chaise

blockchain skills for Europe

D4.3.1:

European Blockchain Skills Strategy

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21	INDUSTRIA Technology Ltd	INDUSTRIA	BG
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23	Economic and Social Research Institute	ESRI	IE

Abbreviations

AF	Application Form
AML	Anti-Money Laundering
BC	Blockchain
D	Deliverable
DG	Directorate General
EACEA	Education, Audiovisual and Culture Executive Agency
EQF	European Qualification Framework
EC	European Commission
EU	European Union
ESCO	European Skills, Competences, Qualifications and Occupations
HE	Higher Education
D	Deliverable
ICO	Initial Coin Offering
ICT	Information and Communications Technology
KPI	Key Performance Indicator
M	Month
MOOC	Massive Open Online Course
NACE	Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE (for the French term "nomenclature statistique des activités économiques dans la Communauté européenne")
OER	Open Educational Resources
PM	Project Management
PMT	Project Management Team
PT	Points
QA	Quality Assurance
SC	Steering Committee
SME	Small and Medium-sized Enterprise
SSA	Sector Skill Alliance
T	Task
TL	Task Leader
VET	Vocational Education and Training
WP	Work Package
WPL	Work Package Leader

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INATBA
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Forewords

This document is the result of a very constructive and efficient collaboration between the CHAISE partners. It has been a very interesting journey from the beginning of this project with the assembly of top-quality market analysis data, workshops, and collaborative discussions regarding the right approach to take for establishing this Skill Strategy. Thanks to all, who have actively contributed to it.

INATBA, as a work package Leader for the realisation of the Skill Strategy, has then setup a dedicated team of **Volunteers** for working on it. The team has been initiated by the Education Working Group (of 65 members) thank to the guidance and support of Margherita Leder and Wim Stalmans as Co-chairs. As from September 2021 the Core team has been meeting almost every week for discussions about the information made available by the CHAISE project previous work packages; then they have worked together in designing and organizing the Skill Strategy approach and structure. Recognizing all the efforts and dedication of the team members, INATBA is willing to say thank you for your time and hard work. Special thanks to Wim Stalmans, founding partner of The Blockchain Academy; Kristjan Kosic, CTO at Protokol.com; Dr. Milly Perry, CKO and Research Director at The Open University of Israel; Dr. Merav Ozair, Professor at the University of NY; and Dr. Michaela Bednárová, Accounting Professor at Pablo de Olavide University in Seville, Spain.

1 CONTEXT OF THE REPORT

New technologies and digital innovations are gradually reshaping many sectors. We can see how blockchain technology in particular has been proliferating into different industries and functional roles over the last few years, causing a significant impact on the current job market.

The main mission of CHAISE as a Sector Skills Alliance is to tackle blockchain skills shortages and to develop a strategic approach to blockchain skills development in Europe. The project is also committed to delivering future-proof training solutions to respond to the current and future skill needs of the European blockchain workforce.

In the previous CHAISE project report, the characteristics of a blockchain labour market (D2.2.1) were analysed, revealing a higher blockchain-related job demand than the current supply could satisfy. Therefore, further reports looked closer at the blockchain skills demand (D2.3.1) and skills mismatches in the blockchain sector (D2.5.1). Based on the number of surveys and interviews conducted to elaborate these reports, we learned that to address the complexity of current labour market needs, it is essential to put the emphasis on three pillars of skills development: technological, transversal, and business. Hence, focusing only on the development of technological skills would be a mistake in this emerging complex environment which blockchain represents.

All previous CHAISE efforts highlighted the urgent need to reverse talent scarcity in the blockchain labour market and call for an elaboration of an efficient and effective Skill Strategy. This would set the framework for sectoral cooperation and outline actions to address the skills needed in the blockchain sector to ensure the leading role of the EU in future digital technology markets. Therefore, this report aims to propose a general Blockchain Skill Strategy and contribute to the final report towards the end of the CHAISE project. In addition, the ongoing Skill Strategy developments are planned to be reviewed once a year.

Lessons we have learned so far can be summarised as follows:

- there is already a higher demand for blockchain-skilled employees than the supply can satisfy,
- an even broader gap can be expected in the future if no action is taken,
- the blockchain profiles most in demand seem to be blockchain manager, blockchain architect, and blockchain developer,
- there is a low and slow responsiveness from formal education to current and future labour market needs,
- education and training is needed to meet the needs of the 21st century.

If the EU is to play a leading role in the blockchain sector globally, an efficient and effective Skill Strategy must be developed. In such a strategy, public education should be complemented by private training

providers and VET programmes, should be flexible, client-oriented, customised, business and community-connected, etc.

Thus, the main aim of this report is to propose a Skill Strategy that would meet the needs of the 21st century. It addresses *what* to teach (which skills), to *whom* (identifying the stakeholders), and *how* (strategies and action plans).

2 INTRODUCTION

With the main objective in mind, to develop a Skill Strategy that would help the EU achieve and maintain a leading position in the blockchain sector, we intend to provide both theoretical and practical contributions. Hence, our report would serve not only to provide insights into which general blockchain skills are required, who the main stakeholders are for blockchain education and training programmes, existing blockchain educational initiatives, etc., we also put great emphasis on *how* it should be done. Understanding the principle of *changing mindset* (Kotter, 2012) is of great importance to be able to understand and accept the kind of revolutionary approach that is being proposed. Thus, alongside the more traditional approaches, a decentralised database for a blockchain job market and educational initiatives will be recommended in parallel. We believe that our final proposal for a decentralised job market/training platform will have practical implications and real contributions in this area as it will represent a decentralised, bottom-up, dynamic, up-to-date, and tailored educational approach.

The rest of the report is organised as follows (Figure 1). First, we provide a brief overview of the current labour market needs. Second, we take a closer look at different categories of blockchain skills (technological, transversal, business) and discuss what a general blockchain curriculum might look like and how it can be adjusted (tailored) to specific job profile requirements. The next section offers some insights into current educational and training initiatives related to blockchain. The following section identifies the main stakeholders for blockchain education and training activities. After introducing the main stakeholders, upskilling approaches for each category will be outlined as well as the introduction of an innovative idea of a decentralised (blockchain-based) job market/training platform. Last but not least, the Skill Strategy section deals with the main principles underpinning the strategy, and introduces objectives, strategies and actions to be taken.

Figure 1: Structure of the report

3 Labour market needs

3 LABOUR MARKET NEEDS

The previous task of the CHAISE project (D.2.2.1) was to map out the situation in the blockchain sector and labour market, and to identify challenges we are currently facing. The findings of the research suggest that the blockchain sector is faced with a shortage of talent. The demand for blockchain skills is steadily increasing and employers are facing a shortfall of skilled professionals.

Obviously, the size and complexity of the blockchain labour market varies from country to country, but generally, the rapid evolution of this technology is reflected in the increased number of job vacancies related to the blockchain profile (BC/DLT expertise), but it is no longer limited to ICT and the financial sector. There is an increasing number of other industries recruiting blockchain talent.

Regarding the occupational profile, recruitment is mostly concentrated around development and engineering, thus technological roles. In terms of geographical statistics, over 50% of all blockchain job adverts are concentrated in four countries: Belgium, Germany, France, and Italy.

Regarding gender, this is a predominantly male industry in terms of both ICT and non-ICT positions (around 80% men vs. 20% women). Thus, some initiatives to attract and motivate women to enter this industry should be implemented to promote inclusiveness.

The characteristics of the current blockchain workforce also show that it is composed predominantly of young people in their twenties and thirties. In general, these demographic groups are more open to expanding their knowledge and are essential for start-up development. The level of growth of blockchain-related start-ups depends on individuals with a complex and diverse skill set, which allows them to grow their business. Therefore, a Skill Strategy should have a strong focus on this particular demographic group.

The problem in the blockchain labour market is evident when looking at current job offers that require zero or less than 5 years' experience. This is not because companies would not welcome an experienced applicant, but they are aware of the lack of skilled employees and thus must rely on in-house training. Currently, there are only a handful of university degrees in Computer Science which include specialised blockchain courses. Having candidates who already have a good grasp of the basics of blockchain, cryptography, smart contracts, or the functioning of blockchain-based platforms like Ethereum, Hyperledger etc., will make the onboarding process much easier and would be a significant advantage for the candidates themselves.

The main reasons for this situation are the limited connection between education and the market and the low or slow responsiveness of formal education to new labour market requirements. Therefore, improving the responsiveness of formal education in this field, as well as designing an efficient education and training strategy, would decrease the burden on companies who currently invest a lot of time and resources to in-house training.

Although the European blockchain sector is well placed on a global level, its future development is highly dependent on the availability of a skilled workforce. Hence there is an urgent need to reverse this situation, or it will prevent the sector from unleashing its full potential.

In summary, the previous report (D.2.2.1) provided critical insights into the current blockchain labour market, pointing out the urgent need for proper education and training in this field and a comprehensive Skill Strategy which would tackle the existing skills scarcity.

The previous research also pointed out the need for an open database where specific information related to the blockchain labour market could be found. Indeed, better data collection and organisation in this field would help us to understand the most recent skills requirements and observe changes in labour market trends, which would help us identify skill gaps and be more agile in designing a proper training curriculum for this emerging labour market. In addition, such a database could relate to the educational and training offerings, which is one of the proposals of this Skill Strategy discussed in more depth in section 7.3. where we introduce the idea of a decentralised job market-training platform.

4 Blockchain skills

4 BLOCKCHAIN SKILLS

When defining the Skill Strategy, it is important to break it down and clarify *what, how* and *whom* to deliver the knowledge to. While the section related to stakeholders will cover "who" and the sections related to upskilling approaches and skill strategy will cover "how", in this section we will take a closer look at "what" knowledge should be delivered. The main inputs were the outcomes from the previous reports Study on Blockchain Skills Demand (D2.3.1) and Study on Skills Mismatches in the Blockchain Sector (D2.5.1) as well as interviews and focus groups with the members of the INATBA Academic Advisory Body.

Although the most recruited occupational profiles were related to developer and engineering roles, the evidence from the online survey, job adverts and in-depth interviews pointed out the importance of a "complete skills package", thus extending the technological skill set with business and transversal skills (D2.3.1). Indeed, transversal skills are becoming more relevant especially in advanced technological fields.

The previous report (D2.5.1) provided a brief overview of three different blockchain employee roles (BC Developer, BC Architect and BC Manager/Consultant) each with a focus on different skills, suggesting a possible combination of learning modules where the skill level in a particular area (technological, business, and transversal) will depend on the BC occupational role. The three roles previously identified cover a large part of the blockchain qualifications currently in demand and are also registered in the ESCO database.

In this section, we will take a step forward and outline possible thresholds for various blockchain skills (awareness, general, practitioner, expert) depending on the BC occupational role.

4.1 Complexity of the Blockchain Skills Curriculum

The blockchain curriculum should focus on providing a fundamental understanding of technological principles and socio-economic implications on the one hand, and on the other hand, different levels of technological mastery (general, practitioner, expert) depending on the specific occupational requirements of the BC position.

The first level – awareness, would represent a knowledge threshold incorporating all the basic concepts and ontologies needed to understand blockchain technology and governance vocabulary, including the understanding of basic blockchain use cases. Witnessing the rapid evolution of blockchain technology, if this stage is not appropriately addressed, the lack of education in this area could push some of the population into a new type of digital illiteracy exclusion. Therefore, states, international organisations, universities, and businesses should take this threat seriously and implement adequate education strategies.

After the awareness level, a Skill Strategy should also include a more technically oriented section into the blockchain curriculum with different levels of mastery (general, practitioner, expert) depending on specific professional requirements.

4.2 Blockchain Skills

> ***Blockchain Skills Definition:*** *Through research and study inputs we can define Blockchain skills as an interdependent compound of skills, which consist of interrelated technical, transversal und business skills and thus relate to knowledge abilities, attitudes, and values in these areas.*

Hence, an important step would be to clarify the knowledge threshold that an individual or a collective needs to acquire. Nevertheless, as the Study on Blockchain Skills Demand (D2.3.1) points out, in order for the blockchain curriculum to be complete and cover the gap in the current job market, it should not be limited to blockchain-specific skills (from awareness to expert level), and should be enhanced by certain business and transversal skills as well. For instance, during in-depth interviews with employers, they pointed out that there is a lack of communication skills to translate technical knowledge into business language and therefore, strong communication skills (those who can understand and explain the blockchain technology) are crucial. Table 1 lists the previously identified skills and matches them with the proposed thresholds.

