Stakeholders' Perceptions of Blockchain Adoption in Tunisian Higher Education

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ABSTRACT

Thanks to the technological breakthroughs of recent years, accelerating the digital transformation of businesses is a fundamental challenge, with the transmission, storage and authentication of information at its heart. Blockchain technology has emerged as a solution, revolutionizing several business sectors by combining transparency, decentralized governance, security and more. Higher education is no exception to this trend. There is growing interest in integrating blockchain into its institutions because of its potential to transform academic, administrative and research processes. However, symptomatic of the youth of this technology, literature seems to lack analysis of the perception of its adoption by the actors involved.

This study aims to explore the attitudes and perceptions of the various stakeholders, notably, students, teachers, administrative staff and decision-makers, towards the adoption of blockchain in academia. To do this, we mobilized a qualitative study through semi-structured interviews with a sample of actors located at different levels of this process.

The results reveal a wide range of benefits, as well as major challenges and concerns. This study thus contributes to a better understanding of the perspectives and concerns of the various players involved in this process, providing valuable insights for decision-makers.

Keywords: Blockchain, Higher Education, perception, decision-makers, students, administrative staff.

INTRODUCTION

Over the last few years, the rise of a deeply connected era has been paired with changes in modern organizations and the spread of smart products (Alzahrani et al, 2021). In this context, the bitcoin system has acted as an accelerator, fostering the emergence of numerous innovative applications using blockchain technology, which has become widespread across various sectors (Zhang et al, 2020). This system has gone far above its original design as a simple tool for monitoring cryptocurrency transactions, growing into a sophisticated and structuring technology that supports the deployment of decentralized applications (Arishi et al., 2018; Mitchell et al., 2019). It is particularly noteworthy as it often guarantees disintermediation, allowing various players in the network to store and share information or carry out transactions without the intervention of any controlling body (Bach et al, 2021).

Coupled with artificial intelligence, it ensures the security and organisation of sensitive data and contributes to accelerating innovation, thereby bringing about major changes in a wide range of sectors such as supply chains, healthcare, the Internet of Things, etc. (Salah et al, 2020) In particular, it has a major impact in the university context, which is complex and involves a wide variety of stakeholders (Panachev et al, 2021; Reis Marques et al, 2021; Raimundo and Rosário, 2021; Lam and Dongol, 2022). In addition to its educational role, this field is a key local territorial and social player with a significant role in the diffusion of innovation and the formation of human capital (Kitagawa, 2004; Panachev et al., 2021). However, this field's digitalization, combined with the increase in international students, makes managing and protecting academic data more challenging. Many countries are dealing with proven instances of academic manipulation, falsification, and fraud, highlighting traditional control systems' limitations (Castro and Au-Yong-Oliveira, 2021; Dharmalingam et al., 2021).

In specific contexts, such as Tunisia, alarming figures surrounding the falsification and fraud of diplomas and curricula vitae reveal the scale of the problem. In October 2023, the economist Ezzedine Saidan1 stated that the number of civil service employees who had managed to enter the public sector with falsified university diplomas in previous years had risen to around 120,000, costing the Tunisian state between 3 and 4 billion dinars a year. This calls into question their professional competence to hold the positions in which they work. In this respect, the president of the anti-corruption association2 added that recruitment verification operations between 2011 and 2021 points to considerable fraud figures, reaching 200,000 civil servants having been recruited during this period with false diplomas. A sample of this population revealed that the ministries most affected were the Ministry of Education (16%) and Finance (11%).

Therefore, these data demonstrate a pressing need for effective measures to protect and authenticate university degree certificates. As a result, blockchain technology is becoming a promising solution to this major challenge. This is a strategic asset (Bucea-Manea-Țoniș et al, 2021) that supports the territory-based responsibilities of academic institutions regarding cost reduction, academic data

[1] https://realites.com.tn/fr/tunisie-faux-diplomes-120-mille-fonctionnaires-publics-seraient-con dark circles/
[2]https://www.tunisienumerique.com/tunisie-plus-de-120-mille-fonctionnaires-recrutes-avec-de-false-diplomas-surtout-dans-ces-ministeres/#google_vignette

protection, and fraud prevention by providing stakeholders with innovative, traceable, authentic, and sustainable mechanisms for academic program and transaction management (Huynh et al., 2018; Fedorova and Skobleva, 2020; Lizcano et al., 2020; Reis Marques et al., 2021; Ali and Bhaya, 2021; Panachev et al., 2021).

