EBSI-VECTOR
Education and work reloaded

D2.1: Needs Assessment Report

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2.1	24.04.2024	KU Leuven	Reported in section 5 the EBSI Team feedback about the results of the survey

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List of Terms and Abbreviations

Abbreviation	Definition
API	Application Programming Interface
BCT	Blockchain technology
CTO	Chief Technology Officer
DEP	Digital Europe Program
DeReg	decentralized registries
DID	Decentralized Identifier
DLT	Distributed Ledger Technology
EAP	Early Adopters Programme
EBP	European Blockchain Partnership
EBSI	European Blockchain Services Infrastructure
EDIC	European Digital Infrastructure Consortium
eIDAS	Electronic Identification, Authentication and Trust Services
ESSIF	European Self-Sovereign Identity Framework
EUDI	European Union Digital Identity
GDI	Geographic Data Infrastructure
GDPR	General Data Protection Regulation
HEI	Higher Education Institutions
IT	Information Technologies
PKI	Public Key Infrastructure
QEAA	Qualified Exchange Accommodation Arrangements
QES	Qualified Electronic Signatures
QSeal	Qualified Electronic Seal Certificates
QTSP	Qualified Trust Service Provider

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SQL	Structured query language
TAO	Trusted Authorized Organization
TI	Trusted Issuer
VC	Verifiable Credentials
VP	Verifiable Presentations
WP	Work Package

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Executive Summary

The EBSI-VECTOR project aims to harness the capabilities of the European Blockchain Services Infrastructure (EBSI) to advance education and social security use cases across European countries by leveraging blockchain technology, Verifiable Credentials (VC), and the European Self-Sovereign Identity Framework (ESSIF).

This report analyses legal, technical, institutional and organizational gaps within use cases and countries at various implementation levels. Utilizing an online survey targeting experts within the European Blockchain Partnership (EBP) and other stakeholders actively contributing to the EBSI ecosystem, the report presents findings on the implementation needs of the EBSI and its use cases.

The survey provides insights into respondent profiles, awareness levels, and knowledge regarding EBSI and its technological solutions. It explores blockchain, EBSI, and country-specific needs related to institutional, technical, organizational, and regulatory aspects, including specific requirements of education and social security use cases.

Key challenges identified encompass capacity constraints, regulatory uncertainties, and bureaucratic resistance. Recommendations are provided to address these challenges, highlighting the importance of strategic decision-making, stakeholder engagement, and sector-specific requirements to support successful EBSI integration in education and social security domains.

Through a comprehensive analysis of stakeholder perspectives and sector-specific needs, this report aims to inform strategic decision-making and facilitate the successful integration of blockchain technologies in education and social security domains within the EBSI-VECTOR project.

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1 Introduction

The EBSI-VECTOR project aims to harness the existing capabilities of the European Blockchain Services Infrastructure (EBSI) to advance education and social security use cases across European countries. By leveraging blockchain technology and the concepts of Verifiable Credentials (VC) and the European Self-Sovereign Identity Framework (ESSIF), the project aims to empower citizens with greater control over their data, facilitate student mobility and employment opportunities across Europe, combat fraud, enhance trust and security, and streamline the verification of data authenticity.

The main objective of EBSI-VECTOR is to prepare European countries and stakeholder organizations for the full implementation of the EBSI use cases in cross-border settings. Within the project framework, Work Package 2 (WP2) focuses on evaluating institutional, technical, and user-level needs to support the implementation of ESSIF and VC in education and social security use cases. The primary objective of WP2 is to identify existing needs among use case implementers and public officials, informing subsequent activities aimed at drafting interoperability, uptake, and scaling-up strategies at both use case and country levels. These insights also inform the development and implementation of technical solutions across WP3, WP4, and WP5.

This report forms part of Task 2.1, the Institutional Needs Assessment. Task 2.1 aims to analyse the legal, technical, institutional, and organizational gaps within the use cases and countries at various implementation levels. It focuses on compiling and analysing input from stakeholders, including beneficiaries, associated partners, and affiliated entities, from the participating countries and use cases.

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Methodologically, this report draws on data collected through an online survey targeting experts within the European Blockchain Partnership (EBP), Early Adopters Programme (EAP), and other policymakers and technical specialists actively contributing to EBSI ecosystem development. We estimate that our total targeted audience consists of approximately 150 individuals who either participated in the EBP policy or technical groups or have been part of the EBSI projects in the Early Adopter Programme or related DEP projects.

We contacted these experts through the institutional channels of the EBSI and the project team. By gathering insights from stakeholders with expertise in EBSI blockchain, technical aspects, and policy-level processes, our aim was to identify technical, socio-political, administrative, institutional, and sector-specific challenges that could influence implementation strategies.

The survey contains questions using 5-point Likert scale, where 1 indicates the lowest and 5 indicates the highest degree of agreement. Additionally, it includes semi-structured questions. Likert-scale questions aim to identify the overall sentiment and readiness across Europe, while open-ended questions aim to gain further insight into the expectations and ideas of the respondents. The questionnaire can be found in the Annex.

The subsequent sections of the report present findings from the online survey, beginning with an overview of respondent profiles and their awareness and knowledge levels regarding EBSI and its technological solutions. The report then delves into country-specific institutional, technical, organizational, and regulatory needs related to blockchain technologies and EBSI solutions. Following this, separate sections explore the specific needs of education and social security use cases.

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The last section of the report offers a comprehensive analysis of identified needs through expert opinions and provides recommendations for addressing key challenges in the implementation of EBSI use cases. Through a holistic examination of stakeholder perspectives and sector-specific requirements, the report aims to inform strategic decision-making and support the successful integration of blockchain technologies in education and social security domains.

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2 Profile of the respondents

2.1 Country profiles

We have gathered survey responses from 16 different country cases, and one respondent from the EU institutions, totalling 33 responses. Considering the total number of reached experts, we assess to have achieved a response rate corresponding to 20% of the total number of individuals who have direct expertise with the EBSI blockchain and functionalities.

Among the country cases, Italy, Germany, and Spain have the highest weight in overall responses. However, the distribution of country cases across respondents is rather well-balanced, indicating a representative sample that covers a broad spectrum of European countries.

Table 1 gives a breakdown of respondents based on their country profiles.

Table I. Country profile of the respondents

Country Name	Number of respondents
Italy	5
Germany	4
Spain	4
The Netherlands	3
Romania	3
Slovenia	2
France	2
Austria	1
Belgium	1

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Croatia	1
Cyprus	1
Denmark	1
Luxembourg	1
Norway	1
Poland	1
Sweden	1
European Commission	1

2.2 Individual and organizational profiles

In assessing the representativeness of our survey data, we ensured a balanced inclusion of participants from different sectors. With 18 respondents from the public sector, 13 from the private sector, and 2 from other sectors, our dataset reflects a diverse array of organizational backgrounds.

Grouping the positions by profile stated by the respondents, we can identify several categories:

Project Management and Coordination in EBSI projects: Project Manager**,** Junior Project Manager**,** Technical Project Manager**,** Assistant Director, Task Manager

Technology and Development: Chief Technology Officer (CTO)**,** IT engineer, Enterprise architect

Governance and Administration: Deputy Head of the Planning and Governance Department of Digital Administration**,** Deputy Head of Institute of Informatics**,** Head of Digital Identity & Trust and Standardization Expert**,** Head of Digital Identity & Trust

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Identity and Security: Identity Head, Commercial Director in a digital signature company, Innovation specialist in a Qualified Trust Service Provider (QTSP)

Research and Education: Founder, Researcher (multiple instances), University Lecturer

Policy and Advisory: EU Policy Advisor, DLT/blockchain policy advisor, Strategic Advisor (Technical) Innovation for Tax Compliance, Policy Officer

EBSI-Specific Roles: EBP National Point of Contact**,** National Representative in EBSI Tech Group

Sales and Product Management: Product & Sales Manager**,** CEO (multiple instances)

These categories do not need to be exclusive, as the respondents may fit into several different categories. However, this categorization helps provide an overview of the diverse roles represented in the dataset, showcasing a mix of technical, managerial, academic, and advisory positions across various sectors and domains.

