# Characterization of the cybersecurity sector in the Basque Country

**CYBASQUE**

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PROLOGUE

# Prologue

In recent times, the business sphere has witnessed a notable transformation because of the evolution of new technologies and the profound digitization occurring in the economy and society. This transformation has led to significant advancements and improvements in processes and services within organizations, entailing not only a revolution in business practices but also a substantial increase in technology dependence across various organizations.

Resulting from this increased dependency, intensified interconnection stands out as one of the main causes of the rise in cybercrime, thereby escalating the risks associated with cybersecurity and impacting the integrity, confidentiality, and availability of the information handled, as well as the services offered by these entities. Furthermore, the ongoing advancement in the sophistication of criminal techniques has created additional demands on various organizations, compelling them to allocate greater resources to the acquisition of cybersecurity services and tools.

Likewise, urgent need to reconsider security parameters in the industrial environment arises, implying an increased interest in the implementation of cybersecurity measures in this sphere.

All the above has led to exponential growth in demand for cybersecurity professionals. This demand has increased in parallel with technological advancements and the digitization of society, resulting in a significant rise in demand for university graduates or vocational training in the field of Information and Communication Technologies (ICT). Although cybersecurity has traditionally been considered closely related to computer science, the complexity and diversification of cyber threats, along with the need to comply with new existing regulations, have generated an increasingly high demand for professionals from various disciplines. Specifically, there has been a growing interest in professionals who possess knowledge in the regulatory and legal aspects related to cybersecurity. This is due to the need to understand and comply with regulations and standards in an increasingly complex and regulated digital environment.

In line with the above, the Basque Country faces a clear challenge in this field, addressing the existing talent gap in the cybersecurity sector. The need for recruitment, training, and employment placement of professionals is one of the sector's primary requirements.

The study serves as an essential tool for gaining deeper insights into the job landscape within the cybersecurity domain in the Basque region. By furnishing valuable data and insights, it equips stakeholders with the necessary information to formulate strategies and policies that not only address the current talent gap but also propel sustainable development and enhance competitiveness across all facets of the cybersecurity sector's value chain in the years to come.

PERSPECTIVES AND
PROFESSIONAL NEEDS

# Perspectives and professional needs

The evolution of the digital landscape has necessitated a shift towards digital transformation, encompassing the integration of emerging technologies, innovative processes, and robust security measures. Cyber threats persistently evolve at an accelerated pace, underscoring the critical importance of ongoing vigilance and adaptation. Despite increasing investments in cybersecurity, there remains a substantial amount of groundwork to be covered in navigating this ever-changing environment effectively.

*In the first quarter of 2023, the Basque Country was ranked as the fifth Autonomous Community in terms of cybersecurity investments made by Public Administrations.*

In the first quarter of 2023, cybersecurity investment by state Public Administrations reached €81.04 million [1]. Thanks to the investments made and the close high-level collaboration within companies, over 70% of executives perceive an improvement in their companies' cybersecurity initiatives in the last year [2].

In this rapidly expanding digital environment, the Basque Government has outlined the "Estrategia para la Transformación Digital de Euskadi 2025 (ETDE2025)" with a Budget of €1,400 million, it represents a new approach to the interaction between the Basque Public Administration and economic and social sectors, aimed at collaboratively addressing global challenges through digital transformation [3].

The primary objective of this strategy is to accelerate the adoption of emerging technological sectors, strengthen their development, and leverage the potential of various available enablers, promoting their rapid integration into essential areas. This will contribute to the Basque Country's transition towards a technological-digital, energy-environmental, and social-health future by the year 2025.

In the technological-digital sphere, the goal is set to create 300 new companies specialized in various technological fields by the year 2025, such as cybersecurity, artificial intelligence, quantum computing, computer vision, blockchain, Internet of Things (IoT), augmented reality, big data, and robotics [3].

Additionally, at the national level, the "Plan de España Digital 2026" is approved, aiming to strengthen the state's cybersecurity capacity. The plan aims to have 20,000 specialists in cybersecurity, Artificial Intelligence, and data by 2025 [4]. The strategies currently available aim to successfully adapt to the existing Digital Transformation in all areas of society. To achieve this, the Basque Country is betting on a new model of Digital Transformation that represents a different way of understanding and practicing the relationship between the Basque Public Administration and economic and social agents, allowing them to jointly address global challenges.

As one of the main challenges within the cybersecurity ecosystem in the Basque Country, there is a need to address the existing talent gap in the Basque territory. In this regard, in order to attain the required levels of professional expertise, two main avenues of action have been identified: the recruitment of new professionals from both university degrees and vocational training programs, and the utilization of experienced professionals' skills through additional training via workshops and courses that enable them to redirect their activity towards this field.

