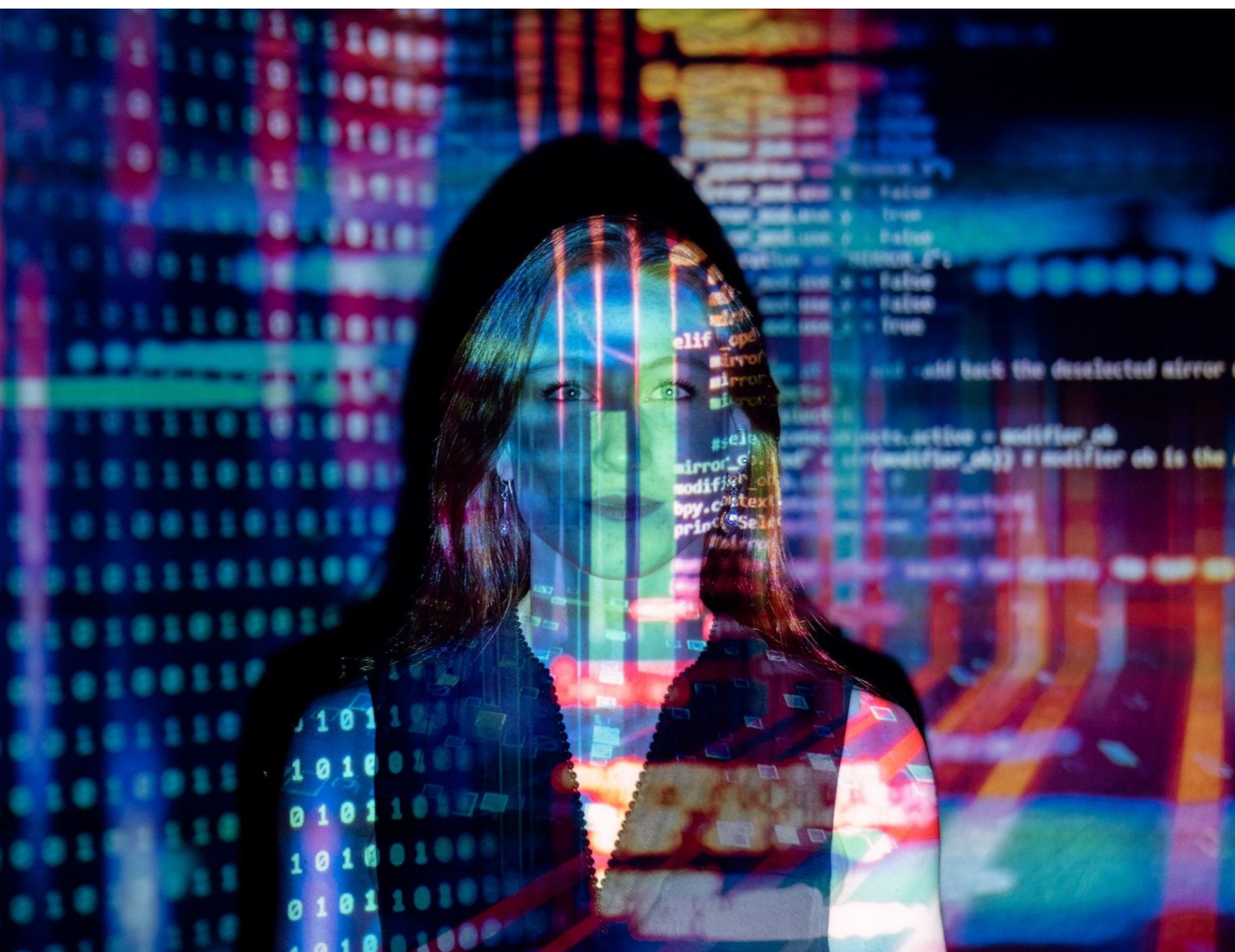# The role of the Vocational Education and Training (VET) workers in IT firms
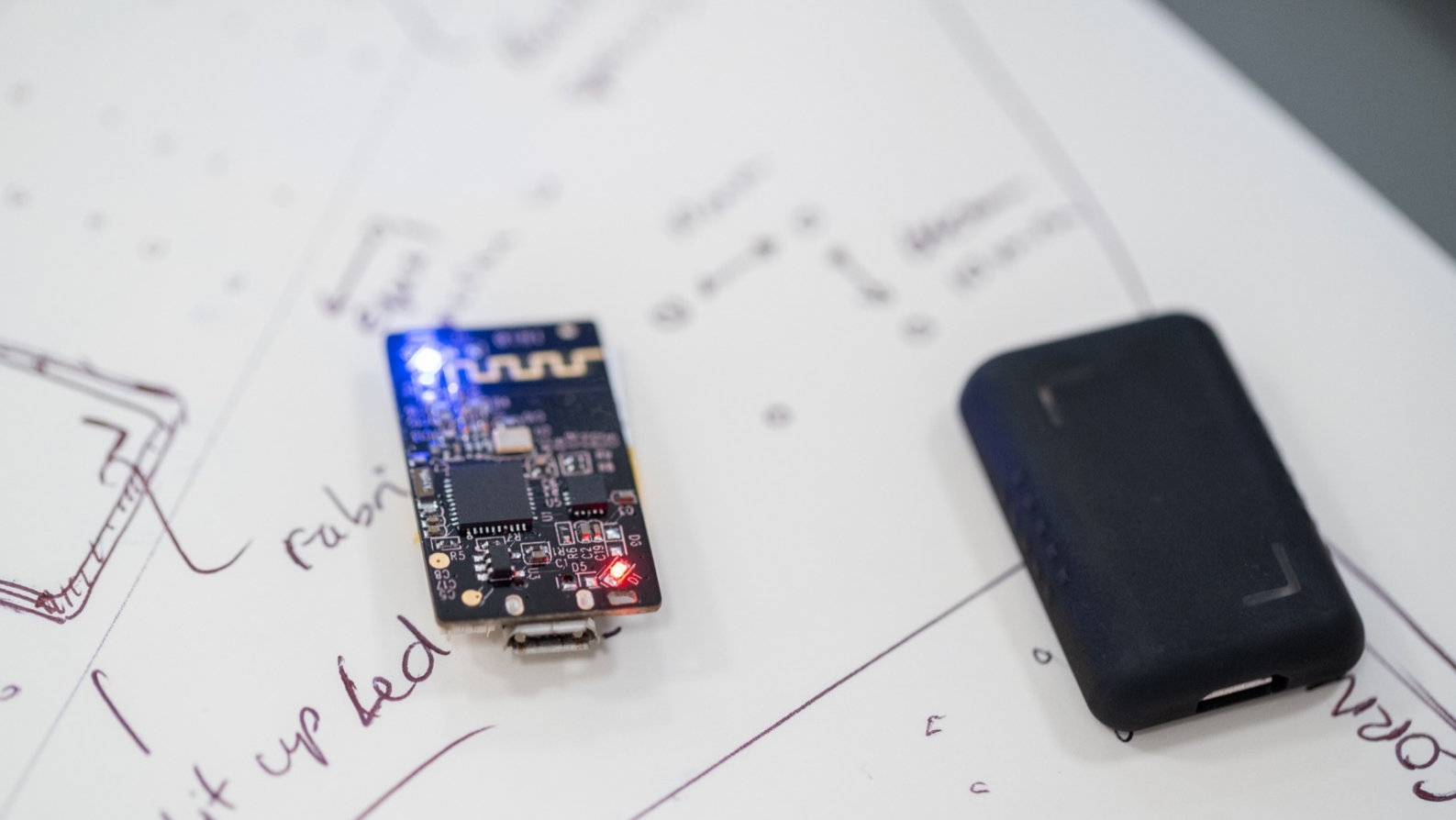
The role of the Vocational Education and Training (VET) workers in IT firms