2.3 Knowledge base

In our survey, we asked people to rate how well they understand things like blockchain technology (BCT), European Blockchain Services Infrastructure (EBSI), verifiable credentials (VC), and decentralized registries (DeReg) (see Q1.4 to Q1.7). We specifically chose participants who already have some experience with blockchain and EBSI, expecting them to have a good grasp of these topics.

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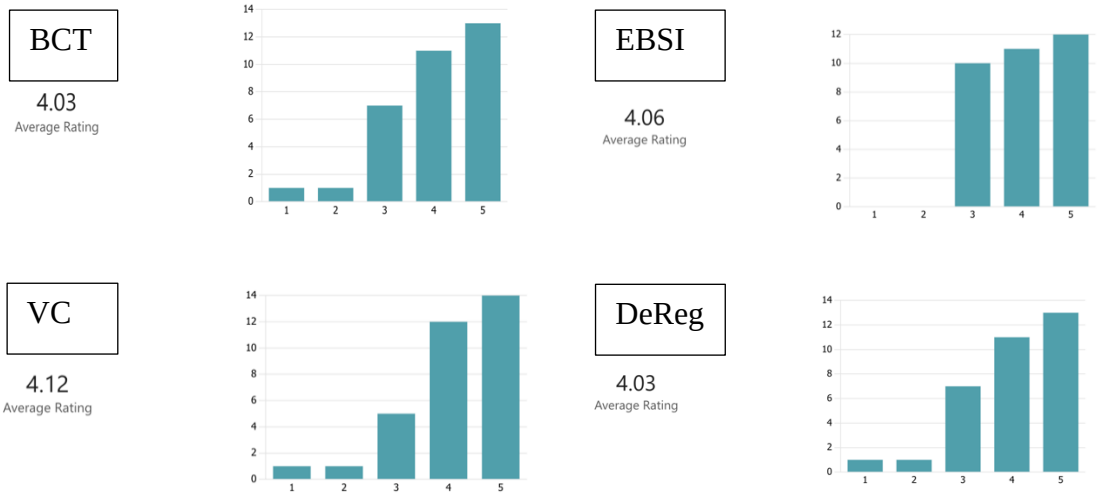
As expected, most respondents feel pretty confident about their knowledge of BCT, EBSI, VC, and DeReg. However, it's interesting to note that a small group of participants indicated they don't feel as comfortable with these concepts, offering a diverse perspective in our findings.

Figure 1. Knowledge base of respondents



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3 Country-level needs

In this section, we take a close look at how well countries are prepared to adopt EBSI blockchain in their public services. We've broken down the assessment into different areas, such as legal and regulatory readiness, organizational capacity, institutional preparedness, and the state of technical infrastructure and interoperability. Our goal is to provide a cross-sectional overview of the countries' readiness to implement the EBSI blockchain and its use cases. The analysis delves into specific challenges within each area, providing insights from expert opinions on overcoming identified obstacles.

Due to the limited representativeness of the informants from the country cases, the report does not include a country-specific needs assessment. This task will be addressed as part of the research activities conducted in T.2.5. National implementation strategies.

3.1 Legal / Regulative

The findings presented here aim to provide a closer look at how countries are prepared, both in terms of their overall legal framework and specific regulatory challenges, to embrace the EBSI blockchain.

Figure 2 provides an overview of the general legal and regulatory readiness of the surveyed countries. The respondents were asked to rate their country's legal framework for blockchain implementation (see Q.2.1). Overall, the surveyed countries reported an average level of readiness in their legal/regulatory framework to implement the EBSI blockchain, whereas several respondents reported low-level of readiness suggesting some lingering regulative issues need to be solved.

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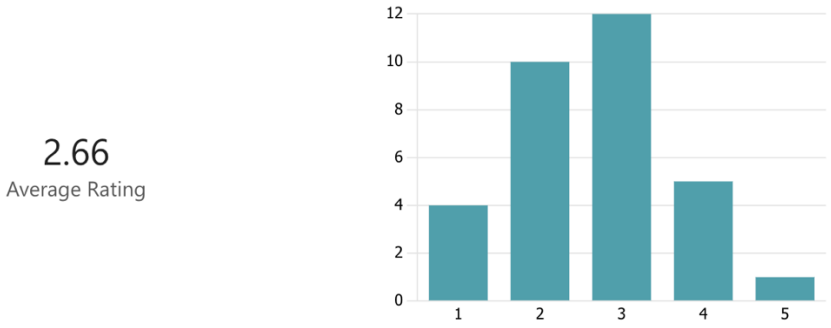
Figure 2. Readiness of the legal framework



To get a better understanding of the legal and regulatory challenges, we asked the respondents for further elaboration. While a few respondents reported that they lack the knowledge to share the specific challenges, we received 20 different responses to the specific challenges on legal/regulatory areas. Below we present a synthesis of the specific challenges reported:

1. **Case-Specific Conditions:**
    - Respondents acknowledged the complexity of answering the question directly, emphasizing that it depends on the practical application of EBSI solutions. This indicates that legal considerations are contingent on the specific use cases and sectors where EBSI is applied.
    - In the context of education, specific legal requirements were identified. For example, a suggestion was made for Spain that a Royal Degree needs updating to include the format of VCs and jADES eSEAL, both based on the EBSI.

2. **Country-Specific Conditions:**
    - In the case of Poland, it was noted that the country has advanced legal solutions for digitalization. Projects like diploma recognitions face no legal obstacles.

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However, challenges arise in sectors where centralized registers are prevalent, and the decentralization aspect of blockchain is not fully utilized.

- The Netherlands highlighted their legal and regulatory considerations, including the implementation of eIDAS2 as a trust system using DLT. Additionally, regulatory aspects such as cloud policy development for risk assessment, an Identification/Authentication Framework, and adherence to the Geographic Data Infrastructure (GDI) Framework were mentioned.
- The Italian legislative system was cited as having a high level of bureaucracy. The need for a regulatory system suitable for adopting blockchain technology was emphasized, indicating potential challenges in adapting the existing legal framework.
- Germany expressed restrictions on the utilization of DLT until there are European/International standards for proven security and trust. The stipulated standards include cryptographic measures, mitigation of threats, certification on operations & maintenance, governance, interfaces/formats, and cryptostability. Certification of DLT providers was identified as a necessity, aligning with eIDAS requirements and the European Union Digital Identity (EUDI) Wallet.

3. **Lack of Regulations/ Clarity at the EU Level:**
    - Issues were raised about the absence or inadequacy of regulations in certain areas. For example, challenges were noted in the legal recognition of blockchains as distributed sources of trust and the acknowledgment of VCs as legally valid proofs.
    - Concerns were expressed regarding the regulatory environment at the EU level. Specific issues included uncertainties related to GDPR and eIDAS, as well as the delegation of responsibilities to states depending on jurisdiction.

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4. **Policy and regulative framework in progress:**
    - A few countries mentioned that they are actively formulating policies to accommodate blockchain technology. This indicates that legal frameworks are evolving in real-time to keep pace with technological advancements.

5. **Resistance from Stakeholders:**
    - Although not entirely specific to the legal challenges, some respondents reported stakeholder resistance for blockchain implementation, while certain entities outright denying the use of blockchain technology. Reasons for this resistance varied, including scepticism about the technology being overhyped. Despite this, some public institutions were reported to be experimenting with blockchain.

In summary, respondents exhibit an average proficiency level in legal aspects related to the implementation of the EBSI blockchain. However, specific insights can be gleaned from their feedback.

Firstly, numerous respondents underscore the imperative need for clarity in EU laws, particularly regarding eIDAS and GDPR. These critical topics are currently undergoing evaluation within the European Blockchain Regulatory Sandbox in collaboration with the EBSI Vector project. The initial consultation rounds on both subjects are anticipated to take place in March and April 2024.

Secondly, respondents express uncertainties and a degree of ambiguity regarding the regulatory compliance of blockchain technologies and EBSI concerning other technological regulations (such as cloud policy, GDI, EUDI, etc.). These areas demand further attention to establish legal clarifications. While the EBSI Vector team is actively enhancing collaboration with DEP projects

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and initiatives focused on EUDI wallet and eIDAS 2.0, there may be a need for a more consolidated effort from EU and national policymakers to address legal uncertainties related to other complementary technologies.

