Digital Talent Overview 2024

Mobile WorldCapital Barcelona

About Mobile World Capital Barcelona

Mobile World Capital Barcelona is a public-private foundation that promotes the digital development of society in order to build a more inclusive, equitable and sustainable future through the humanistic use of technology. MWCapital contributes to positioning Barcelona as a global benchmark in the digital sphere and to consolidating the MWC's legacy over the year by promoting initiatives in the field of technology transfer, fostering digital talent, developing innovative tech projects with a social impact and generating knowledge.

Founding partners:

Corporate partners:

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Methodology

Methodologically, this study is fed from different information sources.

- First, based on a desk research phase, local and international reference publications were identified that provide reliable indicators for monitoring the different parameters associated with digital talent.
- Secondly, through data analysis, different job platforms were scanned to get data on the market in terms of both the demand (hiring companies) and the supply (digital professionals) through the tracking tools on job platforms like TalentUp and Job Market Insights.
- Finally, the perspective of senior managers at prominent companies in the sector were added to reinforce or nuance the data analysed.

Executive summary

Executive summary

Digital talent in Europe

Europe has almost 10 million ICT specialists

In the past 10 years, ICT employment in Europe has grown 59.3%, three times the number of jobs created in the economy as a whole (+10.7%). After more than 385,000 professionals joined the market in the past year, the total number of ICT specialists is almost 10 million in the EU (9.8M). More than half of them are concentrated in 4 countries: Germany (2.1M), France (1.4M), Italy (1M) and Spain (0.9M). These professionals account for almost 5% of the European job market as a whole, although countries like Sweden (8.7%), Luxembourg (8%) and Finland (7.6%) are significant over the average.

Despite the upswing in numbers, only 2 out of every 10 ICT professionals are women

Specifically, 1.9 million women work as ICT specialists

in the EU as a whole. This accounts for 19.4% of all the people employed in the sector, 0.5 points over the 2022 figure (18.9%) and 3.1 points over the 2014 figure. Bulgaria (29.1%), Estonia (26.8%) and Romania (26%) are the only countries where more than 25% of the ICT workers are women.

In the leading European cities, women's salaries are 6% less than men's. In cities like Tallinn and Prague, this difference is more than 15%.

Digital talent in Barcelona

With 13,500 new professionals, 2023 was a record year in adding new digital talent

Barcelona now has 122,185 digital professionals, which means that almost 55,000 new ICT specialist have joined the market since 2018, the first year this report was written. The 13,500 new professionals that have joined the digital job market in 2023 are a 12.4% increase over the previous year in the city's supply of tech talent.

The demand for digital talent has doubled in the past 5 years, although in the last fiscal year it dropped 13% due to the decline in venture capital investments

In 2023, 34,192 job offers were published in Barcelona. The evolution in the demand for digital talent has behaved differently in different segments within the digital economy. While the number of job offers published by the city's tech hubs has risen 37%, startups offered 34% fewer jobs than in 2022, a decline that is correlated with an almost 50% decline in the amount of investment raised. Nonetheless, the demand for professionals has dropped 13% this year, although it is more than double the 15,865 job offers in 2018

The scarcity in the digital job market is declining, although it is 5 times higher than in the job market as a whole

The combination of a significant increase in the number of professionals and a decrease in the number of job offers has resulted in a drop the tension in the digital job market, measured by the relationship between the number of digital professionals and the number of job offers per quarter. This relationship was 14.2 in 2023, 2 points over the previous year (12). However, the scarcity of digital profiles is quite significant when compared to the other professions in the market, where the relationship is 70 works per job offer.

The demand in specialities like blockchain (+58%), cloud (+20%) and artificial intelligence (+12%) is still growing

Among consolidated technologies, web developers (8,908 job offers) and app developers (2,554) were the profiles in the most demand in 2023. Cloud professionals experienced the steepest growth in the number of job offers published (+20%), while the field of cybersecurity, with only 3 professionals per job offer, is the discipline with the greatest scarcity of potential workers.

More than half the digital talent is specialised in software development (35%) and user experience design (17%).

Regarding emerging technologies, there is a great deal of variability in the evolution of the demand. In 2023, companies offered 58% more vacancies for blockchain specialists than the previous year, while the demand for 3D printing professionals dropped almost 60%. New specialities, like NewSpace, microprocessors, quantum technologies and sustainable computing have joined the list of emerging technologies, albeit with modest demand and supply figures.

One out of every 3 digital professionals in Barcelona is a woman

Barcelona has almost 35,000 women working in the digital professions, which is 30.6% of the total talent. Even though this figure is far from parity, in the past 5 years it has risen more than 8 points compared to the 22% in 2018.

Digital marketing (57%) and UX/UI (45%) are the professions with the highest presence of women. On the other extreme are cybersecurity (16%) and blockchain (18%).

In 2023, more than 5,000 professionals from abroad joined the job market

One out of every three digital professionals in Barcelona comes from elsewhere (33%). Cybersecurity (55%), app development (49%) and web development (35%) are the disciplines with the highest presence of foreign talent. London is the city from which the most ICT professionals come (12.1%), trailed at a distance by Lisbon (6.2%), Madrid (3.8%) and Buenos Aires (3.4%). In 2023, 5,111 new international digital professionals joined the market.

In addition to international talent (38%), vocational training (30%) and university degrees (15%) in ICT generate 8 out of every 10 digital professionals

In academic year 2022-23, 2,300 students earned bachelor's degrees in ICT in the university system of Catalonia, a figure quite similar to the previous year (2,350). Regarding enrolment numbers, the figure rose slightly (+3.5%), with almost 20,600 people enrolled compared to 19,900 the previous year.

The number of graduates in the past academic year in postgraduate and master's degrees in ICT (1,881) is also very similar to the number that graduated the previous year (1,800). In contrast, graduates of vocational training degrees in ICT have jumped by 42%, going from 2,880 people trained in academic year 2021-22 to 4,100 in 2022-23.

The average salary of ICT professionals in Barcelona is €47,771, and salary growth has slowed down after years of two-digit increases

The average salary in the ICT field in 2023 was €47,771, 1.8% more than the average compensation in 2022. This increase shows a moderation in salary inflation, which had been +12.6% in 2022 and +10.6% in 2021. However, the field of ICT still pays far above the average salary in the city, which stands at €33,837 (2022). Cybersecurity (€57,200), NewSpace (€54,900) and artificial intelligence (€54,600) are the disciplines where professionals earn the most.

Digital talent in the leading European cities

London, Amsterdam and Barcelona: the cities where the digital job market is the strongest

The behaviour of the supply and demand of digital talent in the 20 European cities compared is similar to that of Barcelona. While tech talent has risen 9.5%, the number of vacancies posted dropped 7.1%. Still, the market tension has lowered as a whole, going from 10.9 professionals per job offer in 2022 to 12.1 in 2023.

London, Amsterdam and Barcelona are the cities where the vacancies for tech jobs take up the biggest slice of the job market. In all three cities, around 30% of job offers are digital, while the European average is 25% and in Spain it is 15%.

Barcelona is the Spanish city that offers the highest salaries in the sector, and Zurich is the city that pays the most in Europe

Zurich (€153,498) and Copenhagen (€91,434) are the European cities that offer the highest gross annual salary, while Bucharest (€24,462) and Zagreb (€34,824) offer the lowest. The salaries increased 2.7% in European cities, where the average salary is €66,097.

In Spain, where the average salary is €38,780, Barcelona offers the highest salaries (€47,771), followed by Madrid (€44,366).

When salaries are adjusted for cost of living in the cities, there are significant changes in their positions. Europe-wide, the average normalised salary in Barcelona is similar to a group of cities like Paris (€52,703), London (€49,990) and Dublin (€49,601).

Emerging sectors and new professions

This report analyses three areas of technology that are in the throes of expansion and have high potential, namely NewSpace, quantum computing and semiconductors. For each of these fields, trends, use cases and the main professional fields expected to be developed are identified.

Semiconductors, a strategic industry that generates opportunities beyond manufacturing

Semiconductors underlie the functioning of electronic devices like computers, mobile phones and tablets, as well as any device that incorporates digital elements and connectivity. The sector is expecting annual growth of 6.3% until 2027.

Its value chain is divided into three main stages: **Design** of integrated circuits and research into new materials and technologies, which requires engineers who design integral circuits and AI engineers; large-scale **manufacturing**, which requires semiconductor and chip engineers; and semiconductor **assembly and testing**, which require quality and assembly engineers.

NewSpace: the democratisation of space will create new professions in both the design and launch of satellites and new terrestrial services

El sector del NewSpace espera una taxa de creixement del 11% anual fins a 2030. Les àrees de creixement d'aquest sector inclouen les microllançadores, els satèl·lits petits i el tractament de les dades espacials.

The NewSpace sector is expecting an 11% annual growth rate until 2030. This sector's areas of growth include micro-launchers, small satellites and spatial data processing.

This sector's value chain is divided into 'Upstream' activities (the manufacture, launch and operation of satellites and other space systems) and 'Downstream' activities (the use and application of data and the services provided by satellites and other space systems). The first group requires professionals like engineers who design and build satellites, programming engineers in charge of launching the satellites into space and the software developers needed to monitor the satellites and process remote data. The second group requires professionals like space data analysts, mapping experts and precision agriculture experts.

Quantum computing: This is a field in the research stage which is expected to create jobs in fields like cryptography, programming and quantum sensors

Quantum computing applies the properties of quantum mechanics, such as particle superposition and entanglement, in the field of computing in order to yield much higher performance than in classical computing. Even though this technology is still in the experimental phase, McKinsey reports that 72% of the professionals who are experts in these technologies believe that a totally quantum computer tolerant to crashes will be around by 2035.

Four main fields of application of these technologies have been identified. Communication is the branch that uses quantum properties to provide cryptographic security when transmitting information; new professional profiles will appear in this field, like designers of quantum communication networks. In computation, professionals like quantum programming developers will be needed. Simulation, which consists of solving quantum problems by mapping controlled quantum systems, will require experts. And sensors, which aim to overcome the limits of current sensors through the use of quantum states, professionals like researchers in quantum meterology will be required.


Business Income

1.
Global trends in digital talent

The employment of digital talent in Europe

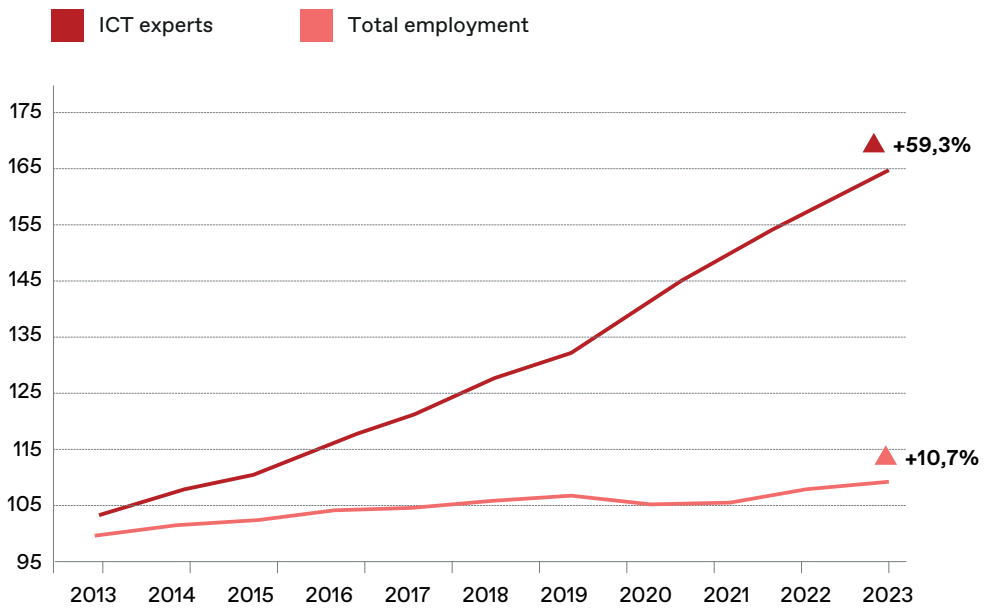
The evolution of employment in the ICT sector in the past decade is 5.5 higher than the growth in employment as a whole. While employment in the EU has risen 10.7 points in the past 10 years, the employment of ICT experts has grown 59.2 points.

The employment of ICT professionals has been on the upswing in the past decade. Since 2019, it has experienced steep growth (+24,6 points), while employment overall has risen 2.4 points.

Index of the number of people hired as ICT experts and total employment, EU.

2012 - 2023

Source: Eurostat



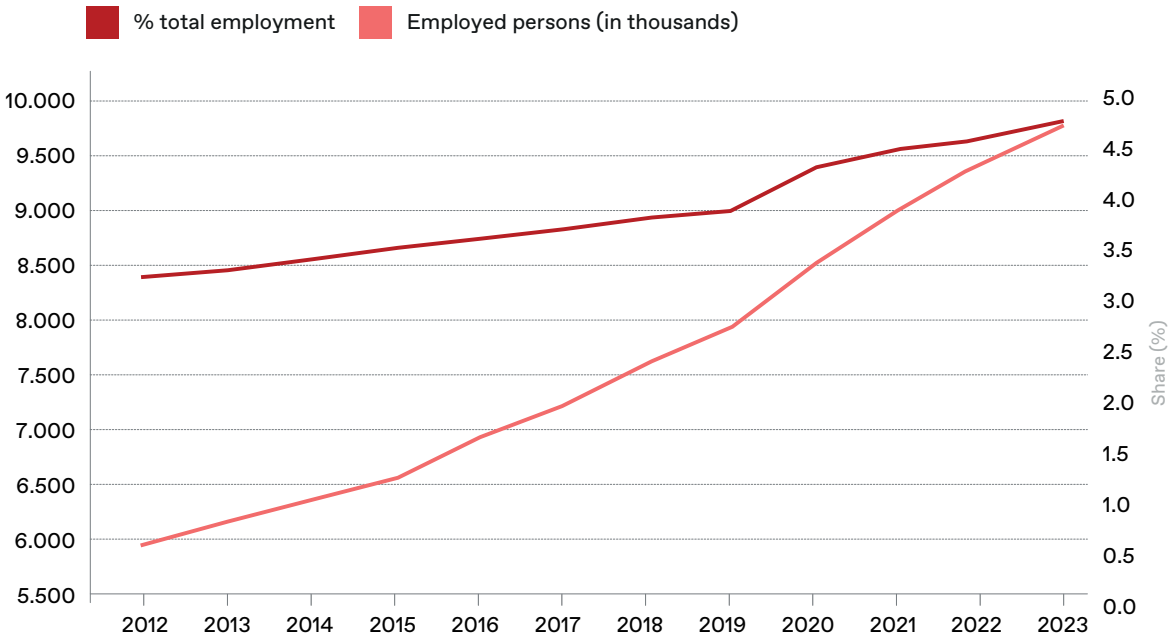
There are currently more than 9.8 million ICT workers in the European Union. The number of ICT workers has risen by almost 3.8 million since 2012.

EThe total percentage of ICT experts hired in the EU over total hires has risen more than 64% compared to 2012, going from 3.2% to 4.8% of total employment.

People hired as ICT experts in the EU (in thousands and percentage).

2012 - 2023

Source: Eurostat



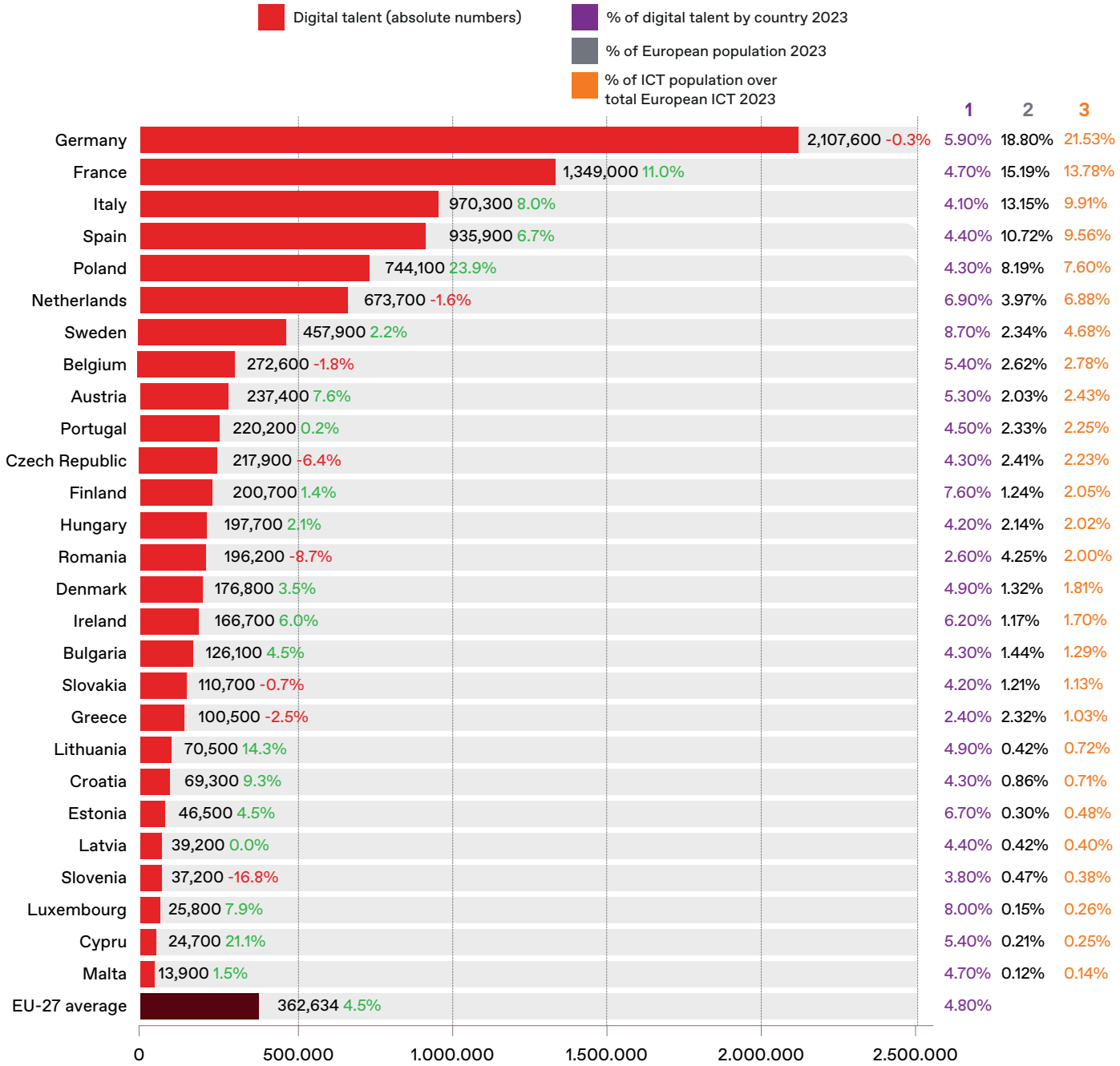
Germany is still the country with the most digital talent in the EU, with more than 2 million ICT workers. There has been notable growth in digital talent in countries like Poland and Cyprus, where it has risen more than 20% over the previous year.

Sweden (8.7%), Luxembourg (8.0%), Finland (7.6%) and the Netherlands (6.9%) are the countries with the most digital talent over the countries' total population.

Number of ICT workers by country.

2023

Source: Eurostat



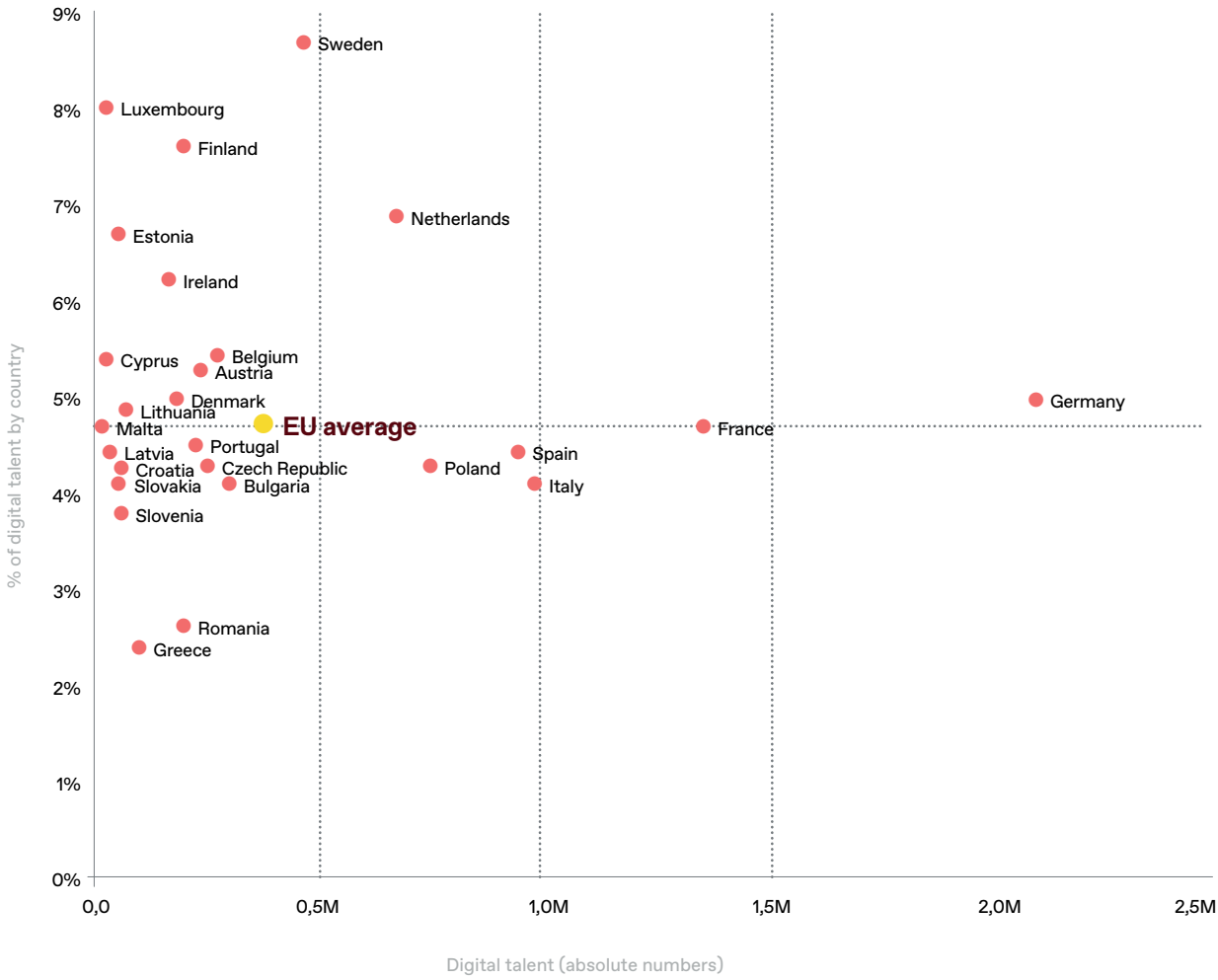
In addition to being the most populous country in the EU, Germany also contributes a volume of digital professionals that is over the EU average. Other populous countries like France, Spain and Italy fall beneath this average.

Medium-sized countries in terms of population, like Sweden (8.7%), the Netherlands (6.9%) and Finland (7.6%), all have more digital professionals (4.8%) than the European average.

Quadrant of absolute number of digital talents vs. % of European population

2023

Source: Authors based on data from Eurostat



ALLIANZ TECHNOLOGY

‘Allianz Technology is Allianz’s digitalising and transformative agent around the world. Digital professionals are the drivers of our strategy by creating new ways of better serving our customers and employees, supporting more profitable financial products, connecting with innovation and evolving our talent development model.’

Gerard Esparducer
Head of the Spain Hub – Allianz Technology

The 3 skills in digital professionals valued the most highly by the company:

- Proactiveness, intra-entrepreneurship
- Analytical thinking and problem-solving
- Knowledge of technology and our business

The 3 digital professions with the most hires in 2023:

1. Fullstack developer
2. Software architect
3. DevOps & Data engineers

BAYER

‘Digital professionals are helping Bayer address today's challenges by optimising processes and improving data management. This allows for more efficient decision-making based on precise data.’

Marc Ferré Hausmann
Head of Bayer GBS Barcelona

The 3 skills in digital professionals valued the most highly by teh company:

- Analytical thinking
- Active learning
- Familiarity with financial management systems and specialised accounting programmes (SAP)

The 3 digital professions with the most hires in 2023:

1. Data engineer
2. Digital experts (improvement in processes, CRM, tools)
3. Data analyst

Estimated job growth in the ICT sector

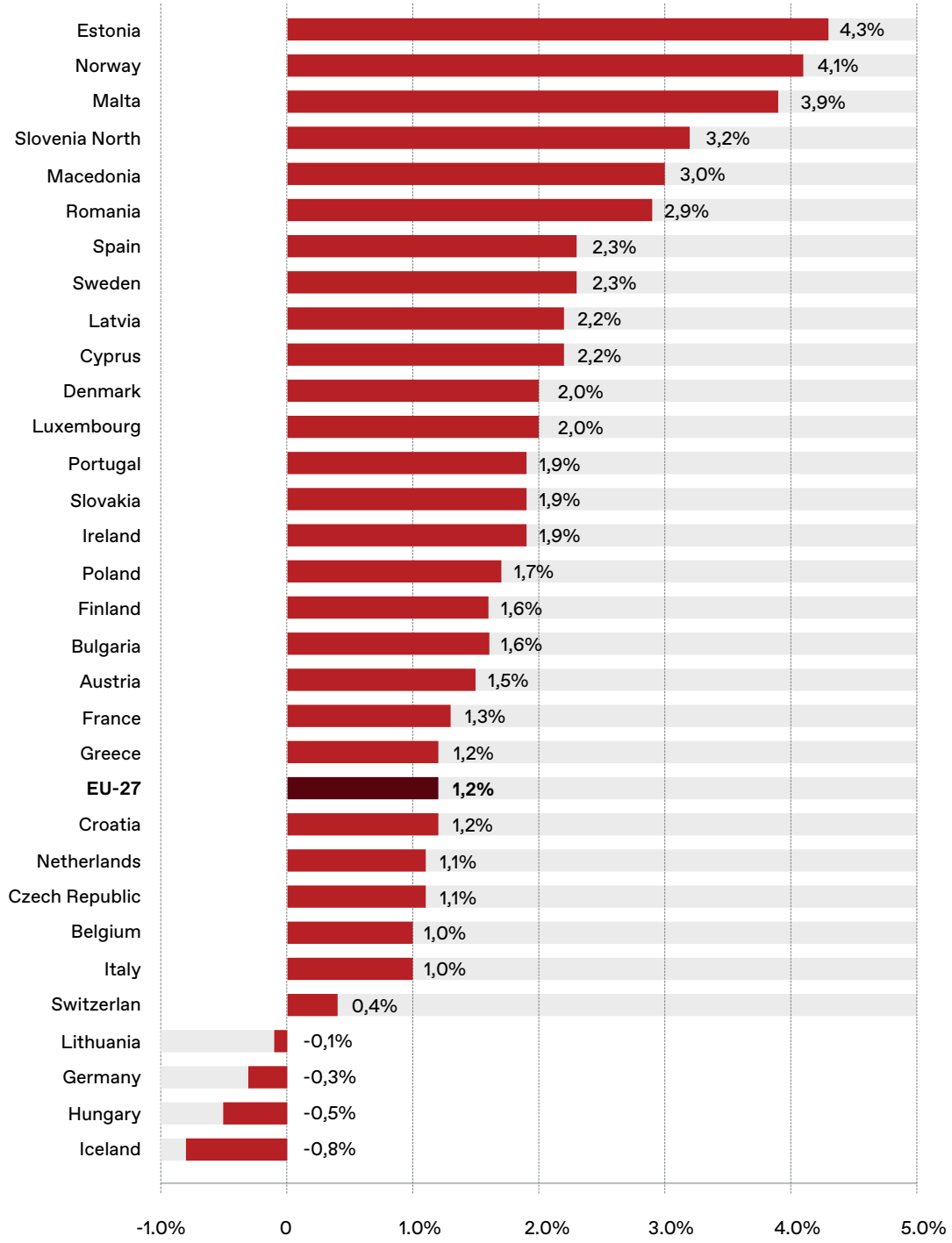
The average estimated annual growth of new jobs in the ICT sector in the European Union is 1.2%. In some countries like Estonia (4.3%), Norway (4.1%) and Malta (3.9%), it is expected to grow more quickly.

Breaking with the overall European trend, some countries are predicting a slight decline in employment in this sector, specifically Lithuania, Germany, Hungary and Iceland.

Estimate of new jobs in Europe in the IT programming and services sector.

2023-2025

Source: CEDEFOP Skills Forecast



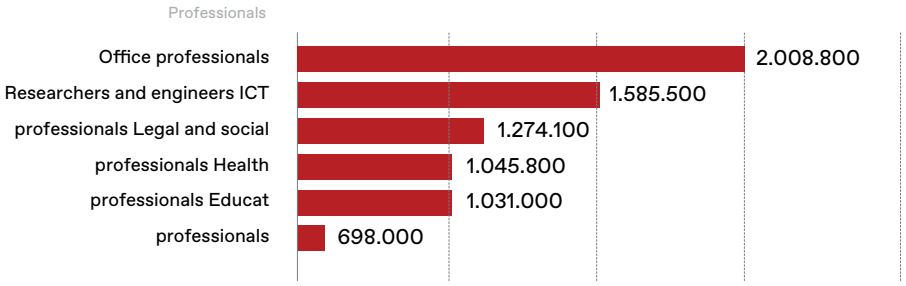
ICT professionals are one of the 3 leading occupations in terms of future job opportunities in Europe.

It is estimated that the changes in future employment in Europe caused by the creation and destruction of jobs will have very positive effects on the ICT sector.

timate of the net creation and destruction of jobs in the professional sector.

2023-2035

Source: CEDEFOP Skills Forecast



BOEHRINGER INGELHEIM

‘The company bears in mind digital roles with the goal improving people's and animals’ lives. The use of digital tools and technologies position the company at the vanguard with the goal of helping healthcare systems achieve more precise diagnoses, personalised treatments and greater efficiency in their processes and resource use.’

Iris Hochmair
Head of Talent Management

The 3 skills in digital professionals valued the most highly by the company:

- Ease of learning – curiosity about new technologies
- Communication
- Problem-solving and critical thinking

The 3 digital professions with the most hires in 2023:

1. Campaign manager
2. Data analytics
3. Digital coordinator

CAIXABANK TECH

‘Tech professionals have helped us to shift to more agile ways of working and have added new skills that have enabled us to evolve quickly and adapt to changes naturally. They are professionals with an open approach who are used to constant change and require a high degree of speed and agility in actions with clear results.’

