BLOCKCHAINED YOUTH WORK

Mapping of blockchain platforms for certification of educational outcomes

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1. Introduction

At a time when verifying academic credentials is a tedious and time-consuming process, the potential for blockchain technology to revolutionise this area is immense. The project aims to transform the digital certification landscape by utilising blockchain to secure educational qualifications and make them immutable and instantly verifiable. This initiative aims to provide a streamlined, efficient solution to the challenges that currently exist in the authentication of educational qualifications.

The main goal of this project is to encode digital certificates on a blockchain or similar platform, creating an immutable record of academic achievement. This approach not only increases the security and integrity of educational credentials, but also simplifies the process of third-party verification of these qualifications. By embedding these certificates in an immutable verification system, the project provides an innovative way to address the widespread problems of certificate forgery and verification delays.

Focusing on a specific implementation method, there are three different ways in which blockchain can be used for credentialing (see Table 1).

Table 1: Comparison of idfferent data storage models for blockchain-based credentials

Method	What is stored on a blockchain	Implications
Method 1: Blockchain-based PKI infrastructure	PKI certificates used by institutions to sign digital documents are stored on the chain. The actual certificate is held entirely off-chain.	It is only possible to automatically verify the identity of the issuer. A separate (but possibly integrated) system would be required to verify the identity of the receiver.
Method 2: Blockchain-secured digital credentials	A hash of the digital certificate together with the public key of the institution issuing and the individual receiving the certificate is stored on the blockchain. The actual certificate is stored off-chain.	Records are immutable. It is possible to automatically verify the identity of the receiver.
Method 3: Credentials issued on a blockchain	The actual content of the credential is stored on-chain, together with the public key of the institution issuing and the individual receiving the certificate.	Records are immutable. It is possible to automatically verify the identity of the receiver. It is possible to automatically recognize and transfer credits between institutions and to create automatically stackable credentials.

Source: Unesco (2022)

The present project aims to capture the potential of blockchain platforms to revolutionise the certification of educational outcomes with a targeted implementation of Method 3 (see Figure 1). Method 3 is characterised by its comprehensive ability to store the full content of educational credentials directly in the blockchain, together with the public keys of the issuing institutions and the recipients. This method not only ensures the immutability and authenticity of academic records, but also facilitates the automatic verification of the recipient's identity. In contrast to Method 1 and Method 2, Method 3 extends their benefits by enabling the automatic recognition and transfer of academic credits between institutions and supporting the creation of stackable credentials, which are essential for promoting lifelong learning and flexible educational pathways.

The introduction of Method 3 addresses the key challenges faced by traditional certification systems. By embedding the actual content of the credentials in the blockchain, this method eliminates the need for external verification systems, simplifying the process for all stakeholders involved. In addition, the ability to automatically transfer credits and create stackable credentials leads to a level of dynamism and interoperability previously unrivalled in the education sector. This feature is particularly important at a time when cross-institutional mobility and continuous professional development are becoming increasingly important.

To adopt Method 3, we researched blockchain platforms that aligned with the principles of Method 3 to ensure that our approach was not only innovative, but also based on proven technology. Our strategy included a thorough review of leading blockchain platforms in the education space, such as Accredible, BCdiploma, BadgeCert, etc. Each of these platforms offers unique features and capabilities that could support the implementation of Method 3.

Our analysis focused on evaluating how these platforms handle data immutability, identity verification, credit recognition and the creation of stackable credentials. The goal was to find a platform that not only fulfils these technical requirements, but also lives up to the values of our project - transparency, security and user-friendliness. By selecting a platform that complies with the principles of Method 3, we wanted to create a blockchain-based certification system that is robust, reliable and can handle the current challenges of verifying educational credentials.

2. Dimensions of a robust platform for certification of educational outcomes based on blockchain

When evaluating platforms for the certification of educational outcomes using blockchain technology, we will consider a number of key dimensions that contribute to the robustness and effectiveness of the platform. Each of these dimensions plays an important role in ensuring that the platform not only meets the current needs of educational institutions and organisations, but can also be adapted to future developments and requirements.