Thirdly, country-specific resistance and hesitations emerge based on the interpretation of existing laws and policy priorities. These factors appear to influence the willingness to adopt blockchain technologies and implement EBSI use cases. This is observed both on a broader scale, as in the case of Germany, and in more specific contexts, limiting the adoption of technology in less complex application areas, such as education in Poland. For a more extensive implementation of EBSI solutions in various public sector domains, a modular engagement approach is evidently required to comprehend the regulatory hesitancies and uncertainties stemming from specific application domains.

3.2 Institutional readiness

In this section, we delve into the institutional readiness of the country cases to adopt the EBSI blockchain. The findings give a snapshot of the institutional support and readiness across the surveyed countries.

Figure 3 shows respectively the level of support and collaboration from relevant government institutions, and the readiness of relevant government institutions to accommodate EBSI in their current digital infrastructure (Q2.3 and Q2.5). Both diagrams suggest that respondents perceive an average level of institutional readiness, whereas no respondent perceives that their country's digital infrastructure is fully ready to adopt EBSI blockchain. Most respondents report a lower level of institutional readiness across the country cases.

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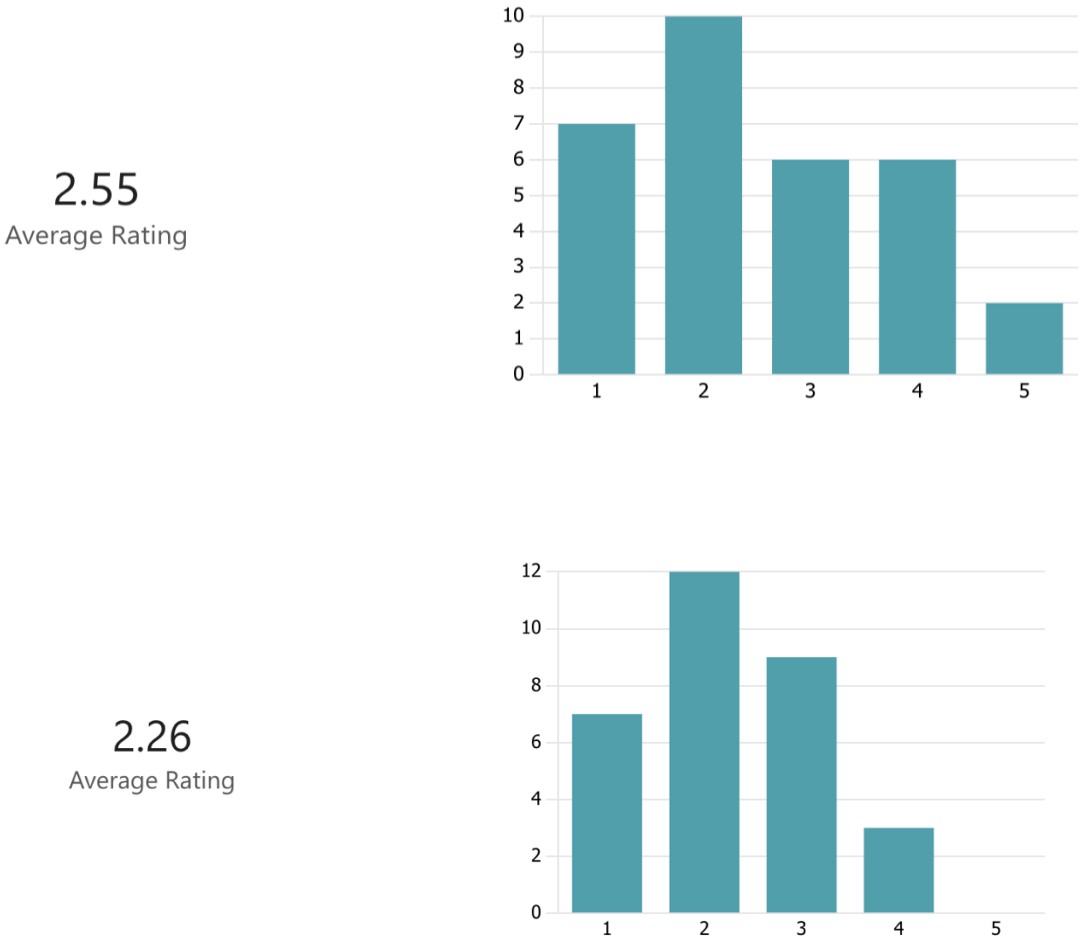
Figure 3. Institutional readiness



We probed respondents for details on specific institutional supports sought for the implementation of EBSI solutions, uncovering three distinct categories of support needs.

1. **Technical Support:** Many respondents expressed the need for technical assistance from EBSI institutions for both public and private authorities. Requests ranged from providing toolkits for public authorities to facilitate seamless integration with existing information

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systems in automating governance accreditations, to aiding small startups with implementation and conformant tests. Additionally, there's a desire for support in getting EBSI nodes operational and running, coupled with comprehensive training and knowledge-sharing initiatives for public authorities.

2. **Institutional Alignment and Coordination:** The second type of support revolves around institutional alignment and coordination. Respondents highlighted the importance of aligning EBSI solutions with the new eIDAS regulation, especially integrating with the new EUDI wallet. Other requests included establishing open lines of communication for EBSI support functions, fostering technological openness, encouraging cooperation among concerned public bodies through specific use cases, and establishing a trust chain among involved authorities.
3. **Overcoming Bureaucratic Resistance:** The third category of requests focuses on overcoming bureaucratic resistance within national authorities. Respondents emphasised the need for motivation among institutions to utilize EBSI nodes, citing early use cases such as the integration of diplomas for full system integration. Notably, German public authorities appear cautious about adopting new technological solutions, particularly after the challenges faced by the Online Access Act (Onlinezugangsgesetz). Convincing German authorities, including the National Cybersecurity Authority, about the security and reliability of EBSI solutions is identified as a crucial step for broader utilization in the country.

3.3 Organizational

Not only the institutional readiness, but also the organizational fitness of the public sector is an important condition in the implementation of the EBSI use cases. Regarding the organizational needs, we asked the respondents to assess the fitness of the EBSI with the organizational culture

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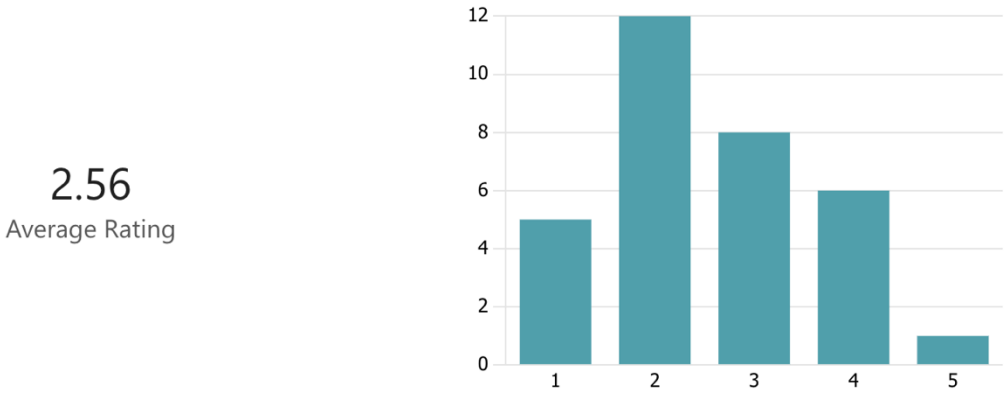
of relevant governments institutions (Q2.6). With an average rating of 2.56, the respondents evaluated an average readiness about the fitness of EBSI with the existing organizational culture in government institutions (see Figure 4).

Figure 4. Fitness of organizational culture



We have further inquired whether the country cases have a dedicated team or unit responsible for blockchain initiatives in the public sector (Q3.1). 23 out of 31 respondents positively responded to the question, suggesting that most of the country cases in Europe have a dedicated team.

Another question (Q3.2) aiming to assess the level of blockchain expertise within the public sector received an average rating of 2.39 (see Figure 5), suggesting that most of the country cases lack a certain level of human resource readiness within the public sector regarding blockchain.

