Exploring the Perceptions of Applying Blockchain Technology in the Higher Education Institutes in the UAE [†]

Abdullah El Nokiti [1,*] and Shafiz A. Mohd. Yusof [2]

[1] The British University, Student Administration department, 345015 Dubai, United Arab Emirates
[2] University of Wollongong, Faculty of Engineering & IT, 20183 Dubai, United Arab Emirates;
shafizMohdYusof@uowdubai.ac.ae
* Correspondence: abdullah.mohd@live.com
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Abstract: Based on the increasing demand for having a reliable method to verify student records in the education sector in the UAE, this research will attempt to get the perception of the managerial unit of higher education organizations in the UAE about the expected value of applying this technology. The study will test two main areas: student academic records and student campus life happiness. Mentioned about the methodology used. The research will finally suggest a possible way to adopt this technology, like spreading the awareness about the advantages of the Blockchain technology, providing support from the governmental organizations and creating the brainstorming & skills workshops that assist in understanding this new technology. These methods will help to grow up the technology and support its implementation process. Finally, evaluations should be conducted after the implementation to review and rate the success in reaching the main organizational goals.

Keywords: bigdata; blockchain; digitization; bigdata; records; management; business case; confidentiality; intigrity

1. Introduction

The current educational system requires high efforts made and capital spent to track and verify student's records academically. The impact of records management is significantly high and have a positive return. According to Bailey and Hyslop who created a questioner on "Have you ever tried measuring the impact of introducing the records management system in your organization?!". The response to this survey was positive for 60% of the 77 participants who took part in it. The importance of records management is remarkably increased in recent years. According to JISC infoNet in 2009, it was concluded that records measurements are less and less increasingly needed for the process of record management [1].

The excellent investment in records management system or method will enhance the usability of the information recorded. This information may contain a sequence of event, transaction or activities. Unless we can assure that, the information recorder is reliable, organizations and institutes cannot use it to support their daily operations. For instance, in the education sector, the adoption of the Electronic Records Management System can reduce the gap between the demand and supply of education [2]. Currently, we are living in a digital era. With the introduction of Big data concept with all the underlying technologies such as Blockchain; that can help support the process of records management positively in a secure way. According to Kefa Rabah in 2018, who explained how data is the life and blood for any

business. And how it extends to reach every concept, big data solution will be proactively identified to help enterprises to fulfill their work statement [3].

Blockchain is known for its reliability in providing trust between two parts where data exchanged between both of them will be verified and secured. It is also able to provide a recorded history of the previous transaction happened. Currently, the applications followed the Blockchain structure are in stages 1.0 & 2.0. There is an increasing demand for researches in the commercial & educational areas [4,5].

Research Questions

Based on the lifecycle of the student in the university, we have created these research questions to reflect the main stages in which the student goes through to graduate:

1. Starting from the admission process, which requires the previous graduation certificates of the student.
2. Validation the records with the Ministry of Education to ensure that they are accurate and correct.
3. Registering to courses and completing them.
4. Storing the final grade of the courses passed.
5. Generating special requests (Like registration letters).
6. Participating in university event and group trips.
7. Graduating from the university and obtaining a degree.

This research will help to answer the following questions:

- How does the utilization of Blockchain technology reduce the costs of student record archiving?
- How does the utilization of Blockchain technology enhance the integrity of student records?
- How does the utilization of Blockchain technology enhance the confidentiality of student records?
- How does the utilization of Blockchain technology enhance the student life experience in the High Education (HE) institutions?

2. Literature Review

2.1. Blockchain

2.1.1. Definition

Known as the "*Distributed ledger*", the Blockchain technology is a decentralized, peer-to-peer technology which is used to create verified transactions. The chain (ledger) will keep growing by the increased number of transactions made. As Raul Zambrano has mentioned in his paper, "*Blockchains can be defined as a public spreadsheet that sequentially records transactions among users operating within a decentralized peer-to-peer network*" [6,7].

