

chaise

blockchain skills for Europe



D2.2.1:

Study on Blockchain labour market characteristics

April/2021

Co-funded by the
Erasmus+ Programme
of the European Union



PROJECT DETAILS

Project acronym: CHAISE
 Project name: A Blueprint for Sectoral Cooperation on Blockchain Skill Development
 Project code: 621646-EPP-1-2020-1-FR-EPPKA2-SSA-B

Document Information

Document ID name: CHAISE_WP2_D2.2.1
 Document title: D2.2.1 – Study on Blockchain labour market characteristics
 Type: <type>
 Date of Delivery: 30/04/2021
 WP Leader: DHBW
 Task Leader: INATBA
 Implementation Partner: INATBA
 Dissemination level: **Public** / Restricted / Confidential

DOCUMENT HISTORY

Versions	Date	Changes	Type of change	Delivered by
Version 0.1	31/03/2021	Initial document	-	INATBA
Version 0.2	15/04/2021	1 st Revision	All Partners Reviews	INATBA
Version 0.3	21/04/2021	2 nd Revision	Task Partners	INATBA
Version 0.4	22/4/2021	Validation	WP Leader Validation	DHBW
Version 0.5	23/04/2021	Proof Reading	Quality Assurance	UCBL
Version 1.0	30/04/2021	Final Version		INATBA

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20	EXELIA	EXELIA	GR
21	Industria Technology Ltd	INDUSTRIA	BG
22	Crypto4All	C4A	FR
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
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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Disclaimer (Scope of the report)

The report has been developed based on the desk and database research of 14 countries (CHAISE project partners) complemented by interviews with experts and publicly available sources. Although we tried providing an extensive overview of the European blockchain ecosystem and blockchain labour market, due to the lack of publicly available data we might not have achieved complete coverage. Another issue that should be raised is that as employees, collaborators and legal entities spread over different locations, it might be misleading trying to pin blockchain projects (startups) to one geographical area as these are virtual, decentralised organisations.

1 BACKGROUND INFORMATION

1.1 Context of this report

Blockchain is at the core of the EU strategy to advance digital transformation, benefitting society and businesses and stimulating sustainable growth. The European Blockchain Sector is well placed to acquire global leadership; still its competitiveness largely relies on the availability of a competent and versatile workforce. Whereas the demand for blockchain skills is steadily increasing, employers face a shortfall of skilled professionals that prevents the sector from unleashing its full potential. The Blockchain sector is challenged by a talent shortage, global competitive pressures, the limited connection between education & the market, and low responsiveness of formal education to new workplace requirements.

CHAISE is a transnational initiative or a Sector Skill Alliance, funded by the European Commission, to set forward a sectoral approach to Blockchain Skills Development. CHAISE will formulate and deliver a European strategy to address skill mismatches and shortages in the Blockchain Sector and deliver appropriate and future focused training, qualifications, and mobility solutions, geared to sectoral realities and needs. The Major objectives of this initiative are:

- Improve Blockchain skills intelligence and document prevailing skills mismatches at the EU level.
- Set up a collaborative approach to monitoring the evolution of workplace requirements and anticipating future blockchain skill needs, to act as an early warning information mechanism for imbalances between demand & supply.
- Design a European learning outcome-oriented modular VET programme and educational resources on Blockchain to address technical, non-technical and cross-discipline (horizontal) skills requirements.
- Define EU-wide occupational requirements for the Blockchain workforce to address fragmentation in the labour market.
- Establish a sectoral qualification linked to the new Blockchain specific occupational profile to set standard educational requirements for Blockchain Skills across the EU.
- Connect job seekers and blockchain companies to support professional transnational mobility and increase the attractiveness of the Blockchain sector.
- Set up a post-project permanent cooperation network to systematically monitor labour market and skill developments and keep the European Blockchain Skills Strategy up-to-date and relevant.

1.2 Research Methodology

The CHAISE research methodology follows a consequent combination approach, mixing different research methods and various data sources to gain a better and more profound, broader understanding of how skills are in demand, provided, and how the context of the skills in Blockchain in Europe can be described. The methodological concept we follow is called triangulation.

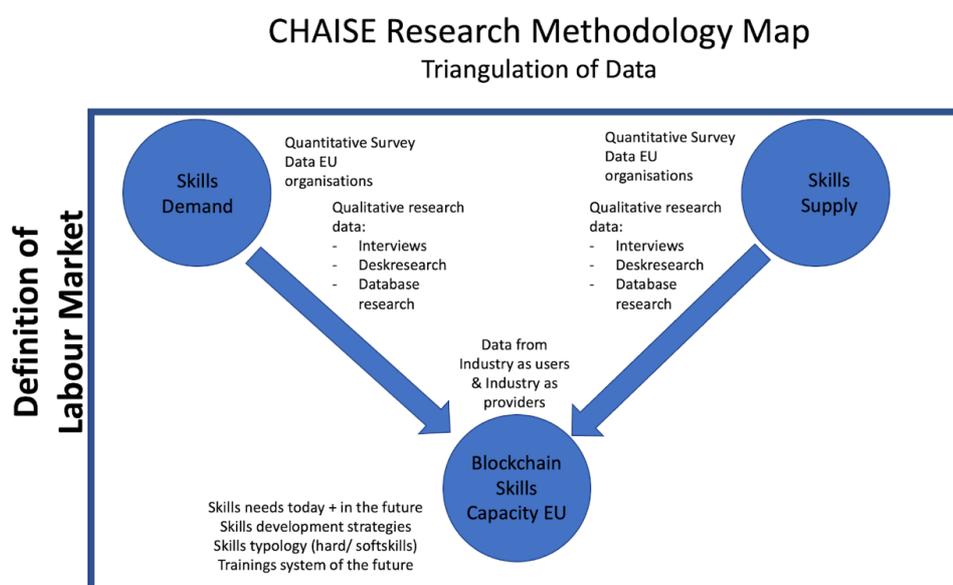


Figure 1 – CHAISE Research Methodology Map

For methodology triangulation, we are combining qualitative research methodologies like desk research in which we are analysing existing information in terms of research papers and official documents, qualitative interview studies in which experts in focus group or semi-structured interviews are asked about skill demands, skill supply, education and training methodologies and qualitative validation exercises through focus groups, with quantitative methodologies in which we are using data extraction strategies from databases to gain quantitative insights into skill demands as well as education and training participation rates and a comprehensive standardised online survey to gain insights into skills and skill demands from European enterprises using Blockchain as well as from IT service companies providing Blockchain services. To define the Blockchain skills capacity in Europe and its member states, which is composed of the demands industry has in terms of Blockchain skills concerning the supply of Blockchain-related skills as well as the strategies and existing provision of education and training, the CHAISE project is triangulating different data sources as well. Official documents, databases, experts, and online communities are surveyed and analysed. Through the research design, which is shown in

the Figure 1 above, it will be possible for the CHAISE project to define the inner structure of skills for Blockchain uptake, development and integration into European private and public sector, the intensity and level of skill demand, strategies for skill support, skill development and skill supply as well as providing a basis for the future of skill supply.

1.3 Research Approach

1.3.1 Major questions considered for this research.

A. Blockchain market characteristics. Describe a model of a European Blockchain Market through the definition of Segmentations of the Blockchain (BC) market into Developers of BC tech; Providers of BC Services; Companies as users of BC Tech with different usage intensity; List of Industry sectors in which Blockchain technology is used; Blockchain market size of the sectors found (turnover, revenues); Number and characteristics of Blockchain companies.

B. Blockchain workforce characteristics: the number and characteristics of people employed (gender, age); type of employment (employed, self-employment); type of contract (part or full time); level of wages; level of education/qualification; occupations in demand; skills profiles/ experiences in demand; number and characteristics of job vacancies in BC market and in each segment; number of unfilled job positions; existing occupations affected through structural/ skill/ other changes; the number and area of underskilled people.

1.3.2 Research Steps

The research has been conducted by following the steps described below:

1. Online Focus Group discussion aiming to define the relevant research criteria, a description of the blockchain market, identification of relevant data sources.
2. Desk Research aiming to collect a large set of papers within Partner's countries which would provide valuable information on how to define the blockchain market and demarcating information.
3. Database Research
 - a. Consultation of national and European databases (official NSO and others) for collecting statistical information about the blockchain labour market.
 - b. Complementing the collected data with a second wave of research for filling the gaps where necessary

4. Collection of Relevant Job Vacancies: Creation of a registry of Job Vacancies and analysis of the main characteristics
5. Analysis and Compiling of all collected information for extracting preliminary observations and conclusions about the Blockchain labour market characteristics.
6. Validation of our findings during three online focus groups with three blockchain community of experts

1.3.3 Contributing Partners

Participant organisation name	Short name	Country
International Association of Trusted Blockchain Applications	INATBA	BE
Fujitsu Technology Solutions NV	FUJITSU	BE
Ministry of Education and Religious Affairs	YPEPTH	GR
ECQA GmbH	ECQA	AT
DIGITALEUROPE AISBL	DIGITALEUROPE	BE
IOTA STIFTUNG	IOTA	DE
Universitat Politècnica de Catalunya	UPC	ES
DUALE HOCHSCHULE BADEN - WURTTENBERG	DHBW	DE
INTRASOFT International S.A.	INTRASOFT	LU
University of Tartu	UT	EE
UNIVERZA V LJUBLJANI	UL	SI
BerChain E.V.	BERCHAIN	DE
ITALIA4BLOCKCHAIN	ITALIA4BLOCKCHAIN	IT
AUTORITATEA NAȚIONALĂ PENTRU CALIFICĂRI	ANC	RO
EXELIA	EXELIA	GR
Industria Technology Ltd	INDUSTRIA	BG
Crypto4All	C4A	FR
Economic and Social Research Institute	ESRI	IE

Table 1 – Contributing Partners

2 INTRODUCTION

In this report, the blockchain ecosystem is defined as a group of entities that interact to create a special environment. It consists of startups, corporations, governmental institutions, clusters, think tanks, networks, and associations that provide a legal framework, promote blockchain technology or operate in the blockchain sector.

The size and complexity of the blockchain ecosystem vary from country to country. Yet, while among certain European countries a steady startup growth might be observed (Germany), in others, we can see certain maturity signs where startups are converted to blockchain communities, and big players enter the market (France, Italy)¹. However, the main drivers of the blockchain ecosystem are new startups and B2B blockchain-based solutions. Big players such as Orange (France); Erste Bank (Austria); SAP (Austria); Elia Group (Germany); Yuso (Belgium); Ulster Bank (Ireland), and many others have already embraced blockchain technology which is a clear indicator of technology acceptance. Nevertheless, different European countries have adopted a different approach to a regulatory framework related to blockchain. Some have taken significant steps to enable and facilitate blockchain development, like Luxembourg and Malta, while governments in others have been relatively passive.

Another important aspect of the blockchain ecosystem is the labour market. This technology's rapid evolution is reflected in the increased number of job vacancies related to blockchain profile. Although most of the blockchain vacancies are related to general ICT skills, there is an increasing trend of other blockchain positions being published. Indeed, The European Skills, Competences, Qualifications and Occupations (ESCO) is currently working on creating a specific category for the blockchain-related job position.

Yet not all EU member states are at the same level on the overall blockchain maturity curve. However, there is a growing trend in almost all countries that helps Europe mature toward becoming one of the most important players in this field globally.

¹ https://www.eublockchainforum.eu/sites/default/files/reports/EU%20Blockchain%20Ecosystem%20Report_final_0.pdf?fbclid=IwAR24FkNF_Y8VG3WVHVkMGhd-_BC5sXAZEfmzzXfZSFr29vWKyBSX90RGiw

3 BLOCKCHAIN ECOSYSTEM

In this section, we focus on national strategies, regulation, industries, and blockchain market and companies' characteristics. Blockchain strategies vary across EU countries, many are still under development or there are not any yet. Most affected sectors are the ICT (information technology and services; computer software; internet; telecommunications industry) and financial sector (financial services and banking industry). However, an increasing trend of blockchain technology use can be observed in other industries too. Startups are driving the technology development, whose deployment is often hampered by missing or incomplete legal frameworks. Hub-organisations exist in every investigated EU country; however, they lack collaboration and cooperation.

3.1 National strategies

Although numerous blockchain projects are being developed on the national and international level, only a few countries have defined a clear blockchain strategy. Among the countries that have explicitly determined what we can call a national strategy on blockchain development are Luxembourg, Estonia, Germany, and France. Italy and Austria's strategies are under development.

