

Artificial intelligence, blockchain and the future of Europe:

How disruptive technologies create
opportunities for a green and digital economy

Executive Summary



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This report was produced with funding from the European Union, under the InnovFin mandate.

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Published by the European Investment Bank.

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print: QH-09-21-094-EN-C ISBN 978-92-861-4964-1 doi: 10.2867/758278

pdf: QH-09-21-094-EN-N ISBN 978-92-861-4963-4 doi: 10.2867/89580

Foreword

Artificial intelligence (AI) and blockchain are two of the most transformative and disruptive technologies of our times. The ongoing transition towards a digital economy has undeniably been accelerated by the COVID-19 pandemic. These technologies will play a central role on the path towards a sustainable and resilient recovery, and towards Europe's technological sovereignty.

This report presents a compelling case for allocating more resources to increase Europe's innovation capacity, to look beyond immediate needs and to think long-term, to think strategically and to think visionary, asking ourselves: where do we want to be in 10, 20, 30 years from now? What type of innovations and technologies will lay the ground for future generations?

All major economies in the world are racing to achieve a leading position in the development and deployment of AI and blockchain technologies. Europe, despite its scientific excellence, is lagging behind in particular on the financing front, where we only account for 7% of annual global equity investments in these technologies. We need to give our emerging startups more firepower to compete globally, and to instil confidence and conviction to back our future tech champions.

However, finance only is not enough. We also need to strengthen and connect our ecosystems further in order to translate brilliant ideas into commercial value better and faster. However, we equally must pay close attention to the challenges and risks associated with AI and blockchain technologies, despite their countless benefits and opportunities. The risks notably relate to the trustworthy, responsible and ethical implications of AI and ensuring technologies will be developed and deployed in line with our European values.

At the EIB Group, we understand this nexus and are ready to provide finance and advisory support to leverage on the AI and blockchain opportunity while keeping a human-centric and inclusive approach in mind. In close collaboration with the European Commission, our colleagues at the European Investment Fund (EIF) recently launched a successful €100 million pilot project for a dedicated AI and blockchain investment scheme, while the EIB has launched a €150 million co-investment facility to invest in AI and blockchain projects alongside EIF-backed fund managers and private sector investors. This report will further guide us in our efforts.

I would like to thank my colleagues at the European Commission for their excellent collaboration with our Innovation Finance Advisory team. I am looking forward to continuing our close cooperation to boost Europe's performance in AI and blockchain for the benefit of our economy, our people and wider society.

European Investment Bank Vice-President
Teresa Czerwińska

Introduction

Artificial intelligence and blockchain defined

The High-Level Expert Group on Artificial Intelligence set up by the European Commission defines **artificial intelligence (AI)** as “systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals.”¹ AI-based systems can be purely software-based, acting in the virtual world (such as voice assistants, image analysis software, search engines, and speech and face recognition systems), or embedded in hardware devices (such as advanced robots, autonomous cars, drones or internet of things applications). **Blockchain (BC)** is defined as “a technology that allows people and organisations to reach agreement on and permanently record transactions and information in a transparent way without a central authority.”² The potential of blockchain technologies goes well beyond cryptocurrencies and financial applications, and use cases outside the financial sector are growing in number.

Artificial intelligence (AI) and blockchain (BC) are two of the most significant disruptive technologies of our time, set to have a major impact on future societies and economies.

As transversal technologies, AI and blockchain can potentially disrupt a wide range of sectors and will likely play central roles in the success of Europe’s green and digital transitions, and in strengthening its technological sovereignty. Regions lagging behind in the AI race will probably see diminished global market shares in several industries, from finance and e-commerce to manufacturing and mining. Investments in AI research and development (R&D) are also crucial for security and defence, so underinvestment could undermine Europe’s national security.³ AI is expected to have a significant impact on progress towards achieving the Sustainable Development Goals (SDGs), especially on climate⁴ but also on diversity and inclusion, notably “gender smart” technological development. Both AI and blockchain have their own degree of complexity, but their development can be mutually reinforcing, for example on the integration of machine learning (ML).

In 2019 it was estimated that global gross domestic product (GDP) could increase by up to 14% (the equivalent of €13.3 trillion) by 2030 because of the accelerating development and take-up of

1 A definition of artificial intelligence: Main capabilities and scientific disciplines, High-Level Expert Group on Artificial Intelligence, 8 April 2019 (link, accessed 6 April 2020).

2 Shaping Europe’s digital future. Blockchain strategy (link, accessed 11 May 2020).

3 Artificial intelligence and national security, US Congressional Research Service, Washington, DC, 30 January 2019, <https://fas.org/sgp/crs/natsec/R45178.pdf>.

4 Vinuesa, R., Azizpour, H., Leite, I. et al. The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications* 11, 233 (2020).