Although its significance, this technology is not widely adopted by higher education institutions (Mohammad and Vargas, 2022; Gupta and Rai, 2025), even though they are required to adapt quickly to changing technology to overcome traditional infrastructure constraints (Panachev et al, 2021). Furthermore, despite the prevalence of several existing reviews of blockchain in higher education (Castro and Au-Yong-Oliveira, 2021; Alzahrani et al., 2021), gaps remain in terms of the analysis of institutional and contextual challenges, especially in emerging countries (Fernández-Caramés and Fraga-Lamas, 2019; Hernandez-de-Menendez et al., 2020; Ge and Hu, 2020), such as Tunisia.

In this context, this study aims to analyze in depth the importance and implications of implementing Blockchain technology in the country's universities and examine the attitudes and opinions of the players involved. It seeks to provide an answer to the following central research question: How do the various stakeholders in Tunisian Higher Education perceive the value of adopting Blockchain technology?

Its objectives are as follows:

- Identify potential applications of Blockchain technology in Higher Education in Tunisia.
- Analyze the benefits and challenges of using Blockchain.
- Propose recommendations for the development and implementation of Blockchain solutions in Tunisian universities.

To provide an answer to our problem, the paper will be structured as follows: A first section will be devoted to presenting Blockchain technology and its potential applications in education. Then, our research methodology will be proposed, ending with a third section that will deal with the analysis and discussion of the results.

CONCEPTUAL FRAMEWORK

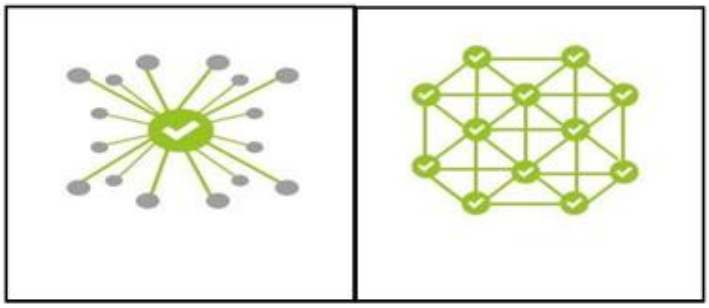
Historical overview and definition

Blockchain is a revolutionary technology that emerged with the creation of the Bitcoin cryptocurrency in 2008 (Blondeau, 2021). The progression of this technology can be divided into three key phases: blockchain 1.0, 2.0 and 3.0 (Swan, 2015). The first stage of blockchain development 1.0 refers to the initial application of the peer-to-peer cash payment system, symbolized by crypto currencies, while blockchain 2.0 represents the emergence of a new generation of consensus mechanisms, embodied by smart contracts. As for blockchain 3.0, it reflects the expansion of blockchain's use in various sectors beyond finance, such as healthcare, logistics, transport, supply chain, education, etc. Although other levels (4.0 and 5.0) of blockchain have been advanced, they are considered an extension of 3.0 (Wu and Chang, 2022).

This technology consists of "*a registry, a large database that has the particularity of being shared simultaneously with all its users, all of whom are also holders of this registry, and all of whom also have the ability to enter data into it, according to specific rules set by a computer protocol that is very well secured thanks to cryptography*"[3]. As mathematician Jean-Paul Delahaye (2016) describes it, it's "a very large notebook, which anyone can read freely and for free, on which anyone can write, but which is impossible to erase and indestructible". "This ledger is active, chronological, distributed, verifiable and protected against falsification by a system of distributed trust (consensus) between members or participants (nodes). Each network member has an up-to-date copy of the ledger (in near-real time), and the content is always in sync with all participants" (Leloup, 2017).

More concretely, this decentralized approach (figure 1) enables networked users to record and verify transactions, eliminating the need for intermediaries. They trust each other without the need for a trusted third party:

Figure 1: Centralized vs. decentralized architecture (Blockchain)



Source: Gorlier (2020)

[3] Report published in December 2018, the National Assembly's joint information mission on the uses of blockchain and other registry certification technologies.