Luxembourg aims to be Europe's pioneer in the blockchain world. The country has adopted an interdisciplinary approach toward embracing blockchain technology, including the Blockchain Standardization, ILNAS, the national standards body, which oversees realizing the national technical standardization strategy, with a firm policy concerning the ICT sector. With associated research and education initiatives², Luxembourg also targets establishing a blockchain hub of excellence³; and supports initiatives related to cryptocurrencies and secondary cryptocurrency markets. The Luxembourg financial regulator Financial Sector Supervisory Commission (CSSF) was the first authority in the financial sector to regulate platforms for the exchange of digital currencies when exercising an activity of the financial sector in 2014. The CSSF considered that activities, such as the issuance of digital or other currencies, the provision of payment services using digital or other currencies, and the creation of a market (platform) to trade those currencies, should be defined as financial activities and that any person wishing to carry out such activity in Luxembourg has to receive a ministerial authorisation. Luxembourg has also been the first country to adopt a legal framework for the issuance and settlement of securities issued over the blockchain. Titled Bill 7363, the legislation is intended to provide financial market participants with legal certainty for issuing securities using blockchain technology.⁴

² <https://gouvernement.lu/dam-assets/documents/actualites/2018/06-juin/13-ilnas-blockchain.pdf>

³ <https://digital-luxembourg.public.lu/stories/luxembourg-targets-setup-blockchain-hub-excellence>

⁴ <https://www.pwc.lu/en/blockchain-and-crypto-assets/luxembourgs-bill-blockchain-held-securities.html>

Estonia is known for its leading digitalization strategy in general. Thus, blockchain strategy is an integral part of cybersecurity strategy, which points out the importance of developing a sustainable digital society and ensure technological resilience. In 2020 the Information System Authority in Estonia issued a document on Cybersecurity in Estonia⁵, which describes the landscape of different sectors' national security and responsibilities. Among others, it indicates that “*Guardtime provides its blockchain technology to protect the most critical logs in Estonia (e.g., Health records).*”

In **France**, the first direction toward the blockchain national strategy was defined by the French government in April 2019 by establishing clear legal, accounting, and fiscal framework, allowing blockchain to transfer financial instruments and the issuance of digital assets in a secure environment. This step was completed with the 2019 finance law and on May 22, 2019, with the adoption of the PACTE law (Action plan for the growth and competitiveness of businesses). A round of consultations with different stakeholders has been carried out to define the new challenges for blockchain development for non-financial use. They have discussed difficulties they are facing and expressed their expectations in this matter. Following this work, the government have defined four main pillars as a core of its strategy to make France a blockchain nation:

- 1) Strengthen the excellence and structuring of French industrial sectors to deploy projects based on blockchain technology.
- 2) Strengthening of interdisciplinary collaborations between research teams and the development of partnerships between research and start-ups.
- 3) Promoting innovative projects based on blockchain technology.
- 4) Support and secure blockchain project leaders in their issues, especially legal and regulatory.

The **German** Federal Government has recognized the great potential of blockchain technology in its recently adopted blockchain strategy⁶. According to this strategy, blockchain innovation will be heavily promoted, supported, and funded, and investments initiated and attracted. In particular, the development of blockchain technology in the financial sector will be supported by liberalizing German law to facilitate electronic securities. Public offering of certain cryptotokens will be regulated and legal certainty for trading platforms, and crypto depositories shall be ensured. The strategy prospects a clear regulation for crypto-currency business models in the financial sector, which should add predictability and reliability for entrepreneurs and investors. Crypto-trading and respective fin-tech companies will be treated as financial services. They will thus be subject to the BaFin regulation, which will improve trust in and acceptance of the blockchain industry significantly. To further support innovation, the German

⁵ <https://www.ria.ee/en/news/cyber-security-estonia-2020.html>

⁶ TW convenience translation of the German Government's Blockchain strategy <https://startup-map.berlin/lists/17912>

Government promotes an “Industry 4.0 Regulatory Testbed.” Startups shall be able to develop and test their products, especially those revolving around smart contracts, in an experimental, less regulated environment. The governmental authorities furthermore intend to act as role models by integrating blockchain technology into their processes. Personal appointments with the authorities, for example, are planned to be replaced by electronic proof of identity. The government is also making special efforts to subsidize climate-friendly and sustainable projects. Plans include introducing of corporate blockchain bonds and shares (as opposed to the current regulation stipulating that bonds/shares must be in paper form). That could even lead to the introduction of new corporate forms with corporate shares in token form. However, the German Government plans to work at the European and international level to ensure that stablecoins will not become an alternative to state currencies.⁷

In **Italy**, the Ministry of Economic Development has selected a group of 30 experts to provide a picture of the current situation, identify possible developments and the resulting socio-economic consequences deriving from the introduction of solutions based on these technologies. The group has drafted the *"Proposals for an Italian strategy in the field of technologies based on shared ledgers and Blockchain"* containing the guidelines to be followed to allow the development and dissemination of this technology, which define the reference context of the national strategy⁸. The main objectives are:

- to provide Italy with a competitive, regulatory framework compared to other countries;
- to increase public and private investments in Blockchain / DLT and related technologies (i.e., IoT, 5G);
- to propose application fields of technology to correctly target possible investments, in line with the key sectors of the Italian economy;
- to improve efficiency and effectiveness in interacting with the public administration through the adoption of the once-only principle and decentralization;
- to foster European and international cooperation through the adoption of the common European infrastructure by the EBSI (European Blockchain Systems Infrastructure);
- to use technology to facilitate the transition to circular economy models, in line with the 2030 Agenda for sustainable development;
- to promote information and awareness of blockchain / DLT among citizens.

⁷ <https://www.bundesregierung.de/breg-en/news/blockchain-strategie-167301>

⁸ https://www.mise.gov.it/images/stories/documenti/Proposte_registri_condivisi_e_Blockchain_-_Sintesi_per_consultazione_pubblica.pdf

In **Austria**, National Blockchain and Crypto-Strategy⁹ is planned to appear in the period 2020-2024 and will focus on the following key areas:

- Building on existing competence centres in the blockchain area.
- Examination of development opportunities in administration.
- Creation of a legal framework for investments in the blockchain area.
- Creation of positioning for the regulation, application, and promotion of blockchain technology and its various applications.

The **Greek** Ministry of Digital Governance recently presented a Digital Transformation “bible” for the years 2020-2025 outlining a holistic digital strategy with guiding principles, strategic axes and horizontal and vertical interventions that will lead to the digital transformation of the Greek society and economy. In this “bible”, there are references for the need to exploit new technologies, including blockchain as a tool for fraud prevention in the public sector and the digital transformation in public procurement.

There is no official national blockchain strategy in the rest of the analysed countries; it is in a preliminary stage, or there were no available data.

3.2 Regulation

To date, most of the countries have exercised caution and refrained from developing a specific domestic regulatory regime for blockchain, preferring to delay and observe whether a common EU approach emerges. The blockchain sector is concentrated in the financial services sector, and as such, the main regulations impacting blockchain relate to general financial compliance rules and directives. Indeed, the most important regulatory regime specific to blockchain in the EU relates to the European Anti-Money Laundering regulation.

Besides, the financial regulators of most of the EU countries as well as the European Securities and Markets Authority (ESMA), have issued warnings against cryptocurrencies, calling on investors to be aware of the risk related to crypto investments given that crypto values are largely unregulated in the EU¹⁰.

⁹ https://www.dieneuevolkspartei.at/Download/Regierungsprogramm_2020.pdf?fbclid=IwAR21w_rI0ktnwWY7LBENj6RDrhq3ep8ybLEp0ivFXDSEhWKRrKS7bw3U3SQ

¹⁰ <https://www.esma.europa.eu/press-news/esma-news/esma-sees-high-risk-investors-in-non-regulated-crypto-assets>

3.2.1 The European Anti-Money Laundering (AML) regulation

Directive (EU) 2018/843 of the European Parliament and of the Council of May 30, 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU, defines virtual currencies as a digital representation of value that is not issued or guaranteed by a central bank or a public authority, is not necessarily attached to a legally established currency and does not possess a legal status of currency or money, but is accepted by natural or legal persons as a means of exchange and which can be transferred, stored and traded electronically. Based on such definitions, entities that offer the safekeeping of tokens in the form of wallets will (together with providers engaged in the exchange services between virtual and fiat currencies) fall within the scope of the AML regulations. With this new European regulation, the European crypto-asset market must conform to applicable AML regulations like any other financial market participants.¹¹

Generally, the current national legislation in the particular EU country, if there is any, is related to anti-money laundering, e.g., **France** and **Austria**. The national financial supervision commissions usually are responsible for monitoring the market for cryptocurrencies and ICOs to undertake specific measures related to money laundering and abuse stemming from their trade.

There also are countries where no specific laws or regulations regarding crypto-assets have been issued, e.g., Austria, Belgium, Bulgaria, Croatia, Denmark, Finland, Hungary, Ireland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

The exception might be **Italy** with the Art. 8 ter. Decree Law December 4, 2018, n. 135 (in the Official Gazette - General Series - n.290 of December 14, 2018), coordinated with the conversion law February 11, 2019, n. 12. Among other provisions, the Decree defines the concept of “technologies based on distributed ledgers (blockchain)” and “smart contracts”, which might be considered a step toward a regulatory regime specific to the blockchain. Similarly, **Greece**, a signatory to the European Blockchain Partnership, is currently preparing the national legal and regulatory framework for crypto assets and blockchain development. Nevertheless, till now there are no specific references to crypto assets in the country’s regulations. Furthermore, no state-sponsored initiatives for the deployment blockchain powered infrastructures and applications have been identified to date.

¹¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L0843>

France adopted the PACTE Act in 2019, which gives France's Financial Market Authority (AMF) greater oversight over digital tokens. Nevertheless, it is not considered heavy-handed making France a rather friendly jurisdiction for ICOs and Security Token Offerings (STOs)¹².

Germany prospects a precise regulation for crypto-currency business models in the financial sector that should add predictability and reliability for entrepreneurs and investors. Crypto-trading and respective fin-tech companies will be treated as financial services and will thus be subject to the BaFin regulation (Germany's Federal Financial Supervisory Authority) that will improve trust in and acceptance of the blockchain industry significantly. So far, in Germany, companies that operate the crypto custody business must have a permit from BaFin.¹³

In the context of globalized competition, the attractiveness of jurisdiction rests primarily on its ability to offer a regulatory framework that meets entrepreneurs, public authorities, and investors' expectations. Thus, the interview respondents pointed out that the lack of a formal regulatory framework specific to the blockchain is a major impediment for product development. Therefore, there is an urgent need to develop a regulatory framework for blockchain-related products and services across all member states to increase the competitive advantage of DLT businesses; mitigate fraud and market abuse on trading platforms and enable cross-border operations. Thus, the European Commission has set out to address this issue, and in September 2020, the Commission presented a proposal for a Regulation of Markets in Crypto-assets (MiCA) which is a regulatory framework that would help regulate currently out-of-scope crypto-assets and their service providers in the EU and provide a single licensing regime across all member states by 2024.

3.2.2 Regulatory harmonization across the European Union for Initial Coin Offerings and Digital Asset Service Providers¹⁴

MiCA regulation establishes a general principle (art. 4) which express that no issuer of tokens can make an offer to the public in the EU or seeks admission of such tokens to trading on a trading platform (secondary market) unless:

- it is established as a legal entity;
- as drafted a whitepaper and notified it to the National Competent Authority (e.g., AMF in France);
- capital requirement (350,000 euros / 2% of the average amount of assets).

¹²https://uploadssl.webflow.com/601814030e1e39d44b52570b/601814030e1e39645952577e_Blockchain%20in%20Europe%202020%20Review.pdf

¹³ https://www.eublockchainforum.eu/sites/default/files/reports/March-Trends%20Report_1.pdf

¹⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020PC0593>

- monthly information obligation for token holders;
- requirements imposed on all issuers (prudential requirements, operational requirements asset retention obligation, etc.)
- complies with ethical and corporate requirements:
 - (a) act honestly, fairly and professionally;
 - (b) communicate with the holders of crypto-assets in a fair, clear, and not misleading manner;
 - (c) prevent, identify, manage, and disclose any conflicts of interest that may arise;
 - (d) maintain all their systems and security access protocols to appropriate Union standards;
 - (e) act in the best interests of the investors.

3.2.3 European Overview of Ecosystem Maturity and Regulatory Maturity

Based on the regulatory maturity (top-down), and ecosystem maturity (bottom-up) the countries might be organized into the ecosystem and regulatory maturity grid (Figure 2).¹⁵

Three stages have been proposed to measure blockchain regulatory maturity in the EU region (Stage I, Stage II, Stage III). Stage I indicates that no specific crypto asset legislation exists in the country to date, under Stage II fall countries that have shown signs of significant involvement by adopting broader regulatory schemes (explicitly related to crypto-assets or regulation of alternative forms of financing such as ICOs) or government-sponsored studies and pilot applications blockchain in the public sector. Stage III signals that specific legislation for blockchain or crypto assets exists, and the country's government has announced a blockchain-specific national strategy. The existence of innovation hubs, pilot programs, regulatory sandboxes, and the involvement of the banking sector are also typical traits of countries in Stage III.

To measure the ecosystem maturity in the country, three main factors have been analysed: (1) presence of a local business/startup ecosystem; (2) number of blockchain-related formal education and academic research initiatives; (3) number of user-driven communities around blockchain or virtual assets. Thus, the countries have been grouped into three main categories (Stage I, Stage II, Stage III). Stage I covers countries where none or only one of the abovementioned factors is present. Stage II refers to countries with at least two of the three factors. Stage III means that there is evidence of all three factors.