Focus
The main goal or focus of the platform we are looking at is a blockchain-based platform for issuing, managing and verifying digital IDs. So we are looking for a platform that not only issues digital certificates, but also allows recipients to manage their credentials so that employers or other institutions can instantly verify their authenticity.

The platform should support the entire lifecycle of a credential, from creation and issuance to management and eventual verification. This means enabling institutions to design and issue credentials, recipients to receive and store them securely, and employers or other institutions to easily verify the authenticity of the credentials. For example, a student should be able to receive a digital diploma after graduation, store it in a digital wallet and share it with potential employers, who can then verify its authenticity with a simple click or scan.

Security
Security is the be-all and end-all in the field of digital ID documents, especially when using blockchain technology. We check whether the platform is able to protect sensitive data, prevent unauthorised access and guarantee the integrity and authenticity of the credentials issued. Features such as end-to-end encryption, secure blockchain transactions and tamper-proof records are important components of a secure platform. For example, we are looking for a platform that uses a decentralised ledger that records every transaction and every credential issued so that any attempt at tampering is obvious and traceable.

Credential Types
We will check whether the platform supports the different types of evidence, including diplomas, certificates, badges and transcripts. The ability to support different types of evidence, such as diplomas, certificates, badges and transcripts, is crucial. This flexibility allows institutions to accommodate a wide range of achievements and learning outcomes. Therefore, we will look at the platform that could offer customisable templates for different types of achievements, from completing a short course (badges) to completing a degree (diplomas).

Customization
Customisation refers to the ability of the platform to allow institutions to design the appearance and content of digital certificates to reflect their brand and the specific achievements that are being recognised. So we will be looking at whether the platform offers customisable templates, branding options and the ability to add specific details for each credential. So we are looking

for a platform that allows an institution to design a credential (e.g. a diploma) with their logo, colours and specific information about the course and the graduate's level of achievement.

Sharing and Verification
This dimension evaluates the ease with which credentials can be shared with and verified by third parties, such as educational institutions. We will look for features that enable straightforward verification processes and improve the usability and acceptance of digital badges. A great feature would be if a platform can provide a QR code on each digital badge that, when scanned, verifies the authenticity of the badge via the blockchain without the need to log in to the platform.

Integrations
The platform's ability to integrate into existing systems such as Learning Management Systems (LMS) is also crucial for our project. A platform that easily integrates with an institution's LMS can automate the credentialing process, making it more efficient and reducing the risk of errors. For example, when a student completes a course, the LMS could trigger the issuance of a digital certificate without manual intervention.

Compliance
Compliance with legal and regulatory standards, including data protection laws such as GDPR and standards for digital signatures and credentials, is also important to ensure that the operation of the platform is legally sound and that users' rights are protected. When developing a platform, these regulations must be taken into account to ensure that all data processing is compliant and that both institutions and credential holders are protected.

White-labeling
White labelling features allow institutions to present the credentialing platform under their own branding and provide credential recipients with a consistent and branded experience. This feature is also important to us.

Bulk Issuing
The ability to issue credentials in bulk is also crucial for us. The bulk issuance function should therefore be efficient, reliable and able to process large volumes of credentials without compromising performance. For example, institutions should be able to issue hundreds of credentials simultaneously during the finalisation phase without experiencing system delays or failures.

Pricing
The pricing structure of the platform should be transparent, predictable and scalable to meet the different needs and sizes of institutions. It should offer good value for money and be in line with the project objectives.

Resources
The availability of resources such as tutorials, documentation, customer support and community forums is also important as they can help with problem solving and continuous learning for platform users.

Together, these dimensions form the framework for evaluating blockchain-based platforms for educational certification. They ensure that the chosen solution is not only robust and secure, but also aligned with the evolving needs of the education landscape.