Although these measures will enable economic activity and public services to benefit from increased professional capacity, in the near future, there will still be a demand for unfilled job positions. In this context, understanding the state of the sector becomes essential for taking the necessary steps to reverse the situation and mitigate the risks associated with cybersecurity. Among these measures, investment, innovation, and cultural change have been identified as key.

# Agents of the cybersecurity sector in the Basque Country

The growing demand for products and solutions to enhance the protection of ICT infrastructures has also fuelled the growth of the cybersecurity sector, creating new business opportunities. the Basque Country boasts a wide range of agents offering cybersecurity products and services. Currently, SPRI has 242 agents registered in its cybersecurity catalogue, compared to 111 registered in 2018, demonstrating the upward trend in the number of agents in the cybersecurity sector in the Basque Country [5].



*Figure 1. Total number of cybersecurity agents in the Basque Country. Source: SPRI*

Following the previous statement, the cybersecurity ecosystem of the Basque Country is comprised of 4 links within the value chain defined in the sector:

- Manufacturing: Companies that provide solutions, applications, and tools that ensure security.
- Distribution: Encompasses companies dedicated to distributing manufactured products, acting as intermediaries between the manufacturer and service providers.
- Services: Providers of cybersecurity services.
- Clients: Public administrations, companies, and individuals who are recipients of the various cybersecurity products and services.

*Through the review of the different versions of the Libro Blanco de la ciberseguridad en Euskadi 2024 published by SPRI, a continuous upward trend in the number of identified agents is observed.*

Furthermore, universities and research centers play a fundamental role due to their promotion and innovation efforts. Additionally, training and accreditation of professionals' capabilities through cybersecurity sector certifications become especially relevant.
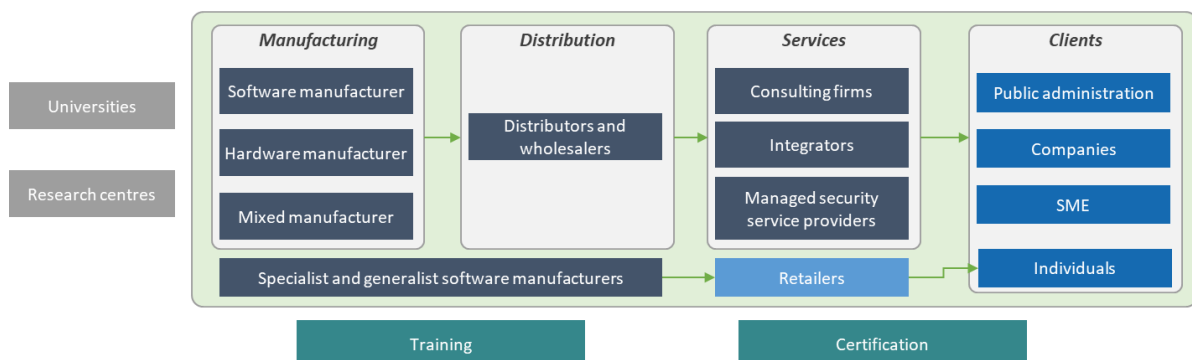


*Figure 2. Cybersecurity sector chain Value. Source: Own elaboration*

Regarding the various agents comprising the cybersecurity ecosystem in the Basque Country, as shown in the following graph, there exists a wide variety and heterogeneity across the territory. It is important to highlight those agents focused on service provision (Integrator/Consultant) or on manufacturing (Manufacturer) and distribution of products (Distributor/Wholesaler), where a disparity in the region is observed. The majority of cybersecurity agents in the Basque Country are focused on providing services in this area, while there is a notable scarcity of those dedicated to manufacturing and distributing cybersecurity products. This reveals the existence of an unbalanced value chain in the supply of cybersecurity products/services.
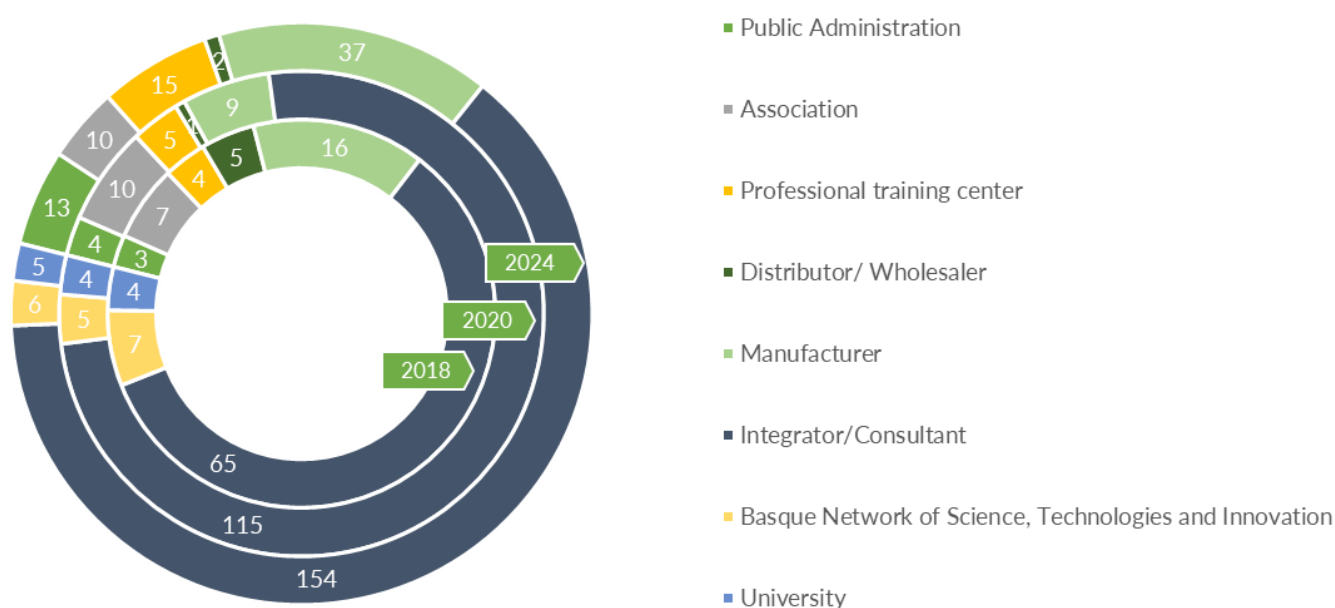