AI.⁵ Blockchain was also forecast to have a wide-reaching impact on GDP by 2025.⁶ Both of these technologies can drive digitalisation across virtually all economic sectors. In addition, researchers and practitioners alike envisage increasing disruptions from the convergence of AI and blockchain, laying the groundwork for a fully digital economy. Their integration with the system of internet connectivity across devices (internet of things, IoT) can lead to even greater opportunities. While this convergence is only just beginning, it has already started within large corporates and is showing powerful use cases.⁷

Global equity investments in AI and blockchain technologies amounted to €80–85 billion⁸ between 2010 and 2019 (annual growth rate of 38%⁹). The COVID-19 crisis may have a negative short-term impact on access to finance for AI and blockchain technologies (for example, on availability of capital and on valuations). However, the current situation is also expected to generate positive commercial momentum for these technologies due to their potential to accelerate digitalisation and reinvent the key sectors hit hard by the crisis, such as financial services, healthcare and business intelligence. AI and blockchain technologies can increase the resilience of the EU economy. For example, in light of the COVID-19 pandemic, AI can significantly help to accelerate drug discovery processes or facilitate the crucial sharing of information from clinical trials and insights on how the disease develops. Meanwhile, blockchain technologies provide a remarkably transparent and decentralised way of recording lists of transactions, which can facilitate anything from the sharing economy to smart contracts and supply chain management, the latter having proven notably vulnerable during the pandemic.

All major world economies, including the European Union, are racing to achieve a leading global position in the development and deployment of AI and blockchain. The European Commission has taken several measures to advance these technologies: the Horizon 2020 programme allocated €1.5 billion to AI in 2018–2020; the Digital Europe Programme (DEP), as part of the 2021–2027 Multiannual Financial Framework (MFF), will complement this by dedicating an additional €2.5 billion to investing in and opening up the use of AI by businesses and public administrations.

On the investment front, the European Investment Bank (EIB) launched a €150 million co-investment facility to invest alongside fund managers and private investors backed by the European Investment Fund (EIF), while the EIF recently launched a pilot for a dedicated AI and blockchain investment scheme of €100 million. Beyond such dedicated funds, the European Commission has made additional resources available under the new Multiannual Financial Framework and the post-pandemic NextGenerationEU programme, particularly the Recovery and Resilience Facility (RRF), which will be deployed with particular attention to strategic technologies.¹⁰

5 Sizing the prize: What's the real value of AI for your business and how can you capitalise? PwC, 2018.

6 Building Block(chain)s for a better planet, World Economic Forum, 2018.

7 Come together: The convergence of blockchain, AI and IoT, EU Blockchain Observatory and Forum, 2019.

8 All currency figures in this report are converted according to annual averages of the corresponding year, presented in euro.

9 Preqin data, Oliver Wyman analysis.

10 MFF Factsheets. European Commission (link, accessed 15 June 2020).

These EU-wide initiatives are complemented by actions at Member State level, such as in France, Germany, Italy and the Netherlands. These measures are helping to catalyse broad-based AI and blockchain expertise in the European Union, which now has more specialised AI researchers (~40 000) than the United States (~30 000) and China (~20 000). The European Union also contributed to 30% of the global AI research publications in 2013–2017.¹¹

Companies and governments in Europe are substantially underinvesting in AI and blockchain compared to other leading regions, and it has become clear that the European Union struggles to translate its scientific excellence into business application and economic success. Compared to other major economic systems, there are no fundamental structural differences in the economy of the European Union that could justify lower business demand to deploy these technologies and take up digital transformation.¹² However, the United States and China together account for over 80% of the €25 billion of annual equity investments in AI and blockchain technologies, while the EU27 only accounts for 7% of this global amount, investing around €1.75 billion.¹³ Europe's venture capital (VC) ecosystem seems to mainly provide early-stage finance for AI/blockchain-based small and medium-sized enterprises (SMEs) (10% of total venture capital investments in the European Union, versus 5% in the United States^{14,15}), but clearly underperforms in subsequent rounds of financing (expansion and growth stages).

Triangulating various methodologies, this study estimates a total investment gap in AI and blockchain technologies in the European Union of about €5–10 billion per year. This gap appears: (i) to consist for the most part of equity investments – as compared to debt; (ii) to be dominated by AI (~80%) – as compared to a gap in blockchain investments; and (iii) to be more prominent in the later stages of financing, such as Series A onwards – as compared to the seed stage.¹⁶ Although the pandemic's long-term commercial impact on these technologies is expected to be positive, access to finance may become more challenging in the short run as a result of market conditions, potentially widening the investment gap. EU and Member State support schemes could plug part of the gap, but private markets will clearly need to contribute the balance.

11 Who Is winning the AI race: China, the EU or the United States? Center for Data Innovation, 2019.

12 For example, as measured by the I-DESI index for 2018 (link, accessed 15 May 2020), digital economy performance is higher in the European Union (on average) than in China and Israel, while only South Korea outperforms the top-4 EU countries.

13 Preqin data, Oliver Wyman analysis.

14 Preqin data, Oliver Wyman analysis.

15 European small business finance outlook, EIF, 2019, p. 51.

16 Preqin data, Oliver Wyman analysis.

Study approach

The study comprises three steps:

