

# The Recent Open Problem, Benefit and Challenge of Blockchain Technology in Education

Meyliana, Surjandy, Yakob Utama Chandra, Cadelina Cassandra, Erick Fernando

**Abstract:** *The development of the education sector, especially the University at this time in Indonesia became the main focus of the government, the University was driven to become a leading university not only in the national scale but globally. The graduates of the university became an interesting topic to study because there is a gap between the Education and industry as a graduate user. Blockchain technology now is not only for cryptocurrency, but many researches nowadays believe that Blockchain technology can provide more benefits for universities*

*Several studies mention Blockchain Technology can help in preventing fake diplomas certificate, libraries for borrowing books, and student loans. Those researches are still separated into several resources, so it is difficult to consolidate the benefits and challenges of using the Technology blockchain for universities. Therefore, this exploratory research tries to look for open problems, recent trends of the benefits and challenges of blockchain technology research in education sector as well as looking blockchain technology influence on the important elements in universities, such as people, process, and technology. This research will be conducted using a systematic method by reviewing literature from 9 well-known publishers such as (ACM, SAGE, IEEEExplore, Taylor and Francis, Science Direct, Wiley, MDPI, AISEL, and Scopus index) to get a complete picture of blockchain technology in university. The study found the benefits and challenges of using Blockchain Technology and 70% of the important factors is on technology, 15% on people and 50% on processes.*

**Keywords:** *About four key words or phrases in alphabetical order, separated by commas.*

## I. INTRODUCTION

The education sector development, especially universities in Indonesia became the main focus of the government, but in its development many universities experienced problems, one

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of them is fake diplomas, blockchain technology have the ability to solve problems in university operational process. Therefore, this study tries to find the newest blockchain technology used in universities. The method used in this qualitative study is a systematic literature review. 9 Reputable journal publishers used in this article search are SAGE, ACM, IEEE Explore, Science Direct, Taylor and Francis, Wiley, AISEL, MDPI and Scopus index to search for open problems, then search the important factors and benefits and challenges in using blockchain technology. After important factors are found then these factors are mapped to the framework or model of the Leavitt model[1]. They are people, process and technology to see the impact or influence of the factors found on these 3 factors. It was founded that of the 20 important factors, 70% affect technology, 15% important factors affect people and 50% affect the process.

## II. LITERATURE REVIEW

### A. Systematic Literature Review

Systematic Literature Review is one of the exploratory research methods that aims to get as much information as possible in this research to get an overall picture Blockchain Technology research Education, especially universities. The SLR method is often used in information systems research, such as to find important factors, open problems, benefits and challenges. In this study, the SLR method is used to look for problems that can be solved by blockchain technology, problems that will be faced by blockchain technology in universities and what the important factors are.

### B. Blockchain

Blockchain is a new technology invented by a person or group called Satoshi Nakamoto 2008[2][3]. Blockchain technology was first used for Cryptocurrency in 2009, but since the smart contract is invented by Nick Szabo a cryptographer in 2014[4], Blockchain technology can be used for Enterprise Systems such as Customer Relationship Management, Supply Chain Management

### C. NVIVO

NVIVO tools used to facilitate the searching factor found in from the selected paper. NVIVO is tools used to analyst wording from the journal text and try to find the several word such as distributed, secure, immutable, protected, shared. Searching words in detail can be seen at Table V.

III. METHODOLOGY

To search the related journals using PRISMA technique of SLR, it is started with a search on the paper TITLE containing the Blockchain keyword and if the findings are more than 500 then the keyword will be changed to "Blockchain and education". After the data is collected, the paper will be filtered by reading the introduction and only select the papers with the same theme and paper will be categorized as candidate paper and then read all the paper and then the selected papers will be processed to find the important factors and will be mapped into the People, Process and Technology framework.