*Figure 3. Agents listed in different editions of the Libro Blanco. Source: SPRI*

In terms of research, the Basque Country has various research and development centres that exert a strong pull on a wide network of professionals. These institutions aim to drive economic and social advancement while enhancing the area's business competitiveness. Additionally, they serve as true engines for the dissemination of science, technology, and innovation, playing a crucial role in knowledge transfer to society and facilitating collaboration among various actors in the Basque Country research and development ecosystem. Their contribution spans from generating new knowledge to creating opportunities for practical application, thereby promoting an environment conducive to sustainable progress in the region.

It is important to highlight the Basque Digital Innovation Hub of the Basque Country, an integrated network of resources and services specialized in advanced manufacturing that provides infrastructures for training, research, testing, and validation, offering companies access, expertise, and specific services in fields such as additive manufacturing, flexible robotics, and cybersecurity. Its main objective is to provide industrial companies, especially SMEs, with the necessary technological capabilities to address the challenges of smart industry. Specifically in the field of cybersecurity, it has the cybersecurity node, which, composed of 5

laboratories, aims to drive entrepreneurship and innovation, focusing particularly on projects linked to smart-grid, automotive, blockchain, and product certification.

In the following image, the research fields that currently have the greatest presence in the entities of the Basque Country are shown [6]:



*Figure 4. Research fields in the Basque Country. Source: RENIC*

# IT and cybersecurity employees

According to the analysis conducted by Cybasque on the various tender documents available in the cybersecurity field of in the Basque Country, it is observed that, when carrying out projects in this area, it is required, among other aspects, that professionals have previous experience in similar activities and that they hold certifications recognizing the capabilities of different professionals in the sector.

Alike, the importance of creating distributed teams where professionals with diverse knowledge and experiences are found is emphasized. This will also help balance the needs of professionals with extensive experience.

In conclusion, the aim is to establish a sector with a quality service offering and experienced professionals [7].

| | |
|---|---|
| Project Manager/Director | 3-8 years of experience |
| Consultant profile | 5 years or a part of the team with 5 years of experience (distributed teams) |
| Analyst-Programmer | 3 years of experience |
| Programmer | 2 years of experience |
| Other profiles (web designer, technician...) | 2-3 years of experience |

*Figure 5. Required experience based on public tender documents in the Basque Country. Source: Own elaboration*

*According to data from Eustat, while the number of ICT users increases in organizations in the Basque Country, the percentage of specialists decreases.*

The shortage of professionals in the field of ICT is evident, especially concerning highly specialized personnel. In the year 2023, nearly 80% of employees in the Basque Country were using ICT systems; however, only 10.2% of these contingent constituted specialized personnel in this field. Compared to 2020, there is an increase in the number of ICT users, although this growth is not proportionally reflected in the expansion of the professional workforce dedicated to ICT. In the service sector, where the highest business activity in cybersecurity is concentrated, there is evidence of an increase in the number of ICT users (2.8%), while the number of specialists experiences a decrease of 0.7%. Therefore, it is essential to focus attention on the shortage of advanced digital experts, as this situation hampers the country's growth prospects [8].