Types of blockchain

Three types of blockchain are identified with specific roles, characteristics and challenges, which are grouped in table 1:

Table 1: The different types of blockchain

Features	The public blockchains	The private blockchains	Consortiums
Accessibility	Accessible to all users wishing to participate, read or write at transactions within the network anonymously	Reserved exclusively for a restricted number of users authorized to participate, read or write transactions, and managed centrally. More expensive implementation, but short information processing time due to limited number of nodes (Yang et al. 2020)	Intermediaries between private and public blockchain, where the power to validate blocks is shared equitably between several users belonging to different entities.
Management mode	Decentralized	Centralized	Shared at several organizations

Source: Adapted from Dumas (2018) and Laforet (2022)

Characteristics of blockchain

Although Bitcoin and other crypto currencies are widely known as use cases for Blockchain technology, it is important to note that this technology is not limited to these financial applications. In fact, this cross-cutting technology has found diverse applications in many industries (Habbani and El Fallahi, 2022). This expansion is largely attributed to the inherent properties of this technology (Berbain, 2017; Kulkarni and Patil, 2009; Awaji et al, 2020), an illustration of which follows in table 2:

Table 2: Blockchain properties

Features	Illustration
Immutability	The data stored on the blockchain is unforgeable due to the chronological order in which it is stored and the cryptographic coding that secures and connects the blocks.
Decentralization	There is no centralized authority. It is shared between multiple stakeholders and has no single point of control.
Autonomy	Each node can access registration, storage and updating
Anonymity	Each transaction is available in different nodes and is unique. The data is anonymous.
Authenticity/Trust	Technology eliminates the need for a third-party service provider to enable communication between players.
Transparent information	This technology guarantees decentralized, highly transparent data storage.
Availabilit/Traceability	Data is stored, reproducible and efficiently accessible by data owners.

Source: Adapted from previous research

Implementing the Blockchain in High Education universities: opportunities to seize

The rise of Blockchain in various fields (healthcare, transport, insurance, energy, supply chain, etc.) illustrates its potential to metamorphose business models and rethink existing processes. Its potential influence is particularly striking in the field of education, where administrative procedures are often complex and susceptible to problems of fraud and inefficiency.

Although the use of this technique in academic institutions is an emerging trend, and solutions based on this technology are still few and far between, it opens the way to many opportunities (Upadhyay, 2020).

The benefits of adopting Blockchain technology in Higher Education

Several benefits have been discussed in previous research, which can affect the various stakeholders involved in the process. Table 3 outlines various advantages linked to the adoption of blockchain:

Table 3: Advantages of implementing blockchain in Higher Education

Benefits	Search	Decision-makers	Students	Administrative Personnel	Teachers	Employers
Improved data security and confidentiality, reducing the risk of fraud and falsification	Bucea-Manea-Tonis et al. (2021); Schuetz & Venkatesh (2019); Kosmarski (2020); Bhaskar et al. (2020)	x	x			
Quality, accessibility, and inclusion	Bhaskar et al. (2020); Alammary et al. (2019)	x	x	x	x	x

Diploma validation and certifications	Kosmarski (2020); Bhaskar et al. (2020); Alammary et al. (2019); Chauhan & Patel (2022); Huang et al. (2022)		x			x
Increased traceability, transparency, confidence, and efficiency of processes for managing diplomas, admissions, school results, and other administrative processes	Bhaskar et al. (2020); Alammary et al. (2019)		x	x		
Ease of data exchange between different university departments	Bhaskar et al. (2020)	x		x		
Improved access to and sharing of data, coordination, and collaboration between students, teachers, researchers, and partner institutions	Huang et al. (2022)	x	x	x	x	x
Reducing costs and time associated with administrative tasks through automation and removal of intermediaries using blockchain	Bhaskar et al. (2020); Chauhan & Patel (2022)	x	x			
Experimentation and development of new applications and services	Dutta et al. (2020)	x				
Creating learner-centric ecosystems	Bhaskar et al. (2020) ; Huang et al. (2022)		x			

Source : Synthesis work

Possible applications of blockchain in the academic sector

Various areas of potential applications for blockchain in higher education will be outlined in table 4, highlighting corresponding illustrations and concrete examples of universities that have adopted this technology.