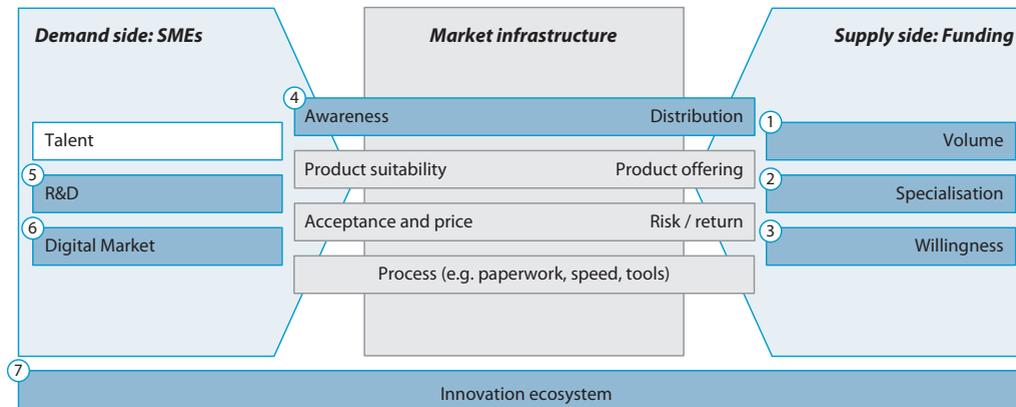
- Step 1. The study analysed the global AI and BC landscape based on Oliver Wyman's experience and expertise in the sector, as well as on other existing research, market analyses, published reports and expertise in the sector. Based on proprietary databases, the study benchmarked the European Union with other international geographies and estimated a range for the equity and debt investment gap for the two technologies, respectively.
- Step 2. The researchers surveyed over 100 AI and BC SMEs located in the 27 Member States and conducted in-depth interviews with 18 of those SMEs, as well as 19 financial market participants (including VC funds, corporate venture capital (CVC) funds, private equity (PE) firms, banks, national promotional banks (NPBs), and innovation agencies). The aim was to identify potential market failures and access-to-finance barriers.
- Step 3. The study presents a set of recommendations targeting the key market failures and barriers identified in the previous steps, supported by a high-level cost-benefit analysis and a high-level action plan for implementing these recommendations.

Bottlenecks in AI and blockchain financing

The analysis, survey and interviews have identified several bottlenecks constraining access to finance for AI and blockchain companies in Europe. These are shown graphically in Figure 1.

The study looked at the demand and supply sides. On the demand side, it is critical that small and medium businesses have the right talent to push innovation and produce high-quality R&D, and can scale up their products in a unified digital market. On the supply side, venture capital investors, banks and other financial providers need to have sufficient available capital to invest, the right tools to assess complicated technologies, and willingness to invest in them. Between supply and demand, the study also examined the market matching system, which brings together small and medium firms and investors to the benefit of all parties. Finally, the study analysed the overall innovation ecosystem and its value chain, in which all players need to cooperate in a coordinated manner, with government initiatives having a central role in defining strategy, and prioritising and enabling the cooperation of such key players.

Figure 1: Framework for the analysis of AI and blockchain access-to-finance conditions



The highlighted dimensions of the framework include the key findings of the analysis.

Table 1: Bottlenecks in AI and blockchain financing

Element	Bottleneck	Description
Supply side	1. Volume	<p>Limited availability of venture capital and private investments Despite a tenfold increase in AI and blockchain investments in Europe from 2016 to 2019, the overall availability of venture capital funding remains a key issue for Europe. In 2019, for example, the funding volume provided by the EU27 venture capital market to AI and blockchain small and medium businesses (€1.9 billion) was considerably smaller than the equivalent volumes in the United States (€17.9 billion) and China (€4.5 billion).¹⁷ According to the interviewees, this might be explained by European venture capitalists being mostly financed by government agencies, family offices (FOs) and corporate investors, whereas large institutional investors – which can typically deploy larger cheques particularly relevant for later business life-cycle stages – only account for about 14% of the venture capital market. In the United States, by contrast, large institutional investors such as pension funds and university endowments account for around 35% of the venture capital market.¹⁸</p> <p>Corporate investors play an important role as sources of capital in the European venture capital system, but only a limited role in the global acquisition landscape. In 2019, corporate venture capital-backed funding to AI startups reached an all-time high of €9.5 billion globally (+70% vs. 2018),¹⁹ of which the European Union accounted for around 7–8%. More generally, large EU corporates contributed about 17% of total venture capital funds (vs. 5% in the United States). However, they play a limited role in the acquisition of AI and blockchain companies, which is somewhat preventing the European Union from achieving high independence from non-EU investors. In particular, after the initial financing stages, several Europe-born AI and blockchain companies have been acquired by non-EU investors (for example, UiPath and DeepMind). From 2000 to 2019 there were 526 acquisitions of AI companies in the United States but only 139 in the European Union (including the United Kingdom). Similarly, during the same period, all of the top ten companies by number of global AI acquisitions were US-based, including Alphabet, Apple, Microsoft, Amazon and Facebook.²⁰</p> <p>Another factor that could explain the low exit opportunities for AI and blockchain investments in the European Union is the limited value of tech initial public offerings (IPOs). In 2019 the United States was the leading country for “Computer & Electronics” IPOs (note that three IPOs accounted for over 50% of the total: Uber, Pinterest and Lyft); China ranked second and the EU27 third – with a value less than one-quarter of the US value.²¹</p>

