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A Study of the New Role of Blockchain in the Indian Education System

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ABSTRACT

Blockchain is the foundational technology that allows cryptocurrencies like bitcoin to exist. Blockchain technology has been used in numerous domains such as banking, justice, and commerce as part of the fourth industrial revolution since the invention of the steam engine, electricity, and computer technology. People's willingness to adopt technology has been influenced by rapid technological improvement. The traditional education system in developing nations has lately been improved through the implementation of distributed ledger technology. Disruptive technology in education is a key prerequisite for better accountability and exposure. The authors investigated the key factors influencing educational institutions' (knowledge providers) and learners' (knowledge recipients) intentions to use blockchain technology.

KEYWORDS

Blockchain in Education, Disruptive Technology, E-Learning, Edtech, Smart-PLS

INTRODUCTION

The global education sector has shifted from hardcopy learning materials and textbooks to online resources through the use of e-learning modules over the previous few decades. The considerable transformation in the education industry has been influenced by digitization. With a population growth rate of 1.5 percent, offering high-quality, advanced education is a difficulty in India. (Ramachandran, 2020) Due to the more efficient, transparent, and secure database solutions that blockchain technology provides, there is a growing awareness of blockchain solutions across India. (Pradhan, 2018).The use of the Blockchain is still in the introductory stage and it's just a beginning as only few educational institutions have started to use the same to store and share the academic records like mark sheets and degrees. However, the Blockchain technology can digitally transform education in various ways like creating greater efficiencies for educators through smart contracts, enhancing opportunities for

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lifelong learning and offering student's ownership of their academic records. The NITI Aayog, the Indian government's policy-making body, is investigating the potential applications of blockchain technology in a range of industries. The major goal is to develop a prototype to examine blockchain in crucial educational sectors. However, along with the benefits of use of Blockchain in education, there are some challenges like threat of student data and fraud on internet accessible databases, difficult in authenticating certifications and documents, complexity of tracking intellectual property, acceptability of massively open certifications and accessibility and cost. The accessibility of Blockchain academic records can neither be modified nor counterfeited which provides a trust factor to the students (Ramachandran, 2020). This study focuses on the benefits of Blockchain in the educational system and how to keep the blended style of student-teacher interaction going.

BACKGROUND OF THE STUDY

On Dec 28th, 2021, when Mr. Narendra Modi, Prime Minister of India at IIT Kanpur awarded the graduating IITians, the degrees based on Digital format of Blockchain, it unveiled a new revolution and facet of Blockchain technology in education industry. Benefits of Blockchain technology are often referred to cryptocurrency which enable Ethereum and Bitcoins trading at the crypto exchanges. During the Covid 19 Pandemic, digital technologies played a critical role across the globe where colleges and universities must shift to online teaching modes in short span of time. Flipped classrooms and blended learning in education will continue even the students join, when the universities are opened.

Adoption of technology in education was already at higher growth and many higher education institutions globally with edutech investments touching US $ 18.66 billion, even before the COVID 19 pandemic in 2019. Online education market and investments were projected to touch $350 billion in 2025. Many Universities and Colleges have taken initiative of using the hybrid education mode – Face to face classes as well as online but the quality of E Content and Communication barriers of direct interaction with teachers were the main reason for low acceptance by students. There has been a substantial growth in the uptake and acceptability of digital learning during Covid through virtual tutoring, language apps, video conferencing tools and online learning software.

Case Studies from Globe - On Line Teaching Learning Initiatives

**BYJU`S –** was founded in 2011 as an online tutoring and educational technology firm based at Bangalore and became the world`s highly valued edutech company, The company has experienced a 200 percent growth in the number of students using its services free live classes on Think and Learn application.

In China about 75% of the users in 2020 used **Tencent classroom –** online education platform, when China's government ordered a quarter-billion full-time students to restart their studies via internet platforms. As a result, the biggest online revolution in educational history occurred with more 730000 students attended online school in Wuhan. Tencent Classroom learning software have improved students' academic performance covering all high school and college students through simulations, PPT Play, shared screen, note graffiti and online answer.

ByteDance

Lark, a company based in Singapore — The Next Gen collaboration suite is an internal application that provides limitless video conferencing time, real-time co-editing of project work, auto-translation capabilities, and smart calendar scheduling to teachers and students. During the pandemic crisis, Lark, in order to ensure the reliable connectivity ramped up its global server infrastructure to provide, chats, calendars, meeting, online classes, uploading documents and E mails at one place.

Ding Talk – Alibaba's distance learning solution and platform for online teaching was considered as a safe and reliable platform with lower costs for multi-platform for homework submission. More

than 100000 new cloud servers were deployed by Alibaba in a few hours to increase the rapid capacity expansion.

