RESEARCHING BLOCKCHAIN TECHNOLOGY AND ITS USEFULNESS IN HIGHER EDUCATION

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ABSTRACT

The current paper focuses on the potential of using Blockchain Technology (BCT) in the Higher Education Domain and explores its usefulness in solving Higher Education issues. This research discusses the Blockchain features, challenges and its benefits in education, followed by review of some current Blockchain Higher Education applications. This paper reviews the Blockchain Technology (BCT) and its implementation in Higher Education. This research used a quantitative methodology and stratified clustered simple random sampling approach. Data has been gathered through an online survey instrument and the partial least squares structural equation modelling (PLS-SEM) technique applied to 383 responses. Blockchain technology has its unique features, benefits that can solve Education system requirements, and its successful implementation issues discussed. An effort made to gather enough consensus to build future implementation. The integrated model of Blockchain features matched to the needs of the Education System by agreement of the experts (discussions), and a survey conducted involving the students, teachers, educationists, Blockchain experts, and professionals, is tested and validated by SEM using PLS.

KEYWORDS

Blockchain Technology (BCT), Higher Education Implementation, Higher Education Domain, Higher Education Management, Higher Education Technology, Structural Equation Model.

1. INTRODUCTION AND BACKGROUND

Blockchain Technology is known to most people about Bitcoin and other cryptocurrencies (Zhao et al., 2016). Blockchain has been now around for about a decade, other than in cryptocurrency it has not been very successful. It has been applied to many areas of Business-like finance, judiciary, Higher education, healthcare, logistics, and commerce; however, with limited success. In its current form in these industries, it can be termed more to be a smart system than a Blockchain. Research has shown that many small implementations in Higher Education have happened; however, success is limited. The full potential of Blockchain Technology in education is desired. The Blockchain Technology features and benefits proven so far have the potential to address most of the challenges currently experienced in Higher Education Framework (Alam et al.,2020), (Mahmood et al., 2020).

The rigidity of the current Higher Education System prohibits the Learner from choosing what to study, in terms of focus on a specific topic. Blockchain Technology is suitable for the Higher Education Domain due to its immutability, transparency, and trustworthiness characteristics, which can be useful in Higher Education application (Underwood, 2016).

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Exploring Blockchain Technology: The Security feature of Blockchain is valuable to the Higher Education sector due to its digital signature and encryption. The Blockchain Technology system for Higher Education needs to be secure, convenient, and tamperproof to keep records of certification and transcripts. Blockchain Technology can provide a system which can control frauds (Chen et al., 2018). The system based on data stored in several decentralized ledgers and encrypted makes it difficult for hackers to get access. Information, if lost, can be quickly recovered. This feature is very crucial in Higher Education as the records need to be secured. Blockchain Technology maintains transparency. The Participants of transactions notified about the completion of transactions, which is both convenient and trustworthy (Alexopoulos et al., 2019). It is free of Intermediates and so no hidden fees as the system is decentralized, free of fees and faster settlements. The Access levels have to be decided by the Users where access is available to anyone (Public) or authorized permission given for each node (restricted) (Swan, 2015). The Speed of Transactions is processed much faster than usual, as there is no need to include payment systems, which reduce the cost and increases the processing speed. Since Account reconciliation is immediate, the validity of transactions is checked and confirmed by participants, thus leading to authenticity. All of these features of Blockchain meets the requirement in the Higher Education Framework (Zheng et al., 2017). Blockchain Technology experience tells us that if there has to be a Blockchain revolution, many barriers- technological, governance, organizational and even societal- will have to break. It would not be proper to proceed with Blockchain implementation without understanding how it is likely to influence the Higher Education field (Lakhani, 2017); (Hughes et al., 2019). It is of interest to understand private Blockchain networks which have been around for some time; however, not integrated (Zheng et al., 2018).

Blockchain Technology usefulness to Higher Education: Most Learners have issues to get their old Higher Educational certificate authenticated, acquired a long time back. The hard copy submitted to the Employer for employment or for pursuing higher studies usually needs authentication by the relevant authorities like the HR Department, the College Administrators, the Ministry of External Affairs. The current system has the issue of a long wait; it would take more than 3- 4 weeks provided the Certificate issuer still exists. If the college from which the Learner has graduated does not exist now, the same certificates look suspicious to the current people who go through it. Such incidents cannot occur if the records are maintained on a Blockchain system, as the record is maintained in different Ledgers all separately kept. In this article, an overview on the BCT with required details is discussed that apply to integrate individual institutions at local level, groups of institutions at the national level to common Blockchain Higher Education platform (Lizcano et al., 2019). Some of the applications are school records management by maintaining verifiable Student transcript and degrees which can be transferred to remote storage easily (Chen et al., 2018). The student privacy, confidentiality is ensured by authorized permissions and management of records using BCT. The public funds distribution and private grants given, student loans payments; license/dissertation/PhD thesis management is easily tracked using the BCT. If the Blockchain Technology integrated across the various sectors and Industries, it would revolutionize the use of BCT. The objectives of this paper are to give insights on the use of Blockchain Technology for Higher Education applications, to highlight the state-of-the-art techniques that currently used to provide these services, to examine their challenges, and to discuss how the Blockchain Technology can resolve these challenges (Batubara et al., 2018).