17 Preqin data, Oliver Wyman analysis.

18 European small business finance outlook, EIF, 2019, p. 41; The state of European tech 2017, Atomico, 2017.

19 The state of European tech 2019, Atomico, 2019.

20 Who is winning the AI race: China, the EU or the United States? Center for Data Innovation, 2019.

21 Dealogic database.

	<p>2. Specialisation</p>	<p>Limited specialisation of EU venture capital funds in AI and blockchain Compared to the United States, the European Union has fewer venture capital investors specialising in AI and blockchain. Several such investors have emerged in recent years, with US blockchain funds including Paradigm, Andreessen Horowitz, Polychain, Pantera Capital and many others raising a combined total of more than €1.8 billion between 2010 and 2019 – more than four times the total of blockchain equity investments in the EU27. US-based venture capital funds are typically equipped with highly experienced engineering teams, which support due diligence and provide portfolio companies with relevant technical support to develop and scale up their products. AI/blockchain specialist funds are far less common in Europe; those that do exist tend to be much smaller compared to their US peers and do not always have the required capability for in-house technical due diligence (17–18% of surveyed small and medium businesses reported this as a key constraint on access to finance in 2019 and 2020).</p>
	<p>3. Willingness</p>	<p>Limited appetite for investments in AI and, particularly blockchain due to high upfront investment needs and the lack of knowledge and low visibility of commercial applications</p> <p>While AI is central to many European funds’ investment strategies, the same amount of funding is not available to blockchain initiatives. According to the EIF VC Survey 2019, while 76% of respondents already had at least one AI company in their portfolio, only 23% had a portfolio including a blockchain company. Nevertheless, 51% considered it likely or highly likely that they would invest in blockchain in the future (compared to 87% for AI).²² For blockchain there is an estimated annual equity investment gap of €1–2 billion, against an annual investment of €0.1 billion in 2019.²³ Limited appetite for blockchain is notably attributable to lack of knowledge, particularly the misconception that “blockchain is Bitcoin.” However, as the technology matures and its commercial viability improves, investments are likely to follow.</p> <p>Despite the perceived importance of AI technologies, investors might still refrain from investing for three reasons: (i) the business model requires higher upfront investments in R&D; (ii) cash flows and commercial traction occur after early adopters have tested the technologies; and (iii) AI technologies need to be incorporated into ready-to-use products or services with direct applicability, which takes time.</p>
<p>Market infrastructure</p>	<p>4. Awareness and distribution</p>	<p>Limited matching between small and medium businesses and investors Small and medium businesses are struggling to connect with investors, especially in the early stages when investments tend to be more concentrated in local markets. In the market consultation, 30% of respondents reported struggling to find the right investors in 2019, while 25% said they would benefit from initiatives that help match small firms and investors across the European Union.²⁴ Furthermore, limited matching troubles companies developing horizontal, core technologies and those addressing a need in a specific “vertical” area, whether a business function or within a specific sector.</p>

22 EIF VC Survey 2019.

23 Preqin data, Crunchbase data, Oliver Wyman analysis.

24 Responses to question: “What could be possible solutions to improve your access to finance?” (select up to three answers).

Demand side	5. R&D	<p>Strong science base, but limited valorisation-related R&D spending The EU27 has more specialised researchers than the United States and China, and is the leader in the production of technology-related academic research; however, compared to peers, it has a lower share of valorisation-related R&D spending. The European Union has the largest talent pool of AI researchers, numbering around 40 000, compared to some 30 000 in the United States and 20 000 in China.²⁵ Europe has also been leading in the publication of AI-related research over the last two decades, although China recently surpassed it in this field.</p> <p>However, the EU27 is notably lagging behind its peers in R&D spending. In terms of recent growth in investments, EU-based companies are being outpaced by their US and Chinese counterparts. Using R&D spending by software and computer services firms as an indicator for corporate R&D spending on AI and blockchain, 62 of the top 100 firms are in the United States whereas only 13 are in Europe.²⁶ In 2019, the total amount of R&D spending by software and computer services firms among the global top 2 500 (by R&D spending) reached €70 billion in the United States, compared to €9 billion in Europe.²⁷ Similarly, the top ten companies granted the most patents in AI technologies contained no European representative²⁸ – despite Europe's strong science base.</p>
	6. Digital market	<p>While Europe's domestic market is comparable in size (GDP) to those of the United States and China, the incompleteness of the EU single market is hampering the scale-up of AI and blockchain small and medium businesses, hence limiting their ability to compete in the global market. US tech companies can benefit from a large, fully integrated domestic market. The same applies to Chinese companies, which can also benefit from partial protection against foreign competition, allowing them to scale up. This is not possible for European companies that need to operate across several, not fully integrated markets. Beyond the most common areas where the lack of a fully fledged single market can disadvantage European companies (for example language barriers), two specific areas are particularly relevant for AI and blockchain players: data and regulation.</p>

25 Who is winning the AI race: China, the EU or the United States? Center for Data Innovation, 2019.

26 Ibid.

27 Ibid.

28 China AI development report 2018, China Institute for Science and Technology Policy at Tsinghua University, July 2018.

