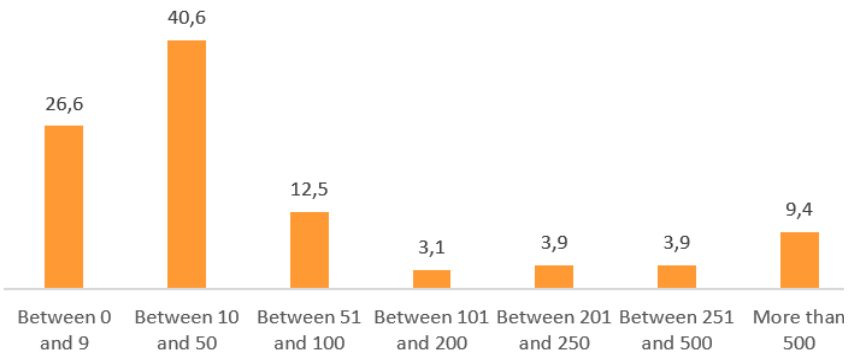
Around 7 in every 10 graduates of ICTs would take the same study programme again

This is just higher than the percentage of those who would take the same programme again in the Catalan university system overall.

THE OPINION OF ORGANISATIONS REGARDING THE EDUCATION RECEIVED BY GRADUATES IN ICTs

Characteristics of the organisations that have recruited individuals who recently graduated in ICTs

Figure 14. Classification of organisations according to the number of workers (%)



Most companies recruiting individuals who graduated in ICTs are small and with qualified staff

Figure 15. Classification of organisations according to the percentage of workers with a university qualification (%)

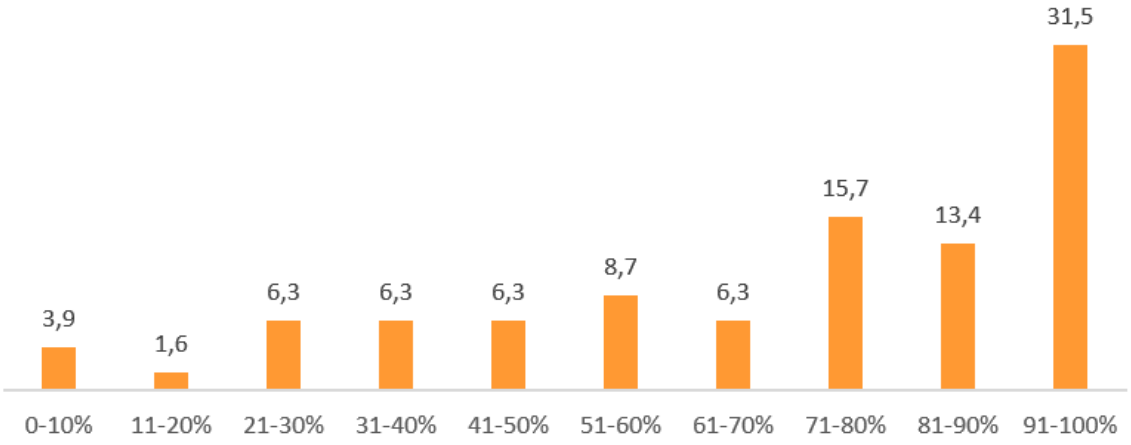
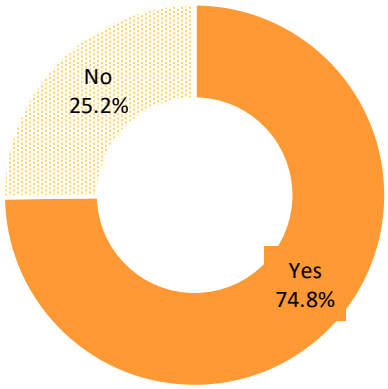


Figure 36. Organisations that have operated in the international sphere



Most of these companies have ventured for internationalisation...

Around 7 in every 10 engage in relations in the international sphere and state that the international market accounts for 42% of their total sales and services on average. This proportion is similar to other sectors for which the international market is important, such as Tourism, Biosciences or Production Engineering.