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Contents

01 Introduction

In 2018, Bilbao Ekintza, the economic promotion agency of the Bilbao City Council, began a collaboration with Orkestra to explore the role of individuals with vocational education and training (VET) in Knowledge Intensive Business Services (KIBS). The term KIBS is linked to territorial development and encompasses some of the core activities for today´s economy (consulting, engineering or digital companies, among others). These activities have a strong urban component, stimulating innovation not only in the local, but also in the regional productive fabric. There is an increasing demand for the expert knowledge required to operate in volatile, complex and technological contexts. Against this backdrop, KIBS have been transformed into strategic services for both urban and regional development.

Exploring the role of VET studies in the KIBS field is an innovative approach. Although it is true that highly qualified individuals play a key role in KIBS, the potential of professionals with VET studies has yet not been examined. The study thus addresses the growing mismatch between offer and demand for these profiles, focusing on technological KIBS.

An action research process was carried out for the analysis, bringing together more than 30 territorial actors in different spaces: Bilbao City Council, Bilbao Ekintza, the Basque Government, Vice-Ministry for Vocational Training, IVAC, Lanbide, GAIA Cluster, Bizkaia Talent, VET Centers in the Bilbao Metropolitan area (Somorrostro, Elorrieta-Errekamari, Nicolas Larburu, Erandio, Calasanz and Txurdinaga, firms providing advanced technological services (Accenture, Gestionet, Ibermática, Edinor and Ingeteam) and Orkestra.

From the outset of the process, these stakeholders highlighted the increasing importance of VET workers for technological KIBS. They also recognized the role of technological firms in the modernization of the productive fabric.

The action research process consisted of 15 meetings conducted between December 2018 and November 2022 and facilitated by Bilbao Ekintza and Orkestra. During this process, new programs and policies were co designed and implemented, as was the case of the Shadowing Experience, an initiative promoted by Bilbao Ekintza to guarantee the equal access of young women to jobs in digital companies. Other initiatives include specialization training programs in Native Cloud, Java and .NET, among others, promoted by the VET Vice-Ministry of the Basque Government. The knowledge co-generated throughout the process has been covered in a number of academic publications (Albizu and Estensoro, 2020; Albizu et al., 2022; Oliva, 2022).

The following report aims to further reflect on the role of individuals with VET studies in IT firms in the current and future context. This exercise departs from the voices of IT firms and addresses the role of VET workers in relation to different knowledge areas they work in, their main strengths and weaknesses, the position they hold in the companies' organizational charts and their complementarity with university profiles.

This analysis will enable us to reach a better understanding of the specific changes happening in the labor market, allowing us to rethink what type of training is the most appropriate to respond to a dynamic production environment. Moreover, it gives us the opportunity to reflect upon how companies can adapt their labor and human resources policies to fully benefit from the skills and capabilities of their employees. This paper will show that individuals with VET studies play a strategic role in IT firms, which are increasingly demanding these kinds of profiles. This debate is essential to foster quality career paths.

Finally, we would like to thank all those who have participated and facilitated this analytical process. First and foremost, the Bilbao City Council, and particularly Bilbao Ekintza, which since 2018 has promoted this process. Their participation has made it possible for us to make our contribution to the promotion of social welfare together.

1. The role of VET in KIBS
https://www.orkestra.deusto.es/es/investigacion/publicaciones/informes/cuadernos-orkestra/2018-200026-rol-formacion-profesional-servicios-avanzados

2. Vocational Education and Training and Knowledge Intensive Business Services: A Promising Relationship in the Digital Era https://foresight-journal.hse.ru/en/2022-16-2/623228827.html

3. The role of Action Research for Territorial Development in democratizing policies: The case of Bilbao NextLab. Master thesis. Basque Country Public University

02 Methodology

With the aim of identifying the overall perception of the role of VET profiles and the most relevant areas of knowledge within companies linked to this sort of workers, employers from 30 Spanish IT firms were interviewed for this report.

The information was collected through semi-structured in-depth interviews conducted between March 15 and May 15, 2022 and an online questionnaire.

2.1. KIBS and IT firms

KIBS

KIBS are companies that provide knowledge-intensive inputs for the production and commercial processes of other companies or other types of organizations. Although they do not form a homogeneous group, they share two common elements:

- Knowledge as a central factor, as both an input and an output. KIBS are companies whose business model is based on specialized expert knowledge, the ability to analyze specific problems, and the development of ad hoc solutions for their clients.

- The importance of the interaction between service provider and client to define the content of the service offered. KIBS offer solutions to complex problems that oblige the KIBS provider to dialogue with the client in order to properly understand the problem and develop solutions accordingly.