	<p>Limited availability of data</p> <p>As stated in the European strategy for data,²⁹ a small number of non-EU Big Tech firms hold a large part of the world's data, which could reduce the incentives for data-driven businesses to emerge, grow and innovate in the European Union. Datasets are key for AI firms to train their models, grow and compete in the global market. Large amounts of data help companies develop accurate models to recognise patterns in large databases and perform several tasks. Firms and countries with access to vast datasets have a competitive advantage in the development and deployment of AI-based solutions. In the United States the collection and management of data are left to the private sector, with a considerable concentration in a few Big Techs. China has a combination of government surveillance and the strong control of Big Tech companies over massive amounts of data. In the European Union, the lack of a fully integrated digital market significantly constrains the creation of large, cross-country datasets. This, in turn, limits the access of AI firms to large pools of data for building and testing their algorithms, while the need to work in parallel on various national-based datasets increases their costs. Overall, this reduces European AI firms' competitiveness vis-à-vis Chinese or American players.</p> <p>Evolving regulatory landscape</p> <p>To mitigate the risks of using AI and blockchain, the European regulatory landscape has evolved quickly, creating several challenges. Since 2014, the European Union has implemented several regulations to facilitate and regulate the development of data-intensive industries such as AI and blockchain. Regulatory involvement is set to increase further as AI and blockchain are increasingly deployed in "high-risk" areas (such as transport, healthcare, defence and public services), which require clear rules on safety, legal liability and rights protection. Member States are currently highlighting the absence of a common European framework. It is crucial to have common EU standards to avoid cross-border uncertainties and the potential for arbitrage by innovators in the field of data-driven technologies. Any regulations should be limited to clearly identified problems for which feasible solutions exist. Using a risk-based approach should help prioritise regulatory focus and avoid overburdening AI developers and service providers. In practice, however, it might be difficult to set clear boundaries for what should be considered higher or lower risk. As a major step in this regard, in April 2021, the European Commission laid out proposals³⁰ for new rules and actions that aim to turn Europe into the global hub for trustworthy AI. The efforts include the first-ever legal framework on AI and a new Coordinated Plan with Member States that will guarantee the safety and fundamental rights of people and businesses, at the same time strengthening AI uptake, investment and innovation across the European Union. This will be complemented by new rules on machinery that will adapt safety rules to increase trust in the new, versatile generation of products.</p>
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29 Communication on a European strategy for data, European Commission, 19 February 2020.

30 On 21 April 2021, the European Commission launched a proposal on new rules and actions for excellence and trust in Artificial Intelligence, including Proposal for a Regulation laying down harmonised rules on artificial intelligence (Artificial Intelligence Act); Coordinated Plan on Artificial Intelligence 2021 Review; and Proposal for a Regulation of the European Parliament and of the Council on machinery product (link).

Innovation ecosystem	7. Ecosystem	<p>Fragmented innovation ecosystem</p> <p>Economies of scale derived from concentration, integration and proximity of talent and financing are the foundations for successful experiences of innovation ecosystems like Silicon Valley. As recognised in the European Commission <i>White paper on artificial intelligence</i>,³¹ efforts at European, national and regional level should be coordinated to create an ecosystem of excellence along the entire innovation value chain. This means creating connected, specialised innovation clusters with universities, startups, large corporates, investors, the public sector and all other stakeholders located in close proximity and fully cooperating. While the white paper focuses on AI, the same arguments could be advanced for blockchain.</p> <p>The European landscape currently features several non-interconnected and non-specialised AI and blockchain innovation centres. Four countries are home to 55% of all European AI and blockchain small and medium businesses (Germany, France, Spain and the Netherlands). A further eight Member States have above 40 AI/blockchain small firms each, while the remaining just have a few. At city level, the top ten EU cities account for over 40% of all AI and blockchain small businesses; however, there is substantial dispersion in other smaller centres within each country.³²</p> <p>On the investment side, Germany and France account for about 70% of the total amount invested by European venture capitalists in AI and blockchain since 2010. Other prominent AI and blockchain centres do not receive investments in proportion to the number of small and medium businesses they have.³³ Similarly, despite the large amount of technology-related academic research in some EU countries (for example Italy, Spain and Poland), relatively few of these projects attract venture capital investments. This is to some extent explained by the maturity levels of local ecosystems (some are mature and visible, others still emerging) and information asymmetries, amplified by the overall lower levels of venture capital and startup financing in Europe compared to other leading regions.</p> <p>The lack of integration can also affect innovation programmes and initiatives promoted by the public sector, leading to fragmentation of resources across countries and technologies, which hampers scaling up and developing big champions in strategic fields for Europe. While there are EU-wide coordinated plans for AI and blockchain, Member States are concurrently pursuing their own strategies, posing a risk of dispersing European resources and creating inefficiencies. Public and private resources are not sufficiently well channelled into creating big champions and investing in them throughout all life-cycle stages (for AI and blockchain in particular, fast scaling is the key to success and a major competitive advantage).</p>
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31 On 19 February 2020, the European Commission published an ambitious package on the European Union's digital policy, including a series of documents including the White paper on artificial intelligence – A European approach to excellence and trust, the European strategy for data, and Shaping Europe's digital future.

32 Crunchbase data, Oliver Wyman analysis.

33 Preqin data, Oliver Wyman analysis.

		<p>Despite a broad range of financing schemes available to tech companies at the EU and Member State level, EU initiatives are struggling to reach Eastern and Southern European countries. None of the EU13 countries³⁴ are in the EU top ten in terms of equity venture capital investments, even though some (such as Poland and Estonia) have several AI and blockchain small and medium businesses. The Central, Eastern and South-Eastern European (CESEE) region is lagging far behind the EU averages for startup and unicorn emergence and small business digitalisation.³⁵ Aiming to boost digital innovations and the scale-up of digital startups in this region, the European Commission, EIB Group, European Bank for Reconstruction and Development, and World Bank recently launched the Digital Innovation and Scale-up Initiative (DISC). This initiative is still in its early days, and much hinges on its design and implementation, which is still to be concretised. Yet such initiatives could provide an important boost to the region's innovation ecosystem.</p>
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34 EU13 refers to the 13 countries that have joined the European Union since 2004: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

35 See recent study by the EIB Innovation Finance Advisory, Financing the digitalisation of small and medium-sized enterprises - The enabling role of digital innovation hubs, <https://www.eib.org/fr/publications/financing-the-digitalisation-of-smes-report>.