Blockchain Technology usefulness to Higher Education is undeniable (Holotescu, 2018).

2. RESEARCH PROBLEM

Research Questions

a. Are the features of Blockchain Technology suitable to Higher Education?
b. Can the Blockchain Technology features & benefits be useful in Higher Education Framework?

3. OBJECTIVES OF THE PROPOSED RESEARCH

a. Investigate the suitability of the features, the usefulness of Blockchain to Higher Education Sector

b. Review the benefits & features of using Blockchain Technology in Higher Education Framework and Investigate the future of Blockchain in Higher Education.

4. SCOPE OF THE STUDY

This Research proposes to conduct a literature review of the usefulness of Blockchain Technology to various sectors and how it can be used in Higher Education to ensure authenticity, avoid frauds, ensure data security. Research until today has shown that the implementation of Blockchain Technology in most sectors, including Higher Education, has been limited and not utilized the immense potential of the BCT. The Research article is to find the gaps and to see the ways all the features, benefits utilized to make it commercially viable to Higher Education Framework. The working of the Blockchain Technology giving the technical details is not in the scope of this paper.

5. PAPER ORGANIZATION AND THE RESEARCH BASIS

This paper organizes the references of various researches done earlier and derive the Literature Review, explaining the purpose for the same. The Gap Analysis developed by identifying the gaps mentioned in the Research papers studied. From this, the most frequently occurring gaps taken for study purpose for this paper. The dependent variable identified as the "Usefulness of Blockchain Technology in Higher Education" and the factors which frequently occur in the above-identified articles for papers are listed. The six factors with the highest frequency form the independent factors to determine the conceptual model shown in figure 1. Based on the above Research problems, research objectives and the possible solutions are determined to form the Research Framework.

Then the Usefulness of the Blockchain Technology to the Higher Education is discussed. The benefits and features of Blockchain Technology have been listed and explained in details. Next, the challenges in the implementation of the same and the hurdles anticipated discussed. The possible solutions suggested in the implementation and the Methodology that followed discussed: the limitations and the conclusion given at the end. The references have been cited at each juncture to make it more creditable and make the arguments robust.

6. SURVEY OF LITERATURE

6.1. Purpose of the Literature Review:

The purpose of the Literature review is to collect information and knowledge on the Blockchain and its various applications and focus on Higher Education (Rowley et al., 2004). The areas of prior studies identified to prevent duplication of the work and to give credit to the other Researchers wherever their material used. It helps to look for inconsistencies, gaps in Research, conflicts or open questions left out in the earlier researchers. The need for additional Research identified and justified. The above would be the contribution to the topic and justify the further study needed. The other research papers and literature study will help the Research with ideas, conclusions and theories, establish similarities and differences and notice principal methodologies and research techniques used (Risius et al., 2017). Most Researches have used secondary Research to come to their conclusions. First, the Articles identified and screened before being included in the Literature Review. The keywords used by the Authors help in identifying the relevant articles. The Keywords mentioned above used in Google Scholar, Mendeley, Article Publishers website like Scopus, Harvard Review, IEEE for the above purpose (Firdaus et al., 2019). It has to be decided what articles to consider for review and which ones to exclude. The main reason is to exclude articles or topics, which are out of the scope of the study, like Bitcoin and Cryptocurrencies and discussing trading (Hart, 2018). It helps to understand the style of writing and research methodology followed by significant researchers in Blockchain and its application in Higher Education, which is majorly secondary research, and Inductive. Therefore, it led the way to make the Research Plan (Ahmed et al., 2018).

6.2. Detailed explanation as to how the literature was identified

The Secondary Research using the Keywords and systematic search and review, 110 articles were identified from credible journals like Scopus, IEEE Access, ProQuest, library resources, upward of 2016. Only SCJ used wherein if the H Index is more than 60, then the journal is considered credible. Care to restrict the literature review search only to peer-reviewed articles so that the selected articles or literature is credible. Sufficient attention to check currency, relevance and reference of the Articles. Seventy-seven articles identified using the inclusion approach and balance excluded due to a lack of quality material to using the Keywords and systematic search and review, 110 articles were identified from credible journals like Scopus, IEEE Access, ProQuest, library resources, upward of 2016. Only SCJ used wherein if the H Index is more than 60, then the journal is considered credible. Sufficient care to restrict the literature review search only to peer-reviewed articles so that the selected articles or literature is credible. Sufficient attention taken to check, currency, relevance and reference of the Articles—seventy-seven articles identified using the inclusion approach and balance excluded due to a lack of quality material used. The articles then compiled into a Summary table identifying the significant findings on which the variable depend on (Machi et al., 2016). The table includes the type of Research done, the Primary and Secondary Research, which has used to collect data and to analyze. The limitations or gaps made to produce the Gap Analysis and the Research conceptual model shown in figure 1. The whole idea is to identify credible references for putting forward the topic attributes in a systematic manner (Creswell et al., 2017). The above will avoid duplication, and it gives the readers a synopsis of the things to come and motivates them. The type of data used by the major of them is secondary data through conference papers, journal reviews, government data, grey literature, books. So, the idea to go further with our Research design ascertained.