3. State-of-the-art providers of certification of educational outcomes by blockchain technology

This chapter analyses and compares in detail leading providers that are using blockchain to redefine the certification processes for educational qualifications. These platforms are at the forefront of integrating the inherent security, transparency and efficiency of blockchain into the education sector.

On the following pages, we present selected certification providers in detail.

Accredible

Accredible stands at the forefront of digital credentialing, offering a robust platform that enables organizations and institutions to issue, manage, track, and verify digital badges and certificates efficiently. Its suite of features is designed to cater to the diverse needs of various entities, ensuring a seamless and secure credentialing process.

Key Features:

- Automated credential management to streamline issuance and tracking.
- Interactive and customizable certificates that can be edited post-issuance.
- Features for revoking credentials and setting expiration dates to maintain their relevance.
- Comprehensive analytics dashboard to monitor the impact and reach of issued credentials.
- Seamless integration with leading LMS platforms for a cohesive user experience.

Benefits:

- Ensures the security and authenticity of credentials through blockchain technology and robust verification processes.
- Enhances operational efficiency and reduces administrative burden through automation.
- Provides extensive customization and branding options to align with organizational identity.
- Offers valuable insights into credential engagement and effectiveness through detailed analytics.

Pricing:

- Launch Plan: Designed for smaller entities, priced at $960 per year, allowing up to 1,000 unique recipients with unlimited credentials issuance.
- Connect Plan: Offers advanced features and custom limits, with pricing available upon request, tailored for organizations seeking deeper integration and customization.
- Growth Plan: Aimed at large organizations requiring extensive scalability and branding, with details provided directly by Accredible.
- Professional Services: Additional tailored services to optimize credentialing strategies, with cost dependent on project specifics.

BCdiploma

BCdiploma specializes in leveraging blockchain technology to offer a secure and streamlined platform for issuing, managing, and verifying digital credentials. It emphasizes ease of use and security, ensuring that diplomas, certificates, and badges are tamper-proof and readily verifiable online.

Key Features:

- Utilizes blockchain for enhanced security, making credentials tamper-proof and easily verifiable.
- Offers customization options for branding, content, and multimedia integration within credentials.
- Facilitates easy sharing and verification of credentials with a single click, enhancing accessibility.
- Ensures compliance with GDPR and other data protection regulations, safeguarding user privacy.

Benefits:

- leverages blockchain technology to ensure the security and authenticity of academic credentials.
- individuals can access their digital credentials anytime, anywhere, as long as they have an internet connection.
- Moving to digital credentials can save institutions significant costs associated with printing, shipping, and storing paper-based diplomas and certificates.
- Blockchain technology ensures transparency in the verification process. Employers or academic institutions can easily verify the authenticity of a diploma or certificate by accessing the blockchain records, eliminating the need for manual verification processes that are often time-consuming and prone to errors.
- Gives individuals ownership of their credentials by providing them with a secure digital wallet where they can store and manage their diplomas and certificates. This empowers individuals to control who can access their credentials and for what purpose, enhancing privacy and data security.

Pricing:

- Opts for a customized pricing approach for its Plus and Pro plans, tailoring costs to the specific needs and scale of its users.

BadgeCert

BadgeCert provides a comprehensive solution for digital badging, catering to the needs of individuals, organizations, and educational institutions. Its platform focuses on issuing, managing, and sharing badges and certificates, offering a modern alternative to traditional paper-based credentials.

Key Features:

- Enables the design and issuance of customized badges and certificates, incorporating organizational branding and content.
- Provides tools for efficient management and distribution of credentials across various channels.
- Offers optional blockchain integration for enhanced security and verification of credentials.
- Includes analytics features to track the distribution, sharing, and impact of credentials.
- Supports integration with popular LMS and other platforms for streamlined workflows.