In closing, it is observed that the use of new technologies has experienced a notable increase in all areas of society, from communication to education and work. However, this rapid advancement has not been accompanied by a proportional increase in the number of experts in these technologies. Despite the growing demand for professionals with digital skills, the gap between the supply and demand for technology experts remains significant. This disparity poses significant challenges in terms of training and talent development, as well as in ensuring that society can fully harness the potential of these innovations for the benefit of all.
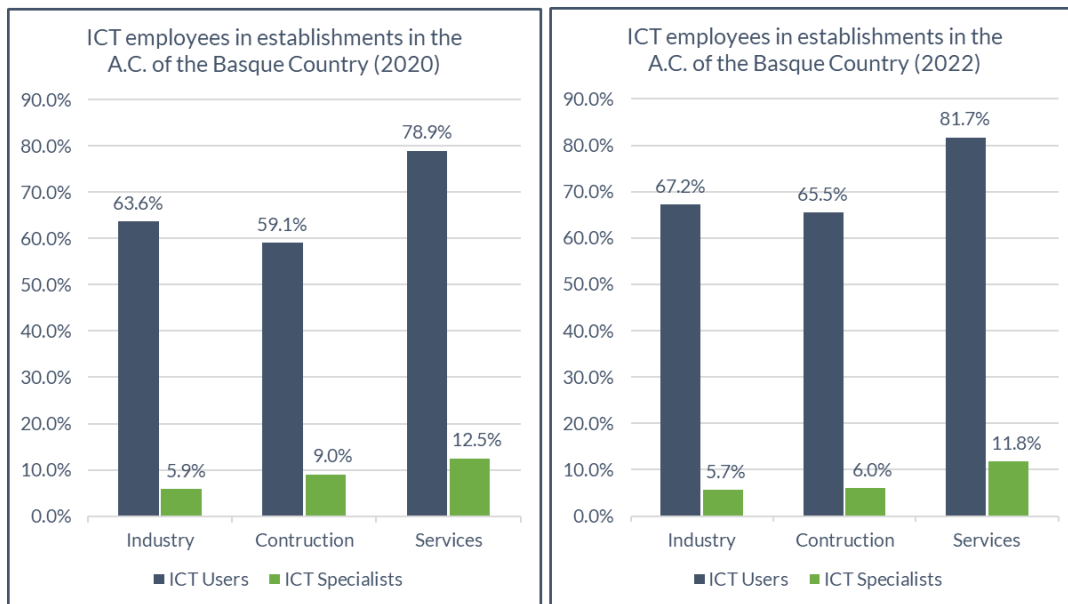
*Figure 6. ICT employees in establishments in the Basque Country. Source: Eustat*

# Hiring

In the Basque Country, new needs continuously emerge along with new professionals to deliver these services and products. While it is true that there's potential to repurpose internal talent for cybersecurity positions, it is crucial to understand the hiring demand anticipated in the upcoming years to ensure availability of adequately trained professionals in the field.

Based on the data obtained by ConfeBask, it is expected that the demand for profiles with higher education will prevail over the rest. The industry increasingly requires profiles with higher education, while construction, on the other hand, is the sector that demands profiles with lower qualifications. In the services sector, the demand for higher education continues to

*Profiles with higher education are predominant in the demand within the cybersecurity field.*

stand out, and the demand for university studies remains higher than that for vocational training cycles [9]. To increase the number of professionals, new cybersecurity studies have been created in recent years.
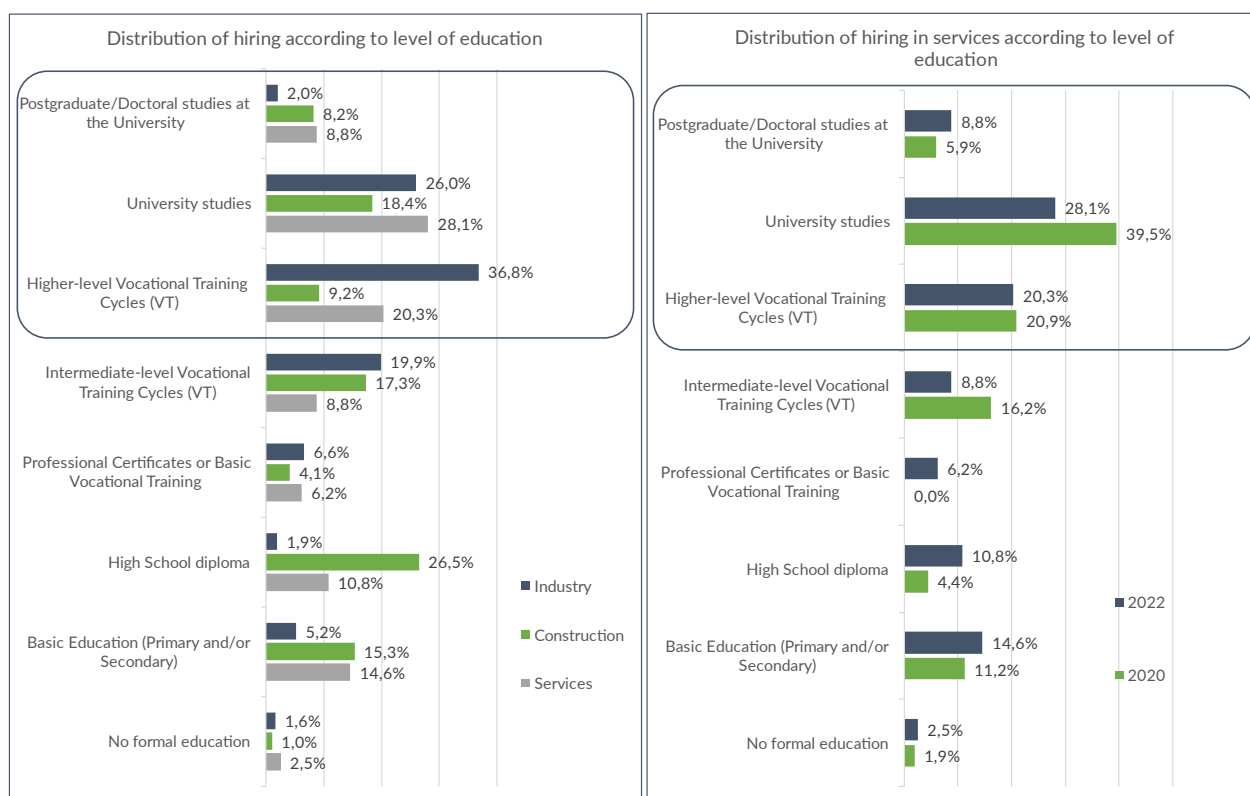