The innovation behind such technology can be justified because of the validity of each record. Records can't be changed or adjusted after they are created. It uses the hashing function that uses the previous "Block's" hash to generate the new hash of the next transaction "block". Following this method, records will be accurate and authentic. Once the information is recorded in the current block, a new one will be generated. There are no limits for the number of blocks that could be created. Blocks are linked to each other chronologically and linearly using the previous blocks hash function. Also, a copy of each ledger will be saved on all the nodes which are taking part in the ecosystem, which helps in the process of the verification [3].

2.1.2. Benefits

The blockchain is expected to be a revolutionary technology that is a game-changer as published recently in the Dubai Future Blockchain Summit. The market worth $20 Billion by 2024 as per transparency market research with over $300 billion expected to be invested in the area of Blockchain according to the Global Blockchain Council at Dubai Future Foundation. Adding to this that 10% of the world's global GDP will be stored in Blockchain by the year 2025 according to world economic forum. Finally, The UAE will apply the Blockchain technology on all of its government services by 2020, saving $1.5 Billion as per the Dubai Blockchain Strategy launched recently by the Smart Dubai office. Indeed, there are several unlocked potential advantages for Blockchain technology [8]:

1. Increasing trust.
2. Empowering users.
3. Quality of information.
4. Transactions processed as agreed.
5. Records are immutable.
6. Instant transactions.
7. Cutting cost.

2.1.3. Challenges

The Blockchain is still an immature technology that is going to change our general public capacities. However, it has several problems that may strict the technology to be implemented [8]:
Technology approach.

- The elimination of intermediary.
- Expensive computer utilization.
- Further security constraints needed.
- Primary changes.
- Change in concept.
- The cost associated.

3. Discussions

This research has four main objectives, as stated in the research methodology earlier. In our study to each of these areas, we will include several parts. Each research objective includes several discussion points where we will contribute to. In the 1st part, we will add to the research findings and discuss it further. This contribution will be incorporated from previous experience, online resources related to the same topic, field case studies and learning materials. In the 2nd part, we will be comparing some opinions obtained from the interview responses. In the 3rd part, we will be suggesting several solutions that will help to implement the Blockchain technology while indicating the ability to use similar emerging technologies like Artificial Intelligence & machine learning. In the 4th part, we will discuss real case studies and scenarios that applied this specific research objective in a real-world example.

3.1. Discussions of the Results Pertaining to the Utilization of Blockchain Technology to Reduce the Costs of Student Record Archiving

The questions in the block focus on users' impressions of the student record archiving systems they already use at their institutions and their expectations for the future and possible implementation of the BC system.

The interpretation of these results will give us answers to different objectives raised in the study. In the first place we see that both students and administrative staff of educational institutions and external personnel, all of them, when asked about current archiving

technology systems or the possible implementation of BC technology, focus their interest on the satisfaction of the student, who is actually the ultimate recipient of the services offered by these institutions.

3.1.1. Student Records Archiving Methods

The Ministry of Education requires the higher education institutions to keep a physical hard copy of the student records archived. This involves printing the complete file of the student as well as any service request processed under his/her name. It is often required to refer to a student's record to check on specific information. To ease the process, some education institute tries to add the student online system to the process. This gives them the ability to generate reports, get contact information and check previous records. The use of both methods will allow the organization to comply with the requirements of the ministry of education while making the process of checking student records smooth.

There is a risk of losing data and information that is stored in the public folder. This creates a critical position for the organization where they may lose the trust element to the university. Additionally, this will lower the level of student satisfaction towards the university. As some universities depend on "word of mouth instead of their marketing activities", this is a potential risk that the student will not recommend the university to their friends/family.

The level of manual work involved in this process opens a window for human mistakes. Since there is no specific format to follow, the information stored on the system may be inconsistent. Additionally, this method will not track the changes made by the staff. Although the personnel may be authorized to access the information on the public folder, they may change the information on the system and no log file will track such changes.