Anna Marqués
Director of People and Organisation

The 3 skills in digital professionals valued the most highly by the company:

- Critical thinking
- Data-driven orientation
- Managing change and continuous learning

The 3 digital professions with the most hires in 2023:

1. IA Specialist
2. Cloud Engineer
3. Cybersecurity Engineers

The gender gap in the ICT sector in Europe

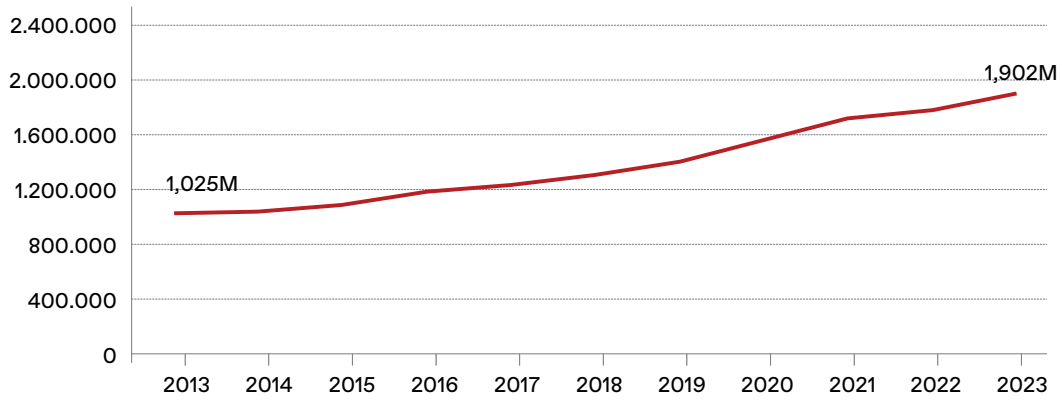
The presence of women in companies in the ICT sector in Europe continues to grow.

Almost one million women have joined the ICT sector in the past decade.

Evolution of the number of women ICT experts hired in Europe (absolute numbers).

2013-2023

Source: Eurostat



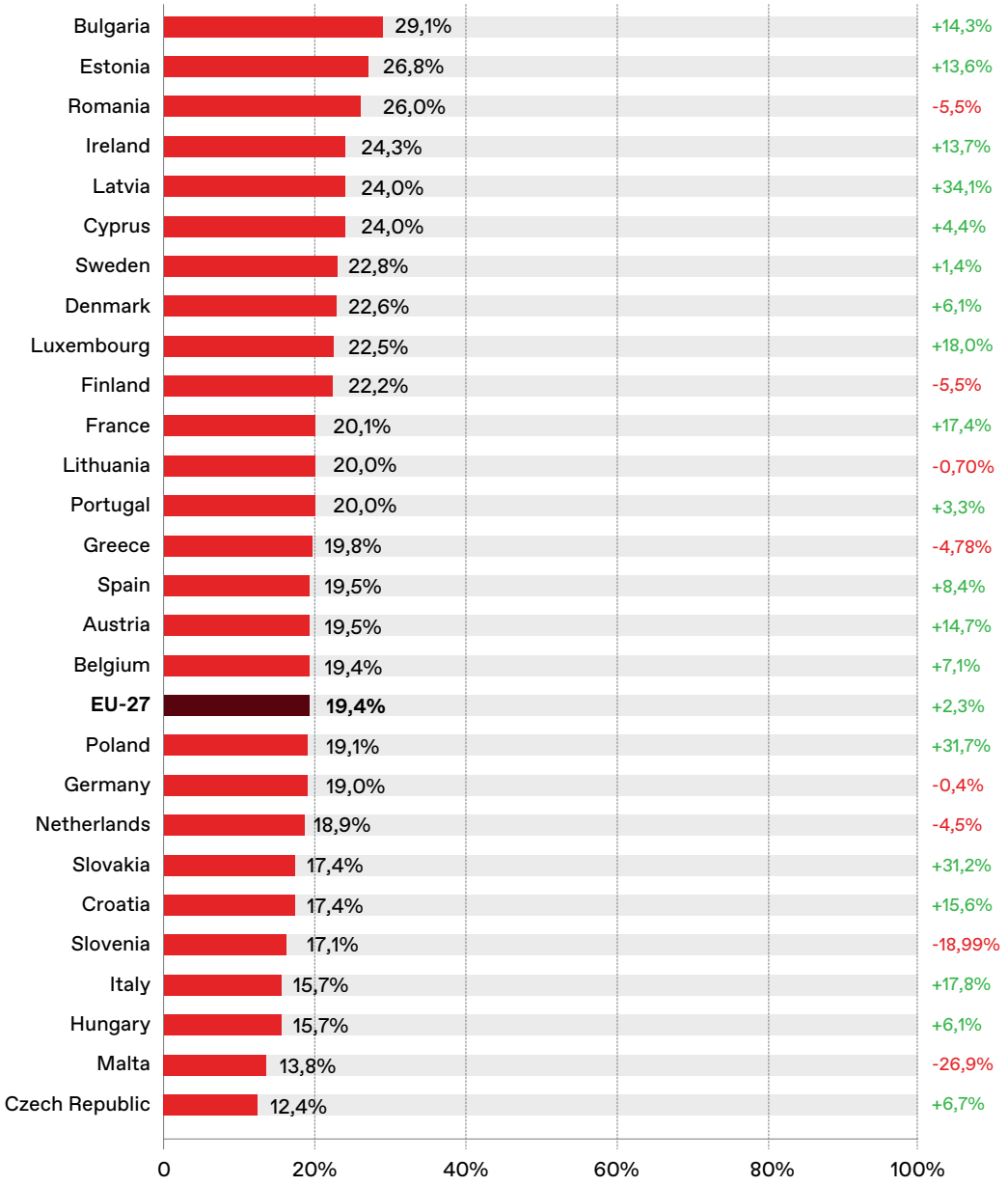
In the European Union, women account for 19.4% of jobs in the ICT sector.

The countries with the most women in this sector are Bulgaria (29.1%), Estonia (26.8%), Romania (26%) and Ireland (24.3%).

Women ICT experts hired (%) in Europe.

2023

Source: Eurostat



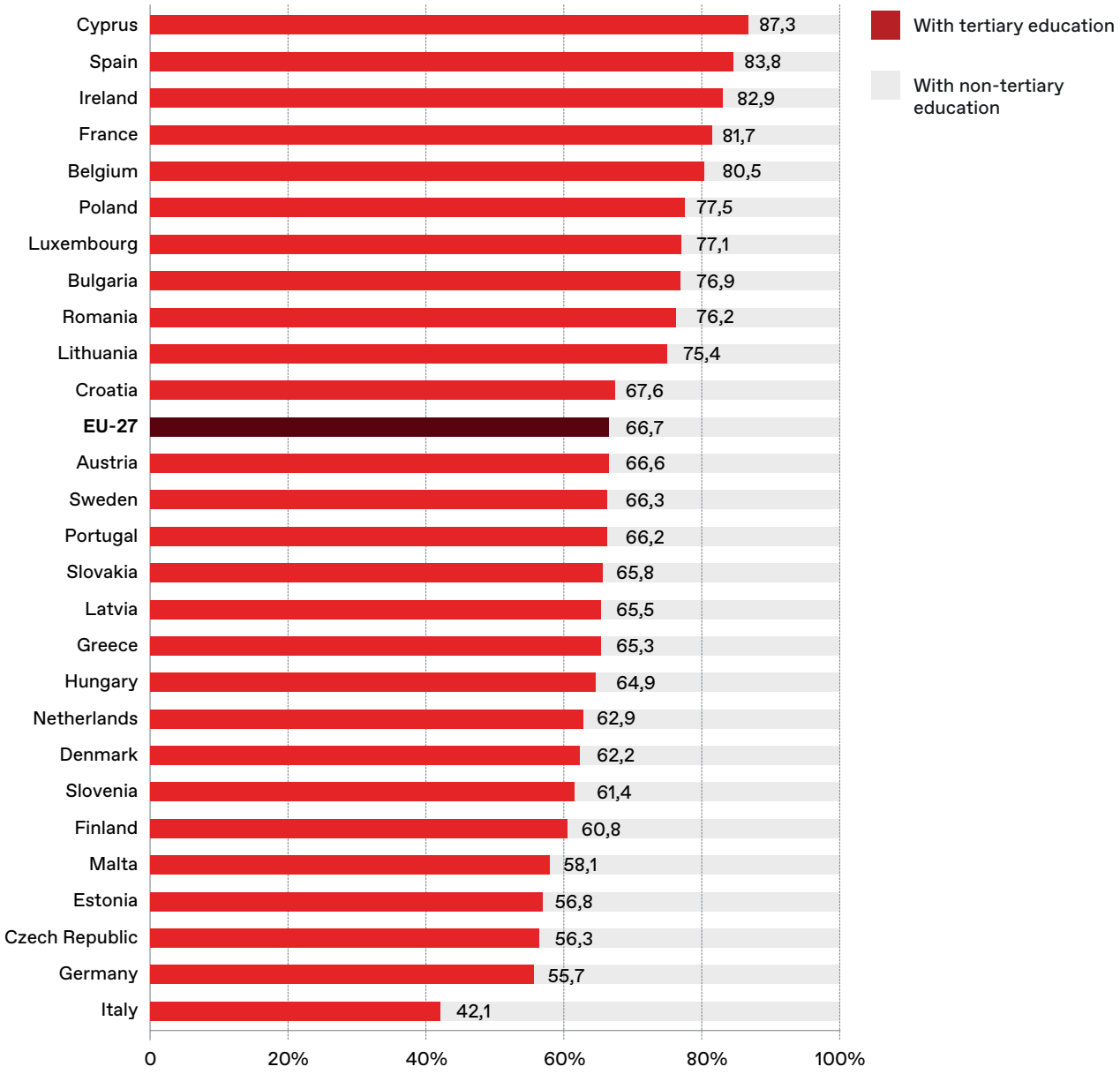
Educational level in digital skills in Europe

Two out of every three ICT experts in the EU have higher education.

More than 80% of the ICT experts in Cyprus, Spain, Ireland, France and Belgium have tertiary education.

Distribution of ICT experts by educational level by country (%).
2023

Source: Eurostat



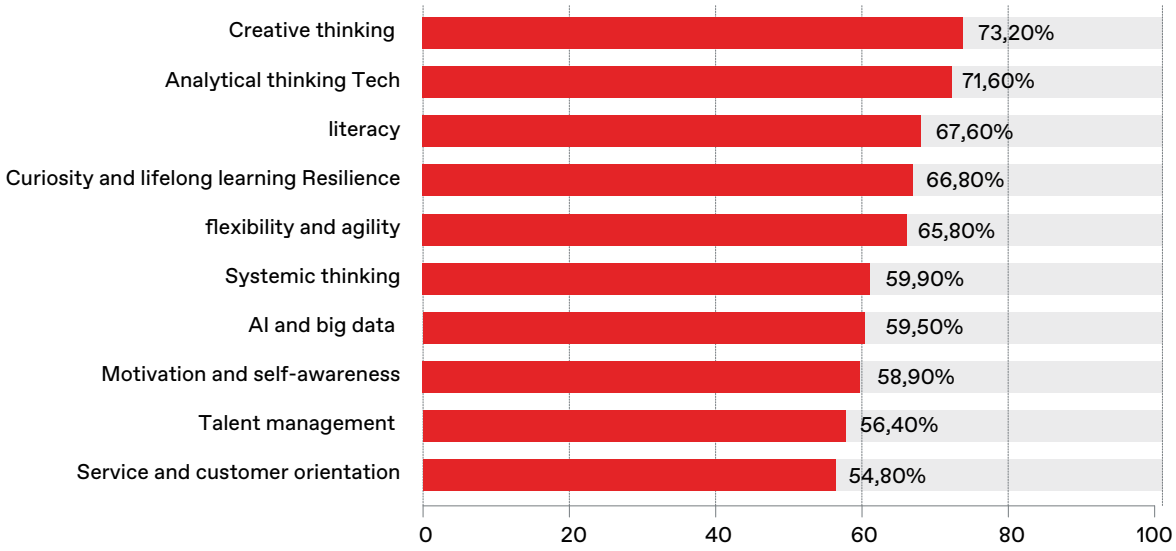
The 5 skills that tech companies believe should be nurtured the most in their workers, in order of importance, are creative thinking, analytical thinking, tech literacy, systemic thinking and mastery of AI and big data.

There is notable growth in the importance of soft skills or attitudes like curiosity, lifelong learning and resilience, as well as flexibility and agility.

Top 10 skills and attitudes that tech companies believe should be nurtured in their workers (% companies).

2023

Source: World Economic Forum, Global Gender Gap Report 2023



Top training centres in Europe

Yet another year, the top rankings for academic excellence in Computer Science and Information Systems are occupied by the United States. It is followed by the United Kingdom, Switzerland and Singapore.

In Europe, the universities in the United Kingdom and Switzerland are still in the lead by a considerable distance. They are followed by the universities in Germany, the United Kingdom and France.

In Spain, the UPC leads the ranking of the top state universities for acquiring the most in-demand technical ICT skills, and the UB climbed in the ranking, making Barcelona the cutting-edge destination for training in this field.

Most recognised educational centres in Computer Science and Information Systems.

2024

Source: QS Top Universities

	University	Country
1.	**Massachusetts Institute of Technology (MIT)**	**United States**
2.	Carnegie Mellon University	United States
3.	Stanford University	United States
4.	University of Oxford	United Kingdom
5.	University of California, Berkeley (UCB)	United States
6.	National University of Singapore (NUS)	Singapore
7.	Harvard University	United States
8.	University of Cambridge	United Kingdom
9.	ETH Zurich	Switzerland
10.	Nanyang Technological University, Singapore (NTU Singapore)	Singapore

Source: QS Top Universities

	University	Country	Position in the international ranking
1.	**University of Oxford**	**United Kingdom**	**4**
2.	University of Cambridge	United Kingdom	8
3.	ETH Zurich	Switzerland	9
4.	EPFL – École polytechnique fédérale de Lausanne	Switzerland	11
5.	Imperial College London	United Kingdom	16
6.	The University of Edinburgh	United Kingdom	20
7.	UCL	United Kingdom	22
8.	Technical University of Munich	Germany	31
9.	Institut Polytechnique de Paris	France	36
10.	University of Amsterdam	Netherlands	36

Top 10 in Spain

Source: QS Top Universities

	Universitat	Country	Position in the international ranking
1.	**Universitat Politècnica de Catalunya · BarcelonaTech (UPC)**	**Barcelona**	**88**
2.	Universidad Politécnica de Madrid (UPM)	Madrid	115
3.	Universitat de Barcelona	Barcelona	126
4.	Universidad Carlos III de Madrid (UC3M)	Madrid	170
5.	Complutense University of Madrid	Madrid	201-250
6.	Universidad Autónoma de Madrid	Madrid	201-250
7.	Universitat Politecnica de Valencia	Valencia	201-250
8.	University of Granada	Granada	201-250
9.	Universitat Pompeu Fabra (Barcelona)	Barcelona	251-300
10.	Universidad de Sevilla	Seville	351-400

DAMM

‘The company's digital professionals are currently spearheading a culture change towards data and AI at Damm and supporting all the workers in this change’.

Laura Gil
Director of the Department of Digital Transformation, Data and AI

The 3 skills in digital professionals valued the most highly by the company:

- Curiosity and lifelong learning
- Analytical thinking
- Business- and service-orientation

The 3 digital professions with the most hires in 2023:

1. Data technician
2. Backend developer
3. Frontend developer

EUROFIRMS

‘Digital professionals are helping to rise to today's challenges by optimising the company's processes and decisions via the use of data, improving user experience and fostering innovation in order to boost our competitiveness and efficiency’.

Dani Oliveras
IT Leader

The 3 skills in digital professionals valued the most highly by the company:

- Data management, analysis and science
- Artificial intelligence/machine learning
- Cybersecurity

The 3 digital professions with the most hires in 2023:

1. Data Analyst
2. Data Engineer
3. Fullstack developer

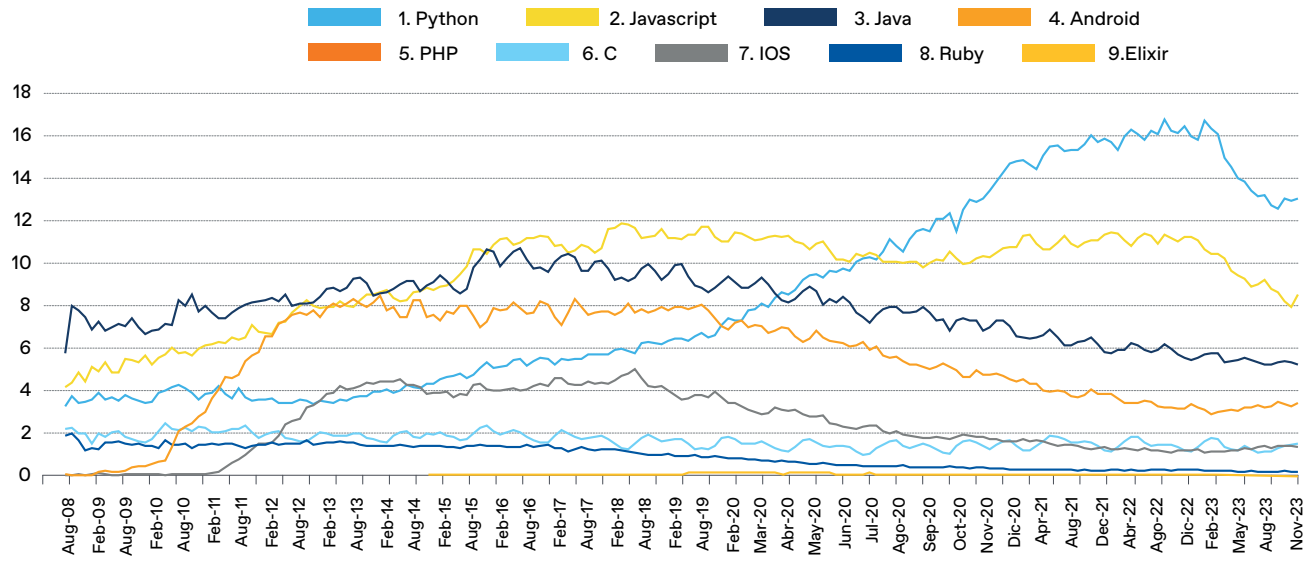
Most popular programming languages in the digital ecosystem

Yet another year, Python is the most popular programming language, ahead of Javascript. Even though the use of both languages started to drop in late 2022, by the end of 2023 they started to rally.

In recent years, a framework that has grown considerably is React. Even though its use started to decline in 2022, by late 2023 it began to rally. This uptick in late 2023 was shared by Node.js, which has shown stable growth since 2020.

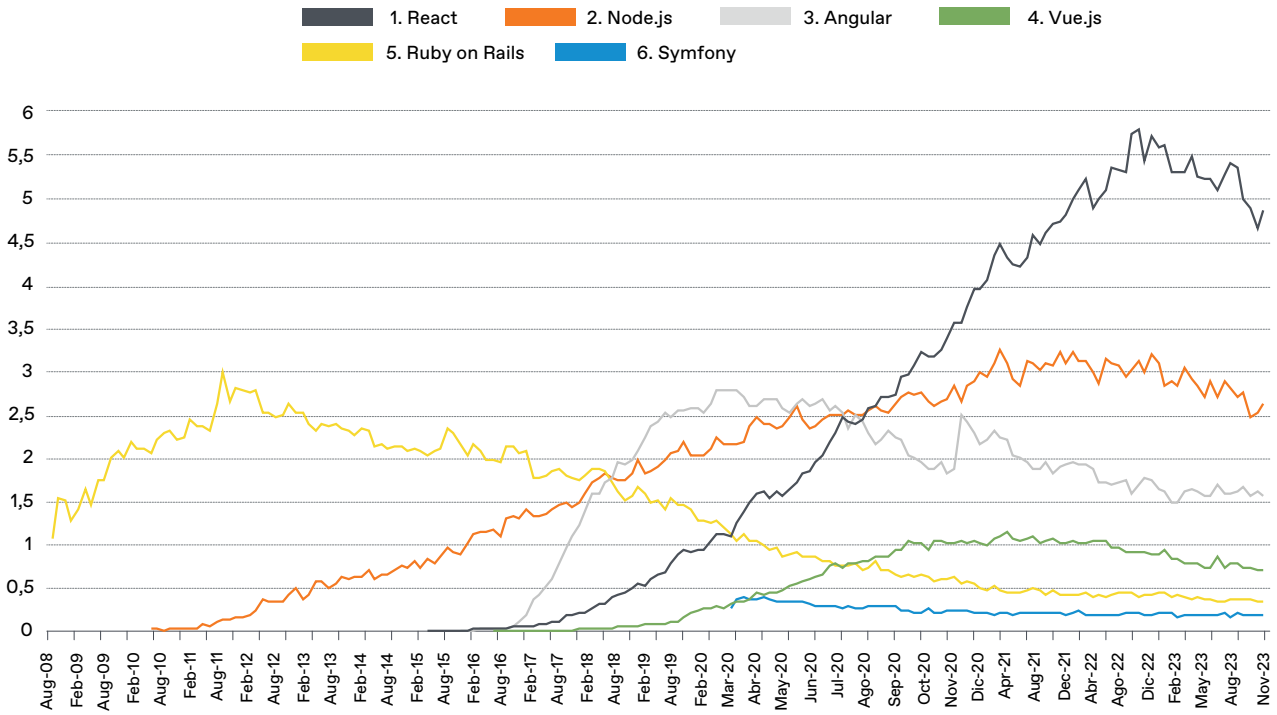
Global trends. Programming languages (%).
2008-2023

Source: TalentUp.io for Mobile World Capital Barcelona



Global trends. Frameworks (%).
2008-2023

Source: TalentUp.io for Mobile World Capital Barcelona



Note: A programming framework helps to provide the support and guidance needed to accelerate its development process and achieve its objectives. In most cases, frameworks come in the form of libraries or components that enable one to jump directly to the core of the task instead of starting from scratch every time.

Most popular cloud database systems in the digital ecosystem

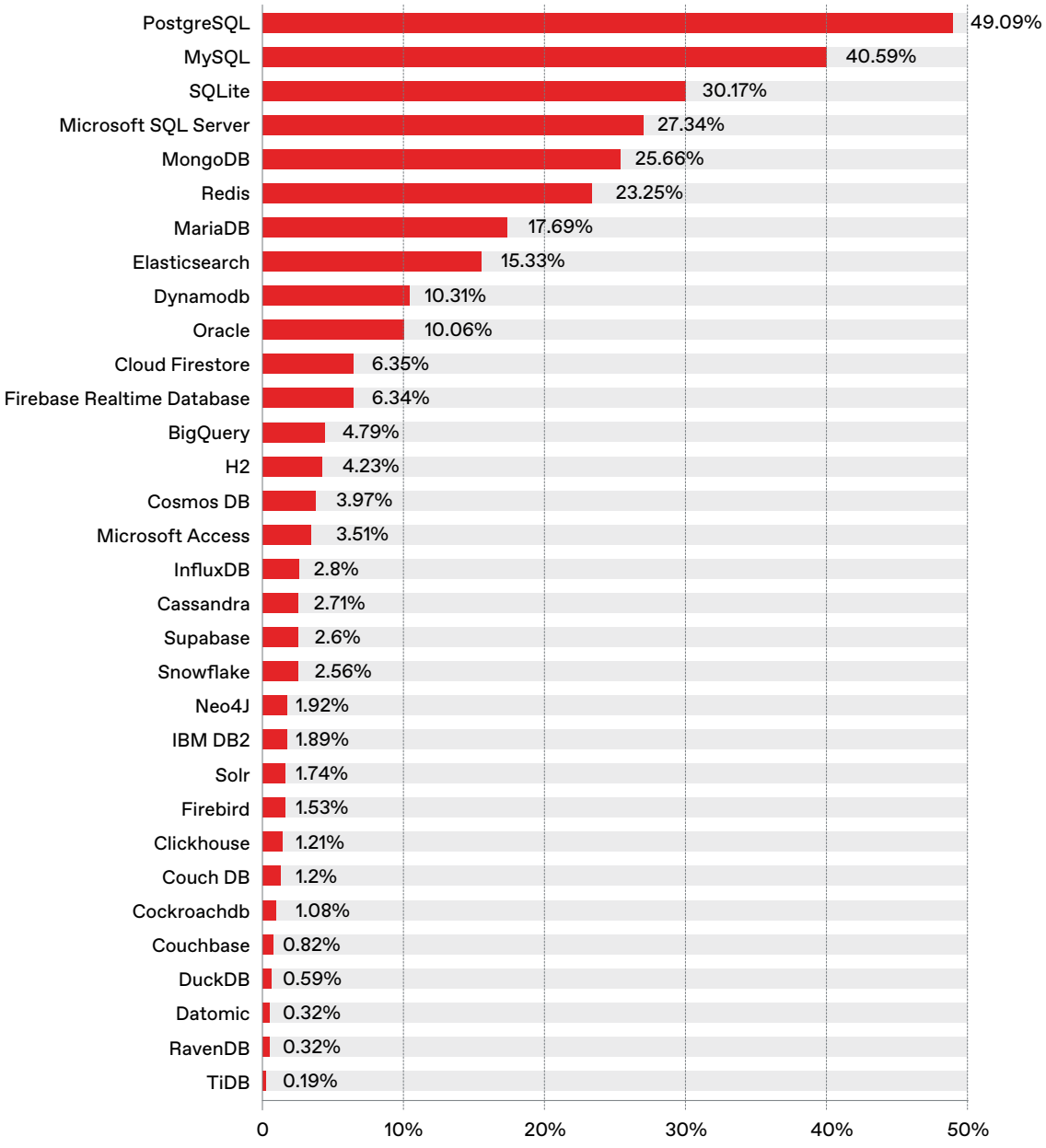
This year, PostgreSQL snatched first place from MySQL. Forty-nine percent of developers have worked with PostgreSQL in the past year, compared to 40% with MySQL.

MongoDB is the NoSQL data base (nonstructured database) used the most by developers (more than 25% of professionals have used MongoDB in the past year).

Databases used the most by developers.

2023

Source: Stack Overflow Developer Survey



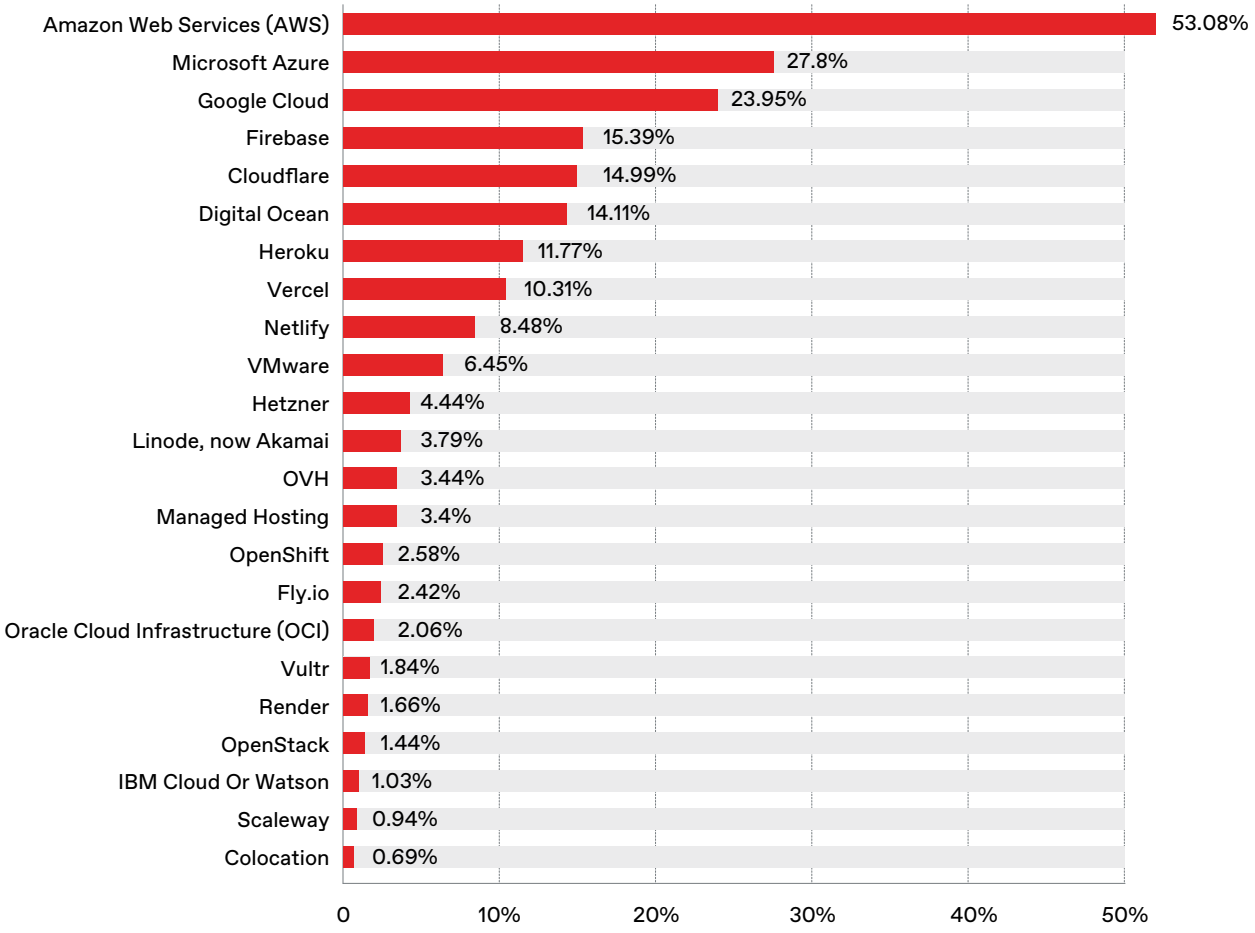
Cloud platforms used the most by developers

AWS is still the cloud platform used the most by developers and ranks first, with almost twice as many users as Azure, the second-ranked platform.

In fact, 53% of developers have used AWS in the past year, almost twice as many as the Microsoft Azure Cloud (27.8%). Google Cloud comes in third (23% of developers), and come Firebase and Cloudflare (15% of developers) follow it.