Level (Knowledge threshold)	Technical and Blockchain specific skills	Professional / Business skills	Transversal future skills
Awareness	Fundamental understanding of technological principles and socio-economic implications of BC technology. Basic concepts, ontologies, and the vocabulary of BC governance.	Business (Needs) Analysis; Business Development; (Blockchain) Use Cases Development; Product Development; Product Management; Skills in Legal & Compliance Matters; Finance and	Learning literacy & Metacognitive skills; Self-efficacy & Self-confidence; Self-determination & Autonomy; Self-Management / Organisation / Regulation & Self-

General	BC solution design Data Analysis	Controlling; Human Resources Development; Customer Success Design; Affiliate Marketing.	Responsibility; Decision Competence & Responsibility taking; Initiative & Performance Competence; Ambiguity Competence; Ethical & Environmental Competence; Design-Thinking Competence; Innovation & Creativity skills; Systems & Networked Thinking; Sensemaking; Future Mindset & Willingness to change; Cooperation Competence; Communication Competence
Practitioner	Maths and Stats, Protocol engineering, Distributed network engineering, Data/network security design, Cloud and infrastructure design, UX design, Scientific computing		
Expert	Coding (C++, Python, Java), Cryptography development, Frontend and Backend development, Smart contract development, development of decentralised apps		

D2.3.1: Study on Blockchain Skills Demand. Based on the in-depth interviews for Specific, Business and Transversal skills.

D2.5.1: Study on Skills Mismatches in the Blockchain Sector.

Table 1: Blockchain curriculum general proposal skills

For a better illustration, Figure 2 outlines how previously identified skills (with technological skills thresholds) might match different BC roles. For instance, BC Role 1 might refer to a BC Developer, who would need a strong basis of technological skills (expert level) and some transversal skills. While BC Role 3 might refer to a position of a BC Manager, who would need a strong foundation in business and transversal skills and only some technological skills (general level). This is just a simplified illustration, but it gives us some idea that there is no such thing as one fit-for-all blockchain curriculum. Instead, there is a need for hybrid, tailored and flexible education and training, which would depend not only on the functional role (which might be both blockchain-specific or a traditional role affected by blockchain development), but also on the industry.

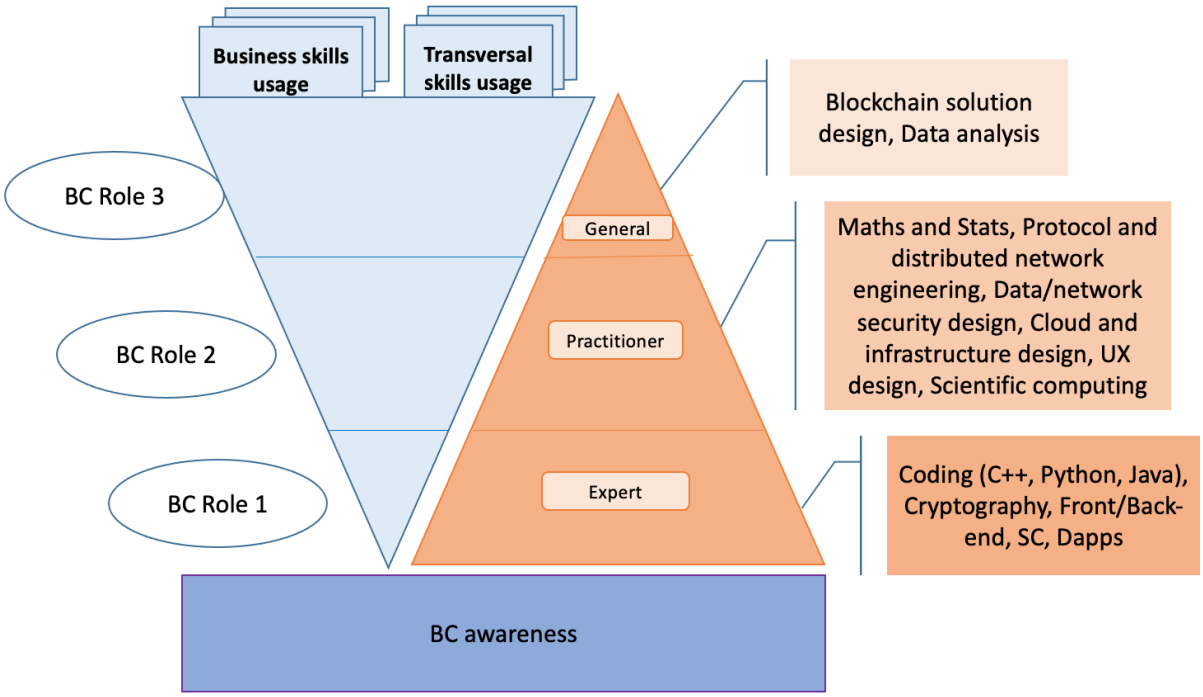


Figure 2: Blockchain skill set usage depending on the BC role

Hence, to be more accurate, the layer of industry specific skills, in addition to business and transversal skills, should be added to the schema (Figure 3).

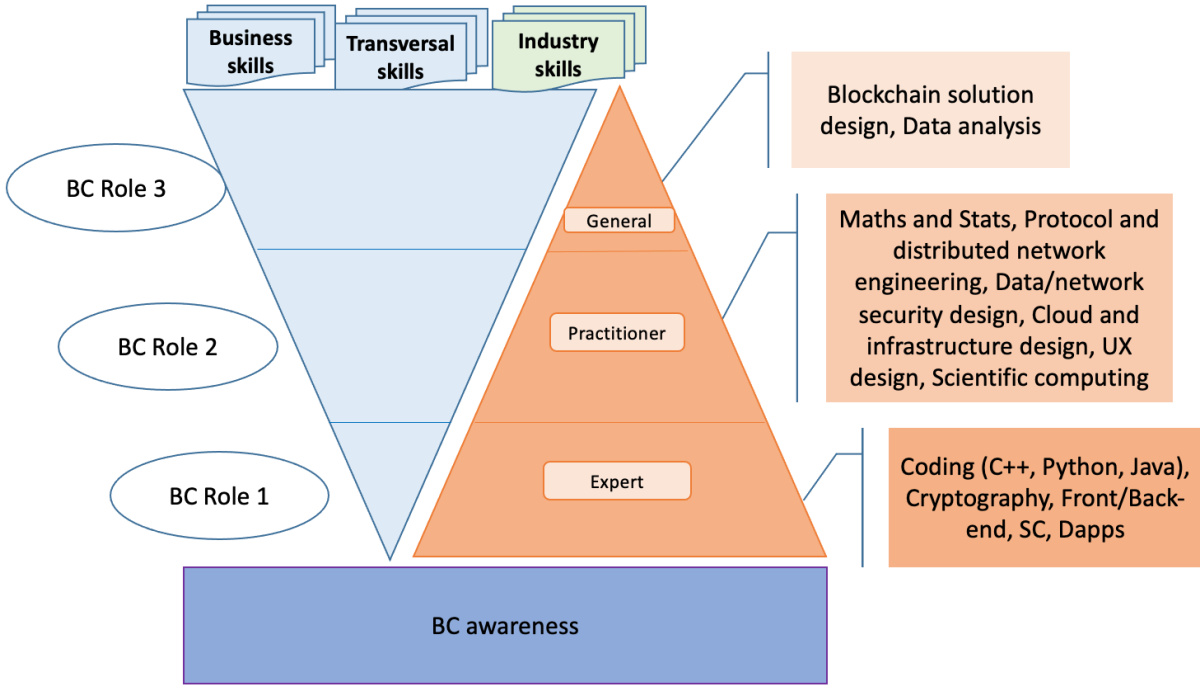


Figure 3: Adding the layer of industry-specific skills

4.3 Blockchain skills orientation based on occupation

To fully understand the complexity of blockchain skill sets, each of the identified roles (BC Developer, BC Architect, BC Manager) with its corresponding business/transversal/industry skill set could be broken down even further, as each of these roles can have an IT or non-IT focus. Table 2 provides some examples of concrete BC occupations in each category distinguishing between IT and Non-IT positions.

Given the complexity of the blockchain ecosystem, there is a wide array of different blockchain occupations, which require different blockchain skill sets. Therefore, to design one fit-for-all blockchain curriculum is not feasible as it can be difficult to imagine a candidate with strong business, transversal and IT skills with a great understanding of industry specifics. They might exist, but it is rare. Hence, companies should be aware of this fact and adjust their expectations accordingly, understanding that building the blockchain curriculum is about a path rather than a certificate of completion and that blockchain training and education should be approached from a continuous (life-learning) perspective.

JOB PROFILE TYPE	SKILLS ORIENTATION and POSITION	
BC Developer (Strong Technical and Transversal skills)	**IT position** Smart Contract Engineer	**Non-IT position** Business Process Developer
BC Architect (Balanced Technical - Business - Transversal Skills)	**IT position** Decentralised Application Designer	**Non-IT position** Value Chain Architect
BC Manager (Strong Business and Transversal Skills in addition to certain Technical Skills)	**IT position** BC Solution Designer	**Non-IT position** BC Consultant

Table 2: Examples of IT and Non-IT BC positions

5 Mapping blockchain educational initiatives in Europe

5 MAPPING BLOCKCHAIN EDUCATIONAL INITIATIVES IN EUROPE

One of CHAISE's tasks was to build The Registry of Blockchain Educational and Training Offerings, which lists existing formal (e.g. HE, VET programmes) and non-formal (e.g. online courses, seminars) training related to blockchain. The final database is comprised of 133 records from 18 European countries and gives us some insights into existing training programmes and educational initiatives focused on developing blockchain related skills.

The registry provides information such as course title; provider and his legal status (public/private); country; discipline; programme orientation; subject; type of learning; course level; type of qualification awarded; mode of study; duration; target audience; modules, etc.

The mapping of the current state of blockchain educational initiatives in Europe helps us understand the strengths and weaknesses of the current blockchain educational approach and identify the gaps which an efficient Skill Strategy should aim to fill.

Provider and their legal status

As can be seen in figure 4, the current educational and training offerings in blockchain are led by the private sector (76%). Nevertheless, there already are some public entities (22%) like universities in Estonia, Italy, Spain, Belgium, Bulgaria, Greece, and Denmark offering education in this field, usually a Master's degree within HE.

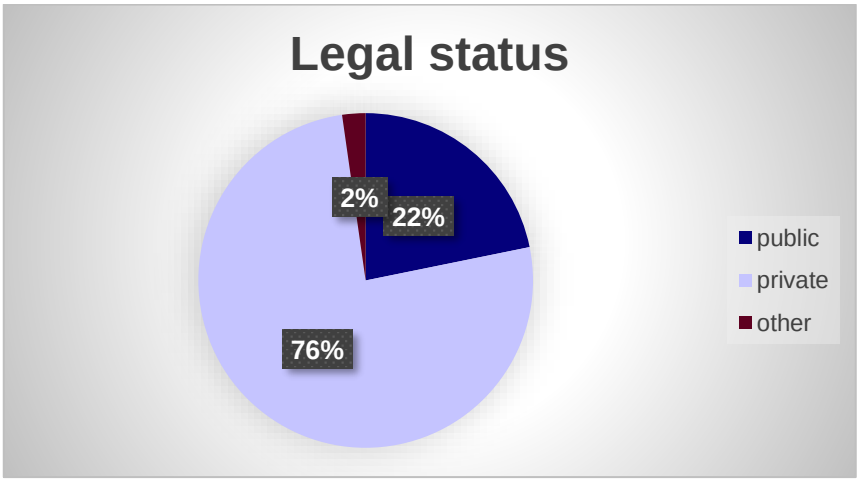


Figure 4: Provider's legal status

Country

Countries with the strongest position in terms of blockchain training and education initiatives are Estonia (17), Italy (14), Slovenia (13), followed by Germany (12), Belgium (12), and Spain (12). These are countries which generally put great emphasis on blockchain initiatives, have developed blockchain national strategies, or are home to a growing number of blockchain startups.