Education institutes tend to migrate their information to ERP systems. "Electronic records management systems help manage the extensive information needed to plan and make well-informed decisions" [2]. Oracle PeopleSoft is known for its ability to provide a unique user experience for both; students and the administration staff. Other technology concepts could be adopted, such as Artificial Intelligence, face recognition and Blockchain. This helps to verify the academic records of the student making it reliable and genuine to use.

Additionally, it could help to conduct process like marking attendance without the need to print any documents using the artificial intelligence concept. Online ERP systems may provide another value for different departments across the organization. An employer may study inside the same university they work in. There will be one profile created for one person with two separate identities.

This is the least likely method to be used by the university. It requires document printing and archiving them to the manual system in the filing room. Similar to the public folder method, administration staff will not be able to generate reports or validate missing documents from the student. Every time the student needs to check, update his/her information, the Administration staff has to check in the filing room and find out the requested information. This will increase the manual work involved and as a result, increase the chances of human mistakes.

3.1.2. Ability to Generate Operational Reports for Other Departments

The student administration department is the entity whiten the university that holds the student academic information, complete service requests, and process academic forms. In case other department needs a report for their references, they will need to approach the student administration department and based on the required request, the head of the student services will decide to proceed or not. This may consume time and efforts that are needed to complete the request. Student administration may need higher management to continue with some applications. In some cases, students may miss the opportunity to get a scholarship or accreditation because of their requests not being processed on time. This creates unsatisfactory

feedback to the student and put the university in a situation where they need to compensate the student. This increases the resources allocated which could be used for other similar tasks.

With the use of technology, the administration team may create an online workflow that follows specific steps. The main benefit here is an instance. The student administration department may be able to track student requests without interfering with them. The efforts made by the administration staff could be used in other tasks that require critical thinking. Such requests may include Appeal requests, credit transfer, dissertation registration, and official letters.

Research in other futuristic technology concepts has shown significant benefits to complete a structured process. Artificial Intelligence may be used to detect student's request and advise the proper procedure to complete it. Additionally, it may help to identify mistakes that are more likely to happen and fix the workflow without human assistance.

3.1.3. Effects of Using Blockchain Technology to Reduce the Cost of Student Records Archiving

The operating cost required to complete activities associated with student records archiving could be reduced. This is an essential area that business leaders look to generally. Instead of printing documents, hiring extra staff members & spending efforts to complete basic processes, once the record is created using the Blockchain technology and encrypted, there will be no need to verify this information, print the record or use efforts from staff members to follow up on it like entering data by mistake, correcting information related to student and generating reports required for higher management.

Our only participant who didn't agree on Blockchain to reduce the operating cost of maintaining the student records specified his opinion because of the initial cost associated with such technology. This cost is required for staff training, research, and development, errors that may occur long the implementation process and cost of uncertainty in which the staff tends to stay in the comfort zone.

I do believe that every new technology requires investing in it if the expected ROI is high. In the case of new technology like Blockchain and after understanding the main requirements of the education sector, we could conclude that it has a positive impact on saving the cost of the daily operations for educational institutes. Blockchain will cut efforts needed to complete the same process manually, enhance the usability of the information by making it reliable and provide security. Additionally, Blockchain provide a way to report to other entities with the need for human efforts.

As five of our participants agreed on the idea of using the Blockchain to reduce the time needed to complete a process, this is because the information will be verified once encrypted. Meaning, the student administration department will no longer need to check records, contact other organizations or request the student to send any document. This will cut the processing time required to finish a particular task.

From a managerial perspective, staff should use the total 8 h associated with work effectively with quality of work. Managers do calculate the time needed for each process and try to find effective ways to finish it.

Two applicants didn't expect the Blockchain to change the process and reduce the time needed to finish tasks. Since it is a new technology, the staff has to dedicate time to learn new concepts to apply technology. Additionally, they may make mistakes which will cost extra time to fix, however, completing the task without the technology has more risks and it was tested before.

I do believe that business has a more significant margin for errors. Managers can accept a higher number of mistakes if the new method is expected to provide them with higher ROI.