¹⁵ https://www.eublockchainforum.eu/sites/default/files/reports/EU%20Blockchain%20Ecosystem%20Report_final_0.pdf

Ecosystem Maturity

Stage III		Lithuania Netherlands Slovenia	Cyprus Estonia Malta
Stage II	Denmark Ireland Sweden	Austria Italy Portugal Spain	France Germany Luxembourg
Stage I	Belgium Bulgaria Croatia Czech Repulic Greece Hungary Romania Slovakia	Finland Latvia Poland	
	Stage I	Stage II	Stage III Regulatory Maturity

Figure 2 - Ecosystem and Regulatory Maturity for countries. Source: EU BC Forum

3.3 Industry sectors in which blockchain is used.

Blockchain and its distributed ledger technology (DLT) were initially mostly related to digital currencies such as Bitcoin, Ethereum, etc., covered by platforms such as Ionomi (Slovenia); Coinfinity (Austria); or Cashila (Slovenia), which was the first Bitcoin company in Europe. Nowadays, blockchain technology has proliferated across almost all sectors. Nevertheless, Finance & Insurance remains the most blockchain intensive industry, but there has recently been a concentration of investments for development of blockchain projects in sectors such as information and communication; retail; real estate;

food supply chain; energy; or research and education. There is also a growing interest from the pharmaceutical and healthcare sectors. Blockchain, which offers immutability to data, seems like a trustworthy platform to facilitate the needs of the multiple stakeholders in healthcare. Therefore, it is expected to make a big impact in this sector. In Estonia, patients' records are digitized and secured by the Blockchain, providing a single immutable data source for healthcare professionals. With a unique digital platform and collaborative ecosystem, Estonia is positioned to lead on preventative medicine, patient self-treatment and industry efficiency. Blockchain usage in the healthcare sector might be accelerated due to the COVID-19 pandemic. Indeed, a representative use case is encountered in Germany with a tender for the German Digital Health Passport, which is supposed to complete numerous tasks as applications for vaccination certificate and tests.¹⁶

Although the DLT, which is the main feature of blockchain technology, already has a wide variety of applications in the European market: e-signature; cybersecurity; digital rights; asset management services; certification of documents; tokenization of assets; digital identity, etc., except of Estonia, it seems that the usage of blockchain in public services so far has not been significant among partner countries. Patient records in healthcare, electronic identification, VAT processing seem to be areas that are naturally suited to benefit from blockchain's technological capabilities. Considering this, we can conclude that these services could see significant and impactful changes over the next few years. With this in mind, it might be helpful to consider if potential usage of blockchain in these areas could somehow be incorporated into the educational programs.

The main actors promoting blockchain development in the EU region are the following:

- SMEs (Blockchain startups companies);
- Large companies involved in blockchain projects (Orange, France; IBM Software Channel Slovenia; SAP, Austria; Elia Group, Germany; Yuso, Belgium; etc.);
- Universities and research institutions (Polytechnique; Dauphine; ESGI; ESME SUDRIA; EMLV; universit   c  te d'azur; Paris II; Paris XIII; Luxembourg Institute of Science and Technology; IBNO – Italian Blockchain National Observatory, Blockchain Observatory University of Milan; etc.);
- Ministries and other national authorities (French Financial Market Authority, Italian Ministry of Economic Development; etc.)

¹⁶ https://www.eublockchainforum.eu/sites/default/files/reports/March-Trends%20Report_1.pdf

- Blockchain clusters, think tanks, industry networks and associations promoting blockchain (Alastria, Spain; Italia4Blockchain, Italy; Blockchain Think Tank Slovenia; The Balkan Blockchain Association – BBA, Bulgaria; Hellenic BC HUB, Greece; etc.);
- Non-profit organizations and blockchain federations (Infrachain, Luxembourg; Berchain, Germany; Banking & Payments Federation – BPF, Ireland; The Balkan Blockchain Association – BBA, Bulgaria, etc.);
- Events on blockchain (DG Connect; Paris Blockchain Summit; Romania Blockchain Summit).

There is no specific category of economic activities defined, particularly for blockchain. Yet, according to NACE classification, the most relevant groups of economic activities where blockchain could be embedded, according to our desk research, are the following: *computer programming activities (4-digit) (62.01)*; *computer consultancy activities (62.02)*; *other information technology and computer service activities (62.09)*; but also, *financial services (K64)*.

3.4 Blockchain market size

3.4.1 Startups

The EU is home to numerous high growth blockchain startups¹⁷. The amount of funding generated by startups seems to again vary significantly by country. Developing a regulatory framework and defining a clear blockchain national strategy seems strongly correlated with blockchain projects' success. Therefore, countries such as **Luxembourg and Estonia** are positioned among the leaders. The Luxembourg Blockchain Map compiled by the Luxembourg Blockchain Lab and ALFI provides an overview of the dynamic Luxembourg blockchain ecosystem, counting with 57 startups¹⁸. According to the Startup Estonia database¹⁹, there are 102 blockchain startups. Slovenia estimates from 50 to 100 blockchain-related startups created between 2017 and 2021. A cluster of startups, think tanks, and networks in a specific location seem to accelerate this process and create a snowball effect. Thus, countries that might be considered significantly vibrant are **the Netherlands, Italy, France, and Germany**.

In the **Netherlands**, there are currently 150 registered startups.²⁰ The country has a very strong blockchain community, and a number of companies accept digital assets as a form of payment. Nevertheless, in this analysis some differences occur in the formula, which identifies the “startup”. It is

¹⁷ <https://www.dgen.org/blockchain-in-europe-2020-review>

¹⁸ Data provided by Intrasoft (Luxembourg) during desk research.

¹⁹ <https://startupestonia.ee/startup-database>

²⁰ https://www.eublockchainforum.eu/sites/default/files/reports/EU%20Blockchain%20Ecosystem%20Report_final_0.pdf?fbclid=IwAR24FkNF_Y8VG3WVHVkMGhd_BC5sXAZEfmzzXfZSFr29vWKyBSX90RGiw

due to different methodologies based on which companies are registered in particular countries. The **Italian** Chambers of Commerce's Registry of SMEs, *Registro Imprese*, records 365 registered Companies whose activity falls under "blockchain" technologies or Services²¹. Nevertheless, the Repository of Innovative SMEs and Start-ups, a service offered by the Italian Chambers of Commerce, *InfoCamere* and The Ministry of Economic Development, records even more, 695 companies of which 76 are innovative SMEs and 619 are start-ups whose sector of activity is "blockchain". Thus, we can see that the definition differences also occur within the same country. In **France**, there is a healthy startup scene but also an influx of serious actors entering the ecosystem, which results in relatively high corporate adoption. In **Germany**, there are 180 startups focusing on blockchain. Berlin is a particularly vibrant place on the European blockchain scene with more than 120 companies, including startups, major corporations, innovation hubs, research institutions, etc. addressing blockchain technologies²². Germany is considered an attractive HUB for blockchain startups, but there is little enterprise involvement. The blockchain ecosystem is also considerably vibrant in **Spain, Slovenia, and Austria**. In Spain, there currently are 150 companies dedicated to the blockchain industry. Austrian startups blockchain ecosystem currently counts with around 80 companies. **Bulgaria and Belgium** demonstrate rather moderate presence of blockchain startups. In Belgium, there currently are 27 startups, most of them operating in the information and communication sector. Similarly, Bulgaria counts with around 40 companies operating mostly in information and communication, financial and insurance activities, and education. However, startup activity in countries like Greece, Hungary, Poland, Romania, and Slovakia is rather small, but there are initiatives such as Hellenic BC HUB in Greece which are trying to raise awareness and promote blockchain in the country.

The above-mentioned startups mostly operate in information technology and communication; finance and insurance; supply chain; research and education; healthcare; retail; energy; infrastructure, digital rights and cryptocurrency; and sectors such as luxury goods.

3.4.2 Funding sources

According to the French Blockchain Federation's latest report, published in October 2020 (Figure 3), blockchain actors in France use various funding methods to finance their development, such as private equity that is very much preferred by blockchain companies in France (61%), followed by token-based fundraising campaign (19.5%), public grant (12.2%) and bank loans (7.3%).

²¹ <http://startup.registroimprese.it/isin/home>.

²² <https://berchain.com/2021/02/berlin-blockchain-landscape/>

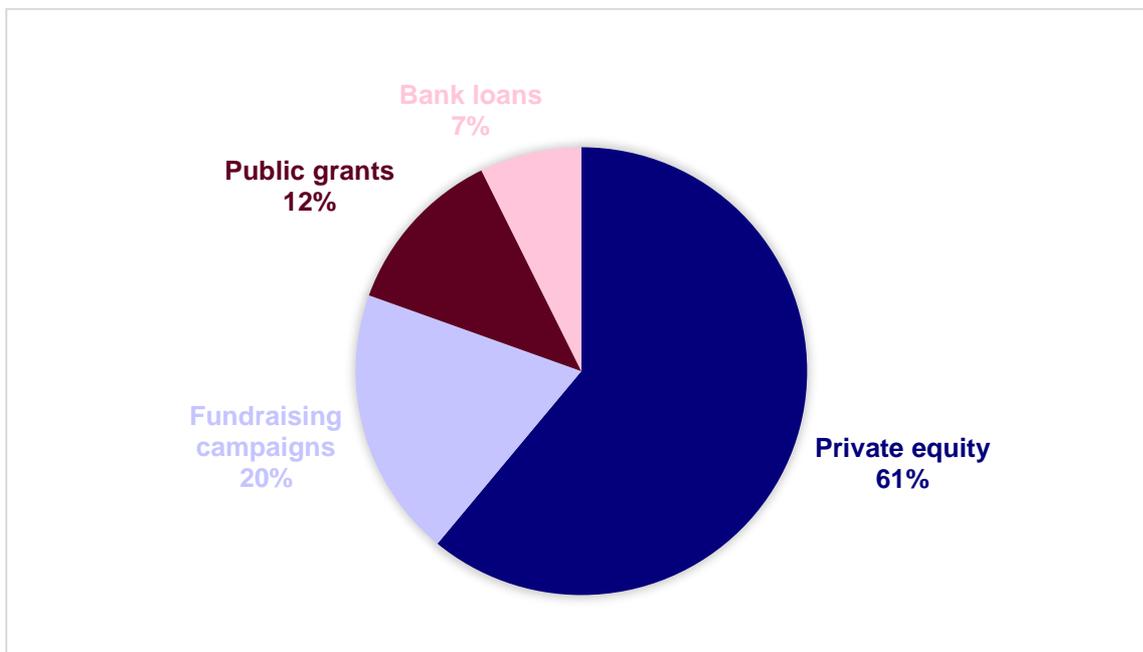


Figure 3 – Funding sources in France. Source: French Blockchain Federation Report (2020)

Venture capital or Business Angels have participated in financing more than half of the projects in Italy. Some companies used regular bank loans, while a few others received public funds and/or grants, often European funds awarded through regional programs. Thus, the most common sources of funding for Blockchain Development projects seem to be:

- private equity;
- angel investors and venture capital;
- national or European grants;
- bank loans;
- Token fundraising campaigns.

3.4.3 Market sizes

The total amount of funding raised by blockchain companies is one of the most relevant indicators portraying a sector's maturity. Across the board, there appear to be strong expectations for continued growth over the next few years. Indeed, based on the data collected from the EU partner countries, it can be concluded that the sector is thriving.

Following Cointelegraph²³ and the EU Blockchain Observatory (Table 2), **Estonia** is among the leaders in fundraising in the Blockchain sector. Similarly, **Lithuania** has raised €422 million in blockchain startups. Significant amount, €337 million has been raised in **the Netherlands**. **Germany** reports €227 million of total funding raised by blockchain companies.²⁴ In **France**, more than €181,5 million have been collected.²⁵ Table 2 provides more detailed statistics related to funds raised in blockchain startups in the EU (and Switzerland, UK) and Figure 4 shows the map of the EU member states highlighting the countries with the highest amount of funds raised. In spite of the substantial amount poured into the blockchain projects in the EU over the last few years, investments in the USA reached 4.5 billion in 2019. Hence, if the EU pursues leadership in this field, there is an urgent need for initiatives to boost the blockchain investments in this region.

The World Economic Forum expects that by 2025, around 10% of the world's Gross Domestic Product (GDP) will originate from blockchain-based systems. In France, almost a quarter of companies operating in the blockchain sector indicated that they achieved more than €500,000 in turnover in 2019 (23.6%) and 53.9% of the companies exceeded €100,000 in turnover in the same year. Regarding the total numbers, Estonia reports €32 million annual turnovers of blockchain startup companies in 2020; Bulgaria estimates up to €80 million and Spain accounts for €103,5 million annual turnover from blockchain-related companies.