There are three main categories of KIBS:

Table 1. Classification of KIBS by NACE* Classification		
Professional KIBS	**Technological KIBS**	**Creative KIBS**
NACE 69: Legal and accounting activities	NACE 62: Computer programming, consultancy and related activities	NACE 73: Advertising and market research
NACE 70: Activities of head offices; management consultancy activities	NACE 71: Architectural and engineering activities; technical testing and analysis	NACE 74: Other professional, scientific and technical activities
	NACE 72: Scientific research and development	

*(Statistical classification of economic activities in the European Community)

IT firms

This analysis focuses on digital firms. Such firms are included within the category of IT KIBS and are associated primarily with NACE 62 (Computer programming, consultancy and related activities), and partially with NACE 71 (Architectural and engineering services; technical testing and analysis). Nevertheless, not all digital firms are registered in these economic activities.

2.2. Participating IT firms

The employers interviewed for this report belong to the following IT firms, as described in Table 2.

Table 2. Participating firms	
No.	**Firm**
1	Accenture
2	Adimedia
3	Airbus
4	Area Proyect
5	Binary Menorca S.L.
6	Biten
7	Code 4 jobs
8	Cognizant
9	Dome consulting & Solutions
10	Dominion
11	ECNA
12	Flat 101
13	Freekip Company
14	Gestamp
15	Gestionet
16	Ibermática
17	Indra
18	Inetum
19	Marsbased
20	NTT Data
21	Serbatic
22	Serikat
23	Tech Edge
24	Telefónica
25	The White Team
26	Versia
27	Viewnext
28	We are Clickers
29	WindUp
30	Zucchetti

2.3. Interview structure

The areas of research on which the interviews were based are described in Table 3.

Table 3. Main research areas for interviews	
Areas of research during in-depth interviews	
1	The relevance of VET workers in the firm's business model.
2	The share of workers in the firm from the VET system compared to those with a university background.
3	Knowledge areas occupied by VET workers.
4	Job profiles filled by VET workers within the companies.
5	The level of technical skills held by VET workers upon arrival at the firm.
6	The level of transversal skills of VET workers upon arrival at the firm.
7	Opportunities for promotion based on VET profile skill sets.
8	Retraining strategies developed by firms.
9	Complementarity between VET and university profiles within the firm.
10	Differences between VET and university profiles within the firm.

2.4. Map of knowledge areas

The knowledge areas in the map were prioritized using a questionnaire designed to capture the value generated by VET workers in these areas, as well as the time relevance of each area. The specific knowledge areas can be found in Table 4.

This report focuses in part on these knowledge areas because they are considered to be a bridge between companies and the educational system, and are a common point of interest for both agents. Companies demand employees with knowledge in the technologies indicated, while training centers offer content related to these technologies.

4. This knowledge map draws on the map developed by the VASS Foundation for its report on employability and digital talent. Now in its fourth edition, this exhaustive report focuses on university profiles. https://www.fundacionvass.org/investigacion/

Table 4. IT knowledge areas		
No.	Digital knowledge areas	Technologies
1	Design and implementation of databases	SQL, MySQL, ORACLE, SQL Server...
2	Front-end web development	HTML, CSS, Javascript, Typescript, UX/UI, React, Vue.js, Angular, Aurelia,...
3	Back-end web development	PHP, JSP, ASP, HTML,...
4	Development of applications for mobile devices	Kotlin, ObjectiveC, Swift, Xamarin, React Native, Ionic, PhoneGap...
5	Developments in .NET and/or Java EE platforms	C#, VB.NET, F#, ASP.NET, JSP, Java...
6	Secure software development	Static code analysis (Sonarqube, Qradar), code injection testing (XSS, SQL Injection...)
7	Deployment and operation of software in the cloud	Kubernetes, Docker, IaaS, PaaS, AWS, Azure, Heroku, Google...
8	Microservices and server-less architectures	REST, Swagger, AWS Lambda
9	Testing techniques and test-driven development	jUnit, jMeter, Gatling,Karma, Puppeteer, Selenium,...
10	Cybersecurity	To be determined
11	Data science	Analysis of large volumes of information: Keras, Tensorflow, R, Python, BigML...
12	Audit and security management	ISO27K, ISACA (CISA), CEH, Compliance RGPD...
13	Administration of application servers and internet services	Apache, nginx, mail, server configuration...
14	Management and planning of IT projects with agile or traditional methodologies	Scrum, Kanban, XP, FDD, PMBOK, PRINCE2...
15	Management and configuration of ERPs	Salesforce, SAP/ABAP, Oracle...
16	3D printing	To be determined
17	Virtual and augmented reality	To be determined
18	Internet of things	Sensors, Edge Computing, Embedded, Cloud Storage, Arduino, RaspberryPi, BeagleBone, C, C++, Zigbee, Z-Wave, LoRaWan, BLE (Bluetooth Low Energy).
19	Data engineering	Creation of software platforms that support the operation of large volumes of information: Spark, Hadoop, Kafka, Scala...
20	5G Network	To be determined
21	BIM (Building Information Modeling)	To be determined
22	Quantum computing	To be determined

The role of VET workers in IT firms: analysis of results

03

3.1. The relevance of VET workers in the business model

The first question that needs to be addressed, and which provides us with a general overview to start building the analysis, is the relevance that technical VET profiles have for the business models of IT firms. Generally speaking, VET profiles are perceived as highly relevant for both the current and future development of firms, with an average rating of 8.3. This is especially true of companies with a large number of workers.

Graph 1. The relevance of VET workers in the IT firms' business model

Relevance of VET workers in the IT firms' business model

8.3

| 0 | 2 | 4 | 6 | 8 | 10 |
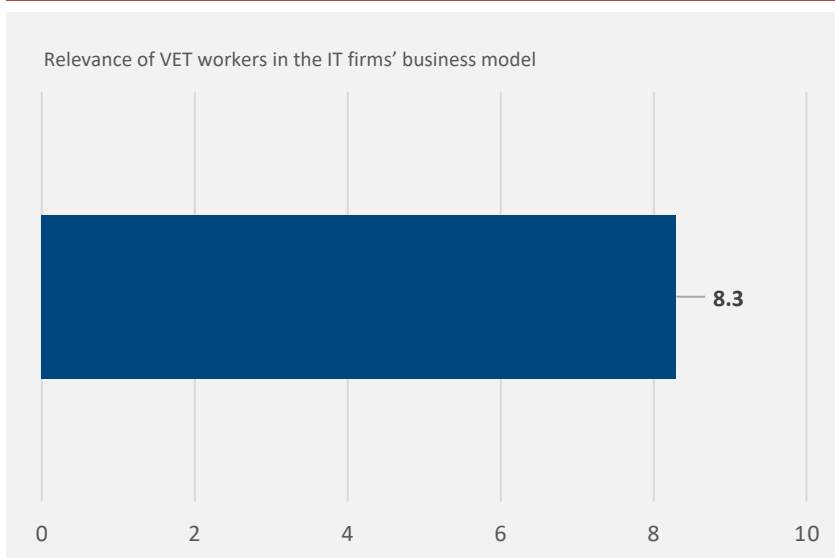
Several employers state that their companies have traditionally hired individuals with university backgrounds, but as a result of the scarcity of this type of profile, they have started to look to other providers such as tertiary vocational training. There are indications that workers with VET are able to generate significant added value, so employers have begun turning to this employee profile directly. The worker's close contact with the company is assessed from the training stage, either through on-the-job training (OJT) or dual training. This second type of internship is more demanding, but is highly valued by firms.