*Figure 7. Distribution of hiring by families of University Studies an VT). Source: ConfeBask*

If we look at the hiring forecasts made, studies within the field of computer science are the most demanded in the Basque Country, both in university degrees and vocational training cycles, followed by other engineering disciplines, and this will continue to be the case at least in the immediate future [9].
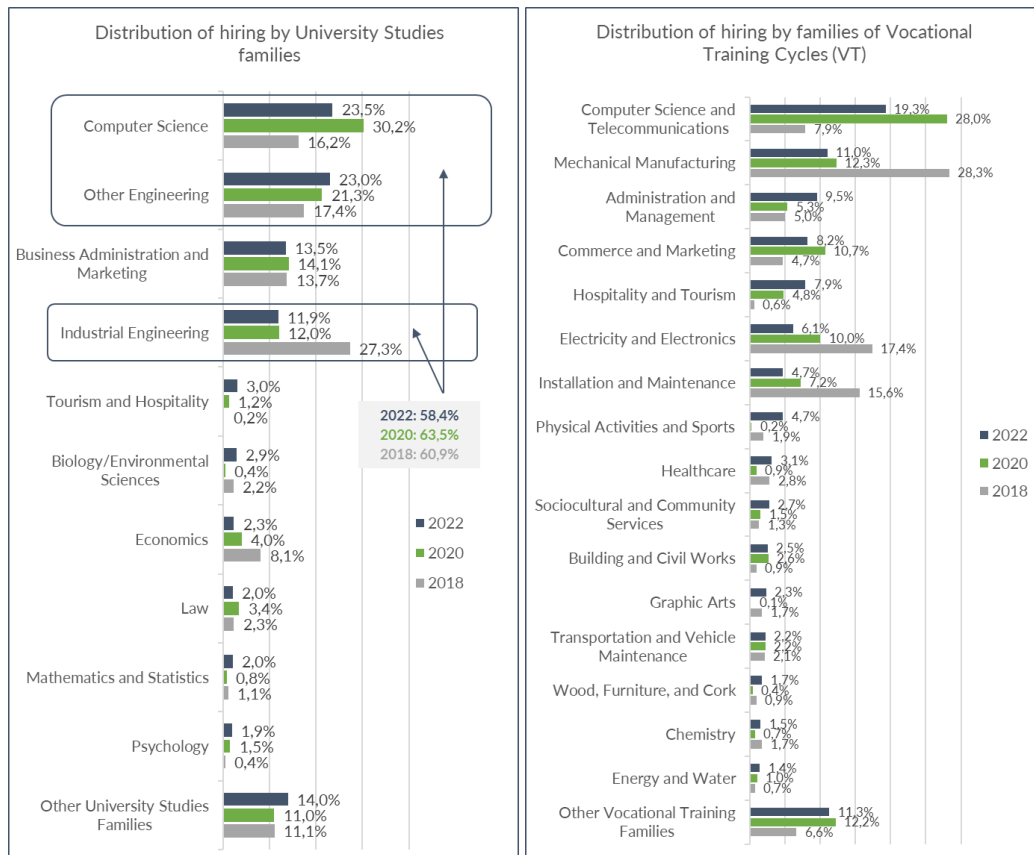
*Figure 8. Distribution of projected hiring by families of University and Vocational Training Studies. Source: ConfeBask*