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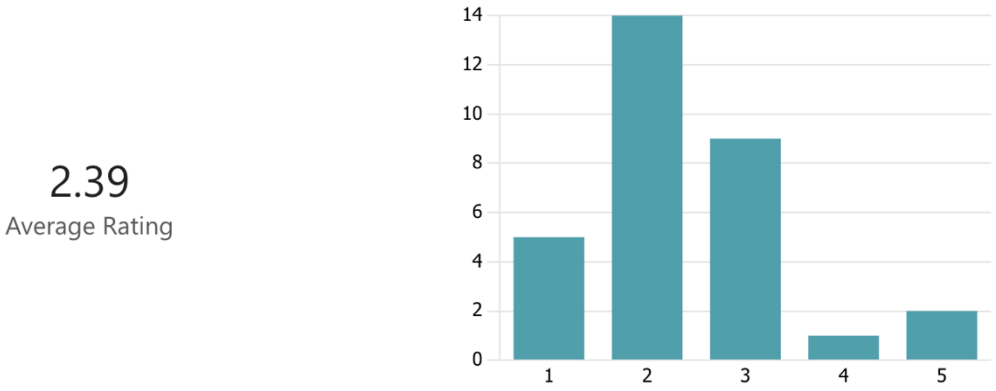
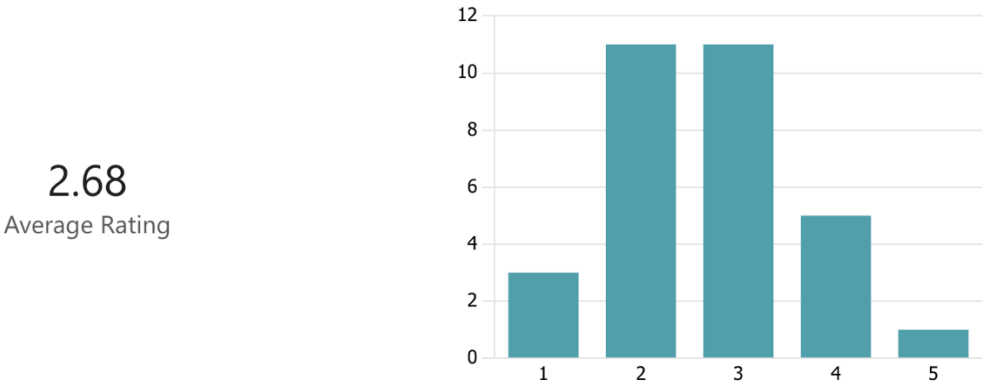
Figure 5. Blockchain expertise in the public sector



In a more specific question (Q4.5) focusing on the use of blockchain technology for the verification of credentials, we asked the respondents to assess the willingness of their government to integrate blockchain technology for the verification of credentials. Once again, the respondents evaluated an average level of willingness (2.68 out of 5) to integrate blockchain technology for the verification of credentials (Figure 6).

Figure 6. Willingness to use BCT for verification of credentials



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The overall assessment of the organizational readiness of the public sector in Europe suggests that there are a variety of organizational barriers among the country cases which is affecting public sector's willingness to implement blockchain solutions despite the presence of a dedicated team in the public sector on blockchain technology.

We asked respondents to provide more details about the organizational challenges or resource constraints related to adopting blockchain technology. Their responses pointed to several key organizational issues such as organizational support from EBSI, financial issues, knowledge, awareness and capabilities in the public sector, organizational culture and resistance in the public sector, coordination mechanisms, and strategies in public sector innovation. Below we outline the feedback we received for each dimension:

1. **Organizational Support from EBSI:**

- There is a need for toolkits for Trusted Authorised Organizations (TAOs) and Trusted Issuers (TIs) for onboarding EBSI solutions.
- The absence of a production blockchain for registering metadata is noted.
- Certification of Distributed Ledger Technology (DLT) providers as Qualified Trusted Service Providers (QTSP) according to Section 11 eIDAS or other QTSP certifications is required.

2. **Knowledge, Awareness, and Capabilities:**

- Challenges include a lack of information on blockchain technology and the need for capability development, including demonstrations, testbeds, and portfolio resourcing.
- It was noted that the core challenge in Germany lies in a lack of understanding of digitalisation foundational elements and the absence of comprehensive knowledge,

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effective collaboration, and political leaders with a profound understanding of digitalisation.

- A call for informed individuals with vision and courage to drive technology adoption is emphasised.
- The necessity for greater awareness to boost adoption is acknowledged.
- One respondent noted that the development of the digital diploma system currently plans to use a simple PDF with a digital signature despite the first major adoption of blockchain technology in the public sector aiming to be in the verification of education credentials.

3. Organizational culture:

- Several respondents pointed out that existing IT systems in the public sector have centralised registries, and resistance is noted among IT experts and specialised experts in moving to decentralised registries. Relatedly, some responses point out the difficulty of integrating decentralised solutions with existing centralised systems.
- Some respondents highlighted negative perceptions of the crypto sector, bureaucratic hurdles, and a mindset favouring existing centralised solutions as potential obstacles in the organizational culture.
- There is an unwillingness to adopt blockchain technology in certain countries (e.g. Germany) and sectoral contexts (e.g. in one case 'identity' is mentioned). In some cases, blockchain is not seen as essential or needed for the digitalisation of services, and there is a lack of engagement and prioritisation in the allocation of resources.
- Business-driven solutions and user experiences are recommended to overcome organizational barriers in the public sector.

4. Financial constraints:

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- A few respondents pointed out limited financial resources and slow financial inflow for EBSI projects.
- Limited resources allocated to DLT in Germany due to decisions by responsible ministries.

5. **Coordination Mechanism:**

- A few responses suggested the creation of an official intergovernmental or national office to prepare the public sector for the adoption of EBSI.
- A whole-of-government approach is recommended.
- The system requires both verifiers and issuers. To create a critical mass, a focus on issuers is suggested to create demand on the verifier's side.

3.4 Technology infrastructure and Interoperability

In this section, we explore the alignment of existing data infrastructure and systems within the public sector with the EBSI blockchain, building upon the organizational and institutional dimensions.

We initially asked respondents about the use of blockchain platforms or technologies in their country's public sector (Q4.1). Out of the 30 responses, 20 confirmed active utilisation of blockchain in public sector operations.

Subsequently, respondents were tasked with evaluating their country's technological infrastructure readiness for EBSI blockchain integration (Q4.2). The obtained average rating of 2.74 indicates that many respondents perceive their country's technological infrastructure as moderately prepared for EBSI blockchain implementation (refer to Figure 7). This finding aligns

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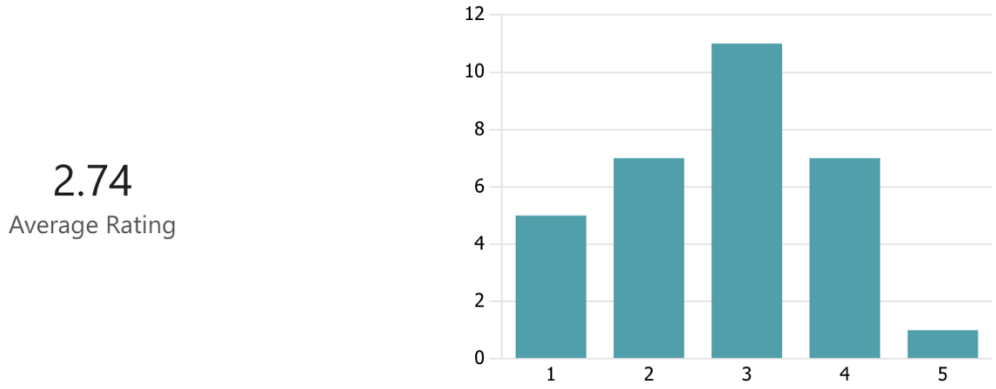
with earlier observations regarding the institutional and organizational readiness of the public sector to adopt blockchain and EBSI. It suggests that countries with prior experience in using blockchain are more likely to assess their readiness to implement EBSI technologies and use cases more favourably.