Cloud platforms used the most by developers.
2023

Source: Stack overflow 2023



INGRAM MICRO

‘Digital professionals are helping the company become more agile, quick, innovative and competitive thanks to their digital and tech skills, although we cannot ignore key competences like the soft skills, such as curiosity, teamwork and strategic thinking’.

Jose Luis Sanchez
Director, Cloud Spain Information Technology

The 3 skills in digital professionals valued the most highly by the company:

- Teamwork
- Adaptability
- Development of learning

The 3 digital professions with the most hires in 2023:

1. Backend Engineer
2. Frontend Engineer
3. QA Engineer

LUFTHANSA BY QUANTION

‘Digital professionals are driving the revolution in customers’ travel experience with the Lufthansa Group by offering more personalised services and travel recommendations and making their transactions with airlines more agile. They are also enabling processes to be automated and real-time communication, which bring operational efficiency and more comfortable, satisfactory travel experience.’

Bea Domenech
COO Lufthansa Group Digital Hangar BCN

The 3 skills in digital professionals valued the most highly by the company:

- Creativity
- Teamwork
- Ability to learn constantly

The 3 digital professions with the most hires in 2023:

1. Data Analyst/Engineer
2. Product Owner
3. Software Developer

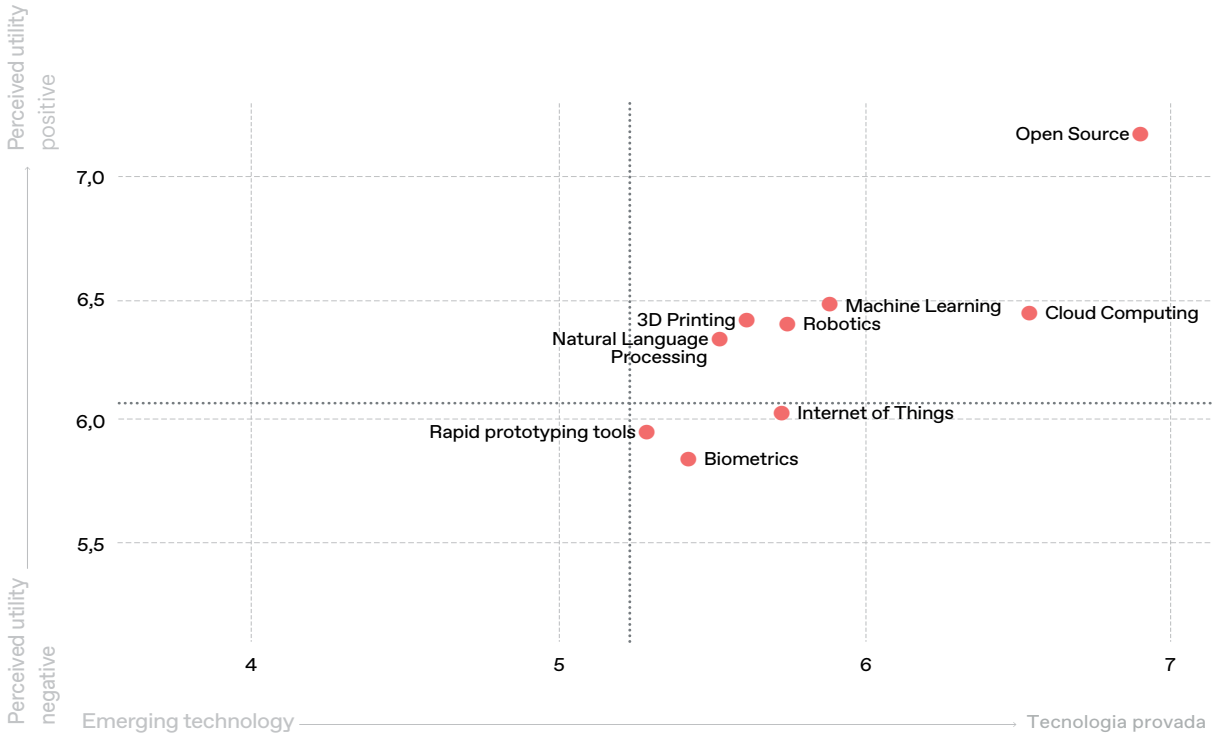
Perceived utility and impact of technologies

Regarding developers' perception of the new technologies, sustainable technologies, privacy-protection technologies, quantum computing, nanotechnology and AI-assisted technologies are the ones with a more positive perceived impact.

Developers consider open code a consolidated technology with a very high positive impact.

Difficulty attracting new digital talent. 2023

Source: Stack Overflow



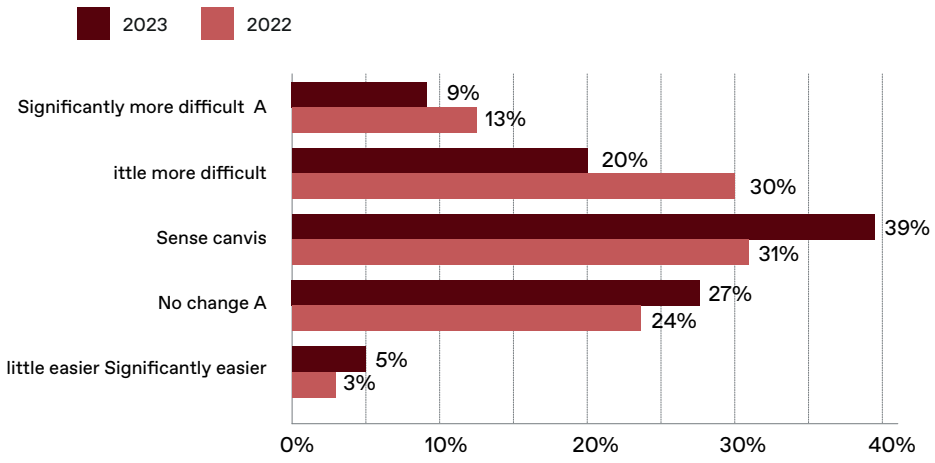
Attracting digital talent

Some business owners continue to have difficulties attracting the digital talent they need. In fact, 39% of business owners say that the hiring conditions have become more difficult in the past 12 months, even though the figure is lower than in 2022.

There is a perception of a loosening of the market for new talent. Specifically, 30% of the business owners perceive that it has been easier to attract talent in the past 12 months.

Difficulty attracting new digital talent. 2023

Source: Stack Overflow Developer Survey

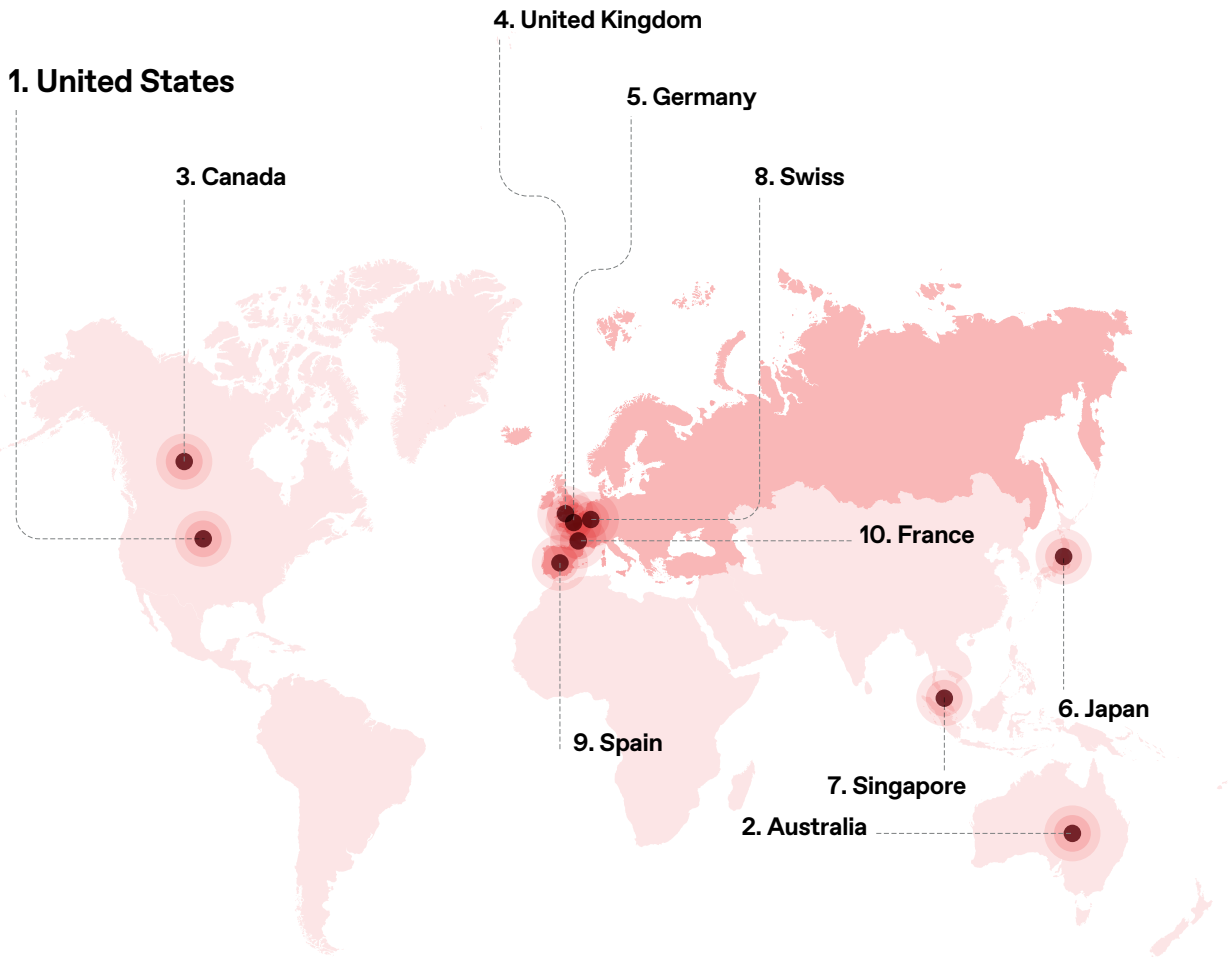


Preferred destinations for working in the digital sector

The United States, Australia and Canada are the three countries where digital professionals are the most interested in going to work. Spain once again ranked ninth in 2023.

Most desirable countries to work in among digital professionals around the world 2023

Source: Decoding Global Talent, BCG



Mobility of digital talent

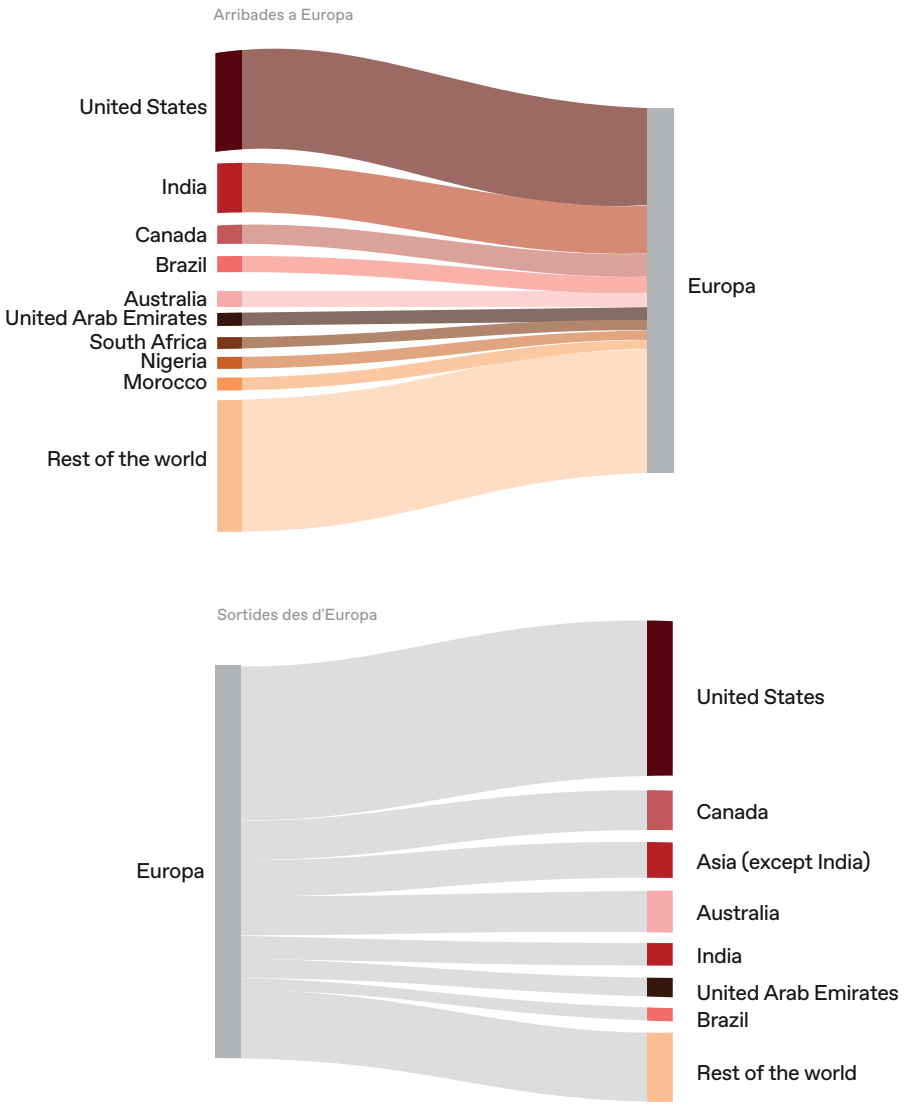
According to the State European Tech 2023 report, Europe is one of the main attractors of digital talent flows in the entire world.

Europe imports talent primarily from the United States and India, while Europe's talent is primarily exported to the United States (39%).

Difficulty attracting new digital talent.

2023

Source: State of European Tech 2023



2.
Digital talent in Barcelona

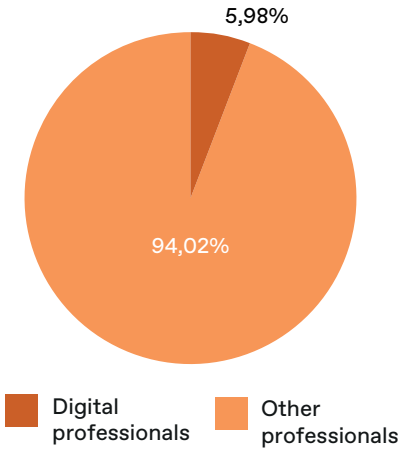
Digital professionals in Barcelona

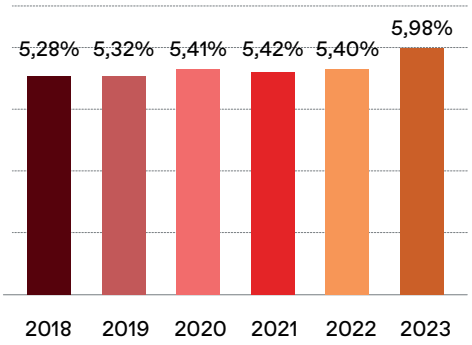
Since 2018, the number of digital professionals in Barcelona has risen almost 70%; specifically, the city has 54,000 more professionals than it did in 2018.

The total number of digital professionals in Barcelona continued to grow from the previous year, with 13,500 more professionals. The ratio of digital professionals over the overall market increased 6% in 2023.

Percentage of digital professionals vs Overall market.
2018-2023

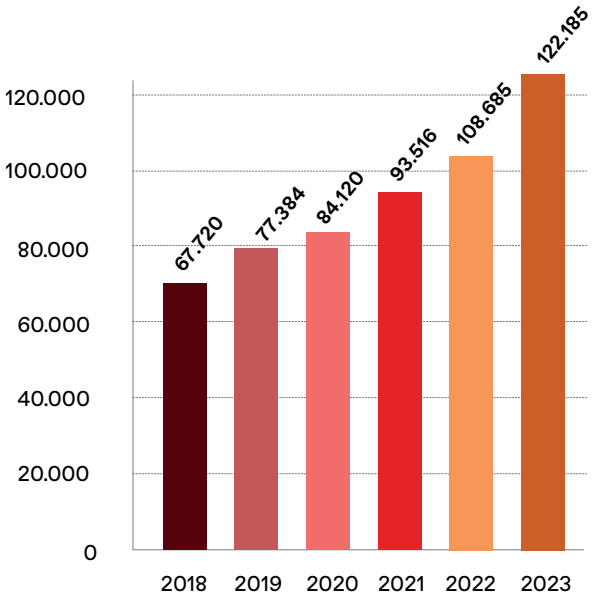
Source: TalentUp.io per a Mobile World Capital Barcelona





Digital professionals
2018-2023

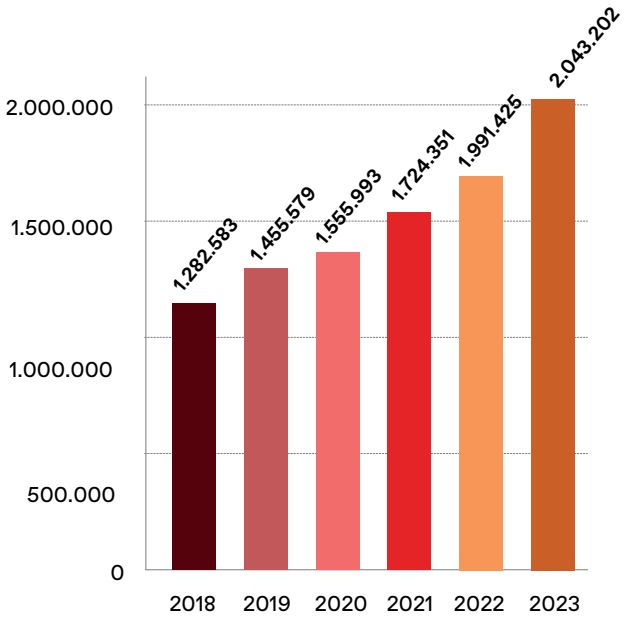
Source: TalentUp.io per a Mobile World Capital Barcelona



2019 ▲ **+14,3%**
2020 ▲ **+8,7%**
2021 ▲ **+11,2%**
2022 ▲ **+16,2%**
2023 ▲ **+12,4%**

Total professionals
2018-2023

Source: TalentUp.io per a Mobile World Capital Barcelona



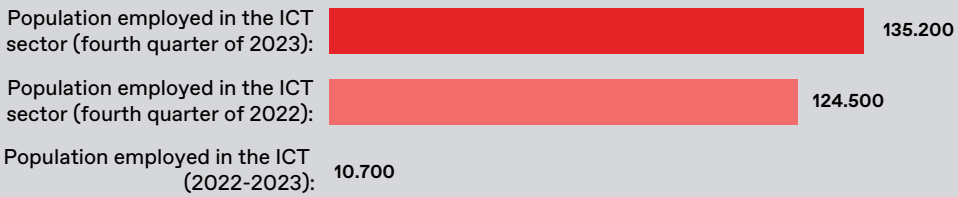
2019 ▲ **+13,5%**
2020 ▲ **+6,9%**
2021 ▲ **+10,8%**
2022 ▲ **+15,4%**
2023 ▲ **+2,6%**

Nota: Digital Marketing professionals started to be included in 2022.

The figures from the 2023 Active Population Survey (INE) show that despite the adjustment in the demand for digital talent, the ICT sector in Catalonia as a whole has created net employment (almost 11,000 jobs).

Evolution of the population employed in the ICT sector in Catalonia 2022-2023

Source: INE



MEDIAMARKT

‘Digital professionals help MediaMarkt to be the trusted omni-channel retailer by personalising the purchase experience and improving our customers’ satisfaction in a technology-driven world’.

Xavier Morejon, Director of the Tech Hub

The 3 skills in digital professionals valued the most highly by the company:

- Technical knowledge
- Innovation
- Customer orientation

The 3 digital professions with the most hires in 2023:

1. Desenvolupador de Software (Front/Back)
2. Data Engineer
3. Cybersecurity Engineer

NESTLÉ

‘Digital professionals supply tech solutions so the organisation can remain competitive in a changing market. Thanks to the value these professionals add, the company is able to transform itself more efficiently, simplify its processes and better respond to its customers and consumers.’

Gabriela Davila
HR Manager IT

The 3 skills in digital professionals valued the most highly by the company:

- Adaptability and resilience to change
- Problem solving and analysis
- Communication and management of stakeholders

The 3 digital professions with the most hires in 2023:

1. Software architect
2. Business analyst
3. Cybersecurity

Job demand in the ICT sector

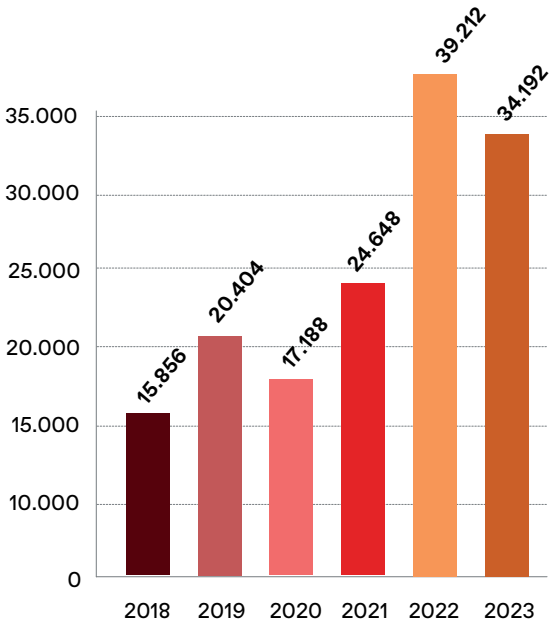
The demand for digital professionals has risen 115% since 2018, going from 15,856 to 34,192 digital job offers in 2023.

From 2021 to 2023, the demand rose more than 38%; however, it dropped 12.8% in 2023 compared to 2022.

Demand for digital professionals

2018-2023

Source: TalentUp.io for Mobile World Capital Barcelona

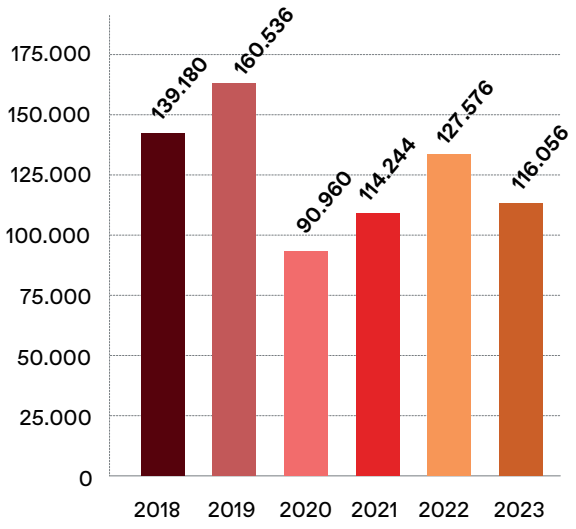


2019 ▲ **+28,7%**
2020 ▼ **-15,8%**
2021 ▲ **+43,4%**
2022 ▲ **+59,1%**
2023 ▼ **-12,8%**

Total demand for professionals

2018-2023

Source: TalentUp.io for Mobile World Capital Barcelona



2019 ▲ **+15,3%**
2020 ▼ **-43,4%**
2021 ▲ **+25,6%**
2022 ▲ **+11,7%**
2023 ▼ **-9,0%**

Between 2022 and 2023, the demand for professionals has experienced significant fluctuations in different sectors. Notably, Tech Hubs have shown a 37% increase in the demand for professionals, reflecting an expansion in this sector. In contrast, the demand in startups has dropped 34%.

Demand by type of company . 2022-2023

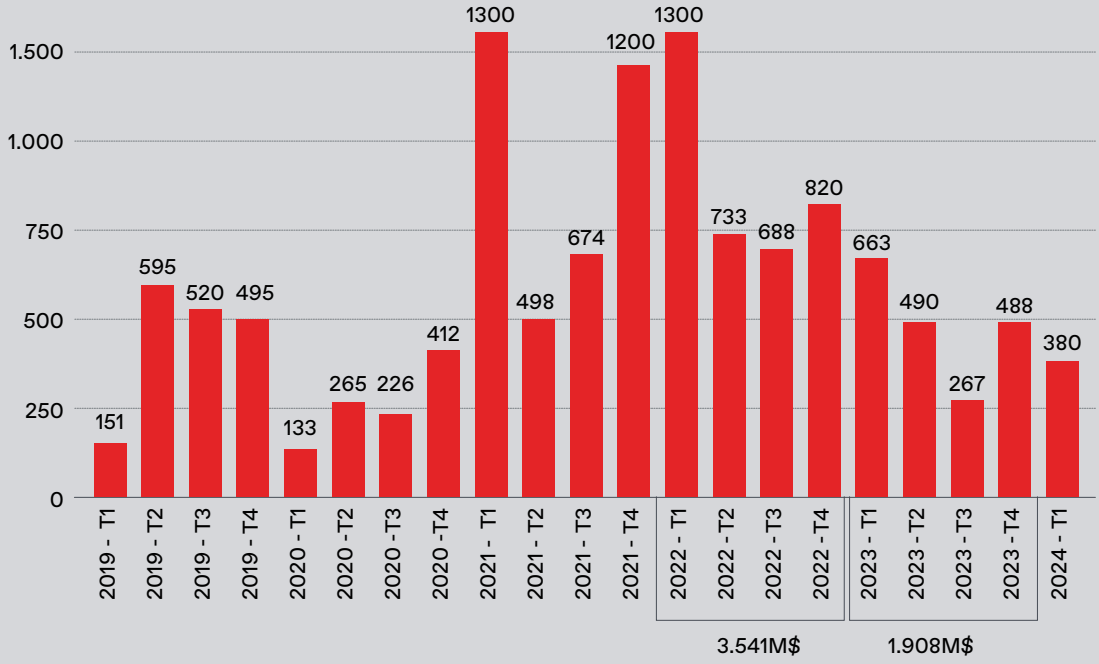
Source: TalentUp.io per a Mobile World Capital Barcelona

Investment in Spanish startups has declined in the past few quarters

There is a correlation between the decrease in startup hiring and the overall decline in the amount of investment raised in 2023, the year when startups in Spain attracted $1.908B in investment, 46% less than the $3.541B raised in 2022.Inversió trimestral de las startups espanyoles

Quarterly investment in Spanish startups
2019 - 2024 (in millions of dollars)

Source: Dealroom

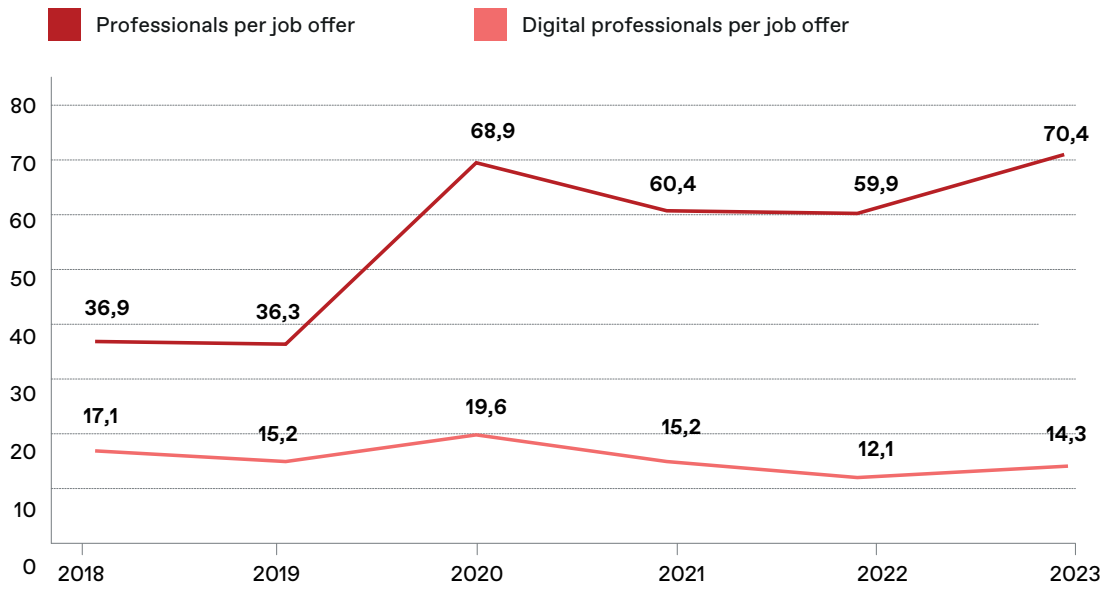


Market tension refers to the number of professionals available per job offer; the fewer professionals, the higher the market tension. Compared to 2022, in 2023 the number of digital professionals per job offer rose, leading the market tension to ease.

The number of professionals per job offer outside the digital fields rose significantly. In fact, 2023 is the year that there has been the least market tension, with 70 professionals per job offer.

Market tension.
2018-2023

Source: TalentUp.io per a Mobile World Capital Barcelona



Note 1: The 'Number of digital professionals per job offer' ratio is calculated based on the quarterly demand.

Note 2: The global figures per sector do not include white-collar workers.