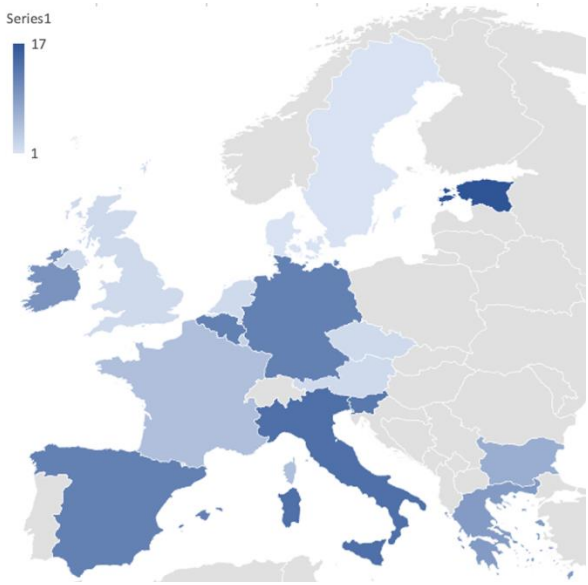


Figure 5: Educational and training initiatives in Europe

Discipline

Blockchain educational and training offerings are dominated by Computer Science & Informatics. Nevertheless, interdisciplinary courses are also gaining popularity. Other important disciplines in which blockchain training is currently offered are Business, Finance, Engineering, Social Sciences, and others.

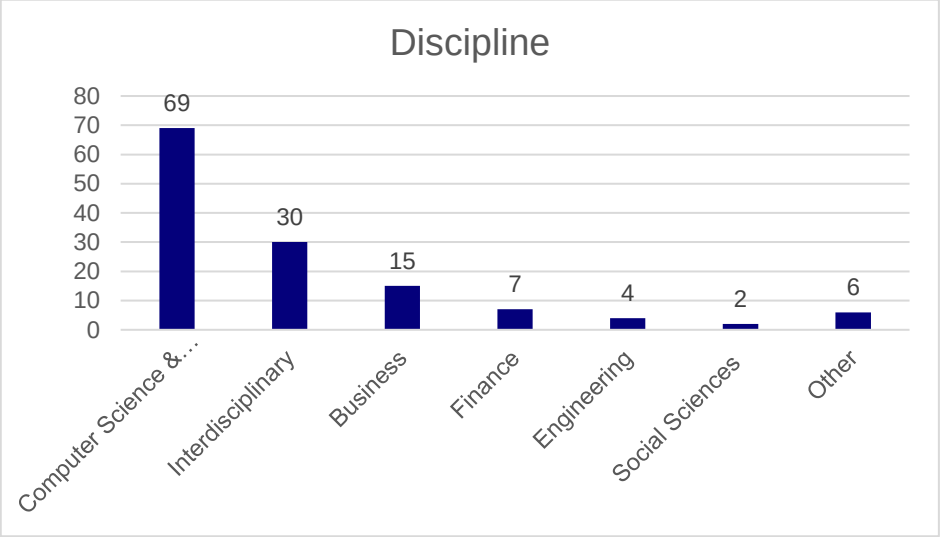


Figure 6: Discipline

Programme orientation

Regarding programme orientation, the courses currently offered are mostly of a subject-specific or general character rather than being sector-specific. By subject-specific we mean that the training focuses on one of the areas such as blockchain, cryptocurrency, cryptography, cybersecurity, Dapp development, etc. without sector/industry specification.

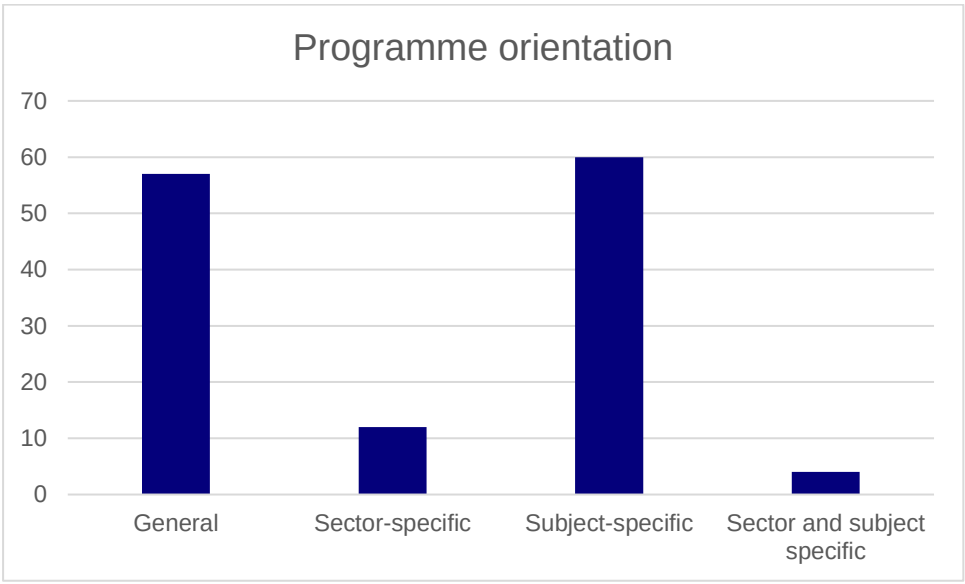


Figure 7: Programme orientation

Subject

Current educational and training offerings cover a wide array of subjects such as blockchain, Bitcoin, cryptocurrency, coding, DLT, blockchain apps development, blockchain innovation, blockchain security,

blockchain supply chains, cryptography, Dapp development, Ethereum, Hyperledger, Smart Contract, etc. However, the course level, mode of study, duration, and other factors might differ significantly.

Type of learning

Regarding type of learning, we distinguish between HE, VET, MOOC online course, seminar, workshop, or in-house training. As can be seen in figure 8, HE, MOOC and VET courses are the most represented in the current offer, whereas VET and MOOC online courses are mostly provided by the private sector, except the University of Tartu (Estonia) and the University of Naples Parthenope (Italy), which both provide VET courses at university level as well.

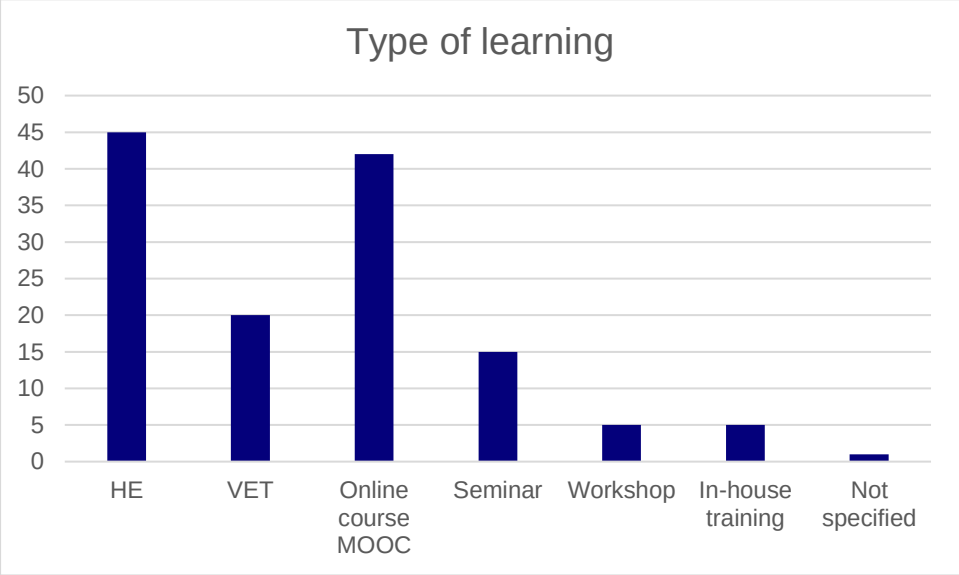


Figure 8: Type of learning

Course level

Most of the current educational and training offerings are beginner level. These are the courses offered e.g. to executives and managers, policy makers, the general public or as a starting point within HE for future blockchain professionals.

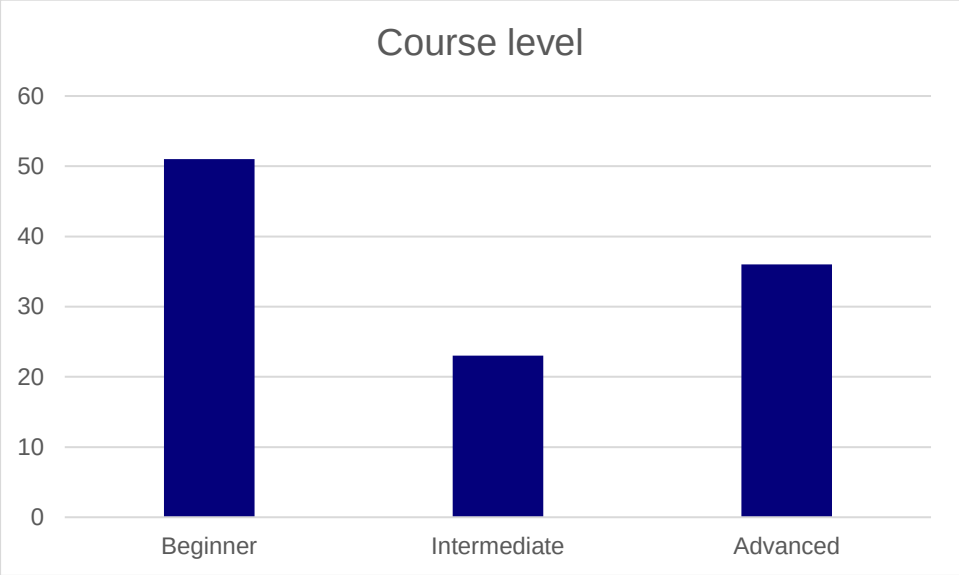


Figure 9: Course level

Type of qualification awarded

There is a wide array of qualifications awarded varying from a certificate of attendance to a Master's degree or PhD. The most common qualification awarded is the certificate of completion, which is normally issued by private academies or companies, followed by a Master's degree and VET professional certificates. In the current offer there were just three Bachelor's degree and only two PhD degree qualifications.

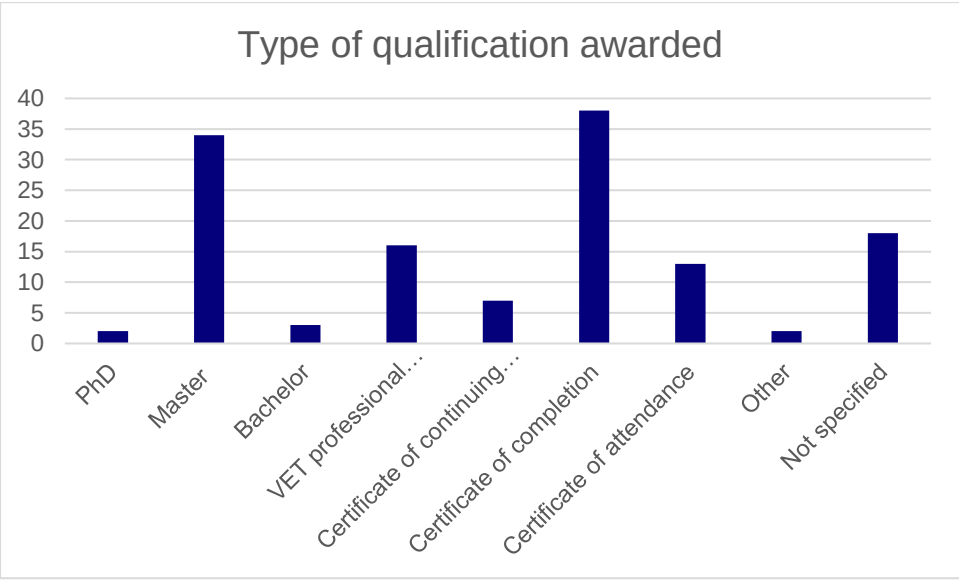


Figure 10: Type of qualification awarded

Mode of study

Mode of study is dominated by distance learning followed by a blended approach, which is a combination of classroom-based and distance learning. Thus, we can observe an increased popularity of distance learning or a mixed approach. Only one private academy in Estonia provides guided on-the-job training. A format, which might be highly efficient in this field. Although, in this case it is just two days long.

