



**SME4DD**

Training SMEs for the Digital Decade



Co-funded by the  
European Union

## Training SMEs for the Digital Decade<sup>1</sup>

### D1.1. Report on upskilling needs in AI, Blockchain and Cybersecurity in Europe

**Abstract:** This document describes the results of the analysis performed on the needs of European SMEs in terms of upskilling their personnel in three domains: AI, Blockchain and Cybersecurity.

Deliverable Due date	31.10.2023
Work Package	WP1: Upskilling needs of SMEs
Dissemination level	Public
Contributing Partners:	EIT Digital BME TAG INRIA ASS KIFÜ
Quality Assurance	

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<sup>1</sup> This project has received funding from the European Union's Digital Europe Programme under grant agreement No 101100768.

Version	Date	Partner	Author(s)	Changes to previous version
1.0	31.10.2023	KIFÜ ASS		
1.1	29.11.2024	KIFÜ ASS	Ádám Kőrösi	Please see below the detailed breakdown of changes.
Rewriting chapter 4.1			added text at the end of first paragraph: (“to validate and expand on the quantitative survey data.”)	
			added text of the last paragraph which focusing on Inria activities	
			added text to INRIA’s last paragraph	
			added text to BME-KIFÜ’s second paragraph: (“and with 24 participants.”)	
			added text to BME-KIFÜ’s second paragraph (“So, the following subject has been presented:”)	
			added text to BME-KIFÜ’s second paragraph: (“Development needs of SMEs”)	
			rewriting the last paragraph of this chapter	
			added two extra paragraphs to this chapter’s closure	
Rewriting chapter 3.3			added a sentence to the “Lack of motivation’s paragraph”: (“Example: Hungarian SMEs showed limited knowledge and interest, while French SMEs generally avoided questionnaires, considering them time-consuming with no immediate benefit.”)	
			added text to the fourth paragraph’s end: (“often struggled to interpret the questions and identify their own company’s precise needs.”)	
			added a new last paragraph to this chapter	
			added text of the first paragraph: (“and to improve accessibility”).	
			added text of the second paragraph: (“and extended the survey deadline”).	
			added text of the third paragraph: (“This limited the ability to make reliable cross-country comparisons or draw statistically significant conclusions. The issue stemmed more from the quantity of responses than their quality.”)	
			create a new paragraph before the final paragraph: (“Unforeseen ageing of the data”).	
Creating a new chapter 4.2			Chapter name: Course design	
Adapting the previous 4.2 / 4.3 / 4.4 chapters to the new structure and chapter 4.2			4.2 chapter become: 4.2.1 4.3 chapter become: 4.2.2 4.4 chapter become: 4.2.3	
Optimizing figures in chapter 3.4.1			Figure XVI: removed absolute values; The entries “Agriculture”, “Aerospace”, “Chemical and Pharmaceutical”, “Defense”, “Hospitality and Tourism”, “No reply”, have been grouped under "Other".  Figure XVII: data from the four countries have been combined into a single chart showing the sector breakdown of respondents regardless of their geographic origin. The numbering of all subsequent figures has been revised accordingly.	
Optimizing figures from XIII to LXVIII			Removed the column reporting absolute values from all the figures in the report.	

## Table of Contents

<b>Table of Contents .....</b>	<b>3</b>
<b>1 Introduction: WP1, Upskilling needs of SMEs .....</b>	<b>4</b>
<b>2 Review and mapping of digital upskilling needs .....</b>	<b>6</b>
<b>2.1 The methodology.....</b>	<b>6</b>
2.1.1 The desk research .....	6
2.1.2 The DTT tool-based analysis .....	6
<b>2.2 The Findings .....</b>	<b>7</b>
2.2.1 The desk research .....	7
<b>3 Understanding of SMEs digital upskilling needs.....</b>	<b>27</b>
<b>3.1 Survey methodology .....</b>	<b>27</b>
<b>3.2 Structure of the survey.....</b>	<b>27</b>
<b>3.3 Survey submission and promotion.....</b>	<b>29</b>
<b>3.4 Preliminary analysis .....</b>	<b>30</b>
3.4.1 Company profile and data management .....	31
3.4.2 Company profiles by country.....	42
<b>3.5 Artificial Intelligence: strategy, need and skills.....</b>	<b>43</b>
3.5.1 AI company adoption by country.....	53
<b>3.6 Blockchain: strategy, needs and skills .....</b>	<b>55</b>
<b>3.7 Cybersecurity: strategy, need and skills .....</b>	<b>71</b>
3.7.1 Cybersecurity company adoption by country.....	77
<b>3.8 Courses: the best way to master your skills.....</b>	<b>78</b>
3.8.1 Course preference by country .....	83
3.8.2 Contact interest in future SME4DD courses .....	84
<b>4 Conclusions and next steps.....</b>	<b>86</b>
<b>4.1 Workshops .....</b>	<b>86</b>
<b>4.2 Course design .....</b>	<b>89</b>
4.2.1 Blockchain.....	90
4.2.2 The network established around the project as a result of interactions in Task 1.2 will facilitate further connections with the relevant audience of the training programs offered by the project and help build a pool of SMEs in need of upskilling in AI, Blockchain, and Cybersecurity in SME4DD focus countries.Artificial Intelligence .....	91
4.2.3 Cybersecurity.....	92
<b>Annex 1 – Desk research resources.....</b>	<b>94</b>
<b>Annex 2 – List of figures.....</b>	<b>102</b>

## 1 Introduction: WP1, Upskilling needs of SMEs

The aim of the upskilling the needs of SMEs Work Package (WP1) is to lay the foundations for the professional work of WP2 with regard to the upskilling needs of European SMEs in three digital technology domains: AI, Blockchain, Cybersecurity with a particular focus on France, Hungary, Italy, and Sweden.

Activities within the WP took place within the framework of two groups of tasks: 1) mapping of existing, relevant professional analyses and revision, evaluation and analysis of studies and the results of key initiatives, and 2) collecting evidence by assessing stakeholder needs by means of surveys and workshops: With regard to the target group of SMEs and with their representative and direct involvement, questionnaires will be provided to relevant employees, managers, executives and high-skilled workers requesting them to give feedback on their professional needs and priorities, which will be analysed and evaluated. In addition, to verify the survey results and obtain more accurate and specific responses, workshops will be held for participants of the surveys and potentially other target audiences and companies.

The outcome and the findings of the above mapping activities will be directly channelled to training institutions, which will include them and take them into consideration when finalising the course materials.

As a result of the above activities, we will be able to gain reliable, credible and up-to-date insight into the upskilling of digital skills needs of the target group in the three technology areas, and relevant training will be elaborated and prepared accordingly in a well-founded way, with several review perspectives.

The main activities to review and map of digital upskilling needs are:

- Identifying the methodology data and information collection in line with the objective.
- Identifying concrete sources of information and relevant studies to be researched in connection to the upskilling needs of European SMEs in the three selected digital technology domains and mapping SME needs in the identified studies, strategy papers, and work documents.
- Analysing the relevant key documents.
- Defining the conclusions and findings.

The WP1 objective is twofold:

- To collect the upskilling needs of European SMEs in three digital technology domains: AI, Blockchain, and Cybersecurity, with a particular focus on France, Hungary, Italy and Sweden.
- To reach and connect with relevant SMEs in need of upskilling in AI, Blockchain, or Cybersecurity in four focus countries (France, Hungary, Italy, and Sweden).

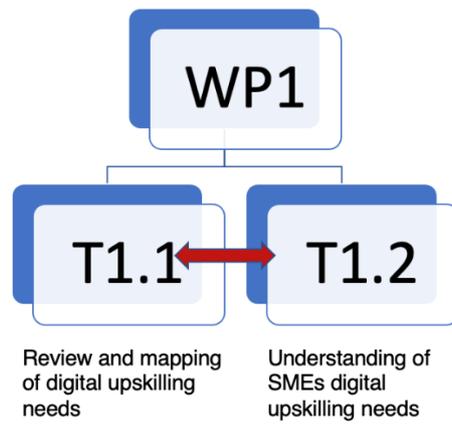


Figure I. Structure of WP1 tasks

Task 1.1 aims to review the existing literature linked to the needs of European companies, in particular SMEs, for upskilling in the three areas.

Task 1.2. looks into collecting data from companies in Europe to gain first-hand information and insights into their needs for upskilling in AI, Blockchain and Cybersecurity, with particular attention to the four focus countries of this project (France, Hungary, Italy, Sweden).

## 2 Review and mapping of digital upskilling needs

In reviewing and mapping the digital upskilling needs of SME4DD's general target audience, Task 1.1 relied in the first stage on the existing knowledge and previous mapping activities run by all the project partners. Via the desk research, we scouted mainly for general information about the project's target audience. In order to gain more insightful knowledge, we went beyond the initial task plan and performed more in-depth research by using the Deep Tech Talent (DTT) Tool, an AI-based platform. With the support of this tool, we identified more country and domain-specific information in terms of knowledge and skills needed for the SME4DD target audience while also identifying some related courses on the market.

### 2.1 The methodology

#### 2.1.1 The desk research

In view of running the desk research, we initially invited all the partners to provide pointers to relevant documents by filling in a predefined table stored on the SME4DD data repository hosted under the EIT Digital Shar Point. Between the items collected were source title/ authors/ link/topic relevance/ industry relevance/ country relevance. Together with the partners, we identified 43 targeted resources (studies, reports, articles, statistics), the vast majority issued in 2021 and 2022.

As part of the desk research, we looked into answering the following main questions linked to the target audience:

- What is the level of digitisation of SMEs?
- What are the obstacles for the SMEs to adopt the technologies?
- What are the characteristics of the teaching models appropriate for SMEs?
- What are the main highlighted business aspects of AI, blockchain and cybersecurity?
- What are the opportunities and best practice scenarios for SMEs in digitalisation?

The main findings of the desk research are presented in the subsequent sub-chapter. We are also including in Annex 1 the collection of sources of information for further use of the project ecosystem.

#### 2.1.2 The DTT tool-based analysis

The Deep Tech Talent (DTT) tool was developed by the [EIT KICs for the AI community](https://kic-ai-mapping.cognitive.city/)<sup>2</sup> to assist in identifying the missing skills in different EU regions while recommending companies/individuals relevant courses covering those skills. The database contains information about (1) AI startups/companies and their employees' skills extracted from the LinkedIn profiles and (2) AI specialised courses. Both the employees' skills and the course objectives are mapped against the [ESCO](https://esco.ec.europa.eu/en)<sup>3</sup> (European Skills, Competences, Qualifications and Occupations) framework. Since it offers a “common language” on occupations and skills at the EU level, we considered it relevant to take advantage of the ESCO structure for the

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<sup>2</sup> <https://kic-ai-mapping.cognitive.city/>

<sup>3</sup> <https://esco.ec.europa.eu/en>

purpose of the project, both in terms of defining and delivering the courses and in terms of Certification.

Within the framework of the project, we used the DTT tool by expanding the database of companies and courses to the domains of interest, namely cybersecurity, blockchain, and AI. We thus invited the project partners to:

- (1) Suggest companies to be analysed for identifying the missing skills in the countries targeted by the project.
- (2) Identify the role profiles to be targeted by the SME4DD courses, along with the associated main set of knowledge and skills.
- (3) Provide details on the current version of courses to build on under WP2 to help better match the existing content against different role profiles we plan to target while also identifying the possible needed skills not covered currently by the SME4DD partners courses portfolio.

The analysis done under the DTT platform looked into responding to more country and domain-specific questions, namely:

- What are the missing skills per target audience Categories (SMEs – managers, IT professionals, non-IT professionals) in the targeted Verticals (AI, blockchain, cybersecurity)? - comparison at the targeted country level, regional level, and European level
- What are the skills covered by the SME4DD courses with respect to the target audience?
- What skills are needed on the market but not covered by the SME4DD courses?
- What are the European courses covering the missing skills identified?

## 2.2 The Findings

### 2.2.1 The desk research

The assessment of the SMEs' skills development needs and models must be evaluated considering the different realities and challenges of the European market, such as the digitalisation maturity and technology accessibility and uptake.

#### 2.2.1.1 SMEs and Digitalisation

The digitalisation of SMEs is a significant challenge: various evidence suggests that SMEs are hesitant when it comes to adopting new technologies. Despite market volume or business growth opportunities, most SMEs keep lagging behind. The EC initiative on [Skills for SMEs](#)<sup>4</sup> looked into finding the root causes and remedies to this situation. Between the findings, the following elements were prevalent:

- SMEs are increasingly under pressure as they compete with large companies in a tense job market.

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<sup>4</sup> <https://op.europa.eu/en/publication-detail/-/publication/82aa7f66-67fd-11ea-b735-01aa75ed71a1/language-en>

- Significant skills-related issues exist across company roles: there is a lack of digital leadership skills at the top, a shortage of IT professionals and a severe lack of adequate skills amongst users.
- Skills shortages, gaps and mismatches hinder organisations from defining their growth strategy, implementing it and enabling employees to use new technologies.

The PWC analysis regarding [What challenges do SMEs and entrepreneurs face in CEE?](#)<sup>5</sup> shows that despite massive efforts and improvements in digitalisation in CEE, smaller enterprises still lag behind the larger ones when it comes to digital activity. The slower progress is mainly due to:

- Lack of resources: Limited human and organisational capital, insufficient digital skills, and the lack of resources to train employees make it hard to adopt digital technologies.
- Insufficient understanding of benefits - without understanding the broader impact of digitalisation, it is hard to create a clear, informed business case that puts the opportunities and gains above the high cost.
- Concerns around cybersecurity and data privacy: This is another area where mitigation strategies are needed to understand and balance the risks with the benefits.

The [DESI Digital Scoreboard](#)<sup>6</sup> index related to the Digital Intensity of SMEs with at least a basic level of digital intensity shows a level of slightly over 40% at the EU level. Regarding the SME4DD targeted countries, it can be observed that France and Italy are scoring a bit below, respectively, above the EU level. On the other hand, Hungary reports a digital intensity level of almost 20% compared to Sweden, which is in the top 3 EU countries with more than 80% digital intensity.

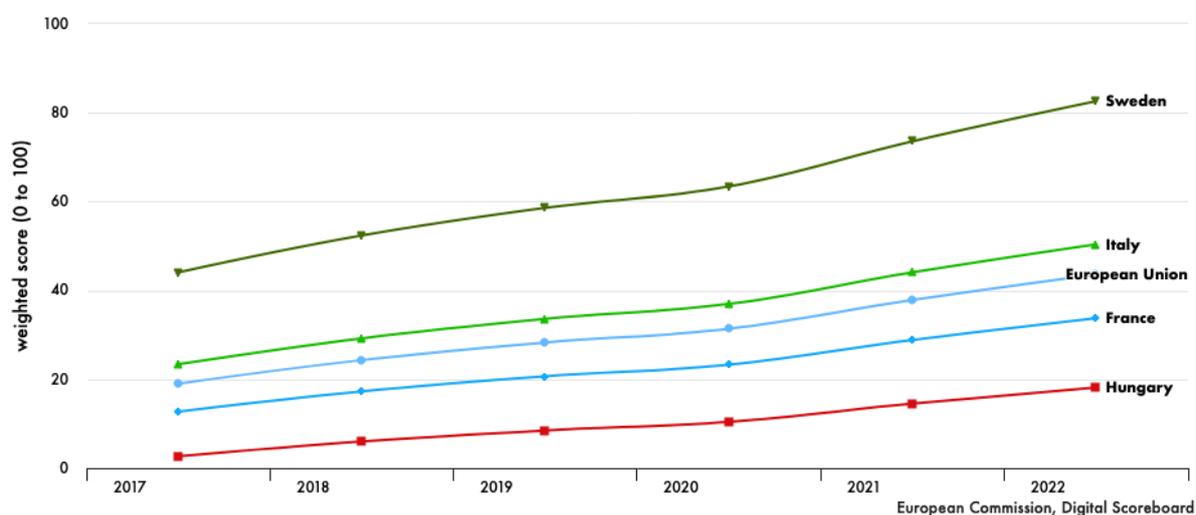


Figure II. Digital intensity by SMEs with at least a basic level of digital intensity, in SME4DD countries

These findings are backed by the [2020 OECD study](#)<sup>7</sup>, which states that SMEs lag in the digital transition despite potentially tremendous benefits. The OECD study concludes that SMEs must be better prepared to adapt their operations for digital adoption, and the stakes are

<sup>5</sup> <https://www.pwc.com/c1/en/future-of-government-cee/entrepreneurship-and-smes-in-CEE.html>

<sup>6</sup> <https://digital-agenda-data.eu/datasets/desi/visualizations>

<sup>7</sup> <https://www.oecd.org/industry/smes/PH-SME-Digitalisation-final.pdf>

high. Not only because SMEs are the main form of business in most countries and regions and play a key role in building inclusive and resilient societies but also because digital gaps have proved to weigh down on a country's productivity. The COVID-19 crisis has exemplified how differences in digital maturity and preparedness could undermine business resilience and their chances of faster recovery.

But a digitised company, or one in the process of being digitised, requires skilled/specialised personnel to handle the specific technologies and deal with the associated risks brought by these technologies. One of the structural barriers to digital adoption flagged by the Institute for Competitiveness in the report [SME adoption of digital technologies: a Transatlantic view](#)<sup>8</sup> appears to be an internal skills gap that prevents managers and workers from identifying the digital solutions they need and adapting business models and processes accordingly. The SME digitalisation might be a challenge if looking at the progression of the new generation of ICT graduates and ICT specialists in the SME4DD targeted countries, as displayed by the DESI Digital Scorecard. The two indicators were pretty stable over the last 3 years, with few exceptions: while Hungary experienced a sharp drop in 2022 (there might be hidden influencing factors not detailed in the referred report. After/during CV-19, the general requirement of a foreign language exam for a diploma has been relaxed in Hungary), Sweden saw an increase in graduates in 2022 as compared to 2021 while continuing to expand its pool of ICT specialists, as shown in Figure III. and Figure IV. It is worth flagging the low number of ICT graduates in Italy compared to the EU level of this indicator.

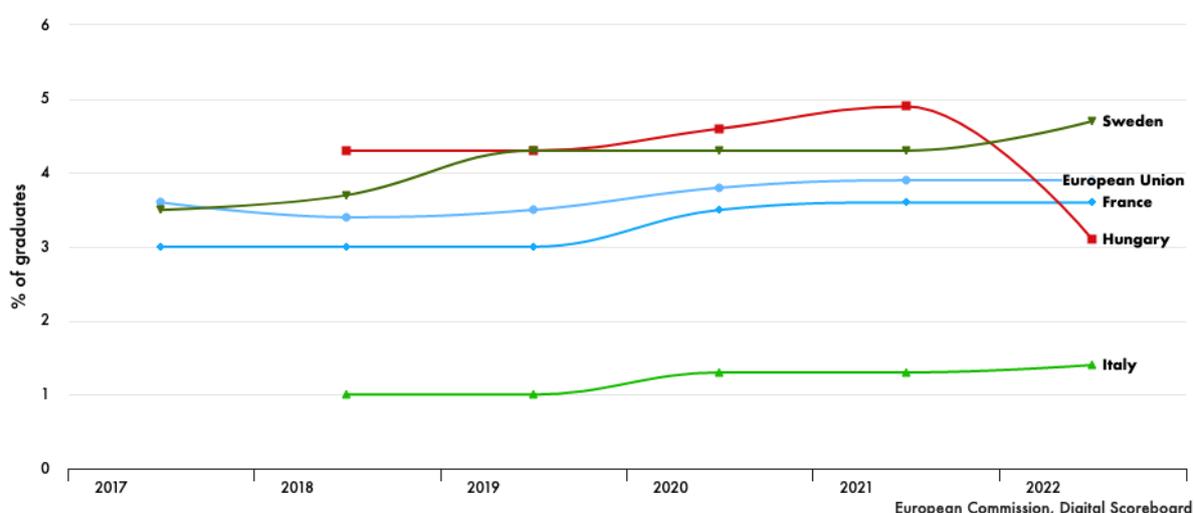


Figure III. ICT graduates in SME4DD countries

<sup>8</sup> [https://www.transatlantic.org/wp-content/uploads/2022/01/11-03-2021-SME-digitalization\\_SdE-GM-final.pdf](https://www.transatlantic.org/wp-content/uploads/2022/01/11-03-2021-SME-digitalization_SdE-GM-final.pdf)

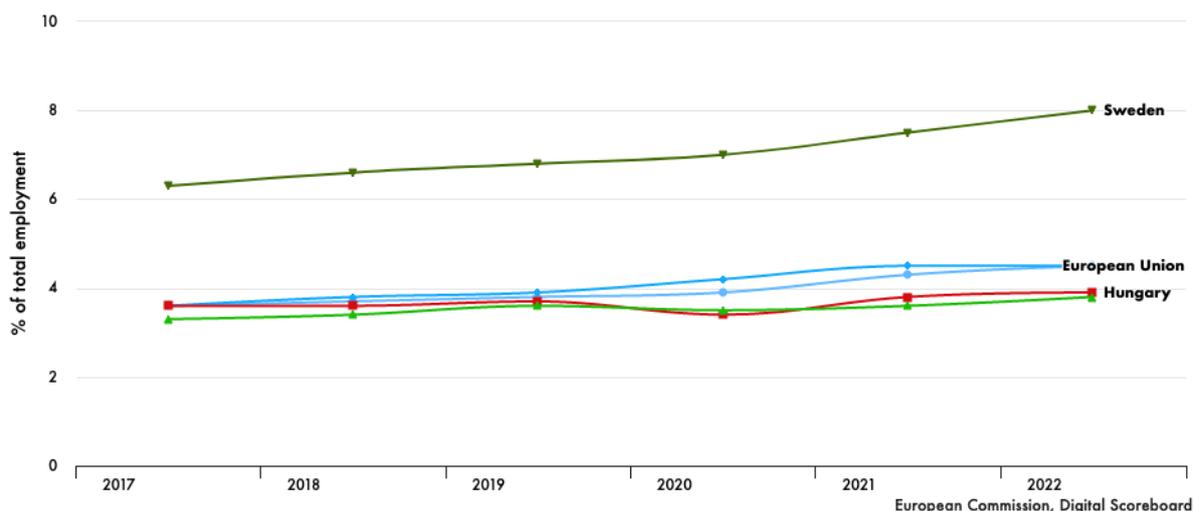


Figure IV. ICT specialists in SME4DD countries

Yet, only a fraction of these specialists are finally hired by SMEs, as shown in the [DESI – Integration of digital technologies 2021](#)<sup>9</sup> report and also depicted in Figure V. below.

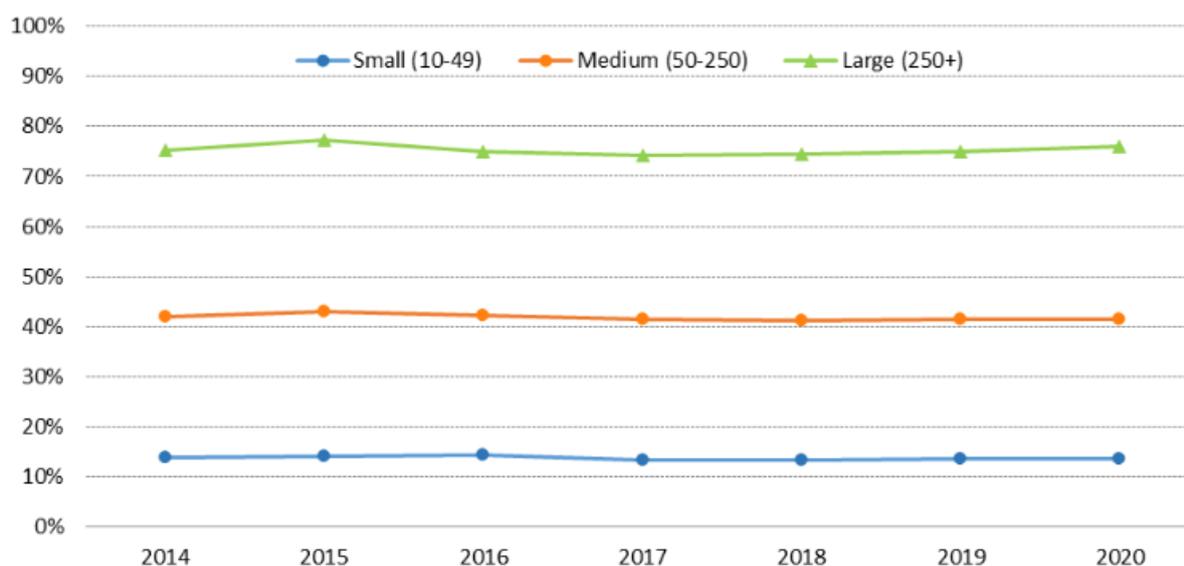


Figure V. Enterprises employing ICT specialists (% of enterprises)

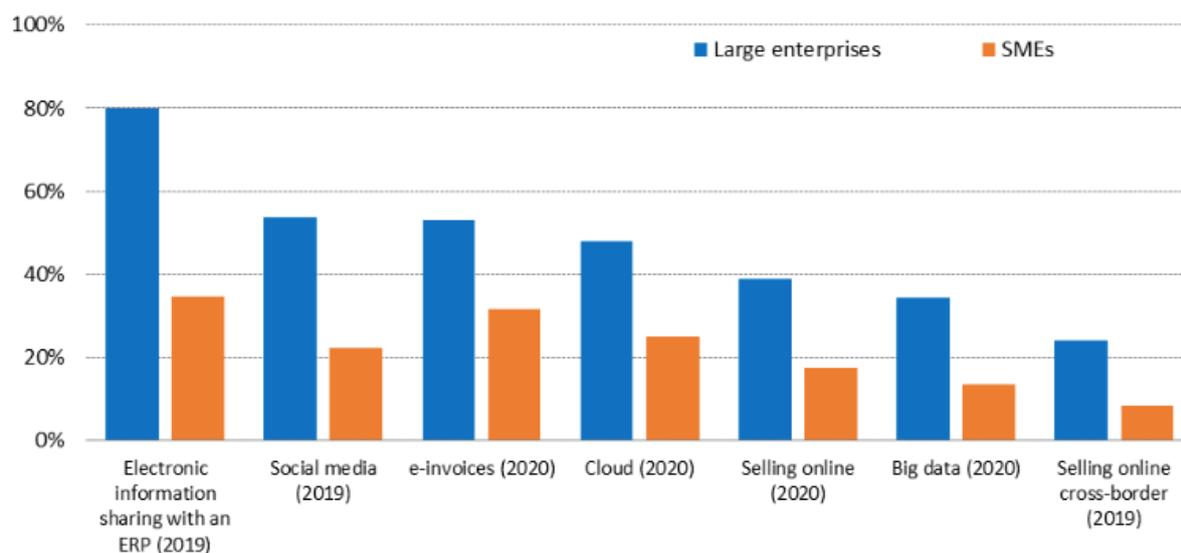
### 2.2.1.2 SMEs and Advanced Digital technologies

Digital technologies enable businesses to gain competitive advantage, improve their services and products and expand their markets.

When it comes to the usage of digital technologies, SMEs tend to digitalise general administration and marketing operations first, with a level of business-to-government interactions or an intensity of the use of electronic invoicing. The comparison between types of enterprises with respect to the adoption of digital technologies shows that, for instance, electronic information sharing through enterprise resource planning (ERP) software is much

<sup>9</sup> <https://digital-strategy.ec.europa.eu/en/policies/desi-integration-technology-enterprises>

more common in large enterprises (80%) than in SMEs (35%). MEs exploit e-commerce opportunities to a limited extent, as only 17% sell online (versus 39% of large enterprises) and only 8% sell cross-border online (24% for large enterprises).



Source: Eurostat, European Union survey on ICT usage and e-commerce in enterprises.

Figure VI. Adoption of digital technologies (% enterprises)

Related to the SME4DD country focus, a zoom-in into this DESI indicator related to the integration of Digital technologies over the last 5 years shows a correlation with the ICT graduates and ICT specialists' trends for Sweden, France and Hungary. Italy comes as a surprise with above the European Union average on the integration of digital technologies in the context of very low number of ICT graduates reported. This could be explained by the medium number of ICT specialists registered.