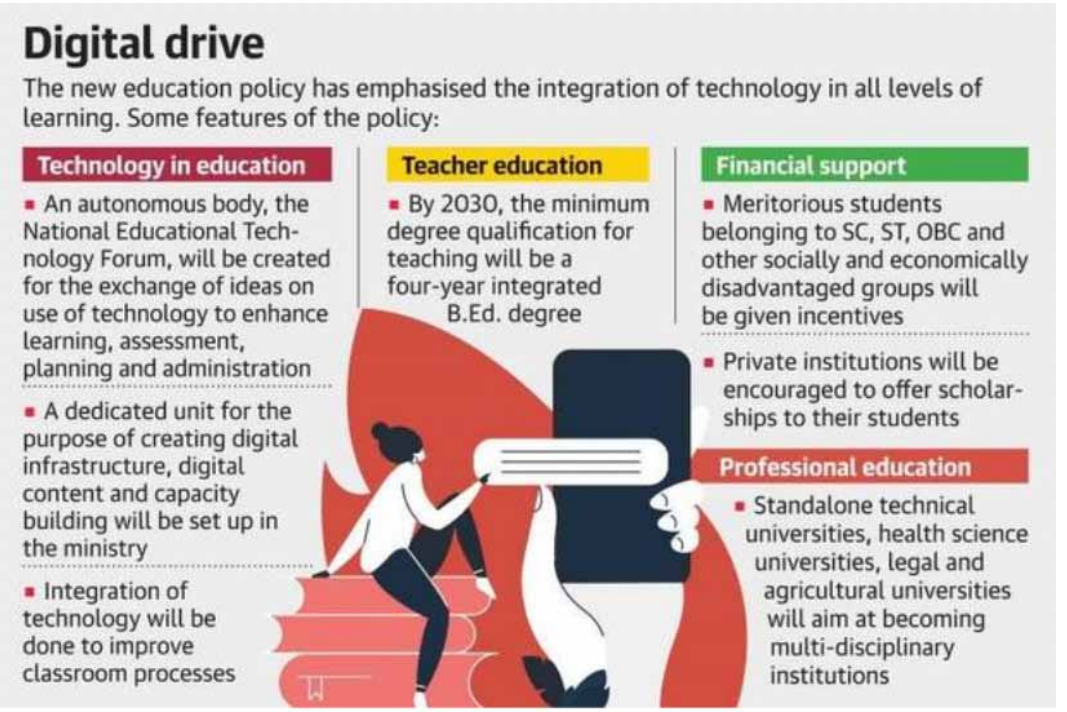
Microsoft Teams (MS Teams) – Many higher education institutes used MS Teams for online teaching as it provides various features of creating team or class of the students for online teaching, assignments, evaluations, downloading attendance, chat and uploading E content during the pandemic. Class recordings can be shared with the students and students can view their score of the assignment. MS team is also used for faculty meeting, FDPs and MDPs programme.

Swayam (Study Webs of Active Learning for Young Aspiring Minds) Portal launched by Government of India in 2017 and created by MHRD and AICTE with the help of Microsoft. Online courses from class 9th to Post Graduation are taught online through video recorded lectures and written notes in different weekly modules. During Covid Pandemic, many Universities and Higher education institutes linked their curriculum with Swayam courses where the students can transfer their credit. Other portals - NPTEL – self paced online short-term courses is a project funded by MoE, Government of India.

To encourage equal use of technology, the New Education Policy in India (NEP) includes a new component on digital education. Use of emerging and disruptive technology like Artificial Intelligence, Robotics, 3D and Simulation will improve teacher – learning evaluation process, support teacher preparation & professional development, enhance educational access and remove language barriers. In every sector of the economy, Digital Transformation has played a significant influence.

The pandemic of Covid-19 has led universities and colleges to across the Globe to shift to online education from the traditional face to face learning. The new teaching mode of Digital Inclusion for University education was a big challenge for professors and students regardless of their circumstances, prerequisites of internet connectivity, WIFI speed and possession of laptops / mobile to run the online

Figure 1. Digital drive – new education policy



Source: New Education Policy, 2020. MHRD, Government of India

educational applications. However, in a short span of time, in colleges across the world, various flexible and simple techniques of studying and teaching have been established. Hybrid learning approach, Four Quadrant E Learning approach – E tutorial, E Content, Online Group Discussions and Evaluation system were developed with the new emerging technologies like Block Chain, Artificial Intelligence, Big Data, IoT, and Robotics and to remove the technical and communication barriers. AI systems provide personalized learning for students, automating instructors, adoptive assessments and routine tasks.

There are two school of thoughts – One who believe learning cannot be happen online because rapid shift to online learning from face-to-face mode was unplanned with no formal training to the faculty, little preparation of quality E content, connectivity issues like insufficient bandwidth and poor user experience. Others, who consider that a future of educations is new amalgam model of education with considerable benefits. Global Disruption with innovative emerging technologies in education has integrated information and further development will accelerate the online education. Post Covid 19 Pandemic also, Blended mode of online and face to face teaching – learning module will continue as both have their own synergies and will play important role in the overall academic and personality development of students.

LITERATURE REVIEW

Al-Omari (2019).This study used the Technology Acceptance Model (TAM) to predict the approval of Blockchain Technology in Saudi Arabia. The validity and application of the TAM model in higher education to predict and explain students' behavioral intentions were investigated. External independent factors and hypotheses to confirm the study results on Behavioral Intention to Use (BI) were Perceived Usefulness (PU), Technology Anxiety (TA), Perceived Cost (PC), and Perceived Privacy (PP).

Alharbi &Sohaib (2021) To better understand why individuals are adopting cryptocurrencies, this essay examines the technological components of optimism, innovation, discomfort, and insecurity. Researchers used (PLS-SEM) analysis to investigate the relationships between these characteristics and estimate bitcoin adoption with more accuracy.

Blockchain: The Indian Strategy (2020)The report is the result of several consultations over the previous two years, as well as NITI Aayog's personal experiences with blockchain systems in various situations. It is intended to serve as a "must-read" for anyone interested in developing a blockchain system in India, as well as to guide broader thinking in the field. The study starts by looking at how blockchain can help build confidence in government-private-sector relations. Before moving on to factors to consider when evaluating a blockchain use case for implementation, hurdles to anticipate, and lessons learnt from NITI Aayog's blockchain implementation experiences.

Oliva et al., (2019).This study investigated the effective growth of cryptocurrency from the standpoint of customer behavior. Testing a model utilizing the Technology Acceptance theoretical framework explained 85 percent of the intention to adopt Cryptocurrencies. This study's findings have a variety of critical implications for the development of cryptocurrencies, including risk, financial literacy, facilitating conditions, social impact, effort expectancy, and performance expectancy.

Chen et al., (2018)The report concentrated on the usage of blockchain technology in the education sector and how it can assist in overcoming educational issues. This research adds to the corpus of information about blockchain's novel applications in education.

Ullah et al., (2021).The findings indicated the key factors influencing educational institutions' decisions to adopt blockchain technology for e-learning. Compatibility has a considerable impact on the implementation of blockchain in smart learning settings, according to the results of the online poll. The findings help us grasp a larger Technology Acceptance Model for blockchain adoption in educational institutions.

Steiu, M.-F. (2020).The advantages and disadvantages of using blockchain technology in education are discussed in this article. A case-based and research-based methodology are both used in the study.

