



Research Fellow 

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The Synergy of Blockchain and
AI and its Potential to Reduce
the Skills Gap in Europe

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List of Abbreviations

BT – Blockchain Technology

CCI – Cultural and Creative Industry

CIRCE – Creative Impact Research Centre Europe

EU – European Union

GDP – Gross Domestic Product

GDPR - General Data Protection Regulation

GPT – Generative Pre-Trained Transformer

HEI – Higher Education Institution

HR – Human Resources

IoT – Internet of Things

IT – Information Technology

RUN-EU FASA – Regional University Network – European University, Future and Advanced Skills Academy

SETU - South East Technology University

SME – Small and Medium Enterprises

STEM – Science, Technology, Engineering and Mathematics

A. Main argument/insight

This CIRCE project was initiated in response to a set of diverse challenges, which affected industries, economies and societies worldwide. These disruptions included digital and social transformations, technological advancements, as well as Brexit and Covid-19 pandemic. According to the EY study, the cultural and creative economy is one of the most affected in Europe, with a loss of 31% of its turnover (EY, 2021). COVID-19 pandemic affected cultural and creative industries (CCIs) more than even tourism and air transport industry. The cultural sector accounts for 3.1% of global domestic product (UNESCO, 2022) and 4.2% to European GDP (Pasikowska-Schnass, 2019). Considering CCIs key contribution to the overall economy and its potential to lift the EU out of the crisis and prepare for the forthcoming disruption, this report concludes that the creative sector should be central to Europe's recovery efforts.

This research underscores the urgency of embracing innovation in education and workforce development. The proposed solutions, using the combined power of blockchain and artificial intelligence (AI), serve as a promising path to overcome existing difficulties. Potential alternatives for addressing the European skills gap include but not limited to credential verification, predictive analysis, lifelong learning records and skills marketplace. These solutions aim at enhancing skills recognition and matching, as well as promoting lifelong learning opportunities in CCIs. They hold the potential to not only address the European skills gap but also empower individuals, boost economic growth and secure the future competitiveness of Europe's cultural and creative economies. These proposed solutions present a roadmap for future research and investigation.

The emergence of Industry 4.0 technologies presents both an innovative opportunity and a pressing challenge for the continued prosperity of CCIs. Cultural and creative industries have been taking their time to adjust to worldwide changes and new technologies. The integration of digital tools, platforms and processes has transformed the way creative industries operate, collaborate and engage with audiences. Nevertheless, there is a lack of digital capacity in both the leadership and processes within the cultural and creative sector. As a result, new skill sets have emerged and existing skills have evolved to meet the demands of the digital landscape. These challenges have created uncertainty for Europe, but also revealed numerous opportunities, requiring a proactive response to ensure the continued growth and resilience of CCIs.

Through comprehensive analysis this study identified that while industries experience difficulties in finding qualified specialists, the root causes of these challenges are multifaceted. European skills gap extends beyond technical competencies, including a range of soft and hard skills. Fresh graduates, despite their creative abilities, often lack digital, entrepreneurial and business skills necessary for their employability prospects. Innovative tools combining blockchain and AI empower individuals to effectively acquire and validate digital and business creative skills, enhancing their employability and resilience within the rapidly changing job market. This approach benefits both individuals and the overall competitiveness of Europe's cultural and creative sectors.

This study also highlights the significant role of cultural and creative majors in higher education institutions (HEIs). It advocates for the integration of digital and business creative skills into HEI curricula, expanding students' horizons and employability prospects. By bridging the gap between artistic and technological expertise, this approach fosters a generation of creative professionals well-equipped to work in any sector in the current and future digital age.

Innovatively, this research recommends the creation of a blockchain-based AI-driven skills forecasting solution to be adopted across the European Union member states. This technological approach aligns educational curricula with industry needs, fostering collaboration between academia, government, industry and society. It empowers students with personalized learning paths, promoting lifelong learning and adaptability. By securely storing and verifying educational credentials, blockchain ensures transparency and trust in job seekers' qualifications, while AI facilitates precise skills matching.

Both of these technological collaborative efforts involve government, academia and industry representatives, coming together to form a “skills development ecosystem”. Only when they are all together, they have an ability to foster innovation and effectively navigate through emerging contexts.

B. Research problem/Creative endeavour

Background and Starting Point: CCIs challenges

The idea of this project emerged against the backdrop of the unprecedented disruptions sweeping through industries, economies and societies worldwide. The rapid pace of technological advancements, digital and social changes has redefined the terrain of various sectors, with the cultural and creative industries standing out as particularly vulnerable to these transformative forces. Brexit and COVID-19 pandemic have also introduced significant challenges, particularly in the European landscape. According to the EY study, the cultural and creative economy is one of the most affected in Europe, with a loss of 31% of its turnover (EY, 2021). COVID-19 pandemic affected CCIs more than even tourism and air transport industry. Reports indicate that during this period, as many as 10 million jobs disappeared from the cultural and creative sectors, which contracted by US\$ 750 billion globally in 2020 (UNESCO, 2022). This dynamic environment presents both uncertainties and opportunities, requiring a proactive response to ensure the continued growth and resilience of these vital sectors.

The starting point of this work is the recognition that creative economy is vital for sustainable development. The cultural sector accounts for 3.1% of global domestic product (UNESCO, 2022) and 4.2% to European GDP (Pasikowska-Schnass, 2019). CCIs create jobs and economic activity. Cultural and creative industries generate 50 million jobs worldwide, employ 7.7 million people in the EU. It is equivalent to 3.8% of the total workforce in the EU, representing 1.2 million enterprises. CCIs employ more young people (15-29 years old) than other sectors (United Nations, 2021). In the creative industries, women account for around one third of the workforce and 60% of part-time positions (National Advisory Council on Women and Girls, 2022). Cultural and creative professionals can be found in almost all sectors.