Recommendations

The study identified three major areas needing improvement in Europe’s AI and blockchain landscape. The bottlenecks in financing of AI and blockchain require a strategic and comprehensive public-private response. The challenges identified span the development of AI and blockchain technologies, their deployment in the market, and the wider EU innovation ecosystem. Accordingly, the study makes several recommendations for addressing the three key objectives:

1. **Development:** Boost financing for AI and blockchain development and scale-up
2. **Deployment:** Support take-up of AI and blockchain technologies in the market
3. **EU innovation ecosystem:** Develop a European integrated innovation ecosystem

The recommendations for each of these objectives are outlined in Figure 2 and discussed in more detail in the remainder of this summary.

Figure 2: Mapping of recommendations to key identified objectives

Development	Deployment
Boost financing for AI and BC development and scale-up	Support take up of AI and BC technologies in market
<p>A. Intensify fundraising for AI/BC investment scheme with institutional investors, corporates, FOs and NPBs; and carve out funds for growth-stage VCs</p> <p>B. Monitor the deployment of and consider expanding AI co-investment facility to provide additional firepower to successful AI/BC fund managers backed by the EIF</p> <p>C. Expand the EIB Venture Debt programme to support successful SMEs recovering from the COVID-19 crisis, starting with the development of a customised thematic (pilot) facility</p> <p>D. Launch a dedicated AI/BC call for projects as part of the EIC, similar to the recent one on COVID-19, and consider transforming part of the new and existing grant budget of the EIC into contingent grants and/or forgivable loans</p>	<p>E. Provide advisory services to EU MS in deployment of AI/BC investment programmes and support the deployment of AI/BC technologies by traditional companies (esp. SMEs) that want to transform their business models in the aftermath of COVID-19 – links to RRF and DEP</p> <p>F. Develop a risk framework to assess and certify AI/BC-based technologies that meet EU-wide “trustworthiness” and regulatory requirements; this would help build trust with investors and deployers</p> <p>G. Adapt EU and Member State public procurement processes to accommodate participation of small, young and innovative AI/BC companies to help turn the European Union’s strong research outputs into successful businesses</p>
Innovation ecosystem	
Develop a European integrated innovation ecosystem	
<p>H. Strengthen DIHs to connect stakeholders of the AI/BC ecosystem across the European Union and foster clusters of specialisation, as per recommendations included in the EIB report titled <i>Financing the digitalisation of small and medium-sized enterprises: The enabling role of digital innovation hubs</i></p> <p>I. As part of the EIF AI/BC investment scheme, fuel competition and specialisation in the VC market by supporting the creation of new specialised VCs (first-time funds)</p> <p>J. Scale up the Investment Support Programme within the AI/BC investment scheme to establish a networking platform connecting AI/BC companies with relevant investors across the European Union, with particular focus on addressing the investment imbalance in Central, Eastern and South-Eastern Europe (CESEE)</p>	

Table 2: Recommendations to improve Europe’s AI and blockchain landscape

Objective	Recommendation
<p>Boost financing for AI and blockchain development and scale-up</p>	<p>A. Intensify fundraising for the AI/blockchain investment scheme with institutional investors, corporates, family offices and national promotional banks, and carve out funds for growth-stage venture capitalists</p> <ul style="list-style-type: none"> • The EIF could, within its capacity, leverage its visibility in the European venture capital space and its track record to focus fundraising for the dedicated AI/blockchain investment scheme among private institutional investors, large corporates and family offices. This could be done via an investment structure aimed at optimising the trade-off for participating parties with a lower risk-return profile, for example through a dedicated fund-of-funds (FoF) and/or downside guarantee mechanisms to attract institutional investors (for example with asymmetric returns, to the extent that appropriate products would be made available to the EIF). The EIF could also maximise fundraising with Member States (via national promotional banks) to further increase the scheme’s capacity, and aim for optimal complementarity with other national programmes. • The EIF could then carve out funds dedicated to growth-stage venture capitalists investing in AI scale-ups. This could be done as a pilot similar to the recently launched European Scale-up Action for Risk Capital Programme, and could focus purely on AI technologies (blockchain is still in the early stages). In the longer term, funds could be carved out within the dedicated AI/blockchain investment scheme (currently focused on the startup phase only, up to Series A). This would contribute to improving opportunities within the European Union for growth-stage small and medium businesses that might alternatively get financing outside the European Union, hence also improving exit opportunities for EU venture capitalists that invested in earlier stages.
	<p>B. Monitor the deployment of and consider expanding the AI co-investment facility to provide additional firepower to AI/blockchain fund managers backed by the EIF that invested in successful small and medium businesses</p> <ul style="list-style-type: none"> • The EIB could leverage the InvestEU programme to monitor and eventually expand the recent AI co-investment facility to successful venture capitalists backed by the EIF, while also extending its scope to include blockchain investments. This facility amounts to €150 million and deployment began in January 2021. The proposed expansion would complement the AI/blockchain investment scheme in sustaining the growth of successful startups and scale-ups through co-investments between the EIB Group and top-ranked venture capital funds and investment partners. The operational burden would be limited by leveraging due diligence performed by the EIF. The facility would invest pari passu with other investors, and would also be able to deploy smaller tickets. If proven successful, the scale-up of the initiative could be highly impactful.