As part of the first method, interviews and research were conducted with commercial and public higher education institutions that use blockchain technology. As part of the second strategy, this study included abstracts of research papers written by educators, lawyers, and technologists.

Bartolome et al(2017). This research paper explains the various challenges in Blockchain in education beyond optimization of the teaching learning processes and interoperability of certification. The paper also focuses on the four basic parameters / components of Blockcerts and the role of issuer and verifier of digital certification by the Institutions.

Chakraborti, Unni & Singla (2021) presents the simplified picture of blockchain technology in education to scale up the accountability and transparency. This result is a well-balanced situation for both the teachers and the students in improved satisfactory education experience.

Nayak (2021). The article talked about the use of Blockchain by Central Board of Secondary Education, India. He also explained that Universities and colleges need to look beyond classrooms by replacing them with digital platforms through blockchain smart contract concept.

Steiu (2020) The article explains the decentralization, digitalization, motivation and enhancement of lifelong learning and the key challenges of data protection in Blockchain application in education.

Sankar et al., (2022), National Law Review, 2022 in their article "Blockchain Education – Legal Nuances to Know" lists the use of Blockchain in Education in future for student identify verification, authentication of university degree and certificates, tokens as rewards of task completion, intellectual property management and payments through cryptocurrency as safe and secure methods depending on the legal framework. The author also discusses legal and regulatory issues like as privacy and data security, as well as cyber security.

CONCEPTUAL FRAMEWORK

Blockchain is being used in a variety of fields, in addition to its original and traditional usage. Blockchain first professional implementation was Bitcoin in 2009, and following Bitcoin's widespread acceptance, technology from a variety of disciplines is attempting to apply blockchain professionally. One of the most well-known Blockchain applications is in the field of education. In this study, we looked at the latest research on characteristics that determine whether a Blockchain implementation will be accepted in education. Our primary purpose is to assess blockchain planned application and adoption in the higher education sector. In recent years, blockchain has emerged as one of the most promising alternative new technologies in this field. Blockchain is not just a new way of storing, retrieving, and moving data safely and transparently, but it is also a supplement to existing cyber security solutions.

The goal of this project is to test and build a Blockchain technology theory model in higher education. A survey will be created specifically for this study and disseminated to randomly selected student respondents from various higher educational institutes to collect the necessary data for evaluating the research model and determining adoption intentions. The data will be evaluated with the Structural Equation Model (SEM), which is based on the Partial Least Square (PLS) technique. Such research is required to assist decision-makers in better understanding the adoption of Blockchain technology in education, as well as the factors that influence acceptance, to lessen user resistance or rejection.

This will be one of the initial studies looking into the use of blockchain in the education business. The effects of three aspects on the adoption of blockchain, perceived usefulness, perceived ease of use, and perceived risk, were evaluated in the suggested model on education sector transformation. (Figure-2)

1. Perceived Usefulness (PU) is a personal propensity to see technology innovation as beneficial. This indicates a positive attitude toward technology and the belief that, for technical reasons, it increases the control, flexibility, and efficiency of daily life.

2. Perceived risk (PR) is linked to a sense of nervousness about technology, as well as anxiety about security and privacy, as well as a lack of faith in technology.
3. Perceived ease of Use (PE) is associated to how user-friendly the technology is and how well it is built to handle discomfort and the complexities of new technologies.
4. Transformation in education (TE) is correlated to bring into play of blockchain technologies in the teaching sector, which leads to improved educational certification, digitization, and decentralization, as well as motivation for lifelong learning.

OBJECTIVES OF THE STUDY

1. To study the impact of perceived usefulness, perceived ease of use, and perceived risk in adoption of blockchain in education on Transformation in Education.
2. To investigate the numerous factors that influence the adoption of blockchain technology in the teaching sector.
3. To study the association of independent factors perceived ease of use & perceived usefulness in adoption of Blockchain in the presence of Perceived Risk.

RESEARCH HYPOTHESIS

The Hypothesis framed for the study is as under:

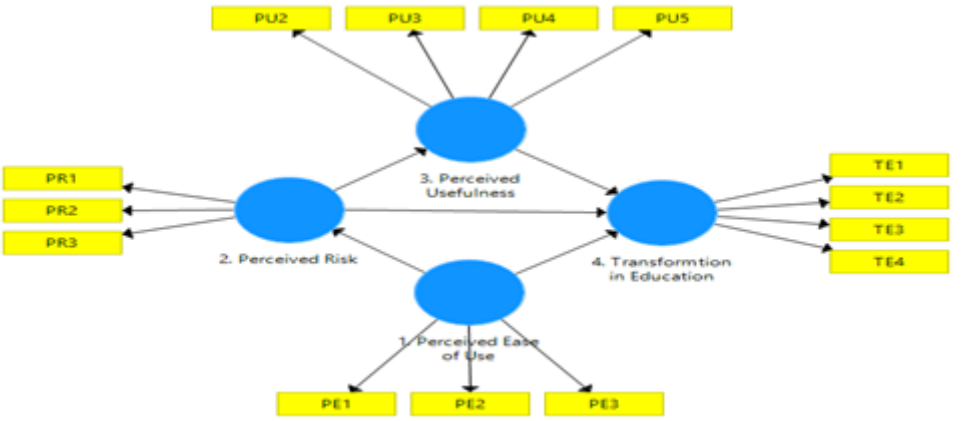
H1 Perceived Ease of Use in adoption of Blockchain in education sector has no significant impact on the Perceived Risk

H2 Perceived Ease of Use in adoption of blockchain in education sector has no significant impact on Transformation in Education.

H3 Perceived Risk of adoption in blockchain in education sector has no significant impact on the Perceived Usefulness.

H4 Perceived Risk in adoption of blockchain in education sector has no significant impact on the on Transformation in Education.

Figure 2. Conceptual framework



Source: Authors' Original Work using SmartPLS

H5 Perceived Usefulness in adoption of blockchain in education sector has no significant impact on the Transformation in Education.