²³<https://cointelegraph.com/news/from-2-9-billion-in-a-month-to-hundreds-dead-trends-of-the-rollercoaster-ico-market-in-18-months>

²⁴https://www.eublockchainforum.eu/sites/default/files/reports/EU%20Blockchain%20Ecosystem%20Report_final_0.pdf?fbclid=IwAR24FkNF_Y8VG3WVHVkMGhd_BC5sXAZEfmzzXfZSFr29vWKyBSX90RGiw

²⁵ https://www.eublockchainforum.eu/sites/default/files/reports/EU%20Blockchain%20Ecosystem%20Report_final_0.pdf

Country	Blockchain startups	Total Funds Raised (€)	Population	Funds Per Capita (€)	Funds Per Startup €
Austria	40	47,000,000	8,859,000	5.31	1,175,000.00
Belgium	23	9,500,000	11,460,000	0.83	413,043.48
Bulgaria	24	620,000	7,000,000	0.09	25,833.33
Croatia	7	50,000	4,058,000	0.01	7,142.86
Cyprus	27	142,000,000	875,900	162.12	5,259,259.26
Czech Republic	38	1,450,000	10,690,000	0.14	38,157.89
Denmark	24	32,300,000	5,806,000	5.56	1,345,833.33
Estonia	143	257,000,000	1,329,000	193.38	1,797,202.80
Finland	17	4,600,000	5,518,000	0.83	270,588.24
France	170	181,500,000	66,990,000	2.71	1,067,647.06
Germany	180	227,500,000	83,000,000	2.74	1,263,888.89
Greece	9	147,000	10,720,000	0.01	16,333.33
Hungary	14	4,000,000	9,773,000	0.41	285,714.29
Ireland	50	45,000,000	4,904,000	9.18	900,000.00
Italy	67	25,600,000	60,360,000	0.42	382,089.55
Latvia	8	2,000,000	1,920,000	1.04	250,000.00
Lithuania	31	422,000,000	2,794,000	151.04	13,612,903.23
Luxembourg	49	13,000,000	613,894.00	21.18	265,306.12
Malta	60	51,000,000	514,564.00	99.11	850,000.00
Netherlands	150	337,000,000	17,280,000	19.50	2,246,666.67
Poland	54	20,000,000	37,970,000	0.53	370,370.37
Portugal	16	40,000,000	10,280,000	3.89	2,500,000.00
Romania	20	20,000,000	19,410,000	1.03	1,000,000.00
Slovakia	8	13,700,000	5,458,000	2.51	1,712,500.00
Slovenia	25	67,700,000	2,081,000	32.53	2,708,000.00
Spain	150	23,000,000	46,940,000	0.49	153,333.33
Sweden	20	47,330,000	10,230,000	4.63	2,366,500.00
Switzerland	800	3,500,000,000	8,570,000	408.40	4,375,000.00
United Kingdom	700	1,970,000,000	66,650,000	29.56	2,814,285.71

*All data on funding figures sourced from Crunchbase pro from the period of August 2020 to September 2020. Keywords used: Blockchain, Virtual Currency, Virtual Currencies, Digital assets, Digital assets, Bitcoin, Ethereum.

Table 2 - Startups and Fund Raised in Europe

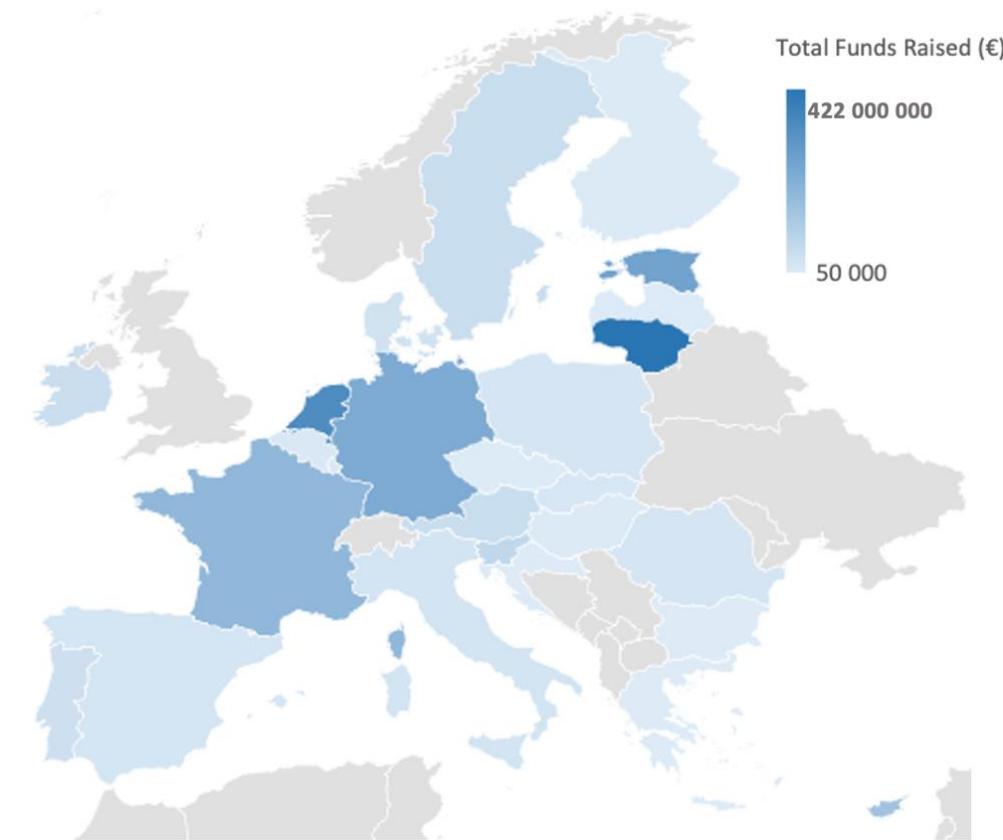


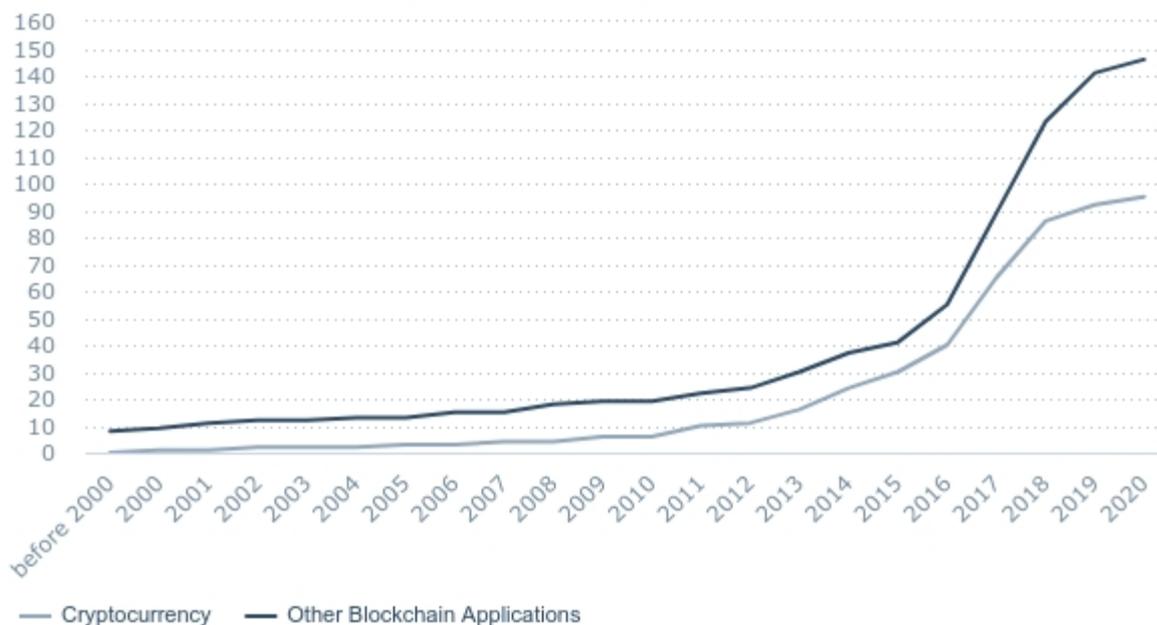
Figure 4 – Total Funds Raised. Source: INATBA, based on EU BC Forum

3.5 Characteristics of Blockchain Companies

According to Crunchbase database, Germany is one of the leading countries in the number of companies operating in the blockchain ecosystem. Most of the blockchain companies in Germany are startups operating in financial services (as there is an overlap with cryptocurrencies which are digital currencies such as Bitcoin, Ethereum, and others that allow financial transactions between participants). Still, there is an increased number of companies developing other blockchain-based services (Figure 5).

The German Blockchain Companies

Number of companies, founded in the current year or before



Source: own calculations based on Crunchbase data

Figure 5 – The German Blockchain Companies Source: iwkoeln.de²⁶

Most blockchain companies (75%) explicitly focus on this technology in their business model. The rest are mostly information technology and software companies offering blockchain-related services, among other IT services.

Figure 6 depicts the blockchain landscape in Austria (2021), which has changed substantially over the last three years. Whereas in 2017 ICOs and startups dominated the scene, nowadays the focus shifts toward early corporate adopters, who are working on blockchain use cases, proofs-of-concepts, and prototypes. The dominating categories are finance and consulting, with an increased interest in research. Within the finance category, the most dominant industries are decentralized finance applications. An uptake in virtual asset providers can be observed and an increased number of startups in arts, mobility, and energy.

²⁶ <https://www.iwkoeln.de/studien/iw-kurzberichte/beitrag/markus-demary-vera-demary-german-blockchain-companies-496530.html>

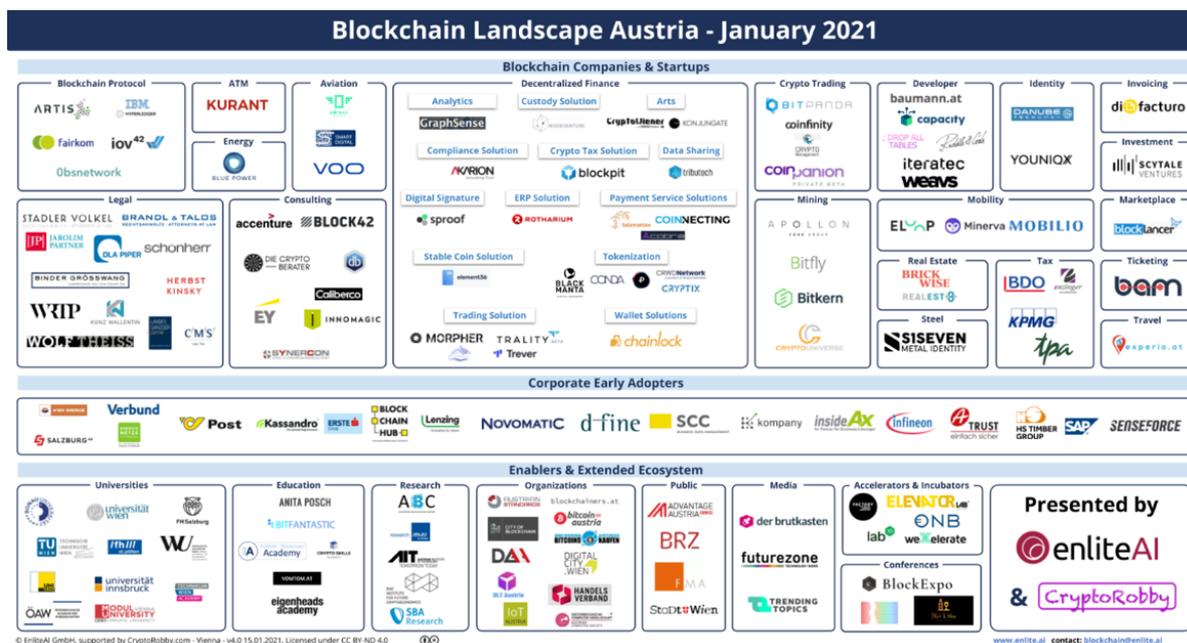


Figure 6 – Blockchain Landscape in Austria Source: Enlite.ai²⁷

Although there is an increasing trend of other blockchain-based applications, ICOs are still a global phenomenon. However, some countries and markets have taken to them far better than others; within the EU, it is Estonia who leads the way²⁸.

Similarly, most blockchain focused companies in Bulgaria are in the Finance sector (29%) and Software development (25%). Blockchain companies in the country generally have under 50 employees. Some notable examples include Aeternity ventures, Industria, ReCheck, and LimeChain.

Luxembourg’s blockchain ecosystem is also dominated by startup companies operating mainly in information and communication, financial and insurance activities, but also arts, entertainment and recreation and other services.

A recently published study by B-Hub for Europe, mapping the Blockchain Startup Ecosystem in Italy, reports as “main sectors” of blockchain application in Italy: Finance (fintech and cryptocurrency), Agri-food, Art, Luxury and Fashion, Cybersecurity and Digital Identity and digital marketing.²⁹

²⁷ <https://www.enlite.ai/insights/blockchain-landscape-austria>

²⁸ <https://cointelegraph.com/news/from-2-9-billion-in-a-month-to-hundreds-dead-trends-of-the-rollercoaster-ico-market-in-18-months>

²⁹ https://b-hub.eu/wp-content/uploads/2021/01/B-Hub_Blockchain-Report_December2020.pdf.

To sum up, general characteristics of blockchain companies observed across the EU region are:

- Startups dominating the scene, but there is an increased number of early corporate adopters.
- Age: young companies, less or equal to 5 years.
- Size: small (majority has less than ten employees).
- Most of the companies operate in financial services (due to cryptocurrencies).
- Trend: Increasing number of companies developing other BC-based services: gaming industry, visual intelligence solutions, supply chain, decentralized could provide storage, healthcare, secure data encryption, digital advertising, consulting.³⁰
- Located in big cities.

3.6 The Blockchain market: A country level analysis

3.6.1 Blockchain market specificities

One of the main strengths of Europe is that it has a high potential to collaborate due to the greater sharing between countries, which makes it an important player in the global market.

Each country has unique strengths which can push forward the innovation even more. Analysing the culture that drives much contemporary blockchain development in the region, we might observe that planning a national strategy and embedding it is clear but not restricting legislation help create a productive environment for new blockchain initiatives. Still, most of the countries do not have a crypto-specific legal framework in place today, save warnings issued by national authorities in some cases.

In **Belgium**, there is a vibrant crypto-assets community with a strong focus on Fintech startups. It is an attractive location for international companies due to its proximity to EU headquarters. The country has received a large number of EU-funding for blockchain research and innovation activities.