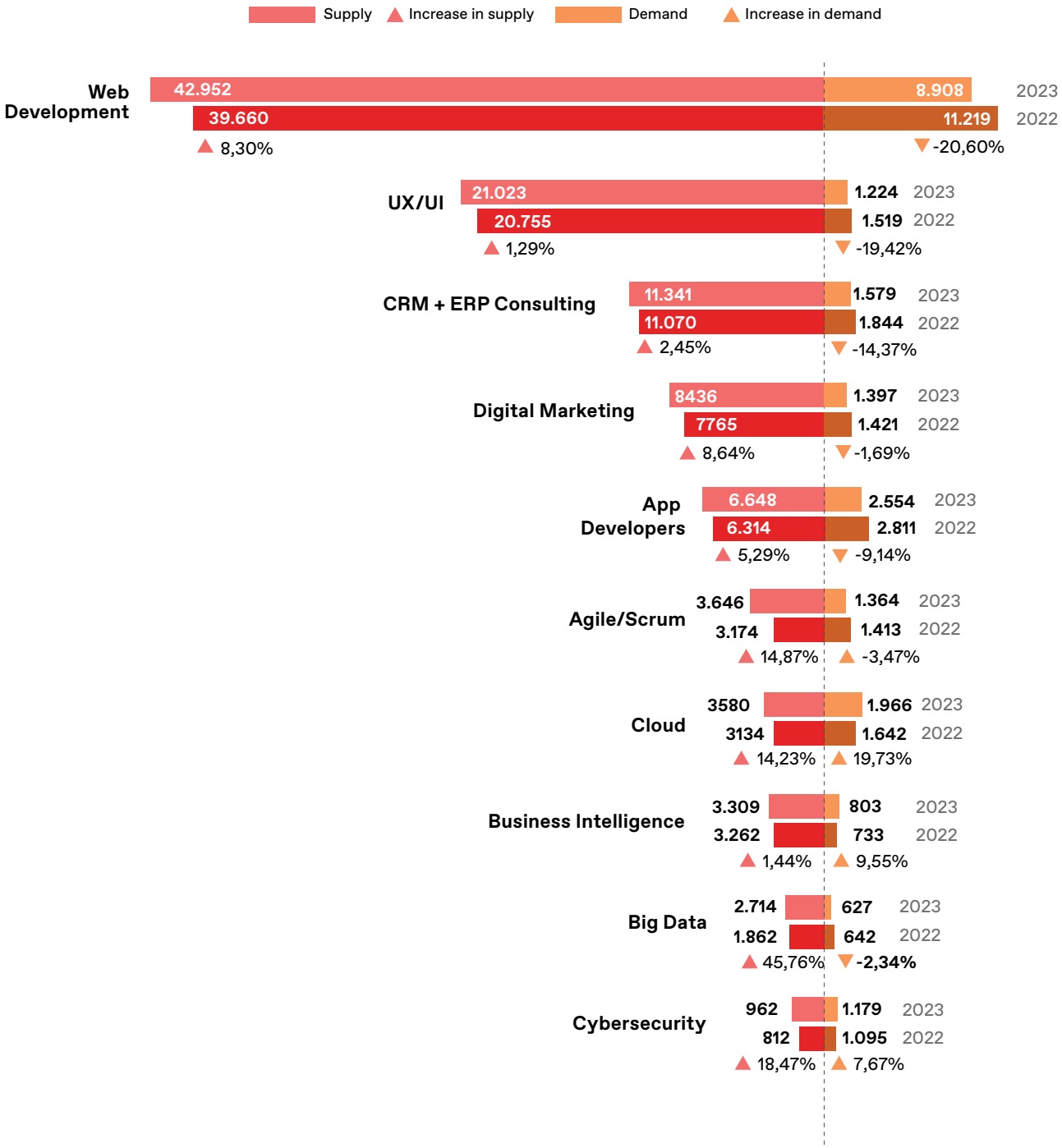
Supply and demand of consolidated tech talent

The digital professional talents in the highest demand and with the most job offers in 2023 were web developers.

In fact, 51% of the job offers were based on web development and UX/UI technologies. The professions in which job offers rose the most are big data (+45%), followed by cybersecurity (+18%) and the cloud (+14%).

Job supply and demand for consolidated technologies.
2022-2023

Source: TalentUp.io per a Mobile World Capital Barcelona



As stated above, market tension refers to the number of professionals available per job offer; the fewer professionals, the higher the market tension. In 2023, there were more professionals available per job offer in the majority of technologies than in the previous year.

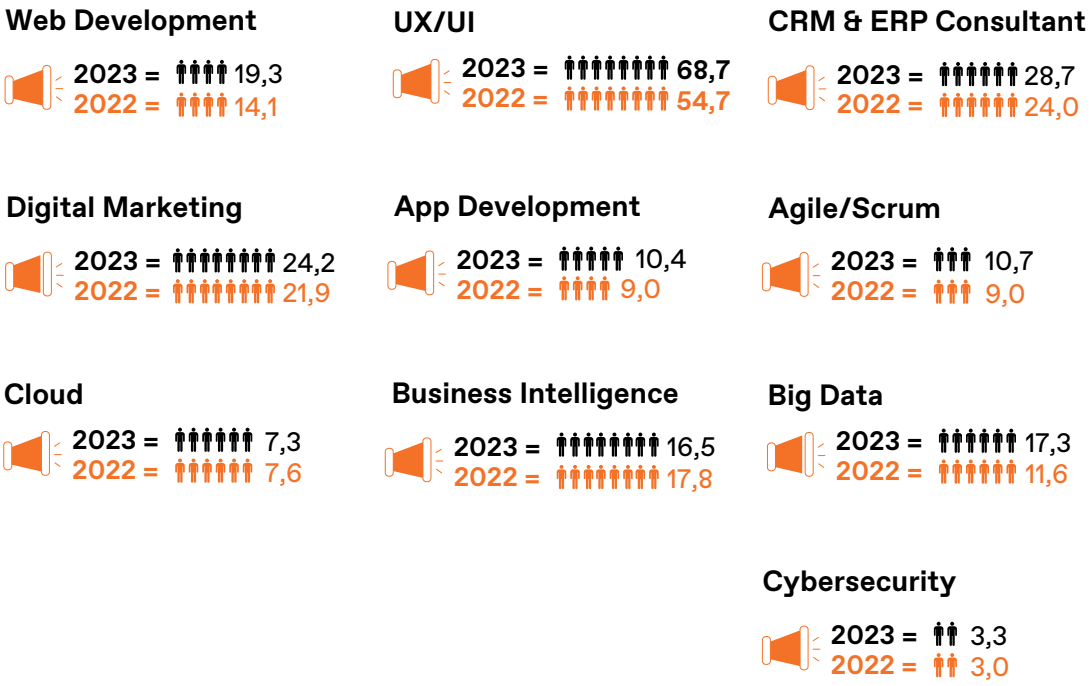
The technologies with the highest market tension are cybersecurity

(3 professionals per job offer), cloud technologies (7 professionals per offer) and app developers and Agile/Scrum (10 professionals per offer). The technologies with the lowest market tension are UX/UI (69 professionals per job offer) and CRM + ERP consulting (29 professionals per offer).

Digital professionals per job offer for consolidated technologies.

2022-2023

Source: TalentUp.io per a Mobile World Capital Barcelona



The three most popular professional roles within the 10 most popular areas of knowledge in the digital sector, which have remained constant compared to previous years, are: web developer, UX designer and data scientist. The other positions have varied over time.

Most popular positions for the consolidated technologies.
2023

Source: TalentUp.io per a Mobile World Capital Barcelona

	1	2	3
Web Developers	Web Developer	Full Stack Developer	Frontend Developer
App Developers	iOS Developer	Android Developer	Mobile Developer
UX/UI	UI/UX Designer	User Experience Designer	Frontend Developer
CRM + ERP Consultants	ERP Consultant	CRM Manager	Project Manager
Agile/Scrum	Scrum Master	Backend Developer	Agile Coach
Cloud	Cloud Engineer	Devops Engineer	Data Engineer
Cybersecurity	Cyber Security Engineer	Cyber Security Analyst	Devops Engineer
Business Intelligence	Business Intelligence Analyst	Business Intelligence Developer	Data Analyst
Big Data	Data Engineer	Data Analyst	Data Scientist
Digital Marketing	Marketing Digital Strategist	Marketing Digital Manager	Marketing Manager

OCADO TECHNOLOGY

‘In a world that is constantly evolving, digital professionals are the key to business success. Digital natives and professionals who have reskilled to the digital field, coupled with a passion for everything digital, contribute to our innovative vision and capacity for adaptation to rise to future challenges. Only together will we be able to build a better tomorrow.’

Guillem Vila Palau
Technology Centres Director

The 3 skills in digital professionals valued the most highly by the company:

- Technical skills
- Alignment with the company's values
- Advanced English

1. The 3 digital professions with the most hires in 2023:
2. Backend engineer
3. iOS engineer
4. DevOps Engineer

PEPSICO

‘The digital talent at our Hub is a catalyst of the company’s digital transformation, working together with the business and bringing new digital solutions to the planning, manufacturing, distribution and sales processes to create a competitive advantage and sustainable business growth’.

Gaston Besanson
Global Data Science Vicepresident and Digital Hub Lead for Spain

The 3 skills in digital professionals valued the most highly by the company:

- Software development
- Data science
- Data engineering

The 3 digital professions with the most hires in 2023:

1. Data scientists
2. Data engineers
3. Product managers

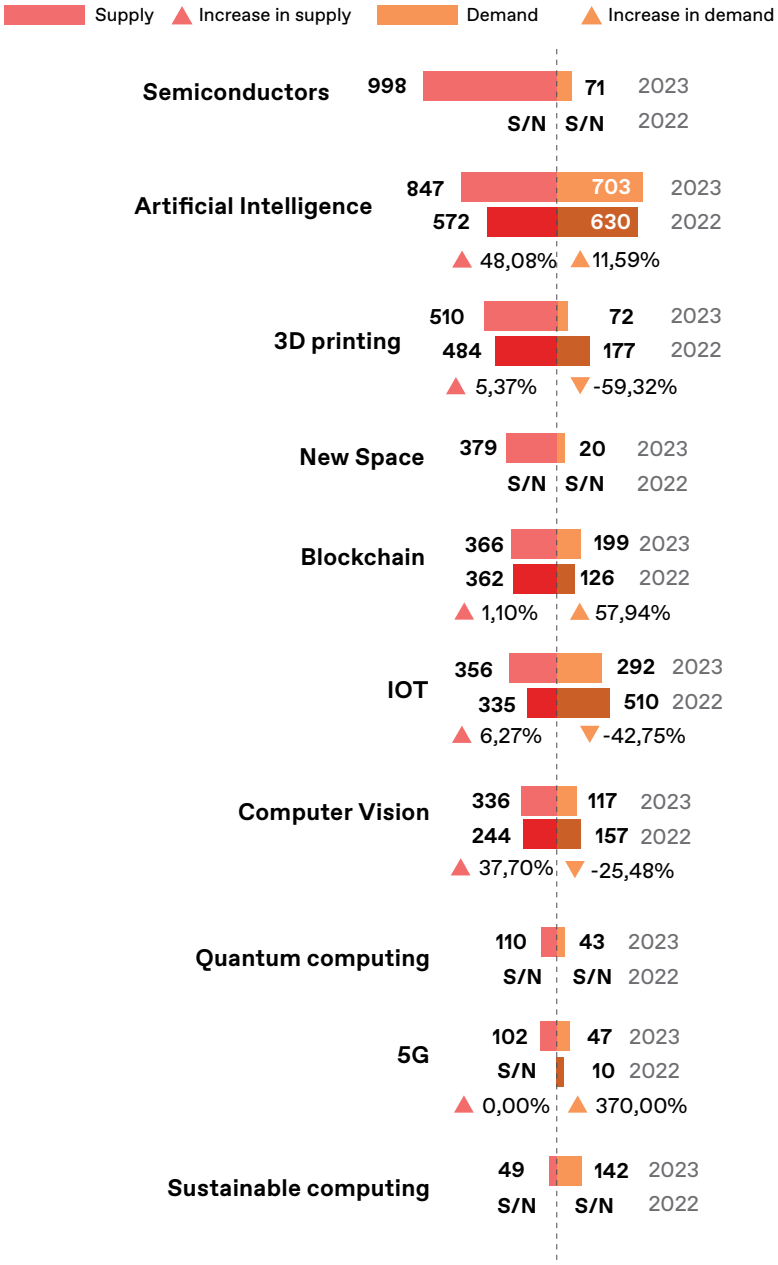
Supply and demand of emerging tech talent

AI and IoT, the emerging professions with the most talent. The supply of AI and the demand for blockchain are growing the most.

New emerging professions are being added, albeit with modest figures, in fields like semiconductors, quantum computing and NewSpace.

Most popular positions for the consolidated technologies.
2023

Source: TalentUp.io per a Mobile World Capital Barcelona



The emerging technologies that have the most professionals available for the job supply are 3D printing, computer vision and NewSpace.

Demand for emerging technologies.
2022-2023

Source: TalentUp.io per a Mobile World Capital Barcelona

Semiconductors
2023 = 14,1
2022 = -

Artificial Intelligence
2023 = 1,2
2022 = 0,9

3D Printing
2023 = 7,1
2022 = 2,7

New Space
2023 = 19,0
2022 = -

Blockchain
2023 = 1,8
2022 = 2,9

IOT
2023 = 1,2
2022 = 0,7

Computer Vision
2023 = 2,9
2022 = 1,6

Quantum Computing
2023 = 2,6
2022 = -

5G
2023 = 2,2
2022 = -

Sustainable computing
2023 = 0,3
2022 = -

Positions in the most demand for emerging technology.
2022-2023

Source: TalentUp.io per a Mobile World Capital Barcelona

	1	2	3
New space	Backend Developer	Data Engineer	Frontend Developer
Semiconductors	Electrical Engineer	Design Engineer	Project Manager
Blockchain	Full Stack Developer	Backend Developer	Blockchain Developer
Computer vision	Data Scientist	Full Stack Developer	Data Specialist
IoT	Backend Developer	Java Developer	Frontend Developer
3d printing	Product Engineer	Mechanical Engineer	Industrial Designer
Quantum computing	Quantum Software Engineer	Quantum Data Scientist	Specialist In Quantum Criptography
5G	5G Core Engineer	5G Core Architect	Test Engineer
Sustainable computing	Software Engineer	Devops Engineer	Research Associate
Artificial intelligence	Data Scientist	Prompt Engineer	Machine Learning Engineer

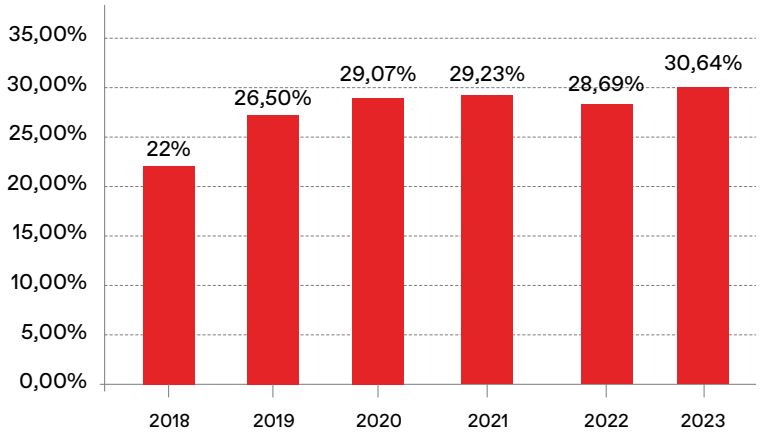
Barcelona is one of the cities with the most women in the digital sector

1 out of every 3 digital professionals in Barcelona is a woman, specifically almost 31%, and 2023 was the year with the highest percentage of women in the digital sector.

The number of women in the tech sector has risen more than 8 points since 2018. In 2020, 2021 and 2022, this growth was somewhat steady, but it increased steeply in 2023 after these 3 flat years.

Percentage of women in the digital sector.
2022-2023

Source: TalentUp.io per a Mobile World Capital Barcelona

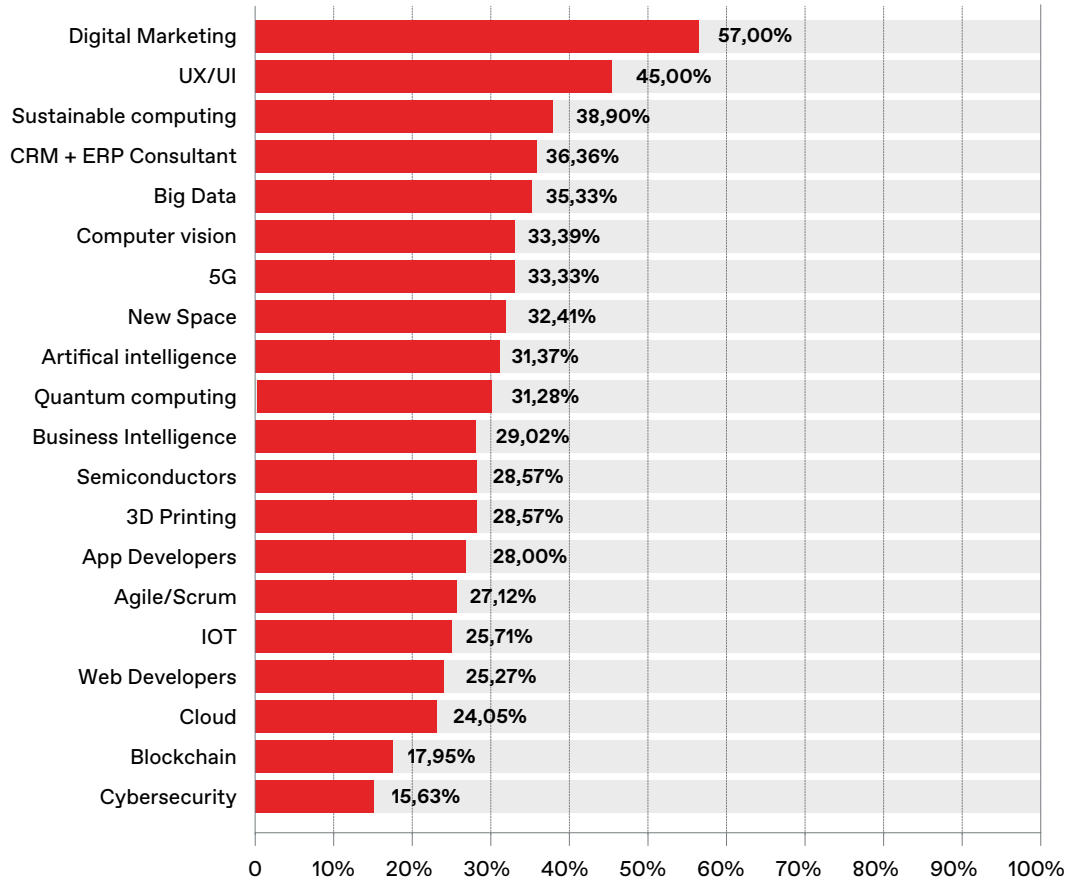


More than half the professionals in the Digital marketing sector (57%) and around one-half of professionals in UX/UI (45%) are women. The technologies with the fewest women are blockchain and cybersecurity.

The technologies with the highest growth in the number of women in the past year are digital marketing (+24%) and computer vision, with more than 12% growth.

Percentage of women in the digital sector by technology.
2023

Source: TalentUp.io per a Mobile World Capital Barcelona

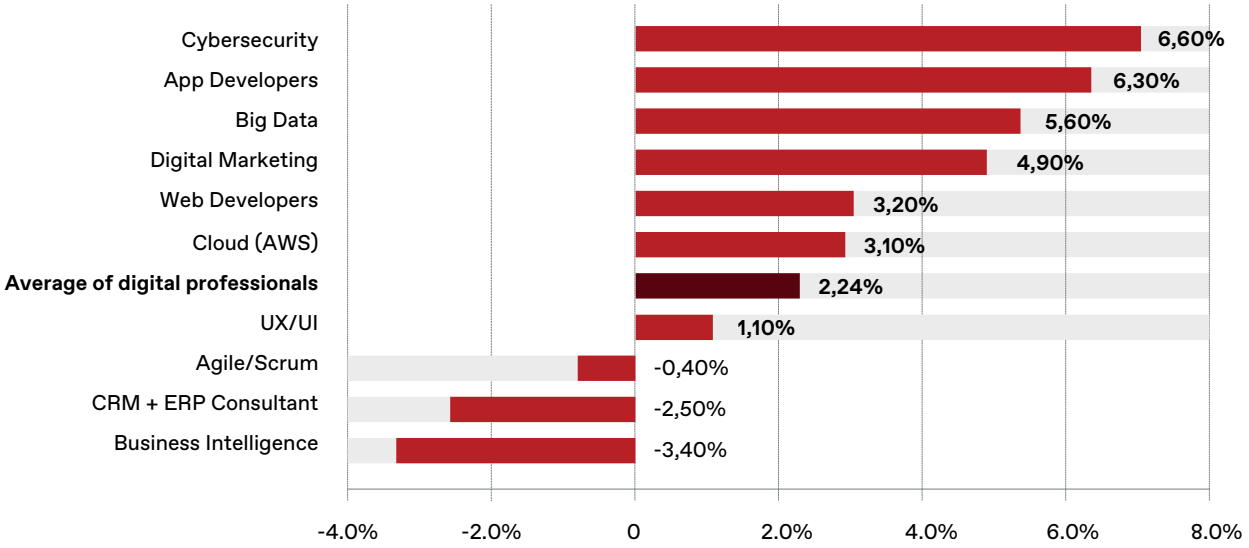


The average salary difference between men and women is over 2%. Cybersecurity, app development and big data are the 3 technologies with the largest salary gaps (more than 5%).

In professions in business intelligence, CRM + ERP consulting and Agile/Scrum, women have a higher average salary than men.

Salary difference between men and women in the same job.
2023

Source: TalentUp.io per a Mobile World Capital Barcelona



*Percentatge d'increment salarial dels homes respecte les dones.

PORSCHE DIGITAL

‘We create digital products for our customers to guarantee a perfect experience of Porsche quality and a stimulating connection between the driver, the vehicle and the digital space’.

Scott Francis
Managing Director

The 3 skills in digital professionals valued the most highly by the company:

- Empathy
- Agility
- Product mindset

The 3 digital professions with the most hires in 2023:

1. Fullstack Developer
2. Agile Team Coach
3. Product Owner

SALESFORCE

‘Talent has played an important role in our growth. Our ambition is to transform the regional businesses to make them more efficient and successful and to continue earning trust on our platform’.

Jordi Ossó
Regional Sales Director at Salesforce Barcelona

The 3 skills in digital professionals valued the most highly by the company:

- Complex problem-solving
- Resilience
- Flexibility

Els 3 perfils digitals més contractats el 2023:

1. Data and AI Specialist (Architect or Administrator)
2. Salesforce business analysts and Marketers
3. Salesforce developer

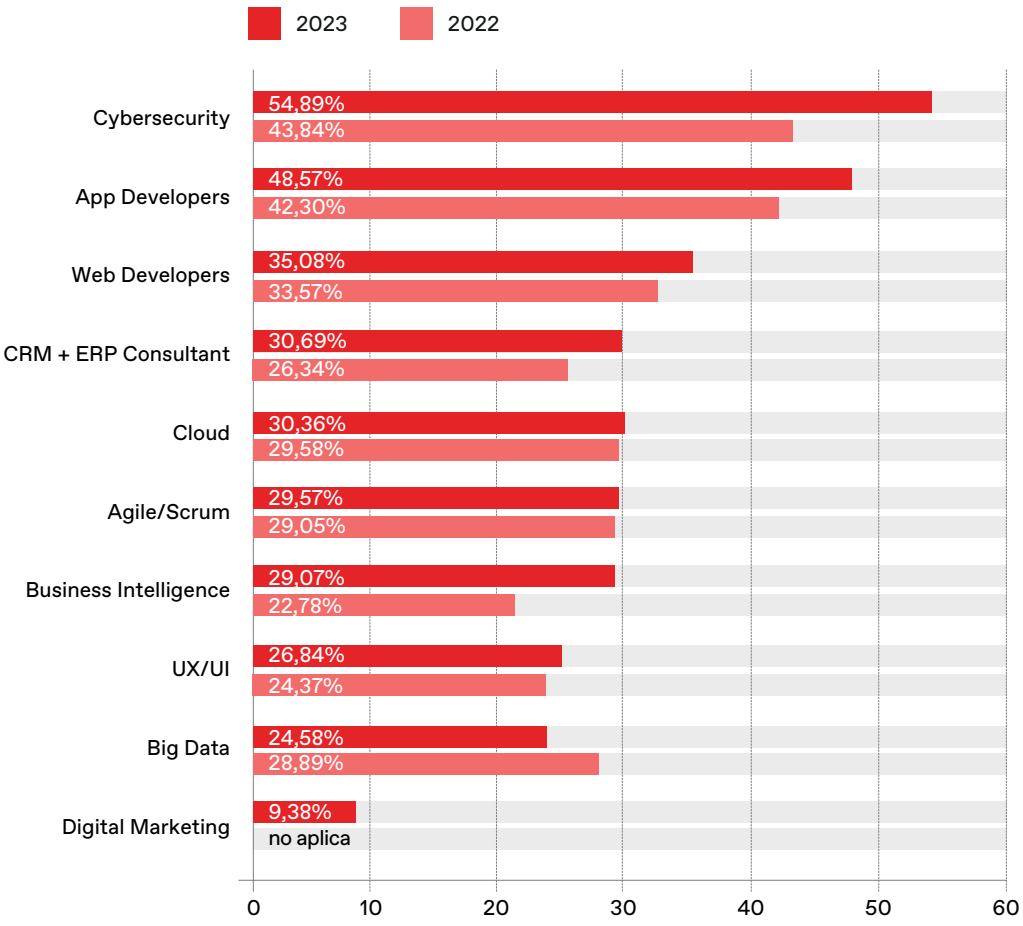
Digital talent from outside Catalonia

n 2023, Barcelona managed to attract around 5,111 digital professionals.

The specialities that attract the most outside talent are cybersecurity (54.9%) and app (48.6%) and web development (35%).

Professionals from other cities working in Barcelona. 2022-2023

Source: TalentUp.io per a Mobile World Capital Barcelona



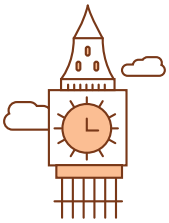
+19.000

digital professionals
from outside Barcelona
2018-2023

+5.111

digital professionals
from outside Barcelona
2023

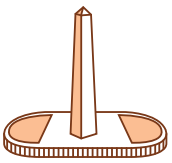
With 12.09%, London is the city that has exported the most talent to Barcelona. Other cities exported 1% to 6% of the talent to Barcelona in 2023.



12.1%
London

6.2%
Lisboa

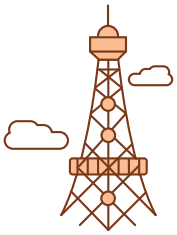
3.8%
Madrid



3.4%
Buenos Aires

3.2%
Sao Paulo

2.6%
Valencia



2.6%
Paris

2.4%
Mexico City

1.6%
Seville

2.0%
Dublin

1.9%
Amsterdam

1.6%
Milan

56.6%
Other

The companies that hire the most in the digital sector

Diversity of business professionals among companies that posted the most job offers.

In Barcelona, the three companies that hire the most digital professionals are Seidor, NTT Data and BSC.

Companies in Barcelona that hire the most.

2023

Source: JobMarket Insights

	Empresa	Sector
1	**Seidor**	Consulting
2	**NTT Data**	Consulting
3	**BSC** - Barcelona Supercomputing Center	Technology
4	**Capgemini**	Consulting
5	**Inetum**	Consulting
6	**Zurich**	Insurance
7	**T-Systems**	Consulting
8	**Glovo**	E-commerce
9	**HP**	Technology
10	**Ricoh**	Consulting

Top hiring companies by digital professions.
2023

Source: JobMarket Insights

	1	2	3
Web Developers	BSC. Barcelona Supercomputing Center	Seidor	Alexion - Astrazeneca
App Developers	Media Markt	Fluidra	Allianz
UX/UI	CIMPRESS	HP	King.com
CRM + ERP Consultant	HP	FreeNow	Mango
Agile/Scrum	Mango	ADP	Altran
Cloud	TD Synnex	NTT DATA	SAP
Cybersecurity	EY	NTT Data	Ibermatica
Business Intelligence	Hewlett Packard - HP Development Company, L.P.	Puig, SL	Amazon
Big Data	Capgemini	CIMNE. Centre Internacional de Metodes Numerics en Enginyería	Accenture
Digital Marketing	Grupo Planeta	Papernest	Amazon
Artificial Intelligence	Accenture	Avanade	BSC. Barcelona Supercomputing Center
New Space	Indra	GTD	GMW
Semiconductors	Capgemini	Inmersia	Catalan Institute of Nanoscience and Nanotechnology
Blockchain	European Blockchain Convention	Tok&Go	Accenture
Computer Vision	BitMetrics	Gestoos	Bayer
IOT	Seidor	Avanade	Fluidra
3d printing	HP	Aridditive	BCN 3D Technologies
Quantum Computing	IFAE	DevsHealth	Signaloid
5G	OFG Adquisiciones e Ingeniería	Gestelcom Servicios	Iquadrat Informatica
Sustainable computing	Siemens Energy	Caixabank	HP

SANOFI

‘Our goal is to become the leading pharmaceutical company driven by artificial intelligence on a large scale, which provides our team with tools and technologies based on insights that enable us to take better decisions. The use of artificial intelligence and data science is already supporting our teams’ efforts in many areas.’

Irena Herrero Viñas
Talent Acquisition Lead – Global Innovation Center

The 3 skills in digital professionals valued the most highly by the company:

- Adaptability
- Teamwork
- Resilience

The 3 digital professions with the most hires in 2023:

1. MLOps engineers
2. SAP specialists
3. Data Scientists

SCHNEIDER ELECTRIC

‘Innovation, development, management and optimisation of the different applications, platforms and systems we use help us to drive the digital transformation of the company, our customers and our partners’.