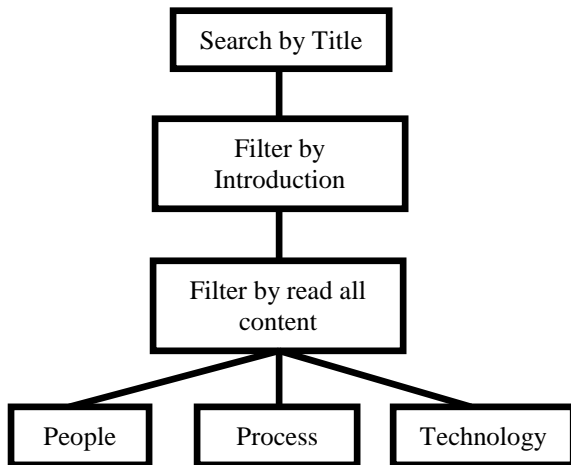


Fig. 1. Research Design of SLR

A. Exclusion Criteria

In the paper searching process, there are some exclusion criteria such only English written paper, a paper that discusses blockchain technology for cryptocurrency, paper that discusses blockchain technology for security. Only those paper that discuss the blockchain technology for education are selected.

B. Inclusion Criteria

Paper that fall into the criteria or inclusion criteria such as papers in English, papers with the publication of the last 5 years (since smart contract was found). Paper that discusses the use of block engineering technology for universities.

IV. RESULT AND DISCUSSION

This section discussing about the SLR result.

A. Type of Paper

This section will discuss about the sources. For details, it can be seen in table I. which consists of 7 (43.75%) papers with conference type, 7 (43.75%) papers with journal type and 2 (12.50%) other papers. 4 papers (25%) on 2017, 6 papers (37.5%) on 2018 and 6 papers (37.5%) on 2019.

Table- I: Paper Source

Type	Description	Year
Other	CCEG Blockchain UN Lab	2017
Journal	National Education Perspectives	2017

Type	Description	Year
Other	Educauserreview	2017
Conference	8 <sup>th</sup> International Conference on Information Technology (ICIT)	2017
Journal	Journal of Higher Education Policy and Management	2018
Journal	IEEE Access	2018
Conference	Chinese Automation Congress	2018
Conference	Second International Conference on Advance in Computing, Control and Communication Technology (IAC3T)	2018
Conference	IEEE Frontiers in Education Conference	2018
Conference	Chinese Automation Congress (CAC)	2018
Conference	4 <sup>th</sup> MEC International Conference on Big Data and Smart City (ICBDSC)	2019
Journal	International Journal Network Maangement	2019
Journal	Applied Sciences	2019
Conference	International Conference ICT, Society, and Human Beings	2019
Journal	International Journal of Recent Technology and Engineering	2019
Conference	3 <sup>rd</sup> International Conference on Future Networks and Distributed Systems	2019

B. Author's background

The author's background can be seen on table II. There are 3 papers from United Kingdom (18.75%), 2 papers from China and India (12.5%), and the rest is 1 paper (6.25%).

Table- II: Author's Country

Country	Paper(s)	%
UK	3	18.75%
China	2	12.5%
India	2	12.5%
Slovenia	1	6.25%
Oman	1	6.25%
Brazil	1	6.25%
Finland	1	6.25%
Saudi Arabia	1	6.25%

Indonesia	1	6.25%
Singapore	1	6.25%
Malaysia	1	6.25%
Canada	1	6.25%
USA	1	6.25%
Pakistan	1	6.25%

### C. Open Problem

This section discussing about the open problem founded from the previous research and using Blockchain Technology as the solution. The detail can be seen on table III.

Table- III: Open Problem

No	Problem Found	References
1	Keep maintaining relevance of curriculum and delivery of course dan assesment	[5]
2	Control data by 3 <sup>rd</sup> party	[6]
3	Unsecure student profile data	[7] [8]
4	Manual or semi manual academic transcript verification,	[9] [10]
5	Transcript validation Berauracy	[9] [11]
6	Forgeries Transcript	[9]
7	Loss of transcript record	[9]
8	Attacked (unsecured data)	[12] [13]
9	Security Issues (centralized data)	[14] [8]
10	Failure data access	[14]
11	Higher access time	[14]
12	Fake Certificate	[15]
13	Poor management filling system	[16]
14	Difference educational organization	[17]

### D. Benefit of Blockchain Technology in Education

This section will show how the advantages and disadvantages by using blockchain technology in education for details can be seen in Table IV.