The significant findings with the dependent, independent, sub-variables identified, and the frequency of occurrence will help to ascertain Research Variables (Fink, 2019). It also enables the Researcher to focus on contribution to the existing Research Topic like Energy Requirements in the Blockchain Technology and the Regulator, First Sponsor necessity in today's context is the contribution of this Research Article (Koteska et al., 2017). This article should look at the perspectives to be included and excluded and should be reflective (Miles et al., 1994), (Batubara et al., 2018).

6.3. Usefulness of Blockchain in Higher Education

From the Literature review, it has identified that the Independent Constructs are Decentralization, Traceability, Immutability, Currency properties, Scalability, First Sponsor Organization and Energy Requirements. These are the main features of Blockchain Technology, which will be useful in Higher Education Domain, identified as the Independent Variable (Johnson, 2018); (Beck, 2018). Most of the Systems are centralized, i.e. all the data are maintained in a single spot, and this makes it vulnerable to the risk of losing data, being hacked or the information compromised, for example, Facebook data leakage and Education data leakage from Universities, Education websites (Cheng et al., 2017), (Alneyadi et al., 2016).

Decentralization is the process of keeping Data in various places and not with a single entity. In Blockchain, in peer network with decentralized structure the system has various nodes with storage, data verification, maintenance, and transmission facilities. A decentralized system, built trust using mathematical methods between distributed nodes. In Higher Education, it translates to storing certificates, records of Learners, maintained and transmitted on Blockchain system with lesser fear of being hacked or compromised (Huang et al., 2017). The Blockchain uses cryptic codes to encrypt transactions, done by Miners, which is complex to crack and gets more complicated with increased transactions and nodes added to the network. It does not involve any third-party intermediator and Employers can verify Student certificates at the click of the mouse. (Chen, 2018)

Traceability means to be able to trace the source from the existing position. For example, if potential Employee Profile is claiming to be Masters, Blockchain can trace the source of the Master's certificate, issued by which University, the transcript and the Mark sheet. Blockchain Technology promises traceability, provenance and transparency of information. At the same time, there is reassurance that Participants cannot change the information in a bid to hide the exact origin without consensus from each of them (Khachaturova et al., 2018). Traceability is possible by linking block information through hash keys. All transactions need to be arranged chronologically on Blockchain, and adjacent blocks are connected using the hash function cryptographically (Salman et al., 2018).

Immutability is an integral part of the Blockchain due to its structure, as all transactions storing blocks are linked using hash keys from the previous block and another hash key linking to the next. In the Higher Education system, every new transaction needs to be linked to an old block and made very secure, thereby avoiding system manipulation. Tampering in an evolved Blockchain is possible only if 51% of the ledgers stored by the network is changed which is very unlikely to happen (Tschorsch et al., 2016), however, can be an inherence for small networks.

Currency Properties: Blockchain Technology in Higher Education and tokens/rewards like Taelim coins go together; every Blockchain network has a potential cryptocurrency property. Point- to- point transactions are the essence of Blockchain Technology with no third-party involvement. The Tokens or coins meant to compensate the Miners for encrypting each transaction to be recorded. The above means lot of energy requirements, more than used in smart

systems. Therefore, the Miners have to reward for their efforts and energy usage (Panda et al., 2019).

Scalability: Most Blockchains have problems when the transactions increase beyond some particular level, and the whole system slows down. There is need to work on Increased Capacity, better known as scalability to handle and make transactions faster using the Miners/Nodes. The miners get rewarded with token coins. Delegated proof-of-stake is a viable consensus mechanism by which users, vote on a small number of delegates, who maintain the ledger, in this case, would be identified Miners. The reduction in active nodes means the network can increase its throughput. Each node is paid through inflation and can justify running a large data center to support the network. It depends on the Segwit, Block Size Increase, Sharding, Proof of Stake, Off-Chain State Channels and Plasma used (Salman et al., 2018).

First Sponsor Organization: Most people view not having a Regulator as the main advantage of Blockchain Technology. However, it is the major reason financial systems do not accept it. First Sponsor Organization like UAE Smart Government can be the guarantor of sorts; they take care of the regulations required to set it up and give its credibility in financial parlance. It ensures the credibility of the members, the miners, the ledger keepers who identified to avoid money laundering, illicit money flows (Bryson et al., 2017).

Energy Requirements: The Blockchain Technology needs much energy to create the codes, to record, store and to transmit these across networks (Nakamoto, 2008). The energy consumption is much higher than used by the smart system of similar magnitude. Mining consumes a lot of energy, which has been a limitation in it spreading fast across the sectors and to countries (Truby, 2018) ;(Tschorsch et al., 2016); (Fanning, 2016).

Technology Adaption Model and Acceptance model explains the way users accept new technologies like AI, ML, Blockchain over some time. The perception changes with the use of technology to start accepting and take advantage of Blockchain. The initial resistance and mindset need to be managed with the spread of awareness and induce the usage of modern technologies (Verma et al., 2016); (Wu et al., 2017).

7. RESEARCH FRAMEWORK –

Suggested Solution Framework Blockchain in Higher Education Domain, Usefulness of Blockchain in Higher Education as shown in figure 1.