| Table 5. Representative quotes about the relevance of VET workers in IT firms	
Results	**Representative quotes**
VET workers are essential for the future development of IT firms.	"They work very well and is one of the keys to face the growth and lack of resources in the market." (I2) "(Candidates) come with a pretty strong base and we are going to continue collaborating with the Training Centers with the dual model because it has a lot of potential and workers adapt much better." (I34)
There is an evident shortage of VET workers in the IT sector	"Right now, we have very large growth prospects in a highly stressful context. The availability of professionals is much lower than what we need." (I13) "We have been short of workers for eight, ten years, and now they are beginning to hire technicians from abroad." (I14)
The discovery of VET workers	"At first there was resistance and it was considered that (VET candidates) were second-rate workers, but what has been shown in recent years is that VET workers are much better in certain areas. Of the 400 internship students that we currently have, 90% are VET candidates. For the subject of programming and development, VET workers are much better, on average." (I3)

On the other hand, the vast majority of employers indicate that despite broadening the focus of the recruitment process to include VET profiles, they continue to have problems finding employees. The 2022 Digital Talent and Employability report[5] developed by the VASS Foundation shows that this structural talent deficit can be extended to the entire VET system.

Currently, the shortage of ICT Specialists constitutes one of the main problems for digital companies, if not the most important. As a result, some IT firms are opening new branches in municipalities that are often far from the main business centers with the aim of improving their connection with VET Centers and attracting students during the initial stage of their professional development.

Companies are also trying to fill their vacancies by hiring remote workers from foreign countries, especially from Latin America.

According to the participating companies, nearly half (47.1%) of the employees of these companies come from the VET system, the same percentage as the total number of employees with a university background (Graph 2). The remaining 5.8%, it can be assumed, correspond to other training profiles.


Graph 2. Distribution of workers in IT firms by educational level

- VET studies: 47.1%
- University studies: 47.1%
- Others: 5.8%
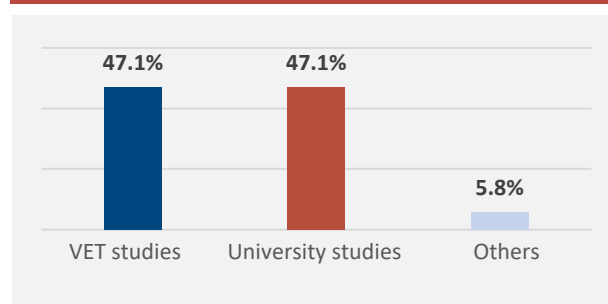
3.2. Technical skills of VET workers

Not everyone agrees on the technical skills VET students bring with them to companies. On a scale from 0 to 10, where '0' is the lowest level and '10' is the highest level, employers rate the technical competencies of VET students as a '6' on average.

Graph 3. Level of technical skills of VET workers in IT firms

Level of technical skills: 6.1
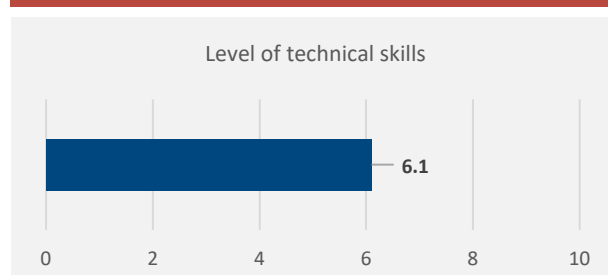
Employers generally provide a positive estimation of the practical experience of VET workers in different programing languages, as well as of their direct contact with the company. In contrast, they negatively judge the superficiality of the candidates' technical knowledge when entering the firm. Some employers consider that a lack of specific technical knowledge is reasonable at early stages, and highlight that companies should be responsible for providing workers with specific training.

5. Source: www.fundacionvass.org/wp-content/uploads/2022/06/Informe-Empleabilidad-Talento-Digital_-Web-comprimida-1.pdf

For others, although the training that VET students receive generally meets acceptable standards, it should be more innovative and should address the evolution of the market.

Existing programming languages are many and varied, and given the nature of the industry, it is highly likely that those currently in use will become obsolete in the coming years. For this reason, as we will see in the next section, employee adaptability and the willingness to learn are highly valued qualities.

Another element that employers highlight is the young age of VET workers. The majority of students begin their internships before they reach their twenties, and in many cases they simply lack the maturity associated with the experience that workers acquire over time.

3.3. Transversal skills of VET workers

The assessment of transversal skills of VET workers (5.8) is slightly lower than the score awarded for technical skills (6.1), and employers have recognized that there is room for improvement in this area.

Graph 4. Level of transversal skills of VET workers at IT firms

To a large extent, deficiencies are once again associated with the youth of the new employees. Employers generally indicate that transversal skills are essential for companies to run smoothly, and they highlight the importance of teamwork and the willingness to continue learning. Interest in training seems to be key in a changing production environment where knowledge and tools are evolving rapidly.

VET workers also seem to have slightly lower overall expectations than university graduates, who often show a greater interest in career development. English proficiency tends to be weaker in VET students, which is perceived as a handicap by employers, particularly in multinational companies.

Another element is the lack of motivation displayed by VET candidates during interviews, although employers recognize that it is difficult to generalize and that this phenomenon can vary significantly from person to person. It is also important to mention that deficiencies in transversal skills have been detected not only in VET candidates, but in workers with a university background as well.