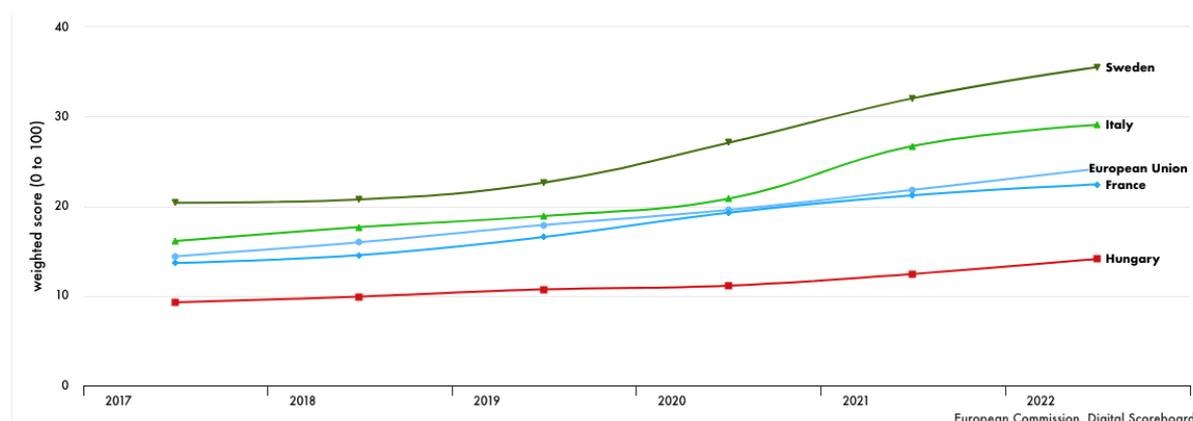


Figure VII. Integration of Digital Technology, by Digital technologies for business, in SME4DD countries

SME gaps in adoption increase when technologies become more sophisticated. These are generated by the different barriers the SMEs face when adopting new technologies. Specific barriers are listed in the report [Skills for SMEs - Cybersecurity, Internet of things and big data](#)

[for small and medium-sized enterprises](#)<sup>10</sup> put together by Capgemini Invent together with the DIGITAL SME Alliance and Technopolis, such as the dominance of domain specialists, shortage of in-house data analytic expertise, bottlenecks in the labour market in case of the big data adoption.

### 2.2.1.3 Cybersecurity

Cybersecurity as a concept in an industrial and business environment was considered in the past as an afterthought of the design and operation of the Informational Technology systems process. This had to do with the lack of proper training and security awareness of the business/industrial professionals involved in such environments. In light of many cybersecurity attacks that have sometimes caused disorder at the European and international level and produced considerable risks and damages, this attitude has considerably changed.

A report issued by the World Economic Forum addressing the [Principles for Board Governance of Cyber Risk](#)<sup>11</sup> mentions that cybersecurity is a strategic business enabler, and it is vital to understand the economic drivers and impact of cyber risk. The boards should align cyber-risk management with business needs while ensuring the organisational design supports cybersecurity.

On the other hand, in an OECD study linked to the digital transformation of SMEs related to cybersecurity – [The Digital Transformation of SMEs - Digital security in SMEs](#)<sup>12</sup>, the authors state that SMEs tend to have less comprehensive and sophisticated digital security risk management practices than big companies. They often do not have a dedicated person in-house, tend to seek less information from external sources and are not likely to have formal procedures in place to detect intrusions. They also tend to invest less in digital security, due partly to their lower relative size by revenue, although this varies between sectors and countries.

In the project named Concordia, [a short research](#)<sup>13</sup> was conducted to examine the approach of publicly available studies and other sources in relation to cyber security considerations for SMEs.

According to the results of the investigation, the publicly available educational resources aimed at the very basic issues, and primarily intend to increase the awareness and orientation of employees.

The research identified the following topics in order of occurrence:

- employee awareness
- software use
- virus removal
- network protection
- management of backup copies

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<sup>10</sup> <https://op.europa.eu/en/publication-detail/-/publication/82aa7f66-67fd-11ea-b735-01aa75ed71a1/language-en>

<sup>11</sup> [https://www3.weforum.org/docs/WEF\\_Cyber\\_Risk\\_Corporate\\_Governance\\_2021.pdf](https://www3.weforum.org/docs/WEF_Cyber_Risk_Corporate_Governance_2021.pdf)

<sup>12</sup> [https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes\\_cb2796c7-en#page1](https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_cb2796c7-en#page1)

<sup>13</sup> <https://www.concordia-h2020.eu/wp-content/uploads/2023/03/concordia-report-SME.pdf>

- recognition of incidents
- internal training
- password management
- encryption
- roles
- security monitoring
- physical security
- access management

Concordia project research also found that none of the analysed sources addressed the business/economic aspects of cybersecurity.

The document entitled "[Cybersecurity for SMEs - Challenges and Recommendations](#)<sup>14</sup>" published by ENISA provides a detailed overview of the cybersecurity topic from a human, technical and process perspective.

According to the results of a survey of 249 businesses from 25 EU countries, 85% of respondents rate cyber security as a key business factor. This is mirrored in the information that the majority of SMEs (>80%) process critical information. This survey also identified a low level of awareness within SMEs and insufficient emphasis on cybersecurity-related roles.

CISA Cybersecurity & Infrastructure Security Agency has published several documents for SMEs. The document entitled "[Cyber Guidance for Small Businesses](#)<sup>15</sup>" uses a novel approach, emphasizes individual company roles, and highlights the importance of the commitment of the managers.

In the case of the CEO, the development of the internal culture and the active support of the IT area arise, while an independent program manager can be responsible for the organization of internal trainings and practices.

An analysis published in the IEEE Access journal entitled "[A Survey on the Cyber Security of Small-to-Medium Businesses: Challenges, Research Focus and Recommendations](#)<sup>16</sup>" cites many references regarding the factors of business challenges.

Among the key findings, it states: "Based on the major role that SMBs play in the economy, it would be expected that they would adequately implement cyber security strategies."

IEEE Access points out that SMEs should adopt cyber security frameworks - like NIST - to guide their cyber security implementations. NIST developed a [basic version](#)<sup>17</sup> of its Framework specifically for SMBs.

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<sup>14</sup> <https://www.enisa.europa.eu/publications/enisa-report-cybersecurity-for-smes>

<sup>15</sup> <https://www.cisa.gov/cyber-guidance-small-businesses>

<sup>16</sup> <https://ieeexplore.ieee.org/document/9853515>

<sup>17</sup> <https://nvlpubs.nist.gov/nistpubs/ir/2016/NIST.IR.7621r1.pdf>

The IEEE Access article cites other professional sources:

- It is [reported](#) <sup>18</sup>by the National Cybersecurity Alliance that about 60% of small businesses that were victims of a cyberattacks went out of business within six months. This demonstrates that small businesses have a lot to lose by cyber attacks.
- In [Ponemon Report 2018](#)<sup>19</sup> “State of Cyber Security in SMBs” study, one of key takeaway were to strengthen SMEs cybersecurity postures, companies need more in-house expertise and budget. However, almost half (47 percent) of respondents say they have no understanding of how to protect their companies against cyber attacks.
- Milos Zec from Linnaeus University [found](#) <sup>20</sup>that awareness levels of IT professionals in SMBs is low due to the lack of appropriate education since they are not dedicated to cyber security tasks.

#### 2.2.1.4 Blockchain

According to the paper issued by Small Business Standards (SBS) and European Digital SME Alliance - [SME Guide on Blockchain and Distributed Ledger Technology](#),<sup>21</sup> the EU blockchain market is expected to be valued at around €59bn by 2028. SMEs can use blockchain to grow their businesses and lead the way in digitalisation and sustainability.

In the near future, the scope of using blockchain will widen by the many possibilities of trust management. This will have a huge economic impact in the digital sectors, allowing faster interactions and transactions, reducing costs, increasing effectiveness, and opening the door to automation in a world of many new types of services. Blockchain can also support better digital identification to enhance trust management. As blockchain networks can be decentralised and autonomous, SMEs can transact directly with each other and the clients without intermediaries.

The report emphasises that blockchain technology is also beneficial for non-ICT sectors to become more efficient and sustainable through authenticated transactions and increased transparency methods. Moreover, the document provides an update on EU policy developments and the geopolitical challenges that SMEs may face in using the proposed technology and standards.

Yet, the OECD study on blockchain, [The Digital Transformation of SMEs – How can Blockchain ecosystems serve SMEs?](#),<sup>22</sup> mentions significant challenges to technology diffusion among SMEs. These include low awareness of relevant features of blockchain, lack of interoperability across different systems, limited access to digital infrastructure (mobile and fixed high-speed broadband connection) and uncertainty over legal responsibilities. Insufficient awareness and understanding of blockchain technology and applications represent a key obstacle to

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<sup>18</sup> <https://www.inc.com/joe-galvin/60-percent-of-small-businesses-fold-within-6-months-of-a-cyber-attack-heres-how-to-protect-yourself.html>

<sup>19</sup> <https://www.keepersecurity.com/assets/pdf/Keeper-2018-Ponemon-Report.pdf>

<sup>20</sup> <http://www.diva-portal.org/smash/get/diva2:849211/ATTACHMENT01.pdf>

<sup>21</sup> <https://sbs-sme.eu/news/new-sme-guide-blockchain-and-distributed-ledger-technology-developing-smes-strengths-lead>

<sup>22</sup> [https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes\\_18ac5acb-en#page1](https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_18ac5acb-en#page1)

adoption, in particular by SMEs. Despite the introduction of use cases beyond cryptocurrencies, trust in the technology is being affected by “booms and bursts” and frauds associated with virtual sets. Wider technology adoption depends on entrepreneurs’ understanding of blockchain applications’ potential benefits, use cases, and challenges. SMEs can benefit from using blockchain to increase business efficiency, the quality of products and services, enhanced supply chain utilisation and blockchain-driven innovation in business models.

The lack of skills is identified as an important blockage of implementation. Without a proper level of understanding, building trust among possible users is challenging. For a blockchain system to become the standard in a supply chain, it has to be accepted and understood by all participants. This creates a strong barrier to a wide range of adoption. This experience can also be a setback for companies that might otherwise have been able to improve on their own side, but their partners failed to do so.

On the same line, the [BEGIN Blockchain project](#)<sup>23</sup> lists in its [Guide to blockchain competencies](#)<sup>24</sup> the challenges and barriers the SMEs were identified as facing in the process of integrating the blockchain technologies: distrust and misconceptions, cost of integration, blockchain skills shortage, privacy and security concerns, and regulatory barriers. While mentioning the advantages of implementing the technology, the guide includes a list of [EntreComp](#)<sup>25</sup> (see Figure VIII.) and DigiComp-based key entrepreneurship competencies that entrepreneurs, and SME managers should develop when integrating blockchain into their business.

DigiComp offers a tool to improve citizens’ digital competence. DigiComp classifies 5 main digital competence areas: 1) Information & Data Literacy, 2) Communication & Collaboration, 3) Digital Content Creation, 4) Safety, and 5) Problem Solving.

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<sup>23</sup> <https://www.beginblockchain.eu/>

<sup>24</sup> <https://www.beginblockchain.eu/blockchain-competencies-guide-success-stories-en/>

<sup>25</sup> <https://ec.europa.eu/social/main.jsp?catId=1317&langId=en>

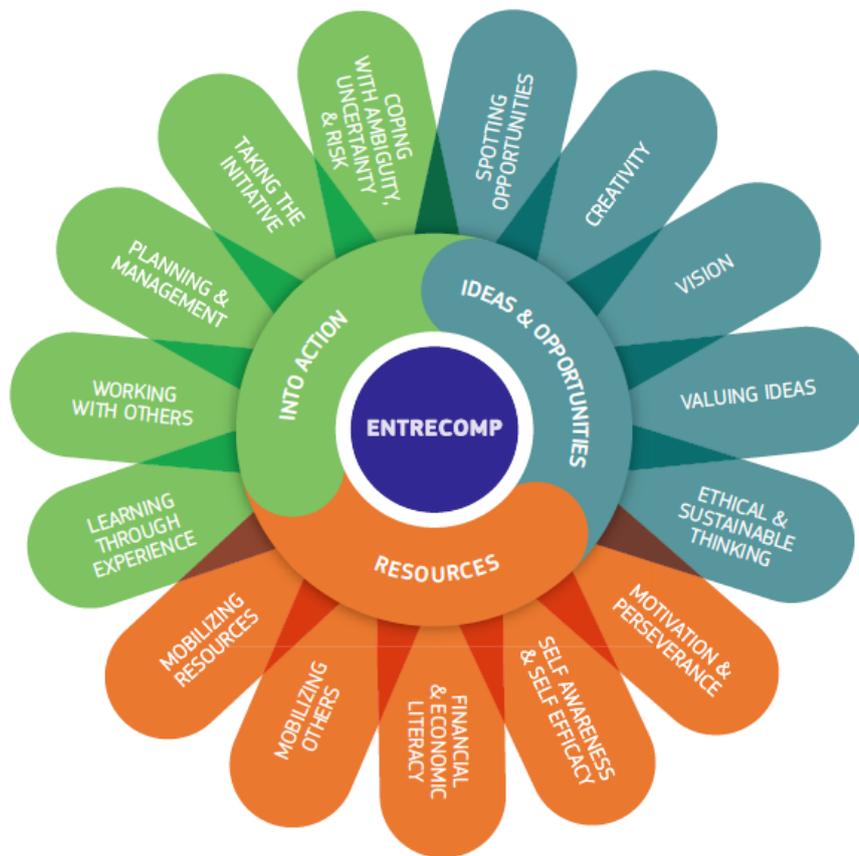


Figure VIII. Areas of competences of Entrecomp

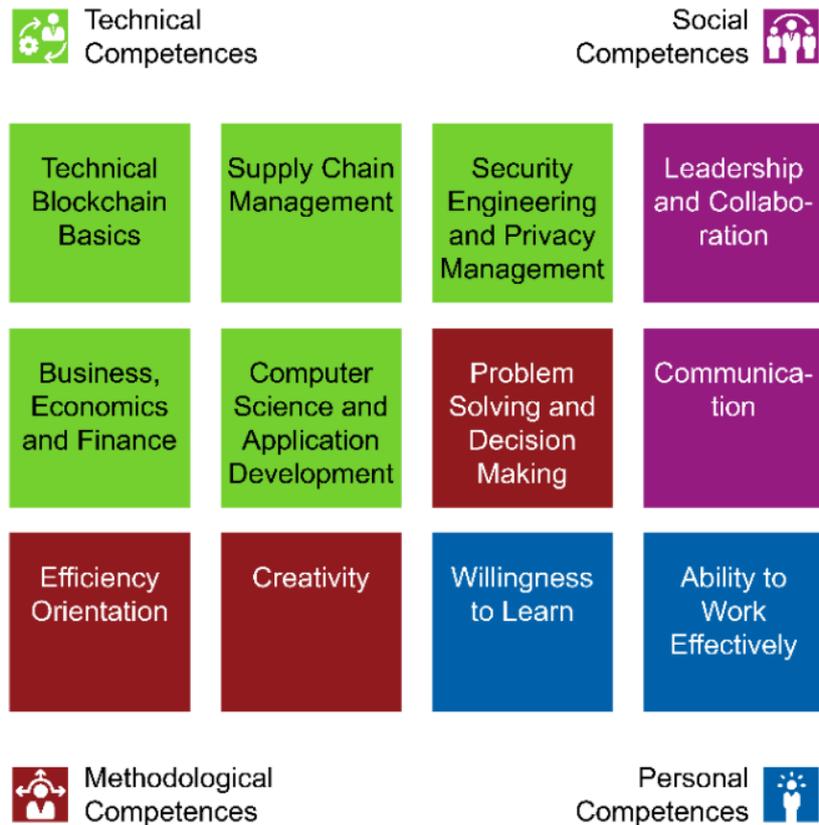
The report points out that blockchain cannot be easily taught; courses need practical and real-life examples for learners. Developing material based on case-based learning (CBL) or problem-based learning (PBL) is suggested, where learners can work on real-life challenges. Educators should also express the digital innovation process and design thinking principles. This will be useful for learners to identify the right pain points and problems to solve.

For the interdisciplinary approach, there is a deeply elaborated example resource called [BlockNet – Blockchain Network Online Education for Interdisciplinary European Competence Transfer](#)<sup>26</sup>. The insights gained in this project were empirically validated by case studies with European firms in order to identify the best practice use cases for blockchain and the required skills and competencies. It also provides a comprehensive and systematic analysis of skills and competence needed to be covered in an online course.

Furthermore, we can learn about a detailed competence model in the BlockNet [White Paper](#)<sup>27</sup> (Exploring the Blockchain Skills Concept and Best Practice Use Cases). The BlockNet interdisciplinary blockchain competence concept includes interdisciplinary skills related to technical, methodological, social, and personal competencies expected (or required) from graduates of higher education institutions for working on Blockchain-related projects/jobs. See Figure IX.

<sup>26</sup> <https://ifo.tu-dortmund.de/blocknet-blockchain-network-online-education-for-interdisciplinary-european-competence-transfer/>

<sup>27</sup> <https://arxiv.org/ftp/arxiv/papers/2102/2102.04333.pdf>



### BlockNet Competence Model

Figure IX. BlockNet Competence Model

There is a crucial source of skill related information in the repository of the [CHAISE project](#)<sup>28</sup>. The core mission of the CHAISE project was to develop a strategic approach to blockchain skills development for Europe and to deliver future-proof training solutions to tackle blockchain skill shortages and respond to the European Blockchain workforce's current and future skill needs.

The European Blockchain Skill Strategy builds on over one year of extensive research carried out by the CHAISE partnership, analysing the blockchain labour market and the supply and demand of blockchain skills, as well as on numerous consultations with key European stakeholders. The main aim of the strategy was to address what to teach (which skills), to whom (identifying the stakeholders), and how (strategies and action plans).

The CHAISE report reviews the labour market needs. The main takeaways are:

- recruitment is mostly around development and engineering,
- over 50% of all blockchain job adverts are concentrated in four countries: Belgium, Germany, France, and Italy,

<sup>28</sup> <https://chaise-blockchainskills.eu/wp-content/uploads/2022/05/CHAISE-European-Blockchain-Skills-Strategy.pdf>

- companies are aware of the lack of blockchain-skilled employees, and therefore, they rely on in-house training,
- The connection is limited between education institutions and the market players; therefore, training institutions respond slower than necessary to market needs.

Regarding the upskilling approaches, the strategical report highlights these methods:

- use-cases/case studies,
- sandboxes,
- hackathons,
- coaching or mentoring,
- project-oriented teaching activities,
- organise lectures, talks and discussions,
- participate in collaborative actions with universities,
- professional organisations and public authorities,
- collaborate on publishing material (books, documents, reports, guidelines, etc.) with professional organisations,
- adopt an interdisciplinary approach through conferences, networking, and common projects.

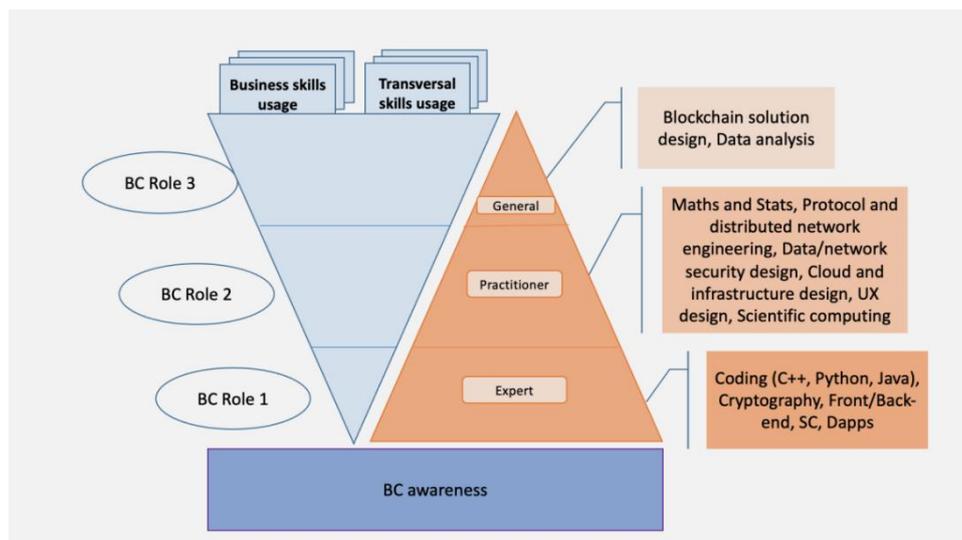


Figure X. CHAISE-European-Blockchain-Skills-Strategy Figure provides an overview of existing training programmes

Source: [Registry of Blockchain educational and training offerings](#)

The [Study on Blockchain Skills Demand](#)<sup>29</sup> (2021) offers relevant findings for understanding SMEs' upskilling needs. In the CHAISE online survey, firms were asked about the type of role employees work with blockchain. The 5 most common answers were in roles related to product development (49%), solution architecture (48%), business development (46%), blockchain technical engineering (46%) and research (43%).

<sup>29</sup> [https://chaise-blockchainskills.eu/wp-content/uploads/2021/09/CHAISE\\_D2.3.1\\_Study-on-Blockchain-Skill-Demand.pdf](https://chaise-blockchainskills.eu/wp-content/uploads/2021/09/CHAISE_D2.3.1_Study-on-Blockchain-Skill-Demand.pdf)

Same survey respondents further stated that a key aspect of employment was to focus not just on particular Blockchain-related occupations, but on existing occupations that need to understand the potential of integrating Blockchain key properties (distributed traceability, trust, etc.) in products/industry sectors.

Firms that indicated they experienced recruitment difficulties were asked about the main reason for these difficulties. Five firms (50%) answered that there is a low number of applicants with the required skills, while 65 firms (43%) answered that there is a low number of applicants in general.

The relevant survey question was: “Which educational courses are most needed to support better the talent you seek to attract within your county?”. Technical-related courses were the most frequent answer (128 firms, or 42%). More specific courses, including “industry-specific use cases” and “solution architecture”, are indicated by 54 (18%) and 48 (16%) firms, respectively. However, 39 firms (13%) indicate more general education courses based on transversal skill development.

In the summary section, it is expressed that there is a lack of ‘appropriate’ education and training available, which includes the necessary complex mix of skills required for different aspects of current and future Blockchain employment. There was also a view that transversal skills will become increasingly important in the sector.

In Baker Institute’s review titled “[Accelerating Small Business with Blockchain Technology](#)<sup>30</sup>”, we find similar focus points for business utilisation: Fully automated legal agreements through smart contracts, more efficient fundraising, increased transparency and accountability in shipping logistics, and eliminating background checks. As the article stated, one of the simplest ways to adopt blockchain technology is to accept cryptocurrency as payment. Also, if a business operator seeks a fast and easy solution, choose a customisable, predesigned blockchain and focus on adjusting the blockchain to fit the business’s needs.

#### 2.2.1.5 Artificial Intelligence

Regarding AI adoption, the publication [European enterprise survey on the use of technologies based on artificial intelligence](#)<sup>31</sup> (2020) mentions a major challenge: internal obstacles such as lack of skills, difficulties in hiring new staff with the right skills and the cost of implementing the technologies. They are complemented by external, in particular, the liability for potential damages when adopting AI technologies and the lack of citizens’ trust and the access to public or external funding associated with the adoption of some technologies along with regulatory barriers and data standardisation efforts (strict standards for data exchange).

Similar conclusions are drawn in the AI-related OECD study from 2020 titled [The Digital Transformation of SMEs – Artificial Intelligence: Changing landscape for SMEs](#)<sup>32</sup> SMEs face

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<sup>30</sup> <https://www.bakerinstitute.org/research/accelerating-small-business-blockchain-technology>

<sup>31</sup> <https://op.europa.eu/en/publication-detail/-/publication/f089bbae-f0b0-11ea-991b-01aa75ed71a1>

<sup>32</sup> [https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes\\_01a4ae9d-en#page1](https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_01a4ae9d-en#page1)

barriers in adopting AI, some of which are common to other digital technologies, such as lack of awareness and reactivity. Yet, some others largely stem from the characteristics of machine learning techniques: high costs and uncertainty about AI benefits (high sunk costs for internalising AI, plus a need for engaging complementary investments; little evidence and visibility on the returns on investment); reputational and legal risks; unclear understanding of potential and risks of using AI, from managers to workers; lack of data culture and weak data management practices.

Various scientific articles also underline the challenges stated in the studies mentioned above. Relevant articles show that the most critical challenges that SMEs face are the following:

- Lack of funds

While there are small differences between industries in the impact of the lack of AI, it can be stated that missing AI developments due to the lack of resources creates a competitive disadvantage.

For example, an article titled Future of Artificial Intelligence and Machine Learning in Marketing 4.0 focusing on marketing aspects related to AI reveals that digital transformation in marketing affects micro/small business enterprises adversely due to a lack of funds for such investments. Surviving in these times of technological advancement may prove to be a threat for SMEs in this competitive environment.<sup>33</sup>

Studies also disclose that this challenge is not really dependent on geographical location – if we take the technologically more developed world. A case study examining South Korea identifies the same problem - lack of financial resources - in the technologically advanced South Korea.<sup>34</sup>

- Lack of expertise

Installing customised AI solutions on embedded devices requires expertise and integration of data, algorithms, and tools, which can be a challenge for small and medium enterprises.

- Market competition

Partly because of the first two challenges, many sources mention competition with larger companies as another determinant challenge.

#### *2.2.1.6 Needs of Small and Medium Enterprises related to AI*

Continuing the list of findings from the study of scientific articles, challenges lead us to the needs of small and medium enterprises.

1. Pressing inflation, associated uncertainty, and the possibility of a recession force SMEs to adapt their business models and strategies (Kraus et al., 2022, Škare and Soriano, 2021, Xie et al., 2022)<sup>35</sup>

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<sup>33</sup> Source: Future of Artificial Intelligence and Machine Learning in Marketing 4.0

<sup>34</sup> Source: Case Studies for the Establishment of the Optimized Smart Factory with Small and Medium-Sized Enterprises

<sup>35</sup> Source: [Digital transformation and European small and medium enterprises \(SMEs\): A comparative study using digital economy and society index data](#)

2. A work introducing a modular AI pipeline to address the challenge of lacking expertise states there are initiatives aiming to simplify the integration of AI, lower expertise requirements, and enable end-to-end AI product development for embedded devices.<sup>36</sup>
3. The need for tailor-made solutions – Turning back to the South Korean case study, it reveals an important point to notice that the implementation of the smart factory can be different according to the factory environments, the type of the manufacturing facility, and the data to be collected, even if the companies want same s vice. Moreover, because every company has its own requirements, it is necessary to design a factory-optimised smart factory.<sup>37</sup>

#### *2.2.1.7 SMEs and Advanced Skills development*

It becomes evident that given these specific barriers to advanced technology adoption, skills development is not straightforward for SMEs. Participating in training courses not only depends on internal factors such as capacity and financial resources but also on the ‘fit’ between SME training demands and courses available on the market.

On the same line, the PWC analysis underlines that digitalisation efforts also require upskilling of employees in order to efficiently use the new technology. However, the awareness among SMEs regarding their existing skills gap and desired skill levels varies, as many smaller enterprises do not consider employee training and development a priority. Another barrier to SME skill development is financial and time constraints. Enterprises often have insufficient funding to provide quality training, particularly specialised training abroad. Similarly, entrepreneurs may struggle to plan their business activities around training programmes.

When it comes to digital skills development, the choice of a strategy is largely determined by the digital maturity stage of SMEs, which implies the willingness of the management team to embrace changes in a firm and the assessment of the impact of technologies on business processes. According to the PWC report, the cost-benefit analysis usually guides the choice of a strategy and the size of investment for skills development in SMEs. If a technology is at the core of all business processes and consequently has a significant value for an SME, then a company is likely to invest more resources into skills development to ensure the effective operation of the technology. In such a case, the number of people who receive training to upgrade their skills will likely be larger than if a technology has a small function in a company.

In this context, the previously mentioned [Skills for SMEs - Cybersecurity, Internet of Things and Big Data for Small and Medium-Sized Enterprises](#) report concludes that the training offerings should be set up to be tailored to the needs of SMEs and go beyond ‘generic’ digital skills. They need to be:

- Modular, blended, not necessarily during business hours. Innovative methods (e.g. gaming) should be explored.
- Focus specifically on the targeted technologies.