Table 4: Possible areas of blockchain application in Higher Education

Area of application	Illustration	Case studies
Secure storage of data, diplomas and certifications Verification of diplomas Admission management	Students can easily share their diplomas and certifications with employers or higher education institutions, making it easier for the latter to verify them.	University of Malta University of Lucerne University of Melbourne The University of Nicosia
Transparent academic tracking systems	Store and share students' academic results in real time, with the option of sharing them with third parties. Institutions can effectively monitor progress and performances.	University of Nicosia Stanford University Ghent University
Data exchange between university services	Facilitating secure exchanges and visist between various university departments	University of Illinois
Copyright and intellectual property management	Registration and traceability of intellectual creations Building trust in the publications and information sources used (Dutta et al. 2020).	Using blockchain to protect copyrights for: The University of Geneva and University of Melbourne
Identity management	Create a digital identity management system for students and teachers (reduce the risk of fraud and identity theft).	University College London Sovrin Company Stanford University
Participatory funding for research and education	Facilitating participatory financing of university research projects. Easier, more affordable access to loans and scholarships.	University of California at Berkeley
Certification of skills and continuing education	Certify skills acquired by students as part of continuing education and professional development programs	The University of Zurich is developing a blockchain-based system to certify the skills of professionals trained in its continuing education programs.
University governance	Democratic systems for universities make it easier for students and teachers to participate in decision-making.	Using the Blockchain to track student votes by: City University of New York, King's College London
Research and collaboration	Secure data sharing for research and collaboration.	The University of Melbourne

Source: Adapted from previous research (Dutta et al. 2020; Laforet, 2022)

Pioneering Blockchain in Tunisian Higher Education

Although blockchain offers considerable potential in the administrative or academic process of academic institutions, its adoption is limited. In May 2018[4] , it was estimated that the first version of the prototype application using the Blockchain solution for issuing and legalizing Tunisian university diplomas was initially scheduled for the last quarter of 2018. It should be made available to the Tunisian Ministry of Higher Education from October onwards.

To our knowledge, Carthage University is the only organization that has been committed to deploying blockchain technology since 2012 with the support of the AUF[5]. Up to March 15, 2023, more than 4,000 diplomas issued by Carthage University have been issued in digital form and authenticated on blockchain.

RESEARCH METHODOLOGY

Data collection procedure

Given that the study aims to explore stakeholder perceptions, opportunities, risks, as well as implications related to the use of Blockchain technology in academic institutions, we have chosen to conduct a qualitative study through individual interviews with the actors involved. This will enable an in-depth and nuanced understanding of the said phenomenon. For this purpose, a semi-structured guide was drawn up (Appendix 1).

Study sample

Participants were selected based on their mission and involvement in potential blockchain projects. The main participants were:

Academic and administrative staff:

We approached a purposive sample (Etikan et al, 2016) which consists of a set of academic and administrative staff from selected academic institutions to vary perspectives, whose profile is described in table 5:

Table 5: Profile of academic and administrative staff in the study sample

Participants	Decision-makers	Teacher-researchers	Administrative staff
Sample profile	5 (1 Dean; 1 Vice-Dean; 3 Department Heads)	6 teachers (specialties: management, marketing, quantitative methods, economics)	4 (IT, schooling, general secretaries)

Source: Profile of our study sample

Students:

Given the importance of including students as a major target for this emerging technology, we thought it appropriate to approach them to analyze their perceptions. Two focus groups were conducted, involving 4 master's students and 3 undergraduates. Adjustments were made to the interview guide.

Data analysis procedure

The interviews were conducted face-to-face. They were recorded with the participants' consent, then fully transcribed for in-depth analysis. Each interview lasted approximately 35-90 minutes. The collected discourse was then subjected to thematic analysis, following the approach suggested by Creswell and Miller (2000): preparation and organization of data, initial reflection, coding of data and themes, establishment of connections between themes, and final descriptions and interpretations.

RESULTS

This section will present the perception of blockchain implementation in academic institutions by the actors interviewed. The content analysis enabled the emergence of the themes mostly mentioned as the main benefits or obstacles and challenges to the adoption of blockchain in academic institutions.

Perceived benefits

The rise of blockchain technology presents the potential to transform the education sector. It offers several perceived benefits. A verbatim analysis allowed us to identify five major themes:1) Academic transactions security 2) Transparency and perceived trust, 3) Information accessibility and automation of administrative processes, 4) Procedures and tasks simplification and 5) Time saving.