The following graphic illustrates the projections of supply and demand for cybersecurity professionals in Spain, revealing a talent gap in the sector in Spain, with a similar outlook expected in the Basque Country next year [10]. To address this gap, various initiatives are being promoted, such as the STEAM Euskadi strategy and the promotion of new higher education degrees, university degrees, and master's programs in cybersecurity.
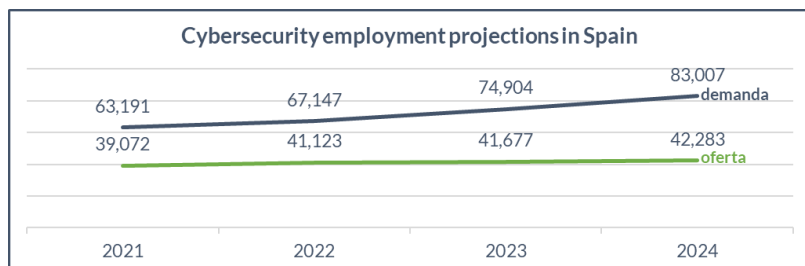
*According to the projections, the gap between supply and demand for employment in the field of cybersecurity shows a growing trend that will continue into 2024.*



*Figure 9. Projections of cybersecurity employment in Spain. Source: ObservaCIBER*

Given the evident talent gap emerging in the cybersecurity sector, companies will find themselves compelled to reassess their hiring strategies. Rather than relying exclusively on professionals holding university degrees or higher education, there will be a need to seek talent beyond this conventional academic sphere. This will involve both identifying individuals with relevant skills and experience, as well as investing in training and retraining programs for employees who may not have come from this educational background. The priority will be to assemble teams that are well-rounded in terms of experience and skills, aiming to effectively address the talent gap in the near future.

# Talent offer

When we evaluate the available talent in a region, it is essential to address the conversation about educational offerings, as it is closely linked to the availability of talent in that location. The quality and diversity of educational programs not only influence the personal development of students but also have a considerable impact on the area's ability to cultivate and harness local talent. Therefore, by focusing on improving and expanding educational offerings, we can enhance the growth and competitiveness of the territory, ensuring a constant flow of skills and knowledge that drive both economic and social progress.

To understand the diversity of profiles dedicated to cybersecurity, an analysis of emerging talent is proposed, encompassing both university graduates and those with degrees in Vocational Training (VT) programs. It is important to consider that not all graduates with aptitudes for the cybersecurity sector necessarily enter specific roles within this discipline.

According to statistics from 2021/22, 9,689 students completed their undergraduate studies at universities in the Basque Country, with 20.5% of graduates in the field of Engineering and Architecture [11].
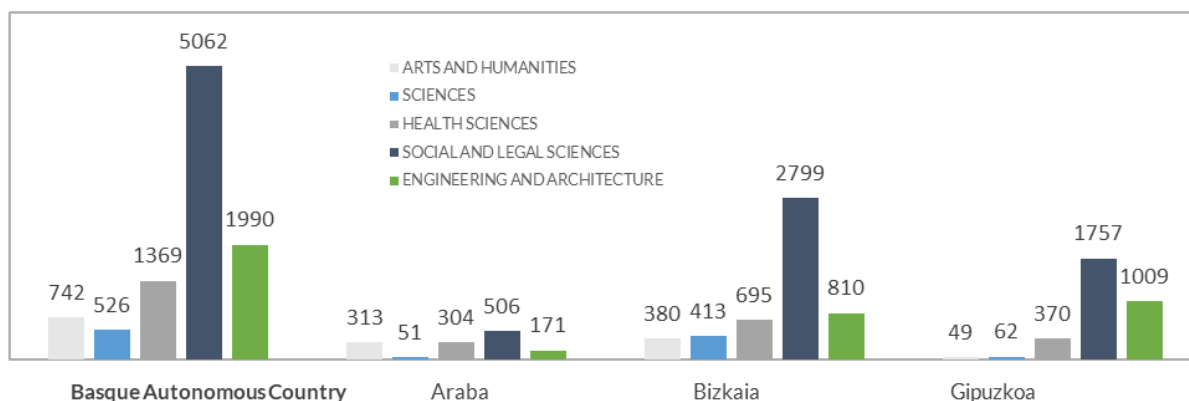


*Figure 10. University graduates by field of study in the Basque Country. Source: Eustat*

Considering the fields of study inherent to each degree and with the purpose of identifying those with greater aptitude to perform tasks in the field of cybersecurity, degrees in Computer Science, Telecommunications, and other programs that incorporate the study of emerging technologies will be taken into consideration. A total of 332 graduates (equivalent to 3.4% of the total) could demonstrate interest or have taken relevant subjects in cybersecurity, with a higher number of graduates in Computer Engineering (173 graduates), Computer Engineering in Management and Information Systems (70 graduates), as well as in Telecommunication Engineering (42 graduates).

