

# Reimagining Higher Education in India leveraging Blockchain Technology: A study to categorize challenges and opportunities

Swapnil Gaidhani, Abhay Saxena, Om Prakash Nautiyal, Geetaanjali Gaidhani

**Abstract:** Blockchain makes debut as cryptocurrency in the world. Later, it starts influencing other areas too. Although its use cases are growing day by day, it will be very exciting to try a different perspective to address the problems in the higher education sector of India. And the potential it inherits can revolutionize the Indian higher education system. Besides a remarkable stature of Blockchain, its real-time implementation, adoption, scaling comprises challenges and opportunities too. This study tries to categorize them all to know better what the higher education system may expect from Blockchain technology and up to what extent.

**Keywords:** Blockchains, Smart contracts, Universal certification, credentials, open-source Universities, e-scholarships.

## I. INTRODUCTION

India aspires to become a 5 trillion-dollar economy by 2024. To reach the mark, it needs to evolve systems and mechanisms to convert the present demographic dividend into high quality technical human resources [1]. In order to develop high-quality human resource, higher education institutes in India bears a huge responsibility on its shoulder. Although India is a young country, the Government of India has to transform the country into a digitally empowered community and knowledge society, digital education is necessary.

Higher Education in India has its own issue to deal with. Standing committee report by PRS legislative Research on issues and challenges before the higher education sector in India by examining few higher education institutions enlisted key observation such as – Shortage of resources, Teacher vacancies, accountability and performance of teachers, lack of employable skills [2].

In the 21st century, we are equipped with such technologies that can help us to resolve an ample amount of issues around us. The only thing required is a leadership thought which can map the solution with a problem and shows a mindset to upgrade the existing models so that technologies can play their role efficiently & effectively for the well-being of society. Hope emerged in 2008 with an intent to manifest digital currency overcoming the shortcomings of

conventional currencies ruling the world well known as Bitcoin, invented by a person with a fictitious name Satoshi Nakamoto who envisioned a peer to peer digital currency system using a cryptocurrency [3]. This peer to peer electronic cash system uses a distributed network consisting of a series of blocks where data is recorded and is immutable by using military-grade cryptography called Blockchain.

Blockchain technology has such salient features like trust manufacturing, decentralization, security, etc. It can be utilized to resolve the issues in the area of the Higher education sector in India. Although there are immense opportunities, challenges are also the other side of the coin.

## A. About Blockchain

A Blockchain is a distributed data-structure which can be operated by the participating nodes to manage transactions. There is an in-built verification process that ensures the authenticity of these transactions; hence it inherits transparency. Verified transactions get identified through a long identification number and get collected into a block. Each block assigned its own unique hash which gets generated by combining the hash of the previous block and the transactions. In such a way these blocks get linked together into a chain. In Blockchain, assets are defined as a chain of digital signatures. The participating nodes transfer the assets to each other by digitally signing a hash of an earlier transaction of asset and public key. One who initiates a transaction can verify the chain of ownership [3].

## B. Background

- Blockchain in education across the world: Woolf University has set a milestone in Blockchain for higher education. Its university has earned the crown to become the world's first online university with full degree-granting powers in the US [7]. This university focuses to remove the administrative complexities and over-exploitation of students for tuition fees. This implementation proves that Blockchain would definitely help to create a borderless, digital, educational society. As per the Forbes report, MIT is a leader in blockchain-based credentialing, having developed an open standard for verifiable digital records with a company called Learning Machine [8]. Central New Mexico Community College in Albuquerque last year began issuing "student-owned digital credentials" on a Blockchain platform that the college plans to make available to other educational institutions in the state.

Revised Manuscript Received on November 30, 2020.