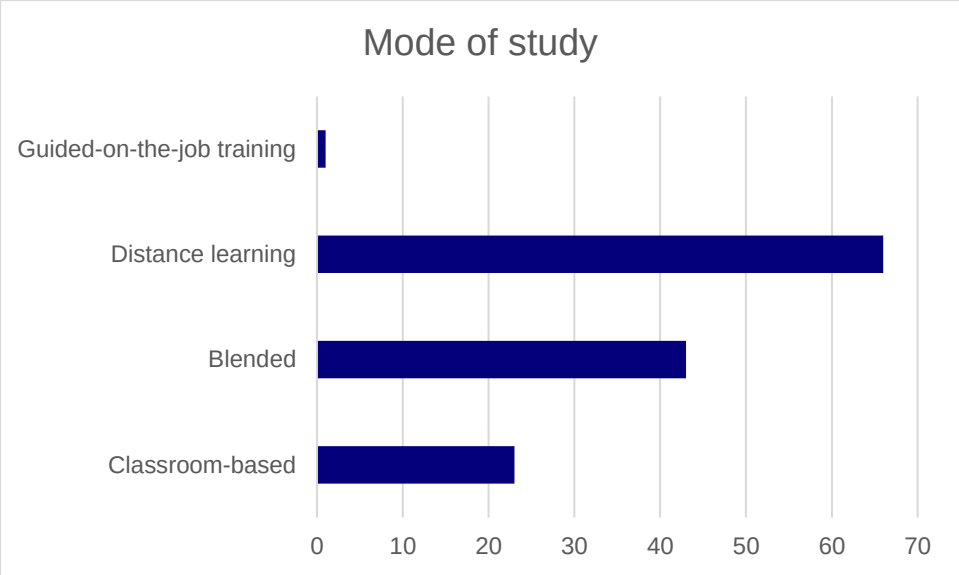


Figure 11: Mode of study

Duration

While public providers offer courses with a duration of months, even years (for Bachelor, Master, and PhD. degrees), in the private sector we can find courses of just a few hours (e.g. 1.5 hour long course provided by Think Tank Slovenia about blockchain or a five-hour course about Bitcoin offered by a Swedish private academy about Bitcoin).

Target audience

By analysing the current offer at the Registry of Blockchain Educational and Training Initiatives, we can observe that most of the courses are designed for blockchain professionals such as consultants, developers, etc. or ICT professionals. Nevertheless, there are an increasing number of courses dedicated to executives and managers and some to policy makers and the general public as well.

The registry of educational initiatives gives us some insights into the current offer of blockchain courses in Europe. There is a wide range of educational and training initiatives which vary significantly in different aspects such as course level, mode of study, qualification obtained (from certificate of attendance to degree), duration (from formal three to four years long to only two hours long), etc. Nevertheless, experts point out the high level of mismatch between the skills in demand and those offered. Indeed, many

courses have been created because blockchain seems to be a trending topic over the last few years and their quality might be questionable. Thus, an efficient Skill Strategy should tackle this problem by providing smart solutions to ensure the match between the demand and offer of blockchain skills rather than focusing on the development of blockchain courses simply because it is trending.

6 Stakeholders

6 STAKEHOLDERS

This chapter identifies the type of individuals or collectives that would need to develop general blockchain skills or specific skills. Thus, this section will answer the question “who” should receive blockchain education and training. Figure 12 identifies five main categories of stakeholders. Similar approach has been adopted by the British Blockchain Association (2021), where they identified 4 main pillars of Blockchain ecosystems: Academia, Industry, Government, and Society.

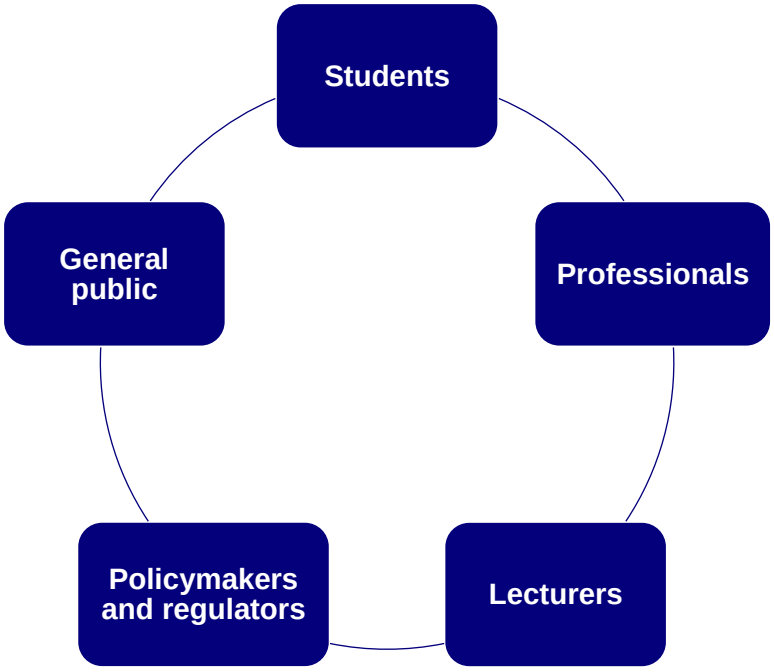


Figure 12: Stakeholders

The identified stakeholder categories have different resources (time-money) and motivation (needs) to acquire blockchain skills. Thus, they have different interests content-wise (what to learn) and different training model preferences (how to acquire the skills). Therefore, an efficient and effective Skill Strategy should respond to the needs of each stakeholder group adequately.

Different resources: *time-money (e.g. students who have limited resources might prefer self-study instead of paid courses, but they might have more time and better opportunities to access universities. On the other hand, companies can afford to pay courses for their employees, but might have time constraints).*

Different motivation: *needs (companies would prefer more specific training, use cases, sand boxes, etc. more than a general understanding of the technology, while university students area able to gain a deeper understanding of the ”philosophy” of the technology).*

6.1 Students

According to the interviews published in the Study on Skills Mismatches in the Blockchain sector (D2.5.1), experts consider training at a young age particularly valuable because the learning process is usually faster and more efficient. In addition, students are the future candidates that will soon enter (or are entering) the job market and therefore need a set of skills which will guarantee their future career success. In addition, it would be in the EU´s interest to support this particular stakeholder category, as well equipped and blockchain savvy candidates would help to maintain and improve the EU position in the global blockchain development start-up market.

GENERAL RECOMMENDATION: *Design a modern business-related syllabus for blockchain programmes to respond to urgent labour market needs by formal education.*

6.2 Professionals

There are two main stakeholder classification areas in which any person can be active/re-train at any point in their professional life regardless of age, seniority or gender. These are functional roles and industries. Thus, a blockchain stakeholder needs to understand how blockchain impacts their functional role as well as the specifics of the industry in which the candidate is active.

1) **Functional roles**

- *Blockchain specific roles*: community manager/assistant, token economics manager/assistant, blockchain/web3 developer/architect, decentralised business manager, etc.
- *Traditional roles*: project manager/assistant, finance manager/assistant, product development manager/assistant, IT manager/assistant, policy maker, regulator, etc.

2) **Industries**

- *Automotive, insurance, construction, manufacturing, aviation, etc.* Despite the fact that the sector with the most BC vacancies is currently Information and Communication Technologies, followed by Financial Services, other sectors should also take education and training in BC seriously as the technology is rapidly proliferating into other sectors such as Energy and Utilities, Media, Consulting, Supply Chain, and others. In addition, sector boundaries are getting blurred in complex BC projects. That is why the CHAISE project points out the importance of sectoral cooperation while developing a Skill Strategy.

***GENERAL RECOMMENDATION**: There is a need for a stronger cooperation strategy, and change of mindset in education and training, which would be project-oriented instead of a traditional rigid university syllabus.*

6.3 Lecturers

Although this category could be a part of professionals (functional role: BC lecturer, industry: education), given the important role it plays in the context of training and education, it deserves special attention. The lack of BC skilled candidates affects the academic world as well. Lecturers from different areas should understand the latest advances in their subject, which now often includes blockchain technology. Nevertheless, the sources of knowledge available to them are limited to the latest research in their field and self-study from forums, online courses, etc. and they often find themselves struggling as a result, in particular those who are less tech-savvy. Therefore, the Skill Strategy should address how to efficiently tackle these issues, as having skilled lecturers (in both the public and private sector) is crucial to properly advance in this sector.

***GENERAL RECOMMENDATION**: Business is driving knowledge. Strengthen collaboration between businesses and formal education to boost cross-sectorial research in this area.*

6.4 Policy makers and regulators

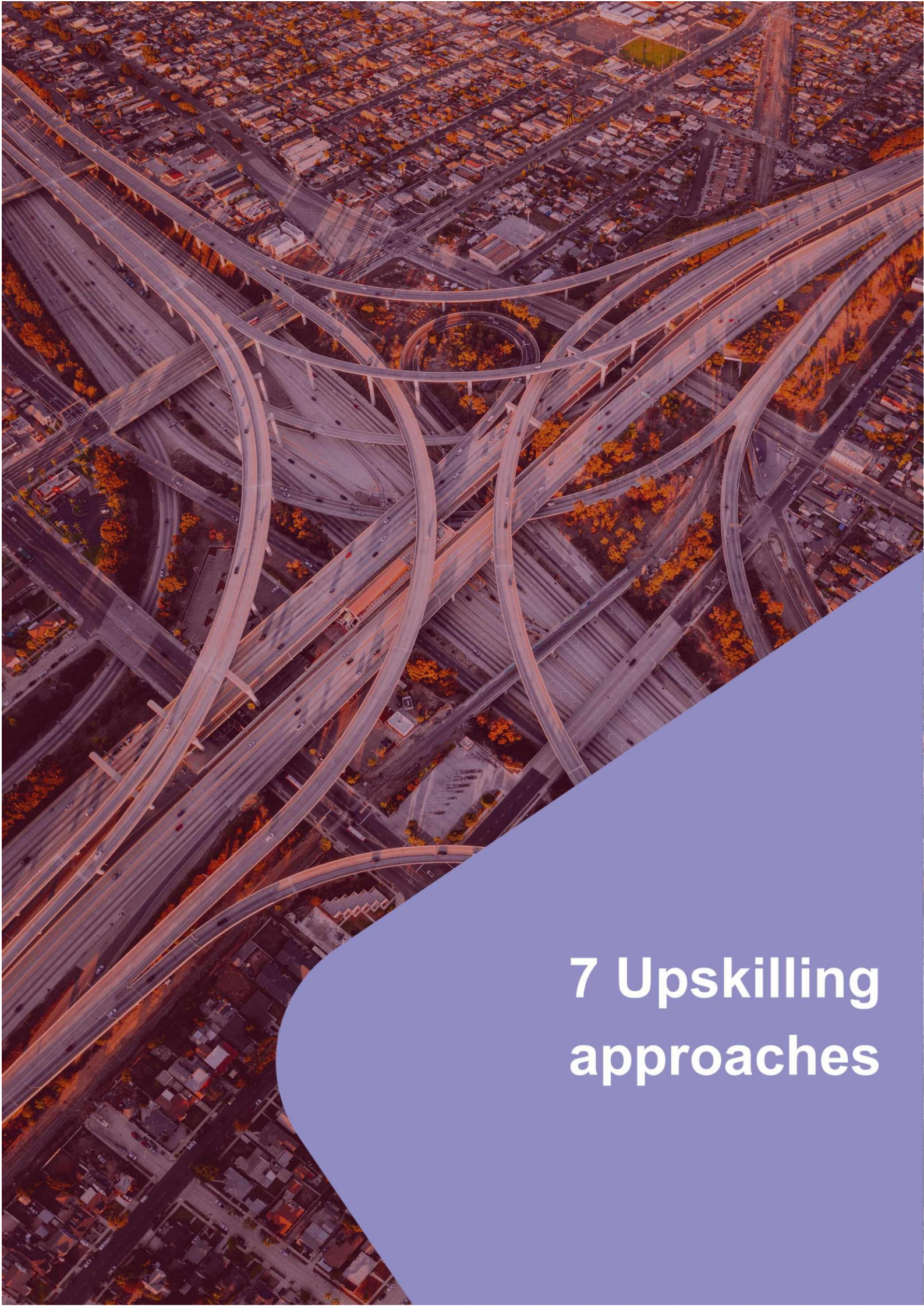
Policy makers and regulators, despite being two types of profiles, are supposed in certain terms to govern different fields. Thus, their decisions may have an immense impact on the development of technology e.g. regulations that are too restrictive might impede future technology development. Therefore, general understanding of the technology is necessary with a clear comprehension of both the implications and limitations of blockchain. Professional associations might play a key role in educating this stakeholder group. The importance of international (cross-border) collaboration and regulation should also be pointed out here. Similarly, an open minded, supportive approach towards this new technology should be adopted rather than one of excessive regulation.