Figure 17. Percentage of sales and services in the international sphere compared to the total

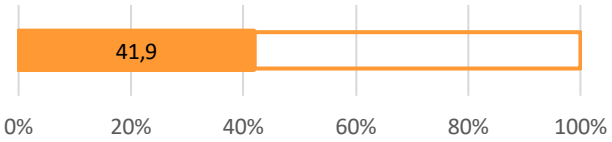
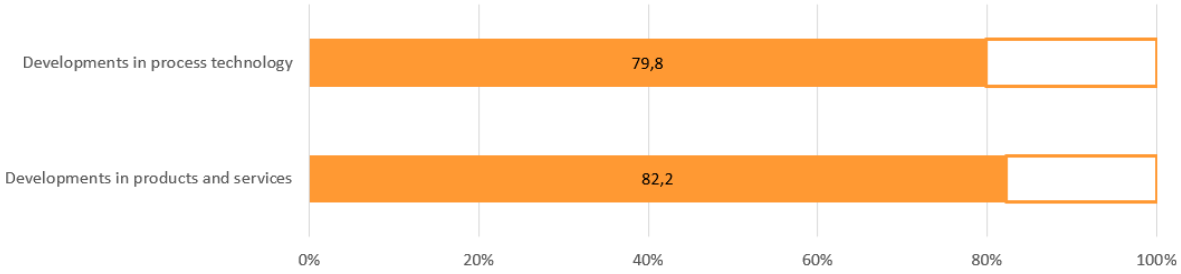


Figure 18. Organisations that have introduced developments in process technology and/or in products or services (%)



Note: "Developments in process technology" refer to major changes in process technology: new machinery or software, new forms of management (just-in-time production, quality and/or knowledge management). Also, "developments in products or services" refer to products or services that are completely new on the market or to the company (or substantially enhanced products or services).

...and for innovation

80% state that they have incorporated major changes in their process technology, i.e., new equipment or software and/or new forms of management. Moreover, 82% have released new products or services onto the market or incorporated them into the company. These organisations are the most innovative when compared to those operating in other sectors.

Recruitment of individuals who recently graduated in ICTs

Table 1. Number and percentage of organisations that have recruited individuals who recently graduated, according to ICT study programmes

Study programme sub-field	Study programmes	*n*	%
Telecommunications	Telecommunication Systems Engineering	23	18%
	Electronic Systems Engineering	7	5%
	Telematics Engineering	2	2%
	Telecommunication Technologies and Services Engineering	3	2%
	Engineering in the Management of ICTs	3	2%
	Audiovisual Systems Engineering	1	1%
Computer Science	Computer Engineering	78	61%
	ICT Systems Engineering	6	5%
	Multimedia Engineering	3	2%
	Geoinformation and Geomatics Engineering	2	2%
	Total	**128**	**100%**

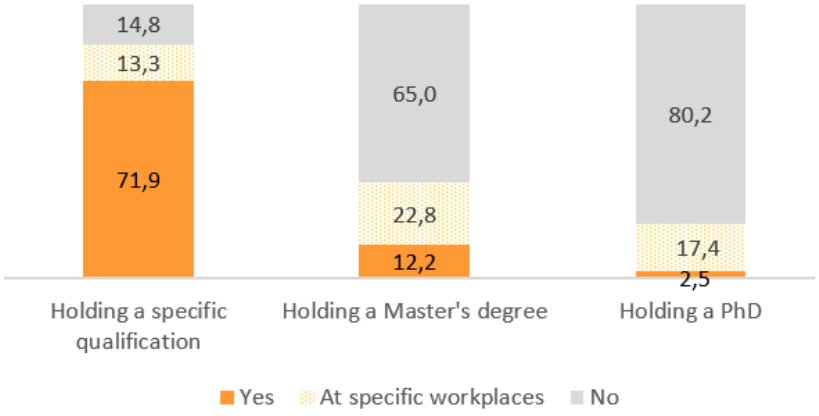
Table 2. Business activity of the employer according to the sub-field of the study programme followed by the individual recruited

	Telecommunications	Computer Science	Total
Manufacturing industries	15%	4%	8%
Sale and repair of motor vehicles / Transport and storage	3%	1%	2%
Information and communications	44%	45%	45%
Financial and insurance activities / Real estate activities	3%	3%	3%
Professional, scientific and technical activities	15%	28%	24%
Administrative activities and ancillary services	5%	3%	4%
Public administration / Education	3%	1%	2%
Artistic, recreational and entertainment activities		1%	1%
Others	13%	12%	13%
Total	100%	100%	100%

Companies that recruit individuals who recently graduated in ICTs primarily belong to the information and communications sector

Secondly, 24% are companies in the professional, scientific and technical activities sector (largely consultancy firms). There are no major differences between companies recruiting individuals whether they graduated in the sub-field of Telecommunications or Computer Science.