Table 6. Representative quotes about the technical skills of VET workers in IT firms

Results:
Assessments of the technical skills of VET workers are varied

Representative quotes:

"VET workers come with knowledge, but often without a framework or methodologies. In half a year they begin to work with a minimum standard. They arrive with the basics." (I5)

"They cannot be assessed because they do not arrive with the programming skills they need. The technology of this company cannot not be acquired at the VET Center. Vocational training students have spent very little time studying, and they are very young." (I12)

"In technology, considering that they are interns and practical, they often need support. They stick to the basics, at most html and java script. In this sense, VET needs to go deeper into code." (I25)
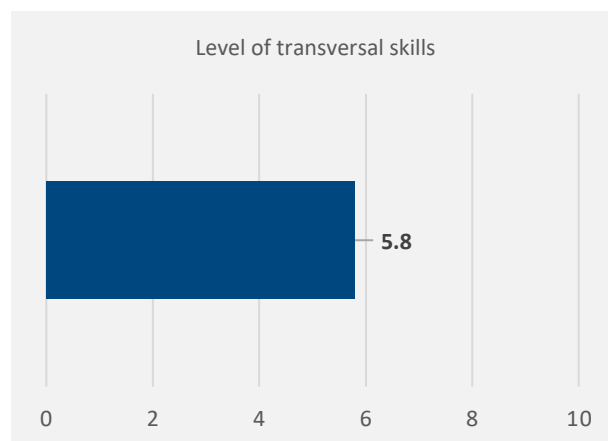
"I would always like them to have more skills, but we are happy, a 7. As we have commented at the meeting, often the technical skills of VET workers are greater than those of university graduates." (I13)

"A 7-8. In general, they are very closed to some languages, and if they have to learn a new programming language, it is more difficult for them. Workers with university background can read faster but workers from VET programs are more competent, with more practice. By competency, I mean a 3-month internship in a company, and 2 years of theoretical-practical training." (I8)

Table 7. Representative quotes about the transversal skills of VET workers in IT firms	
Results	**Representative quotes**
Significant weight is given to transversal skills, and employers generally consider that there is an opportunity for improvement. To a large extent, deficiencies are associated with the youth of the newly incorporated workers.	"The kids that come here are just 21 years old, of course, it is normal to require them to know how to relate to the client, etc. but they are 21, what do you expect?" (I28) "It's just that they are very young. They are just settling in, and it is their first contact with the world of work." (I30) "They do not measure the circumstances, the formality. They show up to the interview with their hands in their pockets, with no pen or notebook, or on the first day of work they show up in shorts. All of this just shows how 'green' they are." (I16) "It makes me very angry, because it's like people's lack of motivation to be able to develop their careers and be more competitive. We do not have a productive mass that allows us to talk with our German or Italian peers because we do not know English, and we do not know how to deal with conflicts. These are weak points that would make us more internationally competitive." (I5) "I think there is a lack of transversal skills both in vocational training and in university students. It is quite common: we take great care to train ordinary staff because we believe that they are key to working in the environments in which we operate." (I27)
IT employers recognize that the development of transversal skills in VET workers is a relevant and difficult task to face in early stages.	"It's hard to see and evaluate junior employees who come from their first job, because you can't put them in situations." (I8)
The development of transversal skills is one of the keys to the success of workers within the company due to the importance of ongoing training.	"We place greater value on these transversal skills—how much you are prepared to work as a team, to learn—more than on the knowledge you bring, since in this industry you have to be constantly training and learning." (I1)
There is a perception of a lack of motivation on the part of VET workers to become involved and adapt to the culture of the companies.	"It is a lack of motivation in individuals to be able to develop their careers and be more competitive." (I5) "They do not measure the circumstances, the formality (...). All of this just shows how 'green' they are." (I16)

3.4. Main job positions of VET workers in IT firms

Employers indicated the positions that could be filled by VET candidates based on the jobs mentioned in Table 8. Software Developers and Front-End Developers are the most probable roles to be covered by VET workers when entering the company. The second set of jobs includes *Web and Multimedia Developers, Back End Developers* and *System and Database Administrators*, followed by *Full Stack Developers* and *QA Tester*. Positions where VET candidates are least likely to work are *UI Specialists*, *Graphic Designers* and *Mobile Developers.*

The second set of jobs with the most mentions is made up of *Web and Multimedia Developers*, *Back End Developers* and *System and Database Administrators*. It is followed by the role of Full Stack Developers and QA Tester. The group of positions

with the least number of mentions was made up of UI Specialists, Graphic Designers and Mobile Developers.

Table 8. Main job positions of VET workers in IT firms		
	VET profile job positions	**Ranking**
1	Software developer	1
2	Front-end developer	
3	Web & Multimedia developer	2
4	Back-end developer	
5	System & Database administrator	
6	Full stack developer	3
7	QA Tester	4
8	UI specialist	5
9	Graphic designer	
10	Mobile developer	

3.5. VET knowledge areas: prioritization of results

A map including 22 knowledge areas was presented to the 30 employers that participated in the interview process. Employers assessed the degree of importance of each knowledge area on a scale of 1 to 4, where '1' means "Not at all important" and '4' means "Very important" in relation to the work carried out by VET candidates.

Of the 22 knowledge areas, 13 areas (nearly 60%) obtained an average score equal to or greater than '3' on the assessment scale, which means that they are considered "Important" or "Very important" for VET profiles. These are:

- *Deployment and operation of software in the cloud (3.8)*
- *Front-end web development (3.7)*
- *Design and implementation of databases (3.7)*
- *Back-end web development (3.6)*
- *Microservices and server-less architectures (3.4)*
- *Cybersecurity (3.3)*
- *Testing techniques and test driven development (3.3)*
- *.NET y/o Java EE platform development (3.2)*

- *Data engineering (3.0)*
- *Management and planning of IT projects (3.0)*
- *Administration of application servers and internet services (3.0)*
- *Development of applications for mobile devices (3.0)*
- *Secure software development (3.0)*

Five knowledge areas were scored as being of average importance, obtaining scores of greater than or equal to '2' and less than '3' on the assessment scale:

- *Data science (2.9)*
- *Audit and security management (2.6)*
- *Internet of things (2.4)*
- *Management and configuration of ERPs (2.4)*
- *Virtual and augmented reality (2.2)*

And finally, four knowledge areas were scored with an average of less than '2' points on the assessment scale ("Slightly important" or "Not at all important"):