Cultural and creative employment is also marked by a skills paradox - although cultural and creative employees are more highly educated than average, there are also significant skills gaps that hold the sector back, such as those related to entrepreneurship skills. Due to the highly-skilled and non-repetitive nature of these types of jobs, they are also unlikely to be automated fully, but they have started to be transformed by digitalisation. For example, graphic designers and visual arts artists now need to be proficient in using software tools to create digital illustrations, multimedia content and animations. Musicians are now required to adopt to digital audio workstations, as well as use various digital promotion strategies to distribute their music.

Creative skills have a unique role in driving innovation across the economy. CCIs have historically been digital pioneers. While the creative sector's pivotal role in economic growth is evident, the emergence of Industry 4.0 technologies now presents both an innovative opportunity and a pressing challenge for the continued prosperity of CCIs.

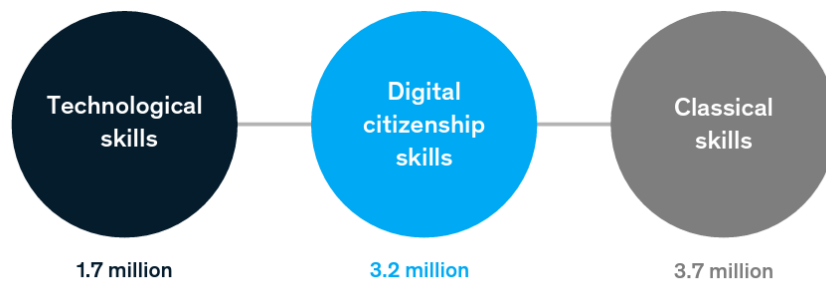
Industry 4.0 provides the creative economy sector with new possibilities. Technologies like augmented and virtual reality, artificial intelligence, blockchain, 3D printing and the Internet of Things have reshaped skills needed for many industries, including cultural and creative sectors. As technological innovations redefine consumer behaviour, market dynamics and creative production, it becomes imperative to address the complex interplay between creativity, innovation and technological disruption. CCIs have been taking its time to adjust to worldwide changes and new technologies. The integration of digital tools, platforms and processes has transformed the way creative industries operate, collaborate and engage with audiences. Nevertheless, there is a lack of digital capacity in both the leadership and processes within the cultural and creative sector. As a result, new skill sets have emerged and existing skills have evolved to meet the demands of the digital landscape. Skill requirements will continue to change rapidly with international competition and technological change (Brunello & Wruuck, 2019). This is leading to a gradual intensification of skills gaps which could slow down progress.

Research Problem: Identifying and Bridging the European Skills Gap

This starting point was further underscored by the pressing issue of the skills gap, which has emerged as a critical concern due to Brexit, COVID-19 and technological advancements. This gap threatens to undermine the potential of individuals, industries and even entire countries to adapt, innovate and thrive in the face of disruptions.

The EU-28 public sector has a shortage of 8.6 million people with necessary skills across three categories: technological, digital citizenship (e.g. digital literacy) and classical skills (e.g. creativity, entrepreneurial mindset) (Chinn et al., 2020).

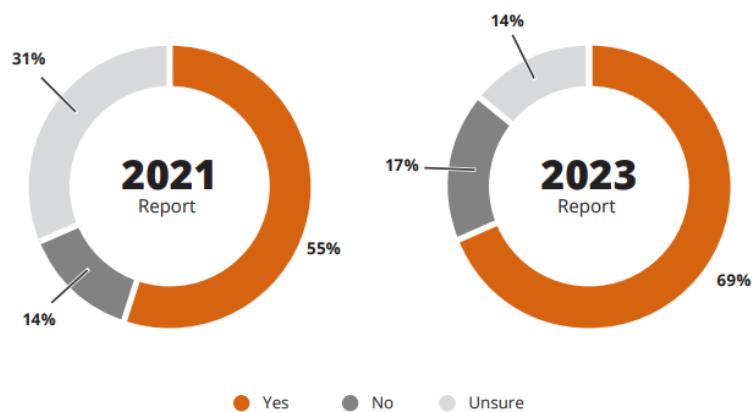
Figure 1: EU-28 Public Sector Skills Gap



Source: (Chinn et al., 2020).

More than three-quarters of companies in the EU report difficulties to find workers with the appropriate skill set (European Commission, 2022). One-quarter of Small- and Medium-sized Enterprises (SMEs) consider the availability of skilled staff and experienced managers the most important problem (Eurostat, 2022a). Furthermore, a shortage of IT specialists and workers with a science, technology, engineering and mathematics (STEM) background (McGrath, 2021). Recent report showed that 69% of the surveyed HR professionals believe their respective organizations suffer from a skill gap, which is a 14% rise from 2021 (Wiley et al., 2023).

Figure 2: Skills Gap Survey Comparison Diagram



Source: (Wiley et al., 2023)

Digital skills play an important role in the creative industries. Digital skills encompass basic literacy, communication, information management, content creation, computational thinking, and data literacy. In today's digital age, these skills are essential for artists and professionals to harness the potential of technology, facilitating innovation and sustainable economic development. Additionally, bridging the digital skills gap enables cultural and creative

enterprises to thrive, provides access to a broader range of job opportunities and fosters the competitiveness and growth of these sectors within the global digital landscape. Creativity is one of the most needed soft and durable skills (27%), especially manufacturing industry highlighted the need of having more workers with creative skills (Wiley et al., 2023). On average about 40% of creative professionals work in other sectors (e.g. designers working in car manufacturing) (OECD, 2022). The number of cultural professionals and artists is growing steadily, while their employment conditions become more and more unstable (Pasikowska-Schnass, 2019). Therefore, central to the research problem is the aforementioned skills gap – the disparity between the competencies possessed by individuals and the demands of employers – that has emerged as a consequence of the rapid technological and societal changes.