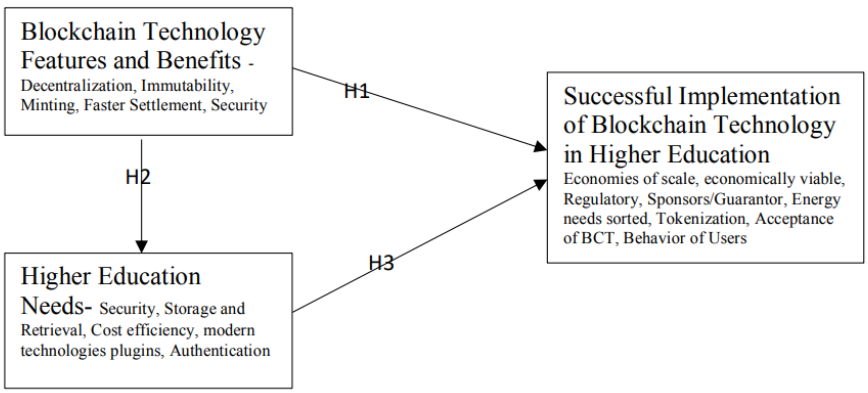
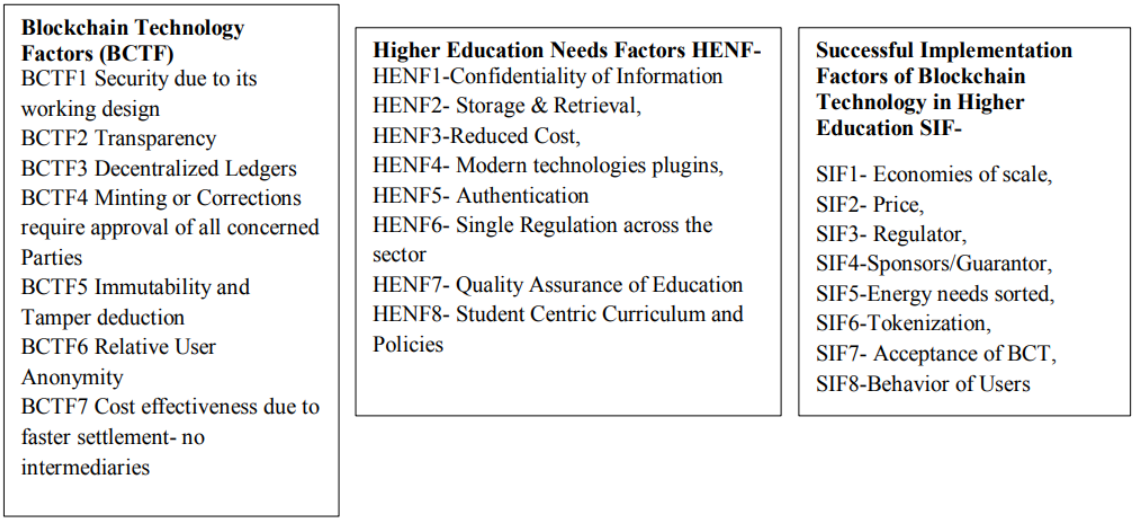


Figure 1

H1: The Reliability, Immutability features of Blockchain be useful for successful implementation of Blockchain Technology in Education?

H2: The trust and efficiency features of Blockchain Technology be useful for storing records of Education.

H3: The Higher Education needs to be addressed for successful implementation of Blockchain in Higher Education



8. RESEARCH METHODOLOGY

8.1. Research Need and type of Research required

Blockchain has been most discussed technology in the last four years. Many things discussed Blockchain and its features are helpful; however, the way to implement Blockchain has been missed. Therefore, it is a matter of interest to research the lack of implementation, the issues, and the challenges to its implementation, especially to Higher Education. The technology development in Blockchain initially experimented using cryptocurrency, and the experience has been maximum in this field. Therefore, it is the root of all Blockchain development and slowly limited successes in other sectors, Banking, Finance, Governance, Higher Education, Health care, Logistics (Johnson et al., 2019).

The Research Topic we endeavor to study of the current status of Blockchain and its implementation in various sectors, study the usefulness of the features of Blockchain to Higher Education Domain, the usage in various sectors, the challenges, the sectors in making it widely applicable in Higher Education Domain. We will be using both the types of Research based on the nature of information needed from experts and through survey, interviews (Mertler, 2018).

8.2. Primary Research conducted through Online surveys

Quantitative Data (300 plus Sample Size planned). The researcher sends a communication to 835 target respondents across the various cities of India, Malaysia, Singapore, UAE. The survey is achievable in a Smart Government environment like in Dubai, for example, where 90,000 government Employees from 28 entities are on the same platform. For the awareness, survey Questionnaire on Blockchain and its application to Higher Education was sent to 835 respondents

across various Government agencies like Energy companies, Transportation authorities, Education development agencies, Higher Education Ministry, Universities and Colleges in UAE, India, Singapore, Malaysia, Pakistan, affiliated to the Higher Education Ministry (Mertler, 2018).