***GENERAL RECOMMENDATION**: Provide a general understanding of the main implications and limitations of blockchain in different areas. Promote an open-minded and supportive approach instead of control to boost, rather than impede, the development of technology.*

6.5 The general public

To achieve acceptance of this technology, it must first be understood by the general public. Very often, with the development of a new technology, resistance to change in adopting it has to be addressed. This can be done through an efficient educational strategy. It is worth noting that we might be talking about, but not limited to, such basic things as that blockchain is not Bitcoin. Nevertheless, it will not be limited to it. Additional questions that might arise and to which the general public would seek answers to include the following: *What is blockchain? Where can it be used? How will I benefit from using it? Will I have to use it in the near future? What are the threats surrounding the use of this technology? How would I be protected?*

***GENERAL RECOMMENDATION:** Provide answers to basic questions to combat resistance to change and achieve acceptance of the technology.*



7 Upskilling approaches

7 UPSKILLING APPROACHES

This chapter provides a general overview of different upskilling approaches together with their main characteristics, advantages and limitations. It also discusses what might be the most efficient, currently available, ways to deliver blockchain skills to each stakeholder group. Nevertheless, the classical training/education techniques are scrutinised and some modern techniques are proposed based on interviews with the members of the INATBA Academic Advisory Body.

In addition, it introduces a necessary mindset change in terms of educational strategies from centralised to distributed-decentralised training models. Thus, the idea of a decentralised (blockchain-based) job market-training platform is presented. Eventually, a drastic shift to such a modern approach might cause certain resistance to change, therefore, it is advisable to start it in parallel with other educational strategies.

7.1 Educational and training approaches

The educational and training approach is the way the blockchain curriculum will be delivered to different stakeholder groups. Generally, we can distinguish between three main forms of educational and training offerings (Dip, 1987): formal (HE, or VET programmes), non-formal (MOOC online courses, e-learning platforms such as Udemy or Coursera, seminars, etc.), and informal (e.g. in-house training, and self-learning). There is no clear consensus on which approach would be the most effective in the case of blockchain education and training. In fact, experts are rather divided on this matter. While some jobs require an academic education in the field of computer science or informatics, other employers do not consider formal education particularly important and accept non-formal blockchain courses offered by numerous e-learning platforms such as Coursera or Udemy.

Figure 13 points out the main characteristics, advantages and limitations of different approaches.

FORMAL education	NON-FORMAL education	INFORMAL In-house training	INFORMAL Self-learning
Face-to-face training, Official degree/diploma or certificate, Does not adjust quickly to the changing environment (HE).	More flexible adjusting to clients' needs, Criticized for being too generic or superficial, Lack of face-to-face training and supervision in case of online platforms.	Focus on knowledge sharing, Interdisciplinary approach, Events such as BC hackathons tend to be a good training opportunities, Expensive and time-consuming (increasing the investment risk for companies).	Flexible, Tailored, focusing only on the area of interest, No supervision, feedback, certificate/proof of completion, Lack of deadlines, slow.

Figure 13: Educational and training approaches

7.1.1 Students

In terms of efficiency, to continue supporting the development of start-ups and to ensure the leading position of the EU in the global blockchain market, an efficient Skill Strategy should have a strong focus on the younger generation. It is important to promote modern educational methods instead of traditional lecture-based university teaching. An effective approach might be a combination of modernised blockchain syllabus with a strong focus on project-oriented learning, which could be developed through collaboration with businesses (i.e. one of the supervisors of a candidate's final project should come from academy and the other from the business environment).

Actions, educational and training methods to be promoted:

- *Integrate modern educational methods into blockchain syllabus (HE,VET):*
    - *Flipped classroom*
    - *Project-oriented learning*
    - *Cooperative learning*
    - *Gamification*
    - *Design-thinking*
    - *Competency-based learning*

- *Introduce and promote additional initiatives:*
    - *E-learning, online platforms*
    - *Interdisciplinary degrees*
    - *Hackathons*
    - *Project calls (Erasmus plus)*
    - *Awards*
    - *Formal and non-formal talks with professionals*

7.1.2 Professionals

If companies actively engage in collaborations between companies from different sectors and universities to provide up-to-date content and enable flexible education and training, it will be a win-win situation for all participants. It will help universities to include adequate market oriented content into their syllabuses and companies will save on extensive in-house training as the entry level of the candidates would be higher.

Actions, educational and training methods to be promoted:

- *use-cases/case studies,*

- *sand boxes,*
- *organise events like hackathons,*
- *provide coaching or mentoring,*
- *project-oriented teaching activities,*
- *organise lectures, talks and discussions as well as less formal events like "coffee with tech" at universities or for the general public,*
- *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.

7.1.3 Lecturers

It is important to accept that in this case, business is driving knowledge. Thus, it is necessary to establish partnerships and strengthen the collaboration between academia and the business world so this stakeholder group is not limited to self-learning and e-learning platforms (such as Coursera, Udemy, etc.).

Actions, educational and training methods to be promoted:

- *Boost research in this field through international and inter-sectoral project calls.*
- *Strengthen cross-border academia-business collaboration.*
- *Participate on a creation and engage in interdisciplinary degrees.*
- *Observation (shading) of experts and projects in the business world.*
- *Follow and engage with professional bodies or pioneers in particular fields*
- *Organise talks and discussions with professionals.*
- *Introduce ambassador/apprentice (train the trainers) initiatives.*

7.1.4 Policy makers and regulators

Cross-border discussions and political debates on this topic should be open with the aim to reach consensus on the direction of future policies and regulations in this matter. It would be important to keep an open-minded approach instead of focusing on control so as not to impede innovation. Professional associations might play an important role here as they could act as a bridge between professionals and politicians.

Actions, educational and training methods to be promoted:

- *Meetings and discussions of different stakeholder groups (academics, professionals, professional associations, policy makers, regulatory bodies, etc.),*

- *Interdisciplinary project-oriented approach led by the private sector (integrating policy makers),*
- *Organisation of professional forums and conferences,*
- *Professional associations in the role of "influencers".*

7.1.5 The General Public

Educating this stakeholder group is important to mitigate the resistance to change, which accompanies almost every innovation. It is important to cover at least the first level of knowledge, awareness, which would cover basic concepts and ontologies needed to understand blockchain. If this stage is not appropriately addressed, it could push some of the population into a new type of digital illiteracy exclusion. Therefore, adequate education strategies should be implemented. It's very important to educate the general public about what blockchain technology is and is not, and how its implementation can benefit society. Thus, there should also be emphasis on explaining and debunking all sorts of misconceptions about blockchain technology. Blockchain communities might play an important role. They can operate like blockchain embassies offering free consultations a) for individuals regarding cryptocurrencies, taxes, cybersecurity, scam warnings or b) for companies offering consultancy and networking.

Actions, educational and training methods to be promoted:

- *Organise public lectures, talks and discussions with experts (with recommendations for books, online courses, university courses, different project calls, hackathons, etc.).*
- *Publishing of material (books, documents, etc.) by professional organisations.*
- *Promote NFT awareness (e.g. related to art) and show the usefulness of the technology.*
- *Support bottom-up approach, innovation.*
- *Create and support blockchain communities – a type of "Bitcoin embassy", a community helping the public for free.*
- *Create and support forums, where people from different disciplines can learn from each other.*
- *Networking (professional associations, public).*

7.2 Summary of important aspects of a successful educational and training approach in this sector

- adopt a hybrid approach,
- make it as interactive as possible,
- focus on practical application dealing with real world problems,
- design project assignments for interdisciplinary teams,

- courses should be designed to stimulate the entire process of blockchain projects, from order acceptance, planning, design, programming to testing and implementation,
- include case studies (successful and not successful),
- encourage mindset change – from centralised to distributed/decentralised business model,
- encourage self-learning capabilities,
- encourage learning by doing/experimenting,
- continuous learning (as it is a quickly evolving area).

A hybrid educational and training approach might be extremely valuable for an individual seeking a career in this particular area. Nevertheless, the access to different forms of education and training depends on a variety of factors such as age, sector, etc. More importantly, we should adopt the idea of continuous (life) learning when it comes to acquiring blockchain skills. Collaboration opportunities between formal educational and training offerings (HE, VET) and companies complemented by additional e-learning courses and a self-learning approach can result in a higher learning efficiency.

7.3 Decentralised job market-training platform based on blockchain

The efficient and effective Skill Strategy should also take advantage of available technological innovations such as blockchain. Thus, we ought to establish a meritocracy-based blockchain ecosystem that will develop and adopt technological and business changes rapidly. To meet this objective, a dynamic blockchain-based training and market platform is proposed (Figure 14). This platform will merge the blockchain job market, where a company can post a job position and look for candidates with a specific skill set, and blockchain training institutions (including companies), which would act as providers of those skills. The main features of this common place can be summarised as follows:

- It will require a dynamic mechanism in which employees would need to elaborate new skills in the ecosystem, which would get the attention of skills providers, like a marketplace.
- Employers will list a job position identifying the required skills. This job position will appear in the search dashboard for potential candidates who might apply if they have corresponding “badges” for the required skills or see the providers for the skills they still need to acquire.
- It could work as a NFT skills marketplace, in which a candidate locates their desired role, they find the right providers, gets their badges, and automatically appear in the bigdata screen of the employer.
- Once an employee is registered on the knowledge centre, they would be offered similar professional communities, new skills that appeared on the markets, as well as new opportunities for senior positions, once they gain new badges from their employers, partners, or educational and training institutions over time.

- The “badges” for each skill might be awarded to a candidate not only after taking a corresponding course (HE, VET, online platform), but also by a company after completing a certain project/job.
- The whole process would be decentralised, bottom-up, dynamic, continuous, and tailored.

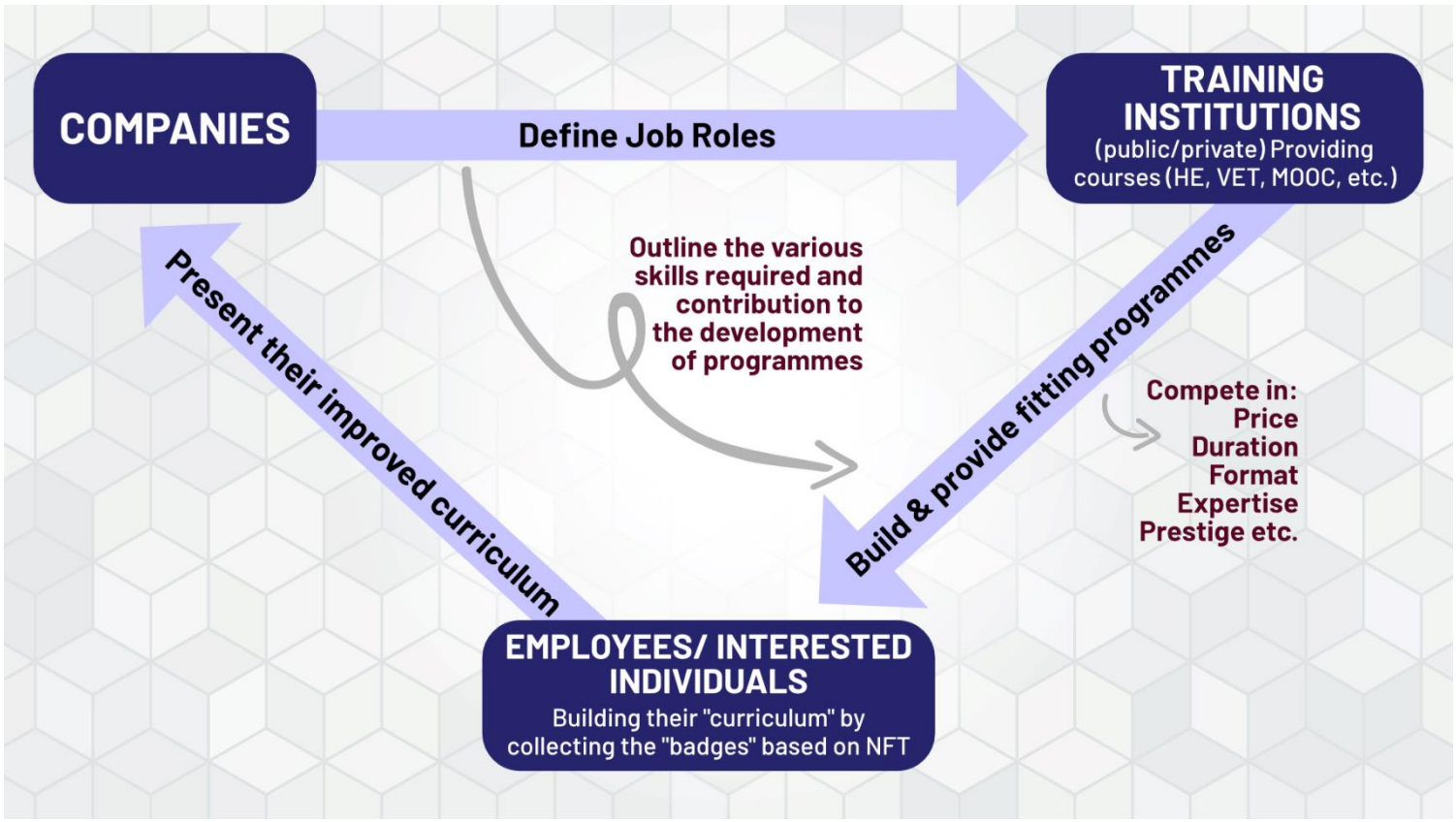


Figure 14: Decentralised blockchain-based job market/training platform

8 Skill strategy evolution approach

8 SKILL STRATEGY EVOLUTION APPROACH

The main goal of the blockchain Skill Strategy is to set a general direction on how to provide different groups of stakeholders with the necessary knowledge and skills in blockchain technology. They might need it because Blockchain impacts the functional role or the specifics of the industry in which they operate; they have responsibility for policy making or regulations and need to know the implications and limitations of blockchain to respond adequately to opportunities and challenges this technology conveys; or they simply want to have a general understanding of this disruptive technology to make informed decisions.