In recent years, the cultural and creative industries have shown significant growth, evident from promising statistics. In 2022, cultural employment in the EU grew by 4.5 % compared to the previous year (Eurostat, 2022b). Enterprise growth in cultural and creative sectors outpaced growth in the business economy (18% compared to 12% on average across OECD). Cultural and creative employment growth outpaced overall employment growth in most countries (13.4% compared to 9.1% on average across OECD and EU countries) (OECD, 2022).

The consequences of skills gaps are far-reaching. They include high unemployment rates as individuals struggle to find suitable jobs. Moreover, businesses face reduced productivity due to a lack of skilled workers. Skills gaps can also contribute to economic disparities, creating a divide between those with in-demand skills and those without, exacerbating social and economic inequalities.

Research Questions

This project aimed to address the following two research questions:

How can blockchain technology and artificial intelligence address the skills shortage in Europe?

and

Which "future" skills are necessary to be ready for the forthcoming disruption?

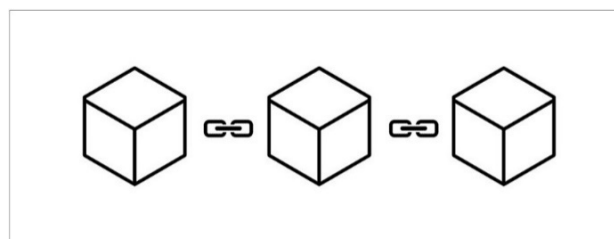
This research problem and questions become particularly relevant in the context of the European landscape, where the European Commission has demonstrated its awareness of the importance of skills development and recognition (European Commission, 2021). The launch of the European Year of Skills 2023 highlights the urgency of addressing skills shortages in

the European Union, including digital skills. It is within this framework that this project aims to contribute to the ongoing discussion on skills development, future competencies and the strategies required to navigate in our increasingly complex and challenging world characterized by the various disruptions.

Theoretical Concept: Blockchain Technology

Blockchain technology has emerged as a ground-breaking phenomenon that hit the global world since the invention of the Internet (Drescher, 2017; Wright & De Filippi, 2015). Several authors mentioned that blockchain represents the second era of the Internet (Jagers, 2017; Tapscott, 2018). This technology cannot be touched or seen, therefore, its intangible nature presents a challenge in explaining it. Visually, it can be imagined as a chain of blocks, that are linked to each other (Antonopoulos, 2010). These blocks contain information in them, which can be stored in any format (text, pictures or audio files).

Figure 3: Structure of Blockchain



Source: made by the researcher

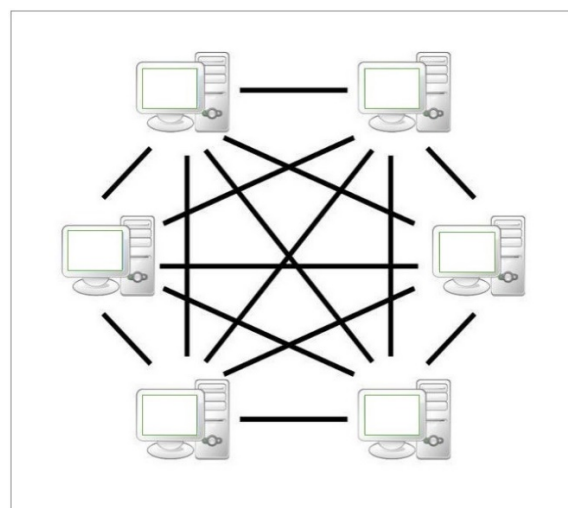
Blockchain technology was initially described in the early 90s, as a tool to timestamp digital documents, so to eliminate the possibility of backdating or tampering with them. In this case, blockchain may be seen as a “digital notary”, digital notebook that lots of people can use and write in, with some special features ensuring its security and reliability.

In 2008, blockchain was revealed in a paper called “Bitcoin: A Peer-to-Peer Electronic Cash System” by Satoshi Nakamoto (the pen name), so to create the digital cryptocurrency called Bitcoin. The initial idea behind blockchain is that it is a virtual database, which is used by Bitcoin and other cryptocurrencies for secure and anonymous transactions (Nakamoto, 2008). Nowadays, blockchain technology is much more than just a tool to enable digital currencies, it is a platform, which has a nearly limitless amount of applications across almost every sector. It is a new global infrastructure that could transform many existing processes in business, governance and society (WEF, 2018).

Let's imagine a situation when someone wants to buy a second-hand car. People generally first look at the mileage or how many kilometres are showing on the odometer. But can they be sure that the number which is there is not a false one? With blockchain technology it becomes possible! Blockchain technology can also be used as a digital platform for e-voting, what may have a number of benefits including increase in a number of voters (due to the inclusivity of people and people's trust), fast end-to-end verification mechanism, transparency in the number of votes. Blockchain has almost unlimited opportunities, which are currently researched all over the world.

For the purpose of this project, researcher defines blockchain as a decentralized distributed ledger, which allows peer to peer transactions secured by cryptographic rules. It is a registry or journal (ledger), which does not have a central authority to control the database (decentralized), which involves many participants who store information (distributed) and operates safely due to securing information from unauthorized access (cryptographic rules). Blockchain is a registry that is distributed among many participants with no central entity to control. Distribution here refers to the fact that information is not stored on a single computer, but is consensually shared and synchronised across many computers, without any central authority to maintain data. Graphic interpretation of blockchain's distribution is shown on the picture below:

Figure 4: Distribution of Blockchain



Source: made by the researcher

Theoretical Concept: Artificial Intelligence

Artificial Intelligence refers to computer systems that can perform tasks similar to human abilities, such as understanding spoken language, demonstrating proficiency in games, and identifying patterns in data. These computer systems acquire knowledge by analysing vast amounts of information and using this knowledge to make decisions. Sometimes, humans teach them, while in other cases, AI systems learn on their own, for instance, through repetitive actions like playing video games. AI encompasses computers performing intelligent tasks, and it can be categorized into two main types based on their abilities and applications.