- *5G Network (1.9)*
- *BIM (Building information modeling) (1.7)*
- *Quantum computing (1.7)*
- *3D printing (1.5)*

	Table 9: Knowledge areas related to VET workers in IT firms	
	Knowledge areas	**Assesment**
1	Deployment and operation of software in the cloud (Kubernetes, Docker, IaaS, PaaS, AWS, Azure, Heroku, Google…)	3.8
2	Front-end web development (HTML, CSS, Javascript, Typescript, UX/UI, React, Vue.js, Angular, Aurelia,…)	3.7
3	Design and implementation of databases (SQL, MySQL, ORACLE, SQL Server…)	3.7
4	Back-end web development (PHP, JSP, ASP, HTML,…)	3.6
5	Microservices and server-less architectures (REST, Swagger, AWS Lambda)	3.4
6	Cybersecurity	3.3
7	Testing techniques and test driven development (jUnit, jMeter, Gatling, Karma, Puppeteer, Selenium,…)	3.3
8	Developments in .NET and/or Java EE platforms (C#, VB.NET, F#, ASP.NET, JSP, Java…)	3.2
9	Development of applications for mobile devices (Kotlin, ObjectiveC, Swift, Xamarin, React Native, Ionic, PhoneGap…)	3.0
10	Administration of application servers and internet services (Apache, nginx, mail, server configuration…)	3.0
11	Management and planning of IT projects with agile or traditional methodologies (Scrum, Kanban, XP, FDD, PMBOK, PRINCE2…)	3.0
12	Data engineering (Spark, Hadoop, Kafka, Scala…)	3.0
13	Secure software development. Strategic code analysis (Sonarqube, Qradar), code injection testing (XSS, SQL Injection,...)	3.0
14	Data science (Keras, Tensorflow, R, Python, BigML…)	2.9
15	Audit and security management (ISO27K, ISACA -CISA-, CEH, GDPR compliance…)	2.6
16	Internet of things (Sensors, Edge Computing, Embedded, Cloud Storage, Arduino, RaspberryPi, BeagleBone, C, C++, Zigbee, Z-Wave, LoRaWan, BLE (Bluetooth Low Energy), 802.11ax (WiFi), 6LoWPAN)	2.4
17	Management and configuration of ERPs (Salesforce, SAP/ABAP, Oracle,…)	2.4
18	Virtual and augmented reality	2.2
19	5G Network	1.9
20	BIM (Building information modeling)	1.7
21	Quantum computing	1.7
22	3D printing	1.5

Time relevance of knowledge areas

Table 10 shows that the areas for which VET candidates are best suited are those where technology is more important in the short term. This could be an indication that VET profiles are increasingly important when technologies are more established within companies and job profiles become clearer. There are six areas of knowledge that most employers consider to be important in the "Medium term": *Internet of things, Virtual and augmented reality, 5G Network, Building information Modeling (BIM), Quantum computing and 3D printing.*

Quantum Computing obtains the lowest score in the "Short term", at 0%, while *Front End Web Development* scores 96%.

Another temporal element mentioned by employers is the short life cycle of computer technologies and languages. An example of this is the .NET language, which may become obsolete in the short term, although it is currently considered to be very important. This phenomenon poses a difficulty for the VET system, which must find a way to integrate the evolutionary nature of the sector into its curricula and tools. The capacity to adapt quickly to these trends will be crucial for a quality VET system.

	Table 10. Time relevance of the areas of knowledge of VET workers in IT firms				
	Knowledge areas	**Score**	**Short term**	**Medium term**	**No answer**
1	Deployment and operation of software in the cloud (Kubernetes, Docker, IaaS, PaaS, AWS, Azure, Heroku, Google…)	3.8	72%	24%	4%
2	Front-end web development (HTML, CSS, Javascript, Typescript, UX/UI, React, Vue.js, Angular, Aurelia,…)	3.7	96%	4%	0%
3	Design and implementation of databases (SQL, MySQL, ORACLE, SQL Server…)	3.7	84%	8%	8%
4	Back-end web development (PHP, JSP, ASP, HTML,…)	3.6	88%	12%	0%
5	Microservices and server-less architectures (REST, Swagger, AWS Lambda)	3.4	68%	24%	8%
6	Cybersecurity	3.3	48%	20%	32%
7	Testing techniques and test driven development (jUnit, jMeter, Gatling,Karma, Puppeteer, Selenium,…)	3.3	60%	32%	8%
8	Developments in .NET and/or Java EE platforms (C#, VB.NET, F#, ASP.NET, JSP, Java…)	3.2	72%	8%	20%
9	Development of applications for mobile devices (Kotlin, ObjectiveC, Swift, Xamarin, React Native, Ionic, PhoneGap…)	3.0	68%	20%	12%
10	Administration of application servers and internet services (Apache, nginx, mail, server configuration…)	3.0	64%	24%	12%
11	Management and planning of IT projects with agile or traditional methodologies (Scrum, Kanban, XP, FDD, PMBOK, PRINCE2…)	3.0	68%	24%	8%
12	Data engineering (Spark, Hadoop, Kafka, Scala…)	3.0	60%	28%	12%
13	Secure software development. Strategic code analysis (Sonarqube, Qradar), code injection testing (XSS, SQL Injection,…)	3.0	60%	28%	12%
14	Data science (Keras, Tensorflow, R, Python, BigML…)	2.9	56%	20%	24%
15	Audit and security management (ISO27K, ISACA -CISA-, CEH, GDPR compliance…)	2.6	48%	24%	28%
16	Internet of things (Sensors, Edge Computing, Embedded, Cloud Storage, Arduino, RaspberryPi, BeagleBone, C, C++, Zigbee, Z-Wave, LoRaWan, BLE (Bluetooth Low Energy), 802.11ax (WiFi), 6LoWPAN)	2.4	20%	56%	24%
17	Management and configuration of ERPs (Salesforce, SAP/ABAP, Oracle,…)	2.4	32%	20%	48%
18	Virtual and augmented reality	2.2	16%	32%	52%
19	5G Network	1.9	12%	44%	44%
20	BIM (Building information modeling)	1.7	8%	32%	60%
21	Quantum computing	1.7	0%	40%	60%
22	3D printing	1.5	8%	28%	64%

3.6. Main functional areas of VET workers in IT firms

In comparison to other economic activities, IT firms operate with flexible and dynamic structures and low levels of hierarchy. In this context, VET profiles work primarily in the program development area. Their organizational charts cannot be associated with traditional schemes that have clearly delimited areas, as in the industrial sector, where there are specific departments for design, production, logistics, etc.