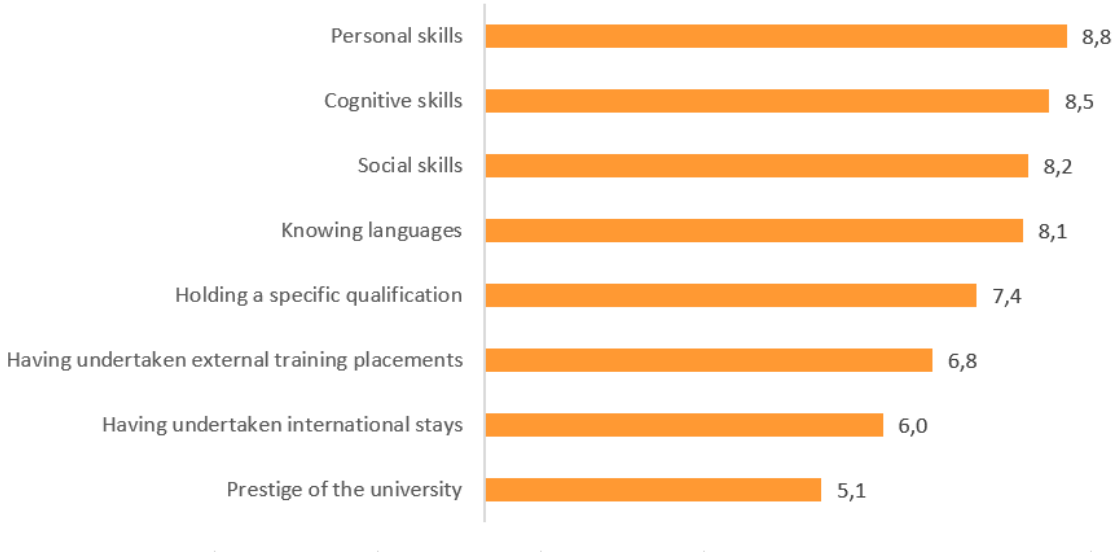
Figure 19. Relevance of higher education in the recruitment of individuals who recently graduated (%)



A Bachelor's level of education suffices for most organisations

A Master's degree is welcomed by 35% of organisations, while only 20% consider holding a PhD to be relevant.

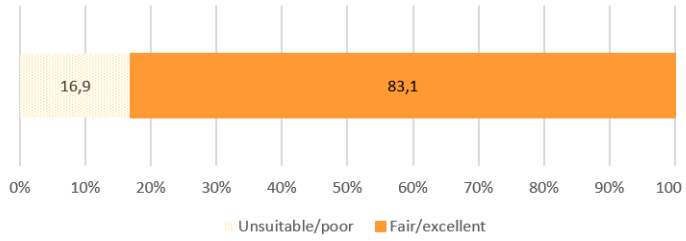
Figure 20. Relevance of certain factors in the recruitment of individuals who recently graduated (from 0 to 10)



Personal, social and cognitive skills, along with languages, are the most highly valued factors when it comes to recruitment

The remaining factors – having undertaken international stays or the prestige of the university – are less important to recruitment, although the scores are above 5 in all cases.