RESEARCH METHODOLOGY

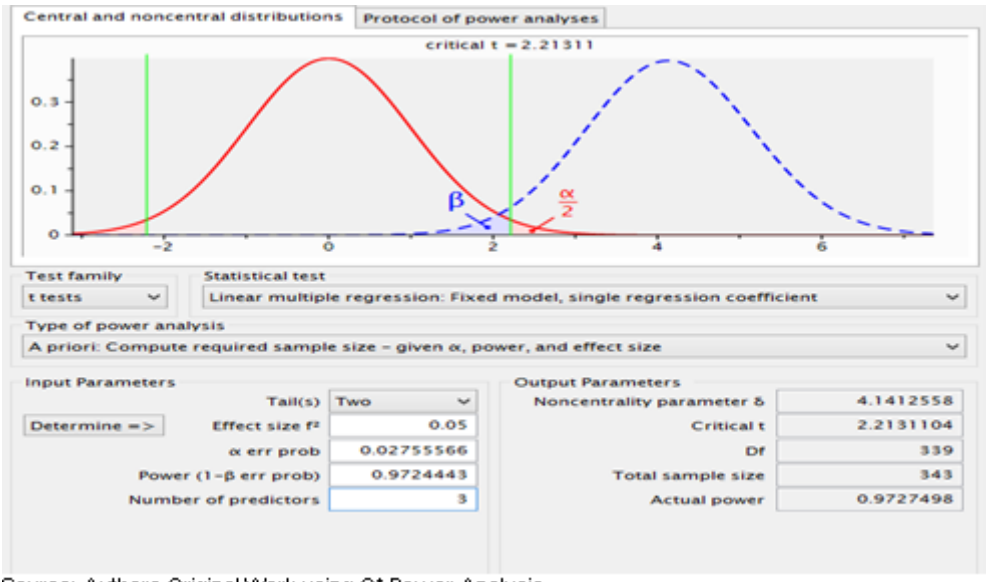
The primary data was collected in the form of a survey using a Google form. The software G*Power 3.1.9.2 was used to investigate the appropriate sample size on the basis of test family t-test and Statistical Test, Linear Multiple Regression. The software calculated a sample size of 343. As larger sample sizes allow researchers to better determine the average values of their data, even though a sample size of 343 was deemed adequate, 385 valid replies were evaluated for the study. The respondents came from all around India. The programme utilized to determine the structural equation model was SmartPLS SEM. The Research Hypothesis was tested in the same way. (Figure-3)

The present study proposed model consists of constructs, namely Perceived ease of Use (PE), Perceived Usefulness (PU), and Perceived risk (PR) and Transformation in education (TE). All the survey instruments were based on previous research. To investigate the relationship between constructs in the conceptual model, we conducted an online data collection survey. A formal questionnaire with a 5-point Likert scale was used to collect data online. Following Statements related with the constructs were asked from the respondents, and level of agreement was recorded on 5-point Likert scale, 5-Strongly agree 4-Agree 3-Neither agree nor disagree 2-Disagree 1-Strongly disagree.

RESEARCH QUESTIONS

1. How block chain implementation would help in transformation of Education Sector?
2. What are the challenges to increase the usage and more adoptions of block chain in education by the academic institutes?

Figure 3. Determination of sample size G* power analysis



Source: Authors Original Work using G* Power Analysis

Table 1.

Constructs	Codes	Questions
Perceived Ease of use	PE1	*The disruptive technology is easy to use at your university*
	PE2	*Blockchain is feasible to do multitask on same time*
	PE3	*The smart contract based distributed ledger system is speedy than traditional education system*
Perceived risk	PR1	*Using Blockchain in education is risky*
	PR2	*There is too much uncertainty associated with the use of block chain in education*
	PR3	*Compared with current / Traditional methods, use of blockchain in education is riskier*
Perceived Usefulness	PU2	*Blockchain can aid your educational institutes for fast learning.*
	PU3	*Blockchain can better transparency for Higher education system.*
	PU4	*Blockchain can aid for mutual learning at your college / university.*
	PU5	*Helps in virtual education to save time of students especially in pandemic situation like COVID-19*
Transforming education	TE1	*Enhancing and motivating lifelong learning*
	TE2	*Empowerment for learners (self-sovereignty)*
	TE3	*Efficiency enhancement for educational institutions*
	TE4	*Trust and transparency integration*

RESEARCH DESIGN

As per the objectives, research methodology and research hypothesis explained above, the research paper is designed in two sections. ***Section 1*** explains the theoretical explanation relating to potential use of blockchain in education as well as the challenges and opportunities. ***Section 2*** relates to data analysis, results and interpretation of primary data collected in accordance with the research questions and hypothesis. Structural equation modeling (SEM) is a second-generation technique applied in our study through SmartPLS Software. The integration of confirmatory factor analysis and path analysis model forms the structural equation modeling. SEM= Measurement Model (CFA) + Structural Model (Path Analysis or Regression), used in the study.

SECTION 1: POTENTIAL USE OF BLOCKCHAIN IN EDUCATION INDUSTRY

What is Blockchain?

Block chains are a new sort of network infrastructure (a technique to arrange how information and value travels around the internet) that introduces distributed verifiability, auditability, and consensus to generate 'trust' in networks. (Blockchain: The Indian Strategy, 2020)

1. Database: A list of records / transactions that grows as additional entries are added, similar to a ledger.
2. Which is distributed: Copies of the full database are stored on various computers connected to a network and sync in minutes or seconds.
3. Adjustably Transparent: Records saved in the database can be made transparent to appropriate stakeholders without risk of change.
4. Highly Secure: Malicious actors (hackers) can no longer assault a single computer and alter its data.
5. Immutable: Once data has been recorded and accepted, the mathematical procedures make it hard to edit or delete it.