Figure 7. Readiness of technological infrastructure for EBSI blockchain



Furthermore, respondents were asked to evaluate the readiness of their technological infrastructure for integrating verifiable credentials and decentralised identity solutions (Q4.3). This assessment resulted in an average readiness rating of 2.87 (see Figure 8), indicating that countries, on average, have a foundational technological readiness for implementing EBSI blockchain and related solutions, including verifiable credentials and decentralised identity solutions.

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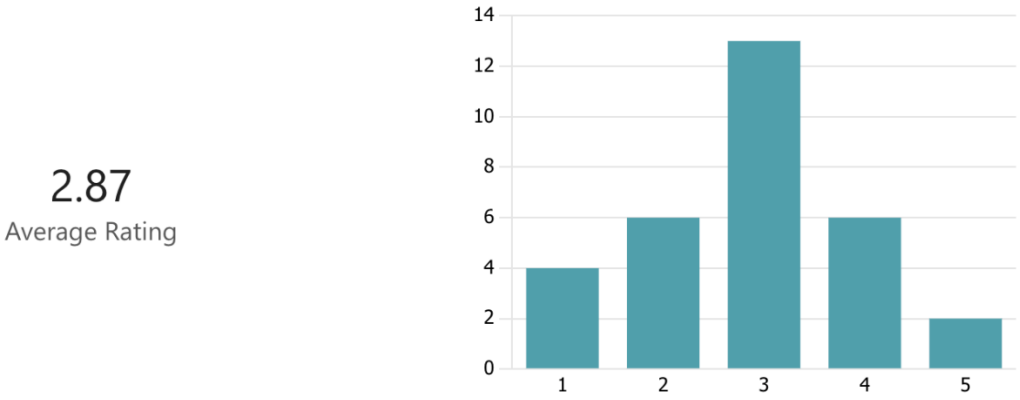
Figure 8. Readiness of technological infrastructure for verifiable credentials and decentralised identity



In our examination of EBSI implementation in the public sector of the country case, we investigated potential technical obstacles and interoperability challenges that may impact the implementation of EBSI solutions at the national level. Despite the country cases' relative technical readiness to implement EBSI and blockchain solutions, the responses indicate a range of interoperability issues affecting cross-domain and cross-institutional integration. Below, we provide a summary of our findings:

1. **Technical Interoperability:**

- Transitioning from JSON to JSON-LD encoding is suggested to enhance context in cross-domain internationalisation aspects. However, some technical experts on digital identity and wallet providers suggest that users and customers are moving away from JSON-LD due to its complexity, preferring JWT, SD-JWT, MDL solutions.
- Services need to integrate legacy and support formats alongside the new DID/VC/VP systems.
- Development of smart contracts may face restrictions, relying on the available capabilities of EBSI.

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2. **Institutional and Organizational Interoperability:**

- Seamless integration of business processes, especially cross-domain/sectors, is imperative.
- Adhering to the "get the job done principle" is crucial, particularly concerning processes involving Euros (payments, grants, etc.).
- Prioritising a 'seamless' experience for citizens or businesses is paramount.
- Cross-border applications may have restrictive requirements.
- Further development of governance, registries, and public catalogues is needed for full-service maturity.
- Transparency and audit trails are essential, specifying the underlying identities/VC/timestamps in a transaction.

3. **Regulative Interoperability & Standardisation:**

- Compliance with regulations, including eIDAS and GDPR, for off-chain data storage is recommended.
- The absence of international standards (ETSI/CEN/ISO) for certification of (qualified) electronic ledgers, according to Section 11 eIDAS 2.0, leads to the forbiddance of DLT utilisation in the public sector and critical infrastructure by the German National Cybersecurity Authority.
- Concerns were raised about differences between EBSI standards and W3C standards.
- Interoperability between EBSI ESSIF and national EUDI/eIDAS is necessary for the citizen digital wallet principle.

4. **Capacity Problems Concerning Digital Transformation:**

- Challenges include a "lack of knowledge" and "resistance."
- Misunderstanding of EBSI by the people who are in charge of developing the system.

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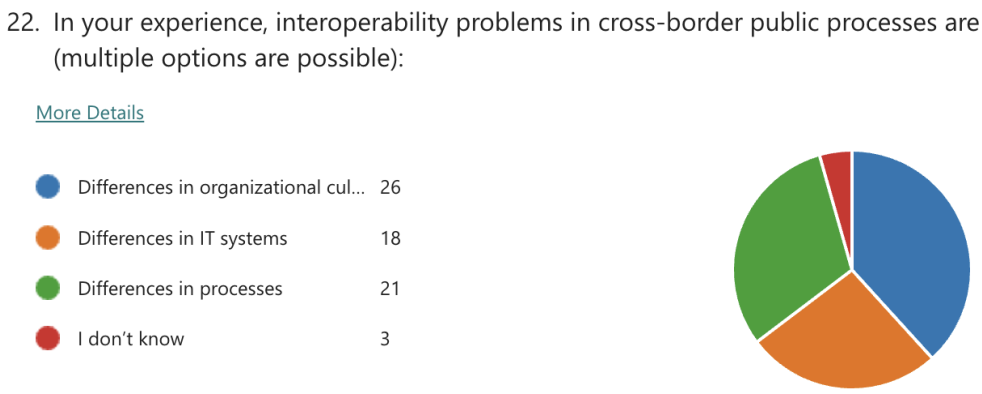
- Extensive education efforts are deemed necessary.

5. **No Issues:**

- For some, the IT infrastructure is robust, allowing for seamless integration from the start with EBSI in mind.
- A stronger general commitment is seen as key to overcoming challenges.
- Availability of an API package for interoperability, complying with regulations, eliminates technical hurdles.

We've focused not only on internal factors but also on cross-border interoperability challenges (Q4.6). Initially, respondents were presented with several options that could potentially lead to cross-border interoperability issues (Figure 9). The responses indicated a relatively equal weight in options related to organizational culture, differences in IT systems, and disparities in processes. Notably, differences in organizational culture emerged as the most frequently cited factor contributing to the challenges faced by cross-border projects in the realm of public processes.

Figure 9. Interoperability at cross-border public services



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Further investigation into the potential reasons for cross-border interoperability issues yielded similar results, highlighting challenges that span legal, semantic, technical, and organizational dimensions. Here's an overview of the reported interoperability issues in cross-border settings:

1. **Legal interoperability:**
    - Absence of foundational data exchange agreements supporting legal data exchange.
    - Addressing different regulations impacting processes.
    - Lack of harmonisation in civil and administrative law within the EU, posing challenges in defining the blockchain ecosystem.
    - Legal requirements on Permissioned vs. Permissionless, Public vs. Private, and revocation/deletion/burden of proof requirements.

2. **Semantic interoperability:**
    - Variances in the interpretation and classification of data.
    - Challenges in ensuring that parties are referring to the same subject.
    - Issues concerning data meaning and validation for building trust.
    - Discrepancies in processes, denominators, or data interpretations.

3. **Technical interoperability:**
    - Utilisation of non-standardised IT solutions.
    - Technical choices influenced by the technological preferences of involved parties.
    - Interoperability challenges of the existing eIDAS system where every country uses different protocols.
    - Interoperability challenges between SQL databases and the issuance of verifiable credentials.

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- Technical challenges in interoperability between DLT and non-DLT systems.
- Issues related to different APIs and backend systems.
- Critical need for standardisation of VC content.
- Early-stage development of cybersecurity measures for blockchain interoperability.

4. **Organizational/Institutional Interoperability:**
    - Siloed approaches within specific sectors.
    - Historical separation of domains between the public and private sectors.
    - Determining priorities in international projects and fostering support for uptake.
    - Importance of a cultural mindset and a clear understanding of EBSI.
    - Varying levels of organizational readiness.
    - Balancing automated issuance of credentials with human interaction and administrative processes.
    - Insufficient use of EU standards, such as ELMO or ELM, for education.
    - Discrepancies in commitment at the service level and differences in IT systems.

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4 Use case specific needs

In this section, we present our findings regarding the specific needs identified by respondents concerning the two use cases of the EBSI Vector project: the verification of education and social security credentials. Our aim is to assess the readiness of the country cases to integrate verifiable credentials into their existing systems for education and social security verification.