Hence, the Skill Strategy should have a wide scope and despite its strong focus on the blockchain labour market with the aim to reverse the current scarcity of blockchain talents, it should not be limited to it. Therefore, this chapter proposes several recommendations on the way to apply the Skill strategy on the mid to long-term. It introduces the main principles underpinning the Skill Strategy as well as objectives, strategies, and actions on how to attain them. We believe that it can serve as a stepping stone for developing operating plans related to blockchain educational and training activities in Europe.

Previous reports revealed the following:

- There is a greater blockchain skills demand than offers can satisfy.
- There is a slow responsiveness of formal education to current and future blockchain labour market needs.
- Education and training that would meet the needs of the 21st century is needed (connected with the real world – businesses, online, personalised – build your own course, etc.).
- Flexible, dynamic, bottom-up approach based on available technological innovations is necessary.

8.1 Principles

A good strategy should provide a clear roadmap, including a set of guiding principles or rules, that defines the actions that should be taken and the things that should be prioritised to achieve the desired goals. Hence, strategy principles are the fundamental rules and guidelines that serve as a foundation for reasoning and decision making about the long-term direction of an initiative. This subsection describes the main principles underpinning the blockchain Skill Strategy for Europe.

General principles for the blockchain skills development strategy:

- **BROADNESS**
- **INCLUSIVENESS**
- **TIMELINESS**

- **COLLABORATION**
- **EFFICIENCY**
- **PROJECT ORIENTATION**
- **DECENTRALISATION**
- **INNOVATION**
- **ENTREPRENEURSHIP**
- **TRANSVERSALITY**

Broadness principle implies that the Skill Strategy should have a wide scope including business and transversal skills and not be limited to ICT skills.

Inclusiveness principle points out the importance of education of different stakeholder groups including the general public, at least on the awareness level – having a general understanding of blockchain, to avoid some of the population being pushed into a new type of digital illiteracy exclusion. Based on this principle, the Skill Strategy should also support the skill development and ease the entry baiers for minorities and vulnerable individuals.

Timeliness principles emphasizes the need for a dynamic and continuous update of blockchain course content to ensure a match with the latest labour market requirements.

Collaboration principle encourages cross-border, cross-disciplinary and cross-experts collaboration.

Efficiency principle emphasises the importance of developing efficient methods of training and education which would take advantage of available technological innovations such as blockchain.

Project Orientation principle points out that education and training in this field should relate to the real world and be project-oriented instead of applying a traditional rigid lecture-like approach.

Decentralisation principle refers to the importance of a bottom-up approach, which means that a need for a particular skill is created in the labour market and academia or other educational initiatives respond to it by providing adequate training and not vice-versa (top-down).

Innovation principle promotes education and training based on methods of learning, where creativity and innovation are stimulated.

Entrepreneurship principle supports learning through practice and encourages self-learning and the adoption of an entrepreneurial attitude.

Transversality principle: The Skill Strategy should focus on explicit components to include transversal future skills in education and training settings, curricular and the awareness of all stakeholders addressed through the skill strategy.

8.2 Strategic objectives

Formulation of the strategic objectives is essential for achieving and measuring the attainability of goals. Figure 15 lists the objectives (O1-O5) the Skill Strategy aims to achieve**.**

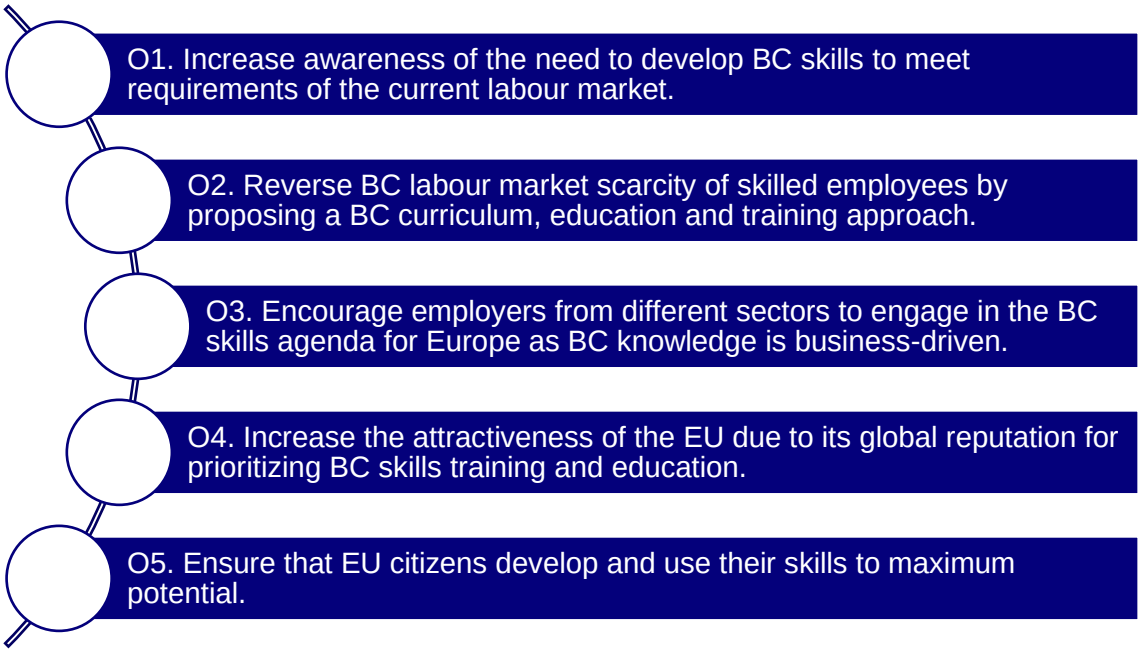


Figure 15: Strategic Objectives

To tackle a problem, first it is necessary to identify it and second, to increase the awareness around the problem. In the previous reports, we identified the urgent need to develop blockchain skills to meet the current requirements of the blockchain labour market. Thus, the next step would be to increase awareness of this situation so responsible actors perceive an urgency to act (O1).

The second objective will be to respond to labour market scarcity for skilled employees by proposing a blockchain curriculum, education and training approach (O2). In this regard, the complexity of the blockchain curriculum has already been discussed and the future CHAISE effort can build upon it while designing a blockchain curriculum, which is out of the scope of this report. We have also pointed out that blockchain training should be approached from a continuous (life-learning) perspective. In addition, a hybrid educational approach with an emphasis on flexibility, business collaboration, and project-orientation has been stressed.

It is important to acknowledge that blockchain is business driven. Therefore, the next objective is to encourage employers from different sectors to engage in and actively contribute to the blockchain skill agenda for Europe (O3). This is the only way to guarantee a match between the labour market skills requirements and the skill offer.

One of the flagship EU initiatives is to build a strong education pillar, which would contribute to the international competitiveness of the EU[1]. Thus, due to the great potential of blockchain to disrupt various industries, increasing the attractiveness of the EU via the priority given to blockchain skills training and education is our next strategic objective (O4).

As the EU aims to be a leader in blockchain technology, becoming an innovator in blockchain and a home to significant platforms and applications[2], having a skilled workforce is an essential element. Therefore, our next strategic objective is to ensure that EU citizens develop and use their skills to maximum potential (O5).

8.3 Strategies and Actions

After identifying the strategic objectives, actors who can take advantage of this Skill Strategy should be assisted in achieving the strategies. Hence, this subsection lists the strategies and supporting actions to get closer to the desired goals (Figure 16).

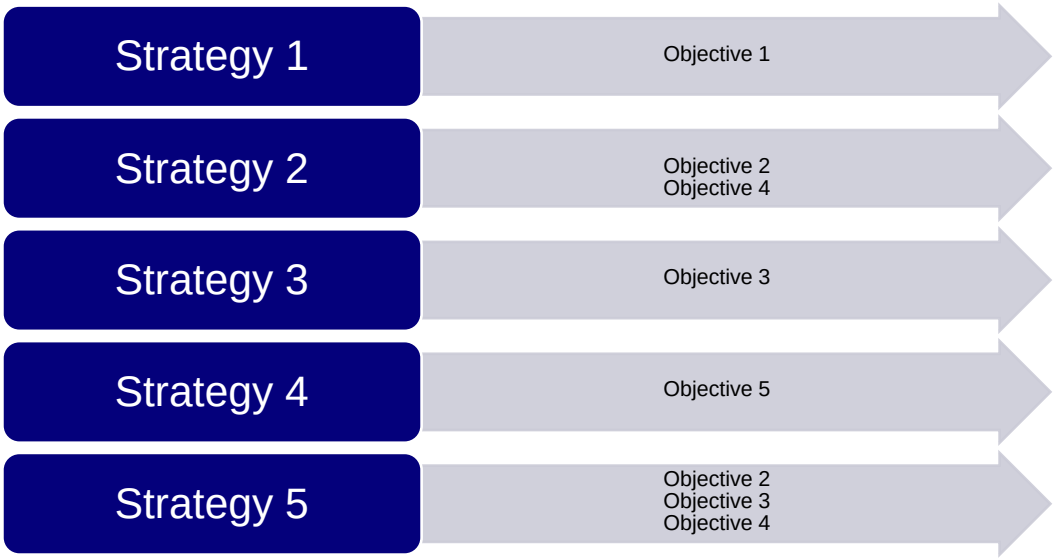


Figure 16: Strategies and objectives matching

Before closing, important milestones which would follow the release of the Skill Strategy should be highlighted (Figures 17-21). For better illustration, they are broken down to the roadmaps for each particular strategy.