During Covid-19 pandemic, digital transformation had a significant role in all areas of the economy and experts believe that online education is going to stay with blended learning method. Blockchain technology is a viable option and have potentials to meet the challenges to provide secure systems for keeping the student's academic records in digital mode. (Chakraborti, Unni & Singla, 2021)

Economic Potential of Blockchain by Industry sectors

Blockchain is said to have the ability to alter all businesses and economies. According to a McKinsey analysis, the potential value created varies by sector, with the public sector being the best positioned to benefit in terms of prospective impact and application feasibility. (Blockchain: The Indian Strategy, 2020)

Potential area in the education sector where the Blockchain can impact are listed as below (Nayak, 2021)

- **Student Records**
- **Issue of Degrees, Diplomas and Marksheets**
- **Information Storage**
- **Evaluation of Courses**
- **Digital Examination**
- **Transfer of Records**

Blockchain Powered Education system in India

(Mittal, 2017) Blockchain is a cutting-edge technology that is still evolving. To keep India ahead of the curve, it's critical to grasp the opportunities it offers, as well as the actions that must be taken to realize its full potential and support the development of the necessary ecosystem. It's worth mentioning that blockchain's usage in education is still in its early stages. Chitkara University is the first university in India to employ Blockchain technology to create electronic documentation for students. (Block chain: The Indian Strategy, 2020.)

In 2021, India become the fourth country to implement blockchain-based educational records. Saintgits Group of Institutions, a Kerala-based educational institution, is putting in place a blockchain-based scholarship processing system for its students. It has inked a memorandum of understanding with Sernez.io, a peer-to-peer lending platform that facilitates educational loans, based in Kerala. Globsyn Business School (GBS), situated in Kolkata, is leveraging blockchain to offer digital diplomas to post-graduate management students. To build its certification management solution, the institution has teamed with Mumbai-based Zeonlab. (Pradhan, 2018)

Challenges and Opportunities for Blockchain in Education – Legal Framework in India

The legal and regulatory hurdles, as well as the scalability challenges, are two sorts of challenges when it comes to implementing blockchain in the education industry. (Stieu, 2020). Widespread adaptation of Blockchain Technology in education will involve storage of highly sensitive personal data of students on a decentralized network and will revolutionize the existing legal framework of education. Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information Rules 2011) ("SPDI Rules") is the current regulatory landscape on data protection in India. Under SPDI rules, the consent of the students or parents required for uploading the student's identity and personal degrees certificate on the University`s website. SPDI rules treat these biometric facial recognition and personal documents of students as sensitive personal data. SPDI rules have laid down security standards and practices for collection of sensitive data from students and the University must comply with the guidelines. University must inform the students that this data is being collected and uploaded for future verification and the data cannot be removed as it is stored in the Blockchain – distributed ledger system.

Scalibility challenges mean the slow speed blockchain transactions whereas the educational institutes have a huge data of students which will lead to increase in the size of blocks. Because blockchain can handle three to six transactions per second, large blocks take longer for peer-to-peer verification. Other obstacles include data privacy, security, market adaption, and innovation. Section 2 Data Analysis and Interpretation provides answers to all the study questions as well as remedies to any problems that may arise.

SECTION 2: DATA ANALYSIS, RESULTS AND DISCUSSIONS

Confirmatory Composite Analysis

Measurement Model

The constructs' reliability and validity were assessed using Confirmatory Composite Analysis. In this study, Cronbach's Alpha, Composite Reliability, and Rho A with a value of 0.7 were used. Cronbach's Alpha (Nunnally, 1978), Composite Reliability (Hair et al., 2010), and Rho A (Henseler, 2015) values greater than 0.7 (Morgan, Leech, Gloeckner, and Barret, 2004) for all three components (Table-1& Graph-1), showing that the questionnaire was reliable based on this model. Cronbach's alpha is an internal consistency metric that expresses how closely a group of items are linked. In contrast to Cronbach's alpha, composite reliability is an internal consistency reliability measure that does not presume equal indicator loadings. The average variance extracted (AVE) is a convergent validity metric that assesses a latent concept's ability to account for the variation of its indicators. The average variance extracted (AVE) cutoff level is 0.50. As indicated in (Table-1 & Graph-2), the questionnaire also meets the AVE criteria. As a result, it is concluded that the data meets all the criteria for reliability. The factor loading in Smart PLS software is calculated using partial least squares and should be more than 0.70. All indicators have a factor loading more than 0.70 (Table-1, Figure 3), implying that they are all appropriate and that none should be reduced.

Discriminant Validity

The discriminant validity was investigated using the Fornell-Larcker Criterion (1981). It follows that the square roots of Average Variance Extracted (AVE) must be greater than the correlational values of the constructs. Table-2 below shows the same, showing that the study is suitable for carrying out the final analysis.

HTMT is the average of all correlations of indicators across constructs. The desired HTMT threshold has been established at 0.85 (Kline, 2011, Henseler et al., 2015) and 0.90 (Gold et al., 2001). The number is smaller than 0.85 in (Table-3& Graph-3), showing that the construct has discriminant validity using HTMT as well.

The link between the fluctuations of a dependent and independent variable is calculated using R-square. The R square is discussed in detail in (Table-4 & Graph-4). The element has a clear influence on 51.2 percent of educational transformation.

Collinearity Statistics

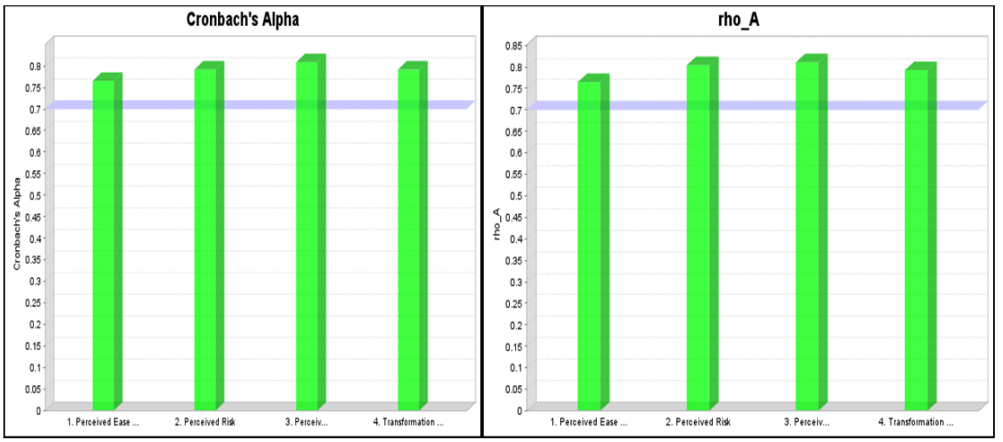
The Variance Inflation Factor (VIF) is used to quantify collinearity in regression analysis. In the case of high VIF values, the regression results are less credible. The VIF value must not exceed 3.33. (Diamantopoulos, 2008). The VIF values of each indicator are less than 3.33 in Table-5, indicating that the study is trustworthy.