Benefits:

- Increases the accessibility and flexibility of credentials, providing a modern format for showcasing achievements.
- Enhances the security and credibility of credentials through blockchain technology and real-time verification.
- Improves professional visibility and networking opportunities by facilitating easy sharing of credentials online.

Pricing:

- Offers a range of plans from the Starter package at $550 per year for up to 200 badges to customized Enterprise solutions for high-volume needs.

TruScholar

TruScholar is a blockchain-powered platform dedicated to revolutionizing how digital credentials are issued, managed, and verified. It emphasizes improving the traditional credentialing system's security, accessibility, and trust.

Key Features:

- Adds a layer of security and verification, making credentials tamper-proof.
- Enables personalized badges and certificates that reflect the issuing organization's branding.
- Streamlines the distribution of credentials through various channels, enhancing administrative efficiency.
- Offers insights into the distribution and impact of credentials, aiding in the evaluation of their effectiveness.
- Seamless integration with popular LMS and other platforms, ensuring a smooth workflow.
- Enhances professional visibility by facilitating the easy sharing of credentials online and through social media.
- Provides a mobile solution for managing and sharing credentials, adding convenience for users on the go.

Benefits:

- Ensures the authenticity and integrity of credentials.
- Facilitates global access to credentials, promoting career mobility.

- The verifiable nature of blockchain-based credentials fosters transparency between issuers and recipients.
- Simplifies the issuance, tracking, and management of credentials, reducing administrative burdens.

Pricing:

- Opts for a customized pricing approach for its Plus and Pro plans, tailoring costs to the specific needs and scale of its users.

CredSure

CredSure is a digital credentialing platform that leverages blockchain technology to secure and instantly verify credentials. It offers a streamlined process for institutions to issue, revoke, or reissue certificates with ease.

Key Features:

- Ensures the security and verifiability of credentials.
- Simplifies the process of verifying the authenticity of credentials.
- Provides insights into the usage and impact of issued credentials.
- Allows organizations to tailor credentials to their branding.

Benefits:

- Blockchain integration guarantees the integrity of credentials.
- Facilitates efficient management and distribution of credentials.
- Promotes global access and recognition of digital credentials.

Pricing:

- Start Plan: Priced at €920/year, offering basic features for organizations beginning their digital credentialing journey.
- Grow Plan: Custom pricing, catering to expanding organizations requiring more customization and support.
- Boost Plan: Also custom priced, designed for large or complex organizations needing advanced features and integrations.

4. Blockchain platforms from a comparative perspective

Analysing the blockchain platforms based on the key dimensions we defined in Chapter 2 allows us to identify the strengths and potential growth areas of each platform and thus make the most suitable choice for our project. Below we present a detailed comparison of platforms such as Accredible, BCdiploma, BadgeCert, TruScholar and CredSure to highlight the most favourable and less desirable features in various aspects.

Table 2: Comparative analysis of Blockchain platforms

Dimension/feature	Accredible	BCdiploma	BadgeCert	TruScholar	CredSure
Focus	Digital credential issuance, management, and sharing	Blockchain-based digital credential issuance, management, and verification	Digital badge and certificate issuance, management, and sharing	Comprehensive digital credentialing ecosystem	Secure and scalable digital credentialing solutions
Security	Blockchain (optional)	Primarily blockchain	Optional blockchain for added security	Advanced security protocols and blockchain integration	State-of-the-art security measures including blockchain
Credential types	Badges, certificates, transcripts, licenses, awards	Diplomas, certificates, badges, transcripts, licenses, awards	Badges, certificates	Wide range of digital credentials including micro-credentials	Extensive credential types with emphasis on professional certifications
Customization	High level of customization with branding, content, and multimedia	High level of customization with branding, content, and multimedia	High level of customization with branding, content, and multimedia	Customizable credential templates and branding options	Tailored credential designs to align with institutional branding
Sharing and verification	Shareable through email, learning platforms, social media, and Accredible Wallet app	Shareable online, verifiable with a single click, QR code, or API	Shareable through email, social media, and BadgeCert wallet app	Secure and easy credential sharing with instant verification	Dynamic sharing options with robust verification mechanisms