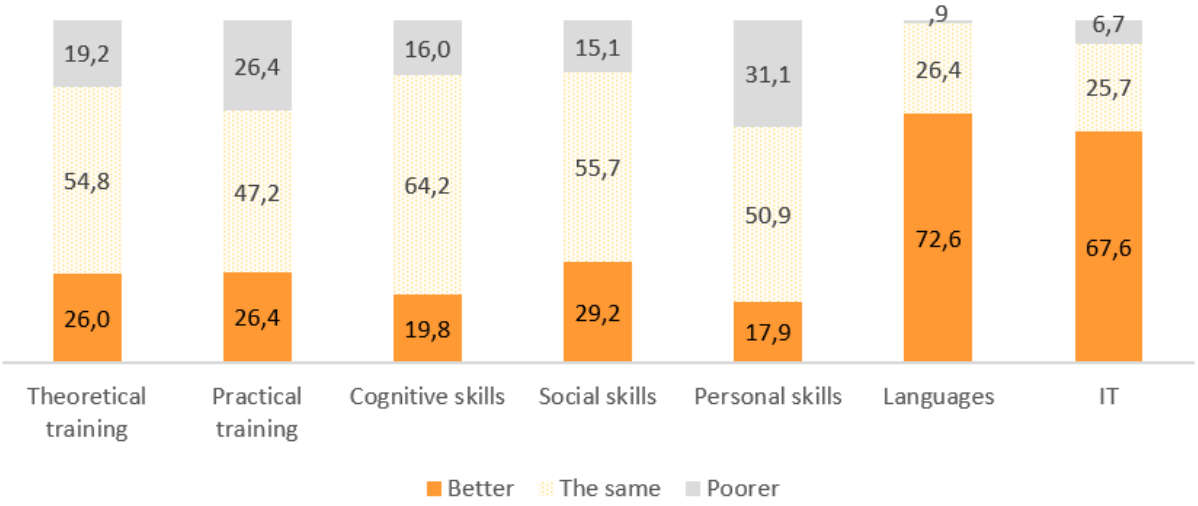
Figure 21. Suitability of individuals who recently graduated in ICTs to the needs of the workplace (%)



Individuals who graduate in ICTs are well suited to the workplace

Almost 8 in every 10 companies surveyed consider that the individuals graduating in ICTs they have recruited in recent years are suited to the needs of the workplace. This proportion is similar to the Engineering sector, although lower than other sectors, such as Biosciences (with 9 in every 10).

Figure 22. Trend in the current education received in ICTs compared to that received 5 and 10 years ago (%)



The education received in ICTs also shows an improvement in terms of languages and IT skills in recent years

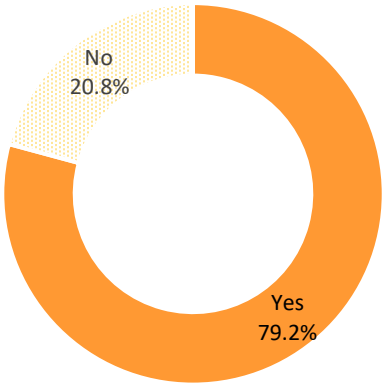
72% of companies consider that language skills have improved while 68% consider this to be true of IT skills. Although these are positive figures, the percentages are lower than those reported in other sectors.

Furthermore, more than half of the companies surveyed feel that the education received by graduates of ICTs in terms of theoretical and practical training and cognitive skills (problem solving, critical thought, creativity, etc.), social skills (adapting to a working group, emotional intelligence, etc.) and personal skills (responsibility, initiative, autonomy, etc.) has remained constant.

As is the case in other sectors, 1 in every 3 organisations consider that the personal skills of individuals who have recently graduated in ICTs have declined in recent years.

Difficulties in recruitment

Figure 23. Employers that encountered difficulties in recruiting staff with suitable profiles (%)



Around 8 in every 10 organisations report having encountered difficulties in recruitment

This statistic is much higher than the value obtained in the employers' study from 2014 for the production sector overall (42%) and it is also above most sectors examined in the survey from 2018, such as Tourism (70%), Production Engineering (67%), and so on.

Figure 24. Reasons for difficulties in recruiting staff with suitable profiles (% of organisations)

Lack of skills needed for the position and a shortage of graduates in a specific field

60% of companies that encountered difficulties in recruitment state that the candidates lacked the necessary skills for the position, as is the case with most of the remaining sectors reviewed. One distinguishing factor is that 42% of organisations report a shortage of graduates in a specific field.