In **Cyprus** there is an ongoing effort to develop legislation related to crypto-assets. In 2019, the country developed a national strategy to promote blockchain initiatives. Besides, Cyprus is the first country to launch an academic course and full degree on the subject offered by the University of Nicosia since 2014. The country among the EU's top member states in funds raised per capita.

Estonia was one of the first countries in Europe to adopt a legal framework for ICO and crypto-assets regulation. As a result, the country has attracted many investments, which placed it in the top spot in funding per capita in the EU. Besides, the government is open to digital innovation, with 99% of

³⁰ <https://www.crunchbase.com/discover/organization.companies/9941d1aa1a19da1827083f85568e3d19>

government services online, with a strong reliance on the blockchain. Thus, Estonia is one of the few countries where blockchain is embedded in the public sector.

France introduced the legal framework on digital tokens. As a result, they are currently attracting important corporate players. The country counts with a relatively solid base of blockchain companies, with one of the world's most successful hardware wallet providers (Ledger) headquartered in Paris.

Germany is one of the leading European countries regarding the number of startups, but there is little enterprise involvement. However, there is a steady influx of new talent into Berlin. The German government has adopted a national blockchain strategy in 2019. The country currently works on legislation that would provide more guidance and fewer uncertainties for the companies willing to operate in this sector. Besides, universities are engaging in research, specialized degrees and professional training programs related to blockchain.

Ireland has a relatively mature blockchain company ecosystem. Regarding the regulation, the country has opted for a flexible and permissive regulatory approach.

Lithuania, with its blockchain-friendly regulatory approach and local engineering talent, became an epicentre of ICO activity in Europe during 2017-18. The country counts with the Blockchain Center Vilnius, acting as an incubator of local startups and the Bank of Lithuania, supporting crypto-asset innovation. The country is currently in the top tier of European Union member states in funding raised by blockchain startups.

Due to their favourable legislation, **Luxembourg** and **Malta** are attractive bases for digital currencies, but also other blockchain projects, and are considered safe-havens. Malta is a pioneer in regulations and cryptocurrency tax. It has been referred to as a "Blockchain island" and due to its low taxes, it is situated as a favourable place to register a company. Nevertheless, there is rather low startup activity and entities are only registered, but not physically present there.

The Dutch government has backed innovation, supported pilot projects, and provided free blockchain courses, which led to a significant resident interest and unique blockchain ecosystem in the Netherlands. The country has a compelling blockchain community, and companies are allowed to apply a principle-based rather than a rules-based approach when dealing with emerging technologies. Recently, the ecosystem is healthy but not necessarily growing, which is a sign of market maturity as there is a focus on bringing projects to fruition.

In Portugal, there is an increasing base of blockchain enthusiasts and a small but dynamic startup scene formed with growing capital in the market.

Slovenia has a vibrant ecosystem and startup scene, combining government support and active business development. It was the first EU member state to launch a national test blockchain infrastructure called SI-Chain, in 2019.

Spain deserves our attention as a leader in the blockchain education space in Europe, with eight universities offering degrees on this subject. There is also a notable initiative, Alastria, a consortium of banking, energy and telecom companies and currently counts with more than 500 industry members ³¹.

Sweden has a developed and vibrant blockchain ecosystem. Its central bank, Riksbank, was one of the first banks globally to research on a Central Bank Digital Currency (CBDC), called the e-krona. The country also hosts notable pilot projects related to a blockchain-based land registry and invests in a number of applications in the financial sector.

Other EU Blockchain highlights

- **Austria** has strong state-sponsored innovation and research activities, such as the Austrian Blockchain Center, which helps to spread innovation through a PPP (public-private partnership model).
- **Bulgaria** has been an epicentre of activity in the 2017-18 Initial Coin Offerings (ICOs) boom.
- **Croatia's** financial supervisor has recently (May 2020) approved a bitcoin investment fund.
- The **Czech Republic** counts with a vibrant crypto-asset community and is one of the largest concentrations of public venues accepting digital currencies as forms of payment.
- **Denmark** is one of the few countries globally where the government has engaged in comprehensive research on the potential economic impact of blockchain on industry and the labour market.
- **Finland** has a number of pilot initiatives in e-government, and the private sector has produced one of the world's first digital currency exchanges, operating since 2012.
- **Italy** was the first in the world to recognize the legal validity and enforceability of smart contracts in 2019.
- **Latvia** has an active community of enthusiasts and a blockchain-friendly business and regulatory climate.

³¹https://www.eublockchainforum.eu/sites/default/files/reports/EU%20Blockchain%20Ecosystem%20Report_final_0.pdf?fbclid=IwAR24FkNF_Y8VG3WVHVkMGhd_BC5sXAZEfmzzXfZSFr29vWKyBSX90RGiw

In Greece, Hungary, Poland, Romania, and Slovakia, the blockchain scene is rather at earlier stages of development but with a growing user community and capital funding.

3.6.2 National Projects

Table 3 provides a list of national projects, cluster, think tanks, networks, and associations related to the blockchain identified in the desk research.

Country	Blockchain initiative
<p style="text-align: center;">Austria</p> 	<p><u>International Blockchain Cluster IBCC</u></p> <p>A network supporting use of Blockchain, Austria-based. In collaboration with various government organizations and experts from the "New digital Economy"; Business developers; Developers; Startups; Lawyers and tax consultants with expertise in blockchain technology form the IBCC as a think tank. In doing so, they rely on a clear, jointly developed definition of the various core elements of this new technology. This jointly created language forms the basis for considering and evaluating new business models and for clarifying open questions. In this forum, a guiding principle is jointly defined in several workshops, which helps orient everyone involved and forms the basis for digital development in Austria and the EU.</p> <p><u>Bitcoin Austria</u></p> <p>Bitcoin Austria promotes and supports the spread of the digital currency Bitcoin (BTC) in Austria. The association "Bitcoin Austria" supports the use and distribution of Bitcoin in Austria. The network of experts offers a contact point for technical, legal, and organizational questions for business and the media. Bitcoin Austria regularly organizes information events on the subject of "Bitcoin", supports innovative project ideas and promotes the networking of Bitcoin interested parties throughout Austria.</p> <p><u>Blockchainers.at</u></p> <p>Online-community that embraces blockchain-technologies, loves to learn about technical aspects of blockchains, provides the opportunity to discuss ideas.</p>

[DLT Austria - Association for the promotion of Distributed-Ledger-Technologies in Austria](#)

DLT Austria plays a key role in making Austria a showcase nation in the field of blockchain technology. They create awareness for the benefits, the opportunities but also for the consequences of blockchain technology (transformation process). They are contacts for blockchain initiatives. They are a knowledge, exchange, and communication platform. They provide the point of contact for questions, problems, or ideas in the DLT area.

[Handelsverband](#)

Austrian Retail Association, provides academy and publication services.

[Smart Blockchain](#)

The Smart Blockchain Initiative in Austria promotes the spread, use and acceptance of Bitcoin (BTC) as a means of payment and a store of value.

[City of Blockchain](#)

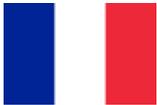
The City of Blockchain® supports the City of Vienna's efforts to achieve the goals defined in the Smart City Wien Framework Strategy. This is to be succeeded through blockchain and related technologies such as artificial intelligence, cyber security and IoT technologies. Projects, products, and services that can change the world are already being created; their mission is to help make them a reality. The City of Blockchain® was established to help connect smart sustainable cities with the disruptive, decentralization power of blockchain and related technologies.

[DigitalCity Wien](#)

DigitalCity Wien is an independent and non-profit initiative of the City of Vienna and the Viennese ICT industry. Together they are pursuing the goal of making Vienna the digital capital in Europe. They are strengthening Vienna's ICT location and making Vienna's digital competence visible. As a flagship project of Vienna's digital agenda, they ensure that people are at the center of the digital transformation of our

	<p>city. Our activities contribute to realizing the goals of the Smart City framework strategy.</p> <p><u>Austrian Standards</u></p> <p>Austrian Standards is the Austrian organization for standardization and innovation. We are independent and neutral. We stand for high service quality and diversity. Together with European and international standardization partners (e.g., ISO, CEN and ETSI), Austrian Standards networks topic-related actors from business, research, administration, and NGOs.</p> <p><u>Österreichische Computer Gesellschaft (OCG)</u></p> <p>The OCG promotes and certifies IT competence.</p> <p><u>The Austrian Blockchain Center</u></p> <p>It is an interdisciplinary research institute focused on Blockchain and related technologies based in Vienna.</p>
<p>Belgium</p> 	<p><u>INFOPOLE Cluster TIC</u></p> <p>Business cluster that brings together and unites professionals from Information and Communication Technologies (ICT) in order to promote business and innovation through partnership.</p> <p><u>DSP Valley</u></p> <p>Brings together the triple helix parties: companies, research institutes, the regional authorities together with other relevant stakeholders (investors, service providers, users, etc.) that play an important role in the entire value chain of smart solutions enabled by digital technologies.</p> <p><u>Software.Brussels</u></p> <p>A network of 150 SMEs & partners active in the software/ICT industry in Brussels-Capital Region.</p> <p><u>Blockchain Association of Belgium</u></p>

	<p>Helps European Governments and private corporations to join the rise of blockchain with a focus on creating jobs and making Brussels the European capital of Blockchain R&D.</p> <p>Bruegel</p> <p>European think tank that specialises in economics (with a section on digital policy).</p>
<p>Bulgaria</p> 	<p>Dev</p> <p>Is a community that is focused on networking and knowledge sharing for the IT industry in general, but has a subgroup dedicated to blockchain as well.</p> <p>Fintechbulgaria</p> <p>The Bulgarian Fintech Association is an organization with no commercial purposes, bringing together all parties in Bulgaria with an interest in Financial Technologies. The organization aims at representing and safeguarding the shared values of its members before regulators, investors, financial institutions, foreign associations, partners, and any other party. They are not entirely blockchain focused, but as part of the Fintech sector they have some initiatives that partly touch on Blockchain such as educational programs.</p> <p>Balkanblockchain</p> <p>The Balkan Blockchain Association (BBA) is a not-for-profit organisation that brings together key individuals and business from the Bulgarian and international blockchain scene. BBA aims to assist the blockchain and distributed ledger technology (DLT) ecosystem development throughout the Balkans region by empowering communication and networking, advocating for adoption of a proper regulatory framework, strengthening the networking of good practices in the industry and promoting education</p> <p>The Balkan Blockchain Association has several practice areas: - Regulatory and Policy making Initiative, Public sector Initiative, Networking Initiative, Educational and Event Management Initiative, Market analysis.</p>

<p style="text-align: center;">Estonia</p> 	<p><u>Blockchain Technology Group TalTech</u></p> <p>The TalTech blockchain technology group focuses on fundamental research about blockchain technologies and related topics such as smart contracts, consensus algorithms, distributed applications for large and very large-scale systems.</p> <p><u>IEEE Estonia Blockchain Group</u></p> <p>The initiative will collaborate with local IEEE Blockchain technical communities worldwide, promote outreach activities to the public, and connect with other organizations that are actively working in the blockchain space.</p> <p><u>Blockchain Tallinn</u></p> <p>This group is for both the old and the new cryptocurrency fans, and any entrepreneurs, developers, dreamers, newbies, fintech professionals, cryptoanarchists, and everyone else that is excited about crypto-issues.</p>
<p style="text-align: center;">France</p> 	<p><u>Blockchain Task Force</u></p> <p>Blockchain task force was created around French experts from associations in the private sector, the world of research and administrations, in order to ensure the follow-up of the Government's strategy in terms of blockchain, to allow sharing experiences on blockchain projects led by public or private actors and to support the structuring of the ecosystem.</p> <p><u>France experimentation</u></p> <p>France experimentation desk, which allows innovative players to request exemptions from legislative or regulatory standards that block the development of their projects.</p> <p><u>Fédération Française des Professionnels de la Blockchain (FFPB)</u></p> <p>Largest federation which represents French blockchain companies.</p> <p><u>Fédération National des Tiers de Confiance (FNTC)</u></p>

	<p>Federation which represents banking actors (banks, asset manager, insurers, etc...).</p> <p><u>Fédération Bancaire Française (FBF)</u></p> <p>Federation which represents banking actors (banks, asset manager, insurers, etc...)</p> <p><u>Pôle Paris Europlace</u></p> <p>Think tank.</p> <p><u>Hub institute</u></p> <p>Think tank.</p>
<p>Germany</p> 	<p><u>Block.IS virtual Cluster Mission Berlin</u></p> <p>Network of clusters working to innovate blockchain.</p> <p><u>Berlin Partner for Economy and Technology</u></p> <p>Innovation entity public/private partnership With the Senate Department for Economy.</p> <p><u>INNOBB</u></p> <p>Innovation cluster network of Berlin region.</p> <p><u>ETHBerlin</u></p> <p>Grass-root association network of developers, blockchain Ethereum professionals in Berlin.</p> <p><u>Blockchain Bundesverband e.V</u></p> <p>Founded in 2017, quickly grew to more than sixty members, among them the leading startups in the blockchain sector with a base in Germany. The association's initiatives focus on education both for decision makers in politics and industry-leading corporations, as well as the broader public with the aim to keep Germany competitive in an increasingly digital world.</p>
<p>Greece</p>	<p><u>Hellenic Blockchain Hub</u></p>

