Awareness And Uses of Blockchain Technology In Higher Educational Institutions of India: A Descriptive Study

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Abstract- *This paper describes an overview of Blockchain Technology and its various applications on across different aspects in concern to higher educational institutions of India. Recently, Blockchain Technology has gained popularity and this technology is an upcoming emerging technology advancement solution in all sectors especially in education sector. This technology can help in solving different kinds of problems of academic administrations of educational institutions. This study explores the possible uses of applications of blockchain Technology in Academia ecosystem of Educational Institutions and Universities in India. There are many papers published on the topic blockchain technology in education sector but no one couldn`t able to find or explore blockchain based educational implementation pilot projects in higher educational universities and institutions. So, there is a gap between the awareness of emerging technology and its implementations in education sector. Moreover there is need to study the literature review to cope with blockchain based education pilot projects implementations.*

Keywords- Blockchain Technology, Education, Smart Contracts, Ethereum, Record Keeping, Libraries

I. INTRODUCTION

We are living in the age of technological revolutions. Blockchain, a digital technology that aims decentralizing trades. It is a network of computer that all have same history of transaction. In Blockchain Technology, the data is secure, transparent and consistent data store using RDM (Research Data Management). It is famous and edge technology in this era. In blockchain there is no central server in distributed network and it allows data to be distributed across the worldwide via network of private computers that are both storing data and executing computational. Blockchain Technology mainly works on computational system as proof of work and consensus rule. Consensus is an algorithm; procedure through which the nodes present in the distributed network comes on common agreement about the present stage of the distributed ledger. In other words, we cannot add or update the information of any individuals in the block; we need the common agreement among the nodes present in the distributed and decentralized network. So far, it can been seen that another approach is Blockchain Technology can also be utilized in Humanitarian Programming which carries information management, identification, supply chain tracking, cash programming and humanitarian financing. Nowadays, some Universities and Institutes have applied blockchain technology into education, and most of them use it to support academic degree management and summative evaluation for learning outcomes (**Sharples & Domingue 2016; Skiba, 2017**). Blockchain consists of three main core parts which are firstly Blocks which includes a list of records of transactions over a period of time. Secondly Chain which connects different blocks with each other present in the network, and if the size of block reaches to its maximum then its link to preceding block through the help of Hash and the value of Hash of a block is inserted into another block. Thirdly, Network in which nodes are connected and each node contains all records of transactions on blockchain.

II. MATERIAL AND METHOD

This paper presents the descriptive study of blockchain technology and its various applications across all higher educational institutions and universities based on literature review. The author has left no stone unturned to search the literature on blockchain based educational projects implementation and its awareness among information society in India. The author collected all literature view related to this topic from Google Scholar, Emerald, Library philosophy and practice and etc.

III. WHAT IS BLOCKCHAIN TECHNOLOGY

Blockchain Technology is distributed (shared) database, an immutable ledger record, global and peer to peer record of transaction. Blockchain Technology works on peer to peer topology which is a distributed ledger technology (DLT) that allows data to be stored globally on thousands on

servers. A group of researchers two person named Stuart Haber and W. Scott Stornet invented blockchain conceptual framework. Santoshi Nakamoto was a person which uses blockchain technology and releases blockchain in 2008 and 2009 bitcoin software released. The first transaction successfully occurred using blockchain technology between two computer scientist Hal Fenny and Santoshi Nakamoto and form this transaction bitcoin because famous around the world. In fact, we have moved from Blockchain 1.0 to Blockchain 3.0 since 2008 "blockchain 1.0 refers to digital currency, Blockchain 2.0 to digital finance, and Blockchain 3.0 to digital society". **(Leon,**

J., Zhon, Fan., Shaokun. & Yan, Jiaqi., 2016). Blockchain is a network of blocks and each blocks contains three important elements which are as Hash, Timestamp and Data. Hash is an algorithm which generated a sequence of numbers and character 256 bit number, whereas timestamp relates to block creation time and data relates to storage data/information. Blockchain mainly works on Ethereum and Hyperledger software framework which includes tools and libraries for blockchain deployment. A single block in blockchain can store 1MB of data and updates itself in every 10 minutes. Every ten minutes of transaction become one block. Information in the block can`t be altered creating a clear history of each transaction. In blockchain technology, the data is secure, transparent and consistent data storage using Digital Right Management. In blockchain if any changes made to transaction then a new hash will be created automatically and the nodes connected in network will recognize the data manipulation and also updates it-self in every ten minutes. On the basis of access of blockchain data, there are three types of blockchain which are public, private and hybrid, which includes two keys which are public and private keys. And based on access to blockchain it has two types of blockchain that is Permission-less blockchain means anyone can access and read data whereas, in permissioned blockchain only approved users can access with public or private keys for particular duration of time. Crypto currencies are an application of Blockchain 1.0 which is related to day to day digital payment-based systems. Blockchain 2.0 is related to the whole economical market, where Blockchain technology is used to expand traditional transactions like bonds, stocks and smart contracts. While Blockchain 3.0 includes all those applications which are not included in the scope of Blockchain 1.0 and 2.0, like digital health records, digitally vote counting and digital art **(Swan, 2015)**. In blockchain all transaction recorded as blocks on network held by multiple people at same time. Every ten minutes of truncation become one block and each transaction validated by each of the individuals on the network. Information in the block can`t be altered creating a clear history of each transaction. Blockchain works on proof