Figure 25. Organisations that encountered difficulties in recruiting staff with suitable profiles depending on the sub-field followed by the graduates they have hired

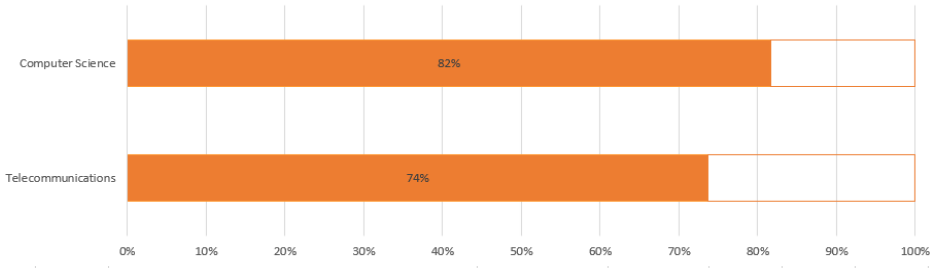
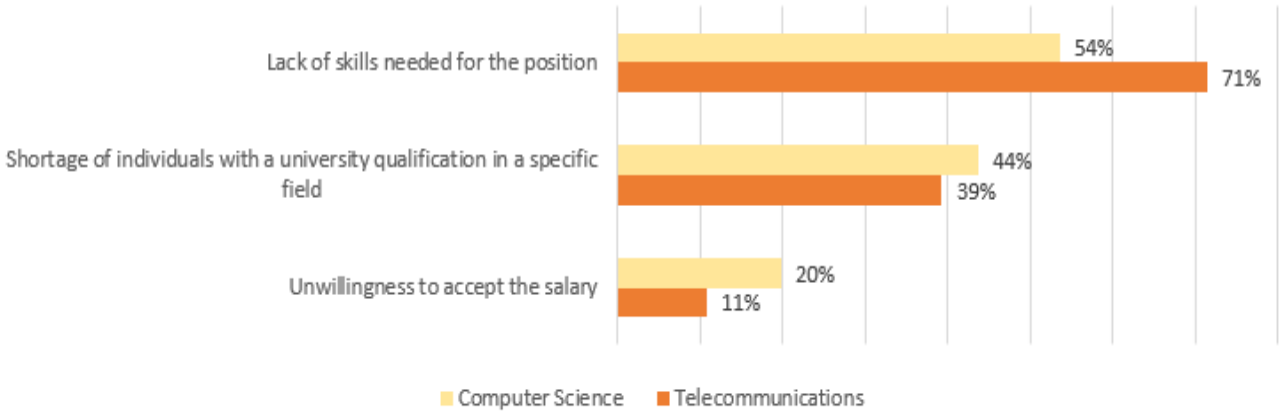


Figure 26. Difficulties in recruiting staff with suitable profiles depending on the sub-field followed by the graduates they have hired (% of organisations)



More companies encounter difficulty in recruiting staff with suitable profiles when hiring graduates from the Computer Science sub-field

Specifically, 82% of organisations report having encountered difficulties in this respect compared to 74% of those recruiting graduates from the sub-field of Telecommunications. In terms of the reasons for these difficulties, almost 4 in every 10 report there being a shortage of graduates in this specific sub-field.

It is noteworthy that 7 in every 10 organisations recruiting individuals from the sub-field of Telecommunications report a lack of skills needed for the position on the part of candidates, although this percentage is lower in the case of organisations recruiting graduates from the sub-field of Computer Science.

Skills of recently graduated individuals

Table 3. Cross-disciplinary skills that should be improved in study programmes in ICTs

	Total % of organisations
Documentation	7.6
Use of most common IT tools	7.6
Numerical skills	8.7
Theoretical training	12.0
Negotiation skills	14.1
Leadership	16.3
Team work	19.6
Written expression	23.9
Capacity for learning and self-learning	26.1
Oral expression	28.3
Languages	32.6
Autonomous work	39.1
Responsibility at work	42.4
Ability to offer new ideas and solutions	43.5
Practical training	47.8
Problem solving and decision-making	53.3

Problem solving and decision-making is the key skill that needs to be improved in study programmes in ICTs

Indeed, 53% of organisations assert this, while between 40 and 50% call for improvements in education with regard to practical training, the ability to offer new ideas and solutions, and responsibility at work.