Upon examining the following graph, it becomes evident that the study programs with the highest number of graduates are those belonging to the field of Computer Science, such as Computer Engineering and Computer Engineering in Management and Information Systems.
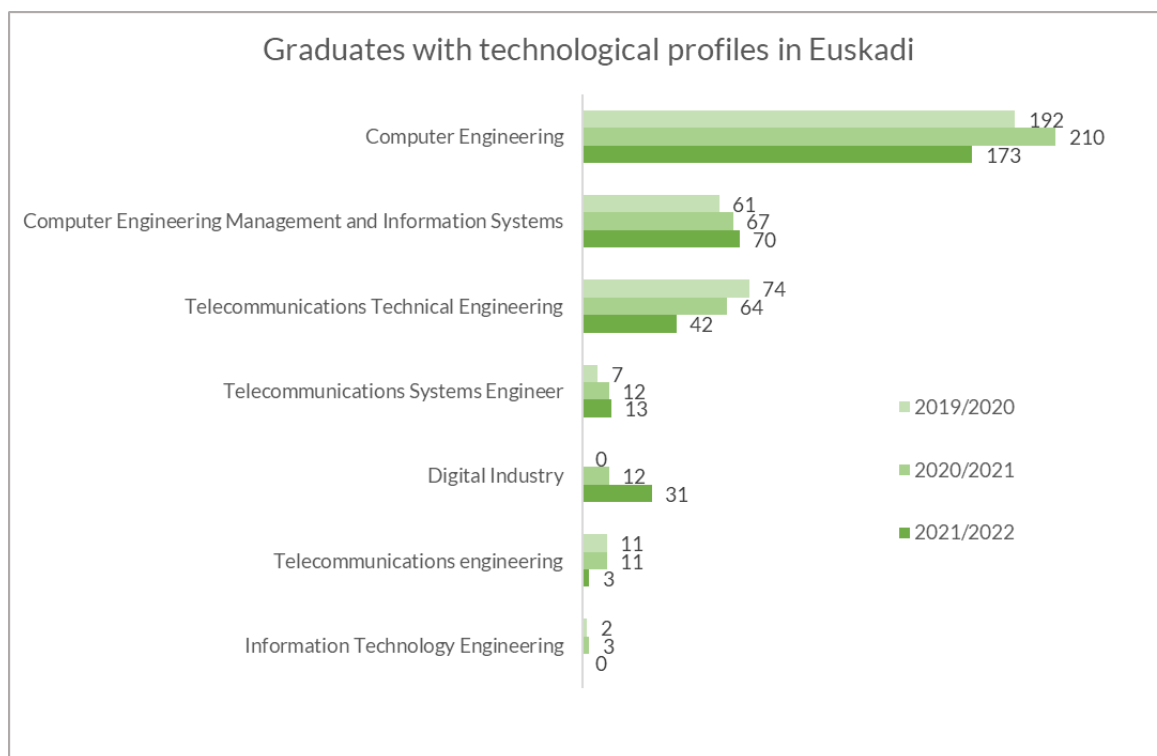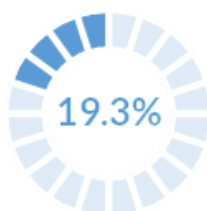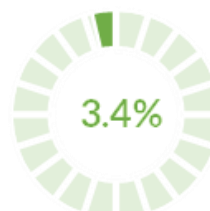
*Figure 11. Graduates with technological profiles in the Basque Country. Source: Eustat*



*Figure 12. University graduates in the Basque Country. Source: Eustat*

Additionally, it is possible to identify profiles that align with different degrees. For example, in the case of Mathematics, there were 72 graduates in both the 2019/20 and 2020/21 periods, and 77 graduates in 2021/22. On the other hand, in the field of Law, there were 621 graduates in 2019/20, 611 in 2020/21, and 576 in 2021/22, which would include students specialized in areas such as privacy and cybersecurity.
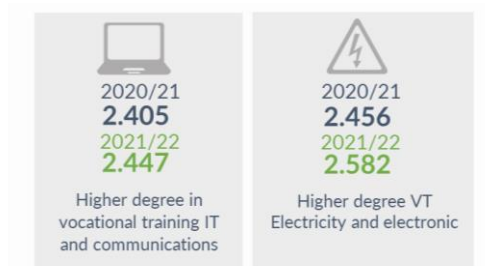


*Figure 13. Enrolled in VT. Source: Eustat*

Regarding vocational training studies, those of particular interest for this sector are primarily higher-level vocational training studies in fields such as IT and communications, and electricity and electronics, where an increase in interest can be observed through the growth in enrolments each year [12].

In the educational sphere of the region, various organizations and institutions are focused on improving and specializing in cybersecurity. In order to address the existing talent gap in this area, members of the Network of Education Centers in the Basque Country are implementing a series of initiatives aimed at strengthening and deepening their knowledge in cybersecurity, including the launch of new curricula focused on cybersecurity.