Dimension/feature	Accredible	BCdiploma	BadgeCert	TruScholar	CredSure
Integrations	Integrates with popular LMS, HRIS, and other platforms	Integrates with various platforms, including learning management systems and educational institutions (details less clear on website)	Integrates with popular LMS and other platforms	Seamless integration with educational and corporate systems	Flexible API for easy integration with existing IT ecosystems
Compliance	GDPR and other regulations adherence mentioned	GDPR and other regulations adherence mentioned	GDPR and other regulations adherence mentioned	Complies with international data protection and privacy standards	Strict adherence to legal and regulatory compliance
White-labeling	Yes	Yes	Yes	Yes	Yes
Bulk issuing	Yes	Yes	Yes	Yes	Yes
Pricing	Only starting prices displayed –Most expensive	Pricing information less transparent, "Get a Quote" button for each plan.	Only starting prices displayed	Pricing information less transparent, "Start trial" button for each plan.	Only starting prices displayed
Free trial	Yes	Yes	No	Yes	Yes
Resources	Webinars, documentation, blog	Tutorials, case studies, blog	Webinars, documentation, blog	Comprehensive support and learning resources	Extensive documentation, tutorials, and customer support

5. Alternatives to existing platforms and approaches

When looking at digital certification, we found that this evolving field is populated by a number of innovative platforms, each offering unique solutions that go beyond traditional methods and existing blockchain-based approaches. These platforms aim to meet the diverse needs of educational institutions, businesses and individuals, with a focus on enhanced security, user-centricity and seamless integration with existing systems.

Below we describe some of the most interesting of these:

Certifaction

Certifaction provides a pioneering eSignature solution prioritizing privacy and document security. Utilizing end-to-end encryption and qualified electronic signatures, the platform ensures rapid and intuitive identification, setting new standards in document verification and security.

Key features:

- Advanced Security: By not requiring document uploads to the cloud and securing digital fingerprints on numerous blockchain nodes, Certifaction offers unparalleled security.
- Seamless Integration: The platform's simple API integration and support for various digital standards facilitate easy incorporation into existing IT infrastructures.
- User-Centric Design: Certifaction's platform is designed for ease of use, with a focus on privacy-first eSignatures and legal compliance, ensuring a secure and user-friendly experience.

Pricing:

- With a flexible pricing model, Certifaction offers monthly and yearly plans, including a 2-month free advantage for annual commitments. The pricing is based on a credit system, adaptable to varying eSigning requirements, making it suitable for organizations seeking scalable solutions.

Diplomade

Diplomade champions the significance of education and professional development by providing a platform that allows for the secure storage, sharing, and verification of credentials using blockchain technology.

Key features:

- Comprehensive Credential Management: The platform supports a wide range of digital credentials, including certificates, badges, diplomas, and micro-credentials.
- Integrity and Security: By leveraging blockchain, Diplomade ensures the immutability

and security of digital credentials, safeguarding them against fraud and unauthorized access.

- User-Centric Platform: Designed with the user in mind, Diplomade offers an intuitive, customizable experience, catering to the unique needs of educational institutions, corporate organizations, and individual professionals.

Pricing:

- Trial:
  - Price: $1,
  - 20 Credits,
  - One-time trial,
  - Blockchain credentials creation & issuance,
  - Customer support
- Starter:
  - Price: $500/yr
  - 100 Credits
  - Blockchain credentials creation & issuance
  - Customer support
- Business:
  - Price: $2000/yr
  - 500 Credits
  - Blockchain credentials creation & issuance
  - Customer support
- Enterprise:
  - Custom Pricing
  - 1000+ Credits
  - Blockchain credentials creation & issuance
  - Customer support