[4] https://www.atlas-mag.net/article/l-application-blockchain-pour-la-legalisation-des-diplomes- bientôt-en-Tunisie
[5] L'Agence Universitaire de la Francophonie ; https://ific.auf.org/certification/

Academic transactions security

According to the verbatim transcripts collected, it is evident that academic data security is a major emerging issue. Participants highlighted concerns about the security of confidential and sensitive data exposed to risks of fraud and falsification, in particular diplomas and certificates. Such concerns appear to be shared across the various interviewee profiles. For example, one of the teachers noted that "*diplomas must be accompanied by a QR code so that no one can falsify them*." Another pointed out that "*if a teacher has course supports protected by blockchain, (...) they can be used by others (...) with no risk of plagiarism*". Another administrative staff member added that: "*If the verification of diplomas and transcripts is made secure by blockchain, it will be easy to ensure their reliability and authenticity, even remotely*" (General Secretary).

A Dean also stated that "*such a diploma brings a high level of international reliability. In this case, it is no longer necessary to go through administrative authorities, such as the municipality or the Foreign Affairs Ministry*". Moreover, students continue in the same line, saying that "*Blockchain makes things easier and prevents falsification.*" (Master's student). Confidentiality is also guaranteed, since *"(...) this would allow the display of grades to be personalized so that each student can only see his or her own"*.

The rise of this topic reflects the growing number of academic data breaches (Vidal et al, 2019). As highlighted in several studies, blockchain and smart contracts are seen as technologies promoting document authenticity and security as well as reducing risks associated with verifications (Cheng et al., 2018; Fedorova and Skobleva, 2020; Ali and Bhaya, 2021).

Transparency and perceived trust

Perceived transparency and trust emerge as a perceived blockchain advantage. As highlighted by several previous studies (Kamišalić et al, 2019; Chang et al, 2020; Lam and Dongol, 2022), the respondents noted that the specific features of blockchain and its functionalities (automation, a peer-to-peer network, immutability) ensure neutrality regarding content. These procedures are therefore perceived as transparent, reliable and credible. This enhances user credibility and reliability (Mikroyannidis et al, 2018; Lam and Dongol, 2022). By way of illustration: "*We are sure we have the right information*" (student); "*(...) it is decentralized, everything that is written is registered, and nobody can edit it*" (Department Heads). As they expressed it, "*This will solve many problems, especially those related to trust and process security*" (teacher).

Information accessibility and automation of administrative processes

The theme of accessibility was widely raised by participants. This can be explained by the fact that blockchain technology is perceived as inclusive. In fact, it is a particularly relevant tool for responding to students and other stakeholders' challenges in terms of accumulating and sharing resources, as raised by participants: "*You've got platforms that are accessible to everyone. (...). Every piece of information that's shared can be instantly downloaded by anyone, according to their access rights*." (Dean); "*As it is available on platforms, it becomes accessible to everyone*" (General secretary). This may also be due to the absence of an intermediate party: "*This could, for example, accelerate information access around the world, as we would no longer need to go through an intermediate organization*" (Teacher). This technology is also useful for learners, as it allows them to monitor and manage their training. "This allows me to get all my key information where I am, with no complications or complex procedures" (Student). We are thus in line with the statements of Matzutt et al (2020).

Some other researchers strongly attribute accessibility to process automation (Lam and Dongol, 2020), arguing that such technology automates academic progress, diploma evaluation and awarding, etc., which benefits all parties involved (students, teaching and administrative staff).

Procedures and tasks simplification

The analysis of the diverse perspectives shared by the participants has allowed us to discern that procedures and task simplification is a key advantage of blockchain. It's the outcome of other perceived advantages, including task automation, the absence of intermediaries, and accessibility, as raised by one of the respondents: *"(...) And above all, it will make all our tasks easier* "(teacher). Another decision maker posits that: "*We'll no longer have requests like: Do you have this degree? Check it for us." We 've access to this database and we could check it from there*" (Dean). In this way, this technology is likely to decrease the risks of errors (Ritzer et al., 2018).

Time saving

Through the collected verbatim, the temporal dimension is also emphasized in the blockchain adoption in academic settings. Some participants state that: "*The advantage, I believe, is that it avoids wasting time*" (General secretary) or "*This solution will facilitate file processing, as we receive several verification inquiries*" or "*I 'm immediately informed, everything is recorded in the system. I log in and the relevant information is available to see. Imagine how much time this can save"* (Dean). These perspectives are thus in line with previous research that emphasizes the significance of blockchain in terms of time savings and error reduction (Steiu, 2020; Bucea-Manea-Ţoniş et al., 2021; Bhaskar et al., 2021).