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<sup>36</sup> Source: [Boneyes AI Pipeline—Bringing AI to You: End-to-end integration of data, algorithms, and deployment tools](#)

<sup>37</sup> Source: [Case Studies for the Establishment of the Optimized Smart Factory with Small and Medium-Sized Enterprises](#)

- Practical, include the whole chain and concrete examples.
- Provided in plain language and in the mother tongue of the SME.

Easy participation by SMEs should be the leading guiding principle when developing the training. Both owners, as well as skills specialists, should be targeted with the training.

The BEGIN project goes on the same line when suggesting the main principles and learning environments to be used by entrepreneurship educators to teach related competencies. Although blockchain-based, these elements emerging from interviews with domain-related experts are valid to most of the digital technologies and beyond:

- Design thinking for identifying the problem to solve and then choosing the technology to solve the challenge.
- Problem-based learning helps in developing analytical thinking and reflective judgement by discussing realistic scenarios.
- Case-based learning on real-life scenarios allows the opportunity to see the diverse usage of the different technologies and show how the technologies could help address some business challenges. Familiar use cases to SME managers as audience are advised.
- Interdisciplinarity problem-solving approach – a principle especially relevant when integrating more technologies in solving a challenge or in integration projects.
- Testing and prototyping environments such as sandboxes where learners could test a concept or an MVP in a safe context for its viability, gaps and customer interest in the solution.
- Online courses, such as MOOCs are a good option, specifically for active people with time constraints.

The [CONCORDIA project](#)<sup>38</sup>, which looked, among others, into skilling cybersecurity professionals, concluded with an assessment of the specific skills market [report](#)<sup>39</sup> with some recommendations on the characteristics of courses needed to be offered in the Cybersecurity skills marketplace to face the current challenges between them:

- Target - general cybersecurity awareness needs to be offered across different industries, not necessarily technical ones, thus targeting non-traditional cyber audiences. Although many online courses address this general need, there is little, or none, tailored to some specific non-technical audience yet targeted and impacted by cyber-attacks. In this respect, the following topics could be envisaged: Economics of Cybersecurity within an organisation, cybersecurity for lawyers, cybersecurity for physicians, and cybersecurity for investors.
- Content: A broad approach to the topic would be advisable to cover both technical knowledge and soft skills, as well as some managerial skills according to the profile of the target audience. The hands-on approach and real case scenarios adapted to the specific audience should be favoured.

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<sup>38</sup> <https://www.concordia-h2020.eu/>

<sup>39</sup> <https://www.concordia-h2020.eu/wp-content/uploads/2020/04/CONCORDIA-AssessmentOfCoursesT3.4-ForWebsite.pdf>

- Language: Although the local language would be privileged for courses taught at the national level, the English language should be prioritised for multinational courses to help with cross-border exchanges and business expansions.
- Certification: Attaching a certification to a course or package of digital skills-related courses, a certification scheme built on a well-established skills framework, will bring added value to the course with the potential of increasing the business worthiness of the SMEs whose employees manage to earn the specific certificates.

These principles were considered when developing and later testing the [CONCORDIA methodology for creation and deployment of courses for cybersecurity professionals](#)<sup>40</sup>.

A summary of our findings in terms of the main barriers faced by SMEs when trying to skill/upskill their personnel in view of integrating/using advanced digital technologies in their business, but also the main characteristics of training addressing some of these challenges as extracted from the literature review is depicted in Figure XI. below.

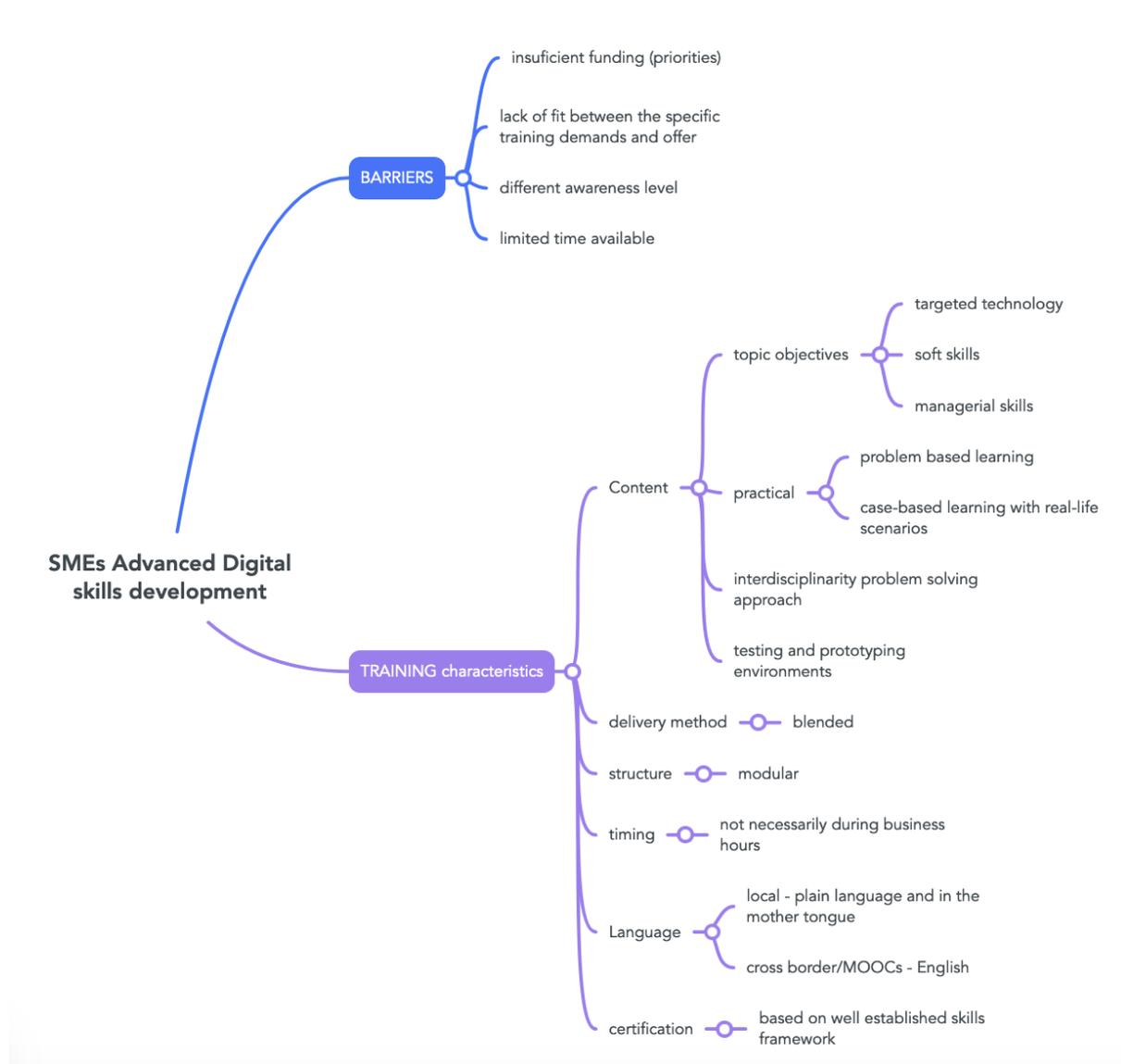


Figure XI. Summary of the desk research findings for SMEs' Advanced Digital skills development

<sup>40</sup> <https://www.concordia-h2020.eu/wp-content/uploads/2020/06/CONCORDIA-methodology-courses-professionals-for-publication.pdf>

### 2.2.1.7.1 The DTT tool-based analysis

The analysis was performed on a database of European SMEs and startups, the SME4DD partners contributed to the DTT database with 330+ SMEs based in the targeted countries (FR – 61; IT – 145; HU – 53; other EU countries – 70) and active in the project domains of interest (AI – 93, blockchain – 172, cybersecurity – 79, with some companies being involved in more than one of the three domains).

With the support of WP2 partners, we have identified 5 role profiles relevant to SMEs acting in one or more of the verticals targeted by the project (AI, blockchain, cybersecurity):

- Managing Director (ESCO 112)
- Production Manager (ESCO 13)
- ICT Manager (ESCO 133)
- ICT Engineer (ESCO 25)
- No-IT business professional (ESCO 24)

Starting from the tasks defining the role profiles as depicted in Figure XII., the partners flagged the most relevant knowledge and skills afterwards considered for the assessment.

Managing directors Tasks	Production manager Tasks	ICT managers Tasks	ICT Engineers Inform. Tasks	Non IT - Business prof. Tasks
Planning, directing and coordinating the general functioning of an enterprise or organization	Planning details of activities in terms of output, services provided, quality, quantity, cost, timeliness and labour requirements	Consulting with users, management, vendors and technicians to assess computing needs and system requirements, and specifying technology to meet those needs	Researching information technology use in business functions	Collecting, analysing and interpreting information on the financial viability, cost structures and trading effectiveness of organizations
Reviewing the operations and results of the enterprise or organization, and reporting to boards of directors and governing bodies	Setting standards and objectives	Formulating and directing information and communication technology (ICT) strategies, policies and plans	Identifying areas for improvement and researching the theoretical aspects and operational methods for the use of computers	Conducting audits, preparing financial statements and controlling treasury systems for organizations
Determining objectives, strategies, policies and programmes for the enterprise or organization	Controlling the operation of plant and of procedures	Directing the selection and installation of ICT resources and the provision of user training	Evaluating, planning and designing hardware or software configurations for specific applications including for Internet, Intranet and multimedia systems	Developing and reviewing financial plans and strategies, executing buy and sell orders, and negotiating the purchase and sale of commodities
Providing overall direction and management to organizations	Assuring quality of the goods produced and services provided	Directing ICT operations, analysing workflow, establishing priorities, developing standards and setting deadlines;	Designing, writing, testing and maintaining computer programs	Developing, implementing and evaluating staff recruitment, training and development programmes
Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources	Preparing tenders and contract bids	Overseeing the security of ICT systems	Designing and developing database architecture and database management systems	Researching, developing and implementing marketing and public relations campaigns
Authorizing material, human and financial resources to implement organizational policies and programmes	Establishing and managing budgets, monitoring costs, and adjusting activities, procedures and resources to minimize costs	assigning, reviewing, managing and leading the work of systems analysts, programmers and other computer-related workers;	Developing and implementing security plans and data administration policy, and administering computer networks and related computing environments	Studying and developing methods and policies to improve and promote government and business operations and effectiveness
Monitoring and evaluating performance of the organization or enterprise against established objectives and policies	Overseeing the acquisition and installation of new plant and equipment	Evaluating the organization's technology use and needs and recommending improvements such as hardware and software upgrades;	Analysing, developing, interpreting and evaluating complex system design and architecture specifications, data models and diagrams in the development, configuration and integration of computer systems.	Acquiring and updating knowledge of employers' and competitors' goods and services, and of market conditions
Consulting with senior subordinate staff and reviewing recommendations and reports	Coordinating the implementation of health and safety requirements	Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources;		Assessing customers' needs and explaining and demonstrating goods and services to them
Representing the organization at official occasions, in negotiations and at conventions	Planning and directing daily operations	Establishing and directing operational and administrative procedures;		
Seminars, public hearings and forums	Overseeing the selection, training and performance of staff	Overseeing the selection, training and performance of staff;		
Selecting or approving the selection of senior staff	preparing, or arranging for the preparation of reports, budgets and forecasts	Representing the enterprise or organization at ICT-related conventions, seminars and conferences		
Ensuring the organization complies with relevant legislation and regulations	Representing the enterprise or organization in negotiations with other agencies, and at conventions, seminars, public hearings and forums			

Figure XII. The 5 ESCO Role profiles and associated Tasks

The main conclusions of the analysis are as follows:

A. The missing skills per target audience Categories (SMEs – managers, IT professionals, non-IT professionals) on the targeted Verticals (AI, blockchain, cybersecurity)

For managers, there's a gap in their technical skills, especially when it comes to handling databases, cloud services, and AI-related market data. The selected companies should focus on improving their business knowledge, including skills in Business Analysis, Process Optimization, and Strategic Knowledge Management. On the technical side, there's a need for more advanced AI techniques (like machine learning and deep learning) and stronger research abilities. Also, customer-focused and agile project management skills could be better. The sampled non-technical roles should work on better data management, visualization skills, and understanding Business Intelligence.

In the field of cybersecurity in French SMEs, a similar pattern emerges. All roles could benefit from a better understanding of cybersecurity laws and software testing. Managers should improve their data analysis and business intelligence skills to adapt to changing security landscapes. Technical roles should focus on mastering technical infrastructure and areas like embedded systems and web app security. Non-technical roles should work on handling unstructured data and improving information organisation, which is important in both AI and cybersecurity.

In the blockchain industry, everyone should prioritise proficiency in software libraries. Managers and technical professionals should focus on providing clear technical documentation, while those in non-technical roles should emphasize user documentation and precise technical requirements.

B. The skills covered by the SME4DD courses with respect to the target audience

When analysing SME4DD courses, we found that they include a specific managerial skill that is also offered by other European courses in our database. This skill is related to understanding ICT security legislation is, which relevant in the field of cybersecurity. Importantly, this skill is beneficial not only for technical roles but also for improving proficiency in cybersecurity as a whole.

These courses provide participants with a strong understanding of technical aspects, particularly in the area of Artificial Intelligence. They cover important topics such as Machine Learning (ML), deep learning, and statistics. However, it's worth noting that these courses do not adequately address the skills needed to fully grasp Blockchain technology. This is consistent with the gap observed in our available sample of European courses on the same subject.

C. The skills needed on the market but not covered by the SME4DD courses

When we analyse the SME4DD courses and the skills gap in the market, we can find significant gaps in various sectors and role categories. In the field of Artificial Intelligence, both managerial and technical roles lack proficiency in several areas, including database management (PostgreSQL, SQL server), cloud technologies, market research, business

analysis, and continuous improvement. Similarly, in the realm of Cybersecurity, roles face gaps in skills such as data analysis, ICT project management, software testing, and understanding ICT communications protocols. In the Blockchain sector, there are shortages in technical competencies like smart contract development and software component libraries across all role categories.

#### D. The European courses covering the missing skills identified at point 1

There are a good number of European courses available in our database for both Artificial Intelligence and Cybersecurity recommendations. Most of these courses are online and taught in English, making them accessible to French SMEs. However, the number of courses decreases as their duration gets longer, with the majority being short, between 0-5 hours, and none exceeding 100 hours.

Unfortunately, we couldn't find any courses that offer recommended skills for the Blockchain sector, whether for managers or technicians. For non-technical roles, there are fewer courses available in this analysis, but they also tend to be in English, online, and have a duration of less than 100 hours.

The complete DTT report document will be available on the site of the SME4DD project.

### 3 Understanding of SMEs digital upskilling needs

The instrument used for the primary data collection is a self-completed online questionnaire aimed at gathering quantifiable data which can be mathematically and statistically analysed. This research phase aims to identify SME's needs for digitalisation regarding AI, Blockchain and Cybersecurity. The data that will emerge from the final analysis will be the base for building courses in the three verticals.

#### 3.1 Survey methodology

Questions in the survey are presented as closed questions; all the respondents have to choose among pre-determined answers previously devised by the researcher. They are also given a chance to type their own answer only where it is asked to be more specific on a certain answer where the answer can vary from the one presented.

Some of the questions are category questions, where only one answer is allowed, and, according to their choice, it leads to a different path of questions. Some questions are multiple-choice, while others are open-ended.

Before submitting the questionnaire, a pilot study was conducted to understand the reliability of the questions. The questions were reviewed during our monthly meetings, and opinions were solicited. In the end, a global evaluation of the questions and general impressions was sought, and some questions were rephrased to appear clearer to the participants.

#### 3.2 Structure of the survey

The structure of the questionnaire has been carefully considered, as well as the construction and the numbers of the questions to submit. This survey is quite atypical since it is lengthy, but all the questions were necessary to gather all the basic information to have a deep and real comprehension of the topics. For this reason, the questionnaire is split into seven pages - or sections - according to the topic of the questions to make it easier to understand and less tedious for the interviewee to fill out. These are:

##### **Section 1: Welcome page**

On the welcome page, the most important information about the survey is presented, such as the title, its purpose, the instructions, the institute the interviewer is researching for, along with a mention of the ethical and privacy requirements.

##### **Section 2: About our company**

The second page is structured to gather information about the respondents' companies, such as the maturity stage, the composition, the sector they operate in, and whether they are ICT or non-ICT companies.

In this part, a screening question is presented, useful for understanding if the respondent's company is an SME. In the case of a negative answer, it is removed from the results for analysis.

The following questions focus on understanding the size of the ICT department, the budget invested in ICT compared with the company turnover over the years, the focus of the investments in ICT, and the main obstacles in the digitalization process.

### **Section 3: Data management**

The aim of this section is to understand data management. For this reason, we asked how important data usage is for business and competitiveness development. The following questions are aimed at understanding if companies have a process to secure their data, what leverage data are considered the most valuable to develop their business, and if companies are already working with a data architecture that helps them benefit from the data they have access to.

### **Section 4: Artificial Intelligence: strategy, needs and skills**

Here, the focus is on understanding the current and desired level of AI-based technologies within companies. The section begins with a screening question aimed at determining if the respondents' company is already investing in or planning to invest in AI. In the case of an affirmative answer, respondents are asked to clarify how they will support the development-whether through internal or external sources - and the reasons behind their choice to invest in AI.

The last part aims to understand the perception of the current level of AI knowledge in the respondent's company and the expected level of AI knowledge within two years. To achieve this, we structured it as a matrix where interviewees must rate different aspects of AI implications on a four-point scale, ranging from low to advanced.

Additionally, an important aspect is presented here that allows us to understand what level of expertise individuals would be interested in for AI training.

### **Section 5: Blockchain: strategy, needs and skills**

The structure of this section mirrors the one dedicated to AI. Here, the first screening question is aimed at understanding if the respondent's company is already investing in or planning to invest in blockchain in the upcoming years. Depending on this answer, two paths are presented. The first path is for those who answered positively, and they are asked to identify how they will support the investment and the reasons why they are willing to invest in blockchain.

In the following part, the focus is on understanding the need for innovation or potential in a list of typical blockchain use cases. Similar to the AI section, the last part is presented as a matrix where respondents must rate on a four-point scale the current level of blockchain knowledge in their company and the expected level of knowledge within two years.

As in the section dedicated to AI, an important aspect is presented here, which allows us to understand the level of expertise individuals would be interested in for blockchain training.

### **Section 6: Cybersecurity: strategy, need and skills**

Similar to the previous sections, this section is aimed at understanding a company's inclination to invest in cybersecurity, investigating which areas are considered the most valuable for investment, and identifying the main challenges a company needs to face in

terms of cybersecurity. The last part allows us to understand how the investment would be supported and the level of expertise individuals are interested in for cybersecurity training.

### **Section 7: The best way to master your skills**

This last section is dedicated to understanding what kind of courses companies prefer. For this reason, questions on the preferred language, format of training and learning models are asked. This part also gives us the chance to understand the importance of providing post courses certificate and how the company workforce is now proceeding once in need of training.

This last part is also very important for our work since here we investigate people's interest in being contacted for future workshops and courses, and they are also free to leave their contact.

### 3.3 Survey submission and promotion

Once we all considered the survey ready, the questionnaire was translated into French, Italian, Swedish, and Hungarian (through the EU portal) to provide each country with a survey in their own language and to improve accessibility.

Ready with the translation, we started posting on the social pages of all the companies leading the project the EU initiative, asking to fill out the survey. In sustain of the social communication we sent to our contacts DEM presenting the project and the survey: at first, this approach did not give the expected results; for this reason, we moved to another plan, sending personalised emails to each contact and extended the survey deadline This method revealed as a turning point, since guaranteed the gathering of a higher number of responses for the first time. Even if this might give us answers with methodological uncertainties, it still helps us to use the insights as input to workshops and to the course's design processes.

In the Work Plan of the SME4DD project, it was stated that the survey will be distributed to more than 400 SMEs, at least 100 per focus country. In general, it can be stated that this reach was not sufficient to provide diversified results from a research and analysis point of view. Even if the project members exceeded the planned reach, the willingness to respond was low. [This limited the ability to make reliable cross-country comparisons or draw statistically significant conclusions. The issue stemmed more from the quantity of responses than their quality.](#)

The reasons for this are analysed below.

The ability to assess one's own situation and needs: based on the answers, it can be assumed that during the interpreting of the questions, the respondent faced difficulties in identifying the situation and [often struggled to interpret the questions and identify their own company's precise needs.](#)

Lack of knowledge: Many SME owners and employees may lack basic knowledge about blockchain, artificial intelligence and cyber security, so this this may affect fundamentally the willingness to participate.

Lack of time: The operation of SMEs is often intensive and time-consuming. Due to the lack of time and resources required for operation, not everyone is willing to take the time to fill out a longer survey.

Uncertainty: When filling out online forms, some SMEs may have concerns about the security and use of their business information. Some individuals may have been unsure of their own authority to answer the questions. As this was filled out remotely and online, personal contact and direct support was not available.

Lack of motivation: The operation of some SMEs may not currently be related to the fields of blockchain, artificial intelligence or cyber security or even to digitalisation, so there is no adequate motivation to complete it. Example: Hungarian SMEs showed limited knowledge and interest, while French SMEs generally avoided questionnaires, considering them time-consuming with no immediate benefit. The inadequate communication to SMEs about the benefits of filling out the questionnaire can also contribute to a decrease in the willingness to fill it out.

Awareness of the project and the consortium: The lack of prior personal recognition of the project could have been a factor in the low completion rate.

Delay of workshops: In view of the fact that there were member changes in the SME4DD project, and that the summer months did not prove to be proper period for holding an informative workshop with a sufficient number of participants, the completion rate of the survey could not be sufficiently supported by these workshop sessions.

Unforeseen ageing of the data: the decision of extending the timing to collect more answers to the survey led to an unforeseen ageing of the data collected due to the speed our verticals are evolving in the market (e.g. Generative AI)

Looking back, the following recommendations could have improved the survey's effectiveness:

- Shorten the survey length to reduce dropout rates.
- Clearly articulate the benefits for participants outside the three focus areas.
- Launch the survey during working months (avoid summer vacation months).
- Provide direct support during survey completion.

### 3.4 Preliminary analysis

The survey implementation process included data extraction from the EU portal, preliminary checks, and an initial screening of responses. Analysis covered company landscapes, adoption status, needs, and preferences for course methodology.

In three months, 226 people participated in the questionnaire. Among them, 7 responses were excluded from the research because they filled out the survey twice. Therefore, we considered our initial target for analysis to consist of 219 companies.

The first question served as a screening question to exclude those who do not fit the criteria for the analysis, as this survey was open to everyone. Nineteen companies (9%) were excluded from the research because they answered negatively to the question designed to

determine if they are SMEs or not. Consequently, the total usable responses collected amount to 88.5%, which is 200 out of the 226 total respondents. Since not all questions were mandatory, some were left unanswered.

### 3.4.1 Company profile and data management

Out of the 200 companies that completed the questionnaire, we collected 12 (6%) of the responses from France, 19 (9.5%) from Hungary, 144 (72%) from Italy, 5 (2.5%) from Sweden, and 20 (10%) from various other countries, which we grouped under the category "other countries" for statistical purposes.

The following three tables below show divided by countries the distribution of the companies based on staff headcount, based on the age of the companies, and the proportion of the ICT and non-ICT companies among all examined companies.



Figure XIII.: Companies distribution based on staff headcount



Figure XIV.: Companies distribution based on the age of the company

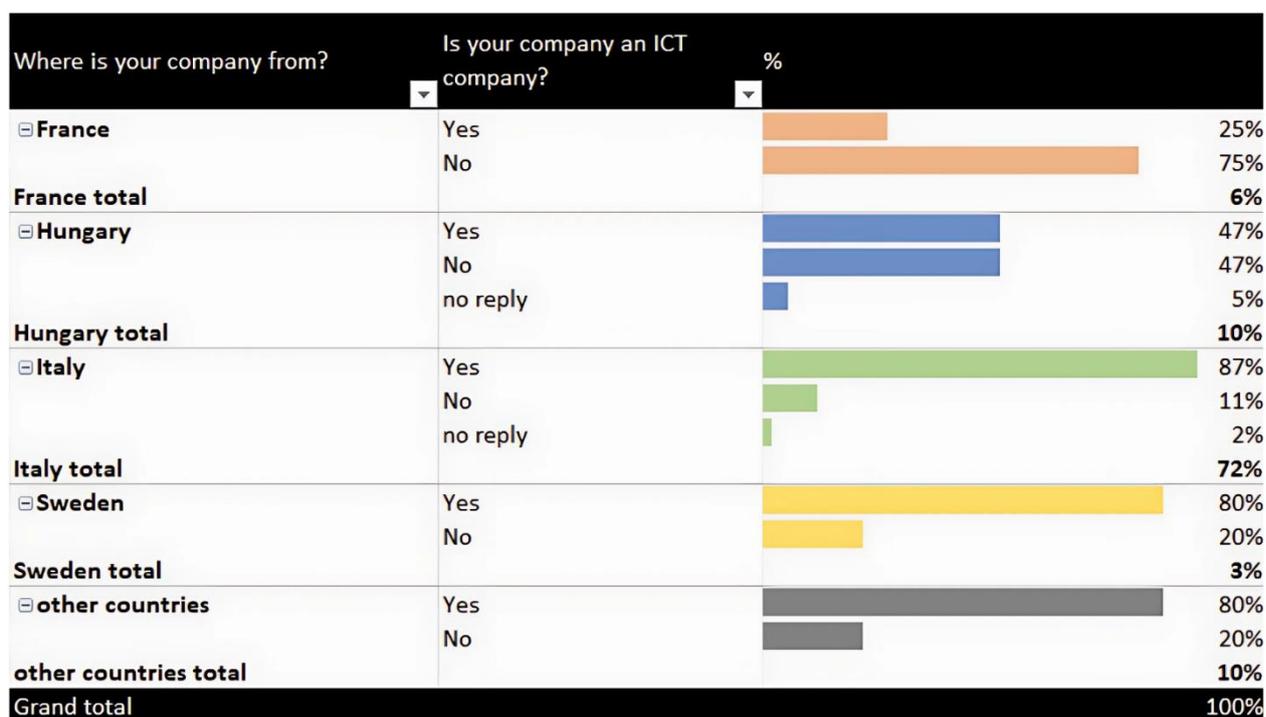


Figure XV.: Proportion of the ICT and non-ICT companies

Below, you can find the graphics of the sector, where companies operate, divided by countries. The respondent chose maximum 3 options among the many options that were provided:

<b>STATE THE SECTORS IN WHICH YOUR COMPANY OPERATES</b>	
<b>FRANCE</b>	
Computer, Software and Telecommunications	22%
Construction	17%
Manufacturing	11%
Transportation	6%
Utilities	17%
Other	22%
<b>HUNGARY</b>	
Bank, Finance, Insurance	3%
Commerce	13%
Computer, Software and Telecommunications	23%
Construction	3%
Food	6%
Healthcare	3%
Manufacturing	10%
Other	32%
Transportation	3%
<b>ITALY</b>	
Bank, Finance, Insurance	5%
Commerce	4%
Computer, Software and Telecommunications	44%
Construction	1%
Entertainment, Information, Mass Media	5%
Food	1%
Healthcare	2%
Manufacturing	2%
Other	11%
Transportation	1%
Utilities	24%

SWEDEN	
Commerce	13%
Computer, Software and Telecommunications	38%
Entertainment, Information, Mass Media	13%
Manufacturing	13%
Other	13%
Utilities	13%

Figure XVI.: Sectors companies operate in

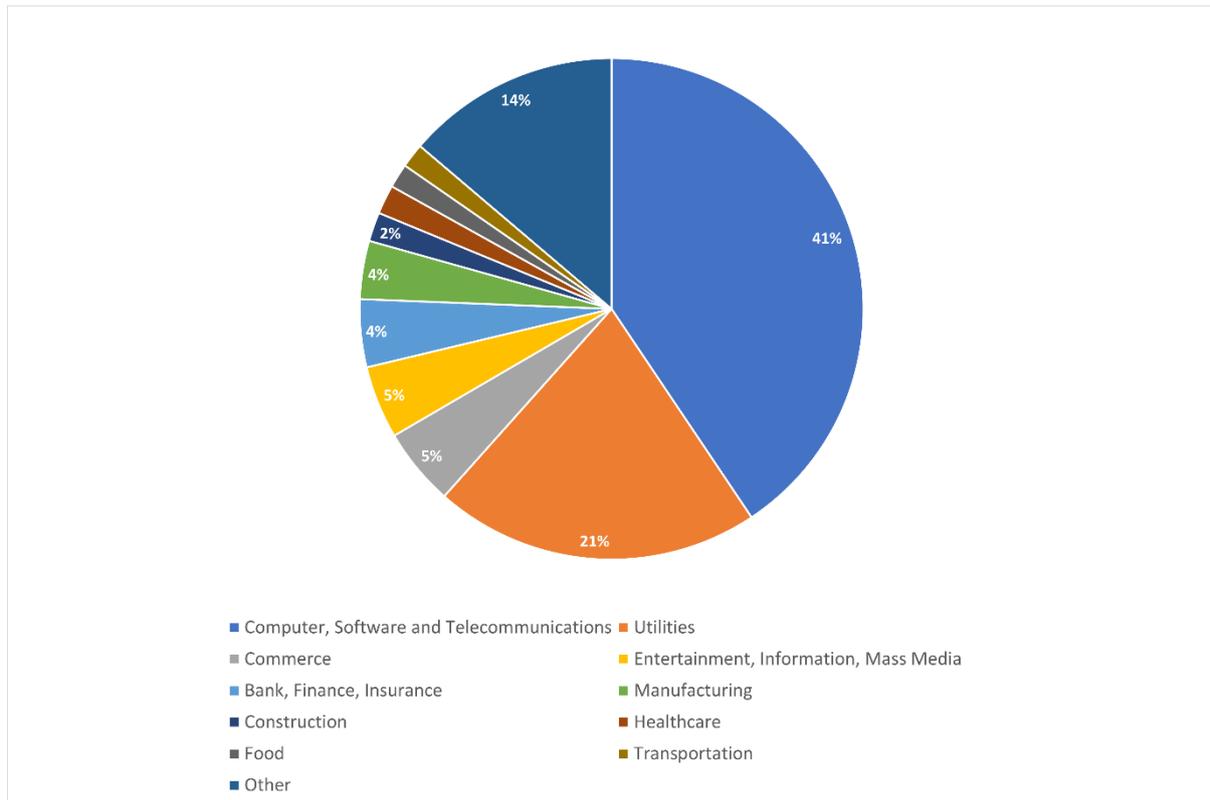


Figure XVII.: Sectors companies operate in (2)

The tables below answer to the need of understanding the size of the ICT department inside the companies and the percentage of budget invested in the same department.