[1] *https://education.ec.europa.eu/education-levels/higher-education/european-universities*

[2] https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy

Strategy 1: Launching a consistent message of blockchain educational needs and mapping of the labour market situation

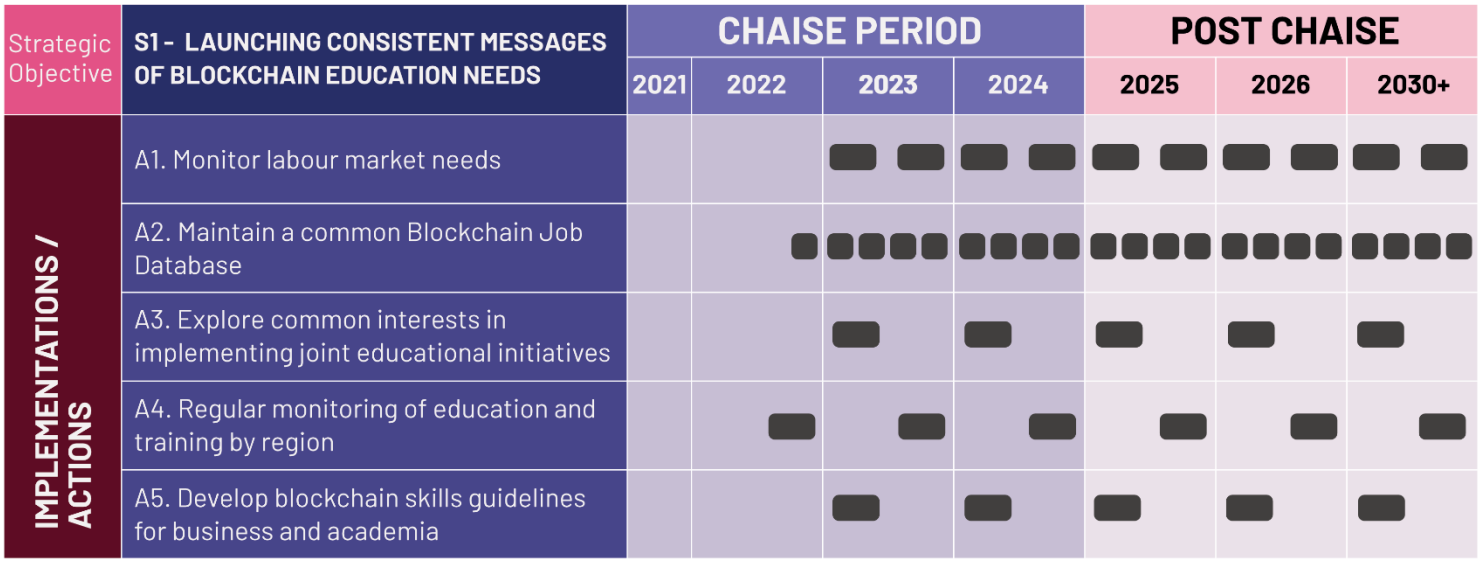


Figure 17: Roadmap Strategy 1

Actions:

- Continuous monitoring and evaluation of the blockchain labour market needs (skills) by interdisciplinary and cross-border working groups. The frequency of the BC job offer analysis is proposed to be conducted quarterly due to the rapid market evolution. Consequently, the observations will be summarized every six months, starting in the second half of 2022 and exceeding the CHAISE project duration. CHAISE or similar interdisciplinary and cross-border consortia can be in charge of this action plan. In terms of duration of the necessary actions, four weeks would be dedicated to job offer monitoring and another four weeks to the market needs analysis. The expected outcome will be an updated summary following the report D2.2.1. Study on blockchain labour market characteristics.

- Creation and maintenance of a common BC job database. The database is planned to be fully operating in the last quarter of 2022. Duration of the maintenance activities related to the periodical data update is estimated at four weeks. The expected outcome will be a quarterly updated database. Entity in charge could be CHAISE or a similar consortium.

- Adoption of a multi-stakeholder approach to initiate meetings of different stakeholder groups (business representatives, professional associations, academics, policy makers, etc.) to explore common interests in implementing joint educational initiatives related to blockchain. The yearly periodicity of such meetings starting in 2023 would be recommended. The expected final outcome will be a report containing a proposal of BC related educational initiatives, whose preparation is estimated at 5-6 weeks. Institutional stakeholders such as DG CONNECT with a strong support of an Academic Network will play a key role in organizing and carrying out these meetings and related activities.

- Continuous monitoring and evaluation of education and training activities in the region by interdisciplinary and cross-border working groups. The frequency of the monitoring and evaluation activities will be on a yearly basis counting with a duration of 6-8 weeks starting at the end of 2022 and exceeding the CHAISE project period. CHAISE or a similar consortium in collaboration with universities should work closely with institutional stakeholders such as DG EDUCATION and DG CONNECT on this task. The expected outcome will be an inventory of BC training programmes by region.

- Continuous development and dissemination of series of guidelines related to the latest updates in the BC labour market (trends related to skills, sector, countries, new educational and training initiatives, etc.) by a panel of experts is planned to start at the beginning of 2023 with a yearly frequency. The estimated duration of the related activities are two months, which would lead to the elaboration of BC Skills guidelines for businesses and academia. The institutional stakeholders in charge of the final outcome could be DG CONNECT or DG EDUCATION.

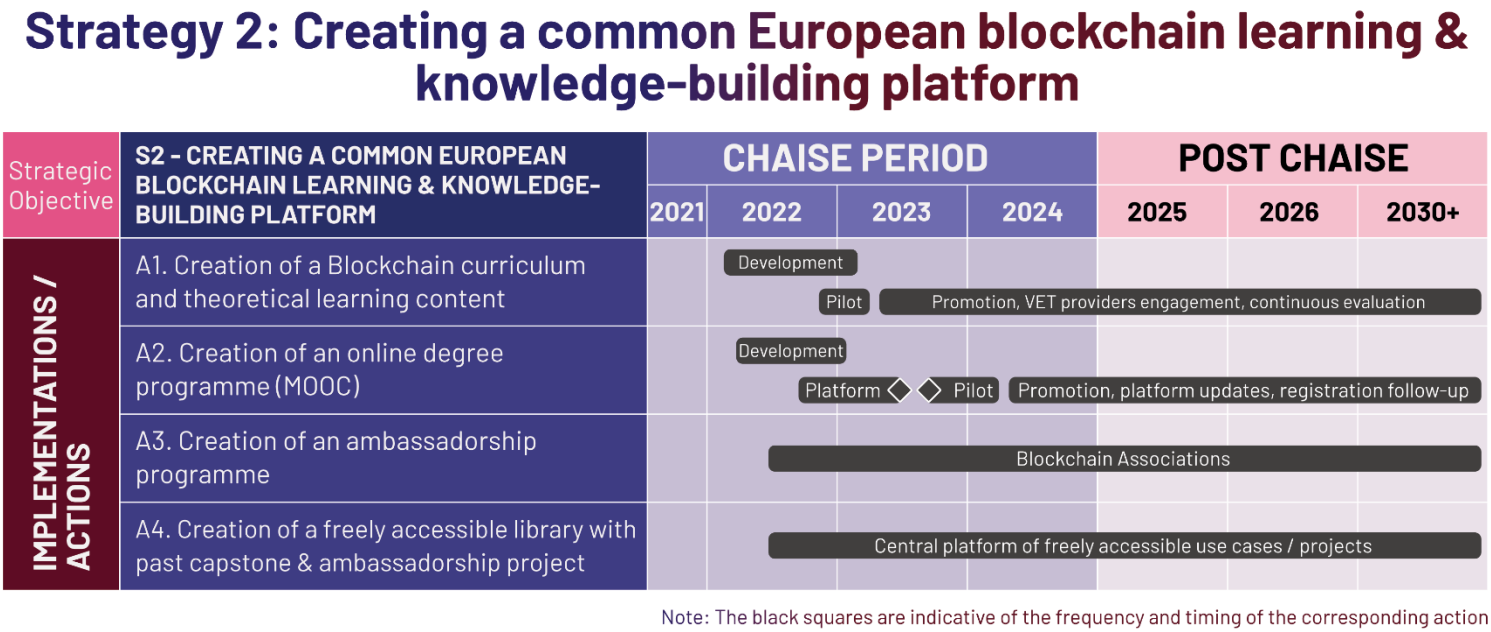


Figure 18: Roadmap Strategy 2

Actions:

- Creation of a blockchain curriculum and theoretical learning content that is:
  - a coherent and exhaustive teaching offer customised to the different stakeholder groups and expertise,
  - collaboratively developed, maintained and evolved by all European academic institutions interested in contributing,
  - accessible in "free-observer-mode" or "academic-program-mode".

During 2022, a blockchain curriculum structure will be designed in compliance with the principles and strategies outlined in this report. The development phase will follow by launching a pilot BC CV content in March 2023. Consequently, the phase of promotion together with VET providers engagement will be initiated. The duration is expected to exceed the CHAISE project period and counts with a continuous evaluation.

- Creation of online degree programs (MOOC) that are:
  - structured around group capstone projects,
  - taught by a pooled teaching faculty from the different contributing academic institutions and experts from the private sector,
  - integrated into university programs through accompanied work classes.

The development of an online platform (technical aspects) will start at the end of 2022 aiming to meet the deadline for an operative platform, mid 2023. The training pilots are planned to kick off in June 2023, where tools for the validation of learning outcomes will be delivered to measure the level of acquired Blockchain skills and at the same time to measure the success rate of the proposed strategies and actions. If necessary, some adjustments would take place. After a successful pilot stage, elaborated teaching materials will be translated into 11 (all partnership) languages. Promotion period should be initiated afterwards complemented by necessary continuous updates. Follow-up registration is planned in parallel and would continue beyond the CHAISE period.

- Creation of an ambassadorship program through BC associations (help to connect students with professional network), where:
    - Past students elaborate a use case within their company internal working groups through a capstone project and collaborate with the degree students.
    - Internal working group at the blockchain association elaborates a use case through a capstone project and collaborates with the degree students.

These actions are planned to start in the second half of 2022 and require an active participation of BC Associations and willingness of companies to get involved in the ambassadorship program through creation of internal working groups that would engage in active training and education of the degree students.

- Creation of a freely accessible library with past capstone and ambassadorship projects.

This action is planned to start in parallel with the ambassadorship programs and would consist of a central platform of freely accessible use cases or capstone projects, which would serve as practical educational materials.

Strategy 3: Enhancing collaboration & knowledge transfer from business to academia

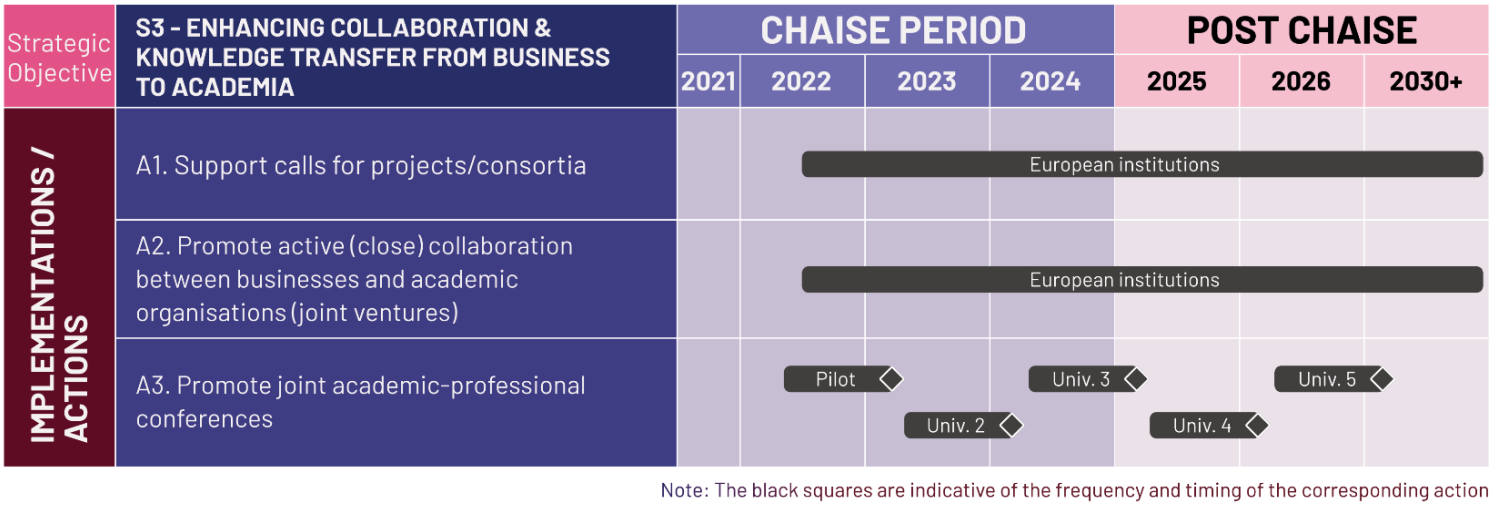


Figure 19: Roadmap Strategy 3

Actions:

- Support project calls for consortiums (interdisciplinary, cross-border, with a balanced number of academia-business partners). By proposing this action, we aim to foment a continuous effort of institutional stakeholders such as DG CONNECT to shove next projects like CHAISE and to encourage the EC to keep its strong focus on digital innovations in the European region. Thus, this action has a continuous character with the main outcomes being calls for consortiums and projects related to BC, where the main actors are institutional stakeholders like DG CONNECT.

- Promote active (narrow) collaboration between businesses and universities (more formal: one of the supervisors of the final project must come from a business world, or less formal – organisation of events such as *"Tech talks and coffee"* at universities by inviting professionals). By this continuous action, we aim to boost the creation of "joint ventures" between academia and businesses. Thus, the main actors in charge would be academia and companies. Nevertheless, the EC can play a key role to encourage such collaborative efforts by providing some incentives.