In addition, it was stated that "*there will be greater efficiency in terms of time savings" (teacher) and that "if we, at the top of our pyramid, think about it... we save a lot of money*" (department heads), which could in turn boost the overall efficiency of universities

by helping those involved to free up their time to focus more on higher value-added tasks (Sahonero-Alvarez, 2018).

We thus corroborate certain research, such as Gupta & Rai's (2025) bibliometric analysis, which highlighted that beyond optimizing data management, blockchain paves the way for a more sustainable education system by reducing waste and increasing institutional efficiency.

Perceived obstacles and challenges

The obstacles and challenges raised by respondents were classified according to the TOE (Technological-Organizational-Environmental) model proposed by Tornatzky et al (1990). This is a conceptual framework that is widely adopted for analyzing technology adoption processes in organizations.

The technological dimension covers the characteristics inherent in blockchain technology. The organizational dimension focuses on internal factors related to organizations, while the final environmental dimension refers to variables external to the organization, such as standards and government regulations that are likely to promote or hinder the adoption of this technology in the context of higher education. These results are summarized in table 6:

Table 6: Obstacles and challenges raised by respondents according to the TOE model

Sub-themes	Verbatim
Technological	
Adapting to technological changes	*"You have to be ready to use this new technology. (Vice-Dean).* *"The problem is that technologies are evolving rapidly. (...) In practice, it's very difficult to follow this evolution." (Dean)* *"We 're not up to date with developments." (Dean)*
Ignorance of blockchain technology	*"The first obstacle is a lack of knowledge about this technology (....). (Teacher)* *"We don't know the purpose or usefulness of this technology. (Department Head).* *"Honestly, I have a very general and superficial idea about it (...). As for exactly how it works, to be honest, I don't really have a good idea." (Teacher)* *"95 percent will remain stunned (...) They have no idea on the subject. " (IT)* *"Blockchain does not allow to correct the error in the case of mistake" (Teacher)*
Organizational	
Blocking inertia	*"In private sector, we can motivate, but in the public sector, it's blocked. It is difficult neither encourage nor punish. (Dean)* *"There are some who want to move towards new technologies (....) and others who, on the other hand, would rather remain in the traditional system, involving paperwork, etc." (Dean)* *"There is resistance to change among teaching staff who consider it an additional burden" (Vice-Dean).*
Lack of skills	*"Administration suffers from skill gap. Managers are not sufficiently trained, and staff are not very qualified." (Dean)* *"When you meet people who don't know how to manage, it can be a poisoned gift. ... it's frightening" (Dean).* *"There is a disconnect between the subjects being taught and the practical knowledge required by the job market." (Master's student)*
Training and awareness-raising	*"Qualified engineers are rare in this field; they are often expatriates…We have to convince people and find the good skills in universities" (Dean).* *"The first challenge is to raise the awareness of the people who are going to be involved on this technology." (Teacher)*
Employee involvement	*"Goodwill, people have to have the goodwill to adhere to this project" (Dean).* *"In order to successfully complete any task, the sole challenge for me is the agent's involvement in that task." (General secretary)* *"If one institution is committed and the other isn't... it slows you down." (Dean).*
Management commitment	*"Universities are not on the same wavelength" (Dean).* *The direction must be involved... because it approves and legitimizes the project (Teacher 1)* *The issue is that there is no project, and no commitment to blockchain. "(Teacher 2)*
Collective involvement in a blockchain project	*"We need to get everyone on board with the blockchain project" (Department Head).* *"Everyone has to be on the same page" (Teacher)*
Inefficient management of financial resources	*"(...) The failure to carry out projects despite the presence of a budget" (General Secretary).* *"The financial resources are available, but they are not used (...). They are lazy about dealing with the issue. (General secretary).*
Resistance to change	*"It frightens the staff; employees are used to their own habits; they work with a system that suits them" (teacher).* *We think it's complicated (Teacher)* *I feel like it's replacing people and making things very mechanical, which irritates me. (General*