Strong AI (Artificial General Intelligence): This represents the kind of AI portrayed in movies, where machines possess the ability to solve problems they have never encountered before, much like humans. However, we have not achieved this level of AI yet, and it remains a challenging goal for researchers.

Weak AI (Narrow AI or Specialized AI): This is the prevalent form of AI today, specialising in specific tasks. For instance, virtual assistants like Siri and Alexa can answer questions and assist with various tasks. Self-driving cars utilize AI to navigate roads safely, while search engines like Google employ AI to swiftly retrieve information. Conversational bots engage in online conversations and provide assistance, email filters rely on AI to keep spam out of your inbox. Recommendation systems, such as those used by Netflix, use AI to suggest content tailored to your preferences.

C. Research Process/Creative Process

Research Methodology

A systematic step-by-step research approach was necessary in planning this project. It was important for me, as a researcher, to understand all elements of the research process before commencing the research project, so to have an idea of the “big picture”. Also, it was essential to complete this project within the given timeframe – six months (April 2023 – September 2023).

This project consists of four main components: (1) writing a project’s protocol, (2) conducting an analysis => performing research techniques, data collection, (3) data analysis and results, (4) writing a final report. I refer to project’s protocol as to main elements of the research methodology, which are shown in the Table 1 below:

Table 1: Elements of a Project

Element	Purpose
Research topic	Keystone of the study. Begins, drives and ends the study.
Research question(s)	Relationship between two or more variables is phrased as a question.
Research aim(s)	General purpose of the research project.
Research objective(s)	Researchable issue. Developed logically from a description of the topic.
Significance of the study	Why is the research question important? What are the implications of the project?
Exploratory design	Methods, techniques.

Source: made by the researcher

The timeframe for the project was limited to six months, during which a comprehensive literature review was conducted to establish the project's foundation. The subsequent phases of data collection, analysis and interpretation were seamlessly integrated into the project timeframe to ensure the successful completion of the study within the specified timeframe.

“The Synergy of Blockchain and AI and its Potential to Reduce the Skills Gap in Europe” – the general research topic - plays a large role in the outcome of the overall CIRCE research project. I conducted a prior academic research: “An exploratory analysis of the Irish blockchain ecosystem” at a Master’s degree level and “Blockchain technology and its potential for the third-level education system” at a PhD degree level), where I got an overview of an overall technology impact on various industries. I identified a significant knowledge gap and made some preliminary results, based on which I proposed an idea of merging two technologies and skills gap, thus making this research an interdisciplinary one. I see promising possibilities in the use of blockchain and AI in addressing the European skills gap. I believe that investigating the use and possible merge of blockchain technology and artificial intelligence to shorten the skills gap can benefit different groups: industries, government, academia and society.

This project aimed to answer two central research questions:

How can the combination of blockchain technology and artificial intelligence address the skills shortage in Europe?

and

What are the "future" skills required to prepare for forthcoming disruptions?

To achieve these objectives, I employed an exploratory mixed-methods approach that included literature review (incl. grey literature) and semi-structured interviews. I chose an exploratory research, so to ensure a comprehensive understanding of the potential and feasibility of these technologies in bridging the skills gap. Incorporating grey literature review into this project was a deliberate choice, because of the contribution to the existing scholarly publications. Moreover, because technology is a rapidly evolving field, it was important for me to be updated with current business case studies, reports, industry-specific findings and weekly/monthly updates. Relying only on peer-reviewed academic sources could have limited the scope of insights and information. Also, I actively engaged with online sources of information, such as webinars, conferences and videos.

Blockchain and AI are emerging technologies, and I did not want to limit data collection methods. In order to answer first research question, a mixed-method data collection approach was used for collecting data. Primary research method included semi-structured interviews with 5 representatives from 5 different industries. I decided to use this research method, as it uses a pre-defined set of questions with a possibility to ask follow-up questions and develop a topic in a direction needed. It was important for me to interview people, who are responsible

for recruitments process or are decision-makers when hiring new specialists, and not random employees from different sectors, but Online (using Zoom and Ms Teams) and face-to-face interviews were conducted depending on the company's geographic location. Due to the limited timeframe of this project, I decided to interview 5 specialists, so to gain an understanding of if/how skills gap affects different industries, especially digital skills gap, and which skills are/will be needed by the businesses in future. Secondary research method included literature review - archival study, analysis of existing academic and scientific literature and business reports, including grey literature. In order to answer the second question there was a need for another interviewing process. Second interviewing consisted of 10 students, from the European Higher Educational Institutions that are already enrolled into a full-time "creative" major, such as graphic design, ceramics, sound engineering and etc. (Out of which there were 5 face-to-face interviews (with Irish students) and 5 online sessions). All participants from both interviewing groups were personally known to me. The sample was thoughtfully balanced in terms of gender representation. Prior to conducting any interview, a detailed informed consent form was provided to all participants and their signatures were obtained.