	<p>Hellenic Blockchain Hub is a non-profit network of executives from the public and private sector aimed at the dissemination of knowledge on the blockchain – DLT technology.</p> <p><u>Neuropublic</u></p> <p>The specific project aims at the design, development, and implementation of the traceability system for the table olive supply chain making use of the blockchain technology.</p>
<p>Italy</p> 	<p><u>Italia4Blockchain</u></p> <p>The Association of Companies, consultants, professionals, students, professional firms, startups, Public Administration, No Profits, universities, teachers, university researchers, business networks and citizens active in development, training, promotion, dissemination is established , study and research on Blockchain technology in Italy</p> <p><u>BEN Blockchain Education Network</u></p> <p>Blockchain Education Network Italia promotes the study and use of Blockchain technology through conference, courses and projects. It focuses on the university environment both students and lecturers, and collaborates with public administration.</p> <p><u>ASSINTEL Working Group on Frontier Technologies “Tecnologie di Frontiera: Blockchain, Artificial Intelligence & IoT”</u></p> <p>It focuses on three area Artificial Intelligence, Blockchain, and Internet of Things (IoT) in business environment, public administration and society.</p> <p><u>ABIE</u></p> <p>ABIE is the Italian Association that supports the integration of blockchain and distributed ledger technologies in industries, administrations, and organizations.</p>
<p>Ireland</p>	<p><u>Blockchain Ireland (BI)</u></p>

	<p>Blockchain Ireland is an expert group of industry leaders focused on the promotion of blockchain technology in Ireland. Blockchain Ireland was established in 2015 with the support of IDA Ireland, Enterprise Ireland, and the Department of Finance to establish Ireland as a global blockchain and crypto hub and to create blockchain and crypto-based jobs.</p> <p><u>the Fintech Foresight Group (FFG)</u></p> <p>Chaired by the Banking and Payments Federation Ireland (BPF), the Fintech Foresight Group is a special cross-sector working group tasked with driving the development of FinTech and informing policy under the Irish government's financial services strategy. It brings together representatives from domestic and international banks, global technology companies, indigenous FinTech firms, third-level institutions, public sector representatives and international experts.</p> <p><u>BlockW</u></p> <p>BlockW aims to facilitate and drive conversation on the possibilities of blockchain technology for women in Ireland. By providing a platform for communication, education, and the discussion of ideas, the group focuses on building awareness around blockchain career opportunities across all industries and sectors.</p>
<p>Luxembourg</p> 	<p><u>INFRACHAIN</u></p> <p>Is a Luxembourgish non-profit organization supported by the Luxembourg government and created by the emerging Blockchain-industry. INFRACHAIN is a Blockchain community, non-profit organization, committed to create an on-top governance framework allowing Blockchain applications to become operational in the current regulatory environment.</p> <p><u>LHoFT</u></p> <p>Is a public-private partnership. The organization is supported by the Government of Luxembourg, by Luxembourg For Finance who assist to promote FinTech around the world and the Chamber of Commerce of</p>

	<p>Luxembourg. LHOft has a task force dedicated to the blockchain with seven members and one of the key challenges is also to issue a recommendation to the Board of the LHOFT. One of the members of the Board is the Ministry of Finance.</p> <p><u>LëtZBlock</u></p> <p>Is a non-profit association created to promote the thriving Luxembourg Blockchain ecosystem. Giving a voice to blockchain in Luxembourg, we connect, educate, inform, and inspire through events, working groups, advocacy and more.</p> <p><u>Luxembourg Blockchain Lab</u></p> <p>Is a common initiative between Infrachain, The LHOFT, LIST, SnT and Letzblock to create and nurture the Blockchain ecosystem in Luxembourg.</p>
<p>Slovenia</p> 	<p><u>Blockchain Think Tank Slovenia</u></p> <p>Blockchain Think Tank Slovenia is a non-profit association open to all stakeholders interested in blockchain technology. Think Tank acts as a single point for collecting ideas and proposals, while having access to relevant representatives in state governments, regulators, and other public sector institutions, to whom it openly communicates ideas and proposals from the economy, entrepreneurs, academics, and individuals.</p> <p><u>The working group for the field of blockchain technology</u></p> <p>The working group for the field of blockchain technology brings together Slovenian organizations working in this field, namely: Blockchain Think Tank of Slovenia, Blockchain Alliance of Slovenia, Blockchain Association and Bitcoin Association of Slovenia. The group also includes a representative of the working group for the field of chain of data blocks within the Ministry of Economic Development and Technology.</p> <p><u>Blockchain Alliance Europe (member)</u></p> <p>The Blockchain Alliance Europe was established with the purpose of mutual assistance in the field of business development, networking,</p>

cooperation, and a joint approach to defending the interests of the members of the alliance. It also seeks to raise awareness of the importance of the blockchain technology among the professional and lay public, and, therefore, organizes various events and training courses. It also cooperates with the government authorities in the field of the relevant legislation.

[Bitcoin Association Slovenia](#)

The Bitcoin Society of Slovenia was founded with the aim of connecting the Slovenian bitcoin community, organizing events, and answering current questions, and above all presenting bitcoin technology to the public.

[AmCham Slovenija](#)

Given the exceptional opportunities offered by the most important innovations in the field of Internet technologies, crypto industry, the presence of knowledge in Slovenia, which is already related to the topic, given the great interest, AmCham Slovenia established a Blockchain working group in June 2017.

[Noordung Blockchain Hub](#)

Aims to create a network of businesses and individuals from different branches, where they can participate in the development and optimisation of their work and business, the development of project ideas and projects, and to access knowledge and information. No resent activities.

[Slovenian blockchain community](#)

Apart from the organised blockchain associations and hubs, the Slovenian blockchain community consists of 22, 000 observers based on the extended outreach data from Facebook Audiences, which corresponds to approximately 1.1 % of the population. Out of those, 723 members are engaged with communities of practice related to blockchain technology and are involved in 6 frequent meetup groups.

<p>Spain</p> 	<p><u>Alastria</u> Blockchain Network. Alastria is a non-profit organization that encourages digital economy through the development of Blockchain-based decentralized registry technologies.</p>
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Table 3 – National projects. Source: Desk Research

4 BLOCKCHAIN LABOUR MARKET

4.1 Blockchain labour market characteristics

A labour market is a place where employers and workers interact with each other; employers compete to hire the best, and workers compete for the best satisfying job. A labour market in an economy functions with demand and supply of labour where both are influenced by changes in the bargaining power.

Labour market statistics measure the involvement of individuals, households, and businesses in the labour market. They cover short-term and structural aspects of the labour market, both for the supply and the demand side, in monetary and non-monetary terms. In this report, we focus on a blockchain labour market which is a relatively new phenomenon.

While there might be some generic data sources related to ICT occupations, there usually are none explicitly related to blockchain profiles. There are a few countries where an official data source on employers and employees with a focus on blockchain technology was found. In **Estonia**, we can find databases such as *startup estonia*³² or *stat estonia*³³.

Although there is a lack of official data with a strong focus on blockchain occupations, some insights might be obtained from professional social network sites such as LinkedIn. According to LinkedIn, **Luxembourg** reports that **there** are 935 professionals involved with blockchain technology nationally. In **Belgium**, they estimate about 3,200 blockchain professionals operating in their national labour market.

4.2 Blockchain occupations

As the number of professionals operating in the blockchain industry is not particularly high for the moment, when recruiting for a new position, companies generally do not require previous experience with blockchain – instead, they look for standard software development skills, such as experience with programming languages and rely on in-house training related to blockchain. Hence, companies do not necessarily offer specific blockchain-related positions or search for blockchain-specific skills. They rather assign a general ICT position within which the employees perform blockchain-related tasks. The most common ICT-related position for the blockchain job is a software developer engineer.

³² <https://startupestonia.ee/startup-database>

³³ <https://www.stat.ee/en/>

4.2.1 ICT related positions:

- Angular Developer
- Asset Integration Engineer
- Business Development Specialist
- Data & Analytics Consultant/Manager
- Digital Tax Transformation Specialist
- Growth Hacker
- Head of Marketing for leading fintech startup
- Innovation Hacker
- Innovation Officer
- IoT Researcher
- IT systems developers (Java, Fullstack, Rust, IPFS, etc...)
- Java architect
- Lead Quality Assurance Engineer
- Linux administrator
- Mobile Application developer
- Product Designer
- Python Developer
- Quality Assurance Engineer
- Runtime Engineer
- Software/DevOps Engineer (Back-End, Front-End, Full Stack Java)
- System Architect
- Technical Analyst
- Technology Consultant
- Tech Lead Operation
- UX/UI Designer
- Web Developer (Backend, Full Stack)

However, blockchain-specific occupation profiles such as Blockchain Consultant or Blockchain Developer start to appear.

4.2.2 Blockchain related positions:

- Blockchain Advisor/Consultant
- Blockchain Architect
- Blockchain Competence Center Associate/ Manager
- Blockchain consultant sector experts (finance, legal, technical, business analyst, business develop, etc...)
- Blockchain Cybersecurity Consultant/ Auditor
- Backend Developer (Blockchain)
- Blockchain Digital Transformation Expert
- Blockchain Developer
- Blockchain director
- Blockchain Engineer
- Blockchain Entrepreneur
- Blockchain Recruiter
- Blockchain Researcher
- Blockchain Specialist
- Blockchain Strategist
- Blockchain Technical Project Manager
- Blockchain Validator
- Crypto Developer
- Crypto Treasurer / Finance Manager
- Distributed Systems Engineer
- EOS Blockchain Engineer
- Full Stack Rubyonrail Developer
- Golang Developer
- Head of Innovation (Focus on Blockchain)
- Junior & Senior Blockchain Developer Application Engineer
- Node Developer
- P2P Network Engineer / Core Developer. Protocol Engineer
- Product Manager (Blockchain)
- Smart contract developer
- Token model architect

Some positions are related to other industries, i.e., Cryptocurrency Analyst or Trader are related to FinTech/Banking sector; positions such as Digital Tax Transformation Specialist, but also Business

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Developer; Banking Specialist; Business Analyst, or Senior Consultant are related to Finance and Business. Some general Blockchain skills might also be required in traditional profiles such as Marketing Specialist, PR, Community Manager, Project Manager or Data Protection Consultant.

4.2.3 ESCO classification

Based on the ESCO classification, the most relevant ICT occupations to include blockchain employees seem to be the following: **(2512) Software Developers**. The respondents also highlighted profiles such as (2513) Web and Multimedia Developers; (2519) Software and Applications Developers and Analysts Not Elsewhere Classified; and (2529) Database and Network Professionals Not Elsewhere Classified. The following occupations might also include blockchain-related skills: (2521) Database Designers and Administrators; and others such as ICT System Architect (2511.13).

Nevertheless, it is worth mentioning that there is a pre-release version of ESCO classification³⁴, which includes new occupations related directly to blockchain profile: Blockchain architect and Blockchain developer.

³⁴ <https://www.esco-projects.eu/esco/portal>

5 BLOCKCHAIN WORKFORCE CHARACTERISTICS

5.1 Characteristics of the people working in BC market.

The following statistics are based on Estonia, France, Slovenia, and Spain, for which publicly available data could be found.

Based on the frequencies of the categories age, education level and gender, we noticed the following patterns:

- **Age:** The highest percentages working in ICT and Non-ICT appear for individuals with age between 24 and 49 years.
- **Education:** Observing the results for education, the highest percentages of people working in ICT and Non-ICT appear for a high education level, followed by medium education.
- **Gender:** We noticed a higher relative frequency for men working in ICT and Non-ICT.

Regarding gender, as can be seen in Figure 7 and Figure 8, the blockchain sector is predominantly male in both ICT and non-ICT blockchain positions. Nevertheless, in non-ICT blockchain position, the situation is slightly better in terms of gender equality (79% Male vs. 21% Female in 2018; 77% Male vs. 23% Female in 2019) than in ICT related BC positions (86% Male vs. 14% Female in 2018; 84% Male vs. 16% Female in 2019).

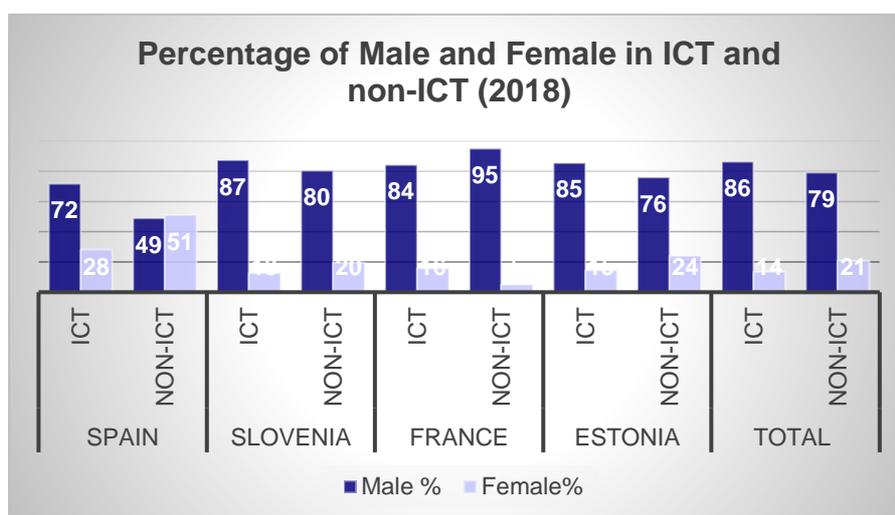


Figure 7 – Percentage of men and women in Blockchain positions in 2018 - Source: Database research

As displayed in Figure 7 and Figure 8, in 2018 there were 86% ICT-related positions occupied by men vs. 14% occupied by women, while in 2019, there were 84% ICT-related positions occupied by men vs. 16% occupied by women. Nevertheless, it is still soon to talk about any trend of increasing equality in the sector.