3.2. Discussions of the Results Pertaining to Utilization of Blockchain Technology to Enhance the Integrity of Student Records

As we said before, the student, as the ultimate user of the services of these institutions, occupies a central place in the responses of the respondents on the integrity of the records. Complete records not only facilitate administrative procedures, saving time and money but also increase student satisfaction and improve the image of the educational institution.

The words that often follow are all the words on which the questions revolve, so, logically, they appear frequently.

However, we are struck by the appearance of words such as records, staff, time and access, which in the previous question, for example, came in positions after 50 in terms of frequency.

When asked about the integrity of records, students and administrators understand the vital role of the administrative staff of the institutions as regards the integrity of records, access to them, and the time invested in the operations of recording, accessing, modifying and maintaining them.

3.2.1. The Current Implementation of the Blockchain to Maintain Records Integrity

Three participants reported that they currently use the Blockchain technology to preserve the integrity of the student records. Information integrity is the state where the information of the student records is whole and complete. Four main elements ensure data integrity [9]:

- Complete.
- Current.
- Accurate.
- Authorization.

On the other hand, two participants didn't agree of using the Blockchain technology at the moment because it is a new technology concept and it requires more time to prove its reliability. They needed a ready and proven technology instead. They are using other methods to keep track of the integrity of the student records. However, I believe that traditional ways to do such a process will involve a considerable risk they may happen and could allow staff to make mistakes.

Ensuring the integrity of the student records will help to save money and time in several dimensions, especially in a country like the UAE. There are several initiatives which were launched to put the UAE at the forefront of other countries. Area 2071 is founded to invest in research and development to make the UAE the best country in the world by the year 2071 (100 years post the independence of the United Arab Emirates). Several jobs were created in many fields that target primary services such as education, transportation, water & electricity, and many more. This requires everyone who is working in any of these areas to have the knowledge and the competencies required. Assuring the integrity of the academic records will help support these objectives and initiatives.

3.2.2. Challenges Occurred to Maintain the Integrity of the Student Records

Several mistakes were reported in our interviews. Information was shared with unauthorized parts who had access to change them. This has a substantial potential risk towards the image of the organization in the community, especially education organizations.

Blockchain will help in the resolution of many issues faced by our administrative staff in educational organizations. The majority of these mistakes are human-based. Automated processes have better ability to satisfy the business needs with fewer errors.

These human mistakes could be the cases like entering information by mistake, changing existing record unintendedly and misleading the correct student profile. Since there is a manual process involved, there is a high percentage of errors to happen. Additionally, in case there are several parts involved in the process, the probability of error increases due to different thinking concepts. Adding to this, at the early stage of implementation, staff could make a mistake without knowing the proper process.

Another percentage of errors may occur because of the wrong way of setting up the system. A general rule of thumb instructs us to understand the business processes before we implement the system itself. Assuring that the system implementation stage is correctly reflecting what a business process is a key to the success of investing in the system. Several technologies were initiated and didn't continue because the users didn't understand the implementation concept.

The technology implementations are enormous. P#02 mentioned that using today's technology, the student may be able to print a graduation certificate and falsify the signature on it. It will look like the real signature in the case of using laser printers. Also, online records may be tempered to reflect false information. From this perspective, we need to adopt a way to verify online information ensuring that they are correct and up to date.

3.2.3. The Ability of Blockchain to Maintain the Integrity

The Blockchain technology can enhance the functionality of the student records archiving, allowing it to be safe and secure to be shared with the authorized parts only. This is because of maintaining a high level of confidentiality that keeps the students' records accessible to ecosystem parties. While satisfying the condition of student records integrity that keeps the whole of the record and correct.

Blockchain Technology will increase the level of student satisfaction by transferring the daily services required by the students to instant and accurate results. This helps to promote the concept of student happiness and helps to implement its effects. Blockchain will be enhancing the trust element allowing the parties who are participating in the same ecosystem to transact safely. This supports the four main part that consists of the integrity factor. We will need to authorize any node before allowing them to access the ecosystem. We will use the permission list access to enable them to contribute and participate.