Table- IV: Benefit of Blockchain Technology

No	Problem Found	References
1	Automated and secured process of student activities and achievement records	[5] [16] [8]
2	Reliable data of student credit	[6] [13]
3	Ensure Privacy and security data transcript	[7] [12]

No	Problem Found	References
4	Reduce berauracy (speed up process) data validation	[7] [18] [11]
5	Saving storage	[7]
6	Identity management	[7] [13]
7	Verified of Academic Certification and Course credit	[14] [10]
8	Open and Transparant (data accreditation)	[19]
9	Counterfied Certificate Diploma	[15] [17]
10	Register, track, Certify and Enhance of learning assets	[18]

### E. Essential Blockchain Technology in Education

This section will explain the important factors by using blockchain technology in education. For details, can be seen in table V.

Table- V: Essential Factors

No	Factor(s)	Technology	People	Processes	Ref
1	Sustainable Development	X			[5]
2	Decentralized	X		X	[6][9] [20][15]
3	Integrity	X		X	[6] [20] [15]
4	Transparent			X	[6] [9] [19] [15] [17] [21]
5	Anonymity		X		[6]
6	Immutability	X		X	[6] [15] [10]
7	Longevity	X			[6]
8	Trusted	X			[6] [8] [18] [21]
9	Secured	X		X	[6] [9] [20] [15] [13] [17] [8] [10]
10	Privacy		X		[15] [16]
11	Shared	X			[15] [17] [8] [18] [21]
12	Consistent			X	[15]
13	Reliable	X			[20] [13] [10]
14	Automatic	X		X	[16] [18]
15	Safety		X		[13]

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No	Factor(s)	Technology	People	Processes	Ref
16	Quality	X			[13]
17	Protected	X			[8]
18	Track	X		X	[18]
19	Time savings			X	[10]
20	Efficient	X		X	[10]
		14	3	10	

Based on Table V, it can be inferred that essential factors that affect technology has 14 factors (70%), people have 3 factors (15%) and the process has 10 factors (50%).

## F. Technology Implication

This section will explain the implication of Blockchain in Technology aspect. The implication of using Blockchain Technology may create sustainable development of the business [5], Decentralized Blockchain technology creates benefit in University industry become robust infrastructure [6][9] [20][15], another impact of technology Blockchain in Business operation such as integrity & immutability of data, trusted, secured information, automatic process, trackable process, efficient[10].

## G. Process Implication

This section will explain the implication of Blockchain technology significant impact to process in university, many aspect will change by Blockchain such as trusted process due to decentralized and shared information, security, reliability and quality of data, privacy of data ownership [6] [9] [20] [15] [13] [17] [8] [10], automatic process my create efficiency of data than reduce time of process in the end will reduce cost of operational or efficiency[16] [18]. The ability of tracking process and immutable data of Blockchain Technology can be facilitate the certificate university diploma originality process or counterfeited the fake certificate diploma[18].

## H. People Implication

This section will explain the implication of people aspect in university due to the Blockchain technology, anonymity, privacy and safety factors are the main factor in people aspect. The anonymity will facilitate the shared information and keep the privacy of user/customer secured and safety because everyone can only see the transaction that has been done by the person but not the person identity[13] [15] [16]

## V. CONCLUSION

At the end, we can conclude that blockchain technology can be used to solve the problems in university, there are various advantages by using blockchain and the research are still growing nowadays. The aspect of People, Process and Technology in the university will impact directly, however the implication of Blockchain Technology bring a lot of benefit not only for student but also for institution. Efficiency process, secure data, reliable dan trusted information might bring another value for university.

In the future, blockchain technology is possibly can be implemented in education sector. The future research needs to look from the side of the best blockchain technology adoption

models in university business processes.