Platforms like Certifaction and Diplomade offer less features com,pared to State-of-the-art providers of certification of educational outcomes by blockchain technology however this platforms still provide some features that cater to the evolving needs of digital credentialing in various fields especially in the field of:

- **Security:** platforms leverage advanced security measures such as end-to-end encryption and qualified electronic signatures, enhancing the privacy and security of digital documents beyond what conventional blockchain platforms offer. This approach ensures that sensitive information remains secure and private, making it highly attractive for institutions and individuals concerned about data privacy.
- **Existing Systems integration**: the ability of these platforms to integrate seamlessly with existing IT infrastructures and popular services like Moodle, WordPress, and LinkedIn makes them particularly appealing. This ease of integration reduces the complexity and costs associated with adopting new technologies, enabling institutions to enhance their credentialing processes without overhauling their existing systems.
- **Customization**: platforms focus on providing a user-centric experience, offering customizable and intuitive interfaces that cater to the specific needs of users. This level of customization and user-friendly design is very important for institutions looking to provide a seamless experience for credential recipients and verifiers,

making these platforms more attractive.

- **Cost-Effectiveness:** the pricing models of these platforms, which often include free plans and scalable options, make them accessible to a wide range of users, from small educational institutions to large corporations.
- **Credential Integrity**: the commitment to credential integrity and anti-forgery measures addresses a critical concern in the credentialing space. This focus on ensuring the authenticity of credentials and the identity of issuers makes these platforms especially attractive to organizations that prioritize the credibility and legitimacy of their credentials.

These advantages make these platforms compelling alternatives to traditional blockchain-based approaches, appealing to a broad spectrum of users seeking efficient, secure, and user-friendly digital credentialing solutions.

6. Proposed platform and recommendation for future action

As the focus of the project is on the implementation of method 3, where the entire content of the educational credential is stored on the blockchain together with the public keys of the issuing institutions and the recipients, the ideal blockchain platform would need to excel in several key areas: Immutability of data, secure and automatic identity verification, credit recognition and support for stackable credentials. Based on these criteria, we can conclude the following for each platform:

Accredible and Bcdiploma appear to be the closest to meeting the requirements of Method 3. Their core functionality is based on blockchain technology, which ensures the immutability of data and the authenticity of academic records. The platform's focus on educational credentials, including diplomas, certificates, badges and transcripts, suggests great potential for supporting comprehensive credential information and stackable credentials. Both platforms also allow for easy online approval and verification through a single click or QR code, addressing the need for secure and automated identity verification.

However, the platform's integration capabilities and support for recognising and transferring credits between institutions would need to be further investigated to confirm their full compliance with the principles of Method 3.

While BadgeCert offers robust capabilities for issuing, managing and sharing digital badges, their optional use of blockchain technology may not fully meet the stringent requirements of Method 3, particularly in terms of immutability of stored badge content and automatic verification of recipient identities. These platforms are characterised by customisation, sharing, verification and integration with existing systems. These are valuable features, but may not fully meet the specific requirements of Method 3 without additional customisation or integration work. In addition, the platform does not allow a free trial and is also quite expensive. The Lite plan is the cheapest option with costs starting at $960/year for up to 1000 individual recipients. The Plus and Premium plans have individual pricing, with the Premium plan being the only one that grants access to all features. It's also important to note that the price increases significantly due to opaque pricing, so if you add just 100 more certificates or badges, it increases tenfold.

TruScholar and CredSure also offer advanced security protocols, comprehensive credential management, and customisable credential designs, so they could meet the requirements of Method 3. However, without specifics on their ability to embed the entire content of credentials into the blockchain, perform automated identity verification, and support the recognition of credits and stackable credentials, it is difficult to fully assess their suitability.

BCdiploma is the most promising platform for your project as it takes a blockchain-centric approach, focuses on educational credentials and provides features for secure and verifiable credential exchange. Its compliance with Method 3, which emphasises immutability,

authenticity and automatic verification, makes it a strong candidate.

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