8.3. Secondary Research

Deterministic Research and accepted factors included in the Research and contribute to the gap identified from various Research papers studied. Correlation analysis used to see how the dependent variable is actually related to the independent Variable. Try to see how many of the independent variables identified have a strong influence on the adaption of the Blockchain Technology. For example, how much influence a Regulator or the First Sponsor/Investor Organization has on the adaption of Blockchain Technology in the Higher Education Domain. Expert opinion from the People in the industry in Higher Education assimilated, or from Consultants. Users in the Blockchain Industry from Banking, Finance, Regulators, Students, Researchers identified for this purpose- Qualitative Data (12 Experts) (Quinlan et al., 2019).

The various philosophies, the Positivism approach seems to be useful for Research for considering the Quantitative data through surveys followed by the analysis using correlation, regression using SPSS software and Adanco. It is required to interview, conduct focus groups for getting the opinion of the experts about the Blockchain Technology application to the Higher Education Framework. It will help to create the Gap Analysis chart, Research Framework by identifying the dependent Variable, Independent Variable and the sub-variables to establish the relationship between them (Machi et al., 2016).

9. DATA COLLECTION

9.1. Research Approach

A quantitative research methodology uses a deductive research, uses structured approach, statistics, and a large adequate sample size to analyze data to come to conclusions. The Sampling population of this Research is Blockchain professionals, Educationists, Blockchain Users and Students working remotely due to forced lockdowns due to COVID-19. Hence this study uses stratified clustered random convenient sampling methodology, which focusses on affirms that every potential working professional and student working-remotely has an equal opportunity to participate in this research (Zikmund et al., 2013). Raosoft Sample size calculator can be used to know the tentative sample size based on the confidence level 95%, margin of error-5%, is found to be 385 respondents (Raosoft Inc, 2020).

The usage and awareness of Blockchain technology are low, the ‘scenario’ method was used to convey the use-case of Blockchain application. The questionnaire for the online survey was adapted from existing questionnaires available for validating task technology fit model and technology acceptance model by using statistical methods. The list of questions for individual constructs of the research framework is shared in Annexure-I. A total of seventeen questions were asked to respondents, which measured their attitude via a 5-point Likert scale (Nemoto&Beglar, 2014). The questionnaire was formulated with consensus with discussion and pilot survey shared with 20 respondents and valuable feedback in improving the questionnaire to avoid ambiguity and bias.

SPSS used in this research, to measure demographics characteristics of the respondents and its relation with the Blockchain in Education. The widely used PLS-SEM method is used for this business research for hypothesis testing and analyzing reflective measurement and structured measurements. Reflective measurements cover indicator reliability, construct reliability,

convergent validity, and discriminant validity. Structural measurements cover predictive relevance, the significance of path coefficients and overall variance of a structured model-Results shown in Table 3.

9.2. Data validation and analysis

Respondent's characteristics

Table 1 show the demographics of participants of the online survey. A total of 835 survey questionnaires were distributed to students, and working professionals in India, Malaysia, UAE, Singapore and several other countries clubbed under the 'rest of the world.' A total of 383 respondents participated in this research survey. (see table 1)

Table 1: Demographics of Respondents

Demographic Variable	Category	Percentage
Age Group	18-25	18.24
	26-35	32.56
	36-45	27.79
	46-60	18.92
	60+	2.49
Gender	Male	55.43
	Female	44.57

Demographic Variable	Category	Percentage	Demographic Variable	Category	Percentage
Education	Highschool	1.28	Region	India	33.97
	Undergraduate	21.54		UAE	37.60
	Post Graduate	60.34		Malaysia & Singapore	15.82
	Doctoral	16.84		Rest of the World	12.61

Demographic Variable	Category	Percentage	Demographic Variable	Category	Percentage
Awareness of the Blockchain Application in Education?	Extremely familiar-Expert in the field	19.60	Association with Blockchain Technology?	Researcher	10.80
				Student/Learner	28.30
				Working IT Professional	10.24
				Business Owner	8.37
				Project Manager	7.11
				Consultant	5.76
				Government Official	8.60
	Very Familiar-working on the Blockchain Application	36.80		Regulator	2.10
				Public	6.80
	Somewhat Familiar-only researching and yet to work on Blockchain	43.60		Trader	3.50
				Miner	2.70
				Others	5.72

Table 2: Indicator Loadings

Indicator	Blockchain Features	Higher Education Needs	Successful Implementation Factors
BCTF1	0.9326		
BCTF2	0.9190		
BCTF3	0.9223		
BCTF4	0.8946		
BCTF5	0.8997		
BCTF6	0.8631		
BCTF7	0.8697		
BCTF8	0.7662		
HENF1		0.9094	
HENF2		0.9546	
HENF3		0.8676	
HENF4		0.9176	
HENF5		0.9032	
HENF6		0.8469	
HENF7		0.9349	
HENF8		0.8084	
SIF1			0.7978
SIF2			0.8142
SIF3			0.8638
SIF4			0.8817
SIF5			0.7864
SIF6			0.8149
SIF7			0.7507
SIF8			0.8852

Table 3: Construct reliability

Construct	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha(α)
Blockchain Features	0.9604	0.9664	0.9598
Higher Education Needs	0.9649	0.9695	0.9637
Successful Implementation factors	0.9369	0.9447	0.9328

Table 4: Convergent validity

Construct	Average variance extracted (AVE)
Blockchain Features	0.7829
Higher Education Needs	0.7992
SuccessfulImplementation Requirements	0.6816