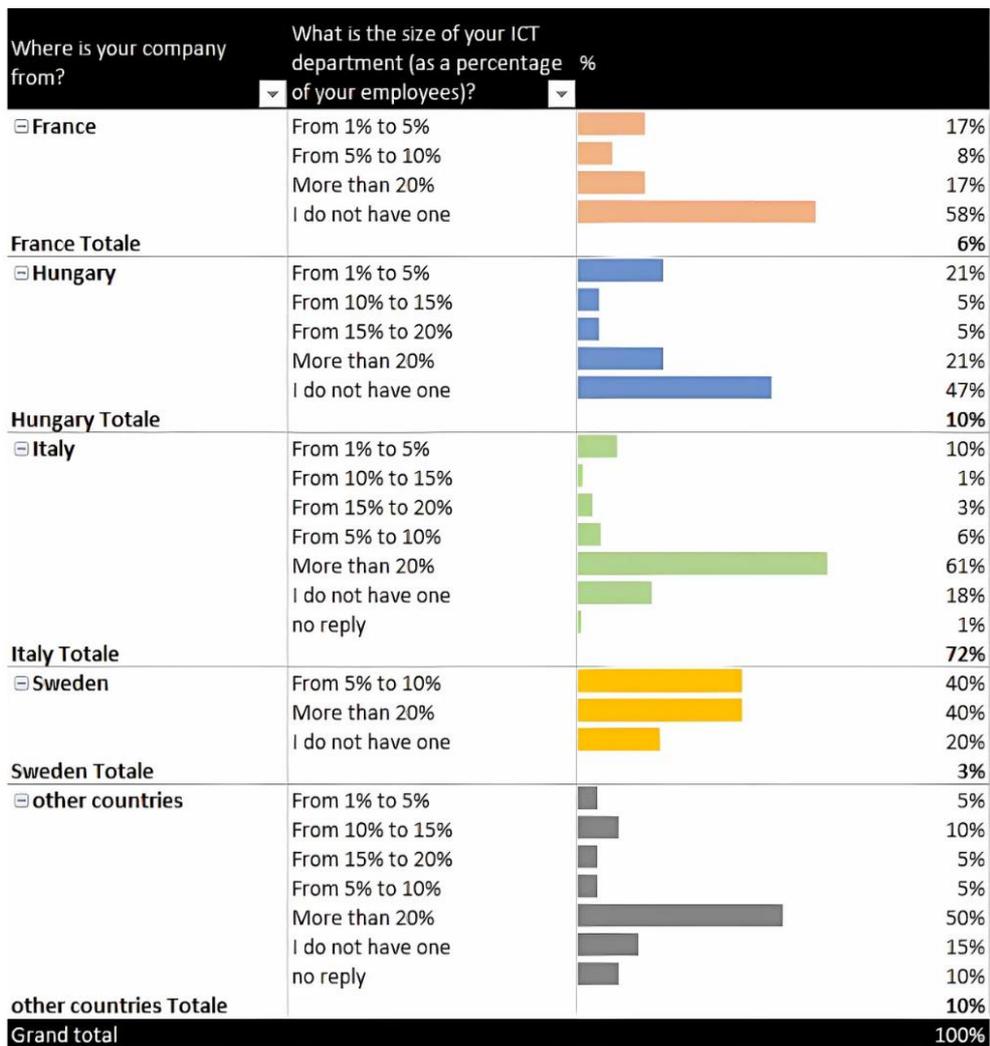


Figure XVIII.: Size of the ICT department at the companies

Where is your company from?	What percentage of your budget do you invest in ICT?	%
France	Less than 1%	25%
	From 1% to 5%	50%
	From 10% to 15%	17%
	More than 25%	8%
<b>France total</b>		<b>6%</b>
Hungary	Less than 1%	21%
	From 1% to 5%	16%
	From 5% to 10%	21%
	From 10% to 15%	11%
	From 15% to 20%	5%
	From 20% to 25%	5%
	More than 25%	11%
<b>Hungary total</b>		<b>10%</b>
Italy	Less than 1%	6%
	From 1% to 5%	14%
	From 5% to 10%	13%
	From 10% to 15%	11%
	From 15% to 20%	6%
	From 20% to 25%	6%
	More than 25%	44%
<b>Italy total</b>		<b>72%</b>
Sweden	Less than 1%	20%
	From 5% to 10%	20%
	From 10% to 15%	20%
	More than 25%	40%
<b>Sweden total</b>		<b>3%</b>
other countries	Less than 1%	5%
	From 1% to 5%	25%
	From 5% to 10%	10%
	From 10% to 15%	15%
	From 20% to 25%	20%
	More than 25%	25%
<b>other countries total</b>		<b>10%</b>
<b>Grand total</b>		<b>100%</b>

Figure XIX.: Proportion of the budget invested in ICT

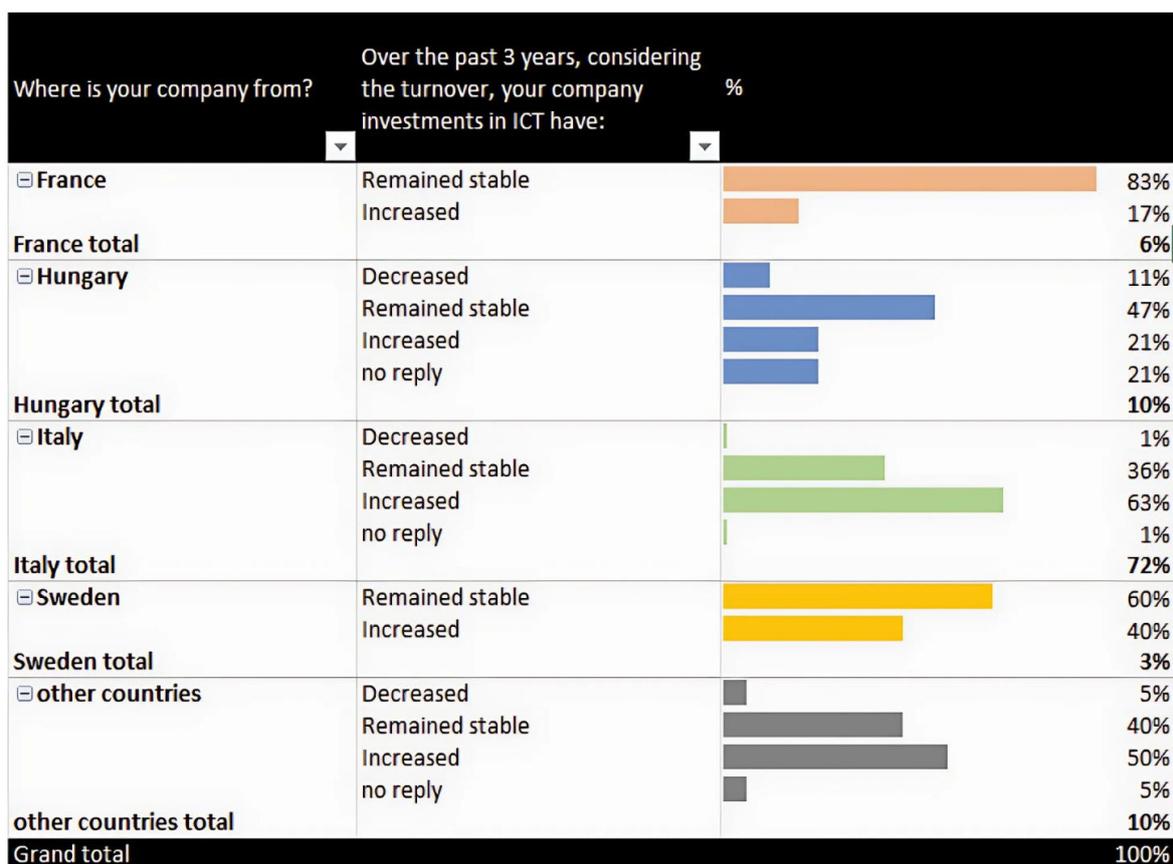


Figure XX.: ICT investment trend

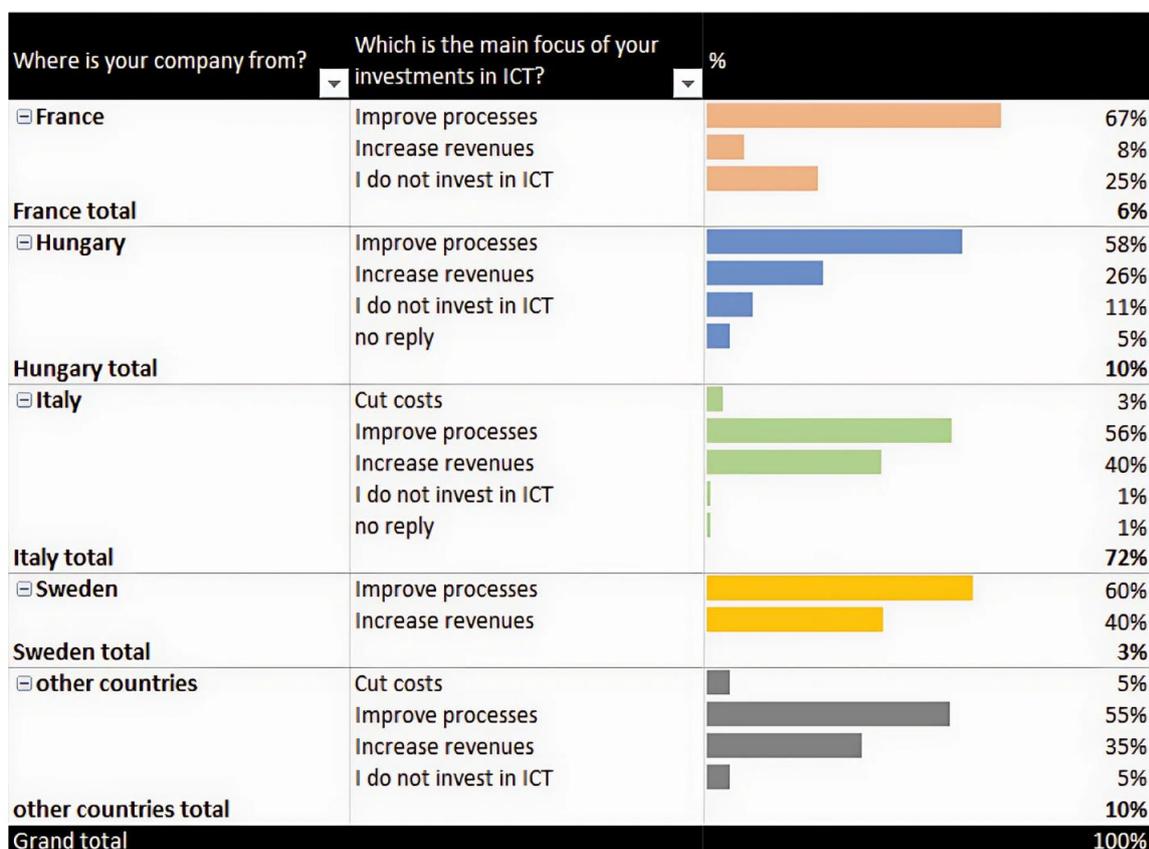


Figure XXI.: Focus of the investments in ICT

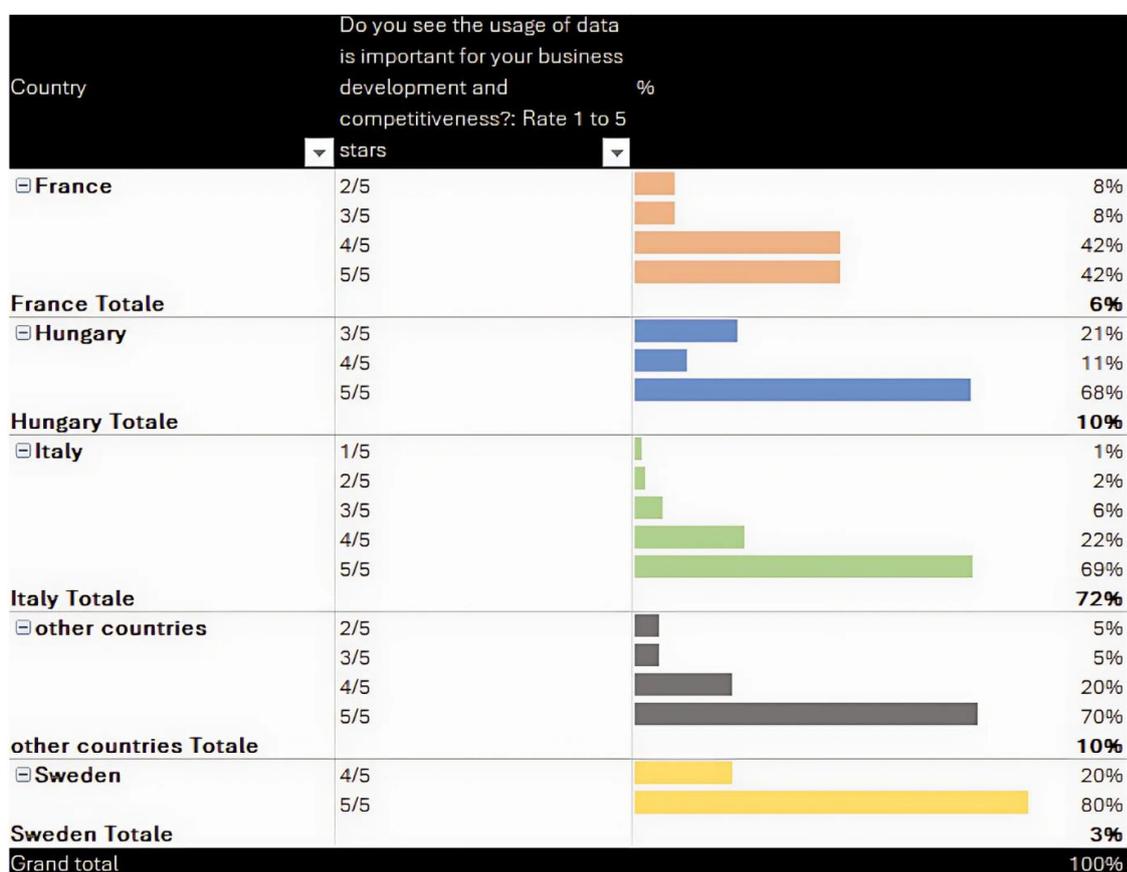
The table below shows perceptions as regards the main obstacles to the digitalisation process: the questions allowed multiple choice answers (no more than 3 options).

<b>Main obstacles for the digitalisation process</b>	
<b>FRANCE</b>	
Access to relevant data	4%
Data management and governance	4%
Difficult to hire new staff with the right skills	12%
Difficulty in connecting technologies to business drivers	8%
Difficulty in defining a strategy	4%
Difficulty in identifying new technologies in which to invest	16%
Difficulty in identifying Partners	4%
Difficulty in measuring outcomes	8%
Limited economic resources	36%
No reply	4%
<b>HUNGARY</b>	
Access to relevant data	3%
Data management and governance	3%
Difficulty in connecting technologies to business drivers	11%
Difficulty in defining a strategy	8%
Difficulty in identifying new technologies in which to invest	8%
Difficulty in identifying Partners	5%
Difficulty in measuring outcomes	5%
Insufficient or incompatible IT infrastructure	8%
Lack of alignment between IT department and business lines	3%
Lack of skills among existing staff	5%
Limited economic resources	32%
No interest or culture of innovation	3%
No reply	8%
<b>ITALY</b>	
Access to relevant data	4%
Data management and governance	4%
Difficult to hire new staff with the right skills	24%
Difficulty in connecting technologies to business drivers	7%
Difficulty in defining a strategy	4%
Difficulty in identifying new technologies in which to invest	6%
Difficulty in identifying Partners	8%
Difficulty in measuring outcomes	5%
Insufficient or incompatible IT infrastructure	1%
Lack of alignment between IT department and business lines	2%
Lack of skills among existing staff	5%
Limited economic resources	22%
No interest or culture of innovation	1%
Top management's low propensity	0,3%
No reply	5%
<b>SWEDEN</b>	

Difficulty in connecting technologies to business drivers	11%
Difficulty in measuring outcomes	11%
Insufficient or incompatible IT infrastructure	11%
Lack of alignment between IT department and business lines	22%
Limited economic resources	22%
Top management's low propensity	11%
No reply	11%

Figure XXII.: Obstacles to the digitalisation process

Respondents have been asked to rate on a scale that goes from 1 to 5 how they consider the usage of data important for their business development and competitiveness, and if they have a process to secure the data quality. In the tables below the results of the two questions' analysis can be seen.



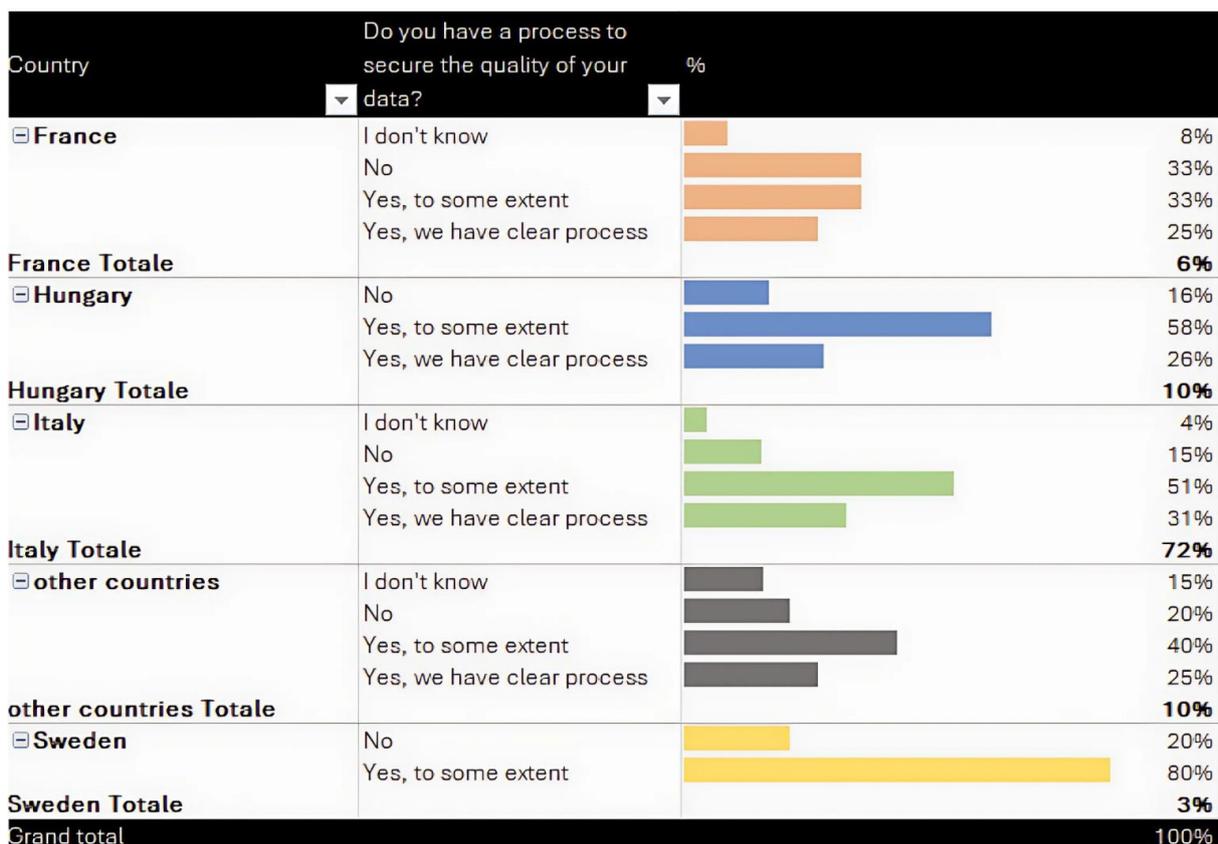


Figure XXIII. and XXIV.: Importance of data usage and process to secure data

The tables that follow represents respondents' statement when they have been asked to indicate the leverage most valuable data useful to develop their business. The question allowed a multiple choice up to 3 options.

LEVERAGE MOST VALUABLE DATA TO DEVELOP THE BUSINESS	
<b>FRANCE</b>	
Customer data	21%
Environmental data (i.e. for taxonomy)	14%
Financial data, financial reporting	18%
Insights and analytics	7%
Legacy, supply chain	4%
Operational data	18%
Sales data	7%
Third-party data	11%
<b>HUNGARY</b>	
Customer data	22%
Environmental data (i.e. for taxonomy)	2%
Financial data, financial reporting	12%
Insights and analytics	8%
Legacy, supply chain	6%
Operational data	16%
Sales data	22%
Third-party data	10%

ITALY	
Customer data	22%
Environmental data (i.e. for taxonomy)	1%
Financial data, financial reporting	13%
Insights and analytics	20%
Operational data	19%
Sales data	19%
Third-party data	5%
SWEDEN	
Customer data	21%
Financial data, financial reporting	14%
Insights and analytics	21%
Operational data	14%
Sales data	21%
Third-party data	7%

Figure XXV.: Focus of the investments in ICT

Once understood what the most important data for a company is, it was crucial to get if the same companies are working with data architecture which help to benefit from the data they have access to. You can find below how this question was answered:

Country	Are you working with a data architecture that enables you to benefit from the data you have access to?	%
France	No	75%
	Yes	25%
<b>France Totale</b>		<b>6%</b>
Hungary	No	47%
	Yes	53%
<b>Hungary Totale</b>		<b>10%</b>
Italy	No	28%
	Yes	72%
<b>Italy Totale</b>		<b>72%</b>
other countries	No	45%
	Yes	55%
<b>other countries Totale</b>		<b>10%</b>
Sweden	No	20%
	Yes	80%
<b>Sweden Totale</b>		<b>3%</b>
<b>Grand total</b>		<b>100%</b>

Figure XXVI.: Data architecture

### 3.4.2 Company profiles by country

#### **France**

Based on the answers, we can profile the respondent companies from France as non-ICT companies with 0-9 staff members, 1 to 5 years old, mainly operating in the computer, software, and communication sector, with no dedicated ICT department.

The budget invested in ICT ranges from 1% to 5% and has remained stable over the past 3 years relative to turnover. French companies invest in ICT primarily to improve their processes. They consider limited economic resources and the challenge of identifying new technologies to invest in as the main obstacles in their digitalization process.

In terms of leveraging data to develop their business, they value customer data, operational data, and financial data and reporting the most. They consider the usage of data highly important for their business. However, they do not have a clear process in place to ensure data quality, and their companies are not working with a data architecture that enables them to fully benefit from the data they have access to.

#### **Hungary**

The companies from Hungary that responded to the questionnaire are primarily SMEs with over 10 years of operation and a staff consisting of 10 to 49 people. Half of them are ICT companies, while the other half are non-ICT companies. They primarily operate in the computer, software, and telecommunications sector and do not have a dedicated ICT department.

Regarding the budget invested in ICT, we cannot provide a definitive position since we received an equal number of responses for both "less than 1%" and "from 5% to 10%." However, considering turnover, the investment in ICT has remained stable over the past 3 years, with the goal of improving processes. The main obstacles they face in their digitalization processes are limited economic resources.

They consider the usage of data highly important for their business (rated 5 out of 5 stars), and they are content with the process they have in place to ensure data quality. However, they do not believe they have clear processes. They are also working with a data architecture that allows them to benefit from the data they have access to. Sales and customer data are regarded as the most valuable data for developing their business.

#### **Italy**

We can profile Italian companies as ICT companies with more than 10 years of activity, typically having a staff count ranging from 0 to 9 members, but with an ICT department that comprises more than 20% of their employees. Italian SMEs primarily operate in sectors such as Computer, Software, Telecommunications, and Utilities. They invest more than 25% of their revenues in ICT, a value that has increased over the past 3 years, considering their turnover, with the aim of improving their processes.

The main obstacles in their digitalisation process are difficulties in hiring new staff with the right skills and limited economic resources. In their business, the usage of data is rated as highly important (5 out of 5 stars). They have a robust process in place to ensure the quality of their data, and they are working with a data architecture that allows them to benefit from

the data they have access to. The most valuable data for their business are customer data, insights and analytics, sales data, and operational data.

### **Sweden**

Due to the small sample of respondents, it is challenging to clearly define a respondent-company profile. An equal number of responses have been provided for staff headcount categories ranging from 0 to 9 as well as from 10 to 49. Similarly, the dimensions of the ICT department received an equal number of responses for both 5% to 10% of employees and more than 20%.

The majority of companies in the sample are ICT companies that are 1 to 5 years old, primarily operating in the Computer, Software, and Telecommunication sector. They invest more than 25% of their budget in ICT, and this investment has remained stable over the past 3 years, with the goal of improving processes.

The main obstacles they face in their digitalization efforts are a lack of alignment between the IT department and the business line and limited economic resources.

The usage of data is considered very important for their business, and the process to ensure data quality is regarded as satisfying. The most valuable data for developing their business include customer data, sales data, insights, and analytics.

### **Other countries**

In this section, we have gathered responses from companies located in Albania, the UAE, the USA, the UK, Spain, Portugal, the Netherlands, Switzerland, Israel, Germany, and Belgium.

From the data management analysis, it emerged that Italy and Sweden can boast of greater data maturity compared to French and Hungary. In fact, despite all the countries claimed that data storage is highly important for their business and are basically satisfied with their process to secure data, there is a major tendency for Italy and Sweden to work with a data architecture that help them benefits and better availing of the data.