4.1 Education domain

We asked respondents to assess the readiness of their country's higher education and secondary education systems to adopt verifiable credentials (Q5.1 and Q5.2). The responses indicate that participants generally perceive their higher education systems as well-prepared to utilise verifiable credentials for student transcripts and diploma verifications. Conversely, respondents view the secondary education system in European countries as less prepared to incorporate these technological advancements (Figure 10 and Figure 11).

Figure 10. Readiness of the higher education system

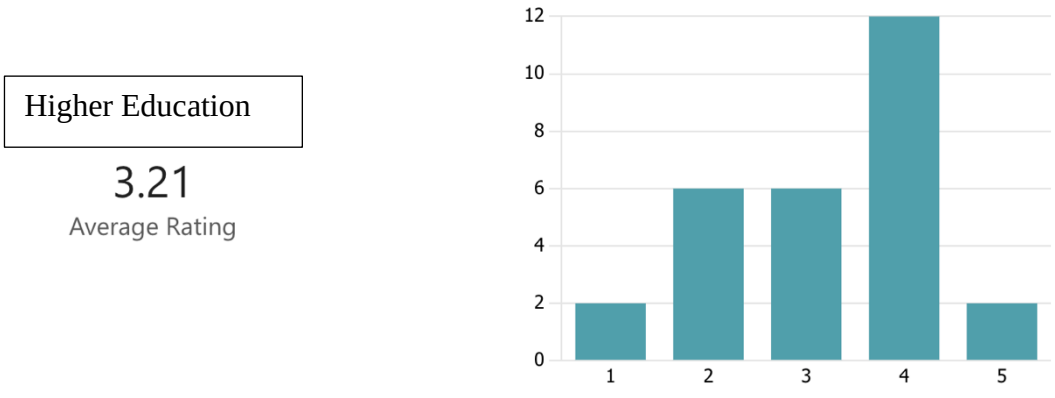

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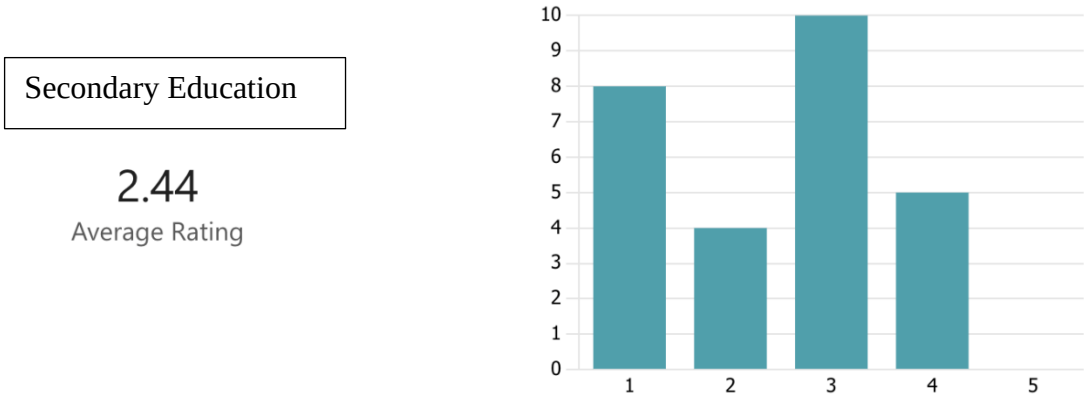
Figure 11. Readiness of secondary education system



Next, we asked respondents to highlight any specific issues requiring attention for EBSI implementation in the secondary and higher education sectors. Many responses emphasised interoperability issues related to the use of verifiable credentials in education. The following conclusions emerged:

1. **Standardisation of VC content and educational credentials:** Ensuring cross-border compatibility of educational credentials is crucial. Harmonising data and terminology facilitates comparability across borders.

2. **Harmonisation of software solutions:** It's important to harmonise various software solutions into a unified standard. This involves consensus-building on data formats, communication protocols, and security measures. Success depends on achieving interoperability among diverse systems while maintaining verification process integrity and security. Provable security requirements for QTSP using EBSI, assurances related to data privacy, standardisation of credential formats, and integration with existing education systems are necessary.

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3. **Alignment with existing verification solutions of Higher Education Institutions (HEI):** Aligning objectives of dedicated HEI software companies with EBSI integration and establishing connections between existing systems and EBSI are crucial. This effort requires compatibility and interoperability between proprietary systems and EBSI. For instance, PDFs are commonly accepted in diploma delivery chains. Establishing connections with existing chains ensures smooth integration with EBSI while maintaining acceptability.

4. **Legislative and institutional changes:** Legislative changes, especially regarding under-aged wallet holders, and institutional adaptations may be necessary to facilitate EBSI integration. Official adoption of verifiable credentials by national education systems and providing user guidelines is required. One respondent noted a lack of a centralised system to manage diplomas under the Ministry of Science and Education's control, hindering diploma digitalisation.

5. **Infrastructure, knowledge, and organizational challenges:** Overcoming infrastructure limitations, enhancing knowledge about blockchain technology, and addressing organizational challenges are critical for successful implementation.

6. **Awareness-raising activities:** Several responses emphasised the need for better publicity and marketing to stakeholder organizations and decision-makers in the education domain. Particularly, there is interest in diploma digitisation and recognition, yet awareness and knowledge of decentralised solutions appear lacking.

Lastly, respondents were asked to specify whether they anticipated differences in government levels regarding EBSI's use in verifying education credentials. While most respondents did not

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foresee differences in VC implementation across government levels, citing unifying diploma standards or cybersecurity standards, some noted administrative and capacity-level variations that could impact implementation strategies. For example, distinctive administrative setups in federal states, like in Germany, regarding policies, technological infrastructures, and administrative practices, could lead to variability in EBSI adoption and implementation in education. Additionally, distinctions across government levels in how education credentials are utilised were highlighted. While central government involvement is necessary for diploma verification, local government involvement is deemed essential for job applications and student benefits using education credentials.

Moreover, the testing and piloting of EBSI use cases occurred only at the central level, implying that implementing certain education credentials with local administrations may require additional time.

4.2 Social security domain

Unlike the education domain, the social security domain is at an earlier stage of implementing VCs and blockchain technology. Therefore, our questions focused on identifying the readiness level for using blockchain technology in the social security domain.

Firstly, we inquired whether existing social security systems or services could benefit from blockchain technology (Q6.1). Of the 29 respondents, 26 responded positively, indicating a perceived benefit of blockchain technology for social security systems in Europe.

Secondly, respondents were asked to rate public awareness and acceptance of blockchain in enhancing social security services (Q6.2). The responses overwhelmingly indicated a low level of

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public awareness and acceptance, with an average rating of 2 out of 5 (Figure 12). Similarly, respondents were asked to assess the readiness of their country's social security system to adopt blockchain technology (Q6.3). Once again, respondents reported an average low level of readiness for blockchain technology adoption in social security systems, with an average response of 2.28 out of 5 (Figure 13).

Figure 12. Public awareness and acceptance (social security)

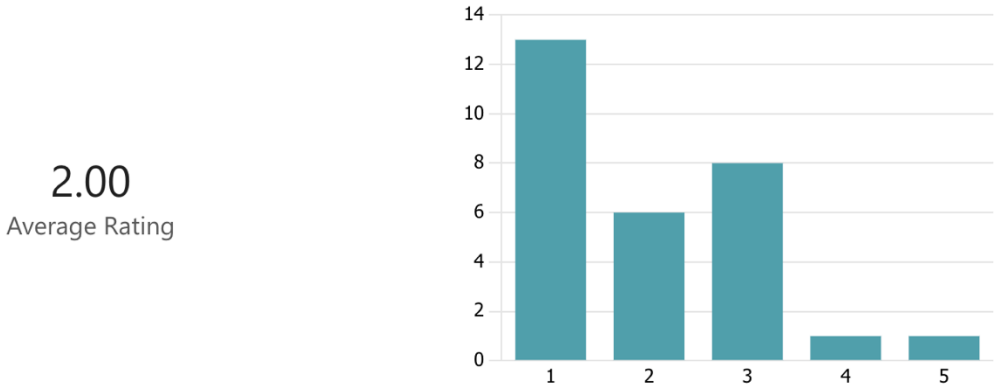
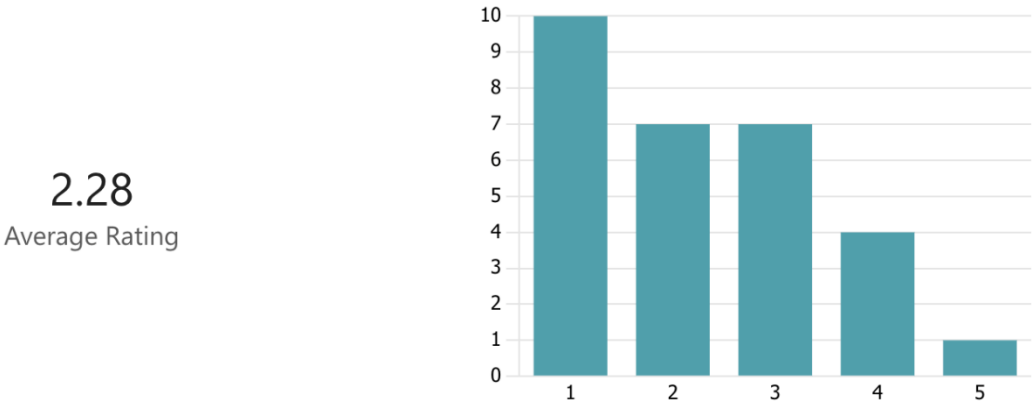