In general, digital companies are categorized by specific technological services or solutions (*Cloud Services, Cybersecurity, E-commerce, SAP, AI...*), which in turn can be associated with sectoral or thematic lines of work (*banking, manufacturing, SMEs, etc.*).

Companies customize technological solutions in response to client needs, based primarily on programming and development services. In many cases, companies opt for standardization and simplification of components, models and production processes to ensure greater business profitability in increasingly competitive and highly globalized markets. In this transition, VET workers are becoming more relevant.

In general, and although each company has its own nature, they seem to operate on three distinct hierarchical levels:

- The first level is comprised of programmers/developers who work to generate technological solutions;

- A second level is comprised of profiles that analyze and interpret the needs of customers and design solutions according to the capabilities of the company. To do this, the developer must understand the client's business process (sector, possibilities), and at the same time have the technical knowledge required to understand the software and technical tools used by the company. In a later phase, the analyst works with developers/programmers to efficiently implement the newly-designed technological solution;

- The third level includes project management positions, where employees manage IT projects in their entirety, from the initial approach to the final execution and delivery, including decision-making, conflict resolution, establishing deadlines, setting objectives and supplying deliverables[6].

In principle, VET workers are more closely associated with the first level, but as we will see later, in many cases they also have access to the second and third levels.

6. Source: https://www2.deloitte.com/es/es/pages/human-capital/articles/IT-Project-Manager.html

Table 11. Main functional areas of VET workers in IT firms

Results	Representative quotes
KIBS firms in general operate under flexible and simple organization charts, tending towards more horizontal and interdisciplinary structures.	"It has nothing to do with a traditional organization scheme. Consulting is very volatile so you have to have a flexible culture." (I8)
In general, VET profiles in companies participate mainly in development areas.	"In general terms, the software development area has 80% of the business model." (I15) "We call them developers. We have three different profiles of developers." (I12)

3.7. Complementarity between VET and university profiles in IT firms

A fundamental aspect of the analysis is the understanding that VET profiles in IT firms are both different from and complementary to university profiles. The difference in occupational profiles (technical and professional) is sustained on the principle of functional complementarity, whereby one profile is better suited to carrying out a series of tasks than another. For this reason, an understanding of the professional relationship between these two types of workers allows us to better understand the organization of internal work within companies, as well as the ways in which it can be optimized by the company itself or by the vocational training system.

Most employers state that there are no clear differences between the two profiles. Candidates from the VET system and university graduates start at the same point, with the same tasks (generally as developers, at the first level discussed in the previous section).

In this sense, initial access to job positions is identical regardless of whether an individual is a VET candidate or a university graduate, so every worker has the potential to follow the same career path. This means that the focus is placed to a large extent on the skills and capacities of each individual.

An analysis of career paths can therefore be established primarily by examining the learning capacity of each person, where both profiles—university and VET—tend to have similar outcomes.

Nevertheless, the employers interviewed state that there are indeed differences between the profiles in this sense. One of these differences is observed when workers enter the company. In general, university graduates show a superior capacity for abstract and theoretical thinking, which is often linked to the greater adaptability of university graduates compared to those with vocational training.

Those who have pointed to differences state that in general, university graduates also arrive with higher expectations and greater levels of motivation for career development.

However, most enterprises do not consider the type of education as a determining factor in the career path of their employees, as they consider that career development is primarily determined by the learning capacity of the employee. If employees have a high learning capacity, the career paths of employees with vocational training and university degrees tend to level out over time.

Table 12. Representative quotes about the complementarity between VET and university profiles	
Results	**Representative quotes**
Companies see learning skills as more important than the type of qualification a worker has.	"There is really no difference. For better or for worse, the important thing is not what you know, but what you are willing to learn. In that sense, the degree program does not matter." (I18) "I do not differentiate when making the selection, and once in the job position, what a person has studied is not evaluated. So basically I only measure workers by their performance." (I16)
Within firms, university and VET workers tend to have a similar career path over time.	"There are different qualities that are assessed: there are people who are technically very good, which are normally university graduates. Then there are others who are very good for management, because they are organized and have good customer service skills, and here they can be university graduates as well as VET candidates." (I20) "University education does not lose value, but in the long term they can level out." (I14)
Firms perceive that in general, university workers start out with a greater capacity for adaptation than VET profiles.	"For workers with similar potentials, the capacity of a university student to adapt is greater than that of a VET candidate in a context in which things must be solved outside of the candidate's skill set. When new things must be developed, university students are best." (I12) "University students can work faster in some stages, but there are no notable differences— it depends on the individual." (I41)
Firms in general consider that university graduates have greater levels of maturity, motivation and expectations for professional development than VET profiles.	"At the beginning, an engineer feels more secure, stronger, we always notice that. The VET profile is less ambitious than an engineer, but it is easier to gain loyalty; they stay longer in the company." (I7) "Everyone wants to be promoted to more important positions, but when they discover that this will require further training, motivation drops. Many say, 'this is what I like, I don't want more.' For me this is the main difference. Maturity in terms of teamwork and of dealing with other cultures is very different with university students, who go on Erasmus exchanges, do Master's degrees, etc." (I5)
Firms believe that university graduates arrive with greater theoretical capacities than VET profiles.	"The more abstract, more theoretical perspective, such as the understanding of the mathematical and matrix components that algorithms have, is what a university degree provides. These are degrees that focus more on the theoretical level, which many believe is useless, but it gives you a mental structure that allows you to transform the problems." (I4) "I see a little more preparation and more extensive knowledge in the university profile." (I16)

04 Conclusions

Based on the results of the analysis, the following conclusions can be drawn:

The relevance of VET workers

- VET professionals are perceived as highly relevant to the current and future development of IT firms.

- On average, half of the employees in IT firms come from the VET system.

- The vast majority of employers report that, despite having access to VET candidates, they continue to struggle to find employees. The 2022 Digital Talent and Employability report developed by the VASS Foundation[7] shows that this structural talent deficit can likewise be extended to vocational and educational training. Currently, the shortage of ICT specialists is one of the primary problems, if not the main one, for digital firms.