When I was in a process of writing a research proposal, I decided to adopt a quantitative research methodology, primarily targeting industry professionals across different sectors, excluding the creative industry. However, as the project progressed and I realised a need to align it more closely with the objectives of the overall CIRCE initiative, I decided to make a significant shift in the research methodology. CIRCE is all about creativity and culture. I realized the fact that I have a unique opportunity to contribute significantly to the body of knowledge of this sector even if coming from business, finance and research backgrounds. Therefore, I decided to widen a scope of my project and incorporate directly both creative and non-creative industries. This change allowed for a deeper exploration of the potential impact of blockchain and AI on bridging the skills gap, offering key insights (from the interview participants) into how these technologies can benefit the creative sector and cultural landscape.

Table 2: Change in Research Methodology

Initial Research Methodology	Current Research Methodology
Surveys	Semi-structured interviews
One target group: industry representatives	Two target groups: industry representatives and students
Various sectors	Various sectors + CCIs
Online	Mixed: online and face-to-face

Source: made by the researcher

Ethical Considerations and Timeline

It is important to note that this project adhered to ethical principles and guidelines, subject to the General Data Protection Regulation (GDPR). Participants' voluntarily consents were obtained to ensure their willingness to participate in this project, and their privacy and confidentiality were safeguarded. All data collected was anonymized and stored securely, ensuring the integrity of the research.

Challenges and Limitations

Limited knowledge of cultural and creative industries. My previous educational background and professional expertise have primarily been in other sectors, and CCIs have their unique features and characteristics. This limitation may have influenced the depth of insights I could gain during interviews with the students studying creative majors. However, I tried to mitigate this limitation by an extensive literature review, so to broaden my understanding about CCIs.

Time constraints. Limited timeframe may have influenced the overall depth and scope of this project. The need to complete this project in six months and the change in research methodology are the main factors affecting the time constraints.

Participant recruitment/Access to industry professionals and creative students. Due to the previous two limitations (lack of creative background and time), the opportunity to recruit a larger and more diverse group of participants was limited. Ideally, I would like to see representatives from a broader range of industries, so to have a more comprehensive understanding of the European skills gap.

Limited data collection methods. Given the time constraints and resource limitations, data collection methods were narrowed to literature review and interviews. I feel that my initially

proposed research approach – surveys or even a larger size of interview participants might have provided additional key insights.

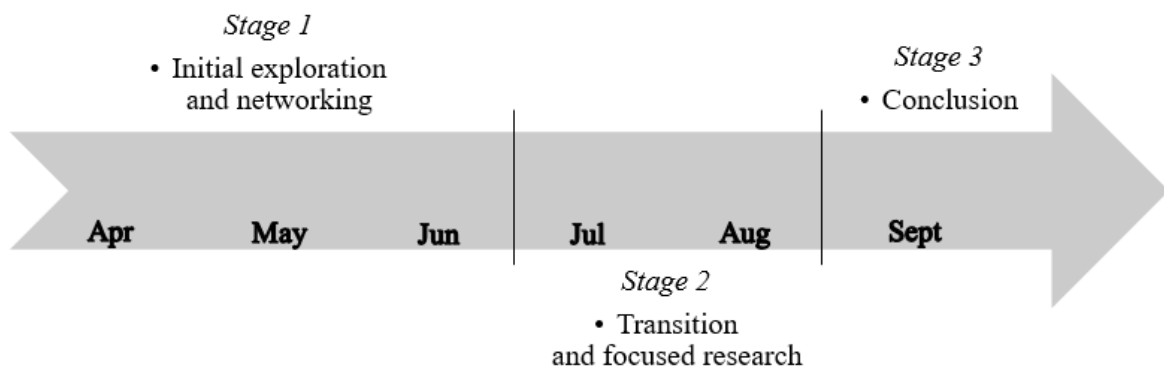
Geographic scope. This project was focused on the European skills gap; however, it may not fully capture the situation in every country/region of Europe.

Funding. Given the limited financial resources, interviews were fairly balanced between online and offline settings. This barrier primarily affected participants located in remote regions, which may have influenced the depth of insights that could have been gained through in-person interactions. A face-to-face approach might have provided a richer context and more detailed understanding of the skills gap.

Research Stages

Now, when I am reflecting on my research process, I think that it can be divided into three stages: initial exploration and networking, methodological transition and focused research, conclusion.

Figure 5: Stages of the Research Process



Source: made by the researcher

Stage 1: Initial Exploration and networking (April to June 2023). The start of this project in April 2023 began a well-organized, structured and carefully planned process. Fully aware of my limited knowledge and understanding of cultural and creative industries, I started reading a lot. It was important for me to get to the starting point of the project => “Creative economy is vital for sustainable development!”. To enhance my insights, I actively engaged within and beyond CIRCE network, participated in networking offline meetings organized by the CIRCE Team. At the same time, I started adding the complex area of skills, skills gap and skills development to the project. I participated in the RUN-EU FASA webinar titled “Future Skills”.

As a coordinator at the European Student Assembly, I had the privilege of contributing to a set of policy recommendations concerning the "European Year of Skills 2023." These recommendations had a direct link to the CIRCE fellowship, especially those focused on comprehensive skills surveys and the integration of Artificial Intelligence into educational processes. The alignment of these recommendations with my research topic highlighted the project's potential impact and relevance at a European level.

Stage 2: Transition and focused research (July to August 2023). The next stage of my project was focused on technological aspect of my project – blockchain technology and artificial intelligence. Late June-beginning of July was the time when a significant change in research methodology took place. I cannot say that it was not challenging, however, I became convinced that a new methodology approach was better suited to the project's time and resource constraints. August was a month of intensive productivity and focused research efforts. Literature review, which had been constantly evolving and updating, began to have a more coherent and structured form. This theoretical foundation consisted of knowledge and explored topics related to skills, skills gap and current solutions offered by businesses and governments. Throughout this process, I used AI, specifically chat GPT, to organize paragraphs and structure my thoughts, check my English and add links between paragraphs if needed. However, I did not rely on chat GPT to generate new ideas. Given the AI focus of my project, it is clear that AI has become an essential tool for successful completion of this project. August is the time when the primary data collection phase started taking place, characterized by interviews with industry professionals and students pursuing creative degrees.