Table 2. Confirmatory composite analysis

		Factor Loadings	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Perceived Ease of use	PE1	.862	.765	.765	.865	.682
	PE2	.769				
	PE3	.843				
Perceived Risk	PR1	.847	.791	.804	.878	.706
	PR2	.882				
	PR3	.789				
Perceived Usefulness	PU2	.762	.808	.811	.874	.635
	PU3	.801				
	PU4	.818				
	PU5	.806				
Transformation in Education	TE2	.840	.791	.792	.878	.705
	TE3	.828				
	TE4	.851				

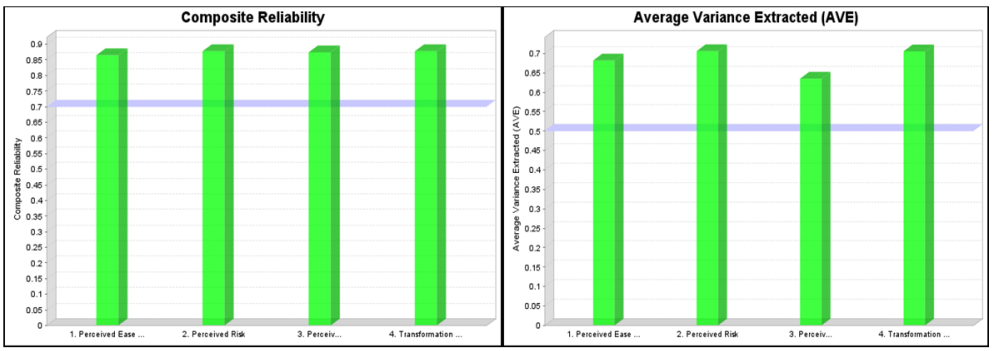
Source: Authors' Original Work using SmartPLS

Figure 4. Graph 1: Cronbach's Alpha and rho_A



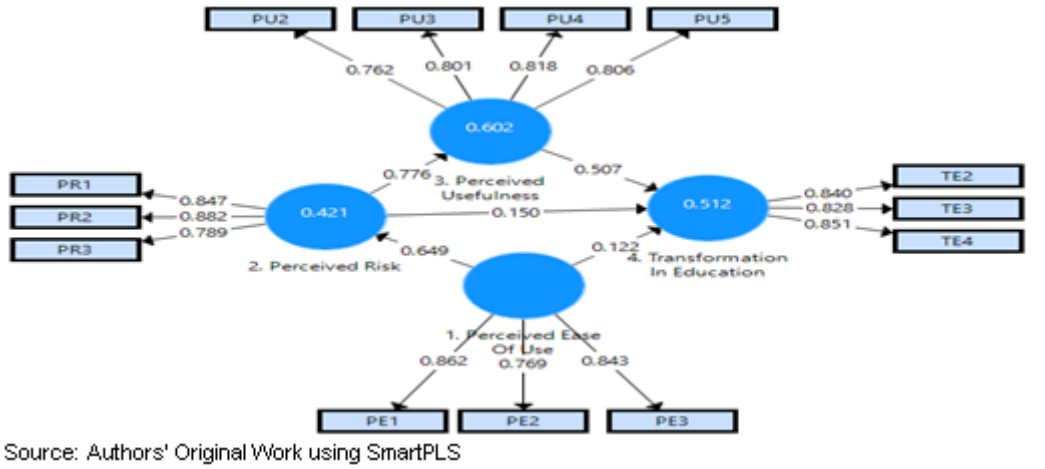
Source: Authors' Original Work using SmartPLS

Figure 5. Graph 2: Composite Reliability & Average Variance Extracted (AVE)



Source: Authors' Original Work using SmartPLS

Figure 6. Measurement model



Source: Authors' Original Work using SmartPLS

Table 3. Discriminant validity (Fornell-Larcker Criterion)

	Perceived Ease of Use	Perceived Risk	Perceived Usefulness	Transformation In Education
Perceived Ease of Use	0.826			
Perceived Risk	0.649	0.840		
Perceived Usefulness	0.615	0.776	0.797	
Transformation In Education	0.531	0.622	0.698	0.840

Source: Authors' Original Work using SmartPLS

Table 4. Heterotrait-Monotrait ratio (HTMT)

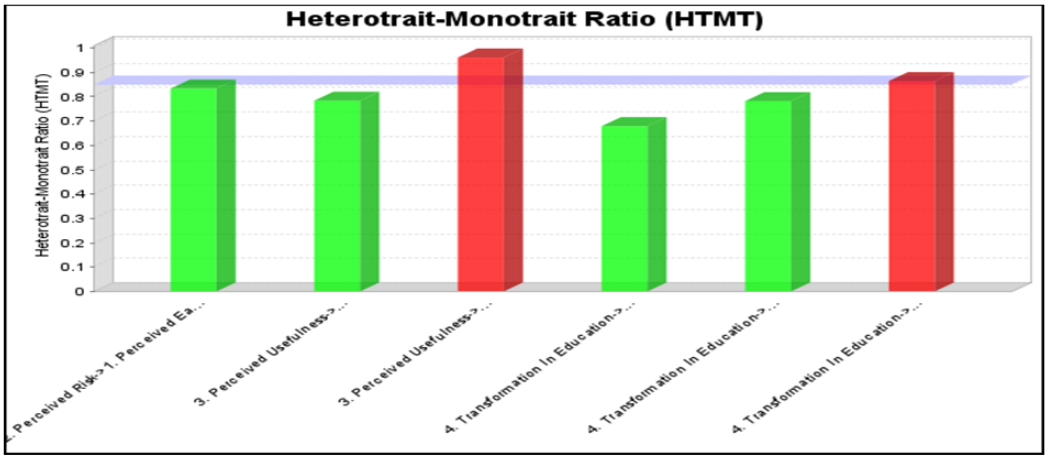
	Perceived Ease of Use	Perceived Risk	Perceived Usefulness
1. Perceived Ease of Use			
2. Perceived Risk	0.834		
3. Perceived Usefulness	0.784	0.961	
4. Transformation in Education	0.679	0.782	0.865