\* Correspondence Author

Swapnil Gaidhani\*, Department of Computer Science, Dev Sanskriti Vishwavidyalaya, Haridwar, India. Email: swapnil.gaidhani@dsvv.ac.in

Durgesh Pant, School of Computer Sciences & Information Technology, Uttarakhand Open University, Dehradun, India. Email: dpant@uou.ac.in

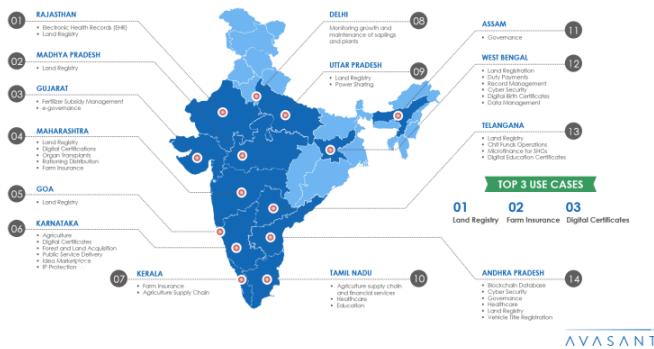
Abhay Saxena, Department of Computer Science, Dev Sanskriti Vishwavidyalaya, Haridwar, India. Email: abhay.saxena@dsvv.ac.in

Geetaanjali Gaidhani, Department of Computer Science, Dev Sanskriti Vishwavidyalaya, Haridwar, India. Email: geetaanjali.gaidhani@dsvv.ac.in

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- Blockchain in education in India: The implementation of Blockchain is gradually spreading in India. A lot of Indian states are taking initiatives with the use cases relevant to them as shown in Figure 1. Blockchain implementation in higher education will ignite the education and act as a catalyst to upgrade the existing crippled education system. In the direction to upgrade the education system using technology an educational institution named Saintgits Group of institutions, based in Kerala, is implementing a Blockchain-based scholarship processing program for its students[10]. Another Kolkata-based GlobSyn Business School (GBS) is using Blockchain to issue digital diplomas to the postgraduate students of its management programs. Using the platform, students can gain access to their certificates digitally. There is a saying in India – You can't go wrong with food or an "education business" [11]. Education has been commoditized in the country so much that, every year there are 1.5 Million engineers being produced. It is also a market where counterfeit certificates and CVs are not uncommon. Block-chain based digital certificates to maintain the integrity of the education process is yet another useful application.

About 50% of the states in India are involved in blockchain related initiatives, driving the public sector blockchain adoption in the country



**Figure 1 States in India and their Involvement in Blockchain Initiatives**

(source: <https://dsk14.elsecoins.com/cache/media/public-sector-blockchain-adoption-india-2019-03-14-1000x625.png>)

## II. METHODOLOGY

### A. Categorization

The method for categorization includes several steps.

Step 1: Identifying the issues in Indian Higher Education with a review of various reports on the status of the Higher Education sector in India.

Step 2: Analyzing salient features of the technology so that the solution can be designed to deal with identified issues. It will obviously direct us to opportunities.

Step 3: Understanding the obstacles comes in the way to implement the technology and during this process, challenges can be identified.

Considering steps 1 through 3 it is assumed that not all identified issues can be resolved by Blockchain alone. But in a few cases, it may partially resolve the issue while few of the scenarios may not be an ideal use-case for Blockchain-based solution. Besides this, opportunities can be evaluated on the basis of various perspectives. It could be from an Institutional point of view, for faculties, staff, and students. Similarly, Challenges can also be assessed on the basis of different parameters such as the cost of implementation, adoption of technology, the necessary level of awareness, prejudice based

on the reputation of an earlier version of the technology.

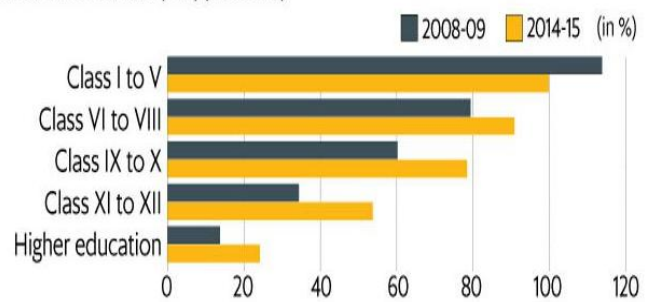
### B. Issues in Higher Education in India

According to Altbach (2005), "India has significant advantages in the twenty-first-century knowledge race. It has a large higher education sector – the third-largest in the world in student numbers, after China and the United States [11].