- Once vacancies have been filled in response to this demand, companies find it difficult to retain employees, who, due to the dynamic nature of the sector, receive multiple job offers. Some offers come from companies based abroad who offer teleworking options.

- This lack of candidates has led some companies to relocate part of their activity, moving away from large national business centers such as Madrid or Barcelona to municipalities with a direct connection to VET centers in order to attract potential employees. This strategy is an opportunity to promote local and regional development strategies.

Technical and transversal skills

- In general, candidates enter companies with a satisfactory level of transversal and technical skills (average rating of 6 on a scale of 1 to 10). However, employers perceive that there is room for improvement in both areas.

- In the case of technical skills, employers indicate that candidates arrive with a general level of knowledge which has to be adapted to the work carried out in the company. This is partly understood as a natural process since it is assumed that the VET system cannot provide highly specialized knowledge. Nevertheless, there is a feeling that the knowledge provided through VET systems should be updated, and that it could be combined with training pills on programming languages and practical cases, among other options.

- The transversal skills that require the most attention in VET profiles are related to project management and teamwork skills. Candidates lack an overarching perspective that links the needs of the customer with the possible digital solutions. In addition, VET candidates are weak in management skills and other project-related aspects (economic, financial, etc.).

- One skill that IT firms consider essential is the ability and willingness to renew knowledge. In such a dynamic economic sector, employees of IT firms need to constantly update their skill set. The ability to continue learning is highly valued and marks the difference between individuals in the sector, regardless of the employee's educational background (university degree, vocational training or other).

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7. Source: https://www.fundacionvass.org/wp-content/uploads/2022/06/Informe-Empleabilidad-Talento-Digital_-Web-comprimida-1.pdf

- Employers also identify a low English language proficiency level in VET candidates. This skill is particularly relevant for multinational companies that interact with colleagues and clients worldwide.

- Companies have established different reskilling strategies, including internal and external training programs.

Most relevant knowledge areas for VET workers in IT firms

- The role of vocational training is considered essential in most knowledge areas. Of the 22 areas on the list, 13 were identified as important in the short term: *Deployment and operation of software in the cloud, Front-end web development, Design and implementation of databases, Back end web development, Microservices and server-less architectures, Cybersecurity, Testing techniques and test driven development, Developments in .NET and/or Java EE platforms, Development of applications for mobile devices, Administration of application servers and internet services, Management and planning of IT projects with agile or traditional methodologies, Data engineering* and *Secure software development.*

- Five of the 22 areas on the list were identified by companies as important in the medium term, including *Internet of things, Virtual and augmented reality* and *5G Networks*. In contrast, the areas of knowledge considered as the least important are *Building information modeling, Quantum computing* and *3D printing.*

- The areas of knowledge that employers consider most important coincide with the more relevant areas in the short term.

- In this sense, the education system should try to cover different time periods, going beyond the immediate needs of companies. Companies are often biased by their own "production urgency", attaching great importance to the technologies they are currently developing for their technological solutions. If an education system is to prove innovative and generate meaningful talent for the different productive areas that are important in the medium to long term, it must take this into account.

Organizational structure in technological firms and the complementarity between VET workers and other workers

- VET candidates are hired by organizations that are generally more horizontal and dynamic than traditional companies, developing tasks primarily in areas as Software Developers and Front-End Developers.

- The differences between VET and university profiles are apparent at the beginning of the candidate's professional career, where VET workers are perceived as being less ambitious and less effective in situations that require abstract thinking skills. The candidate's educational background is not a main criterion in the selection processes, and the worker's career path is determined by the learning capacity of the individual.

- It is generally recognized that the career paths of VET and university profiles within companies tend to level out over time, and both have the opportunity to progress to project management positions. Progression is determined by each individual's ability to learn, progress, understand the client's needs and present the most appropriate technological solution. This similarity between the two types of worker is not common in other economic activities. An example of this can be found in industrial activities, where technical and academic workers have a limited range of tasks associated with more specific job profiles.

- This issue raises at least two reflections. On the one hand, it highlights a mismatch between the educational system and digital companies. With all of the nuances that exist, the fact that a person with a four-year university degree starts in a similar position and has the same opportunities for promotion within the company as a person with a two-year VET cycle is an indicator of this discrepancy. Another hypothesis is that the organization of work in an emerging sector such as the digital field has not yet managed to create sophisticated organizational charts that clearly differentiate technical occupations and their associated tasks. This could lead to the over-qualification of university profiles.

Possible areas of action to address the discrepancy and final remarks

- One of the aims of the VET system is to develop the skills that students need to access a successful working life. In this context, incorporating specific knowledge related to digital companies into the curriculum may be an effective strategy. This knowledge could be incorporated through existing tools, such as specialization courses or specialization programs.

- It seems clear that the educational system both at university and VET level does not respond to the employment needs and demands of this emerging sector. On the one hand, the system is unable to train the number of people required to cover the vacancies generated by the sector, and on the other hand, it cannot meet the challenge of creating appropriate training content due to the dynamic nature of the sector.

- The ecosystems that manage to address this mismatch between offer and demand will become poles for attracting companies, benefiting the employees of local companies and others.

- IT firms currently work with highly qualified workers (university and upper level VET profiles). In this context, another aspect that should be explored is whether other less qualified profiles, such as intermediate level VET workers or individuals with other professional training could respond to the demand for employees. This could give companies a wider range of potential employees, and allow other types of profiles to access a thriving sector. Currently, there are organizations that are exploring this possibility by developing boot camps and other types of professional training modalities associated with the sector.

- A further aspect that has not been addressed in the report, but which will be decisive in the coming years, is the masculinization of the sector. The urgency of promoting equal access to quality employment for women in the sector is a challenge that needs to be addressed, and could clearly have a positive impact on the number of available workers.

- IT firms indicate that they will not be able to fill their current/future vacancies with people who have graduated in fields of knowledge naturally associated with this type of activity (mainly information and communication technology). They therefore consider it necessary to extend their search to other talent pools. In this sense, the relationship between other fields of knowledge and digital skills could be explored in order to integrate them into the sector.

- The discrepancy between the offer and demand faced by the digital sector requires a holistic approach. This analysis includes a detailed vision of IT firms for facing this challenge, but in order for it to be adequately addressed, all relevant actors (training centers, students, organizations and agents responsible for job training, clusters and other sector organizations) should also be involved.