Source: Authors' Original Work using SmartPLS

Model Fit

Model Fitting is a technique for determining how effectively a model is framed to give correct results. The Standardized Root Mean Squared Residual (SRMR) is used to determine fitness, and it must be less than 0.08. For our investigation, the SRMR is 0.083, which is acceptable. The Normal Fit Index (NIF) is used to determine the degree of fit. It must be greater than 0.90, however in our study, it was 0.757, which is slightly below than the conventional norms. (Table-6)

Figure 7. Graph 3: Heterotrait-Monotrait ratio (HTMT)



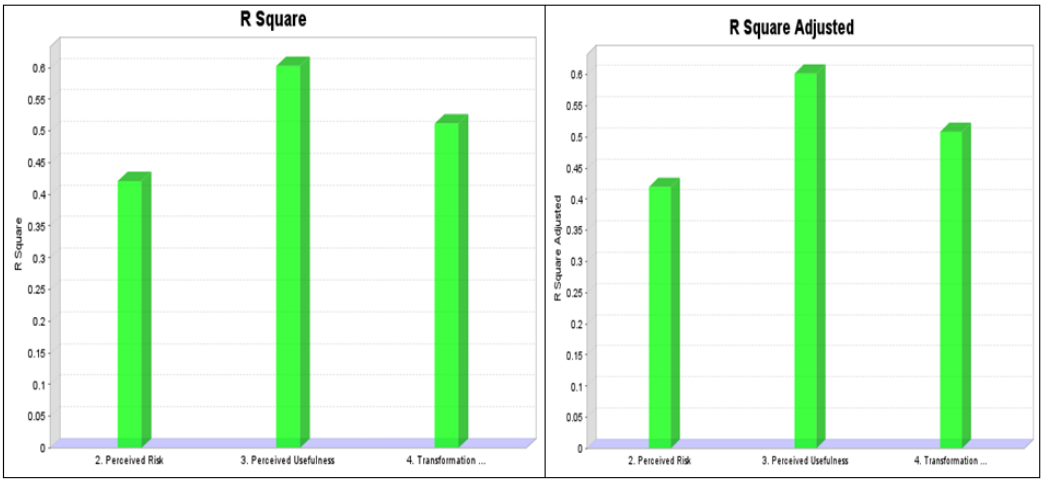
Source: Authors' Original Work using SmartPLS

Table 5. R square

	R Square	R Square Adjusted
Perceived Risk	0.421	0.420
Perceived Usefulness	0.602	0.601
Transformation In Education	0.512	0.508

Source: Authors' Original Work using SmartPLS

Figure 8. Graph 4: R square & R square adjusted



Source: Authors' Original Work using SmartPLS

Table 6. Variance Inflation Factor (VIF)

	VIF
PE1	**1.966**
PE2	**1.336**
PE3	**1.812**
PR1	**1.741**
PR2	**1.881**
PR3	**1.521**
PU2	**1.689**
PU3	**1.821**
PU4	**1.881**
PU5	**1.821**
TE2	**1.765**
TE3	**1.540**
TE4	**1.766**

Source: Authors' Original Work using SmartPLS

Table 7. Model fit

	Saturated Model	Estimated Model
SRMR	0.083	0.087
d_ULS	0.629	0.695
d_G	0.279	0.286
Chi-Square	674.424	673.993
NFI	0.757	0.757

Source: Authors' Original Work using SmartPLS

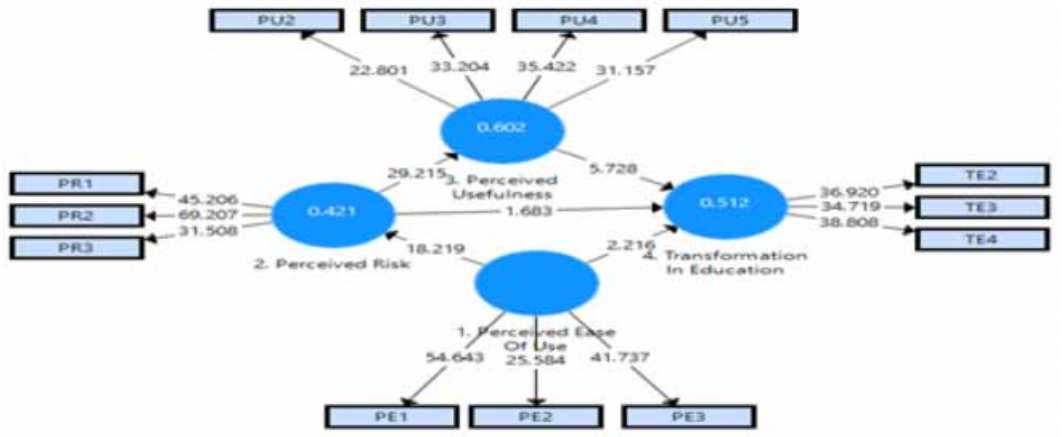
STRUCTURAL EQUATION MODEL

Results of Hypothesis Testing

To test the hypothesis and assess the model's predictive potential, a bootstrapping procedure with 5000 bootstraps was used. The results of the analysis are depicted in Figure 4 and Table 7. The T test and P-value indicate the hypothesis's outcomes. A p-value of less than 0.05 is considered statistically significant. It is strong evidence against the null hypothesis; given the null hypothesis has a less than 5% chance of being correct.