#### 1) Huge gap in supply and demand

One of the ultimate problems in India is providing access to education for the growing segments of the population. The government data (up to 2012) reveals that one out of seven children in India goes to college [12]. With the increasing rate of admissions at the school level, the supply of higher education institutes is inadequate to meet the growing demand for quality education in the country is reflected in the gross enrolment ratio depicted in the Figure 2.

Gross enrolment ratio (GER) (2008-2014)



**Figure 2 Gross Enrollment ratio chart from primary education to higher education in India**

(source:

[https://images.livemint.com/r/LiveMint/Period2/2017/10/02/Photos/Processed/g-Flap10Oct\(EDUCATION\)web2-kvnB-621x414@LiveMint.jpg](https://images.livemint.com/r/LiveMint/Period2/2017/10/02/Photos/Processed/g-Flap10Oct(EDUCATION)web2-kvnB-621x414@LiveMint.jpg))

There might be several reasons behind this but the prominent one could be a shortage of resources [2].

#### 2) Accreditation

Although at present India have both kinds of learning methods i.e. formal and informal. In the case of formal education, the student gets a usual certificate or degree from the accredited institute while in case of informal education such as learning through MOOCs students get the certificates from the training institute or organization which may or may not be accredited by the National Accreditation Agencies. So, this difference realizes when the employers counterfeit fake resumes or certificates of their employees. And besides this employer does not have the means to verify the level of knowledge and skill the aspirant earned during learning.

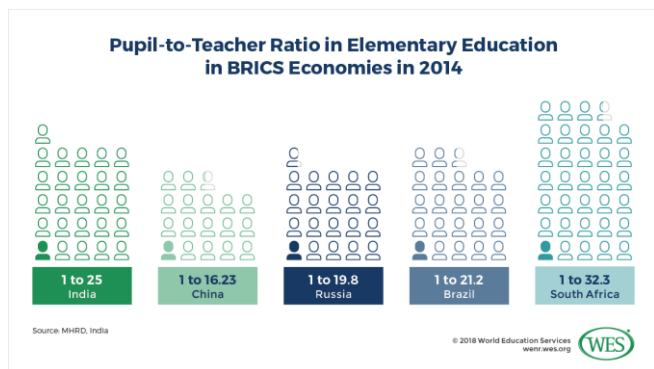
#### 3) Quality of Education

As per the data provided by the NAAC, as of September 2019, "approx. 65% of the total Universities in the country were accredited. And among those accredited, only 23% of the universities were found to be of quality to be ranked at 'A' level" [13].

#### 4) Shortage of Teachers

Teachers are the backbone of any education system. India lacks in the ratio of students and teachers [2]. The data shown in Figure 3 compares the pupil to teacher ratio in elementary education in BRICS economies in 2014.





**Figure 3** Student to teacher ratio in India compared to other countries

(source:

<https://wenr.wes.org/wp-content/uploads/2018/09/WENR-0918-India-Graphics-1.png>)

### 5) Structure of Higher Education

Management of Indian education faces challenges of over-centralization, bureaucratic structures and lack of accountability, transparency, and professionalism. As a result of the increase in the number of affiliated colleges and students, the burden of administrative functions of universities have significantly increased and the core focus on academics and research is diluted [14].

### 6) Affordability

It is a huge challenge for higher educational institutes to sustain in terms of quality, quantity, and availability of resources to serve better. Funding is a dire need for every institute. Government funds are limited and usually allotted to selected higher educational institutes or institutes of national importance viz. IITs, NIITs, IIMs, Central Universities, etc. Nearly 65% of the University Grants Commission (UGC) budget is utilized by the central universities and their colleges while state universities and their affiliated colleges get only the remaining 35% [2]. It is the major reason behind the unaffordable education.