Delving into the offerings regarding vocational training studies, two main higher-level degrees are distinguished in the Basque Country, which are offered in 12 different Vocational Training centers:

- Specialization Course in Cybersecurity in Information Technology Environments.
- Cybersecurity in Operational Technology Environments.

As previously shown, the Basque Country has 15 Vocational Training Centers, which offer a wide range of educational programs, both regulated and non-regulated, demonstrating their commitment to strengthening the territory in this area.

Additionally, various organizations complement this offering by providing non-regulated training programs. A notable example is the cybersecurity boot camp, which was held for the second consecutive year at the 42 Urduliz center in 2023. This boot camp, held in-person and free of charge, is an initiative aimed at meeting the labor demand and is carried out in collaboration with experts from Telefónica Tech. Its objective is to train participants in practical skills necessary to enter one of the fastest-growing industries in the digital market [13].

In the university sector in the Basque Country, educational institutions are making significant efforts to adapt, improve, and incorporate new programs related to cybersecurity. the Basque Country has 5 universities: Tecnun, University of Deusto, EUNEIZ University, University of Mondragón, and the University of the Basque Country (UPV/EHU), which are carrying out different initiatives to strengthen the professional environment in the field of cybersecurity in the territory, providing studies related to the sector, focusing on cybersecurity, data analysis, cloud computing, and data protection.

Furthermore, the recently created EUNEIZ University launched the first bachelor's degree in Cybersecurity at the territorial level, demonstrating its commitment to this field and the need to develop specific educational pathways to specialize students in the region and meet the sector's needs with trained professionals.

Additionally, it is relevant to highlight that the university educational offering in the Basque Country region exhibits notable diversity. This variety not only reflects the commitment of various academic entities to improve and adapt to emerging sector demands, especially through the implementation of new programs in the field of cybersecurity, but also highlights the wide range of STEM degree programs available in the region.

In this regard, it is necessary to mention the STEAM the Basque Country strategy, whose objective is to promote scientific and technical education and training at all educational stages, seeking to promote education in science and technology at all educational levels [14][15]. This strategy is particularly important for the region due to its close relationship with cybersecurity.

In addition to the talent offerings resulting from graduates, different organizations are considering the use of additional measures to hiring new talent, considering existing employees through reskilling and upskilling techniques. Reskilling measures are used to train professionals in the field of cybersecurity despite not being directly related to the subject. On the other hand,

upskilling measures are those aimed at enhancing the productivity and competitiveness of employees in their work areas, as in this case, the field of cybersecurity.

In conclusion, despite the limited availability of talent in the Basque Country territory to date, a significant transformation is anticipated in the coming years. This change is supported by the progressive increase in the offering of educational degrees and programs established by various educational entities.

Likewise, the growing commitment to training and skills development in the region is evident, which bodes well for an increase in the availability of local talent in the near future. It is important to note that the upskilling and reskilling measures, which are being implemented more forcefully in the region, will also significantly contribute to this transformation process. This evolution reflects a renewed commitment to education and training, thus laying the foundation for a more prosperous and competitive ecosystem in the context of the Basque Country.

# CONCLUSIONS

# Conclusions

## Increase in cybersecurity agents

It can be stated that in the Basque Country there is a wide diversity of agents in the field of cybersecurity. However, when analysing the value chain, a greater concentration is evidenced in the services sector compared to that of the manufacturing and distribution of products sector. Despite this disparity, an upward trend is observed in the availability of cybersecurity agents over time, which underlines the growing need of experts in the field, which highlights the strategic importance of strengthening the cybersecurity ecosystem in the region for addressing emerging challenges in this crucial field.

## Talent gap

The increase in the use and in the dependence on new technologies in various areas of society contrasts with the insufficient number of professionals specialized in cybersecurity. This disparity poses a significant challenge in terms of data protection and digital security. However, in the face of this growing demand, it is encouraging to see how different educational centres are taking proactive measures. The introduction of new curriculum aimed at cybersecurity is a crucial step in addressing this talent gap and ensuring that there are qualified professionals to address emerging challenges in the cybersecurity field. These initiatives are essential to ensure the adequate protection of information and the systems in an increasingly digitalized and connected world.

## Need for qualified professionals

In an increasingly specialized sector, there is a need for profiles that have experience and professional certifications that accredit their capabilities in cybersecurity. For this reason, different organizations must promote the training of their professionals and carry out talent retention actions.

## Training existing employees

Facing the lack of new professionals, different organizations are considering the use of measures additional to hiring, built on putting existing employees through, on the one hand, *reskilling* techniques based on professional recycling, training workers for another position and providing them with new competency skills. And on the other hand, through *upskilling* techniques that are based on providing training to a professional in new skills and competencies that allow him to grow in his current role, improving their productivity in the position itself.

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