Eva Roca
Iberian Talent Director

The 3 skills in digital professionals valued the most highly by the company:

- Data analysis
- Cybersecurity
- Digital project management

The 3 digital professions with the most hires in 2023:

1. Data engineer/analyst
2. SAP consultant
3. IT Project Manager

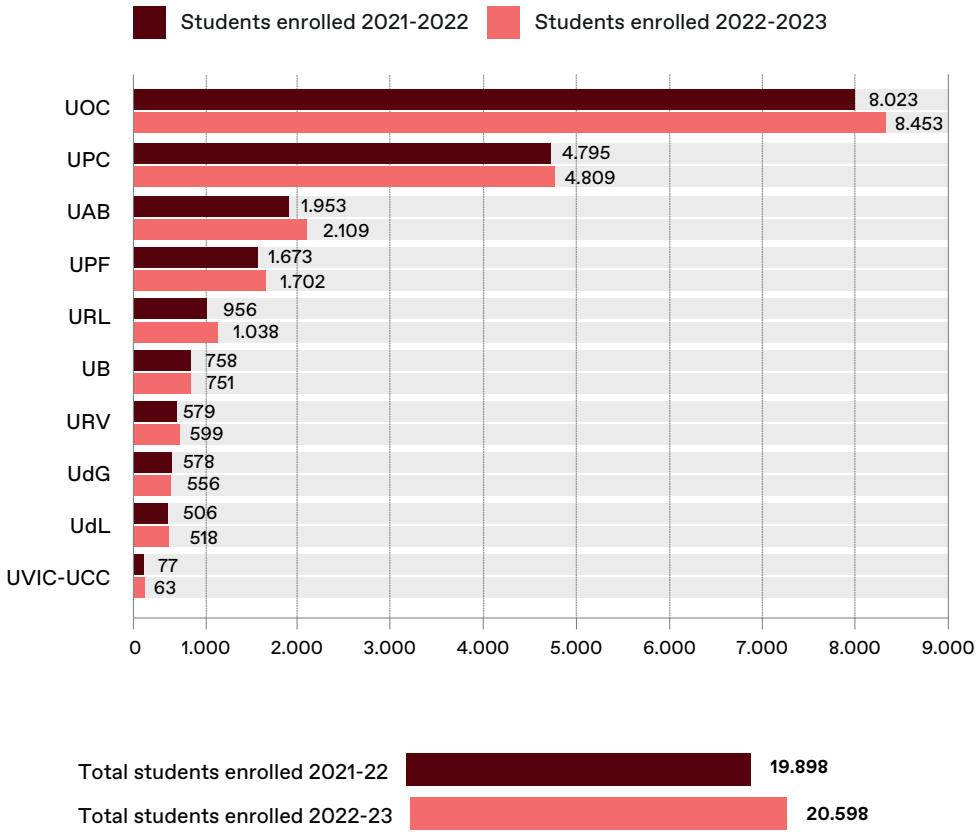
Evolution in university ICT studies

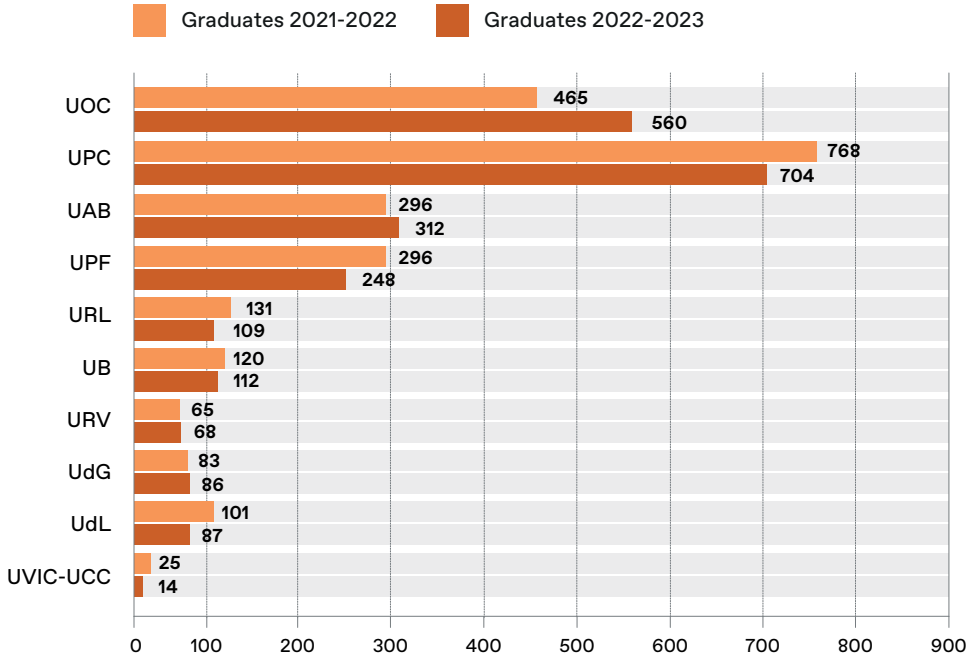
The demand for ICT degrees is on the upswing. The number of students enrolled in academic year 2022-2023 was 3.5% higher than in academic year 2021-2022.

The Universitat Oberta de Catalunya (UOC) is the school with the most students enrolled in ICT degrees, with more than 40% of students enrolled in ICT programmes in Catalonia studying there. It is followed by the Universitat Politècnica de Catalunya (UPC). In academic year 2022-2023, 2,300 students graduated, a similar number as the previous year. The UPC is the university with the most graduates.

Students enrolled in and earning official ICT degrees in Catalonia. 2023

Source: Secretariat of University and Research, Ministry of Enterprise and Knowledge of the Government of Catalonia.

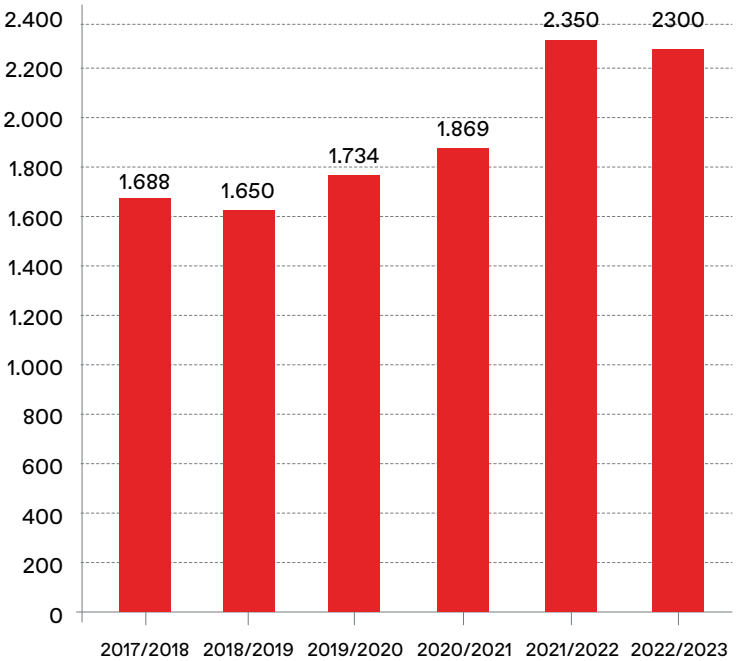




* Includes the following ICT degree programmes: Mathematics, Computer Engineering, Electronic Telecommunications Engineering, Interactive Digital Contents, Telecommunication Systems Engineering, IT and Services, Data Engineering, Smart and Sustainable City Management, Artificial Intelligence, Multimedia, Telematic Engineering, Audiovisual Systems Engineering, ICT Systems Engineering, Videogame Design and Development, Geoinformation and Geomatic Engineering, Data Science and Engineering, Sciences and Technologies Applied to Sport and Fitness, Physics, Biocomputing, Digital Interaction and Computing Techniques, Digital Design and Creative Technologies, Telecommunications Engineering, Software Application Techniques, Health Engineering.

Graduates from ICT degree programmes.
2023

Source: Secretariat of University and Research, Ministry of Enterprise and Knowledge of the Government of Catalonia.



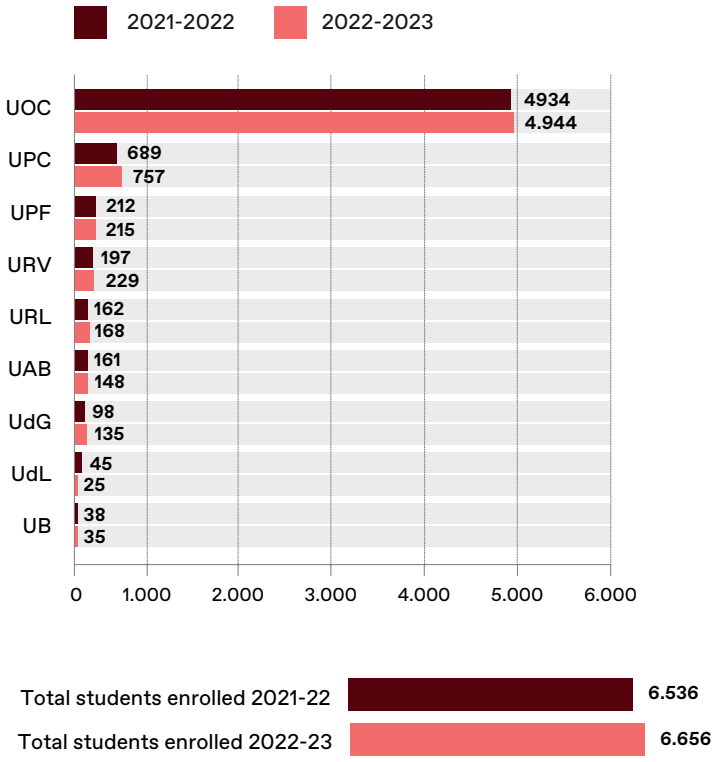
Upskilling via university master's degrees

The number of students enrolled in official master's degrees has remained steady compared to the previous year, with 2% growth.

The number of graduates also remained steady compared to the previous year. The universities that supply the digital sector with the most talent in the form of graduates are the UOC, UPC and UPF.

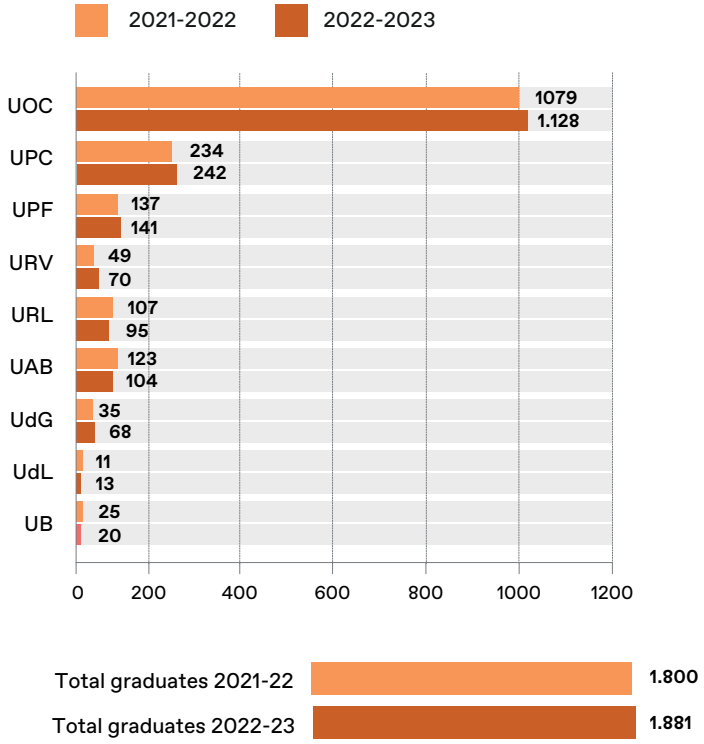
Students enrolled in ICT master's degrees.
2015-2023

Source: Secretariat of University and Research, Ministry of Enterprise and Knowledge of the Government of Catalonia.



Graduates in ICT master's degrees.
2015-2023

Source: Secretariat of University and Research, Ministry of Enterprise and Knowledge of the Government of Catalonia.



*Includes the following ICT degrees: [UB] Fundamentals of Data Science; [UAB] Biocomputing; Telecommunication Engineering; Computer Vision; Remote Detection and Geographic Information Systems; Geoinformation; [UPC] Automatics and Robotics; Computer Engineering; Computer Innovation and Research (MIRI); Artificial Intelligence; Telecommunication Engineering; Telecommunication Engineering Applications and Management (MASTEAM); Advanced Telecommunication Technologies; Cybersecurity; Neuroengineering and Rehabilitation; Data Science; Erasmus Mundus in Big Data Management and Analysis (BDMA); [UPF] Biocomputing for the Health Sciences; Cognitive Systems and Interactive Media; Smart Interactive Systems; Sound and Music Technologies; Computational Biomedical Engineering; Data Science; [UdG] Erasmus Mundus in Medical Imaging and Applications; Data Science; Medical Image Computing; Intelligent Field Robotic Systems (IFROS); Intelligent Robotic Systems (MIRS); [UdL] Computer Engineering; Leather Engineering; [URV] Computational and Mathematical Engineering; Computer and Artificial Intelligence Security Engineering; [UOC] Security of Information and Communication Technologies; Multimedia Applications; Computer Engineering; Biocomputing and Biostatistics; Mobile Device Application Development; Data Science; Telecommunication Engineering; Website and Application Development; Digital Health; Interaction and User Experience Design; Videogame Design and Programming; Cybersecurity and Privacy; [URL] Information and Communication Technologies Management; Telecommunication Engineering; Data Science; Big Data Engineering.

Vocational ICT degrees

Even though there is still a gender gap in Information and Communication degrees (with just 12% women), this figure rose almost 2% over the previous year. There has been a significant absolute increase in the number of women enrolled in computer-based vocational training programmes, with more than 2,000 women students enrolled, a more than 26% increase over the previous year.

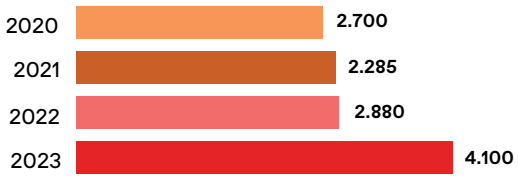
Barcelona continues to increase the number of digital vocational training programmes. In academic year 2022- 2023, the number of places available in Computing and Communications programmes rose more than 12%, with more than 17,000 students.

In academic year 2022-2023, around 4,100 students earned their vocational degrees in Computing and Communication.

Evolution in the number of graduates of vocational ICT programmes

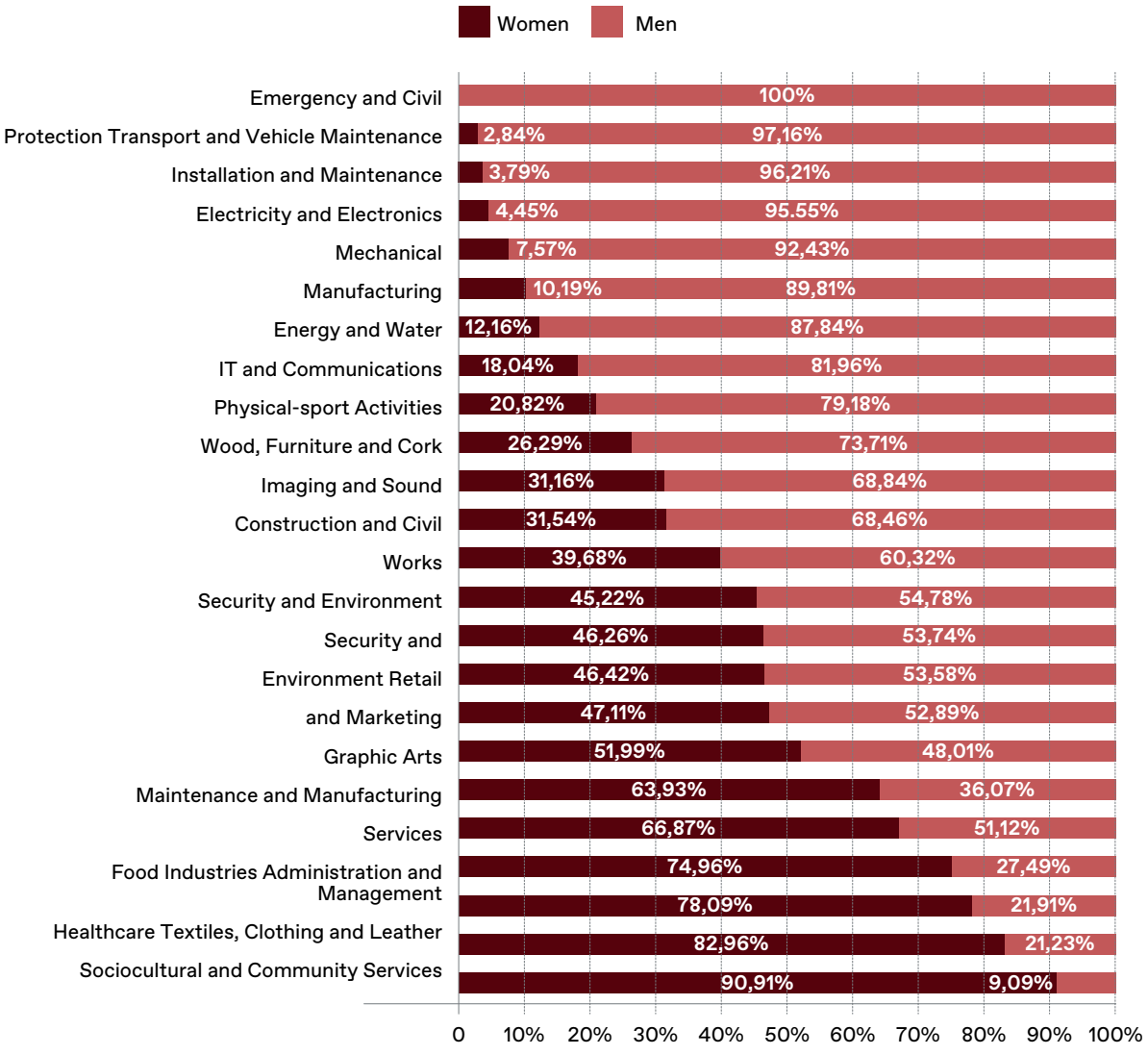
2023

Source: Data from the Fundació BCN Formació Professional based on figures from the Ministry of Education of the Government of Catalonia



Enrolment in vocational education by professional families and sex. 2023

Source: Data from the Fundació BCN Formació Professional based on figures from the Ministry of Education of the Government of Catalonia.



Enrolment in vocational education by professional families and sex. 2023

Source: Data from the Fundació BCN Formació Professional based on figures from the Ministry of Education of the Government of Catalonia.

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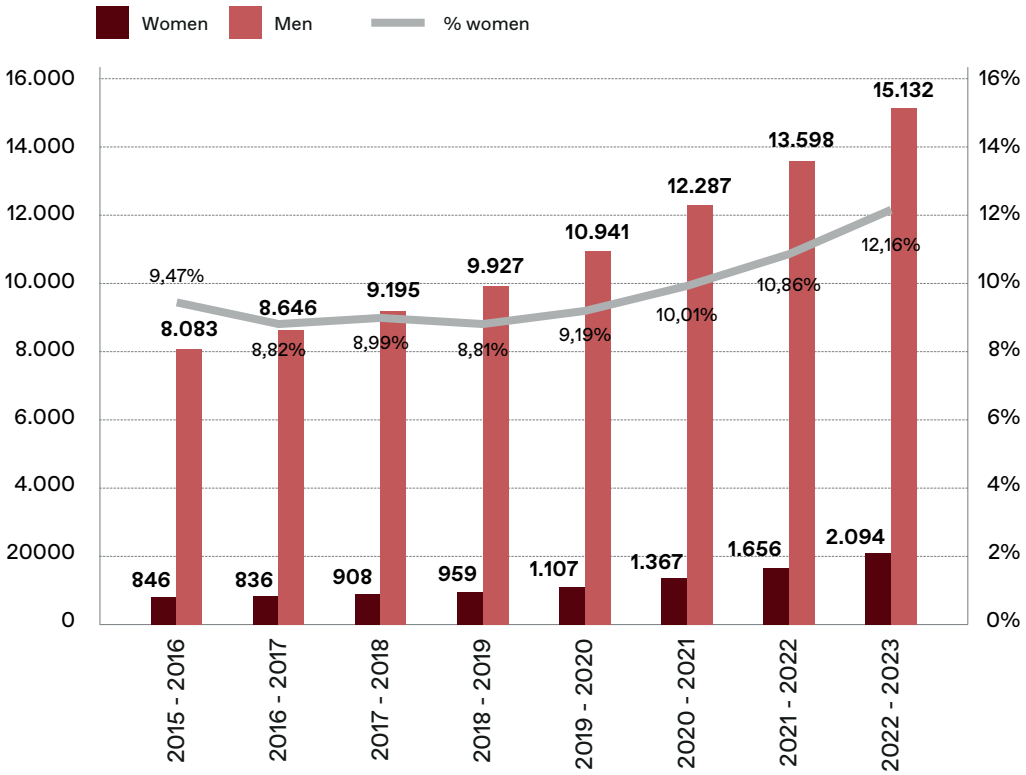
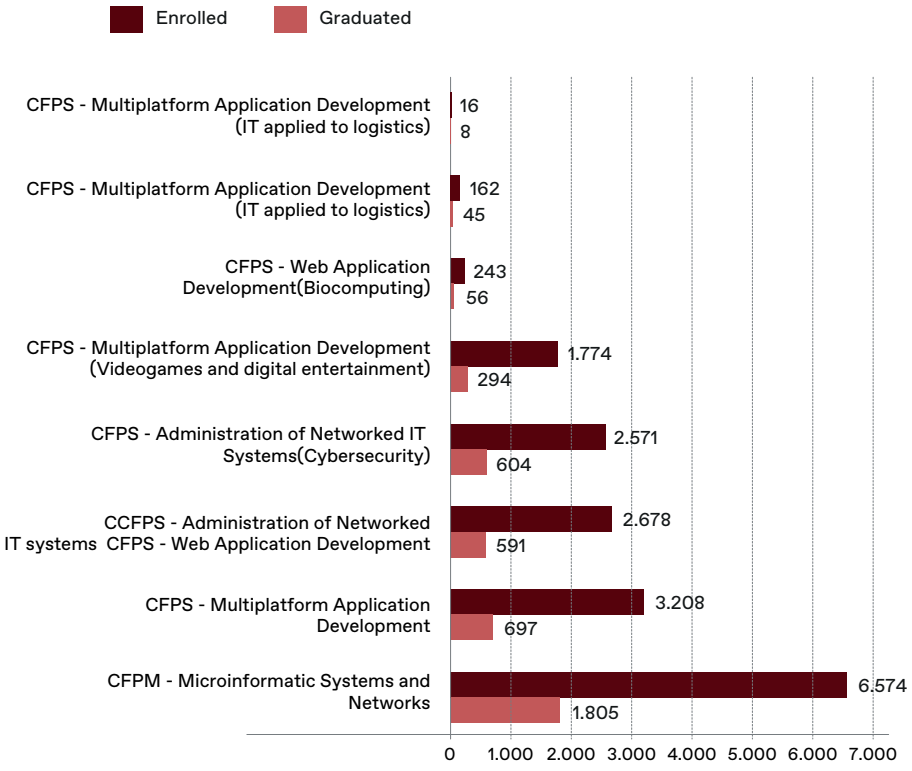


Vocational training specialising in ICT generated 4,100 graduates in academic year 2022-2023. Almost 50% of them specialised in Microcomputing Systems and Networks.

The vocational training programmes with the highest demand were Microcomputing Systems and Networks, with more than 6,500 students enrolled, Multiplatform App Development (3,208) and Web Application Development (2,678).

Students enrolled in and graduating from vocational training. 2023

Source: Data from the Fundació BCN Formació Professional based on figures from the Ministry of Education of the Government of Catalonia.



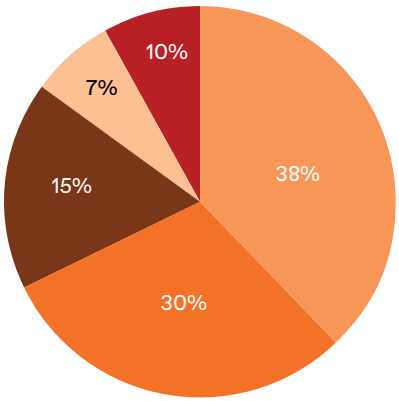
Ways new digital talent is generated

In 2023, both international talent and vocational training generated more than 30% of the new digital talent. Universities provided 15% and master's degrees 7%, all of which are the main ways new digital talent is generated.

Breakdown of the different mechanisms whereby new talent is generated.

2023

Font: Dades elaborades per la Fundació BCN Formació Professional a partir de dades del Departament d'Ensenyament de la Generalitat de Catalunya



International talent	5.111	+14,5%
Vocational training	4.100	+42,4%
Universities	2.059	-1,9%
Masters (50%*)	899	+2,5%
Other	1.331	–
Total:	13.500	

Note: This is an approximation which does not include adjustments like students outside the Catalan university system, migration of recent graduates and the overlap of international talent who also hold degrees. Moreover, 50% of the masters graduates are considered to have upskilled and are therefore not counted.

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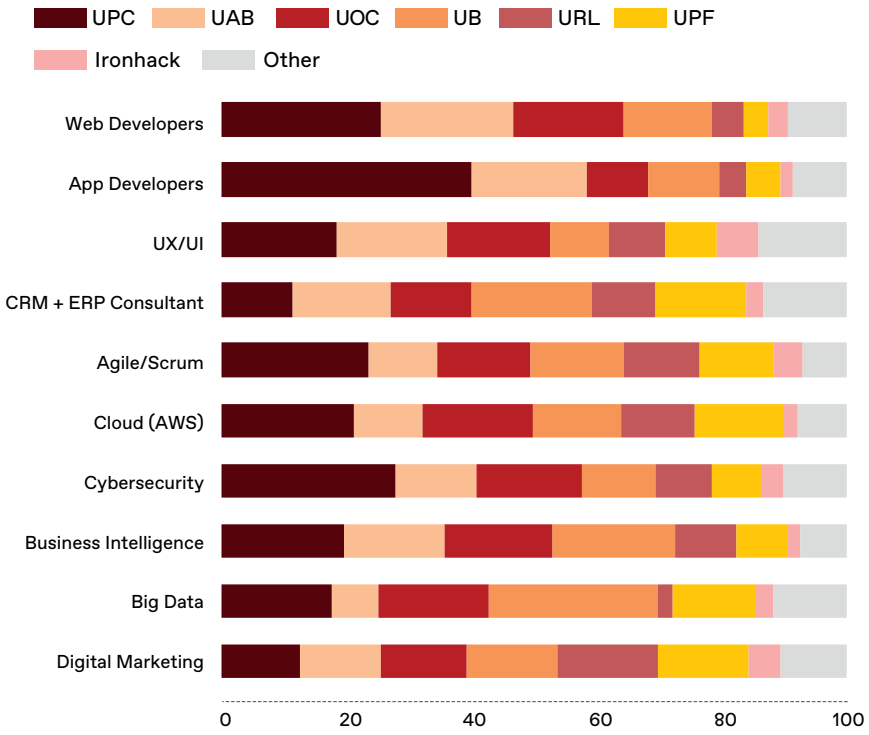
Centres where Barcelona's digital talent has trained

Of all the digital disciplines analysed, the UPC is the main training centre for 70% of them. The UB has offered 15% of the training programmes analysed, followed by the UOC and the URL.

The UPC leads the training in almost all technologies (70%), both emerging and consolidated. The UB leads 15% of the technological training, followed by the UOC and the URL.

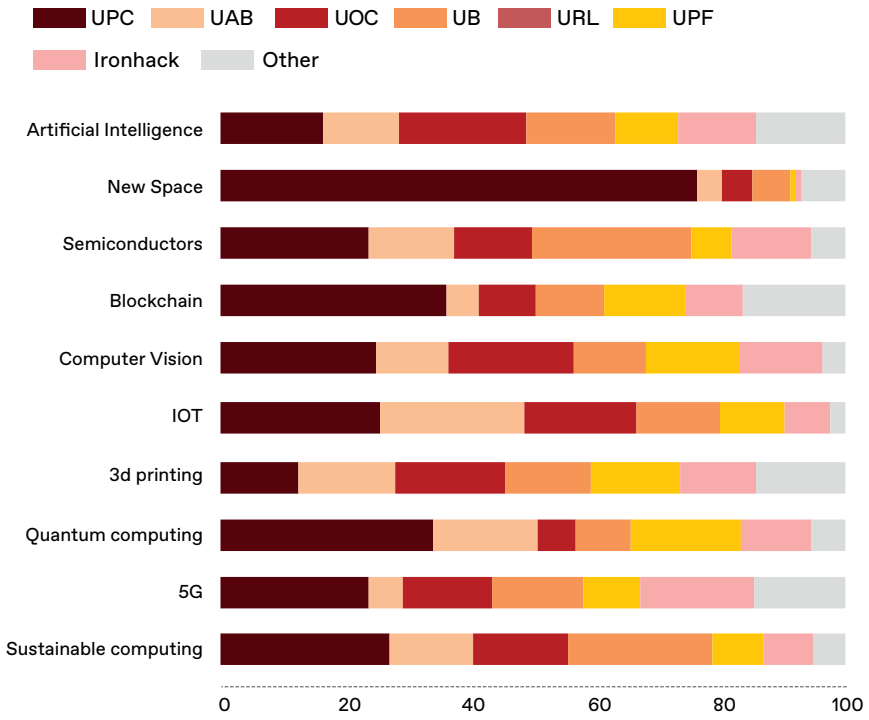
Training centres for consolidated technologies.
2023

Source: TalentUp.io for Mobile World Capital Barcelona



Training centres for emerging technologies.
2023

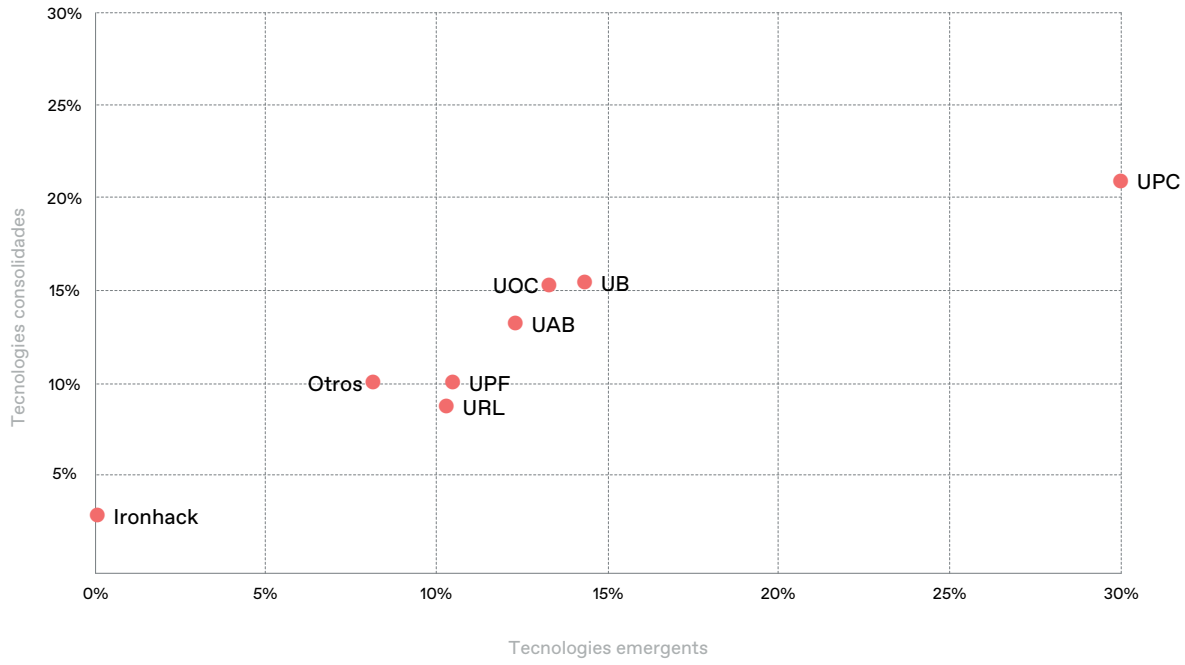
Source: TalentUp.io for Mobile World Capital Barcelona



The UPC leads the training in both consolidated and emerging technologies. The UOC and the UB follow the UPC as the training centres that have best adapted to the emerging technologies.

Emerging and consolidated technologies by training centres. 2023

Source: TTalentUp.io for Mobile World Capital Barcelona



SEAT CODE

‘In a company like SEATCODE, 90% of our professionals have digital profiles and are collaborating in and ensuring that all the projects associated with automotion and mobility are possible. These projects would be impossible without them.’