	<p>C. Expand the overall capacity of the EIB Venture Debt programme to support successful and innovative small and medium businesses recovering from the COVID-19 crisis; potentially also develop a customised thematic (pilot) facility for AI and blockchain (or a wider “deep-tech” facility)</p> <ul style="list-style-type: none"> • The EIB could leverage the InvestEU programme to expand the capacity of its Venture Debt programme and strategically focus on innovative firms struggling to raise their next round of financing in the aftermath of COVID-19. Venture debt financing would allow these innovation-driven small and medium businesses to extend the cash runway until more favourable market conditions return for a new independent round of financing, and prevent them suffering depressed valuations because of the pandemic. The EIB could also consider expanding programme eligibility to earlier financing stages (such as after Series A, instead of B/C) and smaller tickets (minimum ticket size is €7.5 million under the European Growth Finance Facility but €3 million for companies in moderate innovator countries and €5 million in other countries under the Pan-European Guarantee Fund (EGF)). A similar setup could also be envisaged under InvestEU. • Furthermore, the EIB – in close collaboration with the European Commission – could explore the development of a thematic (pilot) facility dedicated to AI/blockchain companies, or a facility with a broader scope covering deep tech. The setup could be similar to those of successful concepts such as the Energy Demo Project, Future Mobility Facility and InnovFin Infectious Diseases Facility. Compared to the EIB’s generic venture debt product, a dedicated facility such as this could benefit from higher risk-sharing capacity and allow for increased risk-taking, in line with the profile of AI and blockchain companies.
	<p>D. Launch a dedicated AI/blockchain call for projects as part of the European Investment Council (EIC), similar to a recent dedicated EIC call on COVID-19, and consider transforming part of the new and existing grant budget of the EIC into contingent grants and/or forgivable loans</p> <ul style="list-style-type: none"> • Up to €2.5 million in grants and €15 million in equity are provided by the EIC to innovative startups in Horizon 2020 countries. The EIC could launch a specific AI/blockchain call (similar to its recent call for COVID-19) to give a dedicated opportunity for researchers and young startups active in this field to turn their projects into successful business solutions. This call should award grants/equity funding and European Commission Seals of Excellence. • With applications to the EIC having more than doubled since the pandemic began, the European Commission could consider transforming part of the new and existing EIC grant budget into forgivable loans or contingent grants. These could be repaid as a loan if the company is successful and not repaid otherwise, thus increasing the capacity of the EIC scheme as repaid grants are made available for new grants. The EIC could “outsource” the recovery function (to the EIB or other financial institutions).

Support take-up of AI and blockchain technologies in the market

E. Provide advisory services to EU Member States in the deployment of AI/blockchain investment programmes to enhance coordination between the European Union and Member States, and support the deployment of AI/blockchain technologies by traditional companies (especially small and medium businesses) that want to transform their business models in the aftermath of COVID-19. There are potential links to the Recovery and Resilience Facility and the Digital Europe Programme.

The European Commission and Member States have launched several huge support schemes to promote economic recovery from the COVID-19 crisis. Accordingly, key recommendations include:

- The Commission could consider drawing on some components of the EU-level schemes (such as InvestEU) to encourage investments in AI/blockchain technologies that could accelerate the recovery of the hardest-hit sectors. For example, conditional grants/forgivable loans could be attached to the deployment of AI/blockchain technology-based solutions and assigned via specific competitions. In particular, anchoring business models more robustly in AI/blockchain could materially benefit sectors such as automotive, manufacturing, hospitality and education. The Commission would also need to ensure coordination between the European Union and Member States in deploying EU and local AI/blockchain investment programmes.
- Most national promotional banks have launched support schemes in the aftermath of COVID-19. The EIB Group could deploy coordinated co-funding models with national promotional banks to ensure that AI/blockchain technology and startups become more central in local financing responses to recover from the crisis generated by COVID-19 (for example via the EGF).
- Under the Recovery and Resilience Facility, Member States will prepare recovery and resilience plans for a coherent package of reforms and public investment projects. Each plan must devote at least 20% of expenditure to fostering the digital transition. To step up financing from other sources, the EIB could closely collaborate with the European Commission to support Member States in the design and implementation of these plans, exploring and encouraging top-up possibilities by Member States for particular thematic areas, for example, focusing on the development and deployment of AI/blockchain technologies.
- AI is one of the five high-level components of the Digital Europe Programme. Given the complexity of AI technologies, deep specialist knowledge could be required to assess their potential and mitigate significant information asymmetries that could limit deep tech developers' access to finance. To bridge the information gap and improve the positioning of digital companies with respect to investors, one key recommendation is to implement dedicated advisory support, perhaps through the EIB's Innovation Finance Advisory team. The activities envisaged could help create the necessary financial preconditions (for example through market intelligence and development of the investor ecosystem, financial products and blending structures) and pilot initiatives (such as flagship/demonstration projects) that could be further scaled up under InvestEU (complementary to other financial sources such as the Recovery and Resilience Facility).