- Promote an ongoing employer-educator dialogue to match identified needs with training provision in the EU region, thereby optimising the return on EU investment in education and training through academic-professional conferences. The pilot conference is planned to be held

at the beginning of 2023 and will be repeated on a yearly basis. The proposed duration is of 2 days. However, a preparatory phase (organization) is estimated to take a couple of months. The final outcome would be conference proceedings and reports. The entities in charge might be DG Connect, CHAISE or similar consortium, other associations such as INATBA, a hosting university, etc. The conference will take place in different country every year and be organized in collaboration with local universities and businesses, which would be a great opportunity for networking.

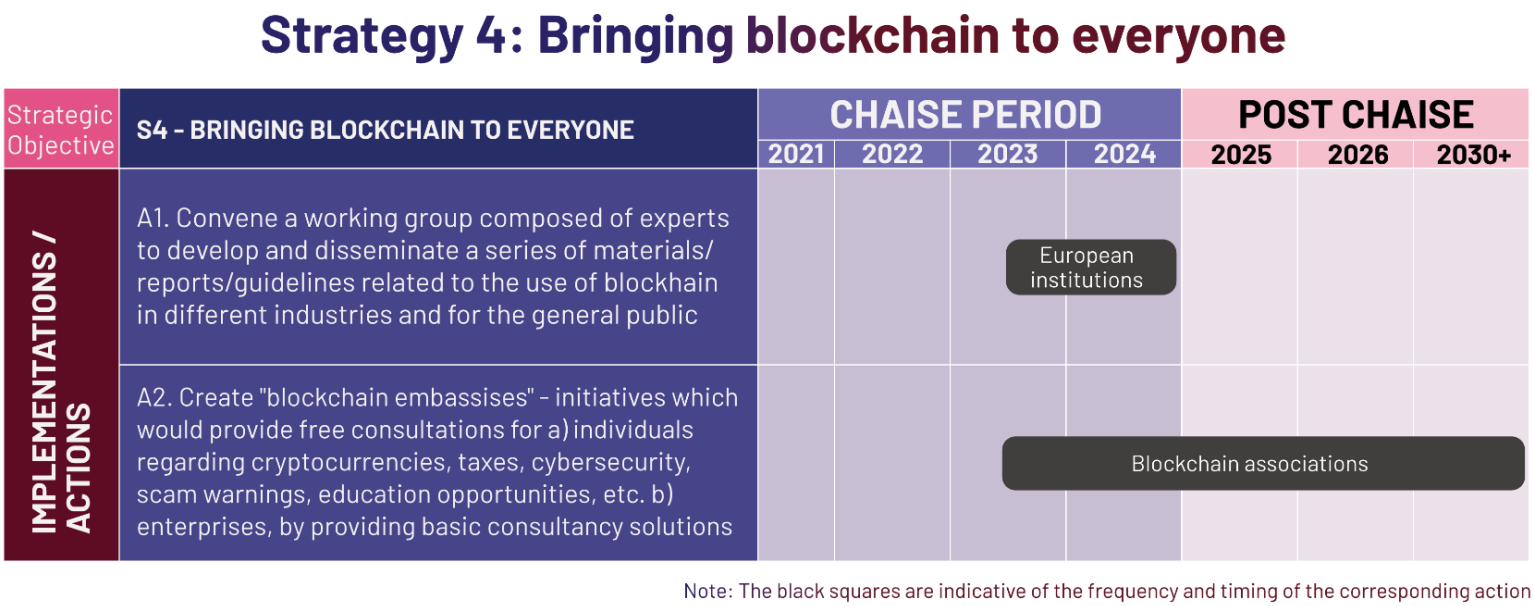


Figure 20: Roadmap Strategy 4

Actions:

- Convene a working group composed of experts to develop and disseminate a series of materials/reports/guidelines related to the use of blockchain in different industries and for the general public. This action is planned as a 1-year effort (with a possibility to be extended if necessary) to create materials and prepare a campaign starting in the second half of 2023. The expected outcomes will be dissemination and marketing activities in form of communication materials, flyers, TV ads, YouTube videos, etc. The organizations in charge would be PR companies in collaboration with BC associations.

- *Creation of "blockchain embassies"* (initiatives, which would provide free consultations for a) individuals regarding cryptocurrencies, taxes, cybersecurity, scam warnings, education opportunities, etc. b) enterprises, by providing basic consultancy solutions and networking). This action is also planned as a continuous effort with the outcomes having form of events or info-sessions on topics such as cryptocurrencies, NFT, or how and where to use BC in everyday life, what are the latest trends, etc. The organizations in charge might be local BC associations that spark closeness and trustworthiness and can be based on a membership (corporate/individual) which will be for free or for a symbolic fee to ensure the access for everyone.

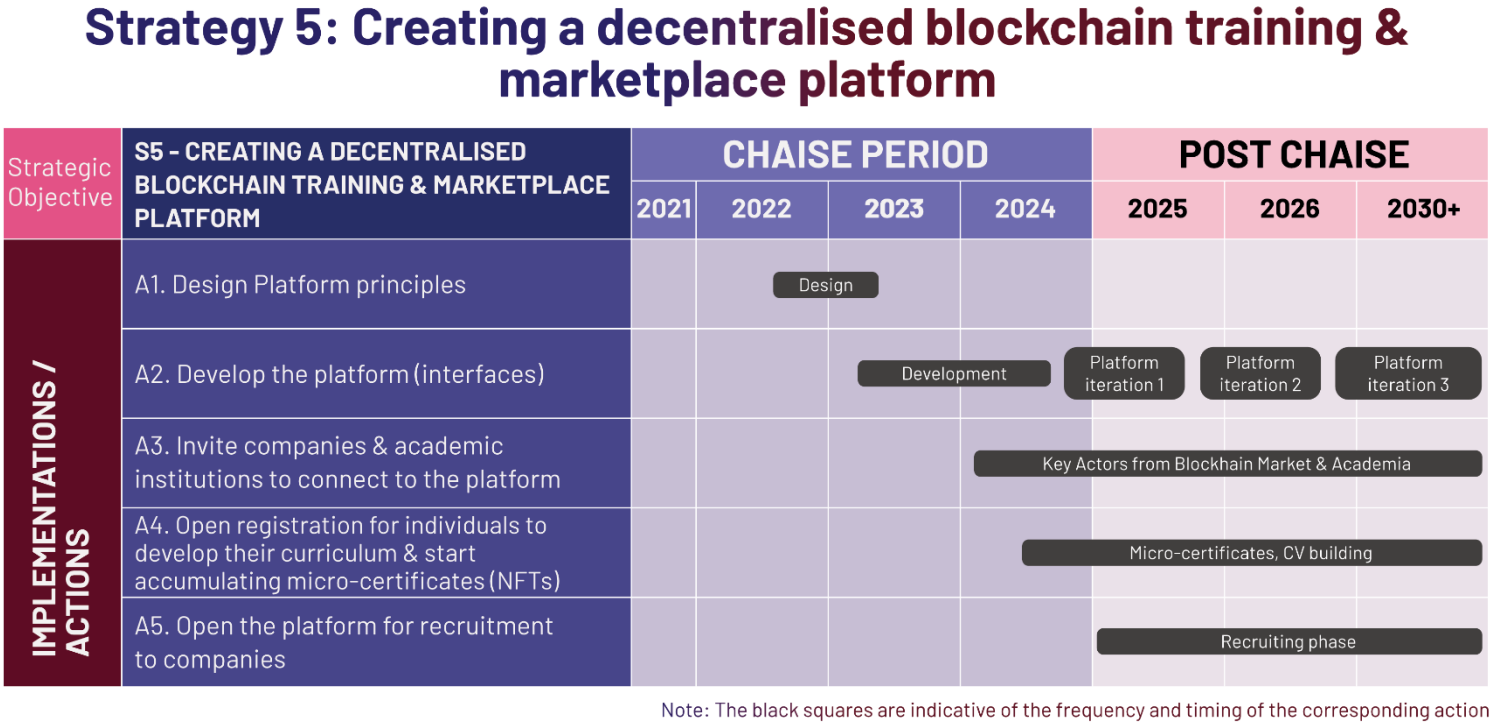


Figure 21: Roadmap Strategy 5

Actions:

- Design a training platform (see Figure 14) that will meet the educational needs of the 21st century (taking advantage of available technologies, bottom-up, flexible, tailored, decentralised, etc.).

- Based on three main nodes (companies publishing roles with required skills; training institutions like universities or private academies competing by providing the course of their expertise; employees/interested individuals collecting their "badges").

Designing platform principles and functionalities will start in October 2022. In 2023, the platform development will start off with a duration of 12 months and technical functionalities will be periodically revised. In the first quarter of 2024, the key actors from BC market and academia will be invited to test

the platform. The testing period is estimated to take from 6 to 9 months. After a successful testing period and necessary adjustments, the registration will be open for individuals such as students and professionals who can start to build their CV through micro-certificates. This phase will start at the end of 2024, which is the last year of the CHAISE project. Consequently, the platform will be opened for all companies seeking BC candidates and is expected to be “autonomously” maintained based on blockchain technology with some periodical revisions to detect potential errors or biases. The final outcome of this action will be a decentralized platform, which represents a new way of learning, hiring and developing a personal curriculum. The key actors in charge will be academia, companies, and blockchain.

9 CONCLUSIONS

New technologies and digital innovations are gradually reshaping many sectors and skills shortages are emerging in different areas. Over the last few years, we have observed how blockchain technology is proliferating into different industries[3] and causing a significant impact on the job market. This new technology also seems to be one of the key drivers of change for the future, therefore, availability of a skilled workforce in this sector will be vital for the future of the EU.

There already is a higher demand for blockchain skilled employees than the supply can satisfy, and the gap will widen if there is no action. As a Sector Skills Alliance financed by the Erasmus+ programme, CHAISE aims to address the growing demand for blockchain skills across Europe. Thus, the key mission of the CHAISE project is to develop a strategic approach on blockchain skills development for Europe as well as to deliver future-proof training solutions to tackle blockchain skill shortages in the European blockchain labour market.[4] Therefore, this Skill Strategy should serve to provide a roadmap, including a set of guiding principles, strategies and actions that should be taken to respond to the current and future skill needs of the European Blockchain workforce.

The formal education system is not flexible enough and has not responded in time to meet current labour market needs. Thus, important reforms of the current education and training system must be implemented to improve its relevance. In addition, collaboration between different stakeholder groups such as businesses, the education sector, policy makers and regulators will play a vital role.

In this report, we have provided a brief overview of the current labour market needs. We have also taken a closer look at different categories of blockchain skills (technological, transversal, business) and discussed the complexity of the blockchain curriculum. In addition, we have offered some insights into current educational and training initiatives related to blockchain and identified the main stakeholders for blockchain education and training activities. Last, but not least, different upskilling approaches have been discussed together with an introduction of an innovative idea of a decentralised (blockchain-based) job market/training platform.

The Skill Strategy aims to contribute to the skills development of the blockchain labour market by proposing an educational strategy and actions that would meet the needs of the 21st century. At the same time, it seeks to address *what* to teach (which skills), *whom* to (identifying the stakeholders), and *how* (strategies and action plans).

[3] https://www.oecd.org/daf/blockchain/
[4] https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy

10 REFERENCES

CHAISE (2021). Study on Blockchain labour market characteristics - https://chaise-blockchainskills.eu/wp-content/uploads/2021/05/D2.2.1-Study-on-Blockchain-labour-market-characteristics.pdf

CHAISE (2021). Registry of Blockchain educational and training offerings. Available at: https://chaise-blockchainskills.eu/the-registry-of-blockchain-educational-and-training-offerings/

CHAISE (2021). Registry of Blockchain online job vacancies. Available at: https://chaise-blockchainskills.eu/the-registry-of-blockchain-online-job-vacancies/

CHAISE (2021). Studies on Blockchain skills demand & supply. Available at: https://chaise-blockchainskills.eu/publications-and-reports/

CHAISE (2021). Study on skills mismatches in the Blockchain sector. Available at: https://chaise-blockchainskills.eu/publications-and-reports/

Dip, C.Z. (1987) Formal, non-formal and informal education: concepts/applicability. Available at: http://techne-dib.com.br/downloads/6.pdf

EC (2020). Digital Education Action Plan. Available at: https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

EC (2020). Blockchain Strategy. Available at: https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy

Kotter, J. (2012). Leading change. Harward Business Review Press. Boston, Massachussetts

OECD (2021). Blockchain and distributed ledger technology. Available at: https://www.oecd.org/daf/blockchain/

The British Blockchain Association (2021). 'UK's National Blockchain Roadmap'. Available at: https://britishblockchainassociation.org/wp-content/uploads/2021/07/UK-NBR-Excellence-Standards-Framework.pdf