of work and there is only two operations are create and read and no option for update and delete.

IV. BITCOIN

Bitcoin is digital currency, International Payment System and a product of blockchain technology. Bitcoin orders transactions and groups them in a constrained- size structure named blocks sharing the same timestamp. It`s have many advantages like decentralization, distributed, secure and fast, transparent and immutable. Bitcoin works on proof of work where to run bitcoin network or blockchain computing power need. Computing powers comes from bitcoin minors (node in network) that use GPU, graphic cards and ASIS (Application Specific Integrated Circuits). The value of bitcoin fluctuates on 24x7.

V. LITERATURE REVIEW

The present use and future implications of blockchain technology in academia have been discussed by **Chen, Xu, Lu, & Chen (2018), Turkanovic, Holbl, Kosic, & Hericko (2018), Grech & Camilleri (2017), Sharples & Domingue (2016), Rooksby & Dimitrov (2017) Domingue & Bachler (2018) and Grather et al (2018)**. All are exemplifying the present and future potential applications of blockchain technologies in academia like issuing valid certificates, summative evaluation for learning outcomes, storing student's grade, getting register to online courses and making digital payments and so on. Concerning blockchain applications in libraries, **Hoy (2017)** in his study put forward that the gathering, preserving and sharing authoritative information can be easily done with the help of blockchain technology. The blockchain project of San Jose State University explores the technology for building an enhanced metadata system for the libraries, protecting digital first sale rights, host digital peer- to- peer sharing **("Ways to Use Blockchain in Libraries,"2017)**. Law libraries have a further possibility for authenticating primary law documents as suggested by **Debbie (2017)**. **Coghil (2018)** noted the possibility of blockchain for the transfer of fund from libraries to vendors and maintaining electronic receipts as digital evidence. In 2017, the University of Melbourne started using blockchain to solve the issues coming in student`s credentials, sharing verified copies and tamperproof system. A new initiative taken namely **SEED2019** in Davos a town in Switzerland which is Scientific Ecosystem Experimentation and Decentralization, it involves majority of various professional experts belongs to scientific ecosystem from around the world- lawyers, scientists, librarians, technologists, researcher and many other research organizations, joint together to teach the basis of Blockchain Technology. They try to develop and meet industry needs and

works in background on new technological solutions for research. Niti Aayog has recognized the blockchain as a promising technology enabling features such as decentralization, transparency and accountability **(Niti Aayog, 2021)**. Niti Aayog a Initiative of E-governance of India has executed various use cases in blockchain technology and piloted them in association with the various government departments and private agencies. The uses cases includes land records, pharmaceutical, supply chain, fertilizer, subsidy disbursement and educational certificates etc. **(Niti Aayog, 2021)**
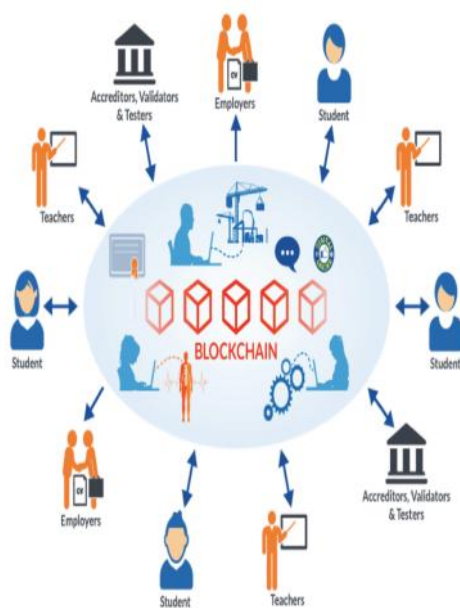