	<p>F. Develop a risk-based framework to assess and certify AI/blockchain technologies that meet EU-wide “trustworthiness,” ethical and regulatory requirements; this would help build trust with investors in and deployers of these technologies</p> <ul style="list-style-type: none"> • The European Commission could develop a risk-based framework to determine whether AI/blockchain-based startups meet “trustworthiness,” ethical and regulatory requirements (for example on data protection and transparency for AI or on energy consumption for blockchain). The level of risk could be driven by the sector and intended use of the technology. Assessment of specific projects could be coordinated by EU digital innovation hubs (DIHs), with projects receiving a “green stamp” to denote EU-wide recognition that their AI/blockchain systems have been developed according to European standards and regulations. Potentially, certification could also be used to grant these projects access to specific EU-wide initiatives, such as pools of data established under the EU Data Strategy. The EIF could use the trademark, among other tools, to guide its investments and give confidence to private investors about a specific technology/company. Digital innovation hubs could also coordinate regulatory sandboxes to drive the fine-tuning of existing (and potentially new) EU regulations to accommodate the specific features of AI/blockchain (based on the EU “innovation principle”), recognising that AI’s true value lies in sustainability and human-centricity to ensure fairness and unbiasedness in which EU citizens can trust. • Regarding trustworthy and ethical AI, focus on “gender smart” AI is particularly recommended to ensure gender equality (linked to SDG 5: “Achieve gender equality and empower all women and girls”). Europe is at the global forefront of considering AI’s ethical implications,³⁶ aiming to ensure transparency, diversity, non-discrimination and fairness, and societal and environmental well-being. Europe is also first in the world to lay out a proposed legal framework for AI,³⁷ with the goal to turn Europe into the global hub for trustworthy AI. These aspects are key for the successful development and deployment of AI across the whole European Union.
	<p>G. Fine-tune EU and Member State public procurement processes to accommodate the participation of small, young and innovative AI/blockchain companies to help turn the European Union’s strong research outputs into successful businesses</p> <ul style="list-style-type: none"> • In line with Open Innovation principles, the European Commission could further facilitate and encourage the participation of small, young and innovative European AI/blockchain companies in procurement processes at the EU and Member State level. This would give opportunities for researchers and young startups to develop AI and blockchain solutions for direct deployment by the public sector, helping realise the potential of the European Union’s strong research outputs by giving researchers a lead “client” for their products in the early stages. It would also help the deployment of these solutions by the public sector. The Commission could also link public procurement to EU research priorities in AI/blockchain, such as the digitalisation of public administration, defence and climate policy. This could involve, for example, lowering certain thresholds, adjusting minimum required financial conditions or introducing more flexible timelines.
	<p>H. Strengthen digital innovation hubs to connect stakeholders of the AI/blockchain ecosystem across the European Union and foster clusters of specialisation, as per recommendations in the EIB report titled Financing the digitalisation of small and medium-sized enterprises: The enabling role of digital innovation hubs</p> <ul style="list-style-type: none"> • EU digital innovation hubs are key to creating a network of smart one-stop advisory hubs to connect AI and blockchain small and medium businesses across the European Union with one another and with investors, large corporates, research centres, businesses wishing to deploy these technologies, and all other stakeholders of the innovation landscape. The hubs should also direct small businesses to entities providing advisory services and in particular advice on available funding programmes (for firms wishing to develop or already deploying AI/blockchain technologies). In each country, digital innovation hubs could also foster the creation of AI/blockchain specialisation clusters in specific EU sector/priority areas (such as healthcare, transport, agriculture, climate and energy).

³⁶ Ethics guidelines for Trustworthy AI, European Commission, 2019.

³⁷ Proposal for a Regulation laying down harmonised rules on artificial intelligence (Artificial Intelligence Act), European Commission, 21 April 2021.

	<p>I. As part of the EIF AI/blockchain investment scheme, fuel competition and specialisation in the venture capital market by supporting the creation of new specialised venture capitalists (first-time funds)</p> <ul style="list-style-type: none"> • The EIF, with relevant resources, could focus the AI/blockchain investment scheme on helping to create new venture capital firms specialised in AI/blockchain (possessing a mix of business and engineering teams) and support/sponsor them until they achieve a critical mass and track record allowing them to raise funds in the market independently. This could fuel competition and expertise in the EU venture capital market by creating a multitude of specialised (and eventually large) funds that could give technical and financial support to European AI and blockchain small and medium businesses.
	<p>J. Scale up the Investment Support Programme within the AI/blockchain investment scheme to establish a networking platform connecting AI/blockchain companies with relevant investors across the European Union, with particular focus on addressing the investment imbalance in Central, Eastern and South-Eastern Europe (CESEE)</p> <ul style="list-style-type: none"> • The European Commission could establish a networking platform (by scaling up the Investment Support Programme of the AI/blockchain investment scheme) to facilitate matchmaking between AI and blockchain small and medium businesses, investors and available EIB Group funding programmes. The platform could help match small firms with appropriate investors based on expertise, financing stage, location and industry. It could also foster information exchange between early-stage and growth-stage investors to share best practices for scaling up in the EU market, offering advice and knowledge on cross-border tax and legal affairs. As part of a larger digitalisation effort, the platform could focus particularly on addressing investment needs in CESEE via cooperation and synergy creation with other EU programmes such as the Digital Innovation and Scale-up Initiative.

The above recommendations clearly demonstrate that Europe needs an integrated approach for the development and deployment of AI and blockchain technologies. Financing for AI and blockchain development and scale-up in the market needs to be stepped up further at all levels, but it is equally important to strengthen the EU innovation ecosystem.



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Advisory

Artificial intelligence, blockchain and the future of Europe:

How disruptive technologies create
opportunities for a green and digital economy

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