## [3.5 Artificial Intelligence: strategy, need and skills](#)

### **AI Investment Intentions**

The tables below have been provided to assess whether companies in each country are currently planning or evaluating investments in AI-based technologies. There is a notable inclination towards investment in all countries, except for France, where the predominant response has been negative.



Figure XXVII.: Companies' interest in investing in AI

## AI Investment Support

The focus of the question in the table below was to understand how companies expressing interest in investing in AI technologies plan to support their development. It is noteworthy that in each country, the primary source of investment support comes from within the company itself.

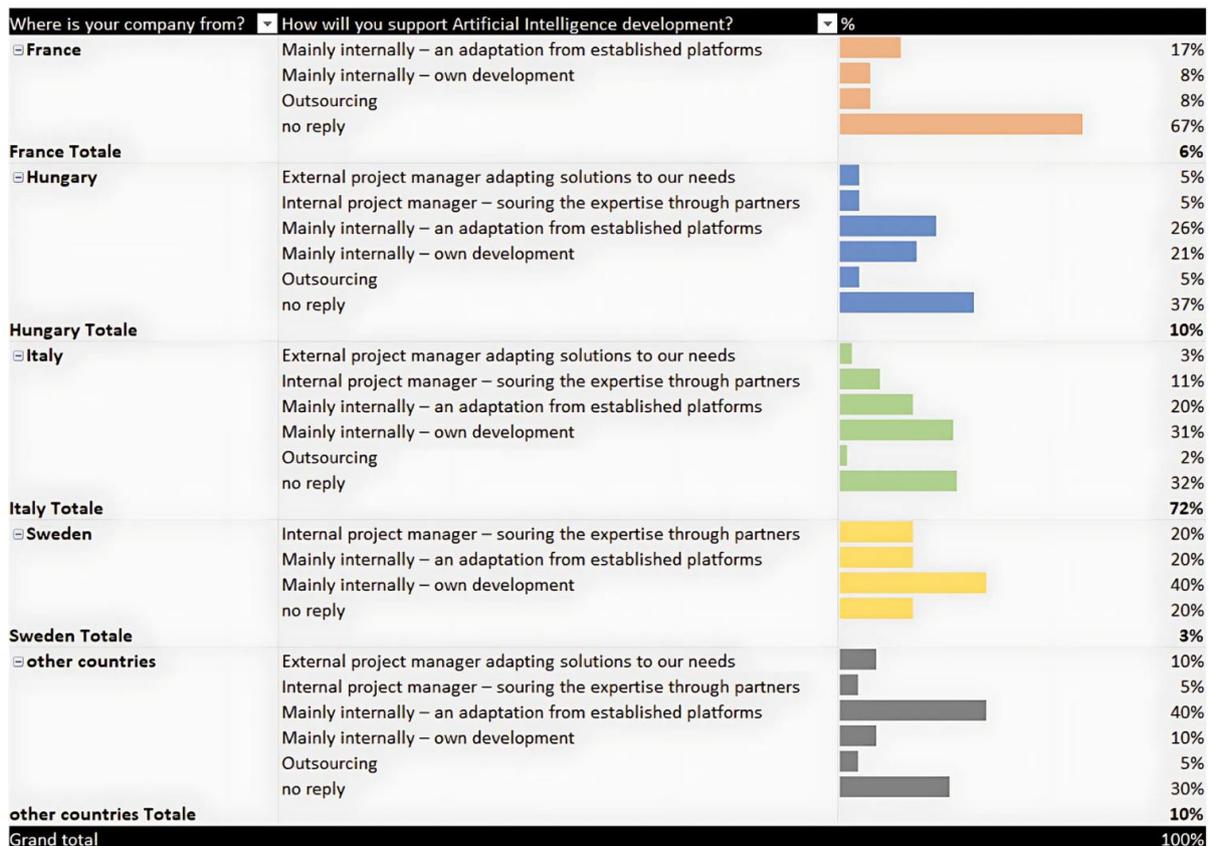


Figure XXVIII.: Companies' willingness to invest in AI

The following tables are useful to understand ICT and non-ICT companies' approach to the AI development:

**France:**

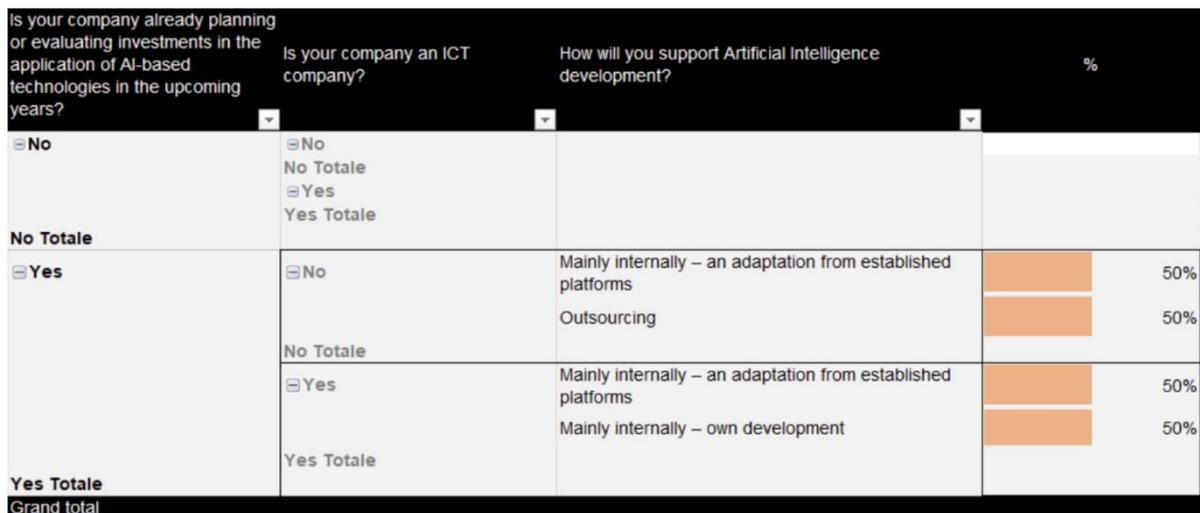


Figure XXIX.: ICT and non-ICT companies’ approach to AI development in France

**Hungary:**

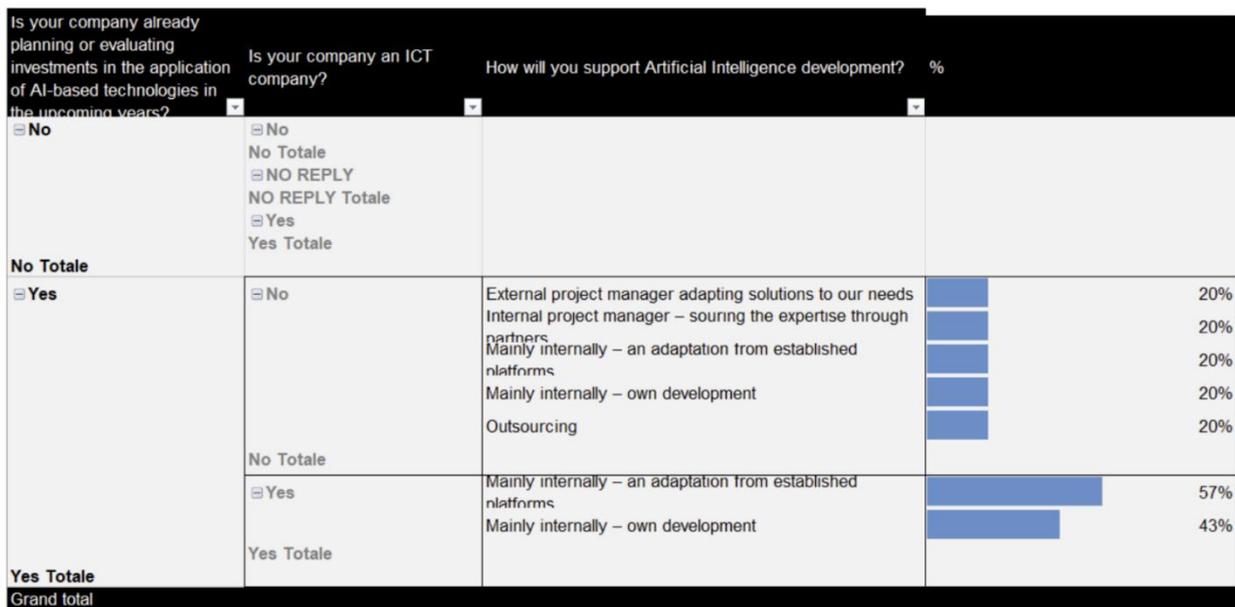


Figure XXX.: ICT and non-ICT companies’ approach to AI development in Hungary

**Italy:**



Figure XXXI.: ICT and non-ICT companies’ approach to AI development in Italy

**Sweden:**

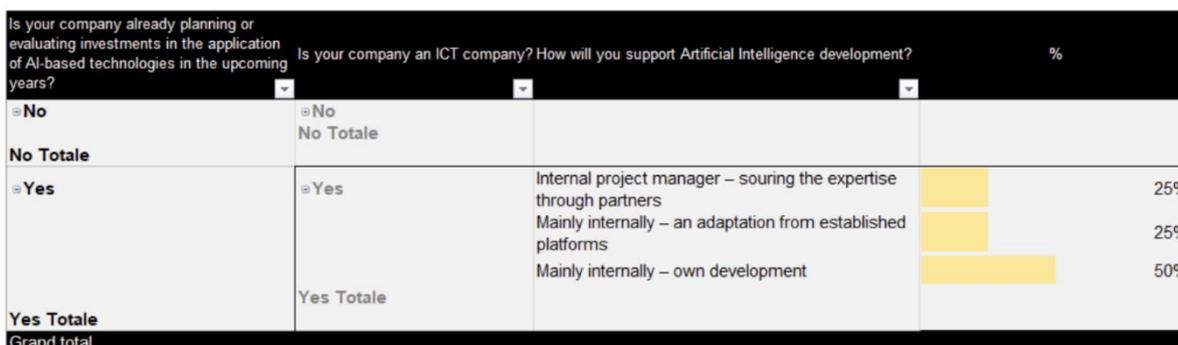


Figure XXXII.: ICT and non-ICT companies’ approach to AI development in Sweden

**AI Investment Motivation**

In this table, we provide a detailed overview of the motivations driving companies in each country to invest in AI. The question was a multiple-choice question where the interviewee could choose up to 2 options:

WHY ARE YOU INTERESTED IN INVESTING IN ARTIFICIAL INTELLIGENCE?	
FRANCE	
Better decision making	7%
Competitive advantage	14%
Increase efficiency	21%
No reply	57%
HUNGARY	
Competitive advantage	18%
Cost Savings	18%
Enhanced customer experience	7%
Increase efficiency	32%
No reply	25%
ITALY	
Better decision making	9%
Competitive advantage	37%
Cost Savings	4%
Enhanced customer experience	21%
Increase efficiency	26%
Other	2%
SWEDEN	
Competitive advantage	60%
Cost Savings	20%
Increase efficiency	80%
No reply	20%

Figure XXXIII.: AI investment motivation

## AI Innovation Potential by Country

The following table (analysed from a multiple-choice question) highlights various areas with innovation potential, providing insights into opportunities for growth and development, per country.

DO YOU SEE INNOVATION POTENTIAL/NEED FOR YOUR COMPANY IN THE FOLLOWING AREAS?	
FRANCE	
AI-Powered Assistants	19%
Data management and data visualisation	37%
Data security	11%
Fraud prevention	7%
I already have AI-based digitalisation ideas	7%
Recommendation systems	15%
Supply chain	4%
HUNGARY	
AI-Powered Assistants	42%
Data management and data visualisation	58%

Data security	32%
Fraud prevention	11%
I already have AI-based digitalisation ideas	5%
Recommendation systems	11%
No reply	5%
<b>ITALY</b>	
Data management and data visualisation	31%
AI-Powered Assistants	19%
Data security	13%
Recommendation systems	12%
I already have AI-base digitalisation ideas	8%
Fraud prevention	6%
Supply chain	6%
no reply	5%
<b>SWEDEN</b>	
AI-Powered Assistants	40%
Recommendation systems	60%
Supply chain	20%
Data security	20%

Figure XXXIV.: AI innovation potential

## Interest in AI Expertise Levels

The following tables present an in-depth breakdown of respondents' interest in various levels of expertise related to Artificial Intelligence across the four geographies.

FRANCE			
CURRENT		EXPECTED	
<b>Understanding the basic principles of artificial intelligence</b>		<b>Understanding the basic principles of artificial intelligence</b>	
Advanced	25%	Advanced	25%
Strong	33%	Strong	50%
Intermediate	42%	Intermediate	25%
<b>Understanding the challenges of AI-Technologies</b>		<b>Understanding the challenges of AI-Technologies</b>	
Advanced	25%	Advanced	25%
Strong	17%	Strong	42%
Intermediate	33%	Intermediate	23%
Low	25%		
<b>Executive's ability to incorporate AI in making strategic choices</b>		<b>Executive's ability to incorporate AI in making strategic choices</b>	
Advanced	17%	Advanced	25%
Strong	33%	Strong	33%
Intermediate	8%	Intermediate	42%
Low	42%		
<b>Understanding how AI investments can be deployed</b>		<b>Understanding how AI investments can be deployed</b>	
Advanced	17%	Advanced	25%
Strong	33%	Strong	42%
Intermediate	8%	Intermediate	25%
Low	33%	Low	8%
no reply	8%		
<b>Efficient tools for machine learning and statistical modelling</b>		<b>Efficient tools for machine learning and statistical modelling</b>	
Strong	42%	Advanced	17%
Intermediate	17%	Strong	42%
Low	42%	Intermediate	17%
		Low	17%
		no reply	8%
<b>Competences in extracting and exploitation of complex data</b>		<b>Competences in extracting and exploitation of complex data</b>	
Advanced	8%	Advanced	17%
Strong	25%	Strong	33%
Intermediate	25%	Intermediate	33%
Low	42%	Low	8%
		no reply	8%

HUNGARY			
CURRENT		EXPECTED	
<b>Understanding Principles of Artificial Intelligence</b>		<b>Understanding Principles of Artificial Intelligence</b>	
Advanced	16%	Advanced	32%
Strong	42%	Strong	42%
Intermediate	21%	Intermediate	16%
Low	21%	Low	5%
		no reply	15%
<b>Understanding the challenges of AI-Technologies</b>		<b>Understanding the challenges of AI-Technologies</b>	
Advanced	16%	Advanced	32%
Strong	42%	Strong	37%
Intermediate	26%	Intermediate	21%
Low	16%	Low	5%
		no reply	5%
<b>Executive's ability to incorporate AI in making strategic choices</b>		<b>Executive's ability to incorporate AI in making strategic choices</b>	
Advanced	11%	Advanced	26%
Strong	42%	Strong	37%
Intermediate	21%	Intermediate	26%
Low	26%	Low	5%
		no reply	5%
<b>Understanding how AI investments can be deployed</b>		<b>Understanding how AI investments can be deployed</b>	
Strong	32%	Advanced	32%
Intermediate	42%	Strong	26%
Low	26%	Intermediate	32%
		Low	5%
		no reply	5%
<b>Efficient tools for machine learning and statistical modelling</b>		<b>Efficient tools for machine learning and statistical modelling</b>	
Advanced	5%	Advanced	26%
Strong	21%	Strong	32%
Intermediate	47%	Intermediate	16%
Low	26%	Low	5%
		no reply	5%
<b>Competences in extracting and exploitation of complex data</b>		<b>Competences in extracting and exploitation of complex data</b>	
Strong	32%	Advanced	26%
Intermediate	42%	Strong	26%
Low	26%	Intermediate	32%
		Low	5%
		no reply	11%

ITALY			
CURRENT		EXPECTED	
<b>Understanding Principles of Artificial Intelligence</b>		<b>Understanding Principles of Artificial Intelligence</b>	
Advanced	19%	Advanced	47%
Strong	28%	Strong	33%
Intermediate	40%	Intermediate	12%
Low	9%	Low	4%
no reply	3%	no reply	4%
<b>Understanding the challenges of AI-Technologies</b>		<b>Understanding the challenges of AI-Technologies</b>	
Advanced	19%	Advanced	47%
Strong	30%	Strong	31%
Intermediate	33%	Intermediate	14%
Low	15%	Low	4%
no reply	2%	no reply	5%
<b>Executive's ability to incorporate AI in making strategic choices</b>		<b>Executive's ability to incorporate AI in making strategic choices</b>	
Advanced	14%	Advanced	43%
Strong	24%	Strong	36%
Intermediate	33%	Intermediate	13%
Low	26%	Low	3%
no reply	3%	no reply	5%
<b>Understanding how AI investments can be deployed</b>		<b>Understanding how AI investments can be deployed</b>	
Advanced	12%	Advanced	40%
Strong	18%	Strong	40%
Intermediate	32%	Intermediate	10%
Low	35%	Low	6%
no reply	3%	no reply	5%
<b>Efficient tools for machine learning and statistical modelling</b>		<b>Efficient tools for machine learning and statistical modelling</b>	
Advanced	16%	Advanced	40%
Intermediate	32%	Intermediate	15%
Low	38%	Low	5%
no reply	2%	no reply	5%
<b>Competences in extracting and exploitation of complex data</b>		<b>Competences in extracting and exploitation of complex data</b>	
Advanced	15%	Advanced	40%
Strong	16%	Strong	35%
Intermediate	34%	Intermediate	12%
Low	33%	Low	5%
no reply	2%	no reply	8%

SWEDEN			
CURRENT		EXPECTED	
<b>Understanding Principles of Artificial Intelligence</b>		<b>Understanding Principles of Artificial Intelligence</b>	
Advanced	40%	Advanced	40%
Intermediate	40%	Strong	20%
Low	20%	Intermediate	40%
<b>Understanding the challenges of AI-Technologies</b>		<b>Understanding the challenges of AI-Technologies</b>	
Advanced	20%	Advanced	60%
Strong	20%	Strong	20%
Intermediate	40%	Intermediate	20%
Low	20%		
<b>Executive's ability to incorporate AI in making strategic choices</b>		<b>Executive's ability to incorporate AI in making strategic choices</b>	
Advanced	20%	Advanced	60%
Intermediate	40%	Intermediate	40%
Low	40%		
<b>Understanding how AI investments can be deployed</b>		<b>Understanding how AI investments can be deployed</b>	
Advanced	20%	Advanced	40%
Strong	20%	Strong	20%
Intermediate	40%	Intermediate	40%
Low	20%		
<b>Efficient tools for machine learning and statistical modelling</b>		<b>Efficient tools for machine learning and statistical modelling</b>	
Advanced	20%	Advanced	40%
Intermediate	20%	Strong	20%
Low	60%	Intermediate	40%
<b>Competences in extracting and exploitation of complex data</b>		<b>Competences in extracting and exploitation of complex data</b>	
Advanced	20%	Advanced	40%
Intermediate	20%	Intermediate	60%
Low	60%		

Figure XXXV.: Current and expected competences in AI in France, Hungary, Italy and Sweden

### AI Training Expertise Preferences

This table offers insights into respondents' preferences for different levels of expertise in AI training. The question allowed multiple choices among the options.

WHAT LEVEL OF EXPERTISE WOULD YOU BE INTERESTED IN FROM A TRAINING IN ARTIFICIAL INTELLIGENCE?	
<b>FRANCE</b>	
Domain Expert	15%
ICT professional	15%
Management	46%
N/A	23%
<b>HUNGARY</b>	
Domain expert	27%
ICT professional	27%
ICT specialist	8%
Management	19%
N/A	15%
No reply	4%
<b>ITALY</b>	
Domain expert	10%
ICT professional	26%
ICT specialist	25%
Management	31%
N/A	7%
No reply	1%
<b>SWEDEN</b>	
Domain expert	13%
ICT professional	38%
ICT specialist	25%
Management	25%

Figure XXXVI.: Level of expertise interested in AI courses

### 3.5.1 AI company adoption by country

With regard to the current level of Artificial Intelligence knowledge in SME-s in Hungary, the following infographic illustrates the characteristics of the answers given by the SMEs, divided by different aspects of the knowledge.

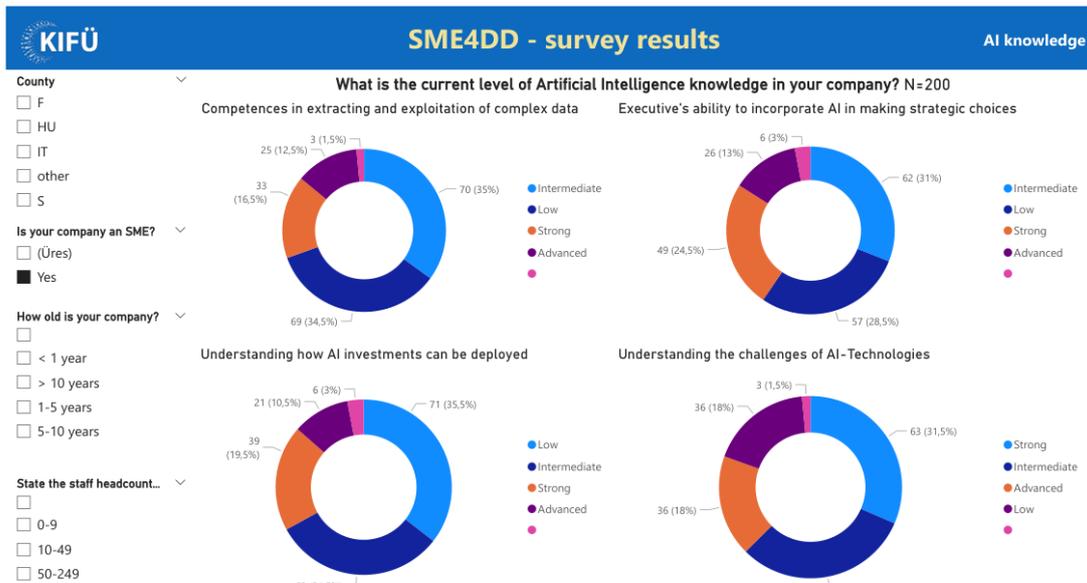


Figure XXXVII.: The current level of AI knowledge in the Hungarian companies

Looking at the graphs together, it can be observed that SME employees already possess a solid understanding of the challenges associated with AI, which serves as the starting point for developments. However, understanding is just the initial step in this journey. Other facets of knowledge are at more modest levels. Responses indicate that a slightly higher proportion of executives, who bear responsibility for strategic decisions in SMEs, demonstrate a moderately strong competence in integrating AI into their company's operations. Approximately two-thirds of respondents have a low or medium level of competence in extracting and leveraging complex data, while a slightly higher proportion (68%) have a low to medium level of comprehension regarding how to make investments in AI.

When we consider the expected level of knowledge in two years' time, the situation appears much more promising, as illustrated in the following table.

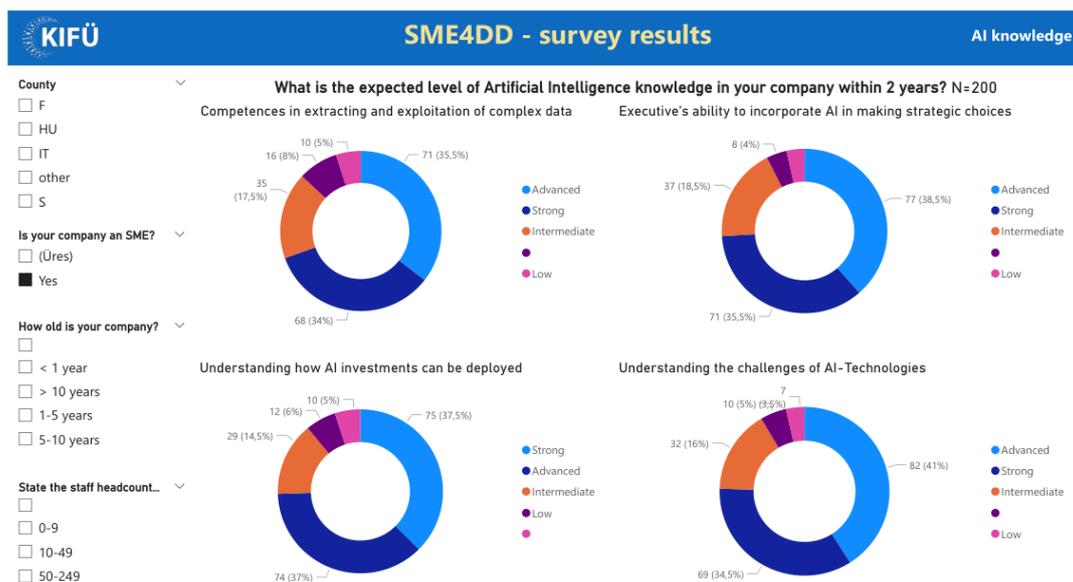


Figure XXXVIII.: The expected level of AI knowledge in the Hungarian companies

Respondents are optimistic in all respects, the proportion of strong to advanced expectations ranges between 70-75%.

Overall, SMEs are eager to integrate AI into their daily business operations and are keen to acquire the necessary skills to do so. However, their current knowledge on the subject remains insufficient.

### **France**

According to the survey results presented, most French companies are either already planning or considering planning for Artificial Intelligence in the coming years. They aim to enhance their efficiency and identify innovation potential, particularly in data management and visualization. Companies are inclined to internally support AI development through adaptations from established platforms. Management is highlighted as the level of expertise interested in training on this topic.

### **Hungary**

As indicated, Hungarian companies are inclined to invest in Artificial Intelligence, supporting internal development through adaptations from established platforms. The primary objective of this development is to enhance efficiency, which is why they identify innovation needs in data management and data visualization. ICT professionals and domain experts are the levels of expertise interested in training.

### **Italy**

Italian companies are already planning or evaluating investments in the application of AI-based technologies in the coming years to enhance their competitive advantage. The development will be primarily supported internally through in-house development efforts. Data management and data visualization have been indicated as the main areas for innovation. Management and ICT professionals are the levels of expertise interested in training.

### **Sweden**

Swedish companies are either investing in or planning to invest in AI to enhance their efficiency and competitive advantage. The development is primarily supported internally. The area where they see the most potential for innovation is in recommendation systems. ICT professionals are the level of expertise interested in AI training.