Figure 13.Readiness of blockchain adoption (social security)



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These responses suggest that despite the perceived benefits of blockchain technology in European countries' social security systems, public awareness and the readiness of social security systems are considered inadequate to implement blockchain solutions.

To gain a better understanding of the implementation challenges of EBSI solutions in the social security domain, we asked respondents to specify domain-specific challenges and potential differences across levels of government. Most articulated challenges align with general challenges foreseen in the adoption of blockchain and EBSI solutions, highlighting knowledge and capacity gaps, perceived risks and benefits, bureaucratic and political resistance, privacy and security concerns, and regulatory issues. However, a few responses pointed out specific challenges of the social security domain. Firstly, the digital divide in the social security domain is perceived as more crucial compared to the education domain. Hence, the characteristics of the population and the variety of application areas in the social security domain could pose enhanced challenges for wider adoption of the use case. Secondly, the social security domain handles a large volume of data, which can complicate scalability of solutions and increase switching costs for technology adoption.

Regarding differences across levels of government, a large majority of respondents do not expect any differences across levels of government. However, some responses also indicate limited knowledge and awareness about the use case, making it difficult to adequately assess whether there might be differences in the use of EBSI among different levels of government.

4.3 Other application areas

In this final section, we evaluated whether respondents had additional comments or insights regarding the implementation of EBSI blockchain in the country case. General remarks indicated

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a positive and willing attitude towards EBSI implementation but with an awareness of pending challenges. Most responses viewed these challenges as standard digital transformation issues that could be overcome by establishing regulations, standards, funding, and public awareness programmes. These remarks align with the current strategy of the EBSI team, which emphasises a gradual implementation approach for use cases.

Some respondents offered more technology-specific remarks for further clarification. One comment requested a definition of the Qualified Trusted Service Provider (QTSP) for electronic ledgers and requirements in case EBSI is used as infrastructure for other QTSPs to be referenced by Implementing Acts and sourced for conformity assessment by the Conformity Assessment Body (CAB). Another comment emphasised the implementation of provable security standards on QTSPs using EBSI and EUDI wallet.

Additionally, two country-specific comments were shared by respondents. Firstly, the Netherlands is perceived to be quite hesitant when it comes to EBSI implementation. Secondly, in the case of Spain, providing EBSI as reusable code to evolve or replace existing blockchain-based infrastructures is suggested to facilitate adoption. In Spain, BLUE[1] is used in the education domain, and the intention is to replace the existing network with a new one based on EBSI. Given the more advanced status of the blockchain solutions in Spain, interoperability concerns across different blockchain solutions might pose an issue for wider implementation.

Finally, we assessed the growing potential of EBSI and verifiable credentials beyond existing use cases in education and social security domains. We asked respondents whether there are any plans to extend the implementation of EBSI blockchain beyond verifiable credentials in their

[1] https://www.blueroominnovation.com/en/blockchain/

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country. About half of the respondents indicated a lack of awareness of any plans to implement EBSI blockchain beyond verifiable credentials. On the other hand, some country cases mentioned plans to use EBSI blockchain in domains such as digital wallets in healthcare and fishing industries, and in the verification of driver's licenses. Furthermore, we asked respondents to specify any other application areas where blockchain and EBSI bring added value to public services in their country cases. Based on the provided answers, we clustered them into the following categories:

1. **Public registries and record management:**

- Services involving public registries and the issuance of certificates, proofs, or permits to citizens or businesses.
- Digital Product Passports.
- Healthcare applications, including secure patient record management.
- Aviation industry for staff qualifications/credentials, medical certifications, etc.
- Management of police criminal records or records of good conduct.
- Issuance and revocation of "green cards" for football fans.

2. **Cross-border administrative processes and supply chain management:**

- Facilitation of payments/receipts for cross-border tax reconciliation.
- Digitisation of administrative processes across borders.
- Supply chain management, brand protection, and food safety.

3. **Confidence and security-enhancing applications:**

- Applications requiring a high level of confidence, such as medical records, social services, and tax-related services.
- Government-to-government (G2G) qualified data exchange where data governance is crucial.

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- Implementation of traceability and decentralised public key infrastructure (PKI) for various purposes like QEAA, QES, QSeal, QTimeStamp, preservation, eDelivery, tokenisation, and digital Euro.
- Potential cybersecurity applications, including the public registry of public keys.
- Ensuring transparency in public procurement and voting systems to maintain integrity and trust in electoral processes.
- Integration of blockchain applications in AI systems.

4. Business value of EBSI:

- Enhancing business value as a European decentralised ledger by adding tamper resistance.
- Exploring opportunities with cryptoassets, digital euro, Self-Sovereign Identity (SSI), and ID wallets facilitated by regulatory frameworks like the Markets in Crypto-Assets Regulation (MiCA).

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5 Interpretation of Results & Recommendations

Our survey findings unveil a nuanced landscape regarding the requirements for implementing EBSI use cases. Across legal, organizational, technical, and institutional domains, several hurdles must be addressed. Chief among these are capacity constraints within the public sector, uncertainties surrounding certain technological and regulatory processes, and bureaucratic resistance to the costs associated with digital transformation. Additionally, there is a clear need for improved communication and awareness among decision-makers, public sector officials, and the general public.

Interoperability emerges as a central challenge across various dimensions, encompassing standardisation and regulatory concerns. While respondents recognise cultural and procedural barriers in cross-border services, technical and legal issues, along with a lack of standardisation, are equally significant. This underscores the necessity for standardisation efforts and enhanced communication strategies. Among regulatory and technical concerns, compatibility with GDPR and eIDAS appears as the most articulated interoperability issues. Uncertainties surrounding technological and regulatory processes underscore the importance of fostering collaboration between stakeholders. One ongoing collaborative venue is established between the EBSI-VECTOR project teams and the European Blockchain Regulatory Sandbox. As part of the consultation activities for 2024, two consultations are planned between technology experts and regulatory experts to address the questions and concerns regarding GDPR and eIDAS. Furthermore, establishing multi-stakeholder task forces or working groups as part of the new Europeum EDIC can facilitate dialogue and knowledge-sharing, helping to clarify regulatory requirements and streamline implementation processes.

In the realm of education, the centralised or standardised nature of systems mitigates implementation issues regarding methodologies, but capacity constraints and knowledge gaps

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pose challenges, particularly in federal countries with diverse technical infrastructures. The higher education sector demonstrates greater readiness for implementation, while secondary education lags behind, suggesting a need for further efforts and granularity. Efforts to address capacity constraints and knowledge gaps can be coupled with initiatives to promote collaboration and knowledge-sharing among educational institutions. Establishing partnerships between HEIs and software companies can facilitate the integration of EBSI into existing systems, ensuring compatibility and interoperability.

Social security use cases are perceived as more complex to implement, with challenges related to the digital divide and the intricacies of application areas. Despite expectations of uniformity across levels of government, scalability remains hindered by digital readiness and organizational preparedness. In tailoring the implementation strategies, attention needs to be paid to addressing the digital divide and enhancing organizational readiness for EBSI adoption.