For the goal of hypothesis testing, the bootstrapping technique was used, and it was discovered that the values for the full hypothesis are supported. Hypotheses H1, H2, H3, and H5 are rejected as a consequence of Hypothesis Testing, as shown in Table- 8 of the P value and T test, showing that perceived usefulness and ease of use had a significant direct and indirect impact on educational transformation. The hypothesis 5 is not rejected since the p-value for Hypothesis 5 was more than 0.05 indicating an increased perceived risk of blockchain adoption will not result in any changes in the education sector. (Table-8)

Figure 9. Structural equation model



Source: Authors' Original Work using SmartPLS

Table 8. Hypothesis testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Perceived Ease Of Use -> Perceived Risk	0.649	0.649	0.036	18.219	0.000
Perceived Ease Of Use -> Transformation In Education	0.122	0.120	0.055	2.216	0.027
Perceived Risk -> Perceived Usefulness	0.776	0.777	0.027	29.215	0.000
Perceived Risk -> Transformation In Education	0.150	0.150	0.089	1.683	0.092
Perceived Usefulness -> Transformation In Education	0.507	0.509	0.088	5.728	0.000

Source: Authors' Original Work using SmartPLS

Table 9. Hypothesis testing result

Hypothesis	P- value	Accepted/ Rejected
H1Perceived Ease of Use in adoption of Blockchain in Education has no significant impact on the Perceived Risk.	0.000	Rejected
H2Perceived Ease of Use in adoption of blockchain in education sector has no significant impact on Transformation in Education.	0.027	Rejected
H3Perceived Risk of adoption in blockchain in education sector has no significant impact on the Perceived Usefulness.	0.000	Rejected
H4Perceived Risk in adoption blockchain in education sector has no significant impact on the on Transformation in Education.	0.092	Accepted
H5 Perceived Usefulness in adoption of blockchain in education sector has no significant impact on the Transformation in Education.	0.000	Rejected

Source: Authors' Original Work using SmartPLS

When calculating the effects of various constructs on the dependent variable, the direct, indirect, and total effects of all independent variables, such as Perceived Ease of Use, Perceived Risk, and Perceived Usefulness, were taken into account (Transformation in Education), Table-9 According to the findings of the study, perceived usefulness of blockchain has the highest direct influence on

Table 10. Direct and indirect impact

Dependent Variables		Independent Variables		
		Perceived Ease of Use	Perceived Risk	Perceived Usefulness
Perceived Risk	DE	0.649		
	IE	-		
	TE	**0.649**		
Perceived Usefulness	DE		0.776	
	IE	0.504	-	
	TE	**0.504**	**0.776**	
Transformation in Education	DE	0.123	0.150	0.507
	IE	0.352	0.393	
	TE	**0.475**	**0.543**	**0.507**

Source: Authors' Original Work using SmartPLS
Note: DE: Direct Effects, IE: Indirect Effects, and TE: Total Effects

educational transformation (β=0.507), while perceived ease of use (β=0.352) and perceived risk (β=0.393) have an indirect influence on educational transformation. The perceived ease of use of Blockchain technology has a direct impact on risk perception (β=0.649). The perceived usefulness of Blockchain technology was also significantly influenced by perceived risk (β= 0.776).

CONCLUSIONS AND IMPLICATIONS

1) To study the impact of perceived usefulness, perceived ease of use, and perceived risk in adoption of blockchain in education on Transformation in Education. According to the study Perceived Ease of Use, Perceived Risk, and Perceived Usefulness in the adoption of Block chain, will have an impact on the transformation in education.
2) To study the association of Independent factors perceived ease of use & perceived usefulness in adoption of Blockchain in the presence of Perceived Risk According to the study perceived usefulness of blockchain has the highest direct influence on educational transformation while perceived ease of use and perceived risk have an indirect influence on educational transformation.
3) To investigate the numerous factors that influences the adoption of blockchain technology in the teaching sector: According to the study the following factors influence the adoption of Blockchain:
    - Strong Legislative Framework-It's hard to predict if blockchain will have a significant and long-term impact on education. There is a growing awareness of blockchain solutions across India due to the more efficient, transparent, and secure database solutions that blockchain technology provides. However, the lack of a legislative framework for the use of blockchain in India may encourage Indian developers to focus on overseas initiatives rather than domestic ones. A Strong Legislative Framework will have appositive impact on the adoption on Blockchain in Education sector In India.
    - Blockchain Technology should not be viewed as Threat: Block chain should not be viewed as a threat to educational institutions or as a replacement for them, but as an innovative technology that can add value to a variety of educational processes, such as making learning more engaging and effective, lowering costs, increasing trust, and providing enhanced security and privacy.

- Automation and Standardization of Credentials should be encouraged: If large organizations and/or governments begin to embrace and value digital credentials, as well as the concept of lifelong education driven by rapid technological innovation, demand for blockchain-backed credentialing may grow. An expert group should be formed to help with policy creation, acceptability, and implementation. Policymakers should create innovation pipelines to look into and develop widely agreed-upon digital data standards for educational records, as well as how they could be integrated into current degree course and qualification certification systems.
- Shifting from paper-based Certification to Digital lockers: The implementation of blockchain technology has the potential to speed the demise of the paper-based certificate system by removing the need for educational institutions to verify credentials. Educational institutions can automate and standardize many of their tasks via a decentralized autonomous network.

The adoption of blockchain in the education industry is still in its infancy. Although the focus is currently on Fintech rather than education, blockchain technology has the potential to revolutionize education in India and around the world. In general, the world's perception of blockchain has shifted from that of a critical technology that underpins crypto currencies to that of a technology with potential in new fields like healthcare and education. To have a large-scale impact, the private sector (multinational corporations) and the public sector (educational institutions, government) must collaborate and, ideally, coordinate their efforts to test, investigate, design, implement, and fund blockchain in education solutions.

LIMITATIONS AND FURTHER STUDY

This research still has certain limitations. The concept of blockchain technology is still very new. There is a lack of knowledge regarding how blockchain can be used in education. This study's sample size is restricted to educational institutions (knowledge providers) and students (knowledge recipients). Suppliers of blockchain-in-education solutions (e.g., start-ups) should be considered in the future to better understand the suggested paradigm. Second, blockchain is a technology that is not self-contained. In this study, we did not look into the integration of blockchain with other technologies. For a deeper understanding, blockchain could be used with big data, artificial intelligence, and the internet of things in the future.

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