	secretary).
Environmental	
Social recognition	*There is a waste of paper, ink, and especially pollution. It impacts the environment. However, this concept is ignored; people don't fully consider it." (Dean)*
Public policy and state resource management	*"The public must follow numerous procedures to sign up, choose an offer. It takes a bit of time. So, it's a bit complicated." (Dean)* *"We can remain dependent of other institutions" (Dean)* *"The government doesn't have a strategy of blockchain's implementation." (Teacher).*
Regulation and task legitimization	*"The ministry needs to change its strategy and ensure compliance with these projects" (Dean)* *"Implementation is governed by law (...) The circular issued by the Ministry must be followed (Dean)* *"We note the absence of a clear national strategy. Why do some universities use blockchain and others don't?" (Master's student)* *"Data storage must be secured at the national level. (IT)* *"Legislation needs to be put in place to reassure staff and to govern tasks" (Teacher)*

Source: Results of our interview guide

DISCUSSION

This paper aimed to comprehend the stakeholder's perception of blockchain adoption in universities. This constitutes a response to calls from previous research and related bibliometric analyses (Gupta and Rai, 2025; Raimando and Rosarion, 2021; Reis-Marques et al., 2021) that highlighted the importance of studying this phenomenon in depth. To this end, we relied on a qualitative study involving Tunisian actors who could be involved in blockchain implementation (students, teachers, policymakers, administrative staff). As a result of thematic analytic, five perceived benefices emerged: academic transactions security, transparency and perceived trust, information accessibility and automation of administrative processes, procedures and tasks simplification and Time saving. This aligns with Technology Adoption Model (TAM) (Davis, 1989), which posits that technology acceptance is driven by the perceived usefulness, ease of use, familiarity and benefits of technology.

Similarly, respondents mentioned various obstacles and risks that could hinder the use of blockchain, reflecting the three dimensions of TOE: the technological, organizational, and environmental aspects. Social recognition of blockchain technology can be a major obstacle. If stakeholders) don't fully understand the benefits of blockchain, they may be reluctant to adopt it. In addition, public policy and state resource management play a crucial role in its integration. Without active support from decision-makers, blockchain implementation can be hampered. Regulation and legitimization of its related tasks are also essential. If procedures and responsibilities are not clearly defined, this can create obstacles. In addition, staff involvement, management commitment and blocking inertia due to a lack of willingness to change can hamper the process. Thus, it can be difficult to successfully implement blockchain technology. These barriers can be explained by Rogers' (2003) Diffusion of Innovations Theory, as they impede the spread and adoption of this innovation.

Besides, lack of skills is another emerged challenge. Blockchain technology requires specific skills, and if staff aren't trained, this can be a hindrance, aligning with the Unified Theory of Acceptance and Use of Technology (Venkatesh et al, 2003) which emphasizes the role of facilitating conditions and social influence. These potential constraints also adhere to the theory of perceived risk (Bauer, 1960), according to which technology adoption involves a preliminary step: assessing its potential limitations. This expressed caution is likely to inhibit actors' adoption of this innovation. These findings corroborate previous studies (Reis-Marques et al, 2021; Mohammad and Vargas, 2022; Rupa et al., 2025) that have highlighted various obstacles, challenges and risks associated with blockchain in this context.

Thus, the analysis of the collected verbatim reveals that the adoption of blockchain technology is not simply dependent on the salient characteristics and advantages of this technology but transcends them to embody a human and institutional aspect.

Managerial And Social Implications

Interviews with stakeholders revealed that the majority had no idea about blockchain. To fully exploit the potential of blockchain technology in Tunisian universities, it is essential to implement a general approach that includes awareness-raising campaigns, training development, management commitment and compliance with regulations related to its use for diploma authentication. Awareness-raising is essential to inform stakeholders about the benefits of blockchain, particularly for degree authentication. University managers need to set up workshops, seminars and training courses which are useful and crucial to enhance staff employability and to promote the adoption of blockchain in education. It is therefore crucial to create communication channels to share information about technology. Online platforms, social networks and educational institution websites can be used to disseminate this information. To strengthen understanding of blockchain, pilot projects can be launched in specific areas of higher education. For example, diploma management, skills certification, research traceability, etc.

Besides, Management commitment is a key factor. University leaders must actively support blockchain integration by allocating resources, establishing supportive policies and infrastructure and by encouraging initiatives, like Carthage University. Also, collaboration between universities, governments, businesses and technology experts is essential to develop sustainable and inclusive Blockchain solutions in education.