Respondents recognise substantial value in EBSI for public services, confidence-building, and business enhancement. Resistance to EBSI implementation stems less from perceived benefits and more from perceived risks, highlighting the importance of clarity in regulations, technical standardisation, and increased interoperability for wider adoption. As clarity improves and standards mature, we anticipate broader integration of EBSI use cases, paving the way for enhanced public service delivery and confidence-building measures.

Overall, decision-makers should adopt a holistic approach to EBSI implementation, prioritising investments in workforce development, regulatory clarity, and stakeholder engagement. Enhanced communication and awareness initiatives are essential to garner stakeholder buy-in and overcome bureaucratic resistance. The findings underscore the universal demand for continuous support from both national and EBSI institutions, seeking assistance to navigate

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technical challenges, bridge knowledge gaps, overcome bureaucratic hurdles, and ensure alignment across relevant authorities and digital initiatives. While some countries are already taking proactive measures to create national support systems, such as in Poland, we recommend expanded efforts through national helpdesks for broader EBSI blockchain implementation. The EBSI team's evolving role from policymaking to more executive public service departments, particularly in education and tax domains, is a positive sign. However, there's a clear recognition that additional efforts are needed to integrate with similar projects, address trust issues, and enhance the knowledge base and capabilities of national institutions. The ongoing work in EBSI Vector project's WP 6, focusing on ecosystem strategy, aims to fortify institutional alignment and coordination strategies and efforts.

While many responses acknowledge the benefits of EBSI solutions and verifiable credentials, the perceived risks associated with adopting these technological solutions suggest the importance of clearly identifying the payoff for use case owners, such as public sector organizations and education providers. Integrating a payoff matrix into communication strategies for all stakeholders, which indicates cost savings, transparency, and reliability in verification processes, could convince users that being EBSI-ready would outweigh the transition costs.

Currently, the EBSI team is focused on preparing the network for production. On one side, the team plans to launch a production-grade network in May 2024 to facilitate the implementation of use cases. On the other side, legal experts from eIDAS and national regulatory authorities are evaluating the QTSP requirements of the EBSI governance, including validator nodes and EDIC management, in accordance with the advancements of the eIDAS 2.0 regulation. These developments hinge on the launch of the Europeum EDIC and the establishment of its governance structure. Consequently, formalizing Europeum would represent a significant

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milestone in transitioning the EBSI network to the production phase and supporting its scaling efforts.

The institutionalisation of the European Blockchain Partnership, under the new Europeum European Digital Infrastructure Consortium (EDIC), and the evolution of the eIDAS 2.0, are expected to be two crucial developments in 2024 regarding the transformation of the EBSI ecosystem. While these developments can help to overcome certain resistance among stakeholders concerning perceived risks, it is imperative that EBSI officials continue to prioritise targeted communication campaigns aimed at raising awareness among key stakeholders, including policymakers, public sector officials, and the general public. Clear and transparent communication about the benefits, risks, and implementation strategies of EBSI and a proactive approach emphasising the long-term benefits of EBSI adoption, including improved efficiency, transparency, and citizen-centric service delivery, can help build trust and support for the initiative.

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Annex- Needs Assessment Survey

EBSI Vector- Needs assessment survey

We greatly appreciate your participation in this survey, which aims to gather valuable insights into the institutional, legal, organizational, technological, educational, and social security needs for the implementation of the European Blockchain Services Infrastructure (EBSI) in your country. Your feedback is instrumental in understanding the diverse requirements and challenges across different regions.

The EBSI-VECTOR project is an ambitious initiative that seeks to leverage blockchain technology to enhance public services and streamline cross-border operations within the European Union. Your input will help us tailor our approach and support mechanisms to better align with the unique circumstances and priorities of your country.

Please take a few moments to respond to the following questions thoughtfully. Your responses will remain confidential, and the aggregated data will be used solely for research and analysis purposes.

Your expertise and feedback are invaluable, and we sincerely thank you for your time and collaboration.

Section 1: General Information

1.1. Country Name:

1.2. Your Role/Position:

1.3. Is your organization a public sector or private sector organization?

- Public sector
- Private sector
- Other

1.4. How do you assess your knowledge about blockchain technology? (1 = Low, 5 = High)

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1.5. How do you assess your knowledge about EBSI? (1 = Low, 5 = High)

1.6. How do you assess your knowledge of how verifiable credentials work? (1 = Low, 5 = High)

1.7. How do you assess your knowledge of decentralized registries? (1 = Low, 5 = High)

Section 2: Institutional and Legal Needs

2.1. How ready is your country's legal framework for blockchain implementation? (1 = Not Ready, 5 = Very Ready)

2.2. Are there any specific legal barriers or regulatory challenges in your country that need to be addressed for EBSI implementation? Please specify.

2.3. How would you rate the level of support and collaboration from relevant government institutions for EBSI deployment? (1 = Low, 5 = High)

2.4. Do you require any specific institutional support for the implementation of the EBSI solutions? Please specify.

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2.5. How would you rate the readiness of relevant government institutions to accommodate EBSI in their current digital infrastructures? (1 = Low, 5 = High)

2.6. How well do you think EBSI fits with the organizational culture of relevant government institutions? (1 = Low, 5 = High)

Section 3: Organizational Needs

3.1. Does your country have a dedicated team or unit responsible for blockchain initiatives in the public sector? (Yes/No)

3.2. How would you describe the level of blockchain expertise within the public sector? (1 = Low, 5 = High)

3.3. Are there any organizational challenges or resource constraints for adopting blockchain technology? Please elaborate.

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Section 4: Technological Requirements

4.1. Does your country already use blockchain platforms or blockchain technologies in the public sector? (Yes/No)

4.2. How prepared is your country's technological infrastructure for integrating with EBSI blockchain? (1 = Not Prepared, 5 = Very Prepared)

4.3. How prepared is your country's technological infrastructure for integrating verifiable credentials and decentralized identity solutions? (1 = Not Prepared, 5 = Very Prepared)

4.4. Are there any specific technical hurdles or interoperability issues that need to be addressed for EBSI implementation in the public sector? Please describe.

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4.5. How would you rate the willingness of your government to integrate blockchain technology for the verification of credentials? (1 = Low, 5 = High)

4.6. In your experience, interoperability problems in cross-border public processes are often caused by (multiple options are possible):

a) Differences in organizational culture
b) Differences in IT systems
c) Differences in processes
d) I don't know

4.7. Could you please briefly describe the interoperability problems you have experienced in cross-border projects?

Section 5: Education Domain

5.1. How would you rate the readiness of your country's higher education system to use verifiable credentials in student transcripts and diplomas? (1 = Not at all, 5 = Fully Integrated)

5.2. How would you rate the readiness of your country's secondary education system to use verifiable credentials in student transcripts and diplomas? (1 = Not at all, 5 = Fully Integrated)

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5.3. Are there any specific issues that need to be addressed for EBSI implementation in the verification of the credentials in secondary and higher education? Please elaborate.

5.4. Are there differences in the levels of government (e.g. local, regional, central) regarding the use of EBSI in the verification of education credentials? If yes, please elaborate.

Section 6: Social Security Domain

6.1. Does your country have existing social security systems or services that could benefit from blockchain technology? (Yes/No)

6.2. How would you rate the public's awareness and acceptance of blockchain's role in enhancing social security services? (1 = Low, 5 = High)

6.3. How would you rate the readiness of your country's social security system to adopt blockchain technology? (1 = Low, 5 = High)

6.4. Are there differences in the levels of government regarding the use of EBSI in the verification of social security credentials? If yes, please elaborate.

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6.5. What challenges do you foresee in implementing blockchain in the social security domain? Please provide details.

Section 7: Open-Ended Questions

7.1. Are there any additional comments or insights you would like to share regarding the implementation of EBSI blockchain in your country?

7.2. Are there any plans to extend the implementation of EBSI blockchain beyond verifiable credentials in your country? Please elaborate.

Thank you for your valuable input. Your responses will contribute to our understanding of the requirements and challenges in deploying EBSI blockchain across different countries.

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If you would like us to get in contact with you for further questions, please include your name and contact information in the box below.

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