Table 5: Discriminant validity

Construct	Blockchain Features	Higher Education Needs	Successful Implementation Requirement
Blockchain Features	**0.6810**		
Higher Education Needs	0.6260	**0.7456**	
Successful Implementation Requirement	0.6133	0.6495	**0.6928**

Table 6: Indicator collinearity

Indicator	Blockchain Features	Higher Education Needs	Successful Implementation Factors
BCTF1	3.2989		
BCTF2	4.0849		
BCTF3	3.2729		
BCTF4	4.9657		
BCTF5	3.4490		
BCTF6	4.0599		
BCTF7	4.0323		
BCTF8	2.7513		
HENF1		4.7696	
HENF2		4.8075	
HENF3		3.6898	
HENF4		4.8264	
HENF5		4.7303	
HENF6		3.9840	
HENF7		4.4588	
HENF8		3.2402	
SIF1			2.6375
SIF2			4.1317
SIF3			3.8795
SIF4			4.1534
SIF5			3.1509
SIF6			4.6817
SIF7			3.7082
SIF8			3.7229
Variance inflation factors (VIF)			

Table 7: Coefficient determination

Construct	Coefficient of determination (R^2)	Adjusted R^2
Higher Education Needs	0.7950	0.7944
Successful Implementation Factors	0.5548	0.5525

Table 8: Bootstrap direct effects inference

Effect	Standard bootstrap results p-value (2- sided)
Blockchain Features -> Higher Education Needs	0.0000
Blockchain Features -> SIF1	0.0000
Higher Education Needs -> SIF1	0.0052

Table 9: Path coefficient

Independent variable	Dependent variable	
	Higher Education Needs	Successful Implementation Factors
Blockchain Features	0.8916	0.4498
Higher Education Needs		0.3154

Based on the results from Table 9, the path coefficient is displayed below

Table 10: Path coefficient

Independent variable	Dependent variable	
	Higher Education Needs	Successful Implementation Factors
Blockchain Features	0.8916	0.4498
Higher Education Needs		0.3154

Table 11: Direct effect Inferences

Effect	Original coefficient	Standard bootstrap results					Percentile bootstrap quantiles			
		Mean value	Standard error	t-value	p-value (2-sided)	p-value (1-sided)	0.5%	2.5%	97.5%	99.5%
Blockchain Features -> Higher Education Needs	0.8916	0.8913	0.0126	70.4966	0.0000	0.0000	0.8541	0.8646	0.9143	0.9205
Blockchain Features -> SIF1	0.4498	0.4479	0.1064	4.2278	0.0000	0.0000	0.1787	0.2398	0.6596	0.7211
Higher Education Needs -> SIF1	0.3154	0.3173	0.1128	2.7952	0.0052	0.0026	0.0265	0.0949	0.5372	0.5932

10. DISCUSSION, FINDINGS AND ANALYSIS

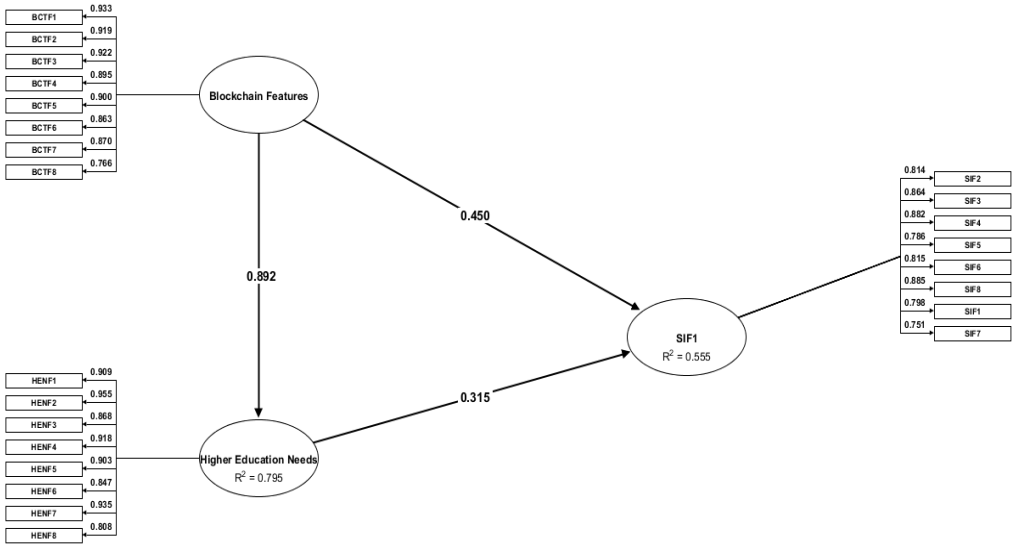


Figure 2

10.1. Discussion and Analysis

Based on the Research Final Model (Figure 2), the Model is tested and validated as per the parameters shown in the tables 1 to 10. The Hypotheses 1 to 3 have been proven to be significantly valid and acceptable. So, we accept the hypotheses and the results will prove that the Blockchain features can adequately meet the requirements of the Education system and the successful implementation is very likely.

10.2. Status of findings

H1, H2, H3 hypotheses have been accepted as the model path coefficients and the R^2 is above the acceptable value, which calculated to be 0.5555 and the hypotheses are supported and have positive significance as shown in the figure 3.