Stage 3: Conclusion (September 2023). Data analysis was essential; however, it was very challenging due to the diverse nature of responses, but very meaningful for key insights and conclusions. The concluding phase of my project was the preparation of the final report and successful delivery of a CIRCE final presentation.

D. Analysis and main insights

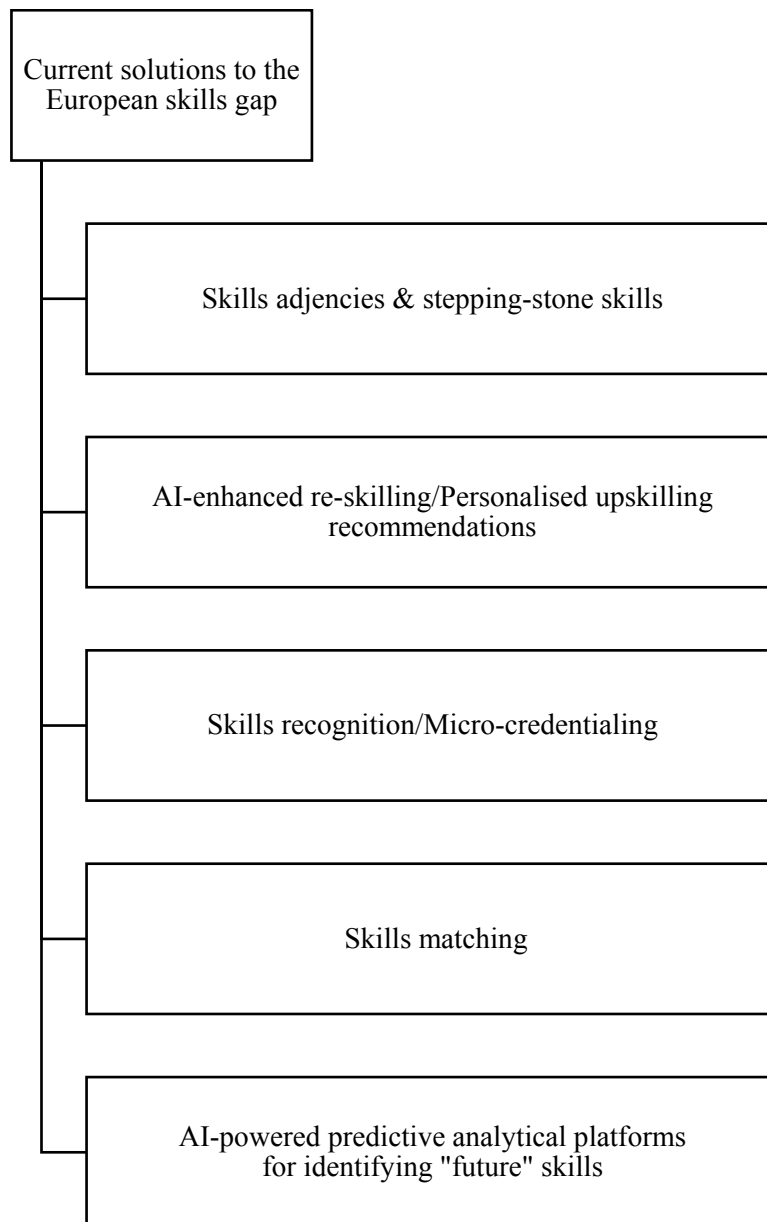
Comprehensive literature review showed that various businesses, industries and governments are working towards shortening the European skills gap. Their efforts include but not limited to an increase in the amount of investments in adult learning, re-skilling and upskilling of company's employees, supporting talent mobility programmes and digital training, focusing on digital skills needed in the modern workforce.

Industry Focus

The results of interviews with industry participants provided valuable insights into the challenges faced by companies in finding qualified specialists. As I expected, all participants confirmed experiencing difficulties in locating qualified specialist. Surprisingly, the nature of these challenges varied significantly. While some answers pointed to a lack of job-related skills, especially concerning the use of particular technologies, others highlighted the absence of a particular "soft" skill-set. Several respondents highlighted that fresh graduates who apply for jobs often lack real practical skills and what is worse, some educational programmes do not align with the industry needs. 60% of the respondents believe that the lack of qualified specialists is due to the factors such as technological advancements and digitalization in general. It is important to notice that these 60% are related to corporate companies that preferred to hire a new specialist rather than investing in the upskilling of their current employees. On the other side, 40% (start-ups) invested into current employees and provided them with an opportunity to learn and grow inside the company based on the organization's needs. I would also like to mention that none of the respondents used the term "skills gap" in their responses, what may mean that industry professionals describe and understand these challenges in different ways.

As I progress with this project, I came across various solutions to the skills gap that have been proposed by various industries, businesses and researchers. Governments and European Institutions have also introduced a number of policies and initiatives aimed to address skills gap challenges. Main current solutions to the European Skills Gap are presented in the Figure 6 below:

Figure 6: Current Solutions to the European Skills Gap



Source: made by the researcher

1. Skills adjacencies and stepping-stone skills

One of the approaches to address the skills gap is to identify and leverage skills adjacencies (Gartner, 2020). Adjacent skills can be defined as skills related to other skills in one way or another. Employees with a particular skill would more likely have or be familiar with these other related skills. This approach means that employees should not necessarily look for a candidate who is defined by a job role and responsibilities, but rather one with the skills which are necessary to perform the work tasks. Let's take an example of skills adjacent to programming language skills. Employees who are skilled in programming languages are more

likely to be skilled in new/evolving programming languages, blockchain development, cloud computing, web development. For example, organizations could target employees with the more common skill of Python to upskill rather than focus on acquiring the rarer, more expensive skill of blockchain development. This is a valuable option in today's challenging labour market. Candidates might not have the required "role experience" but have the skills that allow them to more quickly upskill toward the skills required for a given role.