In a recent study which was conducted by the Ministry of Education and published by Emirates Al-Youm newspaper, the current job market in the UAE has an attractive environment for many employees who would like to work and live in the UAE. In several occasions, those employees would falsify their education degrees to get accepted to their jobs. To maintain a strong level of education in the UAE, several governmental organizations require the employee to apply for the equivalency application in which may take several efforts, as stated earlier.

Nowadays, we live in a fast-changing world where data represent the basis of everything. It is vital to ensure the integrity of the data stored. For instance, this data could be used to take sensitive decisions or forecast future scenarios before they happen. In a business perspective, this helps to reach the organization's goals.

As the technology is still new, touching on its value might be a challenge due to investing lots of time for research and development. For its benefits to be revealed, the implementation plan has to be very careful to address the business requirements to avoid spending double the time needed.

3.3. Discussions of the Results Pertaining to the Utilization of Blockchain Technology to Enhance the Confidentiality of Student Records

We see how, with the introduction of questions about confidentiality, the words access and record become more critical in the answers of our respondents. They understand the importance of the information recorded at universities about their students and the danger that any gap or leaking in this data can pose, not only about the students, their studies and their financial issues but also about the image of the institution. From the answers, we also see that the most crucial concern comes from the insecurity that exists regarding access to this information. Whether or not data has been leaked, the concern about who has access to the data is the most crucial issue in terms of confidentiality.

Importance and Risks Involved in the Confidentiality of the Student Records

Assuring the student that his/her information is confidential, has a positive impact on the university. It reflects a level of professionalism in the community. The student expects this by default. Confidentiality helps to promote the trust element between the university and the student. This will increase the overall satisfaction of the student and help show a positive image of the university. Additionally, confidentiality helps to obtain accreditation from internationally well-known accreditation organizations.

The student might be a victim for attempts to get personal information and use it in other applications like bank verification or telecommunication data update. An individual who knows the necessary information about the student may attempt to visit the university to get further information. If they succeed, they could use this information to replace their mobile phone number and then call the bank and complete financial transactions. From this perspective, it is highly essential to maintain the confidentiality of the student records ensuring that information is only shared with the authorized parts. Education institutes often tend to ask the student to sign on an authorization form that confirms the eligibility of the particular person to access their information.

Risks also could include breaching the privacy of the student, which is considered unacceptable behaviour. Identity theft is the main result for such a threat and could affect the organization negatively.

3.4. Discussions of the Results Pertaining to the Utilization of Blockchain Technology to Enhance the Student Life Experience in the HE Institution

The student is the ultimate consumer of the services offered by educational institutions, especially in a block of questions that revolve around their satisfaction and the improvement of their experience in educational institutions, so it is reasonable that it is the word that appears most frequently. The following words in frequency, Information, System, Data, and Blockchain, are all terms on which the questions have revolved. Frequent words also include access, technology, staff, department, process and time.

3.4.1. Changes Associated with Adopting the Blockchain Technology to the Current Process

To be able to provide the highest level of education, universities in the UAE often benchmark themselves with several goals and objectives that will be able to guide their staff to work towards complying with them. These goals are linked to broader concepts like student's happiness, distinctive education level, high standard research capabilities, capturing the recent technologies and applying them and fulfilling the market demand. Additionally, they continually work to use the new technologies which will save resources and help the student to have a better experience.

University management needs to satisfy the requirements which will help them to reach these goals. Some of which will help to increase the preserved image of the university in the community like complying with the data confidentiality and integrity while reading and

storing the student information. Additionally, meeting these goals will help to reach the mission and vision statements for the organization.

3.4.2. Reaching to the Overall Organization's Goals through Blockchain Technology

University's top management has several objectives and strategies to achieve their mission and vision statements. Organization's goals are essential to draw a path for the staff to follow. These goals may be like getting international accreditation from international organizations, applying research and improve it in the current market, gain value over other intuitions by providing security and technology edges.