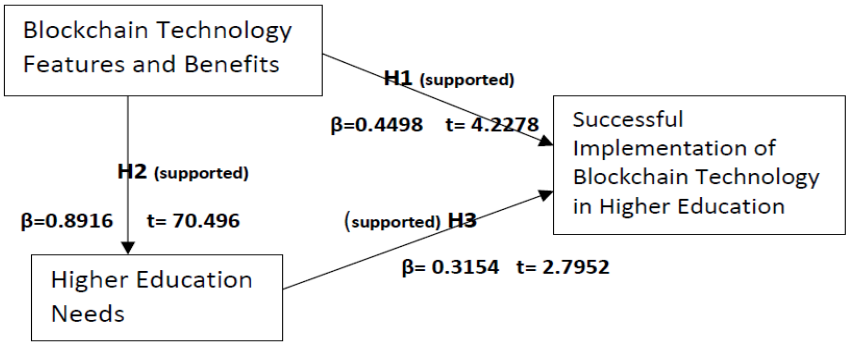


Figure 3 – the PLS-SEM validation and reliability test output

Figure 3

10.3. Features of Blockchain Technology

Decentralization, Traceability, Immutability, Currency properties, Scalability, First Sponsor Organization, Energy Requirements are the main features of Blockchain Technology, which will be useful in Higher Education Domain (Beck, 2018). The Features of the Blockchain have been discussed in the above paragraph.

10.4. Advantages of Blockchain technology, in Higher Education Framework

Some of the advantages of using Blockchain Technology in education can be (Han, 2018)

1. Reliability: Blockchain uses the decentralized ledger distributed over the various nodes in the network so the databases are more secured unlike the centralized transaction records maintained by a few accredited entities. This ensures that the operation of whole network is not affected by malfunctioning of a single node. Therefore, the Blockchain Technology improves the reliability of the applications (Zhang, 2016). In Higher Education it is required as certificates need to be verified often by employees and the Universities Authorities.

2. Trust: Trust is decentralized due to the use of Blockchain network. The trust bearers act as decentralized ledgers instead of relying on central governments issuing currencies, and on commercial banks. These ledgers are tamper-proofed nodes that are shared among Miners (Underwood, 2016).

3. Security: The Blockchain network security is ensured by using the forward (one-way) hash-function, to get fixed length binary sequence from a mathematical function that takes a variable length input string. The output bears no apparent relationship to the input. The process is virtually irreversible as, given just the output, the input cannot be determined (Jesse, 2016). The linear sequence of time is followed by the new block created (Salman et al, 2018).

4. Efficiency: Blockchain Technology can make pre-set procedures efficient by reducing the cost of labor and time saved. This is achieved by avoiding intermediaries to enhance the reconciliation and settlement time of the processes. The automation of distributed ledgers leads to faster settlement as achieved in digital currency of Blockchain 1.0 (Abdel, 2019).

Hence, the single PC cannot be sufficient to process so much data and it will need a pool of computing resources. This will lead to the UAE locals to secure employment with sufficient earning potential in the future. Therefore, it will serve the economic need of the Society, country. (Grech, 2017). A consortium or Government Agency like KHDA/Higher Education Ministry could manage Blockchains, where members make the decisions about how blocks are processed. In addition, Blockchains can be private where one organization controls everything. Some universities like MIT might be interested in hosting a private Blockchain or some group of universities. An ecosystem running on Open Badges, which generates digital representations of learning and skills, can use a consortium Blockchain.

10.5. How will Blockchain Transform the Higher Education System?

The popularity of the Blockchain is due to its superior cybersecurity capabilities, due to the decentralized feature and seen the increase in number of industrial applications that need security features including education, finance and healthcare. The potential uses for the Blockchain will revolutionize classroom management in the future (Ayers, 2019).

Smart classrooms are not too far off, and Blockchain Technology may become an integral part of schools all over the globe in a few years (Wiesner, 2019).

Better Security

Everyone is worried about privacy and the security of his or her data. Schools and parents are especially protective of children's data, and the threat of data breaches on online records is a serious concern.

Security Concerns and Degree Verification on College Campuses (Hafiza, 2019). Security and verification are necessary for Students trying to be employed and is a major concern for Colleges. (Salman, 2018)

Online Teaching and Learning

Blockchain Technology has been successfully used for online teaching and learning, using virtual classrooms. It can bring teachers, students, Employers, Government agencies, Administrators all on a single platform. Assessments, exams can be conducted and results recorded. Blockchain Technology used in Higher Education Domain can achieve this (Wiesner, 2019).

Library and Information Services

The Blockchain can be used to track and store information to enhance library and information services in schools. Though few libraries have started experimenting with Blockchain technology (Guang, January 2018).

Smart Contracts

Smart Contracts may be the best Blockchain application currently. The automated payments and transfer of currency or assets may work out well. Smart contract might be used to pay teacher salaries on specific dates or to make payment for equipment got from suppliers for the classroom (Cong et al, 2019).

Transformation model (Mezirow) can be applied to the change from traditional Higher Education teacher centric models to Learner centric models using modern technologies like Blockchain, Ai etc. It explains the need for the stakeholders to be accept this change, get prepared to change and change in mindset. The people concerned should stress on being inclusive, discriminating, reflective, open, and emotionally able to change (Taylor, 2017).