## **3.6 Blockchain: strategy, needs and skills**

### **Blockchain Investment intentions**

The scope of the table below is to understand if countries are planning or evaluating to plan in the close future an investment in blockchain-based technologies:

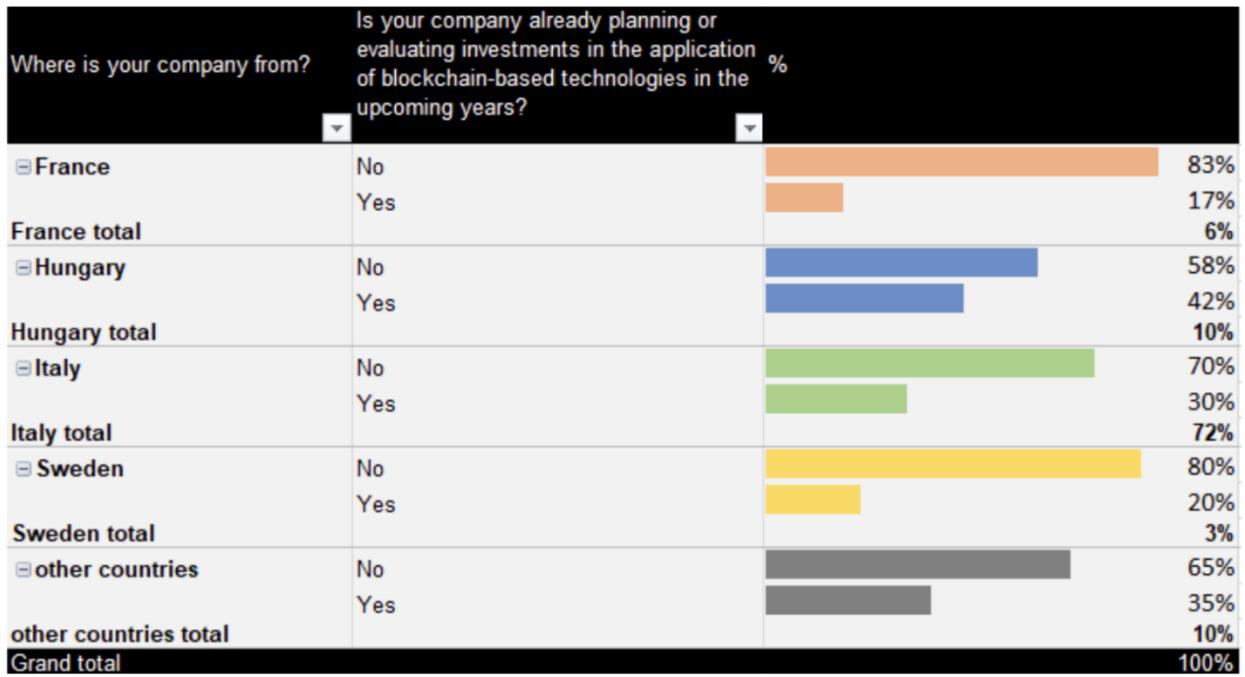


Figure XXXIX.: Companies' interest in investing in blockchain

## Blockchain Investment Support

The table below shows how companies are willing to support the investment in blockchain technologies:



Figure XL.: Companies' willingness to invest in blockchain

The following tables are useful to understand ICT and non-ICT companies' approach to the Blockchain development:

France:

Is your company already planning or evaluating investments in the application of blockchain-based technologies in the upcoming years?	Is your company an ICT company?	How will you support Blockchain development?	%
<input type="checkbox"/> No	<input type="checkbox"/> No No Totale		
<b>No Totale</b>	<input type="checkbox"/> Yes Yes Totale		
<input type="checkbox"/> Yes	<input type="checkbox"/> No No Totale	Mainly internally – own development	100%
<b>Yes Totale</b>	<input type="checkbox"/> Yes Yes Totale	External project manager adapting solutions to our needs	100%
<b>Grand total</b>			

Figure XLI.: ICT and non-ICT companies’ approach to blockchain investment in France

Hungary:

Is your company already planning or evaluating investments in the application of blockchain-based technologies in the upcoming years?	Is your company an ICT company?	How will you support Blockchain development?	%
<input type="checkbox"/> No	<input type="checkbox"/> No No Totale		
<b>No Totale</b>	<input type="checkbox"/> NO REPLY NO REPLY Totale		
<input type="checkbox"/> Yes	<input type="checkbox"/> No No Totale	External project manager adapting solutions to our needs	25%
<b>Yes Totale</b>	<input type="checkbox"/> Yes Yes Totale	Internal project manager – sourcing the expertise through partners	25%
<b>Grand total</b>		Mainly internally – own development	25%
		Outsourcing	25%
		Internal project manager – sourcing the expertise through partners	25%
		Mainly internally – own development	75%

Figure XLII.: ICT and non-ICT companies’ approach to blockchain investment in Hungary

**Italy:**

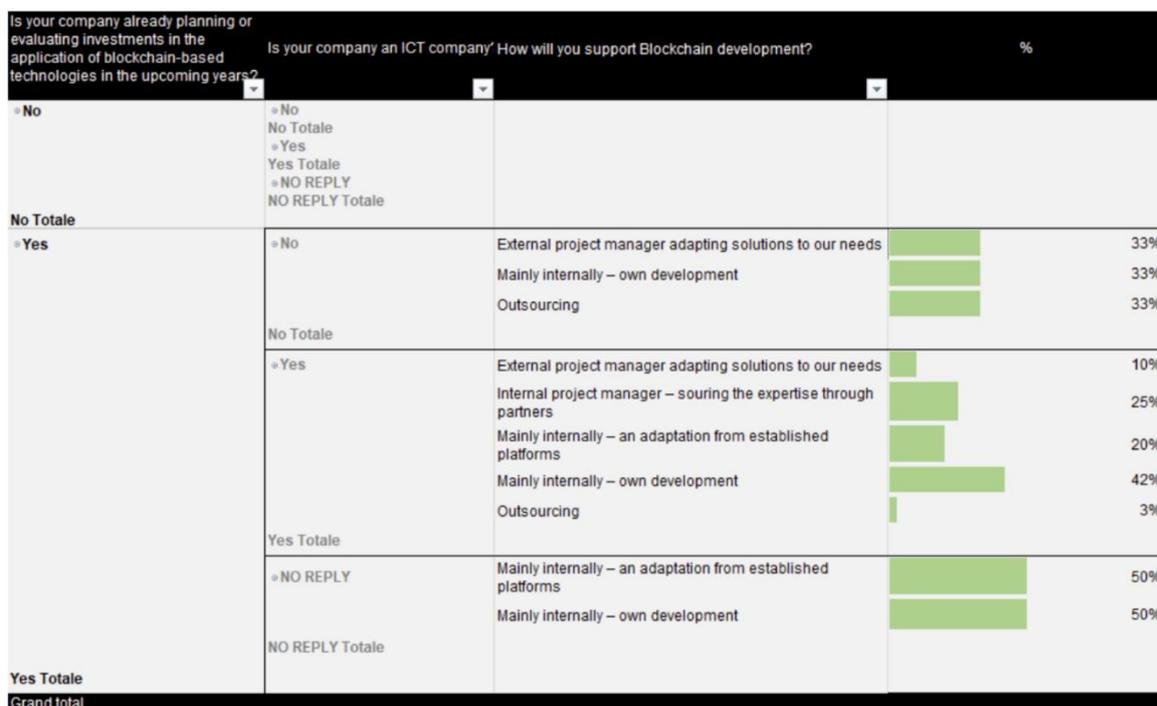


Figure XLIII.: ICT and non-ICT companies’ approach to blockchain investment in Italy

**Sweden:**

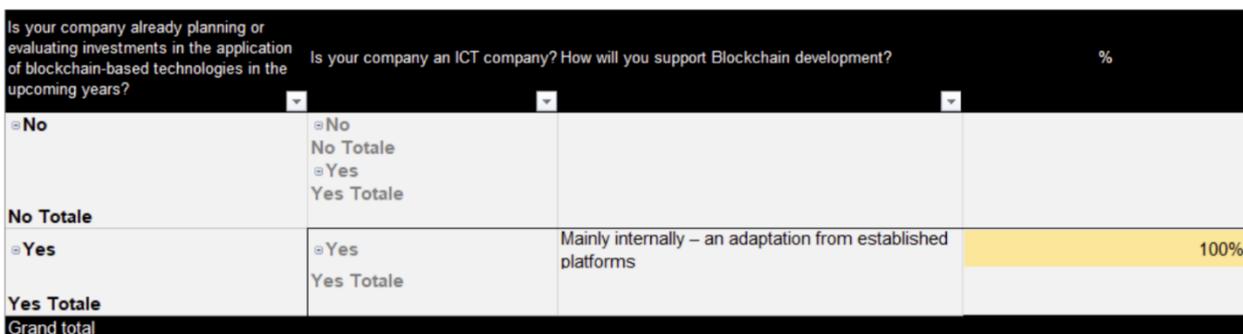


Figure XLIV.: ICT and non-ICT companies’ approach to blockchain investment in France

## Blockchain Investment Motivation

In this table we provide a detailed overview of the motivation driving companies in each country to invest in blockchain. The question allowed a multiple choice up to 2 choices:

WHY ARE YOU INTERESTED IN INVESTIN IN BLOCKCHAIN?	
<b>FRANCE</b>	
Involve crypto-backed funding/crowdsourcing	15%
Increase transparency and traceability	8%
no reply	77%
<b>HUNGARY</b>	
Involve crypto-backed funding/crowdsourcing	4%
Enhance security	7%
Establish new business collaborations	11%
Increase transparency and traceability	11%
Improve efficiency	22%
Other	4%
no reply	41%
<b>ITALY</b>	
Cost reduction	3%
Enhance security	11%
Establish new business collaborations	6%
Improve efficiency	4%
Improve supply chain management	2%
Increase transparency and traceability	13%
Involve crypto-backed funding/crowdsourcing	3%
Other	2%
no reply	57%
<b>SWEDEN</b>	
Establish new business collaborations	20%
no reply	80%

Figure XLV.: Blockchain investment motivation

## Blockchain Innovation Potential by Country

Below the respondents identified the main innovation potentials of the blockchain adoption. Data reported come from multiple choices selection of the respondents.

<b>FRANCE</b>	
Create digital marketplace/auction platforms	15%
Create FinTech services	4%
I already have blockchain-based digitalization ideas	7%
Orchestrating cross-organizational processes	11%

Securing cross-organization document management	22%
Track physical or virtual assets	15%
Trusted data sharing with partners	22%
no reply	4%
<b>HUNGARY</b>	
Create digital marketplace/auction platforms	21%
Create FinTech services	8%
I already have blockchain-based digitalization ideas	5%
Orchestrating cross-organizational processes	11%
Securing cross-organization document management	16%
Track physical or virtual assets	11%
Trusted data sharing with partners	26%
no reply	3%
<b>ITALY</b>	
Create digital marketplace/auction platforms	8%
Create FinTech services	9%
I already have blockchain-based digitalization ideas	5%
Orchestrating cross-organizational processes	12%
Securing cross-organization document management	13%
Track physical or virtual assets	14%
Trusted data sharing with partners	21%
no reply	17%
<b>SWEDEN</b>	
Orchestrating cross-organizational processes	20%
no reply	80%

Figure XLVI.: blockchain innovation potential

### Interest in blockchain Expertise Levels

These tables offer an important cross section of the actual and the desired level of blockchain knowledge inside the companies.

<b>FRANCE</b>			
CURRENT		EXPECTED	
<b>Understanding the basic principles of blockchain technologies</b>		<b>Understanding the basic principles of blockchain technologies</b>	
Advanced	17%	Advanced	17%
Strong	25%	Strong	42%
Intermediate	33%	Intermediate	25%
Low	25%	Low	17%

<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>		<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>	
Advanced	17%	Advanced	17%
Strong	25%	Strong	42%
Intermediate	25%	Intermediate	25%
Low	33%	Low	17%
<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>		<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>	
Advanced	8%	Advanced	8%
Strong	17%	Strong	42%
Intermediate	42%	Intermediate	33%
Low	33%	Low	17%
<b>Competence of RFQs and tenders of Blockchains</b>		<b>Competence of RFQs and tenders of Blockchains</b>	
Strong	17%	Strong	42%
Intermediate	33%	Intermediate	17%
Low	50%	Low	42%
<b>Competence of execute Blockchain projects</b>		<b>Competence of execute Blockchain projects</b>	
Strong	17%	Strong	33%
Intermediate	50%	Intermediate	33%
Low	33%	Low	33%
<b>Competence to integrate Blockchain with existing systems and services</b>		<b>Competence to integrate Blockchain with existing systems and services</b>	
Strong	8%	Strong	33%
Intermediate	50%	Intermediate	42%
Low	42%	Low	25%
<b>Knowledge of the basics of Blockchain interoperability</b>		<b>Knowledge of the basics of Blockchain interoperability</b>	
Advanced	8%	Advanced	8%
Strong	17%	Strong	42%
Intermediate	33%	Intermediate	25%
Low	42%	Low	17%
		no reply	8%
<b>HUNGARY</b>			
CURRENT		EXPECTED	
<b>Understanding the basic principles of blockchain technologies</b>		<b>Understanding the basic principles of blockchain technologies</b>	
Advanced	16%	Advanced	32%
Strong	26%	Strong	26%
Intermediate	37%	Intermediate	26%
Low	21%	Low	11%
		no reply	5%

<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>		<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>	
Advanced	16%	Advanced	26%
Strong	21%	Strong	32%
Intermediate	26%	Intermediate	21%
Low	32%	Low	16%
no reply	5%	no reply	5%
<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>		<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>	
Advanced	16%	Advanced	21%
Intermediate	32%	Intermediate	26%
Low	32%	Low	16%
no reply	5%	no reply	5%
Strong	16%	Strong	32%
<b>Competence of RFQs and tenders of Blockchains</b>		<b>Competence of RFQs and tenders of Blockchains</b>	
Advanced	11%	Advanced	26%
Strong	16%	Strong	21%
Intermediate	32%	Intermediate	32%
Low	37%	Low	16%
no reply	5%	no reply	5%
<b>Competence of execute Blockchain projects</b>		<b>Competence of execute Blockchain projects</b>	
Advanced	11%	Advanced	16%
Strong	11%	Strong	32%
Intermediate	37%	Intermediate	32%
Low	42%	Low	16%
		no reply	5%
<b>Competence to integrate Blockchain with existing systems and services</b>		<b>Competence to integrate Blockchain with existing systems and services</b>	
Advanced	11%	Advanced	16%
Strong	11%	Strong	26%
Intermediate	37%	Intermediate	42%
Low	42%	Low	11%
		no reply	5%
<b>Knowledge of the basics of Blockchain interoperability</b>		<b>Knowledge of the basics of Blockchain interoperability</b>	
Advanced	11%	Advanced	21%
Strong	11%	Strong	16%
Intermediate	32%	Intermediate	42%
Low	47%	Low	16%
		no reply	5%

ITALY			
CURRENT		EXPECTED	
<b>Understanding the basic principles of blockchain technologies</b>		<b>Understanding the basic principles of blockchain technologies</b>	
Advanced	8%	Advanced	20%
Strong	23%	Strong	36%
Intermediate	33%	Intermediate	22%
Low	25%	Low	7%
no reply	11%	no reply	15%
<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>		<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>	
Advanced	6%	Advanced	21%
Strong	24%	Strong	33%
Intermediate	28%	Intermediate	23%
Low	31%	Low	8%
no reply	12%	no reply	15%
<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>		<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>	
Advanced	4%	Advanced	17%
Strong	15%	Strong	29%
Intermediate	27%	Intermediate	26%
Low	43%	Low	13%
no reply	11%	no reply	15%
<b>Competence of RFQs and tenders of Blockchains</b>		<b>Competence of RFQs and tenders of Blockchains</b>	
Advanced	3%	Advanced	15%
Strong	10%	Strong	24%
Intermediate	18%	Intermediate	28%
Low	58%	Low	17%
no reply	11%	no reply	15%
<b>Competence of execute Blockchain projects</b>		<b>Competence of execute Blockchain projects</b>	
Advanced	6%	Advanced	18%
Strong	13%	Strong	26%
Intermediate	20%	Intermediate	28%
Low	50%	Low	13%
no reply	12%	no reply	15%
<b>Competence to integrate Blockchain with existing systems and services</b>		<b>Competence to integrate Blockchain with existing systems and services</b>	
Advanced	6%	Advanced	19%
Strong	11%	Strong	27%
Intermediate	25%	Intermediate	26%

Low	46%	Low	13%
no reply	12%	no reply	15%
<b>Knowledge of the basics of Blockchain interoperability</b>		<b>Knowledge of the basics of Blockchain interoperability</b>	
Advanced	6%	Advanced	17%
Strong	12%	Strong	28%
Intermediate	30%	Intermediate	24%
Low	41%	Low	12%
no reply	11%	no reply	19%
<b>SWEDEN</b>			
CURRENT		EXPECTED	
<b>Understanding the basic principles of blockchain technologies</b>		<b>Understanding the basic principles of blockchain technologies</b>	
Advanced	20%	Advanced	20%
Intermediate	40%	Intermediate	40%
Low	40%	Strong	20%
		Low	20%
<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>		<b>Understanding and evaluation of the potential of Blockchain solutions in a concrete business context</b>	
Advanced	20%	Advanced	20%
Strong	20%	Strong	40%
Intermediate	20%	Intermediate	20%
Low	40%	Low	20%
<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>		<b>Executive's ability to incorporate Blockchain in strategic choices (e.g. supply chains, collaborate with partners, improve efficiency)</b>	
Intermediate	40%	Advanced	20%
Low	40%	Intermediate	20%
no reply	20%	Low	40%
		no reply	20%
<b>Competence of RFQs and tenders of Blockchains</b>		<b>Competence of RFQs and tenders of Blockchains</b>	
Strong	20%	Low	60%
Low	60%	Advanced	20%
no reply	20%	no reply	20%
<b>Competence of execute Blockchain projects</b>		<b>Competence of execute Blockchain projects</b>	
Strong	20%	Advanced	20%
Low	60%	Intermediate	20%
no reply	20%	Low	40%
		no reply	20%
<b>Competence to integrate Blockchain with existing systems and services</b>		<b>Competence to integrate Blockchain with existing systems and services</b>	
Strong	20%	Advanced	20%

Low	60%	Intermediate	20%
no reply	20%	Low	40%
		no reply	20%
<b>Knowledge of the basics of Blockchain interoperability</b>		<b>Knowledge of the basics of Blockchain interoperability</b>	
Intermediate	20%	Advanced	20%
Low	60%	Low	60%
no reply	20%	no reply	20%

Figure XLVII.: Current and expected competences in blockchain

### Blockchain Training Expertise Preferences

This table offers insights into respondents' preferences for different levels of expertise in blockchain training. Information has been gathered through respondents' multiple-choice answer to the question:

<b>WHAT LEVEL OF EXPERTISE WOULD BE INTERESTED IN A TRAINING IN BLOCKCHAIN?</b>	
<b>FRANCE</b>	
Domain Expert	15%
ICT professional	15%
Management	46%
N/A	23%
<b>HUNGARY</b>	
Domain expert	27%
ICT professional	27%
ICT specialist	8%
Management	19%
N/A	15%
no reply	4%
<b>ITALY</b>	
Domain expert	7%
ICT professional	24%
ICT specialist	21%
Management	29%
N/A	12%
no reply	6%
<b>SWEDEN</b>	
Domain expert	13%
ICT professional	38%
ICT specialist	25%
Management	25%

Figure XLVIII.: Level of expertise interested in blockchain courses

The characteristics of the responses regarding blockchain technology are outlined below. The uncertainty surrounding internal activities related to blockchain may be indicated by the high non-response ratio concerning support for development and the willingness to invest in it. The challenge of accessing external providers may be indicated by the prevalence of internal, in-house development. Additionally, the most common area of use cases typically pertains to traceability and security.

Interestingly, the respondents displayed greater creativity in terms of innovation potential, particularly in the context of using applications for collaboration with business partners and enhancing interaction with them.

We inquired about various aspects of the level of blockchain knowledge within the company. The responses indicate that the level of knowledge is generally low, with most respondents possessing only basic knowledge. The only areas where respondents perceive higher levels of knowledge are in identifying suitable use cases and at the strategy-making level. However, respondents are optimistic and anticipate a significant increase in knowledge across all areas within two years.

In terms of the expertise gained through training, management knowledge takes the lead, followed by the highest and intermediate levels of ICT expertise, and finally, experts in sectoral specialisations.

Based on the survey responses, we analysed the current level of knowledge and the required competencies, with a particular focus on respondents who have plans to invest in blockchain technology.

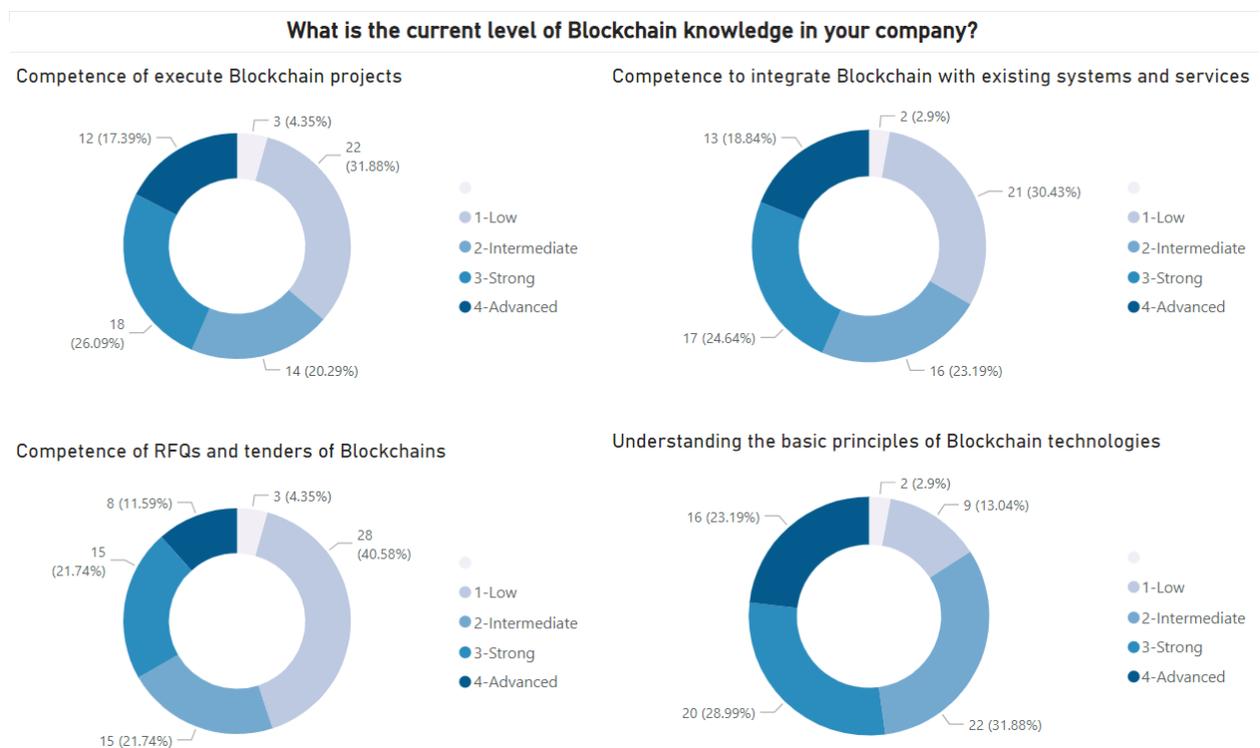


Figure XLIX.: Current level of blockchain knowledge (companies with investment plans, N=69)

The figure above illustrates the ratio and absolute number of companies categorized by their level of preparedness in terms of project execution, integration, RFQ/tender definition, and overall technological background (with a focus on the basic principles).

When the analysis narrows down to the companies that plan to invest in blockchain technology (61 out of 200 respondents), we observe that these companies generally possess a strong foundation in basic technological knowledge, making them somewhat "over-qualified" compared to the general audience. However, only one-third of these companies exhibit solid or advanced skills in RFQ and tender definition. The majority of the companies intend to invest without a strong background in project execution and integration, highlighting the pressing need to develop these competencies. The absence of these skills may potentially lead to project failure, even during the proof-of-concept development phase.

Analysing the expected skill levels among the companies that have expressed interest in blockchain, a significant gap between their current and anticipated skill sets becomes apparent. In most aspects, over 80% of these companies aspire to achieve at least a "Strong" level of competency. This indicates a substantial disparity between their existing in-house competencies and the desired ones.

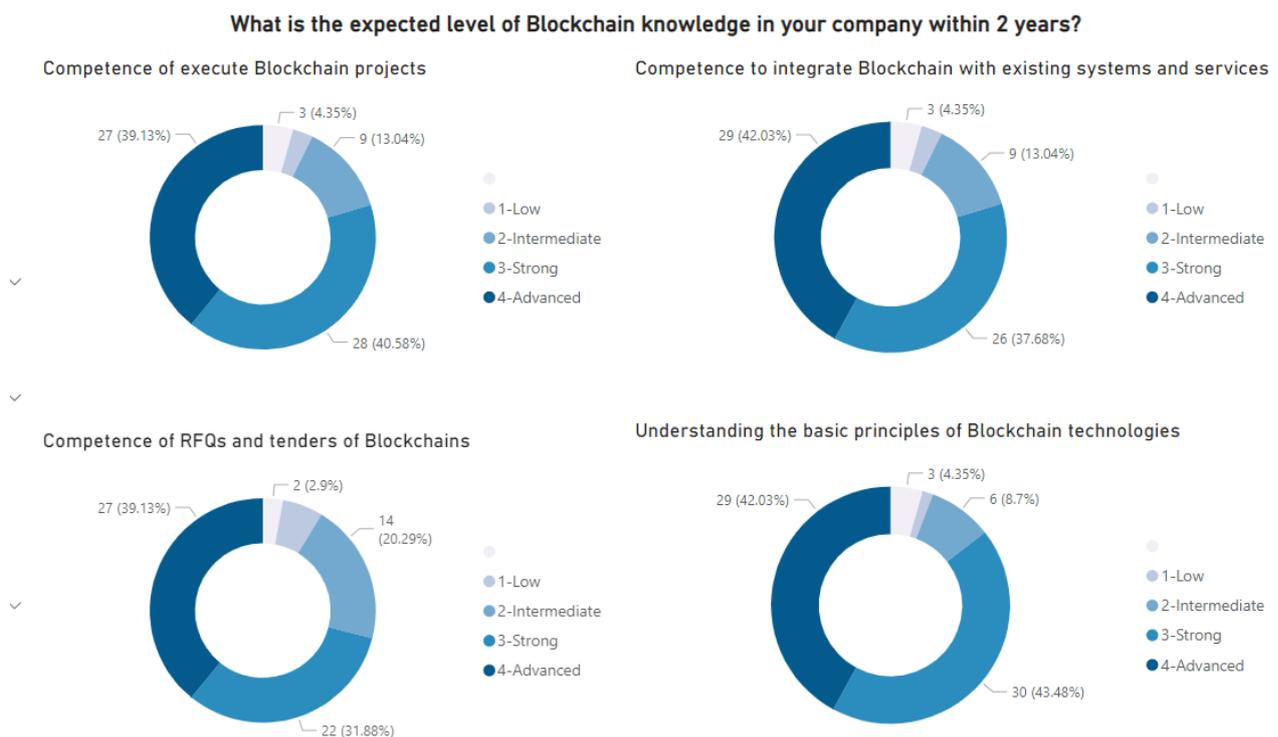


Figure L.: Expected level of blockchain knowledge

Considering the entire dataset, it is worth noting that 70-80% of the companies have recognised the need to attain at least an intermediate level of knowledge in all competencies, even those without actual investment plans. This suggests that there may be a demand for high-level courses designed for decision-makers and product owners within these companies.

When simultaneously analysing various aspects, it becomes apparent that those companies willing to invest in blockchain (31%) also display a strong interest in other technologies (>80% willingness to invest in AI and CyberSec within this subgroup of respondents). This observation suggests that there might be an opportunity to promote, and cross-sell courses related to other fields among participants in blockchain courses.

**Is your company already planning or evaluating investments in the application of AI-based / blockchain / cybersecurity technologies in the upcoming years? N=200**

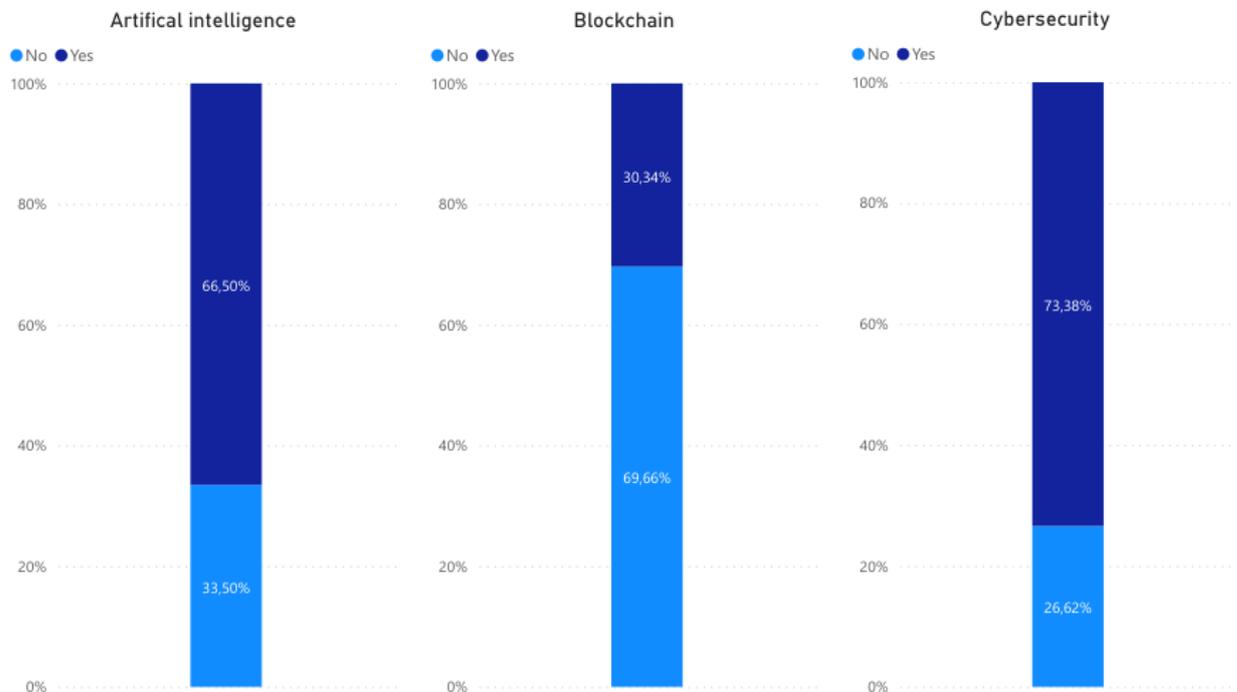


Figure I1.: Investment intentions: plans to invest in other technologies among companies interested blockchain

**France**

Among the companies who took part to the survey, the majority stated that they are not planning or willing to plan investment in blockchain based technologies. The minority who claimed to be interested in blockchain did not help clarifying how the investment will be supported due to the low number of responses. However, it has emerged that most of the French companies are interested in investing in blockchain to involve crypto-backed funding/crowd searching and they see the innovation potential in trusted data sharing with partners and securing cross-organisation document management. The management is the level of expertise more interested in training on this topic.