3.4.3. Demonstration of Using the Blockchain Technology in Education

The British University in Dubai (In association with University of Nicosia) has recently adopted the Blockchain technology to verify the final graduation certificate to its graduation. Earlier, the student used to visit three organizations to complete the requirements of the attestation before heading back to the destination country for the equivalency. It gets more complicated if certain documents are required. With the adoption of the Blockchain technology, the student will be able to graduate and receive an encrypted PDF file which will be used by the final authorizing part to verify the validity of the certificate. This saves time, efforts and money.

4. Research Contributions

Adopting the technology of the Blockchain to reduce the cost of the students records archiving will help to reduce the efforts made by the admission department and the time consumed. It was noticed from all our participants that they do tend to have a Student Information System, which is used to keep track of the student data securely. However, they still have to meet with the auditing requirements of the Ministry of Education to keep a physical hard copy. This requirement doubles the work on admission department since they do use the online system and maintain the physical file for each active student.

Today, several technologies could help to replace the process of maintaining a physical hard copy of the student records. With the adoption of technologies like Cloud computing and Blockchain, the records stored using such techniques will be verified using the issuing organization, and it would be accessible anywhere.

Adding to this, archiving the student records online may help the Ministry of Education to check & audit the student records remotely without the need to visit the organization. This may help to track students with exceptional cases like degree equivalency, English language follow up and GPA conditions and help track & follow up with them. Additionally, different departments in the university may be able to quickly generate reports without the need to follow up with the student administration department.

Adopting this technology is essential in the area of records management. The existing methods available are often expensive and take time/efforts to process. Also, these methods are being managed by intermediaries, assuming that we could trust them; they usually do charge a significant amount of money. We also need to issue documents and use physical papers which is one of the main operational cost for organizations. From the other hand, we would require to train our new staff on how to use such methods and integrate them with the current system available. According to Figure 1, Blockchain does not require any intermediaries to process the transactions. This will save cost. Additionally, there will be no need for audits as the information stored is assured to be correct. It is guaranteed that every business would invest in reducing the time/efforts made by staff members in daily processes. Admission officers require attestation from the Ministry of Education to ensure the correctness of the academic records. This will encounter extra time, efforts and cost to the student to complete the attestation process from the ministry (in addition to providing them

with other supporting documents required in the application with may require another attestation process). In some cases, students may need to travel back to their country to get some reports. Blockchain will cut these efforts made for all parts, student, university and ministry. The student record will be stored online and accessible to anyone on the ecosystem (including university admission staff). The saves time/efforts made to verify the documents and ensure a smooth process.

5. Future Work

The results obtained in this study not only encourage us to continue investigating the infinite possibilities offered by technologies such as Blockchain to improve the experience of users of higher education institutions, improve the security of academic and banking data of students, and ensure the confidential information of the functioning of the organization or entity, but also encourages us to implement this technology, and others such as the use of Machine Learning, to avoid the creation of wrong records.

Additionally, future research is required to show the perception of the student in the higher education sectors and how it will affect their student life experience. A unified system will not only be beneficial for the educational entity that implements this technology, but also for its relations with other entities and with the Government in its different sectors, resulting in more efficient and secure performance and greater satisfaction for students and users.

6. Conclusions

Blockchain technology has proven its capabilities to provide verified accurate information for several related transactions without having to worry about the ability to alter, change or update this information. We need to study the business case very well and implement it on a small scale to be able to identify if such technology will help or not. Also, spreading awareness about this technology plays an essential factor in its success. The Blockchain could have many potential applications due to its advantages: immutable, trust and transparent among all transactions executed on the Blockchain ecosystem between its nodes.

Blockchain can go beyond graduation certificates validation, graduation certificates issuance. It can provide details on the student progression, different learning process in campus and plan & implement learning activities. Blockchain technology could also be used to complete tasks like student supervision, as it helps programme supervisors complete their tasks. It also assists in the evaluation process, where the module coordinator needs every detail on the of the module studied.

Finally, smart contracts could also support the university to check, track and validate the conformity on the teaching skills and experience of each faculty member. Smart contracts will be used as an evaluator to help reach to the overall quality assurance for the university by setting the required performance level that academic staff need to follow and monitors their performance regularly.

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