Another interesting approach (Gartner, 2020) is closely related to the idea of adjacent skills. It has been proposed to leverage stepping-stone skills to provide cross-function mobility. Let's take an example of IT and marketing departments. Data analytics bridges the two collection of skills as it relates to both programming languages and marketing analytics. This "bridge" means that employee from the marketing can be upskilled more easily into programming languages. Once skilled in data analytics, it is a more direct progression to becoming skilled in programming. For the employer, it can also be cheaper to upskill an employee from marketing and higher someone new for this department, then look for a highly demanded today – programmer.

2. AI-enhanced re-skilling/Personalized upskilling recommendations

IBM's analysis showed that traditional learning and training methods are not suitable for today's fast-changing world. It used to take 3 days to learn a new skill, now it takes 36. Therefore, IBM, advocates for a holistic, data-driven approach to reskilling, with artificial intelligence at its core (IBM, 2019b). IBM is using analytics and AI to predict and infer what skills are available throughout the organization and transparently share that information with employees to drive a culture of continuous learning. This AI-approach assists organization in closing skills-related gaps.

3. Skills recognition/micro-credentialing

Micro-credentials are gaining momentum as flexible and targeted tools for individuals to enhance their skills. The European university strategy outlines various measures aimed at cultivating advanced and resilient skills among diverse learners, including those engaged in lifelong learning, with the Council Recommendations on Individual Learning Accounts and Micro-credentials facilitating skill-set updates and enhancements through adaptable and focused approaches, demonstrating government interest in these initiatives (European Commission, 2021b). IBM now uses a blockchain system to check and share educational and job qualifications, which makes things more secure and transparent, speeds up verification, and

could help bridge the skills gap by providing a dependable way to confirm skills and qualifications (IBM, 2019a).

4. Skills matching

The launch of an EU Talent Pool and Talent Partnerships with chosen third parties will aid in aligning candidates' skills with the labour market demands in Europe. Belgian initiative “Be The Change” offers the DigiSkills Passport, a tool providing every individual with insights on the digital skills and the training pathway linked to their unique needs and ambitions (DIGITALEUROPE, 2020).

5. AI-powered predictive analytical platforms for identifying “future” skills

Identifying skill gaps and predicting future jobs is one of the areas where AI's impact is particularly significant. For example, the Belgian association Agora manages the “Be The Change” project, which uses AI algorithms to analyse the consequences of digitalization on the emergence and disappearance of jobs, as well as the evolving skill requirements on a national scale. This analytical model enables the prediction of the effects of policy and social measures on the structure of the Belgian labour market (DIGITALEUROPE, 2020). Similarly, since 2020, the Public Employment Service Austria has used algorithmic profiling of job seekers to enhance the efficiency of its counselling process and the effectiveness of active labour market programs. This system, referred to as the AMS algorithm, relies on a statistical model to categorize AMS clients into three groups: those with a high likelihood of finding a job within six months, those with moderate prospects, and those with limited employment prospects over the next two years (Allhutter et al., 2020). In another example, Germany's Ministry of the Interior, Building, and Community has initiated an interagency network aimed at identifying future skill requirements, reskilling existing employees, and recruiting new specialists within the public sector.

It can be seen that the analysis of different strategies and case studies has shown some promising approaches, however, I have not found any evidence confirming the use of both technologies, despite their individual potential in addressing the skills gap. Therefore, I propose several innovative solutions, incorporating fully both blockchain technology and artificial intelligence, which are shown in Table 3 below:

Table 3: Potential Solutions to the European Skills Gap

Concept	Brief Explanation
Credential Verification and Transparency	BT securely stores skills/degree certificates, making them unchangeable and trustworthy. AI then matches these certificates to job requirements, ensuring that right people get the right jobs.
Personalized Learning Paths	AI understands what individuals need and their learning preferences. BT securely keeps a track of records (courses, achievements). AI and blockchain create personalized learning paths, helping individuals acquire the specific skills needed for certain jobs.
Credentialing and Micro-Credentials	BT can enable the creation and validation of micro-credentials for specific skills or achievements. AI can assist in the assessment of these micro-credentials to determine their relevance and value in the job market.
Predictive Analysis	AI can analyse labour market trends and predict future skill demands. BT can store this predictive data securely. Together, they can help educational institutions and training providers align their offerings with the skills needed in the job market.
Marketplace for Skills	BT can facilitate the creation of a decentralized marketplace for skills, where individuals can offer their skills, verified through blockchain and AI can match these skills with job opportunities.
Lifelong Learning Records	BT can maintain a lifelong learning record for individuals, while AI can help individuals interpret and utilize this record to make informed decisions about their career paths and skill development.