**Hungary**

Despite there is not an important difference among between who voted, the majority of the company choose not to invest in blockchain in the upcoming years. By the other side, the ones how are willing to invest or are already investing will support the investment through outsourcing to improve the efficiency. Trusted data sharing with partners is considered the main innovation potential offered by this technology. Domain expert and ICT professionals are the level of expertise the trainings will be addressed to.

## Italy

In Italy, most of the companies are interested in blockchain-based technologies and are planning or have already planned to invest on this new technology to increase transparency and traceability. Companies stated they will support the development mainly internally, thanks to the own development. Management and ICT professional are the level of expertise interested in courses.

## Sweden

Most of the Swedish companies are not planning or have not already plan in investment in blockchain. Here, as for the Franch companies, due to the low rate of respondents it is hard to profile a clear answer on how they will support the development according to the Figure L, and we can state the same when the question wants to understand the reason why they are interested in blockchain (Figure XLIX). ICT professionals have been indicated as the level of expertise to address the courses on blockchain too.

### 3.7 Cybersecurity: strategy, need and skills

In the table below it is possible to understand for each county if companies are evaluating in the upcoming years or have already planned an investment in cybersecurity-based technologies:

Country	Is your company already planning or evaluating investments in the application of cybersecurity-based technologies in the upcoming years?	%
France	No	42%
	Yes	58%
<b>France Totale</b>		<b>6%</b>
Hungary	No	53%
	Yes	47%
<b>Hungary Totale</b>		<b>10%</b>
Italia	No	28%
	Yes	72%
<b>Italia Totale</b>		<b>72%</b>
Sweden	No	40%
	Yes	60%
<b>Sweden Totale</b>		<b>3%</b>
other countries	No	25%
	Yes	75%
<b>other countries Totale</b>		<b>10%</b>
<b>Grand total</b>		<b>100%</b>

Figure LII.: Companies' interest in cybersecurity

Follow in detail with areas are considered most valuable for a company. Answers were gathered from a multiple-choice question:

<b>WHAT AREAS DO YOU BELIEVE WILL BE MOST VALUABLE?</b>	
<b>FRANCE</b>	
Compliance with regulations and laws	15%
Strengthen business resilience (response plan, awareness planning)	19%
Strengthen cybersecurity operations (Enterprise architecture, threat management, kill chain)	15%
Strengthen cybersecurity software (multi-factor authentication, software updates, data backup, access control, etc.)	19%
Vulnerability and incident management	15%
No reply	19%
<b>HUNGARY</b>	
Compliance with regulations and laws	10%
Strengthen business resilience (response plan, awareness planning)	13%
Strengthen cybersecurity operations (Enterprise architecture, threat management, kill chain)	17%
Strengthen cybersecurity software (multi-factor authentication, software updates, data backup, access control, etc.)	17%
Vulnerability and incident management	10%
No reply	33%
<b>ITALY</b>	
Compliance with regulations and laws	12%
Strengthen business resilience (response plan, awareness planning)	14%
Strengthen cybersecurity operations (Enterprise architecture, threat management, kill chain)	16%
Vulnerability and incident management	19%
Strengthen cybersecurity software (multi-factor authentication, software updates, data backup, access control, etc.)	25%
Other	1%
No reply	13%
<b>SWEDEN</b>	
Compliance with regulations and laws	10%
Strengthen cybersecurity operations (Enterprise architecture, threat management, Skill chain)	20%
Strengthen cybersecurity software (multi-factor authentication, software updates, data backup, access control, etc.)	30%
Vulnerability and incident management	20%
No reply	20%

Figure LIII.: Most valuable areas for cybersecurity

To have a deeper compression of the topic, it is important to understand companies' perception of the main challengers they have to face in when we talk about cybersecurity. Below find a table where it is possible to understand where threats are seen. Answers were gathered from a multiple-choice question:

<b>WHAT ARE THE MAIN CHALLENGES YOUR COMPANY FACES IN TERMS OF CYBERSECURITY?</b>	
<b>FRANCE</b>	
External threats (criminal hacker, phishing, malware)	29%
Internal threats (human errors, negligence)	16%
Lack of awareness among employees	19%
Lack of financial sources for trainings	16%
Lack of qualified staff	10%
Other	10%
<b>HUNGARY</b>	
External threats (criminal hacker, phishing, malware)	25%
Internal threats (human errors, negligence)	21%
Lack of awareness among employees	19%
Lack of financial sources for trainings	17%
Lack of qualified staff	17%
No reply	2%
<b>ITALY</b>	
External threats (criminal hacker, phishing, malware)	35%
Internal threats (human errors, negligence)	17%
Lack of financial sources for trainings	11%
Lack of qualified staff	14%
Lack of awareness among employees	18%
Other	1%
No reply	4%
<b>SWEDEN</b>	
External threats (criminal hacker, phishing, malware...)	38%
Internal threats (human errors, negligence...)	13%
Lack of awareness among employees	25%
Lack of financial sources for trainings	13%
Lack of qualified staff	13%

Figure LIV.: Challenges and cybersecurity

This is how companies intend to support cybersecurity development:



Figure LV.: Cybersecurity development support

The following tables are useful to understand ICT and non-ICT companies' approach to the Cybersecurity development:

**France:**

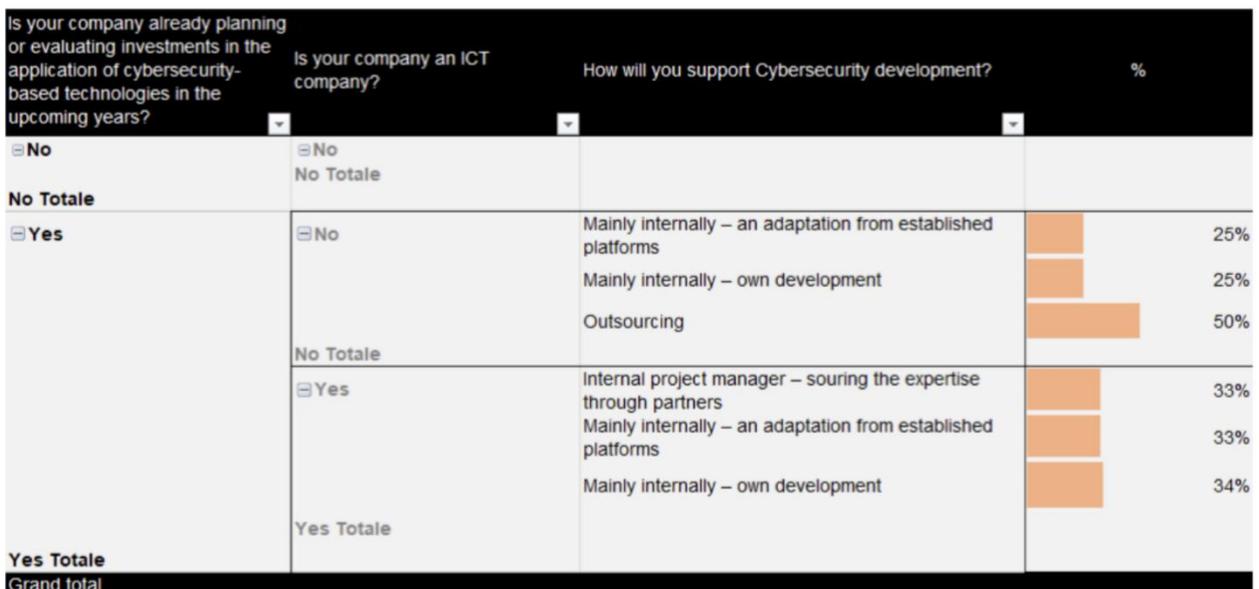


Figure LVI.: ICT and non-ICT companies' approach to the Cybersecurity development in France

## Hungary:



Figure LVII.: ICT and non-ICT companies' approach to the Cybersecurity development in Hungary

## Italy:

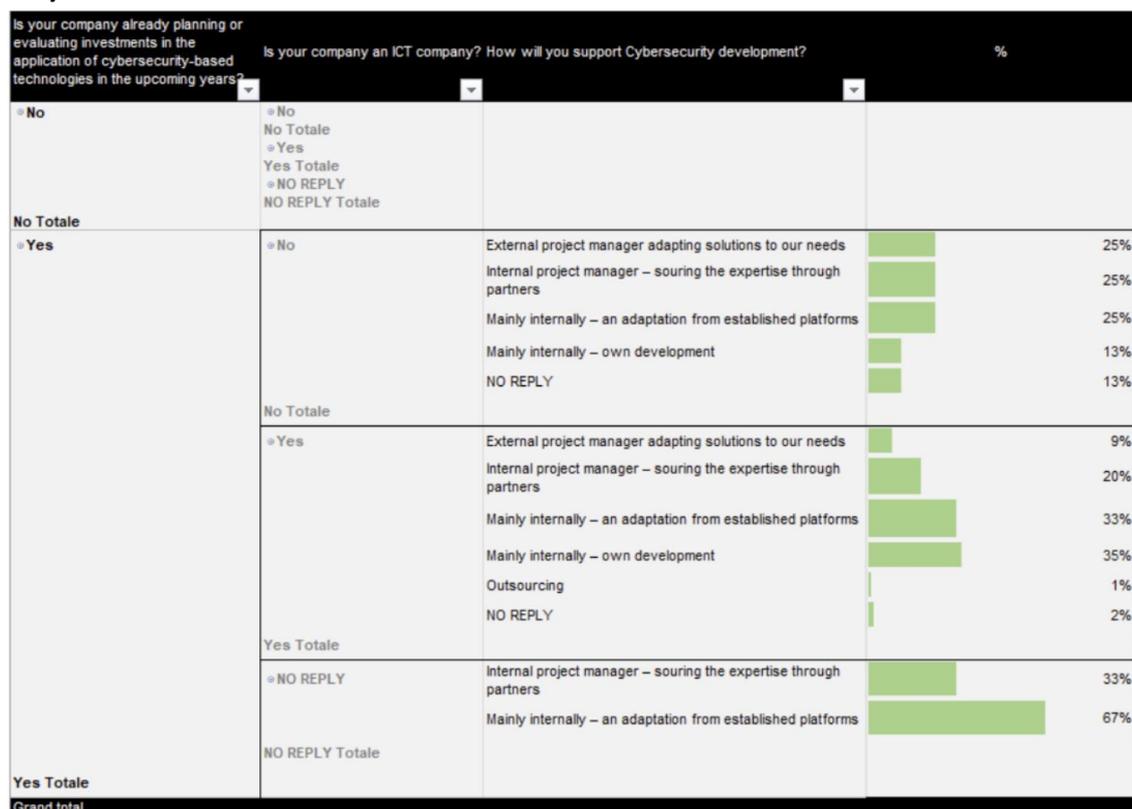


Figure LVIII.: ICT and non-ICT companies' approach to the Cybersecurity development in Italy

Sweden:

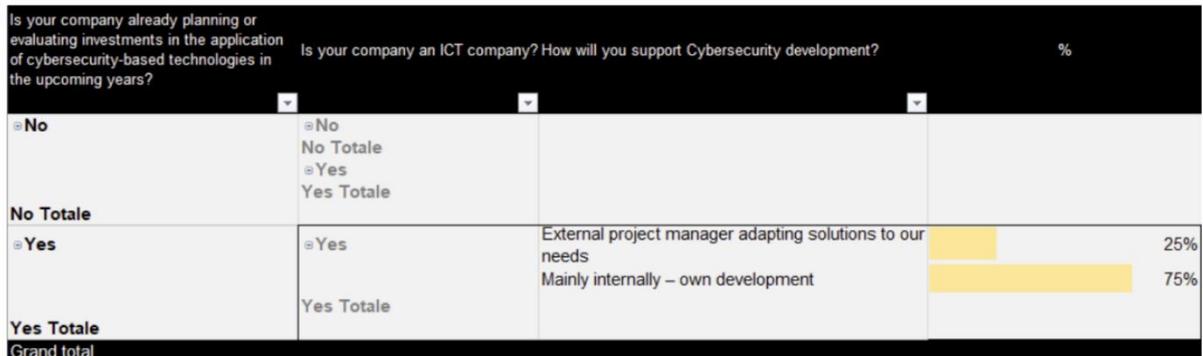


Figure LIX.: ICT and non-ICT companies' approach to the Cybersecurity development in Sweden

Understanding the level of expertise interested in cybersecurity is one of the most important points since not only it allows us to get how the interest in the topic inside a company is distributed, but also it gives us a first information on who will take part of the future courses that will be organized thanks to this project. Answers were gathered from a multiple-choice question:

WHAT LEVEL OF EXPERTISE WOULD YOU BE INTERESTED IN FROM A TRAINING IN CYBERSECURITY?	
FRANCE	
Domain expert	21%
ICT professional	14%
Management	57%
N/A	7%
HUNGARY	
Domain expert	25%
ICT professional	25%
ICT specialist	13%
Management	17%
N/A	17%
No reply	4%
ITALY	
Domain expert	10%
ICT professional	28%
ICT specialist	24%
Management	28%
N/A	5%

No reply	4%
<b>SWEDEN</b>	
ICT professional	17%
ICT specialist	33%
Management	33%
No reply	17%

Figure LX.: level of expertise interested in cybersecurity courses

### 3.7.1 Cybersecurity company adoption by country

#### France

The majority of French companies are either planning or evaluating the implementation of cybersecurity-based technologies. They consider the most valuable areas to be the strengthening of cybersecurity software, cybersecurity operations, and business resilience. The primary challenges these companies face in terms of cybersecurity include external threats, lack of employee awareness, and internal threats.

Due to the limited number of responses collected, it has been challenging to clearly define how cybersecurity development will be supported. However, concerning the level of expertise interested in training in this sector, there is a clear preference for management.

#### Hungary

Based on the survey analysis, there is no clear consensus, but a slight majority indicated that they are not currently investing in cybersecurity or planning to do so. Among those who have decided to invest, the areas considered most valuable are the strengthening of cybersecurity software and operations. The main cybersecurity challenges for companies include external and internal threats, as well as a lack of employee awareness.

The support for cybersecurity development will primarily come from within, through adaptations from established platforms. ICT professionals, followed by domain experts, are the most interested in training on this technology.

#### Italy

The majority of Italian companies are planning or have already planned to invest in cybersecurity-based technologies. They consider the most valuable areas to be the strengthening of cybersecurity software and operations, vulnerability management, and incident management. External and internal threats, along with a lack of employee awareness, are the primary challenges related to cybersecurity technologies within these companies.

There is a clear preference for mainly internal support for cybersecurity development through adaptations from established platforms and in-house development. Management, ICT professionals, and ICT specialists are the levels of expertise interested in training in this sector.

## Sweden

Swedish companies are already investing in or planning to invest in cybersecurity in the coming years. They perceive the most valuable areas to be the strengthening of cybersecurity software, operations, vulnerability management, and incident management. External threats appear to be the primary challenges faced by these companies.

The support for cybersecurity development will primarily be internal, through in-house development. ICT specialists and management are the levels of expertise interested in cybersecurity courses.

### 3.8 Courses: the best way to master your skills

In this section, we examine how respondents learn and the courses they prefer. We explore data and insights from respondents' choices, revealing effective methods for acquiring skills and the preferences that influence their learning paths.

#### Training Language

This table provides data on the preferred language for training, revealing respondents' linguistic preferences in their learning experiences.

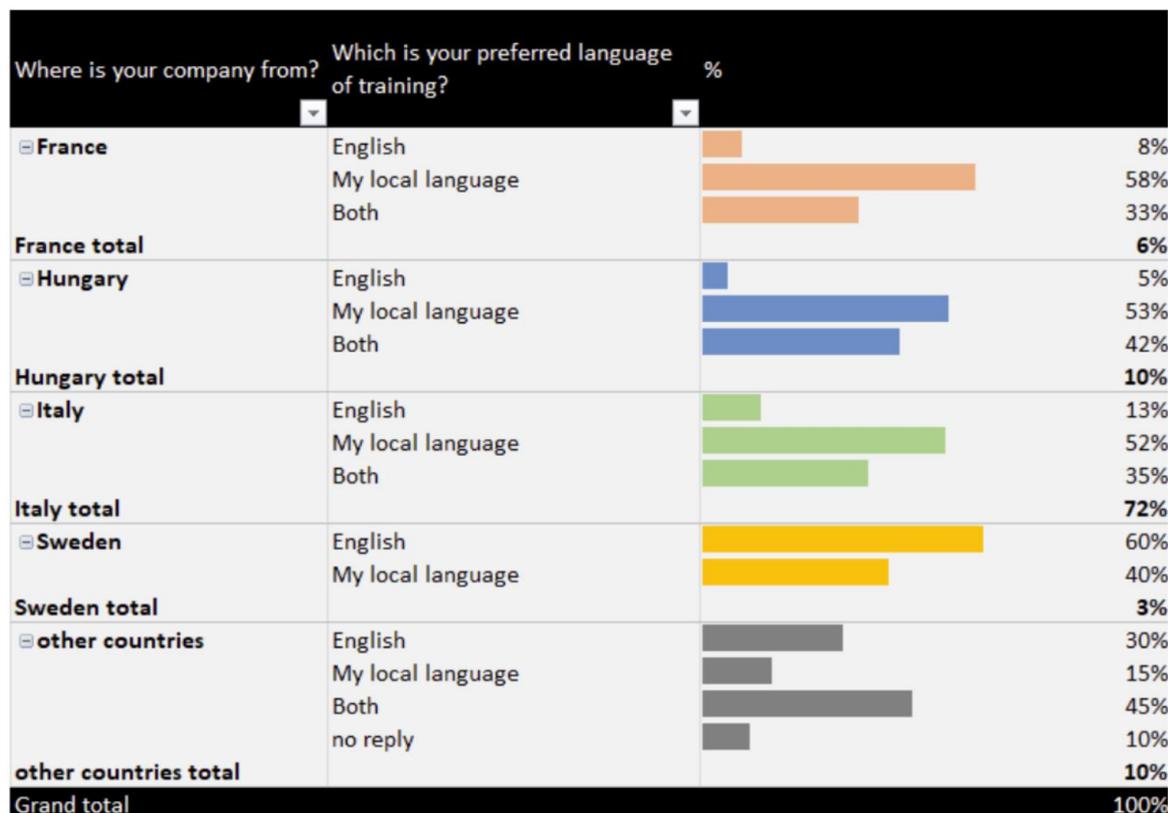


Figure LXI.: Preferred language for trainings

## Training Formats

The table below presents insights into respondents' preferences regarding training formats, including data on the training methods and structures that individuals find most effective for their learning. Respondents could choose up to 2 options of answer:

WHAT FORMAT OF TRAINING WOULD YOU BE INTERESTED IN?	
<b>FRANCE</b>	
1-2 hours open seminars/masterclasses	21%
1-3 days courses	26%
2-3 minutes learning videos (micro learning)	16%
MOOCs (average effort 20-40 hours)	21%
Week-end courses (e.g. 6-8 weekends)	16%
<b>HUNGARY</b>	
1-2 hours open seminars/masterclasses	19%
1-3 days courses	35%
2-3 minutes learning videos (micro learning)	10%
Intensive weekly courses (e.g. 3 weeks in a semester)	6%
MOOCs (average effort 20-40 hours)	16%
Week-end courses (e.g. 6-8 weekends)	10%
No reply	3%
<b>ITALY</b>	
Intensive weekly courses (e.g. 3 weeks in a semester)	5%
Week-end courses (e.g. 6-8 weekends)	7%
MOOCs (average effort 20-40 hours)	13%
2-3 minutes learning videos (micro learning)	20%
1-2 hours open seminars/masterclasses	25%
1-3 days courses	28%
No reply	2%
<b>SWEDEN</b>	
1-2 hours open seminars/masterclasses	38%
1-3 days courses	13%
2-3 minutes learning videos (micro learning)	13%
Intensive weekly courses (e.g. 3 weeks in a semester)	13%
MOOCs (average effort 20-40 hours)	13%
Week-end courses (e.g. 6-8 weekends)	13%

Figure LXII.: Trainings format

## Learning Modes

The table below offers respondents' insights into their preferred learning modes. It provides valuable information about the methods and environments individuals find most effective when acquiring new knowledge and skills. Respondents could choose up to 2 options of answer:

WHICH ARE YOUR PREFERRED LEARNING MODES?	
FRANCE	
All are equally good	12%
Blended/Hybrid	18%
Face to face	18%
Online live	18%
Online self-paced	35%
HUNGARY	
All are equally good	6%
Blended/Hybrid	18%
Face to face	27%
Online live	30%
Online self-paced	18%
ITALY	
No reply	1%
All are equally good	11%
Face to face	14%
Blended/Hybrid	18%
Online self-paced	22%
Online live	33%
SWEDEN	
All are equally good	14%
Blended/Hybrid	29%
Online live	14%
Online self-paced	43%

Figure LXIII.: Preferred learning modes

## The importance of certificates

These following two tables provide insights into the importance of certificates and the preferences for specific certificate types:

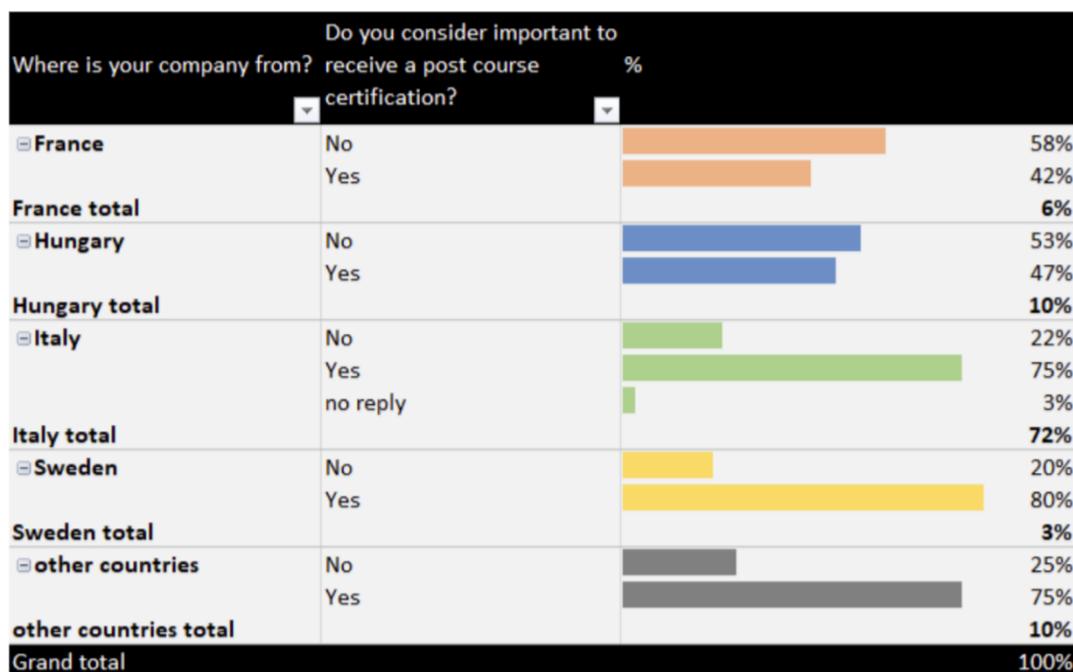


Figure LXIV.: Importance of receiving post-courses certificate

Here we find a list of possible certifications that can be issued by the courses' providers at the end of the trainings. Respondents could choose up to 2 options of answers; this is how they expressed their preferences:

WHAT TYPES OF CERTIFICATIONS WOULD YOU BE INTERESTED IN?	
<b>FRANCE</b>	
Certificate of attendance	8%
Skills certificate	38%
No reply	54%
<b>HUNGARY</b>	
Certificate of attendance	10%
Skills certificate	38%
Other	5%
No reply	48%
<b>ITALY</b>	
Certificate of attendance	25%
Skills certificate	55%
No reply	20%
<b>SWEDEN</b>	
Certificate of attendance	17%
Skills certificate	67%
No reply	17%

Figure LXV.: Types of certifications

## Training strategies for accessing training

The following table provides insights into how respondents typically address their training needs. It offers a comprehensive overview of the strategies and methods commonly employed by respondents when they require training. The question was structured as a multiple-choice question where it was possible to choose up to 3 options.

IF YOU HAVE A NEED FOR TRAINING, HOW DO YOU USUALLY PROCEED?	
<b>FRANCE</b>	
I ask our HR/training department and if I am interested in the proposal, I register to the training	5%
I learn from my colleagues	20%
I make a request on Google/Chat GPT to find a training course and I make a request to my hierarchy to have a financing	45%
I register for MOOCs and other free resources	25%
Other (I ask my network of professionals in that space)	5%
<b>HUNGARY</b>	
I ask our HR/training department and if I am interested in the proposal, I register to the training	6%
I learn from my colleagues	22%
I make a request on Google/Chat GPT to find a training course and I make a request to my hierarchy to have a financing	33%
I register for MOOCs and other free resources	31%
Other	6%
No reply	3%
<b>ITALY</b>	
I ask our HR/training department and if I am interested in the proposal I register to the training	18%
I learn from my colleagues	18%
I make a request on Google/Chat GPT to find a training course and I make a request to my hierarchy to have a financing	22%
I register for MOOCs and other free resources	32%
I learn from my colleagues	22%
I ask our HR/training department and if I am interested in the proposal I register to the training	32%
<b>SWEDEN</b>	
I ask our HR/training department and if I am interested in the proposal, I register to the training	25%
I learn from my colleagues	38%
I make a request on Google/Chat GPT to find a training course and I make a request to my hierarchy to have a financing	13%
I register for MOOCs and other free resources	25%

Figure LXVI. Need for training

### 3.8.1 Course preference by country

#### **France**

French companies prefer training in their local language, preferably through 1–3-day self-paced online courses. For most of them, acquiring a post-course certification is not considered important; instead, they prefer a skill certificate. When French employees require training, they commonly initiate their search using Google or Chat GPT to identify suitable courses. Subsequently, they proceed to seek financial support from their organisational hierarchy.

#### **Hungary**

Hungarian companies also prefer training in the local language, typically through 1-3-day live online courses. There is almost equal interest in receiving a post-course certification, with a slight tendency towards not considering it important. Among those who prefer certification, a skill certificate is the top choice. When they need training, Hungarians request it through Google/Chat GPT to find a course and then request financing from their hierarchy or opt for MOOCs and other free resources.

#### **Italy**

In Italy, the preferred language for training is Italian. The most popular formats are 1-3-day courses or 1–2-hour open seminars/masterclasses. Online live learning is the preferred mode. Receiving a post-course certification is important, especially a skill certificate, followed by a certificate of attendance. When they need training, they typically contact the HR/training department, and if they are interested in the proposed training, they register for it.

#### **Sweden**

In contrast to other countries, the preferred language for training in Sweden is English, often through 1–2-hour open seminars/masterclasses. Online self-paced learning is the preferred method. Receiving a post-course certificate is considered important, with a clear preference for skill certificates. When Swedes need training, they prefer to learn from colleagues.