Stefania Donato
Recruitment Manager & TA

The 3 skills in digital professionals valued the most highly by the company:

- Adaptability
- Motivació
- Teamwork

The 3 digital professions with the most hires in 2023:

1. Backend Developer
2. Product Owner
3. UX/UI Designer

WOLTERS KLUWER

‘Digital professionals offer technological and data analysis skills that enable innovation, efficiency and informed decision-making, driving companies’ digital transformation and competitiveness’.

Gerardo Cid
HR Business Partner

The 3 skills in digital professionals valued the most highly by the company:

- Analytical thinking
- Adaptability
- Collaboration and teamwork

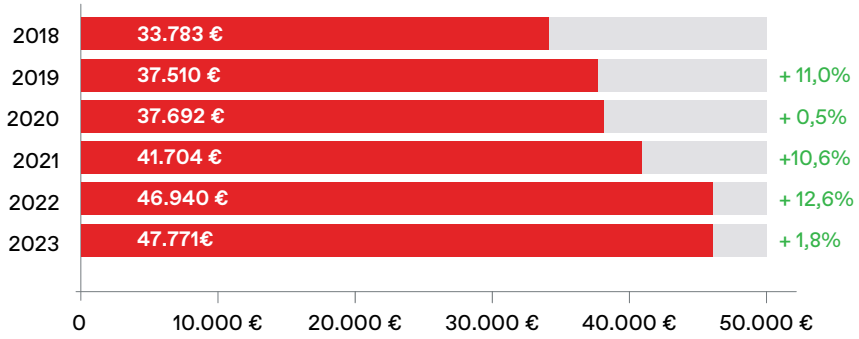
The 3 digital professions with the most hires in 2023:

1. Web Developer
2. Tech Architect
3. Cybersecurity Specialist

Salaries of digital professionals by speciality

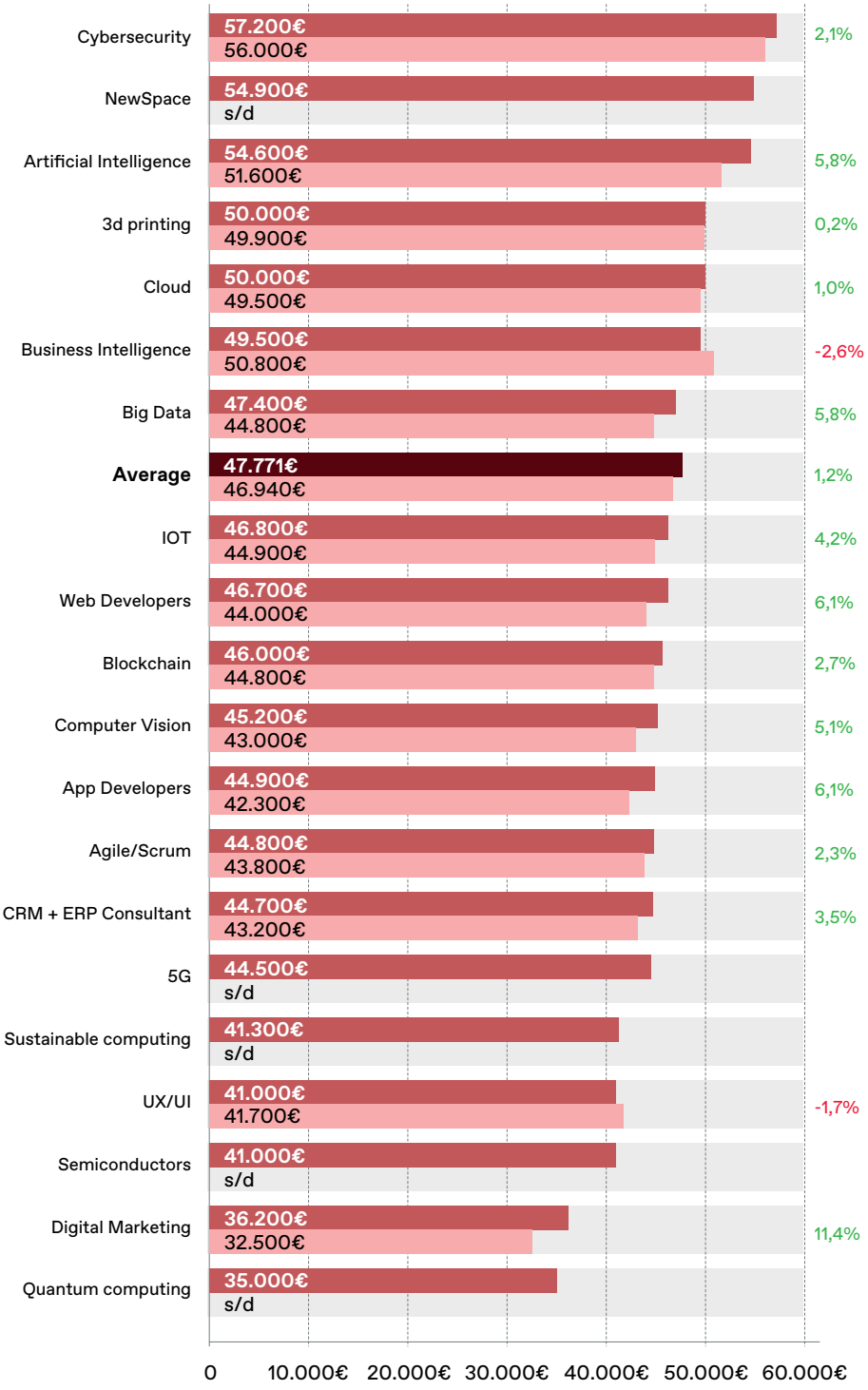
The average salary of a digital professional in Barcelona in 2023 was €47,771, similar to the previous years.

The salaries of digital marketing professionals rose 11.4% compared to 2022. The salaries of UX/UI professionals have also risen considerably: 35%. The salaries in web development, artificial intelligence, big data and computer vision rose more than 5% compared to the previous year.



Salaries of digital professionals by speciality. 2023

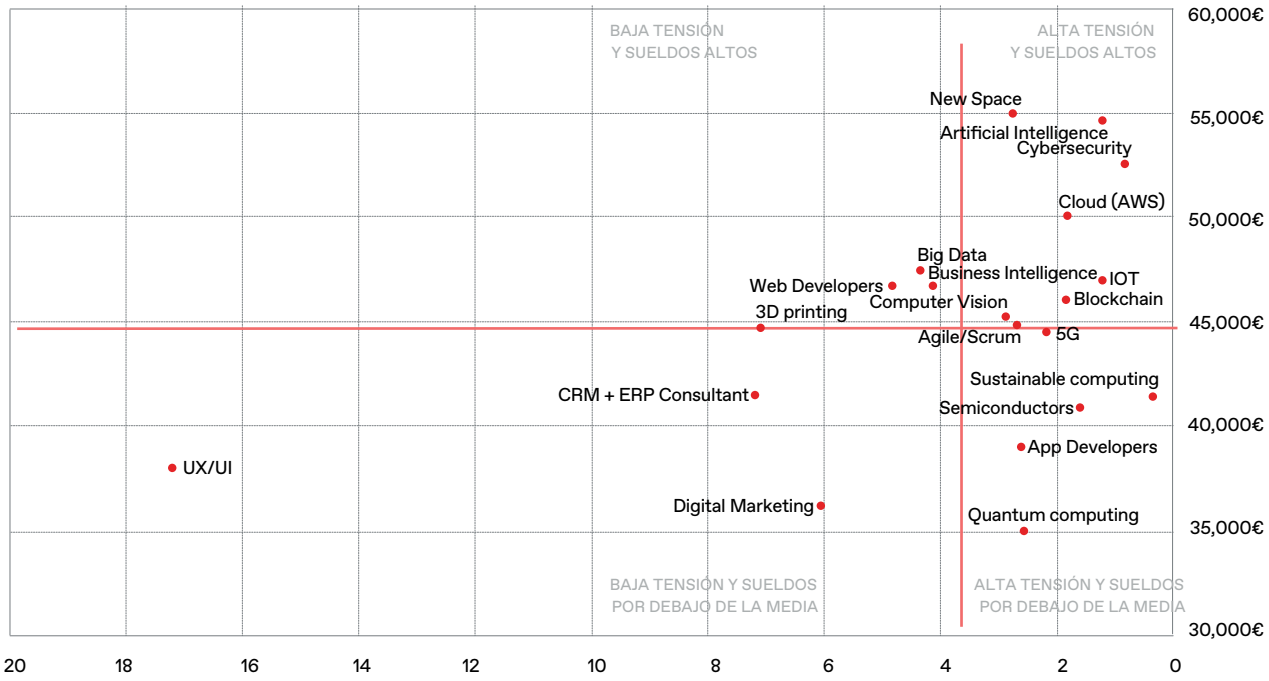
Source: Talentup.io para Mobile World Capital Barcelona



The technologies with the highest market tension are the emerging technologies. The top 3 technologies with the highest salaries are the ones with the highest market tension, specifically NewSpace, artificial intelligence and cybersecurity. In contrast, technologies with low market tension, like UX/UI, CRM + ERP consulting and digital marketing, have salaries below the average.

Relationship between market tension and salary by speciality.
2023

Font: Talentup.io para Mobile World Capital Barcelona



3.
Digital talent in the leading European cities

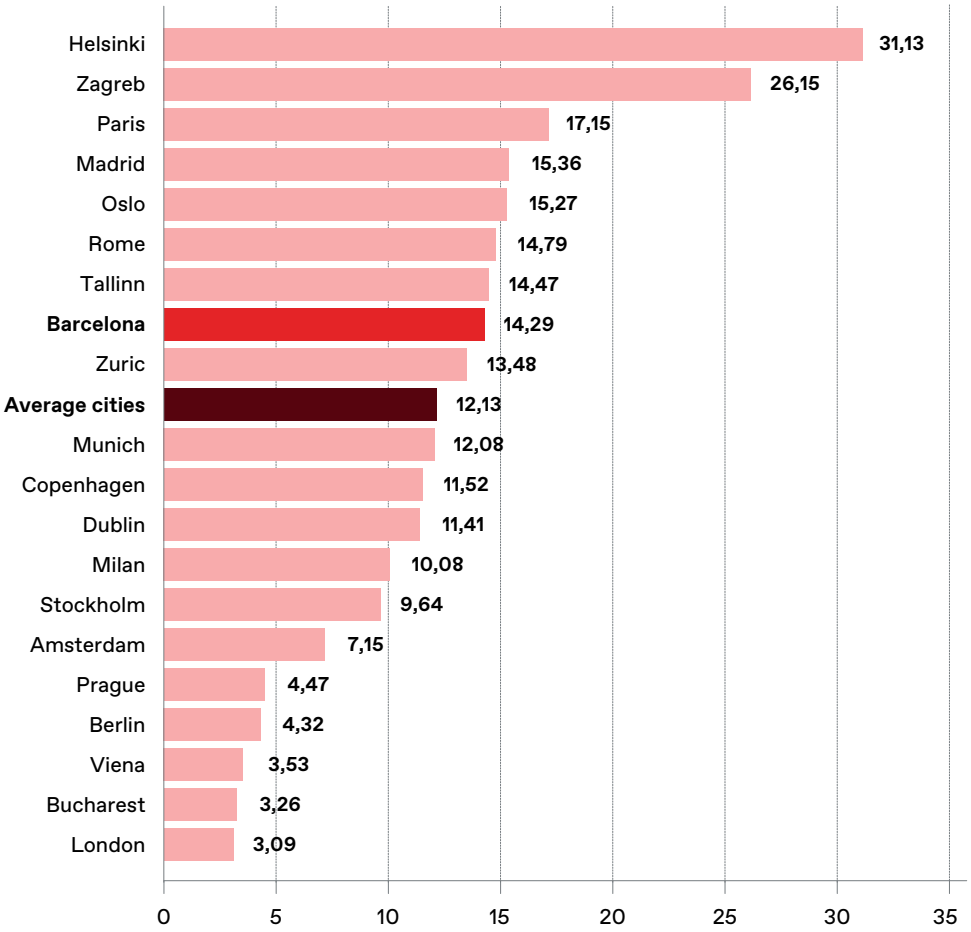
The market tension in European cities

Market tension refers to the number of professionals available for the job offers; the fewer professionals, the higher the market tension. The European city with the most tension in the digital market is London, with 3.09 workers per job offer, followed by Bucharest (3.26) and Vienna (3.53).

The cities with the lowest tension and most professionals per job offer are Helsinki, with 31.13 workers per job offer, followed by Zagreb (26.15) and Paris (17.15).

Market tension: number of professionals per job offer in European cities. 2023

Source: Talentup.io para Mobile World Capital Barcelona



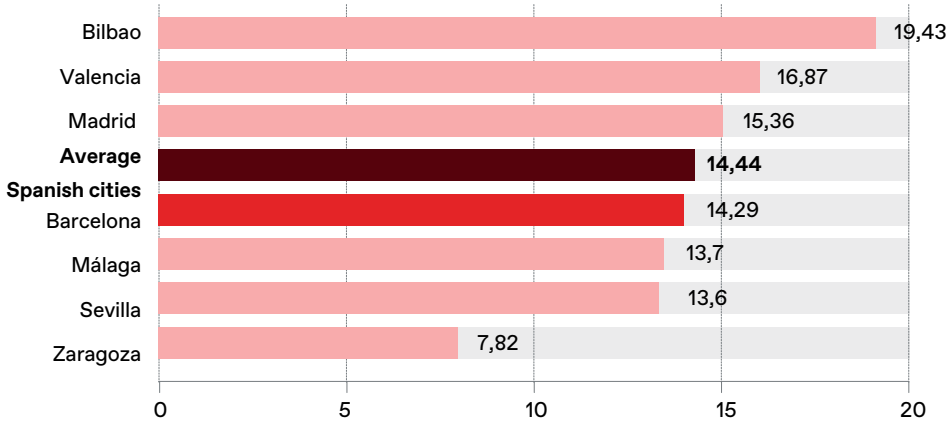
Zaragoza leads the list of Spanish cities with the highest market tension (7.82), which is far below the Spanish average, with 14.44 digital professionals per job offer.

Seville comes in second with 13.6 workers per job offer, followed by Málaga with 13.7. The city with the least tension between supply and demand is Bilbao (19.43). Barcelona, with 14.29 workers per job offer, is slightly under the average of Spanish cities (14.31).

Market tension: number of professionals per job offer in Spanish cities.

2023

Source: Talentup.io para Mobile World Capital Barcelona



ZURICH

‘Digital professionals help our company to provide detailed information on our customers’ insurance policies, behaviours and demographics.
These data are helping us to implement our strategy to improve customer service.’

Josep Badal
HR Lead

The 3 skills in digital professionals valued the most highly by the company:

- Analytical thinking
- Customer focus
- Proactiveness

The 3 digital professions that foresee the most hiring in 2023:

1. Cloud engineer
2. Python developer
3. Solution architect

CLOUDCOACHERS

‘As one of the leading CRM solutions, Salesforce forecasts more than 73,000 digital professionals in Spain with knowledge of this cutting-edge tool, so digital talent will impact data analysis, a greater and better use of artificial intelligence and the optimisation of companies’ automation processes’.

Patricia Irimia
People & Talent Manager

The 3 skills in digital professionals valued the most highly by the company:

- Marketing
- Business analyst
- Einstein analytics - Tableau

The 3 digital professions with the most hires in 2023:

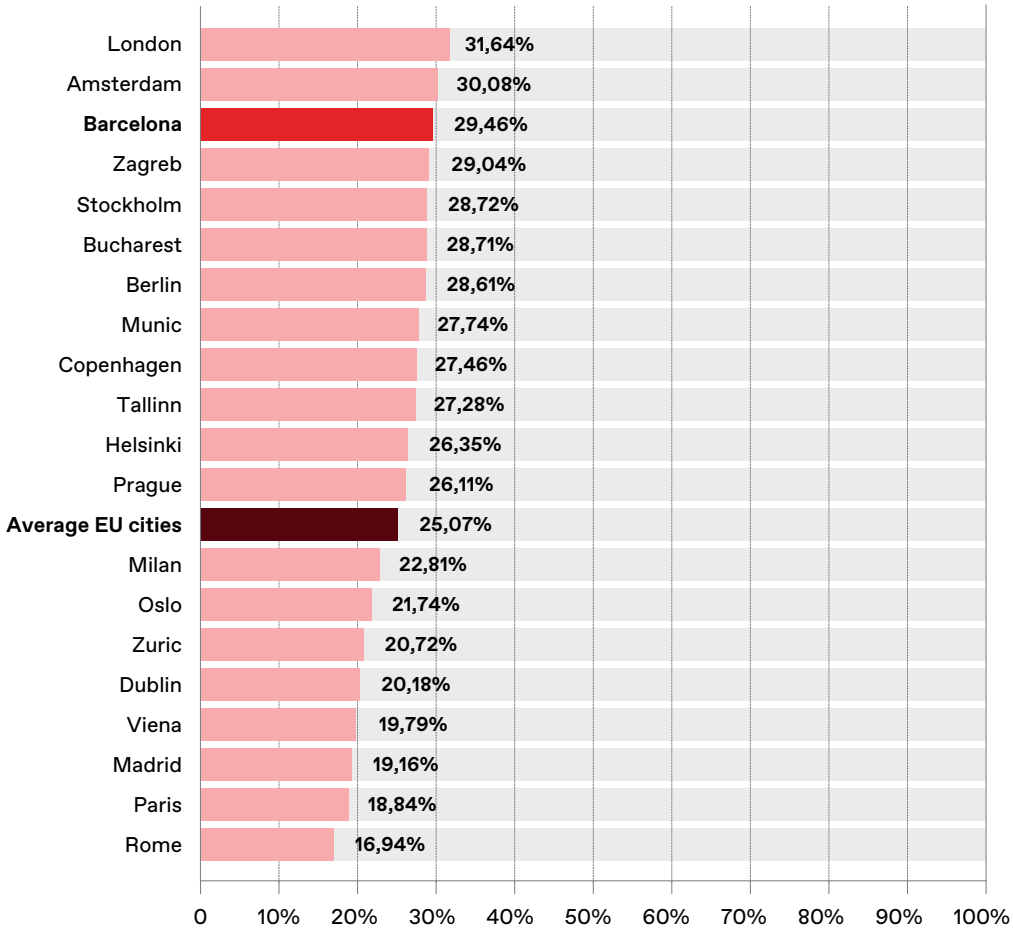
1. Marketing cloud specialist
2. Data analyst
3. Salesforce developer

Demand for digital workers over total demand

London has the highest demand in terms of positions in the tech industry, with 31.64% of the total, followed by Amsterdam with 30.08% and Barcelona with 29.46%. These percentages, showing the demand of digital workers over the overall demand, are above the average of the European cities analysed (25.07%).

Proportion of digital job offers over market total.
2023

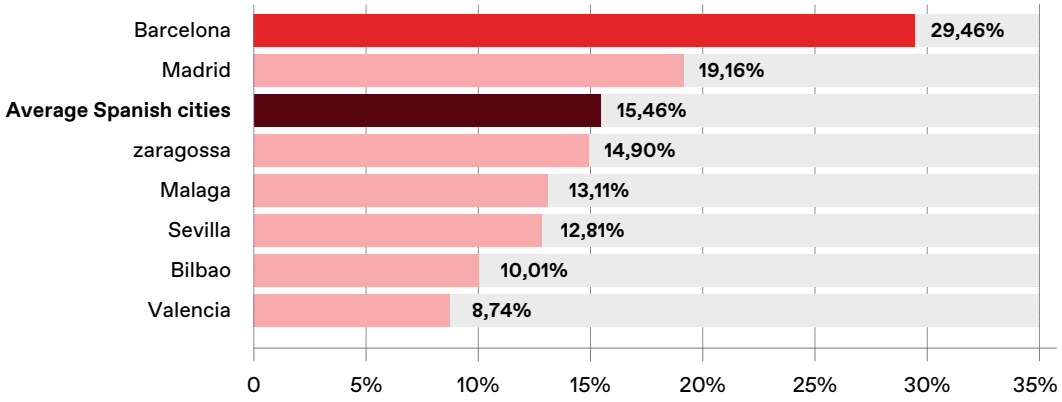
Source: Talentup.io para Mobile World Capital Barcelona



Barcelona is the city with the highest percentage of job offers in the digital sector compared to the overall demand, almost 30%, which is far above the average of the leading Spanish cities (15.46%).

Tension of digital job offers over market total (Spain). 2023

Source: Talentup.io para Mobile World Capital Barcelona



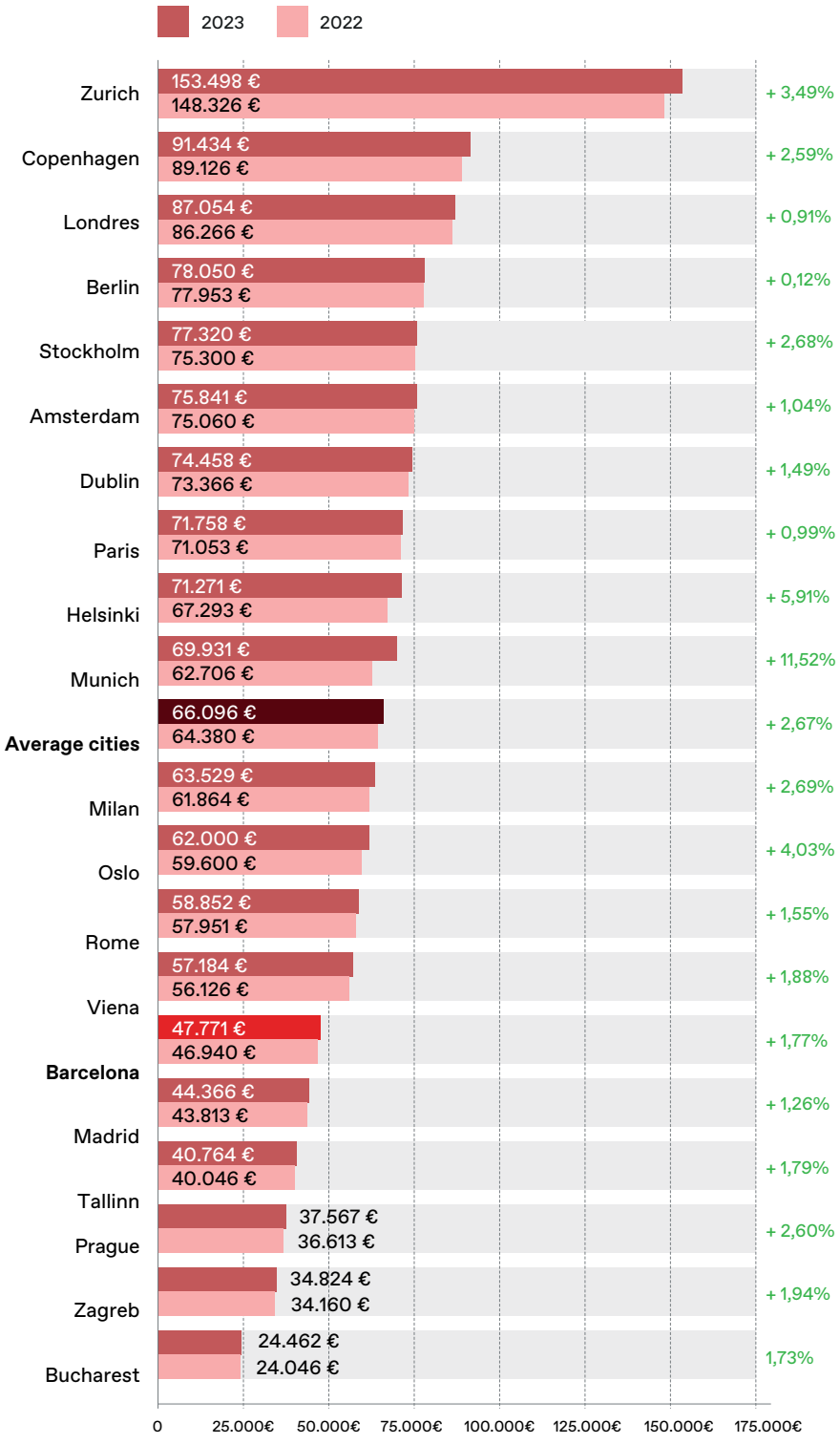
Digital salaries in European cities

Zurich, Copenhagen and London are the European cities which offer digital professionals the highest salaries, over €80,000.

Oslo and Munich are the cities where digital professionals' salaries have risen the most compared to the previous year, over 10%.

Salaries of digital professionals by European city.
2023

Source: Talentup.io para Mobile World Capital Barcelona



EAE BUSINESS SCHOOL

‘Digital professionals are a critical asset in order for companies in the digital sector to be competitive and efficient and to remain attractive in a challenging and ever-changing digital environment like the one we live in’.

Natalia Bagnati
Head of Strategic Partnerships and Business Development

The 3 skills in digital professionals valued the most highly by the company:

- Creativity
- Collaboration
- Solutions-orientation

The 3 digital professions with the most hires in 2023:

1. Data analyst
2. Social media strategist
3. Digital marketing specialist

ESIC

‘With more than 50 years of experience training digital marketing and economics professionals, ESIC trains talent for companies in the digital ecosystem, which enables them to rise to today's challenges by implementing advanced technologies and innovative strategies, thus improving their competitiveness in the global market’.

Jesús Álvarez
PhD. Director of the Bachelor's in Digital Business

Laia Compte
Director of the Professional Development Unit

The 3 skills in digital professionals valued the most highly by the company:

- Marketing
- Business analyst
- Einstein analytics - Tableau

The 3 digital professions that foresee the most hiring in 2023:

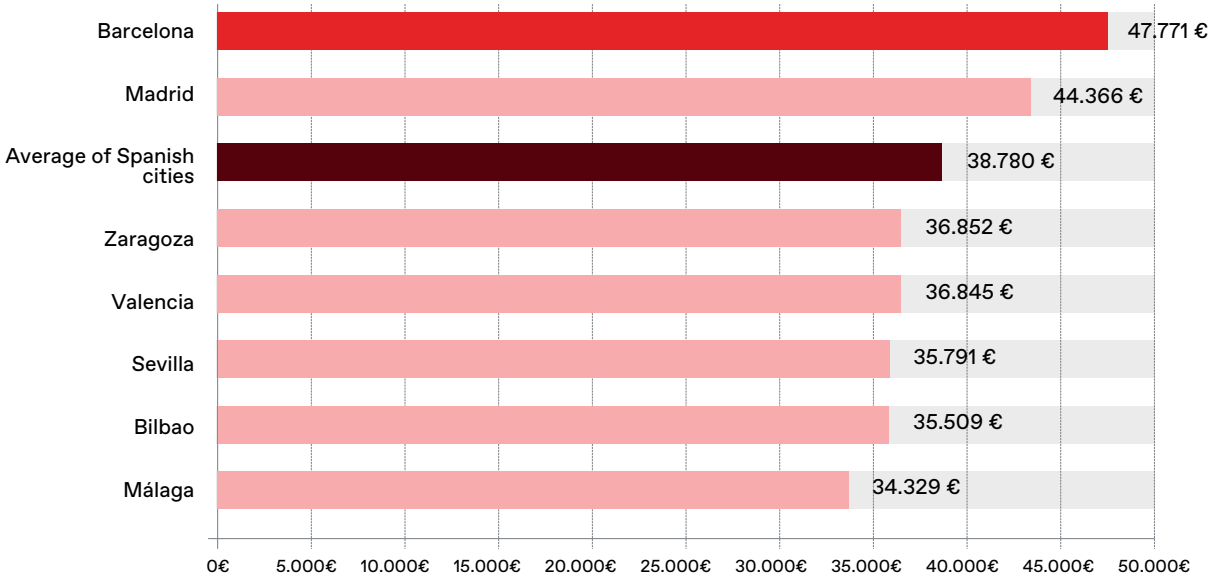
1. Marketing cloud specialist
2. Data analyst
3. Salesforce developer

Barcelona is the city in Spain where digital professionals are paid the most, with an average salary of €48,000.

The average growth in the salary of digital professionals in the leading Spanish cities was 2.5% compared to 2022.

Salaries of digital professionals by Spanish city.
2023

Source: Talentup.io para Mobile World Capital Barcelona



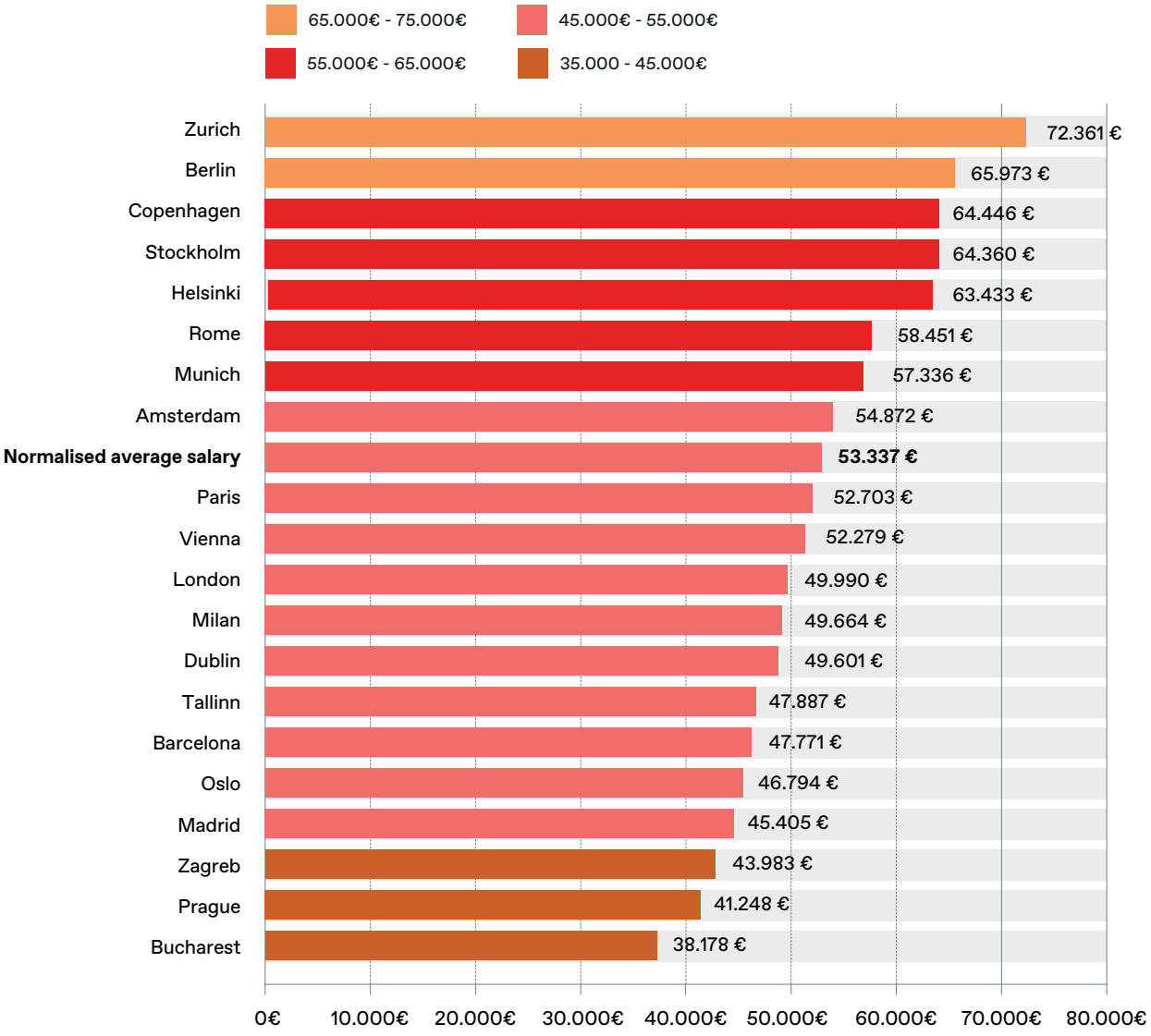
Average salary normalised for cost of living and rent in European cities

The normalised average salary in Barcelona is comparable to the salaries in cities like Paris, London and Dublin.