## III. BLOCKCHAIN-BASED SOLUTIONS TO THE ISSUES OF HIGHER EDUCATION IN INDIA

Blockchain, by its origin, is a public distributed database i.e. Distributed ledger Technology (DLT) that immutably records and verifies transactions. It makes Blockchain fraud-resistant. So, to keep transparency it is the ultimate technology. Now the point comes where we can think of how Blockchain can play its role to improve the higher education system in India.

### A. Accreditation

As it is known, accreditation is a challenge in the higher education system in India from different perspectives i.e. from institutional and student's point of view. So, providing the accreditation through Blockchain digitally will make it verifiable with minimum effort and saves a lot of time and resources of employers and students while recruiting or applying respectively. E-portfolios of students, grades or authority to a higher educational institute by accreditation agencies can be the use cases for Blockchain. MIT is a leader in blockchain-based credentialing, having developed an open standard for verifiable digital records with a company called Learning Machine [15].

### B. Bridging the gap between demand and supply

The huge gap in supply and demand can be dealt with by making formal and informal education resources equally valuable. It will provide the students' opportunities to earn qualifications from diverse sources. And again, Blockchain can play a vital role here by providing a learning platform that could be decentralized in nature and affordable. Woolf University can be considered as a case for reference [7].

### C. Quality of Education

Quality Education is a key factor in which the accreditation agencies are always concerned. Lack of transparency is among the possible reasons behind the defrosted quality. So, using Blockchain, accreditation agencies can keep track of the implementation of standard procedures to improve the quality of teaching & learning processes.

### D. Dealing with shortage of qualified teachers

The shortage of qualified teachers is a bottleneck situation in the Indian education system. With continuously increasing demand there is a lack of higher education institutions and so the faculties. The ratio of teacher to student in India is 24:1. A low student-teacher ratio indicates the burden on a single teacher of teaching multiple students as well as the lack of time that each student gets. Apart from this simplistic effect, in an institution of higher learning, a smaller number of overburdened teachers are also unable to pursue any research or encourage their students to do so," said the Human Resource Development Ministry report [16]. So, a possible solution to this problem is to create a pool of qualified teachers that can serve the students online and it can be tracked and paid for their services through Blockchain. Woolf University can be considered as a case for reference where faculties from Oxford, Cambridge and all over the world come together on one platform to serve their expertise. [7].

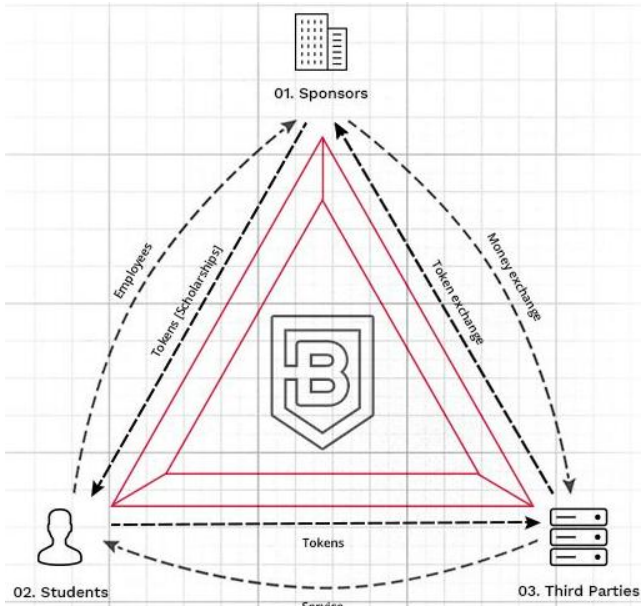
### E. Supporting the Structure of higher education

The structure of higher education issues can be dealt with by decentralizing the educational as well as institutional management. With the help of transparency and comprehensive delegation of roles and responsibilities accountability can be achieved. The excess of administrative burden can be mitigated by automation, well-defined policies. It can be tracked and enforced with the help of a smart contract enabled Blockchain. Woolf University, formed by Oxford professors, uses DLT to execute smart contracts. A series of student and teacher "check-ins" are key to executing a series of smart contracts that validate attendance and assignment completion [17].