Source: made by the researcher

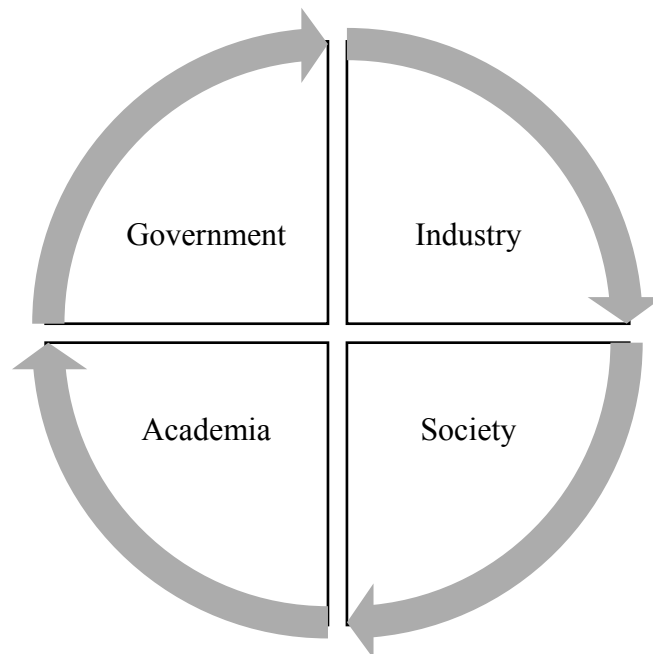
Further research into the integration of these technologies in practical contexts is essential to fully understand their impact and potential benefits. Therefore, these proposed solutions present a roadmap for future investigation.

Creativity Focus

Key insights gained from the interview with creative students show the following trend: 100% of participants are fully satisfied with the creative skills obtained during their degree programme. However, there were concerns in relation to their employment prospects. Students highlighted the problem of lacking skills, which they believe, are essential for their future. For example: entrepreneurial skills (students do not know how to set up a business), social media skills, in particular brand creation and marketing (students do not possess skills to promote themselves as artists or their work), digital skills, as well as proficiency in some other area, even such as financial management.

To address this challenge, there is a growing need in fostering dialogue and collaboration among the main “players” of the “skills development ecosystem”, which are shown in Fig. 7, so to ensure that educational curricula is aligned with the evolving needs of industries.

Figure 7: Skills Development Ecosystem



Source: made by the researcher

One of the successful cases I can share with you is a fruitful dialogue and collaboration between the Government of Ireland, South East Technology University (SETU) of Carlow and young

people, which resulted in offering Irish first “influencer” degree. Government and university representatives understood the needs and wants of the society, as well as the market conditions, and created Bachelor of Arts in Content Creation and Social Media degree. This course will equip students with the skills needed to become successful influencers, brand and content creators, focusing on both – business aspects of content creation and technical skills, such as video and audio editing.

I personally believe that this collaborative approach facilitates the creation of curricula that not only equips students with essential skills, but also empowers them to navigate in a rapidly changing job market, leading to economic growth and societal sustainable progress.

E. Linking back to CIRCE

The rapid and transformative impact of technology, digital and social transformation; impact of Brexit on industries and societies, as highlighted in my project, resonates strongly with the objectives of CIRCE. The Creative Impact Research Centre Europe is uniquely positioned to address the challenges presented by these disruptions, particularly within the cultural and creative industries. With its interdisciplinary approach and international network of experts and research labs, CIRCE can provide valuable insights into adapting to new challenges and opportunities. By focusing on policy support for the creative economies in Europe, CIRCE can play an important role in guiding individuals, industries and countries through the necessary adjustments to navigate the evolving landscape. European Year of Skills 2023, presents a parallel objective to CIRCE's mission. By acknowledging the importance of skills development and recognition, the Commission demonstrates an understanding of the complex link between skills and the resilience of industries facing disruption. The shared recognition of the skills gap between individuals and employers, as emphasized in both my project and the European Commission's initiatives, establishes a natural alignment between CIRCE's mission and my project's goals. My fellowship at CIRCE enables my project to make a significant impact on skills development and cultural industry resilience during the European Year of Skills 2023 and beyond, aligning with broader efforts to enhance the cultural and creative industries across Europe.

My research into the potential of AI and blockchain to address the skills gap in Europe aligns, especially with the project of Sergej Bogatinoski – SkillGenius and Lezo. SkillGenius empowers individuals in cultural and creative industries through AI-powered tools for skill enhancement and job hunting. Similarly, Lezo's personalized AI career guide targets IT and creative professionals, facilitating career transitions. My work complements these efforts by exploring how AI and blockchain can address skills gaps not only at the individual level but also on a broader scale, contributing to a more comprehensive approach to skills development in Europe.

I believe that my research makes significant contributions to CIRCE's goals by offering insights and innovative proposals into the use of blockchain and AI technologies to address the skills gap in Europe. These insights may inform the development of new policies and initiatives within CIRCE and beyond. Also, this project highlights the critical role of the cultural and creative economies in navigating through unfamiliar contexts. The use of blockchain technology and AI in skills validation benefits individuals by enhancing their employability

prospects and it also contributes to the overall resilience of Europe's cultural and creative sectors. This technological synergy helps to match skills with industry needs, as well as promote skills development, which are both necessary for shorten the skills gap.

My research insights have direct implications for policy making. They highlight the need for policies that facilitate the integration technologies into skills development initiatives. Policymakers can leverage my findings to design and implement forward-looking strategies that promote lifelong learning, skills recognition and workforce resilience within the cultural and creative sectors.

Policy recommendations:

1. I propose that the European Commission creates an AI-based skills forecasting solution built on the blockchain platform, which will be implemented by all EU member states. Development of AI-powered system that can analyse various data sources to forecast future skill demands across different industries, sectors, regions and countries in Europe would allow policymakers, educational institutions, industry representatives and individuals (job seekers, future students and etc.) to have an access to an accurate and updated information about the skills, professions, jobs needed/predicted to be needed in the job market. Using blockchain technology as a foundational platform, which is secure, tamper-proof and transparent, would allow all stakeholders to trust data stored on it.
2. I propose that the European Commission integrates digital creative skills and other relevant business skills (for example, entrepreneurial skills) into the curricula of Higher Education Institutions. This integration ensures that the students graduate with a strong knowledge of digital tools and technologies relevant to industries that heavily rely on digital innovation, including creative industries.

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