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## REFERENCES

1. Surjandy, Meyliana, A. N. Hidayanto, and H. Prabowo, ‘THE LATEST ADOPTION BLOCKCHAIN TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT: A SYSTEMATIC LITERATURE REVIEW’, *ICIC Express Lett.*, vol. 13, no. 10, pp. 913–920, 2019.
2. S. Nakamoto, ‘Bitcoin: A Peer-to-Peer Electronic Cash System’, 2008.
3. S. Nakamoto, ‘Bitcoin P2P e-cash paper’, 2008. [Online]. Available: <https://www.mail-archive.com/search?l=cryptography@metzdowd.com&q=from:%22Satoshi+Nakamoto%22>. [Accessed: 22-Jun-2018].
4. M. Swan, *Blockchain Blueprint for a New Economy*, 1st ed. USA: O’Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472, 2015.
5. P. Williams and P. Williams, ‘Does competency-based education with blockchain signal a new mission for universities? new mission for universities?’, *J. High. Educ. Policy Manag.*, vol. 00, no. 00, pp. 1–14, 2018.
6. M. Turkanovic, M. Holbl, K. Kosic, M. Hericko, A. Kamisalic, and M. Turkanovi, ‘EduCTX: A blockchain-based higher education credit platform’, *IEEE Access*, vol. X, no. January, pp. 1–15, 2018.
7. K. Al Harthy, ‘The upcoming Blockchain adoption in Higher-education: requirements and process’, *2019 4th MEC Int. Conf. Big Data Smart City*, pp. 1–5, 2019.
8. H. Sun, X. Wang, and X. Wang, ‘Application of blockchain technology in online education’, *Int. J. Emerg. Technol. Learn.*, vol. 13, no. 10, pp. 252–259, 2018.
9. L. M. Palma, M. A. G. Vigil, F. L. Pereira, and J. E. Martina, ‘Blockchain and smart contracts for higher education registry in Brazil’, *Int. J. Netw. Manag.*, no. June 2018, pp. 1–21, 2019.
10. A. Ghaffar, ‘BCEAP – A Blockchain Embedded Academic Paradigm to Augment Legacy Education through Application’, 2019.
11. D. J. Skiba, ‘The Potential of Blockchain in Education and Health Care’, *Nurs. Educ. Perspect.*, vol. 38, no. 4, pp. 220–221, 2017.
12. X. Gong, X. Liu, and S. Jing, ‘Parallel-Education-Blockchain Driven Smart Education: Challenges and Issues’, *2018 Chinese Autom. Congr.*, pp. 2390–2395, 2018.
13. D. Tapscott and A. Tapscott, ‘The Blockchain Revolution & Higher Education’, *Educauserreview*, Apr. 2017.
14. A. Srivastava, ‘A Distributed Credit Transfer Educational Framework based on Blockchain’, *2018 Second Int. Conf. Adv. Comput. Control Commun. Technol.*, pp. 54–59, 2018.
15. Meyliana *et al.*, ‘DEFYING THE CERTIFICATION DIPLOMA FORGERY WITH BLOCKCHAIN PLATFORM: A PROPOSED MODEL’, in *IADIS International Conference ICT, Society and Human Beings 2019 (part of MCCSIS 2019)*, 2019, pp. 63–71.
16. H. M. Gazali, R. Hassan, R. M. Nor, and H. M. . Rahman, ‘Re-inventing PTPTN study loan with blockchain and smart contracts’, in *2017 8th International Conference on Information Technology (ICIT)*, 2017, pp. 751–754.
17. A. Karale and H. Khanuja, ‘Implementation of Blockchain Technology in Education System’, *Int. J. Recent Technol. Eng.*, vol. 8, no. 2, pp. 3823–3828, 2019.
18. C. Devecchi *et al.*, ‘Blockchain Educational Passport Blockchain Educational Passport: Decentralised’, no. 5.03, pp. 1–31, 2017.



19. A. Mikroyannidis, J. Domingue, M. Bachler, and K. Quick, 'Smart Blockchain Badges for Data Science Education', *2018 IEEE Front. Educ. Conf.*, pp. 1–5, 2018.
20. A. Alammery, S. Alhazmi, M. Almasri, and S. Gillani, 'Blockchain-Based Applications in Education: A Systematic Literature Review', *Appl. Sci.*, vol. 9, 2019.
21. Ž. Turk and R. Klinc, 'Potentials of Blockchain Technology for Construction Management', *Procedia Eng.*, vol. 196, no. June, pp. 638–645, 2017.

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