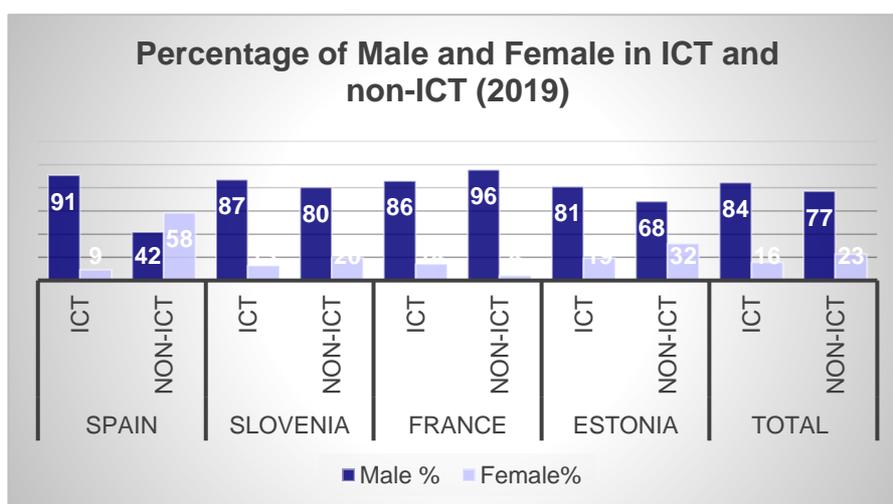


Figure 8 – Percentage of men and women in Blockchain positions in 2019. Source: Database research

5.2 Job vacancies characteristics

To gain some insights into job vacancies related to blockchain in the EU countries, more than 300 job offers have been collected and analysed by the CHAISE consortium, focusing on the industry where the blockchain profile has been required, seniority level, experience, education, and skills.

5.2.1 Industry

As shown in Figure 9, most blockchain-related job vacancies appear in the Information and Communication Technologies sector, followed by Financial Services. However, positions where certain blockchain skills are required appear also in Research, Energy and Utilities, Media, Consulting, Supply Chain, and others. Hence, blockchain job vacancies are no longer limited to ICT and Financial Services.

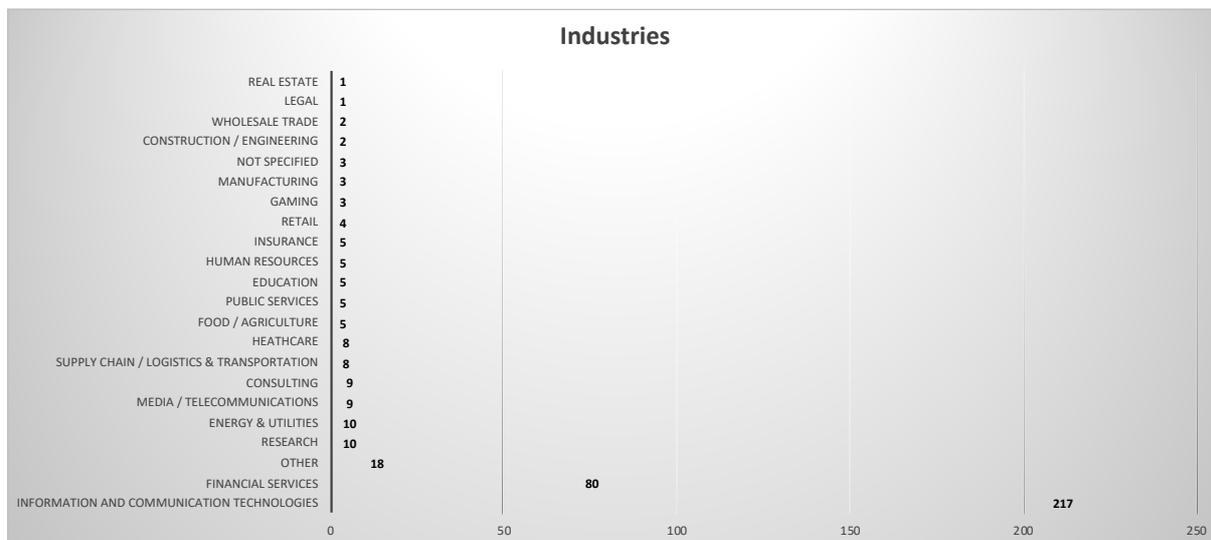


Figure 9 – Blockchain vacancies based on industry. Source: Database research (LinkedIn, ...)

Similarly, based on the data obtained from LinkedIn, Figure 10 shows the top ten industries with the highest number of blockchain professionals. Recently, most blockchain professionals work in the ICT sector (information technology & services; computer software; internet, telecommunications) and the financial sector (financial services; banking industry). Yet, a significant number of blockchain professionals is currently working in management consulting; higher education; and research industry too.

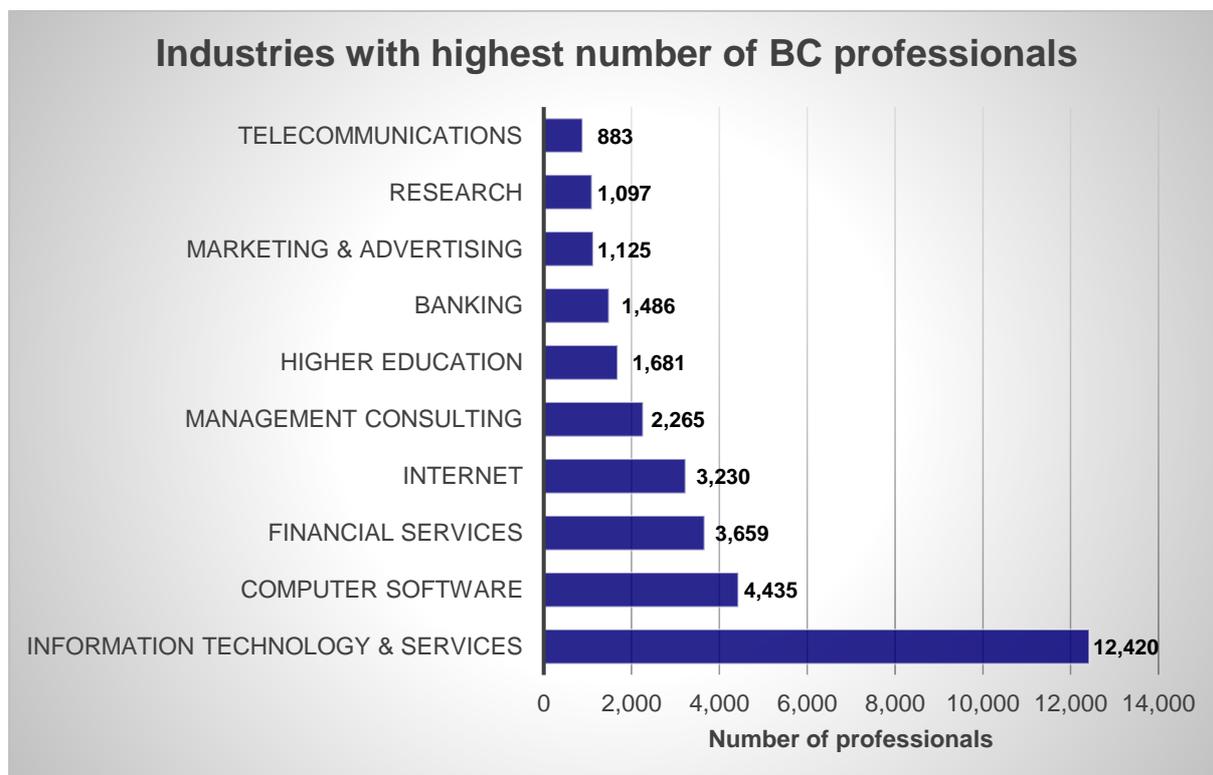


Figure 10 – Top 10 industries for blockchain professionals. Source: LinkedIn

5.2.2 Seniority

Regarding the seniority level, the entry-level with 100 vacancies was the most represented one in our sample (Figure 11). This might be because blockchain is still a relatively young position.

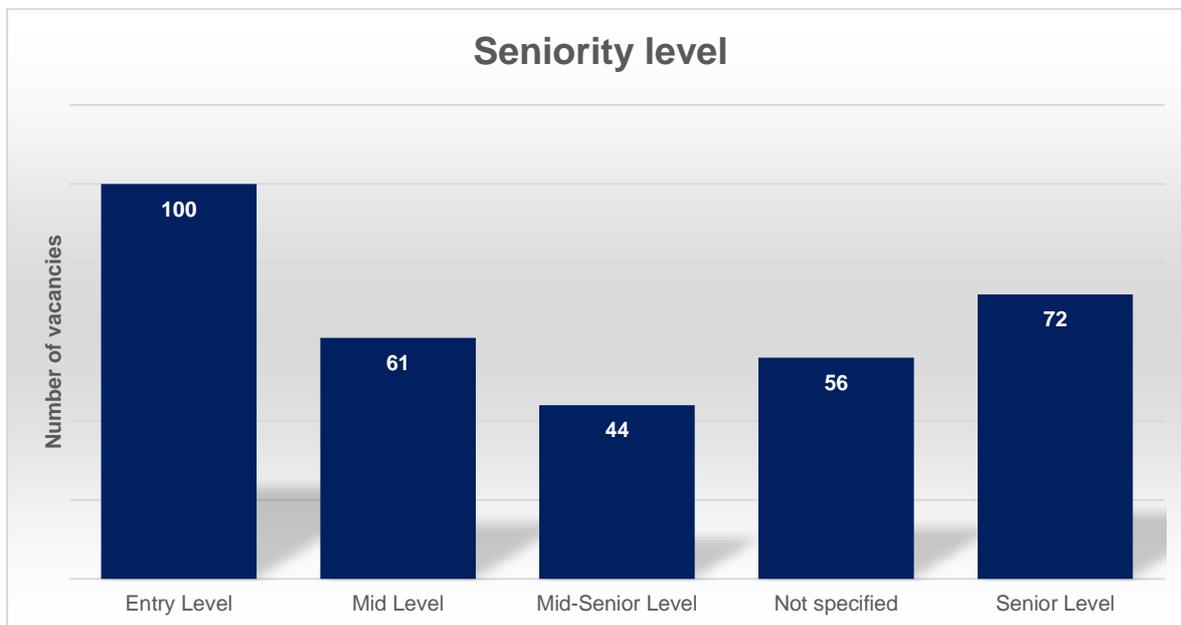


Figure 11 – Blockchain vacancies based on seniority level. Source: Database research

5.2.3 Experience

Most of the job vacancies analysed (Figure 12) required at least three years of experience. Still, due to the higher demand than the supply of blockchain profiles, companies also accept applicants with no experience and provide them with in-house training.

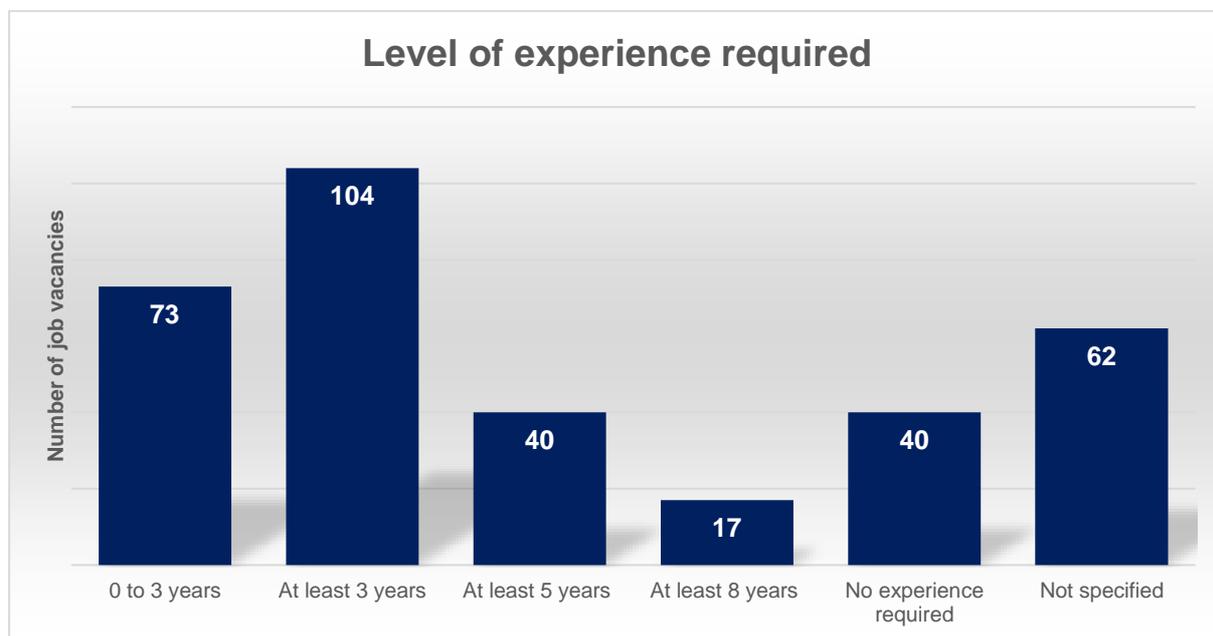


Figure 12 – Blockchain vacancies based on the level of experience. Source: Database research

5.2.4 Education

Recent blockchain-related positions seem to require a university level of education (Bachelor, Master). Still, quite a significant number of vacancies did not require any formal degree, or it was not specified. Only a few positions specified a PhD degree as a requirement (Figure 13).