### F. Making Education Affordable

Funds act as fuel to run business models and make them sustainable. And the educational institution is not an exception to this. Lack of funds makes education unaffordable. So, aBlockchain-powered scholarship fits in the scenario. It also bringing transparency in education donations.

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**Figure 4A Virtual Cycle represents e-scholarship mechanism powered by Blockchain**  
(source:

<https://coins.newbium.com/post/10724-bitdegree-the-world-s-first-blockchain-powered-o>)

Figure 4 illustrates an e-scholarship mechanism based on Blockchain implemented by BitDegree. BitDegree has launched the first transparent open-source micro scholarship system that may transform the education donations system. BitDegree Scholarships is the solution that enables tracking how contributions made by sponsors are used in real-time. Moreover, it enables programmatic giving – sponsors can define rules for their contributions (i.e. geography, demographic data, learning subjects, incentives) and control the implementation as it happens. [18].

## IV. CHALLENGES FOR BLOCKCHAIN IMPLEMENTATION IN THE HIGHER EDUCATION SYSTEM IN INDIA

### A. Reputation of Blockchain

Bitcoin hype was the origin of Blockchain technology when the world realized its potential. Virtually a perception has been built that it is something for crooks and a way to get rich in a short span of time. Due to this no one actually understood the underlining feature of Blockchain.

### B. Blockchain Adoption

One noticeable fact that India reached at sixth position in the number of Blockchain patent approvals [19]. But still, the education sector is not using Blockchain to a reasonable extent. The finance and governance sector are leading in using Blockchain capabilities but in the Indian scenario, it is also lagging behind as compared to other countries. We actually are lacking in awareness for Blockchain Technology and so the quality human resource for the same.

### C. Leadership Deficit

There is an acute shortage of intellectuals those not only match up with present & evolving technologies but can:

- Map suitable technology solution to deal with prevailing issues.
- Visualize and identify the areas where these technologies can play its role.

- Study the immediate and long-lasting benefits over the present systems.
- Innovate so that the stakeholders get benefited from this technology.
- Spread awareness among the common people on the various aspects this technology and the change it can bring to their lives
- Fetch measurable outcomes for constant enhancement.
- Create and publish the study outcomes on the technology.

## V. CONCLUSION

Application of Blockchain technology in the higher education system in India can truly transform the present scenario and could be a paradigm shift. It may also change the way a university is perceived. Open source Universities seems to have prominent future due to a sustainable, minimalist and decentralize model to connect students with Businesses via academia. Smart contracts are the key to manage the multi facet integration in such systems. The future will surely be fruitful that make dream come true of providing quality education with transparency to all learners of India irrespective of his/her socio-economic status. This would surely pave the path to create a robust ecosystem across the nation and worldwide too.

## ACKNOWLEDGMENT

This research paper was supported by USERC (Uttarakhand Science, Education & Research Centre) Dehradun provided financial support for the publication of the article.

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## AUTHOR. PROFILE



**Swapnil Gaidhani** is a faculty in the Dept. of Computer Science at Dev Sanskriti Vishwavidyalaya, Haridwar. He owns specialization in Block Chain Technology with more than 10 research papers in core computing. He had also lead a DST project C.S. Team. He had written couple of books on Discrete Mathematics and Blockchain technology.



**Prof. Abhay Saxena** is Dean (School of Technology, Management & Communication) at Dev Sanskriti Vishwavidyalaya, Haridwar, Uttarakhand. He holds Doctoral Degree in Computer science (ANN). He had authored ten books with 100 + research papers in International Journals. He has been an International Visiting professor at Budapest Business School, University of Applied Sciences, Budapest, Hungary(2017) and National Formosa University, Huwei, Taiwan(2019) along with Honorary Research Fellow at (ISITI), UNIMAS, Malaysia.



**Prof. Omprakash Nautiyal** is acting Director at USERC, Govt. of Uttarakhand. He is a Senior scientist holding Doctoral degree. in Physics. He had completed various DST and national level projects with USERC team.



**Mrs. Geetanjali Gaidhani** is currently Lecturer in Department of Computer Science, Dev Sanskriti Vishwavidyalaya. She is having expertise in Distributed Computing.