It should be pointed out, however, that improvements tend to be reported as necessary with regard to these cross-disciplinary skills in most study programmes in Catalonia.

Moreover, the level of competency is suitable in many areas, such as numerical skills, documentation and IT skills.

Table 4. Specific skills that should be improved in study programmes in ICTs

	Percentage of companies
Definition of system requirements (feasibility studies)	19.5
Professional ethics and understanding of the legislation in the field of ICTs	21.8
Virtual systems: ability to implement virtual systems for applications, desktops, servers, etc.	25.3
Cloud computing: ability to design and develop cloud applications	26.4
Ability to model, design and simulate ICT systems	29.9
Software: knowledge of programming foundations	31.0
Cybersecurity: ability to specify, design and build reliable and secure computer systems	33.3
Data analysis and adaptability: ability to compile, cleanse, handle, analyse and extract useful information from databases	36.8
Critical testing and assessment: ability to assess that the system meets the requirements defined for its use	37.9
Capacity to plan and manage projects	66.7

Of the specific skills with scope for improvement, the ability to plan and manage projects stands out

67% of the companies surveyed report a need to improve the ability to plan and manage projects. This is followed by around 1 in every 3 organisations reporting that improvements would be welcome in the education delivered in terms of cybersecurity, data analysis and adaptability, and critical testing and assessment.

Figure 27. Satisfaction of employers with the skills of individuals who recently graduated in ICTs (from 0 to 10)

Satisfaction with the skills of individuals who recently graduated in the field of ICTs

Despite there being scope for improvement in the education received, organisations are generally satisfied with the skills of the individuals who recently graduated they have recruited. Their overall degree of satisfaction stands at 7.1. This value is in keeping with the overall satisfaction of employers observed in other sectors analysed.

Cooperation from employers with universities

Figure 28. Extent to which organisations cooperate with universities according to the type of activity (%)

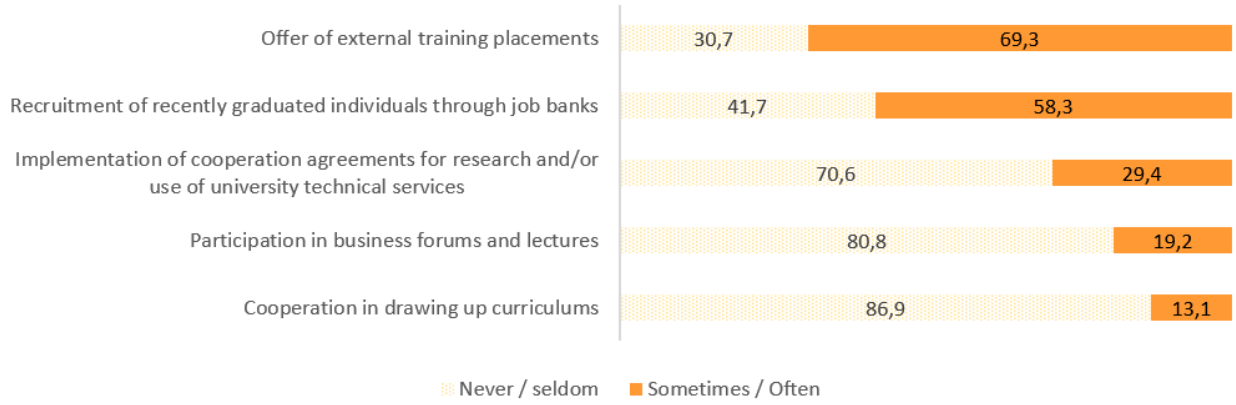


Figure 29. Areas for improvement in job banks or training placements organised by universities (% of organisations)

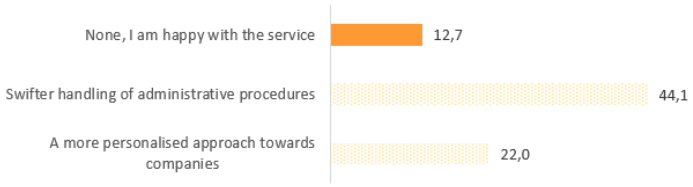


Figure 30. Satisfaction with job bank services or training placement services (on a scale of 0 to 10)

Around 1 in every 3 organisations from the ICT sector have implemented cooperation agreements with universities for research and/or have used their technical services

As with the other sectors reviewed in the employers' study from 2018, the activity in which companies and universities are most closely engaged relates to training placements offered to students (with 70% of companies taking part).