Figure 13 – Blockchain vacancies based on the qualification required. Source: Database research

5.2.5 Skills

According to the LinkedIn database, a Blockchain developer is the most demanded blockchain-related job (Figure 14). To cover a blockchain job vacancy companies, either directly look for blockchain developer skills or extend the search to ICT applicants such as software developer engineer.

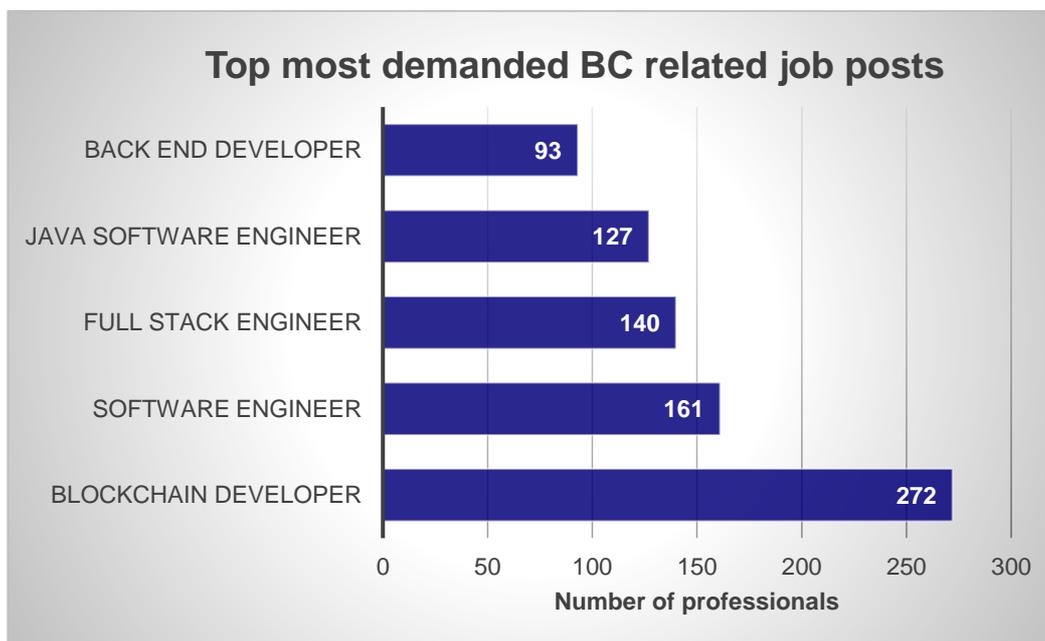


Figure 14 – Blockchain related job posts. Source: LinkedIn

Skills related to smart contracts or databases have experienced a significant growth in demand in the job market over the last year alongside the skills such as data science, big data, digital transformation, engineering, etc. (Figure 15).

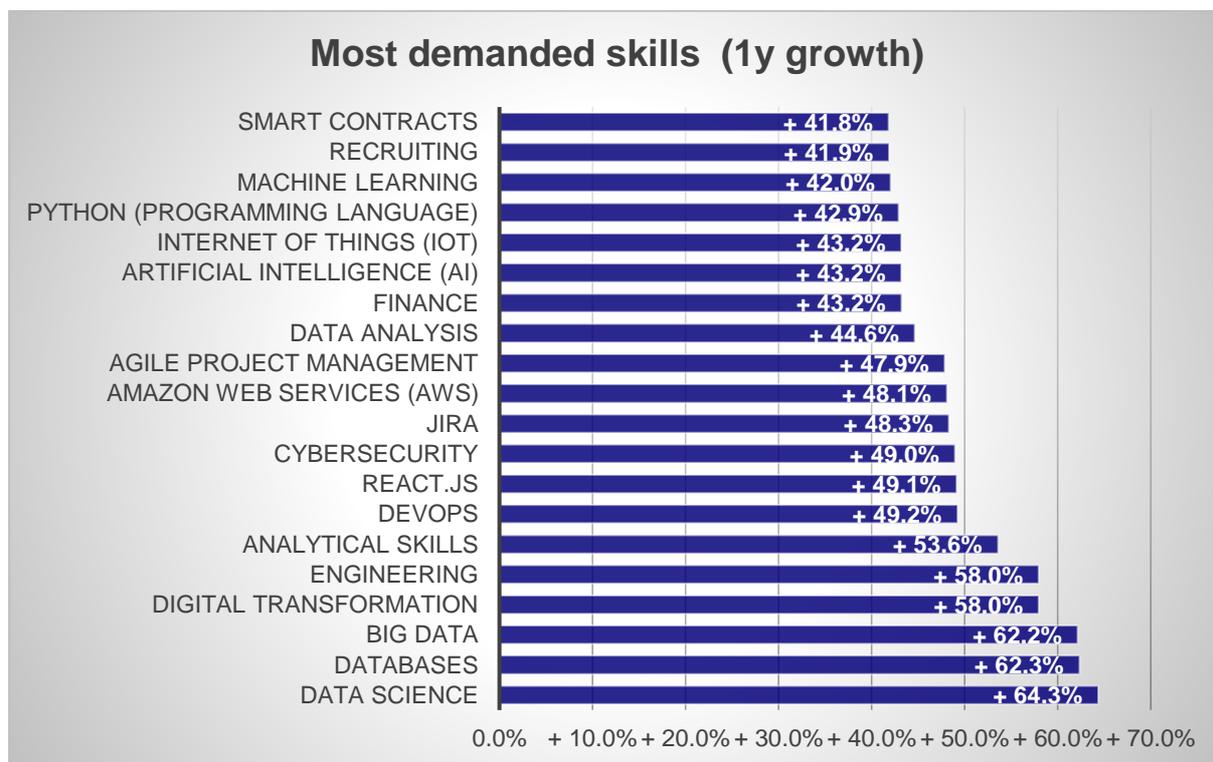


Figure 15 – Most demanded skills (1 year growth). Source: LinkedIn

Yet, there is also an increasing trend of blockchain-related vacancies, which are not on the development level (Figure 16). Instead, a workforce with a certain understanding of this technology is needed in finance, sales, marketing, management, or research, where a deep knowledge regarding blockchain system development is not necessarily required.

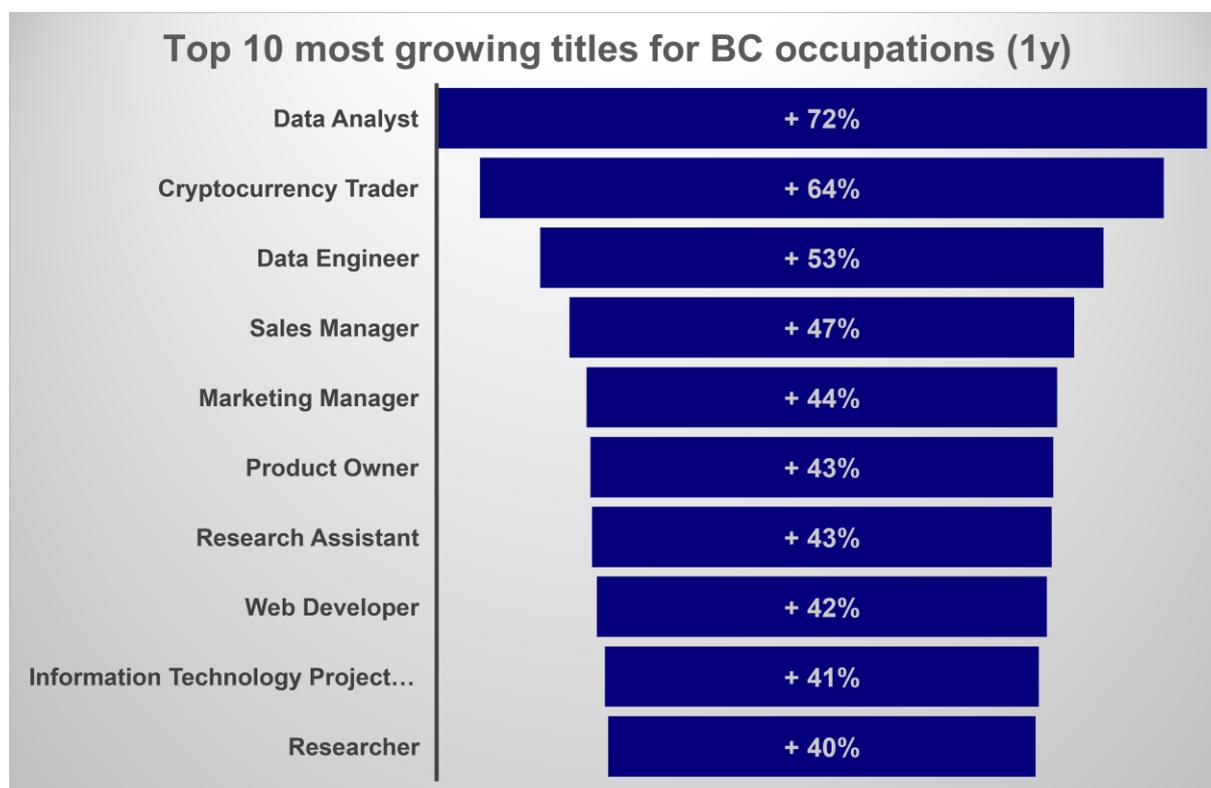


Figure 16 – Blockchain title occupations (1 year growth). Source: LinkedIn

The desk research observations complemented by interviews with experts suggest that there is currently a higher demand for blockchain profiles than a supply could satisfy. Due to the lack of blockchain-related skills, companies have to invest more time and resources into in-house training. Therefore, it is important to fill this gap by providing proper education and training in this field.

One of the main aims of this report was to provide critical insights into the current blockchain labour market and analyse skills/characteristics, which already exist in the market and are not yet present. Our findings indicate that due to the increased demand for blockchain-related positions, there is a need for a learning curriculum which would cover the existing skills scarcity.

Besides, there is a lack of open databases where specific information related to blockchain labour market could be found. Given that there is an increasing trend of blockchain profile demand, there is an urgent need for better data organisation and gathering in this field, to understand requirements and observe the labour market trends. This would help us identify skill gaps, based on which we design a proper training curriculum for this emerging labour market.

6 Conclusion

Although the European blockchain sector is well placed on acquiring global leadership, its future development highly depends on the availability of a skilled workforce. BC/DLT expertise is highly demanded in the ICT and financial sector. Yet, there is an increased number of other industries recruiting blockchain talents.

The findings of our research suggest that the blockchain sector is challenged by talent shortage. Although the demand for blockchain skills is steadily increasing, employers are facing a shortfall of skilled professionals. The main reasons for this situation are the limited connection between education and the market and the low responsiveness of formal education to new workplace requirements. Thus, there is an urgent need to reverse this situation. Otherwise, it prevents the sector from unleashing its full potential.

With blockchain technology being relatively new, we can observe that at the moment, there is a clear tendency for employers not to look for prior blockchain skills or qualifications, even when recruiting for relatively more senior positions. This is not caused by those skills not being important or sought after, quite the opposite, past experience with blockchain would be considered quite valuable. However, as mentioned before, there are precious few qualified candidates. University degrees in Computer Science often do not include specialized blockchain courses, which forces employers to rely on in-house training and expertise to pass on blockchain-related knowledge. Having candidates who already have a good grasp of the basics of cryptography, blockchain, the functioning of blockchain-based platforms like Ethereum, Hyperledger etc., would make the onboarding process much easier and it would be a significant advantage for the candidates themselves. These knowledge and skills are becoming more and more necessary and would be very beneficial for businesses trying to build successful blockchain-related projects.

The exponential growth in blockchain businesses over the past decade has been correlated with a similar rapid development in the technologies used. Considering the numbers of financing and revenue generated by the industry, addressing the skills demand would be greatly beneficial to the sector. It is important to note that the blockchain industry is projected to continue its growth in the near future, increasing the demand for candidates with a higher skill set.

The characteristics of the blockchain workforce show that it is composed predominantly of young people in their twenties and thirties in the ICT sector which, is traditionally fast-paced and susceptible to fast change. These demographic groups are simultaneously more open to expanding their knowledge by attending courses and training and are also predisposed by their environment to learn and develop

continually. In this regard, blockchain focused training would be a requirement for the major groups composing the blockchain labour market.

As this report shows, the national strategies related to blockchain development vary significantly between different European countries. We can observe distinct approaches, from governments undertaking extensive regulations and measures to aid blockchain development, to it being mostly ignored. However, one constant among the continent is the rising number of blockchain related startups who all have a demand for similar knowledge and skills in order to be able to grow their business. Therefore, an educational program that covers the most important areas of blockchain would in this regard be extremely helpful and could also be used by students from across the globe in order to share knowledge.