### 3.8.2 Contact interest in future SME4DD courses

This last part is useful to understand, at this point of the project, if we collected interest and in what extent. It is possible to affirm that the trend is positive, since most of the companies from each country (an exception from Sweden) decelerated they wish to be kept updated on the possibility to take part to future workshops and courses.

In the table below it is possible to see how they express their preferences on being contacted for webinar and for courses:



Figure LXVII.: Interest in workshops and courses

In case of positive answer to at least one of the questions before, the respondents were asked as a last question to leave their mail address; through this analysis we collected:

- 10 mail contacts on 12 from France
- 16 mail contacts on 19 from Hungary
- 122 mail contacts on 144 from Italy
- 2 mail contacts on 5 from Sweden
- 13 mail contacts on 21 from other countries

## 4 Conclusions and next steps

In light of the insights gained from both desk research and our comprehensive survey analysis, we now turn our attention to the specific findings and implications across the three key domains of innovation potential: Blockchain, AI and Cybersecurity.

### 4.1 Workshops

To further and better understand and gain an even more insightful and focused interpretation of the main needs of companies identified via the survey, dedicated workshops in online or face-to-face format were planned in SME4DD project, to validate and expand on the quantitative survey data.

The first series of workshops were executed until Q3 of 2023, and the second series of workshops until Q4 of 2023.

The feedback received from the workshops effectively reaffirmed the findings from our comprehensive questionnaire survey and extensive desk research. Across the board, it became evident that Small and Medium Enterprises (SMEs) continue to grapple with significant challenges in acquiring knowledge related to technology and digitalization.

External resources are often constrained by a shortage of adequately skilled professionals, and the remuneration expectations of such professionals tend to be on the higher end of the spectrum. Meanwhile, internal resources, even within the realm of IT professionals, often lack specialized knowledge essential for navigating the intricacies of emerging technologies.

The overarching expectation regarding training content primarily revolves around the dissemination of best practices, practical, real-world applications, and the imparting of technical know-how that is instrumental for practical implementation.

Moreover, management training has emerged as a foremost priority. This prioritization is attributed to the profound recognition that managerial awareness and firm commitment are pivotal elements in driving strategic planning and effective decision-making within SMEs. The realization of this fact has highlighted the crucial need for upskilling in management practices.

At the employee level, the feedback garnered from participants has underscored the demand for IT training. The primary objective of this IT training is to bolster proficiency in product development, empowering employees with the skills and insights necessary to navigate and excel in this domain. Furthermore, there is an expressed need for understanding the regulatory environment surrounding the application of these advanced technologies to ensure legal compliance, a facet that is increasingly pertinent in the evolving business landscape. So we can say, that best targeted courses must express the principle of interdisciplinarity, too.

In essence, the feedback has shed light on the pressing needs of SMEs, making it clear that customized, practical, and specialized training is essential to bridge the knowledge gap and facilitate the successful integration of technology and digitalization within these enterprises.

Talent Garden in collaboration with Assintel organized and delivered 2 workshops held on 25/09/23 and on 23/10/23 to further understand and gain an even more insightful and focused interpretation of the main training needs.

The workshops were promoted through Talent Garden and Assintel channels, mainly through social media and emails.

The first workshop's title was "First steps into Cybersecurity".

A specific registration form for the event was created. 39 people (including staff) filled the registration form and 13 people participated in the workshop. The workshop aimed to explore cybersecurity topic in an interactive way and collect the training needs of SMEs. Participants had the opportunity to take the first steps toward awareness in this sector and understand their level of knowledge. Using the workshop some basic topics were introduced such as Malware Types & Vectors, the OSI Model, Wireshark and Phishing to test interest from participants and understand the relevance of topics for the training programme. Participants also filled a questionnaire to provide relevant information on SMEs level of knowledge on cybersecurity.

The second workshop's title was "La manipolazione nella cybersecurity: il Social Engineering". A specific registration form for the event was created. 32 people (including staff) filled the registration form and 10 people participated in the workshop.

During the second workshop the pilot course was presented and some background information on cybersecurity were provided. The workshop explored the social engineering topic and explained how small and medium-sized enterprises are exposed to cyber risk, providing historical information, definitions, practical examples, characteristics and data on social engineering.

The workshop, designed in an interactive way, allowed to collect feedbacks from participants in order to understand the relevance of topics proposed for the target group. Good interaction was observed and the proposed topic garnered the interest of the participants.

The workshops allowed to test the interest and relevance of some topics for the course development, such as Security Operation Center, OSI Model, Wireshark, Malware Types & Vectors, Phishing, White Hat Hacker, Social Engineering, etc. The participants provided positive feedback on topics discussed, sharing personal and company experiences.

To further understand and gain an even more insightful and focused interpretation of training needs on AI technologies, Inria Academy took advantage of the presence of Inria at VIVATECH 2023 (June 14-17, 2023), the biggest tech event in France bringing 150,000 visitors, 2,800 exhibitors, 450 speakers.

Inria team met the CTO of a focus group in IT sector to discuss with them their training needs specifically in Artificial Intelligence. It was an occasion to identify the three key barriers these

companies meet to implement the training programs for their staff: proper training offers are not available on the market, internal organizational problems or lack of funds.

The outcomes were in line with the project survey's main conclusions. From the collection of feedbacks on the occasion of these partner meetings, these were the main interest points identified:

- AI for digital health, federated learning
- Machine learning and data visualization
- Cybersecurity based on AI and machine learning
- State-of-the-art modules in virtual reality
- State-of-the-art modules in machine and deep-learning
- Machine learning, Knowledge graphs
- Machine learning, data visualization
- Machine learning, Greentech
- Generative IA state-of-the-art, ethical AI
- Cybersecurity based on AI, Green digital

In addition to the SME discussions, Inria had a stand at VIVATECH with a full 3 day program which included in particular, special sessions to present AI selected technologies relevant to the machine learning field. Demonstrations of these technologies (federated learning in particular) were organised for companies attending VIVATECH and collected their clear interest for training modules. This is a very good point as far as the focus of VivaTech was on SMEs and start-ups.

Inria organized a second workshop on 27/09/2023. The title of this event was, AI in the heart of the SMEs strategy. The main purpose of this workshop was to gain an insightful interpretation of the main SMEs needs in AI. To try to achieve this during the workshop they tested 3 pilot contents, which is designed on the basis of the WP1 results. There were 22 participants on this onsite workshop. Overall, these workshops helped to complement the survey findings with bibliographical analysis and qualitative interviews conducted at these events.

The KIFÜ and BME consortium members jointly organized two Hungarian-language workshops. The first, held online on July 14, 2023, has 50 participants, it was extended as an invitation to the extensive corporate network established within the network of KIFÜ's other projects, as well as to the prominent Hungarian corporate technology associations, namely, the Blockchain Coalition and the AI Coalition. During this online webinar, subject matter experts presented the SME4DD project, the fundamentals of blockchain technology, key characteristics of upcoming training programs, and, most importantly, the business application possibilities. The significance of completing the survey was emphasized during the webinar.

The second workshop took place on September 28, 2023, in person, within the premises of BME, and with 24 participants. On this occasion, the thematic content from the first event was included again. So, the following subject has been presented: presentation of the SME4DD project; the basics of blockchain and current events related to the topic; Blockchain innovation from idea to implementation - our experiences and our courses; Business benefits of blockchain for SMEs. It was supplemented by discussions on topics such as "Blockchain in Energy - Smart Meters, Data Sharing, and Digital Twins", "The Application of Blockchain Technology in Education," and "Development needs of SMEs - Bring Your Own Problem!" - an interactive panel examining the development needs of SMEs. During this interactive panel, participating companies had the opportunity to voice their perspectives.

The feedback from the interactive panel resonated with the findings obtained through the desk research and survey analysis. It highlighted the challenges of recruiting expert personnels, the limited availability of external B2B partners, the effects of resource shortages, and underscored the importance of managerial awareness. In terms of course thematic content, the practical application of business use cases, knowledge related to product development, and understanding the regulatory landscape emerged as key focal points.

These workshops have not only been instrumental in raising awareness of the SME4DD project but have also facilitated valuable discussions and insights within the realm of blockchain, AI, and cybersecurity, and their relevance to the Hungarian corporate landscape.

As the formal modification process for the new consortium member Hyper Island was completed after the first version of this document, it is now possible to include in this restructured document that a face-to-face workshop was held on 11/23/2023. The main agenda of this event with 50 participants was to explore various AI tools in an engaging manner, to hold discussions about the future and to engage in thought-provoking reflections discussions about how AI shapes and impacts the future landscape of work.

By engaging directly with SMEs, the workshops offered further insights into practical challenges, emerging needs, and expectations that were not fully captured in the survey. They helped confirm the trends observed in the quantitative data and provided a richer understanding of the gaps in SMEs' digital skills and readiness, which were important in shaping the course design process.

By supplementing the survey findings with qualitative insights gathered through workshops and interviews, the consortium was able to contextualise the quantitative data and validate the trends observed. The combined data provided a broader understanding of the SME needs, challenges, and expectations. This integrative approach ensured that the findings were meaningful and actionable, despite limitations in representativeness, allowing WP2 to proceed with the course design

## 4.2 Course design

The survey results, combined with qualitative insights from workshops, informed the design of SME4DD courses by highlighting key requirements and expectations of SMEs. These

findings guided the development of training that was practical, flexible, and accessible to diverse audiences. Key considerations taken into account for course design are:

- Training for SMEs should be modular, practical, language-friendly and flexible, focusing on specific technologies tailored to SMEs.
- The basic definition of practicality should be inclusive and understandable in the language of SMEs.
- Learning is key, it should target owners and professionals, and easy participation is crucial.
- Courses should include real life scenarios, cover both technical and soft skills and problem solving.
- Strategies such as design thinking, problem-based learning and interdisciplinary approaches help to integrate technologies.
- Certification based on proven skills frameworks adds value to training.

In addition, the following table summarises the key findings across the three priority areas that further informed the course design.

Blockchain	AI	Cybersecurity
SMEs see the potential, can identify suitable use cases	Lack of internal skills, difficulties in hiring staff	Cybersecurity importance is accepted, investments approved
In-house knowledge base is limited, management-level expertise is key	Low trust from customers, regulatory issues discourage SME investments	Awareness of the business decision-makers achieved
Practical training, real-life use cases	Inadequate data culture and management practices to operate AI services	Top challenges: external threats and low awareness of employees (even in IT)
learning materials must facilitate interdisciplinary cooperation, to comprehend real SME potential	Strong expectations in various aspects of AI adoption, but financial constraints compared to large companies	Lack of planned developments (inadequate internal processes)
	Generative AI has been growing fast during and after WP1	

#### 4.2.1 Blockchain

As stated in an OECD study<sup>41</sup>, SMEs can benefit from improved efficiency and attractive, convenient products and services, enhanced supply chain management, and blockchain-driven innovation in business dealings. We can observe in our survey that respondents have confirmed their recognition of these benefits. They can identify suitable use cases and even

<sup>41</sup> [https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes\\_18ac5acb-en#page1](https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_18ac5acb-en#page1)

extend their application to business partners, but the in-house knowledge base is currently still limited.<sup>42</sup>

The very early stage of blockchain development is evident in the low number of responses indicating a willingness to invest. However, respondents do perceive potential in almost all blockchain-based innovation directions.

This highlights a valuable lesson for future courses: SMEs prioritise the practicality of training and emphasize real-life use cases, which enhances understanding and belief in usability. Consequently, management-level expertise is expected to show the most interest in such training. Survey respondents have expressed that a crucial aspect of employment is not limited to specific Blockchain-related occupations but extends to existing roles that need to comprehend the potential of integrating Blockchain's key properties (distributed traceability, trust, etc.) into products and industry sectors.

In conclusion, interdisciplinarity is expected in blockchain training, and learning materials must facilitate interdisciplinary cooperation.

Furthermore, aside from SMEs identifying the lack of internal knowledge as an obstacle, based on the answers, they do not consider the involvement of external resources or outsourcing as a realistic option. Our foundational research has also indicated that the number of available professionals in the labour market is very low, making it unlikely for development service providers to enter the market in significant numbers.

These findings will inform the work under WP2 and assist training providers in adapting the goals, learning objectives, content, and programme of the courses to be delivered. The planned areas and modules for the different thematic courses described under Tasks 2.1, T2.2, and T2.3 will be reviewed, evaluated, and adjusted based on the outcome of desk research and the feedback collected through the survey and workshops when finalising the curriculum by training institutions.

4.2.2 The network established around the project as a result of interactions in Task 1.2 will facilitate further connections with the relevant audience of the training programs offered by the project and help build a pool of SMEs in need of upskilling in AI, Blockchain, and Cybersecurity in SME4DD focus countries. Artificial Intelligence

Based on the analysis of the literature and the questionnaire responses, the following conclusions can be drawn.

### Key Challenges in AI Adoption

The desk research findings highlight several key challenges in the adoption of artificial intelligence (AI) technologies, both for European enterprises and SMEs globally. These challenges include internal obstacles such as a lack of skills, difficulties in hiring staff with the right expertise, and the high cost of implementing AI technologies. These internal challenges are further compounded by external factors, such as liability concerns, a lack of citizens' trust

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<sup>42</sup> [https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes\\_18ac5acb-en#page1](https://read.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_18ac5acb-en#page1)

in AI, limited access to public or external funding, regulatory barriers, and the need for data standardization.

### Specific Challenges for SMEs

SMEs, in particular, face unique obstacles in adopting AI, including issues common to other digital technologies like lack of awareness and slow responsiveness. Additionally, challenges specific to AI adoption include the high upfront costs, uncertainty about AI benefits, a limited understanding of AI's potential and risks among both management and workers, and inadequate data culture and management practices.

Financial constraints seem to be critical, creates competitive disadvantage compared to large companies. The inability to invest in AI development due to limited resources is a competitive disadvantage.

### Knowledge and Preparedness

The results of the survey indicate that SME employees generally have a good understanding of the challenges associated with AI, providing a solid foundation for further developments. However, knowledge in other aspects of AI adoption remains at a more modest level. It's promising to note that a slightly higher proportion of executives responsible for strategic decisions in SMEs demonstrate moderately strong competence in integrating AI into their company's operations. Looking ahead, there is optimism, with the expectation that SMEs will significantly enhance their AI knowledge within the next two years, with strong to advanced expectations in various aspects of AI adoption.

### Readiness for AI Integration

In summary, SMEs are eager to incorporate AI into their daily business operations and are willing to acquire the necessary skills. However, their current knowledge level remains insufficient. This underlines the importance of the planned trainings to be held in the framework of the project, and support for SMEs to bridge the knowledge gap and overcome the various challenges associated with AI adoption. Additionally, addressing the financial constraints and providing resources and expertise can empower SMEs to leverage AI effectively and remain competitive in the evolving technological landscape.

#### 4.2.3 Cybersecurity

Based on the background research, most studies highlight the importance of cyber security for medium-sized enterprises, as they contribute significantly to employment and the productivity of national economies. Our survey also support this, 70 % of respondents said yes to have investments in the application of cybersecurity-based technologies.

The steps to be taken for enhancing cybersecurity are considered as critical strategic issue, therefore this would also require the awareness of the business decision-makers.

In our survey, at all expertise levels, the respondents indicated around 50% interest in training opportunities, but the highest was the level of management.

In the answers given regarding the main cyber security challenges, external threats leads, but the second place was the lack of awareness of the employees with 38%.

Awareness and training are apparently widely lacking in SMEs, even in IT roles, the focus is usually on a different skill set. This situation gives way to strategical and internal process deficiencies, which results in the lack of planned developments.

The level of those who did not answer to the question regarding support for cyber security developments was 32 % high, while internal developments show a low value of around 20%.

## Annex 1 – Desk research resources

Resource Author	Type of resource	Year	Document Title	Field relevance	Country relevance
WEF	article	2022	To fill the cybersecurity skills gap, the sector needs to boost diversity	Cybersecurity	Global
PwC & WEF	report	2021	Principles for Board Governance of Cyber Risk	Cybersecurity	Global
Capgemini, European SME Alliance, EASME, Technopolis	report	2020	Skills for SMEs - Cybersecurity, Internet of things and big data for SMEs	AI + Cyber	EU
OECD	report	2021	Incentives for SMEs to Invest in Skills : Lessons from European Good Practices	Digital skills - general	EU
Euractiv	article	2022	SMEs need better connectivity and skills to embrace digital transition, experts say	Digital skills - general	EU
European Digital SME Alliance	video	2019	Why your SME should use European e-Competence Framework?	Digital skills - general	EU
EU Digital skills & jobs platform		2021	e-Skills Match Competence Self-Assessment	Digital skills - general	EU
EU Digital skills & jobs platform		2022	Developing Digital Competences for Adults - Hungary		Hungary

EU Digital skills & jobs platform	statistics		The Digital Economy and Society Index (DESI)	Digital skills - general	EU
EU Digital skills & jobs platform		2019	European enterprise survey on the use of technologies based on artificial intelligence	AI	EU
EU Digital skills & jobs platform	statistics	2022	Integration of digital technology (in DESI)	Digital skills - general	EU
EU Digital skills & jobs platform	study	2021	Study on Blockchain Skills Demand	Blockchain	EU
EU Digital skills & jobs platform	report	2021	Blockchain in Practice: Promoting blockchain and DLTs in European SMEs	Blockchain	EU
EU Digital skills & jobs platform	study	2021	Adult Learning and COVID-19: How much informal and non-formal learning are workers missing?	Digital skills - general	EU
EU Digital skills & jobs platform	study	2021	Build the best IT workforce to deliver Europe's digital transition	Digital skills - general	EU
OECD	report	2020	The digital transformation of SMEs	Digital skills - general	Global
PwC	article	2022	Entrepreneurship and SMEs	Digital skills - general	EU
Transatlantic	report	2021	SME adoption of digital technologies: a Transatlantic view	Digital skills - general	EU
Capgemini	report	2022	World Payments Report	Blockchain	Global
Digital SME	report	2022	SME Guide on Blockchain and	Blockchain	Global

			Distributed Ledger Technology		
World Economic Foru	blog	2022	How blockchain accelerates small business growth and development	Blockchain	Global
Mahanakorn Partners Group (MPG)	article	2020	Revolutionizing Trade Finance with Blockchain Technology	Blockchain	Global
OECD	report	2021	The digital transformation of SMEs	Blockchain	Global
Concordia	report	2022	Report on cybersecurity standards for SMEs	Cybersecurity	Global
CISA	report	2021	Cyber guidance for small businesses	Cybersecurity	Global
IEEE	survey	2022	Survey on the Cyber Security of Small-to-Medium Businesses	Cybersecurity	Global
NIST	framework	2016	Small Business Information Security: The Fundamentals	Cybersecurity	Global
Inc.com	article	2018	60 Percent of Small Businesses Fold Within 6 Months of a Cyber Attack	Cybersecurity	Global
Ponemon Institute	report	2018	2018 State of Cybersecurity in Small & Medium Size Businesses	Cybersecurity	Global
Linnaeus University	study	2015	Cyber security Measures in SMEs	Cybersecurity	Global

European Union Agency for Cybersecurity (ENISA)	report	2021	Cybersecurity for SMEs - Challenges and Recommendations	Cybersecurity	EU
OPIIEC <a href="https://www.opiiec.fr/">https://www.opiiec.fr/</a>	report	2019	Formations et compétences sur l'Intelligence Artificielle en France	AI	France
European Innovation Council and SMEs Executive Agency (EISMEA)	article	2021	New Report on EU Support for blockchain and DLTs in SMEs	Blockchain	Global
Rice University's Baker Institute for Public Policy	report	2022	Accelerating Small Business with Blockchain Technology	Blockchain	Global

New SME Guide on Blockchain and Distributed Ledger Technology: Developing SMEs' strengths to lead strategic digital autonomy	article	2023	New SME Guide on Blockchain and Distributed Ledger Technology: Developing SMEs' strengths to lead strategic digital autonomy	Blockchain	Global
European Commission	framework	2019	The European Entrepreneurship Competence Framework (EntreComp)	Blockchain	Global
Technische Universität Dortmund	report	2021	BlockNet - Blockchain Network Online Education for Interdisciplinary European Competence Transfer	Blockchain	EU
Technische Universität Dortmund	whitepaper	2021	BlockNet Whitepaper	Blockchain	EU
Chaise	strategy	2022	European Blockchain Skills Strategy	Blockchain	EU
Chaise	study	2022	Study on Blockchain Skills Demand	Blockchain	EU
Baker Institute	study	2022	Accelerating Small Business with Blockchain Technology	Blockchain	Global
Begin Blockchain project	article	2021	Guide to blockchain competencies	Blockchain	EU
Begin Blockchain project	report	2021	Unlocking the potential of blockchain - A Collection of Success Stories	Blockchain	EU

Economics & Working Capital	study	2022	Blockchain as an alternative financing for SMEs: Italy as a concrete example	Blockchain	Italy
OECD	report	2020	Blockchain for SMEs and entrepreneurs in Israel	Blockchain	Israel
(research/survey paper)	study	2022	Role of Leadership in Adoption of Blockchain Technology in Small and Medium Enterprises in Saudi Arabia	Blockchain	Saudi-Arabia
(research paper in Elsevier journal)	article	2022	Circular economy and digital capabilities of SMEs for providing value to customers: Combined resource-based view and ambidexterity perspective	Blockchain	Global
Métiers 2023	report	2022	Report Dares	AI	Global
Report Villani	report	2018	Report Villani	AI	Global

Science Direct Marinko Skare, María de las Mercedes de Obesso, Samuel Ribeiro-Navarrete	study	Feb-23	Digital transformation and European small and medium enterprises (SMEs): A comparative study using digital economy and society index data	Digital transformation	Europe
Science Direct Dragana Radicic, Saša Petković	study	June 2023	Impact of digitalization on technological innovations in small and medium-sized enterprises (SMEs)	digitalization in production and logistics, digital value chains, and big data analytic	Germany
ACM Digital Library Jin-uk Jung Kyo-hong Jin	research-article	21 September 2018	Case Studies for the Establishment of the Optimized Smart Factory with Small and Medium-Sized Enterprises	AI, Big Data, Internet of Things	South Korea

ACM Digital Library Marco Aldinucci Sergio Rabellino Marco Pironti Filippo Spiga Paolo Viviani Maurizio Drocco Marco Guerzoni Guido Boella Marco Mellia Paolo Margara Idilio Drago Roberto Marturano	research- article	8 May 2018	HPC4AI: an AI-on- demand federated platform endeavour	HPC, AI, Big Data Analytics	Italy
ACM Digital Library Rajeswari Sundararajan Preetha Menon Balaji Jayakrishnan	research- article	9 September 2022	Future of Artificial Intelligence and Machine Learning in Marketing 4.0	AI, Machine Learning	
ACM Digital Library Miguel De Prado Jing Su Rabia Saeed Lorenzo Keller Noelia Vallez Andrew Anderson David Gregg Luca Benini Tim Llewellynn Nabil Ouerhani Rozenn Dahyot Nuria Pazos	research- article	4 August 2022	Bonseyes AI Pipeline—Bringing AI to You: End-to- end integration of data, algorithms, and deployment tools	AI	Global

AI magazine.com Marcus Law	research- article	6-Sep-23	SAP & Google Cloud collaborate on enterprise AI development	AI	Global
AI magazine Catherine Gray	article	4 Feb 2022	SymphonyAI: transforming enterprises with AI solutions	AI	Global
Nature Abdullah Ayub Khan, Asif Ali Laghari, Peng Li, Mazhar Ali Dootio & Shahid Karim	article	30-Jan-23	The collaborative role of blockchain, artificial intelligence, and industrial internet of things in digitalization of small and medium-size enterprises	AI	Global

## Annex 2 – List of figures

Figure I. Structure of WP1 tasks.....	5
Figure II. Digital intensity by SMEs with at least a basic level of digital intensity, in SME4DD countries .....	8
Figure III. ICT graduates in SME4DD countries .....	9
Figure IV. ICT specialists in SME4DD countries.....	10
Figure V. Enterprises employing ICT specialists (% of enterprises) .....	10
Figure VI. Adoption of digital technologies (% enterprises) .....	11
Figure VII. Integration of Digital Technology, by Digital technologies for business, in SME4DD countries .....	11
Figure VIII. Areas of competences of Entrecomp .....	16
Figure IX. BlockNet Competence Model.....	17
Figure X. CHAISE-European-Blockchain-Skills-Strategy Figure provides an overview of existing training programmes .....	18
Figure XII. The 5 ESCO Role profiles and associated Tasks .....	24
Figure XIII.: Companies distribution based on staff headcount .....	31
Figure XIV.: Companies distribution based on the age of the company .....	32
Figure XV.: Proportion of the ICT and non-ICT companies.....	33
Figure XVI.: Sectors companies operate in .....	34
Figure XVII.: Sectors companies operate in (2).....	34
Figure XVIII.: Size of the ICT department at the companies.....	35
Figure XIX.: Proportion of the budget invested in ICT .....	36
Figure XX.: ICT investment trend .....	37
Figure XXI.: Focus of the investments in ICT.....	37
Figure XXII.: Obstacles to the digitalisation process.....	39
Figure XXIII. and XXIV.: Importance of data usage and process to secure data.....	40
Figure XXV.: Focus of the investments in ICT .....	41
Figure XXVI.: Data architecture.....	41

Figure XXVII.: Companies' interest in investing in AI .....	44
Figure XXVIII.: Companies' willingness to invest in AI .....	44
Figure XXIX.: ICT and non-ICT companies' approach to AI development in France .....	45
Figure XXX.: ICT and non-ICT companies' approach to AI development in Hungary .....	45
Figure XXXI.: ICT and non-ICT companies' approach to AI development in Italy .....	46
Figure XXXII.: ICT and non-ICT companies' approach to AI development in Sweden .....	46
Figure XXXIII.: AI investment motivation .....	47
Figure XXXIV.: AI innovation potential.....	48
Figure XXXV.: Current and expected competences in AI in France, Hungary, Italy and Sweden .....	52
Figure XXXVI.: Level of expertise interested in AI courses .....	53
Figure XXXVII.: The current level of AI knowledge in the Hungarian companies .....	54
Figure XXXVIII.: The expected level of AI knowledge in the Hungarian companies .....	54
Figure XXXIX.: Companies' interest in investing in blockchain .....	56
Figure XL.: Companies' willingness to invest in blockchain .....	57
Figure XLI.: ICT and non-ICT companies' approach to blockchain investment in France.....	58
Figure XLII.: ICT and non-ICT companies' approach to blockchain investment in Hungary ....	58
Figure XLIII.: ICT and non-ICT companies' approach to blockchain investment in Italy.....	59
Figure XLIV.: ICT and non-ICT companies' approach to blockchain investment in France ....	59
Figure XLV.: Blockchain investment motivation .....	60
Figure XLVI.: blockchain innovation potential .....	61
Figure XLVII.: Current and expected competences in blockchain .....	66
Figure XLVIII.: Level of expertise interested in blockchain courses.....	66
Figure XLIX.: Current level of blockchain knowledge (companies with investment plans, N=69).....	67
Figure L.: Expected level of blockchain knowledge .....	68
Figure LI.: Investment intentions: plans to invest in other technologies among companies interested blockchain.....	70
Figure LII.: Companies' interest in cybersecurity.....	71
Figure LIII.: Most valuable areas for cybersecurity .....	72
Figure LIV.: Challenges and cybersecurity .....	73
Figure LV.: Cybersecurity development support .....	74
Figure LVI.: ICT and non-ICT companies' approach to the Cybersecurity development in France.....	74
Figure LVII.: ICT and non-ICT companies' approach to the Cybersecurity development in Hungary.....	75
Figure LVIII.: ICT and non-ICT companies' approach to the Cybersecurity development in Italy.....	75
Figure LIX.: ICT and non-ICT companies' approach to the Cybersecurity development in Sweden.....	76
Figure LX.: level of expertise interested in cybersecurity courses .....	77
Figure LXI.: Preferred language for trainings .....	78
Figure LXII.: Trainings format .....	79
Figure LXIII.: Preferred learning modes .....	80
Figure LXIV.: Importance of receiving post-courses certificate.....	81
Figure LXV.: Types of certifications.....	81
Figure LXVI.: Need for training.....	82
Figure LXVII.: Interest in workshops and courses .....	84