Room for improvement in satisfaction with the job bank and training placement services

The level of satisfaction among those who used these services stands at 6.4, lower than other sectors examined in the employers' survey from 2018. They do believe there is scope for speeding up administrative procedures and for gaining a better acquaintance of companies' needs.

In-company training of graduates

Figure 31. Organisations funding training for individuals who recently graduated

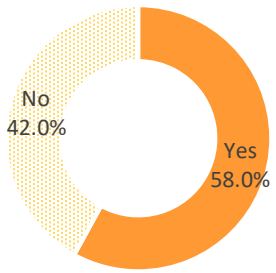


Table 5. Type of training funded by organisations

	%
On-the-job training	63.8
Training during working hours	65.2
Off-the-job training	44.9

Figure 32. Reasons for funding training (%)

More than half of companies fund training for the individuals they have recruited and who have recently graduated

Around 6 in every 10 offer on-the-job training during working hours. For most companies, the goal of this training is to improve individuals' specific knowledge of the ICT sector.

Forecast

Figure 33. Trend in qualified employment in the sector

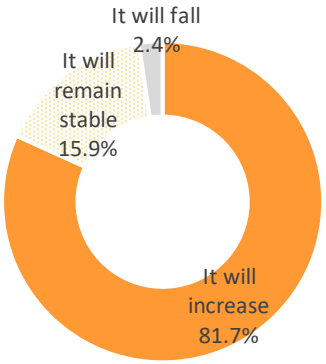


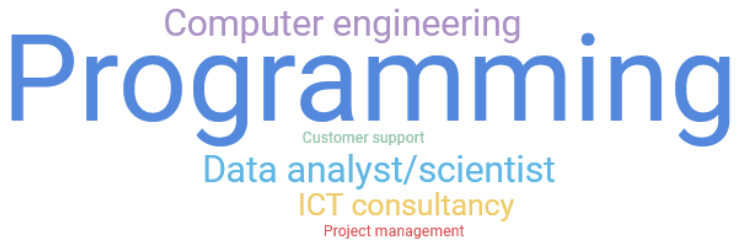
Table 6. Reasons for the increase in employment

Reasons	%
Company expansion	76.2
Organisational or technological changes	25.7
Staff rotation	15.8
Others	7.6

Note: multiple response

Figure 34. Skills that will gain importance in the field of ICTs*

Figure 31. Most important areas of employment in the field of ICTs*



*These are open questions. Responses with the same meaning have been grouped into categories. Categories referred to 5 times or more are shown.

Excellent prospects for companies in the ICT sector: 8 in every 10 envisage growth in qualified employment

This sector reports the highest prospects for growth.

Skills associated with programming, big data, AI, cloud computing and project management will become more important in future.

The most important areas of employment in the coming years shall be linked to programming, data analysis and science, ICT consultancy, and computer engineering.

CONCLUSIONS

- Study programmes in ICTs exhibit a lower percentage of female enrolment.
- Graduates in the sub-field of Computer Science are particularly satisfied with the usefulness of external training placements, while individuals who graduate in the sub-field of Telecommunications report greater satisfaction with the usefulness of the Bachelor's degree final-year project.
- Access to the labour market among ICT graduates is excellent (above the general figures for the Catalan university system), although the percentage of those performing functions relating to the study programme is lower (59% in Telecommunications and 64% in Computer Science). They do, however, benefit from excellent salaries and employment stability.