Finally, the regulatory aspect of using blockchain must be respected. Institutions must comply with legal standards to guarantee stakeholder confidence in the authentication of diplomas via blockchain. In short, a holistic approach is needed to fully exploit the potential of blockchain technology in Tunisian universities.

CONCLUSION

By way of conclusion, this research holds both theoretical and managerial implications. On the theoretical front, this study significantly enriches literature concerning blockchain adoption in education sector based on qualitative exploratory study. This technology has many potential benefits, including security, transparency, confidentiality of student data, trust, time saving, etc. But it's important to consider the associated challenges and risks before its implementation on a large scale.

In terms of managerial implications, the study offers recommendations for actors. The successful integration of blockchain into Tunisian higher education largely depends on a better understanding of this technology by stakeholders. To be successfully adopted in the university context, it is essential to raise awareness of the fundamental concepts of blockchain among teachers, students, administrators and decision-makers.

However, this study is not without limitations which invite further studies. Firstly, working with a small sample can lead to bias and may not accurately reflect the total stakeholder population. Results based on a small sample may not be generalizable to the entire academic community. It is therefore important to clearly state this limitation in any publication or report. To alleviate this problem, it is advisable to use appropriate statistical methods to assess the validity of results. Secondly, uncharted territory can be both challenging and difficult. The lack of existing data can make it difficult to generate rich, in-depth content. In the context of blockchain in Higher Education, there may be few previous studies of stakeholder perceptions. As a result, the information available may be limited. To overcome this challenge, in-depth research and systematic data collection are essential. This may include interviews, surveys, field observations or literature reviews. Collaboration with other researchers or experts in the field can also enrich the content by bringing different perspectives and complementary knowledge.

By analyzing these issues, we aim to provide a comprehensive overview of the current state of the art and open avenues for future research. Such research could facilitate the advent of more efficient systems before they are adopted on a large scale. To this end, we recommend opting for a quantitative approach using triangulation of results. At the same time, a qualitative survey of private-sector players will enable more in-depth comparisons to be made and provide essential contextual information.

Ethical Considerations: Before starting this work, we made sure that all ethical requirements were respected. All participants were informed about the purpose of the research and agreed to take part voluntarily.

Conflict of Interest: The authors state that they have no conflicts of interest that could have influenced research or its results.

Data Availability Statement: For confidentiality reasons, the data cannot be shared publicly. However, they are available from the corresponding author upon reasonable request.

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APPENDICES

Appendix 1: Interview guide

Introduction:

- Presentation of the study and its objectives.
- Thanks for taking part.
- Informed consent for recording the interview (if applicable)

School context (practical use of ICT)

- How does your university currently approach emerging technologies for the daily management of administrative tasks?
- Can you list the innovations and ICT (Information and Communication Technologies) adopted at your facility?

Theme 1: General understanding of blockchain

- Can you describe your understanding of blockchain technology?
- Are you aware of the areas in which blockchain is being applied (healthcare, transport, etc.)?
  (Bounce back on participants' comments to correct or complete them tocreate a concise definition of blockchain technology)

Theme 2: Perception of the potential impact of blockchain in universities

- In your opinion, what could be the impact o f integrating blockchain in academic institutions (security, ease, confidentiality, etc.)?
- Do you think blockchain could improve the security and authenticity of university diplomas and certifications?
- Have you ever recommended / considered / decided to implement blockchain-based solutions in academic fields?
- Which blockchain functionalities would be most important for your university (registration, certification, identity management, etc.)?
- What advantages do you see in using blockchain for administrative and/or pedagogical tasks at your university (registration, certification, identity management, etc.)?
- What challenges or concerns do you anticipate when implementing blockchain in universities?
- What efforts are being made to raise awareness among university stakeholders of the benefits and challenges associated with using blockchain?

Theme 3: Barriers to blockchain adoption in universities

- What obstacles do you perceive to the adoption of blockchain in the university context?
- What measures are needed to overcome these obstacles?

Theme 4: Needs and expectations for blockchain implementation

- What kind of support or coaching (e.g. technical) would your university need to successfully integrate blockchain?
- Are you considering collaborations or partnerships with other institutions, companies or organizations to explore or implement blockchain-based solutions?

Conclusion:

- Summary of key points discussed.
- Invitation to add any additional information.
- Thanks for their time and contribution