The European city with the highest normalised salary is Zurich, followed by Berlin, with Copenhagen in third place. The normalised average salary of the European cities studied is €53,337. The majority of cities fall within a salary range of €45,000 to €55,000 per year, including Amsterdam, Paris, London, Dublin, Barcelona and Madrid.

Salaries of digital professionals by Spanish city.
2023

Source: Talentup.io para Mobile World Capital Barcelona



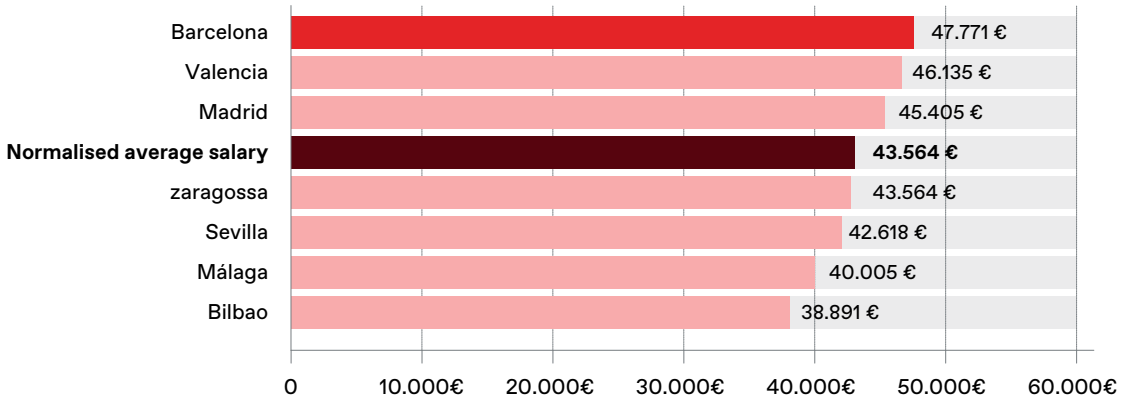
***Note:** The data encompass all digital professionals

With salaries normalised for the cost of living and rent, Barcelona is still the Spanish city with the highest salary (€47,771), followed by Valencia (€46,135) and Madrid (€43,405).

Average salaries normalised for cost of living and rent in the leading Spanish cities.

2023

Source: Talentup.io para Mobile World Capital Barcelona



***Note:** The data encompass all digital professionals

Ratio of cost of living and rent by city.

2023

Source: Numbeo.com

Ciutat	Cost de vida i lloguer	Ciutat	Cost de vida i lloguer
Zurich	92.7	Rome	44
NYC	100	Tallinn	37.2
London	76.1	Bilbao	39.9
Oslo	57.9	Barcelona	43.7
Copenhagen	62	Madrid	42.7
Paris	59.5	Prague	39.8
Dublin	65.6	Lisbon	43.5
Amsterdam	60.4	Sevilla	36.7
Milan	55.9	Zaragossa	36.5
Helsinki	49.1	Zagreb	34.6
Stockholm	52.5	Málaga	37.5
Munich	53.3	Warsaw	36.7
Vienna	47.8	Valencia	34.9
Berlin	51.7	Bucharest	28

IRONHACK

‘Digital professionals’ adaptability and skills are essential in overcoming the technological and competitive challenges of a sector that is constantly evolving. At Ironhack, we promote practical training with an emphasis on tech and soft skills to foster flexibility, innovation and productivity.’

Hel·lena Prat Esquerdo
Director General in Spain

The 3 skills in digital professionals valued the most highly by the company:

- Ability to learn
- Curiosity
- Proactiveness

The 3 digital professions with the most hires in 2023:

1. Data analyst
2. Fullstack developer
3. UX/UI designer

IT ACADEMY

‘Digital professionals are essential to address the current challenges in the business sector. Autonomy, the ability to adapt to emerging technologies and lifelong learning are the skills that digital talents bring, and they are also the key to fostering growth and innovation in companies.’

Sara Díaz Roig
Executive Director of Strategic Sectors and Talent

The 3 skills in digital professionals valued the most highly by the company:

- Learning how to learn
- Initiative, responsibility and commitment
- Autonomy

The 3 digital professions that foresee the most hiring in 2023:

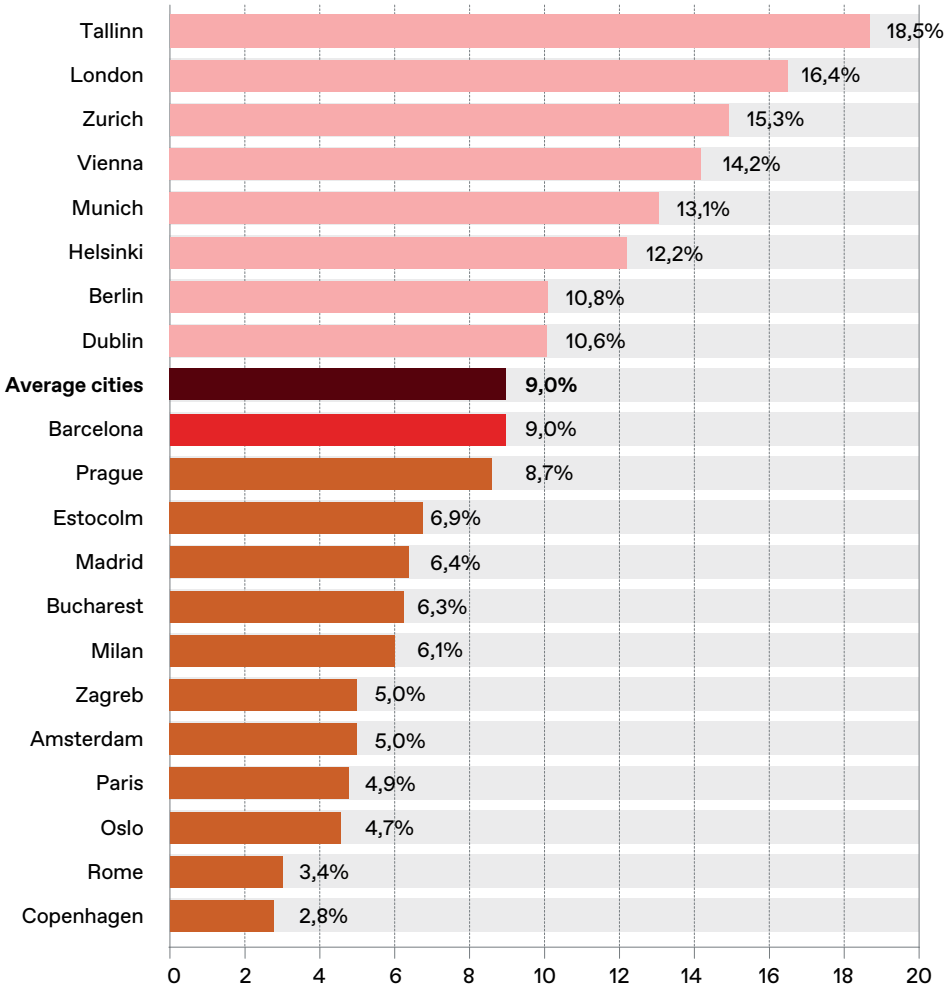
1. Web developer
2. Data analyst
3. Big data

Remote job offers in the leading European cities

Tallinn (18.5%), London (16.4%) and Zurich (15.3%) are the cities with the most remote job offers, far above the average in the leading European cities (9%).

Remote job offers by city.
2023

Source: Talentup.io para Mobile World Capital Barcelona

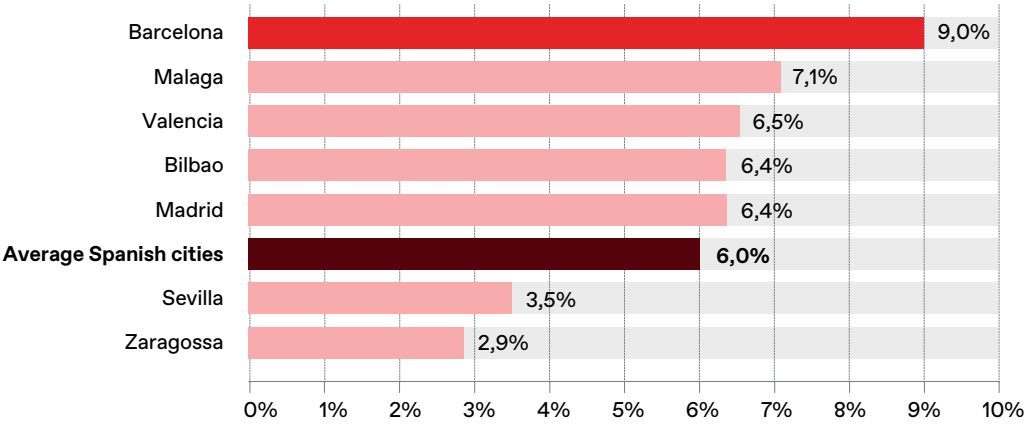


Barcelona is the Spanish city with the highest percentage of remote job offers (9%), far above the average in Spain and aligned with the average of European cities analysed (6%).

Remote job offers by Spanish city.

2023

Source: Talentup.io para Mobile World Capital Barcelona



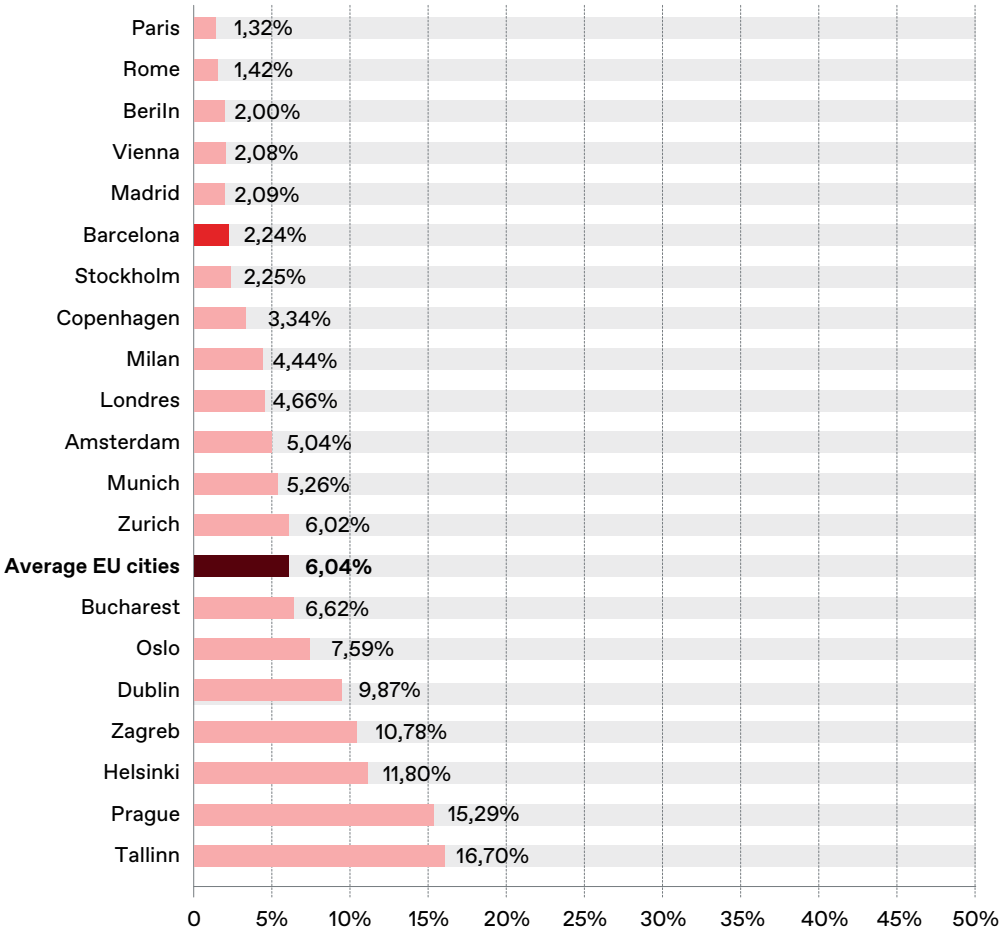
In Europe, women earn around 6% less than men in the digital sector.

Salary equity in the digital sector is still a challenge in Europe. Prague (15.3%) and Tallinn (16.7%) are the European cities with the largest salary gaps.

Paris (1.32%), Rome (1.42%) and Berlin (2%) are the cities with the smallest salary gap between men and women in the European tech sector.

Gender salary gap in the digital sector by European city.
2023

Source: Talentup.io para Mobile World Capital Barcelona



*Percentage by which men's salaries are higher than women's

Presence of women in the ICT sector in European cities

There was a 2.8 point rise in the percentage of women in the tech sector compared to 2022. Barcelona (30.64%) is above the average of European cities (30.03%).

Spanish cities are over the European average in terms of women's presence in the digital sector. Seville (34.32%) and Bilbao (32.36%) are the Spanish cities with the highest presence of women in the digital sector.

Women in the sector by European city (%).
2023

Source: Talentup.io para Mobile World Capital Barcelona

	Dones %		
Milan	33,01%	66,99%	+ 0,24%
Stockholm	31,97%	68,03%	+ 2,12%
Londres	31,63%	68,37%	+ 2,13%
Praga	31,51%	68,49%	+ 2,90%
Dublin	31,44%	68,56%	+ 1,97%
Madrid	31,28%	68,72%	+ 1,09%
Amsterdam	30,86%	69,14%	+ 3,10%
Barcelona	30,64%	69,36%	+ 1,95%
Tallinn	30,59%	69,41%	+ 1,92%
Paris	30,55%	69,45%	+ 4,64%
Zagreb	30,54%	69,46%	+ 3,16%
Helsinki	30,51%	69,49%	+ 1,57%
Rome	30,50%	69,50%	+ 2,05%
Average EU cities	**30,03%**	**69,97%**	+ 2,24%
Copenhagen	29,88%	70,12%	+ 2,36%
Berlin	29,48%	70,52%	+ 2,36%
Munich	29,42%	70,58%	+ 2,78%
Viena	27,65%	72,35%	+ 2,04%
Oslo	27,60%	72,40%	+ 0,72%
Zurich	26,01%	73,99%	+ 2,30%
Bucharest	25,58%	74,42%	+ 3,44%

Women in the sector by Spanish city (%).
2023

Source: Talentup.io para Mobile World Capital Barcelona

	Woman %		
Sevilla	34,32%	65,68%	+ 1,21%
Bilbao	32,36%	67,64%	+ 1,22%
Madrid	31,28%	68,72%	+ 1,09%
Average of Spanish cities	**30,84%**	**69,16%**	+ 1,52%
Barcelona	30,64%	69,36%	+ 1,95%
Málaga	30,27%	69,73%	+ 0,71%
Valencia	30,17%	69,83%	+ 2,48%
Zaragossa	26,87%	73,13%	+ 2,01%

‘Digital professionals understand and drive business transformation by adopting advanced technologies like automation and artificial intelligence. Their ability to integrate new solutions and foster innovation enables companies to quickly adapt to market changes and generate new opportunities.’

Gara Gutiérrez
Director of Operations

The 3 skills in digital professionals valued the most highly by the company:

- Innovation and creativity
- AI and big data
- Self-efficacy

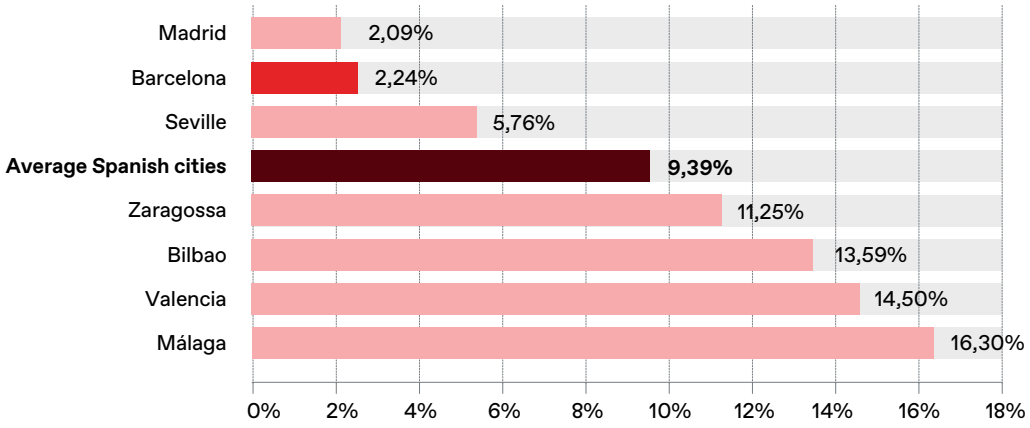
The 3 digital professions that foresee the most hiring in 2023:

1. Software developer
2. Cybersecurity specialist
3. Data analyst

Barcelona has a salary gender gap under the average in Spanish cities (9.39%). Madrid (2.09%) and Seville (5.76%) are also below the average of the Spanish cities analysed.

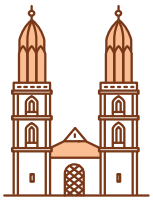
Salary gender gap in the digital sector by Spanish city.
2023

Source: Talentup.io para Mobile World Capital Barcelon



*Percentage by which men's salaries are higher than women's

Hires per city

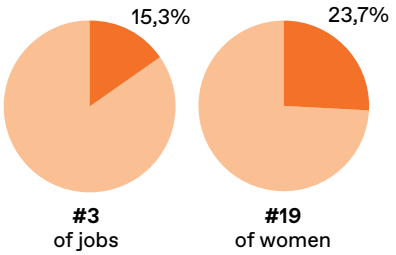


Zurich

#1 Salaries of digital professionals

Positions with the highest salaries

Average salary	153.498,00 €
Gender gap	6,02%



#3 of jobs

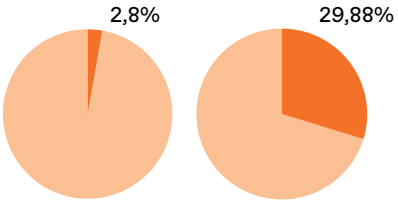
#19 of women

Copenhagen

#2 Salaries of digital professionals

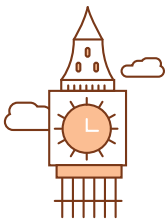
Positions with the highest salary

Average salary	€91,434.00
Gender gap	3.34%



#20 of remote jobs

#14 of women in the digital sector

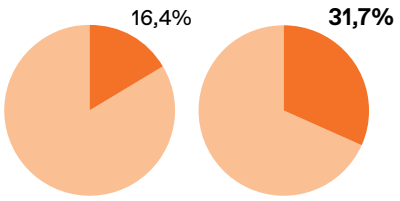


London

#3 Salaries of digital professionals

Positions with the highest salary

Average salary	€87,054.00
Gender gap	4.66%



#2 of jobs remot

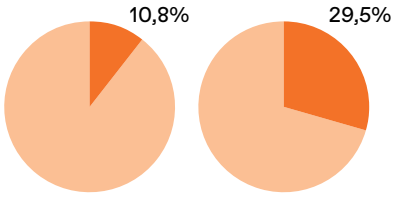
#3 of women in the digital sector

Berlin

#4 Salaries of digital professionals

Positions with the highest salary

Average salary	€78,050.00
Gender gap	2.00%



#7 of jobs remot

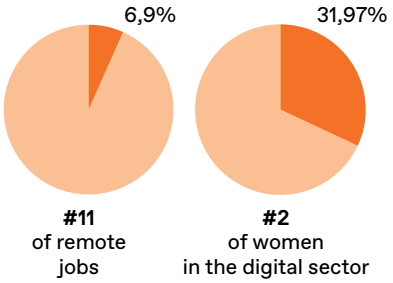
#15 of women in the digital sector

Stockholm

#5 Salaries of digital professionals

Positions with the highest salary

Average salary	€77,320.00
Gender gap	2.25%

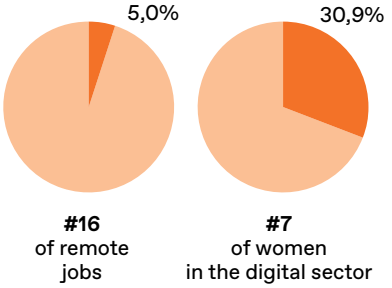


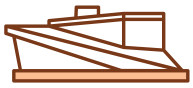
Amsterdam

#6 Salaries of digital professionals

Positions with the highest salary

Average salary	€75,841.00
Gender gap	5.04%



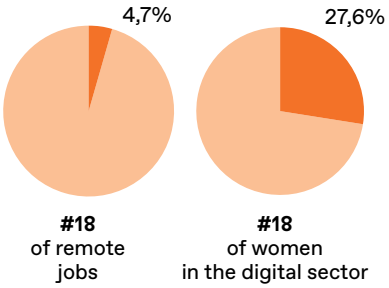


Oslo

#7 Salaries of digital professionals

Positions with the highest salary

Average salary	€74,900.00
Gender gap	7.59%

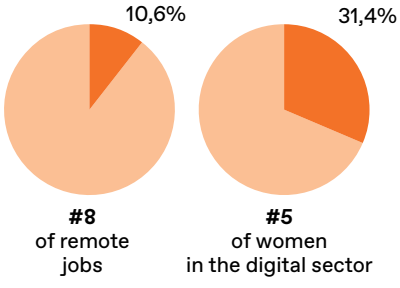


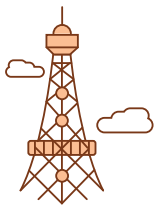
Dublin

#8 Salaries of digital professionals

Positions with the highest salary

Average salary	€74,458.00
Gender gap	9.87%



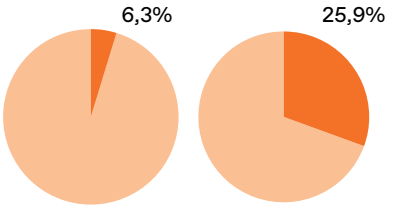


Paris

#9 Salaries of digital professionals

Positions with the highest salary

Average salary	€71,758.00
Gender gap	1.32%



#17 of remote jobs

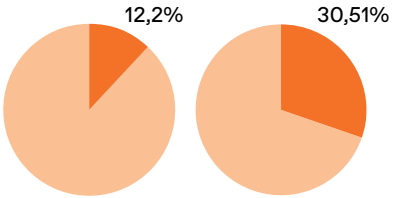
#10 of women in the digital sector

Helsinki

#10 Salaries of digital professionals

Positions with the highest salary

Average salary	€71,271.00
Gender gap	11.80%



#6 of remote jobs

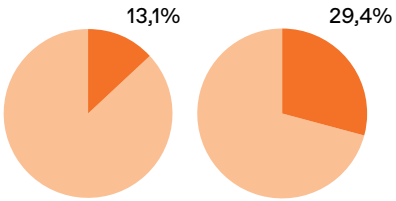
#12 of women in the digital sector

Munich

#11 Salaries of digital professionals

Positions with the highest salary

Average salary	€69,931.00
Gender gap	5.26%



#5 of remote jobs

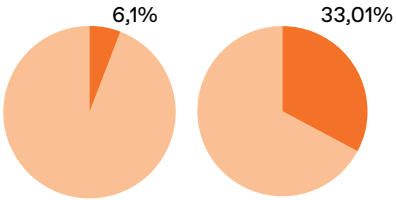
#16 of women in the digital sector

Milan

#12 Salaries of digital professionals

Positions with the highest salary

Average salary	€63,529.00
Gender gap	4.44%



#14 of remote jobs

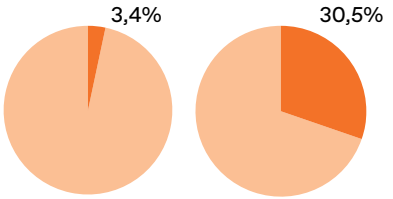
#1 of women in the digital sector

Rome

#13 Salaries of digital professionals

Positions with the highest salary

Average salary	€58,852.00
Gender gap	1.42%



#19 of remote jobs

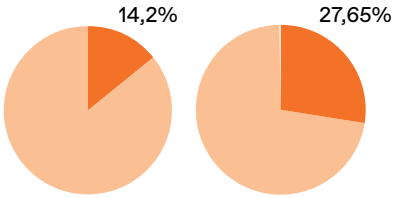
#13 of women in the digital sector

Vienna

#14 Salaries of digital professionals

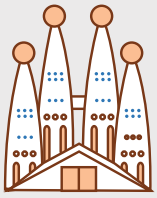
Positions with the highest salary

Average salary	€57,184.00
Gender gap	2.08%



#4 of remote jobs

#14 of women in the digital sector

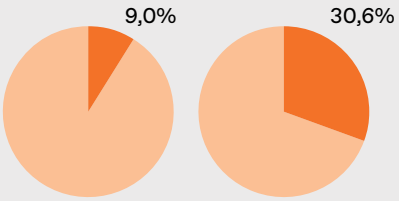


Barcelona

#15 Salaries of digital professionals

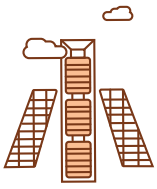
Positions with the highest salary

Average salary	47.771,00 €
Gender gap	2,24%



#9 of remote jobs

#8 of women in the digital sector

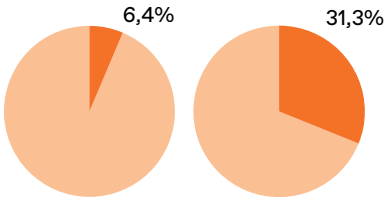


Madrid

#16 Salaries of digital professionals

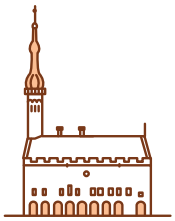
Positions with the highest salary

Average salary	€44,366.00
Gender gap	2.09%



#12 of remote jobs

#6 of women in the digital sector

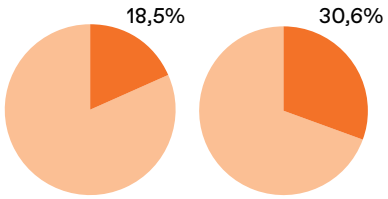


Tallinn

#17 Salaries of digital professionals

Positions with the highest salary

Average salary	€40,764.00
Gender gap	17%



#1 of remote jobs

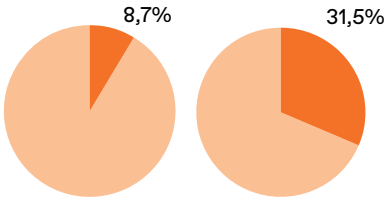
#9 of women in the digital sector

Prague

#18 Salaries of digital professionals

Positions with the highest salary

Average salary	€37,567.00
Gender gap	15.29%



#10 of remote jobs

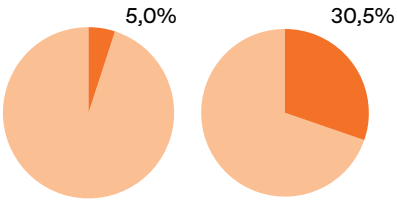
#4 of women in the digital sector

Zagreb

#19 Salaries of digital professionals

Positions with the highest salary

Average salary	€34,824.00
Gender gap	10.78%



#15 of remote jobs

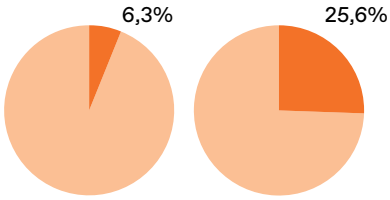
#11 of women in the digital sector

Bucharest

#20 Salaries of digital professionals

Positions with the highest salary

Average salary	€19,700
Gender gap	6.62%



#13 of remote jobs

#20 of women in the digital sector

4.
Impact of the emerging technologies in the job market

Introduction

We are living in a world in constant transformation, where technology is developing at a breakneck speed. The emerging technologies, like artificial intelligence (AI), the Internet of Things (IoT), 5G and cybersecurity, are having a transformative impact in many industrial sectors and are driving their growth and the demand for specialised and multidisciplinary digital professionals.

In this chapter, it was deemed important to examine three innovative emerging sectors which are maturing at different rates, namely NewSpace, quantum computing and the semiconductor industry. All three stand out for being highly innovative and evolving quickly, and they are interdisciplinary sectors that require collaboration among different fields.
Below, for each sector, we will examine the economic value and growth forecast, investments, the leading tech trends and their most prominent fields of application, and we will emphasise the demand for new and emerging professionals according to the value chain or area. Each sector offers digital talent exciting opportunities: they need everything from space engineers who design nano-satellites to experts in semiconductor materials and quantum scientists who explore the frontiers of quantum computing.

Semiconductors

The semiconductor industry is crucial for countries' global economy, given that it is responsible for designing, manufacturing and installing integrated circuits or chips that are the basis of electronic products, that is computer processors, mobile devices and tablets, as well as any device that incorporates digital elements and connectivity. Today, chips can be considered more necessary than oil because they are essential for the modern economy.
Semiconductors are materials with a conductivity which is found between that of conductors and that of insulators, which enables them to control electrical currents very precisely in order to provide chips with the ability to process, store and transmit data. Semiconductors like silicon and germanium are basic in manufacturing electronic devices, including transistors, diodes and integrated circuits, which are the basic components of practically all modern electronic technology.