Companies that recruit graduates of ICTs have the following characteristics:

- Around half of the organisations recruiting in this sector are SMEs who benefit from qualified staff. Most of them operate in the international sphere and have incorporated innovations (both in terms of technology and with regard to their products and services).
- They belong to the information and communications sectors; and indeed the professional, scientific and technical activities (consultancy firms) sector.
- When it comes to recruiting, 35% of organisations hold the possession of a Master's degree in high regard, while around 20% consider the possession of a PhD to be positive. Moreover, they also regard the personal, social and cognitive skills of candidates – along with their language skills – to be of importance.
- Around 8 in every 10 organisations have encountered difficulties in recruiting staff with suitable profiles, primarily on account of the fact that candidates lacked the necessary skills for the position and there was a shortage of graduates qualified in a specific field. This sector reported the greatest levels of difficulty in this respect.

With regard to university education:

- In terms of cross-disciplinary skills, problem solving coupled with decision-making show the greatest need for improvement, as is the case with other sectors. Practical training, creativity and responsibility at work also show scope for improvement.
- In relation to specific skills in study programmes in the field of ICTs, almost 70% of organisations report that shortcomings have been exhibited in the education delivered when it comes to capacity to plan and manage projects.
- Despite these areas for improvement, employers are satisfied with the skills of the recently graduated individuals they have recruited (at 7.1 out of 10).
- As with other sectors reviewed, the activity in which companies and universities are most closely engaged relates to external training placements offered to students (with 3 in every 4 companies surveyed taking part).
- Around 8 in every 10 organisations envisage growth in qualified employment owing to company expansion, making this sector one of the most prominent in terms of expected growth.
- Skills relating to programming, big data, AI, cloud computing and project management will become more important in future according to the organisations surveyed.
- In terms of the trend in employment, increasingly important areas will be related to programming, data analysis and science, ICT consultancy, and computer engineering.

DATA SHEET

Survey for employers

Population	Organisations that may have potentially recruited individuals who recently graduated from universities in Catalonia in the past 3 years[4]
Survey period	Online survey: from 26/02/2018 to 16/03/2018 Telephone survey: from 27/06/2018 to 5/07/2018
Survey type	Online and over the telephone
Average time taken	Telephone survey: 14' 59''

	Population	Sample
Organisations potentially from the ICTs sector	N/a	128
Total contactable organisations	30,018	

Survey on satisfaction (2018)

Degree programme (graduates from 2016, 2017 and 2018)	Population	Sample	Response rate	Sample error
Telecommunications	1,393	377	27.1%	4.3%
Computer Science	2,629	731	27.8%	3.1%

Survey on access to the labour market (2017)

Degree programme (graduates from 2013)	Population	Sample	Response rate	Sample error
Telecommunications	510	264	51,8%	4,2%
Computer Science	829	444	53,6%	3,2%

[4] Most contacts with organisations stem from Catalan universities' job banks.

DRAFTING COMMITTEE

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ANNEX. RELATED STUDY PROGRAMMES

Bachelor's degree programmes on the syllabus in the 2018-2019 academic year

Telecommunications

	UB	UAB	UPC	UPF	URV	URL
Audiovisual Systems Engineering			✓			✓
Telecommunication Systems Engineering		✓	✓			✓
Telecommunication Systems and Services Engineering					✓	
Telecommunication Technologies and Services Engineering			✓			
Telecommunications Network Engineering				✓		
Electronic Engineering and Telecommunications	✓	✓	✓			✓
Engineering in the Management of ICTs						✓
Audiovisual Systems Engineering				✓		
Telematics Engineering			✓			✓

Computer Science

	UB	UAB	UPC	UPF	UdG	UdL	URV	UVic-UCC	URL	UOC
Audiovisual Systems Engineering				✓						
Telecommunication Systems Engineering			✓							
Telecommunication Systems and Services Engineering	✓									
Telecommunication Technologies and Services Engineering						✓				
Telecommunications Network Engineering			✓		✓					
Electronic Engineering and Telecommunications		✓								
Engineering in the Management of ICTs			✓							
Audiovisual Systems Engineering			✓							
Telematics Engineering				✓						
Bioinformatics	✓	✓	✓		✓	✓	✓		✓	✓
Sports and Fitness Science and Technology				✓						
Interactive Digital Content									✓	
Digital Design and Creative Technologies		✓								
Video Game Design and Development				✓						
Data Engineering			✓							✓
ICT Systems Engineering								✓		
Geoinformation and Geomatics Engineering									✓	

Computer Engineering							✓			
Computer Engineering						✓				

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