10.6. How Blockchain will benefit Society?

It will help with the Smart Government initiatives and is a giant jump into the development of Higher Educational needs of the community and society. It will support the society by creating Jobs in terms of Miners, coders, PC domain node maintenance for all the transactions created and to be maintained. For example, in Bitcoin, the need for mining has created more than 1 million nodes, miners along with the maintenance for these servers in the network (Ali, 2019). If we look at multi billion market across the globe, the requirements of nodes and miners will be massive. The Miners are rewarded with Tokens like Taelim Coins for creating and maintaining blocks. (Muhamud,2018) Job creation for the local population can be sufficed by a single Government initiative and investment and can take care of the job requirements in the near future (Svein,2017).

Social Model of Higher Education Benefits includes benefits like enhanced economic growth due to higher employment, higher societal production, fast technological adoption of change, and development of government and business organizations, improved well-being, women empowerment and increased social values. This leads to less crimes and wellness of the society (Behrman et al, 1994), (Williams, 2019).

11. LIMITATIONS AND FUTURE RESEARCH RECOMMENDED

The literature review is the outcome of secondary research and researching on the topic. Secondary data needs to be updated quite frequently till the paper is published which is difficult to achieve. Hence the use of the information obtained may be restricted. Moreover, secondary data might be available but may not include all the required information (Johnston, 2017). Secondary data has no control over its accuracy. Research conducted may be biased to support the vested interests of the source, known as grey material (Bornmann et al, 2019). It appears that digital transformation needs to be further explored especially in the UAE and in the Higher Education industry. Also, longitudinal survey samples can be attempted in the future. Another area of interest will be conduct focus group interviews for the Questionnaire finalization as Qualitative methodology.

The future research can make use of primary data through surveys or interviews. Limited research is carried out to correlate impact of the digital revolution within Higher Education (Almalki, 2016).

12. CONCLUSION

This paper endeavors to give an overview on the Blockchain Technology, and details on applying Blockchain Technology in Higher Education. The benefits and features of the Blockchain Technology have been reviewed and how they can be applied to Higher Education has been discussed. The limitations and gaps have been identified for future Research, to find solution so that the Blockchain Technology can be applied to its full potential and in a commercial manner to earn Maximum benefit. The contribution has been the solution for scalability (Volume of scale), the energy requirements, need for Regulation and First Sponsor Organization suggested and to be area of further Research.

For Future prospects, Research contribution can be first hand survey done with experts, Interviews to confirm the findings and including factors like energy requirements, regulator, First Sponsor Organization to get over the challenges of the Blockchain Technology to implement successfully in the Higher Education sector. The suggested Model is tested and validated using PLS method and the main contribution of building primary data for the Blockchain application in Education to be successful.

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ANNEXURE 1

Questionnaire
Demographics Section: Gmail compulsory *

1. Please specify your Age group *
    a. 18-25
    b. 26-35
    c. 36-45
    d. 46-60
    e. 60 +
2. Please specify your gender *
    a. Male
    b. Female
3. Please specify your highest qualification achieved
    a. High School
    b. Undergraduate
    c. Masters
    d. Doctorate
4. Are you aware of Blockchain Application in Education?
    a. Extremely familiar- Expert in the Field
    b. Very familiar- working on Blockchain Application
    c. Somewhat familiar- only researching and yet to work on the Blockchain.
5. What has been your association with the Blockchain Technology?
    a. Researcher
    b. Student/Learner
    c. Working IT professional
    d. Business Owner
    e. Project Manager
    f. Consultant
    g. Government Official
    h. Regulator
    i. Public
    j. Trader
    k. Miner

l. Owning Domain for recording transactions

6. I believe that the Blockchain features (BCTF) that will be suitable for Education Needs are: (Express your opinion on the statement by marking the most appropriate one)

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Security due to its working design BCTF1					
b. Transparency BCTF2					
c. Decentralized Ledgers BCTF3					
d. Minting or Corrections require approval of all concerned Parties BCTF4					
e. Immutability and Tamper deduction BCTF5					
f. Relative User Anonymity BCTF6					
g. Cost effectiveness due to faster settlement-no intermediaries BCTF7					
h. Long term Storage Ability BCTF8					

7. I believe that the needs of Education sector that drives the Business are: (Express your opinion on the statement by marking the most appropriate one)

8.

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Confidentiality of Information HENF1					
b. Storage & Retrieval HENF2					
c. Reduced Cost HENF3					
d. Modern technologies plugins HENF4					
e. Authentication HENF5					
f. Single Regulation across the sector HENF6					
g. Quality Assurance of Education HENF7					
h. Student Centric Curriculum and Policies HENF8					

9. I believe that the main factors involved in successful implementation of Blockchain technology in Education are: (Express your opinion on the statement by marking the most appropriate one)

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Economies of scale SIF1					
b. Price SIF2					
c. Regulator SIF3					
d. Sponsors/Guarantor SIF4					
e. Energy needs sorted SIF5					
f. Tokenization SIF6					
g. Acceptance of BCT SIF7					
h. Behavior of Users SIF8					

10. Any other factor which you would like to recommend or something missed in this survey

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