Therefore, it is an industry with enormous geostrategic importance, with a global turnover that will reach 588.36 billion dollars in 2024, according to the WSTS,[1], 13.1% more than in 2023, with annual estimated growth of 6.3% until 2027. This forecast for steady growth is due largely to the constant innovation and development in semiconductor manufacturing, as well as the expansion of emerging markets and the adoption of new technologies like the Internet of Things (IoT) and artificial intelligence (AI).

According to McKinsey, the global semiconductor industry is expected to reach a value of one billion dollars by 2030, driven by the increasing demand from sectors like automotive, computing and data storage, as well as wireless communication.
McKinsey also says that investments en in new manufacturing facilities (know as fabs) in the United States are forecast to be between 200 and 350 billion dollars in the forthcoming decade.3.

[1] World Semiconductor Trade Statistics

[2] www.mckinsey.com/industries/semiconductors/our-insights/the-semiconductor-decade-a-trillion-dollar-industry

[3] www.mckinsey.com/featured-insights/sustainable-inclusive-growth/chart-of-the-day/chipping-in-on-semiconductor-fabs

‘Without a doubt, we are looking at one of the sectors that will experience the most growth in the upcoming years. The geopolitical need for strategic autonomy and non-dependence on third parties in the manufacture of this type of device, along with the growth in the digitalization level of every single segment in industry and society, are turning semiconductors into an essential asset in any country's development.’

Antonio A. Conde
Innovation and Digital Transformation Country Leader, Cisco

The semiconductor industry has a wide range of applications, given that semiconductors are essential components in a wide array of sectors, from consumer electronics with smartphones and laptops to industrial sectors like automobiles, telecommunications and medical equipment.

The semiconductor industry has a wide range of applications, given that semiconductors are essential components in a wide array of sectors, from consumer electronics with smartphones and laptops to industrial sectors like automobiles, telecommunications and medical equipment.

Specifically, within the automotive sector, Advanced Driver-Assistance Systems (ADAS) account for the largest share of the semiconductor market,with a compound annual growth rate (CAGR) of 19.8% forecast for 2027, a figure that accounts for 30% of the semiconductor market in the automotive sector. On the other hand, the surge in AI has led to an increase in the demand for servers.

The main tech trends,[5,6] in the sector include (see details in the Annex):

- Development of specific chips for AI
- Advanced manufacturing processes
- Quantum chips
- Integration of edge computing devices
- Search for new materials
- Nanotechnology
- Cybersecurity in the design of semiconductors

The leading actors in the industry are the United States, Japan, South Korea, Taiwan, the European Union, China and several south-east Asian countries. One of the features of this industry is that the manufacture of semiconductors is a globalised process in which different stages of the value chain are divided among multiple countries. The complexity of this supply chain may lead to vulnerabilities, as became clear during the interruptions caused by the COVID-19 pandemic.

[4] www.mckinsey.com/featured-insights/sustainable-inclusive-growth/chart-of-the-day/chipping-in-on-semiconductor-fabs

[5] www.mrlcg.com/resources/blog/semiconductor-industry-trends/

[6] www.startus-insights.com/innovators-guide/semiconductor-industry-outlook/

The value chain is characterised by a high degree of division of labour, highly concentrated market niches and heavy pressure to constantly innovate and invest, and no one country harbours the entire production process on its soil.7

It consists of the following phases:

1. **Design:** This is done by companies without their own factories, also called fabless. This phase includes the design of integrated circuits and research into new materials and technologies. Companies invest heavily in R&D to innovate and improve chips' performance and efficiency.
2. **Manufacturing:** Once a design is developed, the next step is to manufacture semiconductor devices on a large scale. This process, known as wafer manufacturing, entails the use of specialised equipment and materials to create semiconductor devices in a wafer or circular plate. It is a critical stage that requires highly sophisticated and precise facilities, known as fabs..
3. **Assembly and testing:** After being manufactured, semiconductor devices have to be assembled and tested to guarantee their quality and reliability. This process means packaging the semiconductor devices, testing their performance and identifying any flaws..

The United States is the leader in R&D-intensive activities, followed by Europe. The other components in the value chain are divided among Asian countries like Taiwan, China, Japan and South Korea.

Regarding professional profiles, according to McKinsey there is a dire need for qualified engineers and technicians, which could limit the expansion and operation of new factories in the semiconductor industry. The job offers for technical roles related to semiconductors in the European Union and United States increased with a compound annual growth rate (CAGR) of more than 75% from 2018 to 2022. Therefore, the companies in the sector have to adopt new strategies to close the talent gaps, including redefining professional careers and improving working conditions to attract a diverse, qualified work force.8

[7] www.accio.gencat.cat/web/.content/bancconeixement/documents/pindoles/ACCIO-semiconductors-a-catalunya.pdf

[8] www.mckinsey.com/industries/semiconductors/our-insights/how-semiconductor-companies-can-fill-the-expanding-talent-gap

‘Adaptation may be quite an efficient way to accelerate talent-creation. They could essentially involve electronic or other kinds of engineers with extensive exposure to microelectronics, industrial design, telecommunications and computing. There is a broad range.’

Antonio A. Conde
Innovation and Digital Transformation Country Leader, Cisco

The demand first focuses on professionals who are capable of going beyond their field of specialisation and staying on top of any advance in their area of expertise, which also includes knowledge of the emerging technologies, like AI.9

The most in demand, emerging profiles are:

- Analogical and digital design engineers
- AI and machine learning engineers
- SoC architects
- Quantu computing engineers
- Semiconductor engineers
- Materials engineers
- Quality engineers
- Assembly engineers

Phase 1.
Design

Phase 2.
Manufacturing

Phase 3.
Assembly and testing

Design:

- **Analogical and digital design engineers:** They are experts in creating analogical and digital integrated circuits. Their job includes developing circuits that process analogical and digital circuits, which are essential in the operation of electronic devices.
- **AI and machine learning engineers:** As mentioned above, with the increasing integration of AI in semiconductor technology, there is a significant demand for experts who can develop and optimise specific AI algorithms and models for semiconductor applications. This includes roles like AI programming engineers and machine learning engineers focused on semiconductor design.
- **SoC architects:** These are professionals who design and optimise complete systems in a single chip by integrating different components like the CPU, the GPU, the memory and peripheral controllers.

[9] www.mrlcg.com/resources/blog/the-impact-of-emerging-technologies-on-semiconductor-job-roles/

- **Quantum computing engineers:** As quantum computing advances, the demand for engineers trained in quantum mechanics is rising for
- the development of quantum processes.

Manufacturing:

- **Semiconductor engineers:** They work with semiconductor materials and study how to improve chips' efficiency.
- **Materials engineers:** They work with materials to develop new chip designs.

Assembly and testing:

- **Quality engineers:** They assess the durability and lifetime of semiconductors and ensure that they meet quality standards and customers' expectations.
- **Assembly engineers:** They oversee the final assembly process of semiconductors in their packages and ensure that all the components fit correctly and work as expected.

NewSpace

The concept of NewSpace refers to a new era in the aerospace industry marked by the democratisation of access to space and the opening to a new ecosystem of actors, including private and emerging enterprises.

In recent years, the space industry has been transformed to facilitate access to space with the appearance of satellite platforms for low and very low earth orbits (LEO and VLEO), the promotion of nano-satellites (satellites that weight between 10 and 100 kg) and micro-satellites (those that weight between 1 and 10 kg), the miniaturisation of electronics, the standardisation of subsystems that allow there to be subsystem (batteries, stabilisers, etc.) suppliers and experts and a rising demand for commercial and consumer applications.

This evolution revolves around the quick, efficient, innovative and economical development of space technologies, driven primarily by commercial goals, which open the door to many activities, such as the implementation of constellations of satellites to provide Internet coverage.Technologically speaking, the key has been nano-satellites. In general, they orbit around the earth at a low altitude, which enables them to make a full revolution in 90 minutes. They stay at between 400 and 650 km over sea level. Because they have these low orbits, they need much less energy to transmit data and are more protected from solar radiation. Plus, transmissions in these orbits show better latency, that is, there is less delay in the transmission of information, especially with VLEO.

The opening of the sector has enabled public and private initiatives to coexist, and this has driven the global space economy and turned it into a key factor in the technological and economic transformation of our society.

According to a report by the US Space Foundation (2022), this economic sector reached a global value of 469 billion dollars in 2021, 9% more than in 2020.According to the World Economic Forum,10 the space sector is experiencing significant growth, and forecasts showing that the space economy could reach a value of 1.8 trillion dollars by 2035. An annual growth rate of 11% is expected in NewSpace, and it is forecasted to reach 1.1 trillion dollars by 2030.11 The growth areas in this sector include micro-launchers, small satellites and space data processing, with a focus on implementing scalable satellites and reusable rocket technology.

[10] www.weforum.org/agenda/2024/04/space-economy-technology-invest-rocket-opportunity

[11] www.taylorwessing.com/en/interface/2024/the-space-race/the-new-space-race-outlook-and-opportunities-in-2024

‘The NewSpace sector is competitive, based on technologies or methods that are agile to develop, a short go-to-market and very diverse use cases’.

Roser Roca Tohà
Managing Director i CEO, Airbus GeoTech

With regard to investments, according to McKinsey,12 in 2021 public and private markets invested 10 billion dollars in space companies, which is fuelling a new wave of dynamism and innovation in the entire space ecosystem.

Currently, most of the investments in the sector are in the United States, which is the home to around two-thirds of the more than 400 investors from around the world. According to the European Investment Bank (EIB), 19% of the non-EU investors are in Japan, followed by the United Kingdom (15%), Israel (15%), Canada (14%), Spain (12%), India (10%) and China (9%).13

‘It is still feasible to join the NewSpace wave, unlike other fields, such as the Internet, which is monopolised by large tech companies’.

Jaume Sanpera
CEO, Sateliot

Regarding the main activities in the sector, two segments can be distinguished: Upstream and Downstream:

- **Upstream:** This encompasses activities related to the manufacture, launch and operation of satellites and other space systems. It includes satellite engineering and design, components and space systems manufacturing, and launching satellites into space.
- **Downstream:** This encompasses activities related to the use and application of the data and services provided by satellites and other space systems. It includes applications for earth observation, satellite communication, satellite navigation (like GPS), environmental monitoring, precise agricultural positioning and navigation and many other commercial and public-sector uses of space information. In other words, using the data and services provided by space assets generates a wide array of applications on earth.

The expansion of the Downstream space segment generates significant economic value.14 Its growth is increasingly driving by the development of commercial uses in three traditional areas of space applications: communications, earth observation (EO) and satellite navigation. NewSpace is associated with significant changes in the space value chain, especially in the Downstream segment, which is where most of the sector's income is generated. Because it addresses a wide range of markets (like agriculture, transport, digital, finances, health, etc.), the space sector is considered an important potential engine of economic growth.

Els principals àmbits d’**aplicació terrestres** del NewSpace són:

[12] www.mckinsey.com/industries/aerospace-and-defense/our-insights/a-different-space-race-raising-capital-and-accelerating-growth-in-space

[13] www.eib.org/attachments/thematic/future_of_european_space_sector_en.pdf

[14] www.sciencedirect.com/science/article/abs/pii/S0265964623000152

- Telecommunications: better connectivity thanks to orbiting repeaters.
- Observation services: 3D mapping and aerial photographs.
- Meteorology: improved weather and sea predictions.
- Transports and logistics: the use of signals for geolocation and positioning, and the management of transport fleets and urban mobility.
- Border surveillance and control: detection of illegal and smuggling activities.
- Geographic analysis: mapping the territory and coastlines, and detecting oil and gas deposits.
- Agriculture and aquaculture: monitoring crops and fish factories, and fishing activities.
- Forests: monitoring lumbering activities and detecting poaching and illegal tree felling.
- Security and emergencies: monitoring public safety, and detection and control of fires, floods and natural catastrophes.
- Environment and water: monitoring and control of global warming and pollution levels.
- Space communications: collecting information by satellites, IoT sensors located on earth, usually in remote rural areas, and remote, real-time monitoring of variables.
- Smart cities: collection of data for urban planning and the creation of sustainable cities.

'It is a sector that has matured in recent years, but there are still areas of research with prospects for evolving, such as telecommunications among satellites so that they operate in a network'.

Verónica Tercero
NewSpace Strategy Coordinator, Government of Catalonia

Technologically speaking, the forecast trends[15] are the following (see details in the Annexe):

- Micro- and nano-satellites
- High-altitude platform stations
- Advanced space manufacturing
- Advanced communications
- Management of space activities
- Low earth orbit satellites
- Space data

NewSpace is also leading to new and emerging professions to absorb the sector's needs.

[15] www.startus-insights.com/innovators-guide/top-10-spacetech-trends-innovations-2021

‘We need versatile professionals who have general engineering knowledge but also specialise in and are familiar with the reality of space operations. The areas of software development and cybersecurity are key in this sector.’

Roser Roca Tohà
Managing Director and CEO, Airbus GeoTech

If we focus on the value chain of the NewSpace sector, we find the following phases:

- **Manufacturing:** Design, construction and sale of satellites and payload (onboard segment), and design and development of the earth segment (terrestrial infrastructures and systems needed to control, communicate with and process data from missions, like earth-based stations and mission control centres).
- **Launch:** The launch of satellites with a payload.
- **Operation:** The transmission and reception of data and remote control of satellites orbiting around the earth.
- **Earth applications:** Data processing to create services, applications and platforms that can be commercialised.

‘The space sector is very cross-disciplinary: it requires not only engineers and programme developers but also physicists, geologists and biologists, just to cite a few professions’.

Verónica Tercero
NewSpace Strategy Coordinator, Generalitat de Catalunya

El NewSpace ha comportat un increment del ventall d’aplicacions terrestres i, per tant, obrir el ventall de perfils professionals que es requereixen.

The most in-demand professionals include:

- Satellite engineers
- Payload engineers
- Propulsion experts
- Satellite programming engineers
- Aerospace software developers
- Data transfer systems engineers
- Operators of earth observation missions
- Space data analysts
- Mapping experts
- Environmental experts
- Agronomists and agriculture experts

Phase 1. Manufacturing

Phase 2. Launch

Phase 3. Satellite operations

Phase 4. Earth applications

Satellite manufacturing:

- **Satellite engineers:** They are experts in designing, building and maintaining nano-satellites and micro-satellites.
- **Payload engineers:** They are engineers in charge of designing the satellite's sensor system (which may be optical, radar, etc.) or the telecommunications antennas to communicate and send information to the base station.

Satellite launching:

- **Propulsion experts:** They are engineers who develop more efficient, sustainable propulsion systems.
- **Satellite and mission payload programming engineers:** They are in charge of preparing and testing the programmes related to launching satellites. This includes checking the flight control and communication system programming to ensure that they work properly before launch.

Satellite operations:

- **Aerospace software developers:** They create the software needed to control satellites, process telemetric data and develop data-based applications. They are also in charge of developing and maintaining satellite communication systems. These professionals have to be capable of programming a base station. Their functions include programming control systems and managing communication links, optimising transmission protocols and ensuring the integrity and security of the data received and transmitted to and from space.
-

- **Data transfer systems engineers:** They focus on systems and technologies used to transmit data from satellites to earth. There is currently a demand for experts with knowledge of AI in order to optimise satellite images..
- **Operators of earth observation missions:** They configure and manage the image capture from satellites by programming the mirrors, lenses and cameras onboard and ensuring that these devices collect and transmit precise, timely visual data for the surveillance and security of specific events. They have to act under pressure and communicate well in order to follow experts' requests.

Earth applications:

- **Space data analysts:** They are experts in processing and analysing the vast amounts of data collected.
- **Mapping experts:** They are in charge of collecting and processing satellite data to create detailed maps of the earth's surface. They use specialised programmes to interpret satellite images and generate precise maps that can be used in urban planning, infrastructure planning, natural resource management and other areas.
- **Environmental experts:** They use satellite data to monitor and analyse changes in the environment, like deforestation, the loss of biodiversity and air and water pollution.
- **Agronomists and agriculture experts:** They analyse data to monitor crops, predict agricultural yields and optimise the use of resources in farming. These professionals may use satellite images to identify health problems in crops, monitor plant growth and efficiently manage watering and fertilisation.

'NewSpace is a globalised sector where the professionals in demand are highly specialised, but where professional reskilling is also possible, such as with programmers'.

Jaume Sanpera
CEO, Sateliot

Quantum computing

Quantum computing uses methods and tools based on the more paradoxical properties of quantum mechanics, namely quantum superposition (which allows particles to be in different states simultaneously) and quantum entanglement (which connects particles, leading the state of one particle to influence the state of the other, regardless of distance).

This has led to the definition of the qbit or quantum bit, the basic information in quantum computing, similar to a bit. Classical computing is based on programming with ones and zeroes, while quantum computing has two fundamental states which may be superpositioned and therefore contain much more information and operate exponentially more quickly than classical systems.

Applied to the field of computing, these technologies have the potential to offer much higher performance and processing capacity than classical technology. Furthermore, it also shifts the paradigm of how problem-solving
is addressed, and it thus opens a huge window with the creation of new scientific approaches and new algorithms.

Therefore, this is an **emerging field** with a huge potential, although it is still in the experimentation phase. According to McKinsey,16 quantum technologies have been identified as one of the **top technology trends**. The quantum computing sector may be valued at almost **1.3 trillion dollars in 2035**. A study conducted by the National Quantum Computing Centre (NQCC)17 in the United Kingdom revealed that 33% of companies believe that quantum technologies will play a significant role in industry during the period 2026-2030.

As quantum technologies advance, they are predicted to find solutions to extremely difficult problems, with the consequent paradigm shift this may entail. McKinsey reports that 72% of professionals who are experts in QT believe that we will see a totally quantum computer tolerant to crashes by 2035.18

‘We are at a time when there are pioneering projects in different areas of quantum technologies, and it is believed that maturity in the use of this technology may come within 7 or 8 years’.

Marc Estapé
Spain Ecosystem Sales Leader, IBM

[16] www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-quantum-computing

[17] assets.ey.com/content/dam/ey-sites/ey-com/en_uk/topics/emerging-technology/quantum/ey-quantum-readiness-survey-2022.pdf

[18] www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-quantum-computing

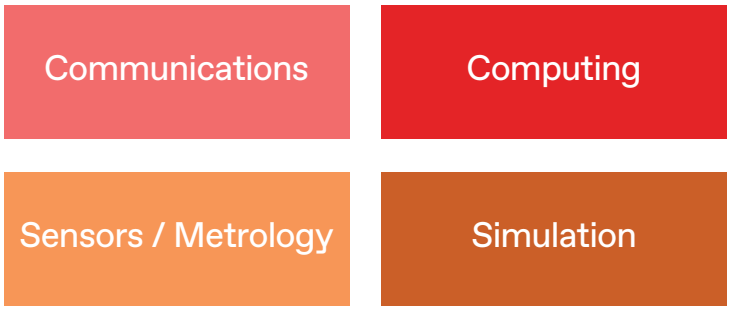
Regarding investments, in 2022 the government of the United States announced 1.8 billion dollars in financing, which raised its total investment to 3.7 billion dollars.

According to ACCIÓ,10 the main global actors are the United States, China, Japan, Europe, Canada, South Korea, Australia, Taiwan, Malaysia and Singapore.19 The quantum computing ecosystem involves actors in both research and academia, industry, government and investors.

'It is a sector where a great deal of headway is being made in the field of research, and where important projects with impact are expected to appear in the upcoming years'.

Sergi Masip
Quantic Computing Strategy Coordinator, Generalitat de Catalunya

Quantum technologies allow for improved performance and applications in areas like computing, communications, sensor systems and metrology and simulation that have been impossible until now.



Communications:

This is the branch of quantum technologies that deals with coding information in quantum states to transmit information and develop applications in cryptography with the purpose of making communications more secure.

Therefore, the main applications are cryptography to protect short- and long-distance communications, and for the Internet of Things (IoT) and critical infrastructures. Currently, progress is being made in quantum key distribution (QKD), a technology that is based on the exchange of cryptographic keys.

In the long term, a quantum Internet that has the ability to transmit entangled information is also being researched.

[19] www.accio.gencat.cat/ca/serveis/banc-coneixement/cercador/BancConeixement/tecnologies-quantiques-catalunya

Computing:

The goal of this branch is to solve computational problems more quickly via the use of quantum phenomena like superposition and entanglement, in order to execute operations.

It is currently used to solve factorisation problems of technologies based on artificial intelligence (AI), among others. Quantum machine learning (QML) is an extremely important field of study in terms of applications for quantum computers. It uses quantum computing to accelerate and improve computers' machine learning. The use of hybrid quantum-classical systems is one of the most promising technologies to make a short-term impact in real-world problems.

Simulation:

This consists of solving quantum problems by mapping controlled quantum systems, either analogical or digital. The main applications revolve around optimising processes such as logistics, risk management, finances and more.
There are also applications in the simulation of new molecules and materials and in modelling complex physical systems, which is needed in industries like pharmaceuticals.

Sensors and metrology:

This aims to overcome the limits of classical detection and current sensors through the use of quantum states in order to improve existing sensor technologies. Quantum sensors can take measurements with much higher sensitivity and precision than classical sensors, and this opens the door to measuring magnetic, gravitational and electric fields. Metrology allows high-resolution measurements of physical parameters to be taken through the use of quantum technology.

The range of applications is quite broad, including medical diagnoses, material analysis, navigation, civil engineering, network synchronisation, the aerospace sector and more.

'Quantum computing applications are quite cross-cutting, as almost every economic sector (logistics, finance, energy, pharmaceuticals) may have the need to optimise processes'

Eva Martín
Innovation and Product Manager, Qilimanjaro Quantum Tech

The demand for professionals related to quantum computing is expected to exponentially increase over time: it is calculated that there will be an estimated 580,000 quantum jobs in the world by 2040.20

The challenge in training professionals in quantum technologies stem from the fact that it requires multidisciplinary knowledge of quantum physics, mathematics and computing.

[20] www.qureca.com

‘There is talk of a system very different to classical computing; programmers as we know them today will no longer be needed. Now we need quantum physicists.’

Marc Estapé
Spain Ecosystem Sales Leader, IBM

Therefore, the current and future job market has to be prepared. The increase in the demand for talent requires anticipating the change in terms of business strategy and training, given that finding and training the right talent is essential.

‘Right now, reskilling in the quantum computing sector is pretty complicated. The professional profiles are quite specific, and it remains to be seen how the sector evolves.’

Marc Estapé
Spain Ecosystem Sales Leader, IBM

The professional profiles in the highest demand are those with training and experience in science, technology, engineering and maths (STEM).

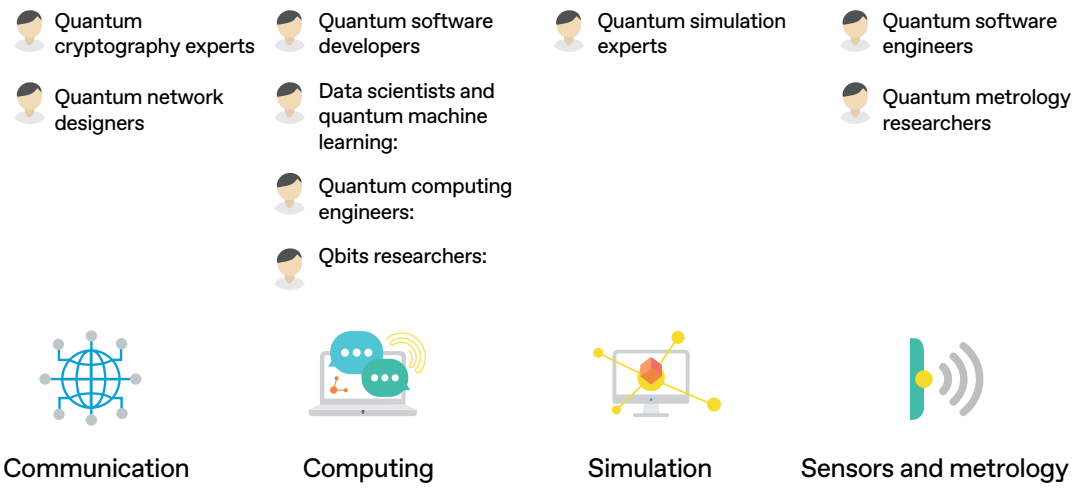
The training required differs depending on whether it is for staff working on the design and development of quantum hardware or quantum algorithms (which require specialised training in quantum computing) or

staff working in the layers of quantum programming (programmers and programme architects, who may not require prior experience in quantum matters and can gain the knowledge by working in the field).

‘Today, professionals with doctorates are needed to occupy senior positions in hardware and applications. As quantum computing studies become part of university degree curricula, this requirement may no longer be necessary.’

Eva Martín
Innovation and Product Manager, Qilimanjaro Quantum Tech

The most in-demand professionals include:



Communication:

- **Quantum cryptography experts:** They develop secure communication systems using quantum principles, such as quantum key distribution (QKD).
- **Quantum network designers:** They design and implement quantum communication networks, including the quantum Internet.

Computing:

- **Quantum software developers:** They design and develop programmes and the algorithms to run them on quantum computers. Given that quantum information is different from classical computer programming, the skills and knowledge from classical programming cannot easily be transferred to quantum programming.
- **Data scientists and quantum machine learning:** They are programmers or engineers specialised in developing quantum machine learning (QML) technologies in order to accelerate and improve computers' machine learning.
- **Quantum computing engineers:** They are in charge of designing and implementing the architectures of quantum computing systems, including the implementation and control of qbits or quantum bits.
- **Qbits researchers:** 21 Even though there are established forms of qbits on the market, experts are also needed to optimise them. They work in conjunction with quantum technicians and engineers to integrate the processes and design of the entire system.

Simulation:

- **Quantum simulation experts:** They are in charge of designing quantum simulations to discover and design new materials with unique properties. Quantum simulation will be the key to designing new materials and drugs and will allow processes in fields like logistics to be optimised.

Sensors and metrology:

- **Quantum software engineers:** They are in charge of designing architectures to develop quantum sensors.
- **Quantum metrology researchers:** They research and improve measurement techniques based on quantum mechanics.

In addition to these technical professions, mixed professionals will also be needed for the business areas with hybrid knowledge that combines training in business and management with scientific-technological training.

[21] www.thequantuminsider.com/2022/06/29/how-to-start-a-career-get-a-job-in-quantum-computing-in-2022/

Annex

Annex

Semiconductors

The leading tech trends in the sector[22, 23] include:

- **Development of specific chips for AI:** These are processes designed specifically to handle the intensive computational tasks required by AI applications and machine learning. These chips are optimised to process large amounts of data and run complex algorithms efficiently.
- **Advanced manufacturing processes:** The demand for advanced processes is rising, with a focus on assembly technologies like 2.5D and 3D, which are expected to grow with a CAGR of 22% until 2028.24**Xips quàntics:** Es tracta del desenvolupament de tecnologies per a la construcció de processadors quàntics. Actualment s'està experimentant amb materials superconductors.
- **Integration of edge computing devices:** With the rise in the IoT, the demand for devices capable of processing data locally has risen in order to lower the need to send large amounts of data to the cloud to be processed. This trend is driving the development of SoC systems, integrated circuits that incorporate all the components needed for a complete computing system optimised for edge computing applications.
- **Search for new materials:** New materials like silicon carbide and gallium nitride are beginning to be used because they have unique properties that can overcome the limits of traditional semiconductors and thus offer better energy efficiency and a higher capacity to operate at high temperatures.
- **Nanotechnology:** Applied to manufacturing semiconductors, it allows smaller and more efficient electronic components to be manufactured. Advances in materials and processes on a nanometric scale are expected, which will contribute to the development of nanoelectronics. This trend not only facilitates miniaturisation but also improves the performance and capacities of semiconductor devices.
- **Cybersecurity in the design of semiconductors:** With the increasing complexity of semiconductor devices, cybersecurity in chip design is essential. The innovations in secure machinery architectures and cryptographic techniques will be the key to safeguarding sensitive data processed by semiconductor devices.

[22] www.mrlcg.com/resources/blog/semiconductor-industry-trends/

[23] www.startus-insights.com/innovators-guide/semiconductor-industry-outlook/

[24] www.deloitte.com/global/en/Industries/tmt/perspectives/semiconductor-industry-outlook.html

Newspace

Technologically speaking, the forecast trends25 are the following:

- **Micro- and nano-satellites:** The small satellite market is calculated to be worth 166.4 billion dollars in 2024, and it is expected to reach 260.56 billion dollars by 2029, increasing with a compound annual growth rate (CAGR) of 9.38% during the forecast period. This growth reveals the increasing demand for different applications of micro- and nano-satellites on space missions.

- **High-altitude platform stations (HAPS):** These are unmanned vehicles like balloons or drones that operate in the stratosphere at altitudes of 20 to 50 km. These platforms are used to provide telecommunication services, environmental monitoring and land observation, and to research their own behaviour in space when they are retrieved after operating for a few months. They are a sustainable alternative to satellites because they cause no space waste.

- **Advanced space manufacturing:** Space manufacturing is adopting cutting-edge technologies like advanced robotics, 3D printing and light manufacturing to improve its products and services.

- **Advanced communications:** New space communication systems are a significant trend in the SpaceTech industry and revolve around advanced methods of transmitting and receiving data in space. The use of laser relay communication systems offers quicker data speeds and more secure communication compared to traditional radio frequency systems. Furthermore, 5G is expanding the capabilities of satellite communication, enabling data to be transmitted more quickly and reliably to and from space. On the other hand, quantum key distribution (QKD) in space provides ultra-secure communication channels using the principles of quantum mechanics. Moreover, the rollout of nano-satellites is improving space communication by enabling a network of devices for broader coverage and more efficient data transmission.

- **Management of space activities:** The increasing number of space missions is requiring the efficient coordination of different space missions and activities. To achieve this, startups or emerging companies are offering advanced space activity management solutions. The development of advanced mission control software enables satellites to be tracked and managed in real time. The use of AI-driven analytics to predict and mitigate possible orbital conflicts improves the safety of space operations.

- **Low earth orbit satellites:** A low earth orbit (LEO) is relatively close to the earth's surface, usually at an altitude of less than 1,000 km. LEO satellites do not always take a specific path around the earth and therefore new routes for other LEO satellites may open.

- **Space data:** The data from nano-satellites create a need to process, analyse and manage the information. SpaceTech startups use data and AI technologies to analyse satellite data, which enables the large flows of information arriving from space to be interpreted more quickly and precisely.

[25] www.startus-insights.com/innovators-guide/top-10-spacetech-trends-innovations-2021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