Fig.1- https://www.gettingsmart.com

VI. WHAT BLOCKCHAIN DEFINE FOR ACADEMIC INSTITUTIONS AND UNIVERSITIES

Nowadays, some Universities and Institutes have applied blockchain technology into education, and most of them use it to support academic degree management and summative evaluation for learning outcomes **(Sharples and Domingue, 2016; Skiba, 2017)**. The University of Nicosia is the first school which uses blockchain technology to manage students' certificates received from MOOC platforms **(Sharples and Domingue, 2016)**. Sony Global Education also used the blockchain technology to create a global assessment platform to provide services for storing and managing degree information **(Hoy, 2017)**. Holberton School is the first institute applying blockchain technology to store degrees and has claimed that they would share this information from **(Chen et al., 2017)**. The blockchain ledger can match all kinds of educational information with the user's unique ID. It includes learning behavior in class, micro academic project experience, and macro educational background, etc. **(Guang**

Chen, et al., 2018). Also it protects from fraudulent of academic degrees, the data stored in blockchain are verified, checked and immutable. Some schools have also started the application with this concept, for example, **Sharples and Domingue (2016)** claimed a kind of Education Reputation Currency named Kudos. It can be used to measure learning outcomes and stored in a virtual wallet. Another use of this technology can be seen in the field of scholarly publishing where it can be used for managing submission process of manuscripts, reviewing manuscripts in a timely manner and for its further verification. **(Casino et al., 2019)**. Higher Education keeps students credentials such as projects, course learning, e-resources, and assessment and gets tampered or may get fraudulent of students attributes. Blockchain offers storage of document and others credentials as transaction in distributed ledger technology. There can be disadvantages of implementing blockchain in educational system that we put in educational blockchain system in schools; all students' educational data would be integrated into blockchain ledgers.

The immutability feature of blockchain technology would act as a double-edged sword. It removes the possibility of modifying educational record for legitimate reasons for some students **(Vukolic, 2015)**. Blockchain provides enables the institution to store the data integrity, important document and other credentials at their own new or existing CRM system. The institutions will able to store the grades or awards provided to students on blockchain. This makes students to make easily choices among the educational institutions or program according to their desired objectives. **Devine (2015)** argues that through blockchain, students' academic records become public and easily shareable with employers and universities for further personal development opportunities For educational institutions the blockchain technology creates possibilities for efficient exchange of data of academic achievement between institutions and lowers the risks of paper documentation of archived educational institutions. Concerning to recruiters which comes for campus placement or outsiders recruitment blockchain helps for searching the specialist with their company`s requirement. Also helps to reduce the lack of trust in the academic qualifications of candidates. The entire exam results work or awards/grades of candidates stores as transaction in blockchain for endless life. The recruiter can verify the candidate's credentials from which it belongs through blockchain peer to peer and distributed ledger technology.

VII. DIFFERENT APPLICATIONS OF BLOCKCHAIN TECHNOLOGY

1. Gradbase-It is used to verify instant educational records and confirms the patron identify for being as university student based on document submitted.

2.Blockcerts-Blockcerts (https://www.blockcerts.org) is an open standard for creating, issuing, viewing and verifying blockchain based certificates **(Blockerts.org)**. It provides platform for storage and verification of digital certificates, diplomas and other academic transcripts. These digital records are registered on a blockchain, cryptographically signed, tamper proof and tamper-proof and shareable. **(MIT Media Lab)** It protect from fraudulent of educational certificates. The journey for learners on the Blockcerts platform is short and simple: users download the Blockcerts app and are offered a private pass phrase to ensure ownership; afterwards, they add credential issuers to their apps; lastly, they receive, manage, and distribute credentials. Blockcerts is a "remarkable case as an initiative based on [blockchain] for certification", as claimed by **(Bartolome, et al., 2017)**.

3. Open Source University- Open Source University provides the platform for learners to organizing and validating all your achievements through a single user account. It also provides anti-falsification and data connectivity solution and also saves time and money on connecting individuals and organizations (https://os.university).

4. ARCHANGEL- ARCHANGEL were introduced which is a Trusted Archives of Digital Public Records that provides data integrity of digital documents using distributed ledger technology and supports digital preservation for long sustainability of digital archives, accurate data for use in official capacities, trustworthy records, avoid tampering or corruption, mutual worldwide protection. Trusted Archive of Digital Public records provides long term sustainability of digital archives, accurate data for use in official capacities, trustworthy records, avoid tampering or corruption, mutual worldwide protection. ARCHANGEL has so far been deployed for initial trial across the national archives of the UK, Australia, Norway and Estonia as well as NARA in the United States.

5. Research Data Management (DaMaHub) - It is a term which describes the preservation, storage and collected data of a research project. It facilitates for sharing of research data for valuable discoveries by others outside the original research team. Data Management Hub is a distributed research data management platform (DaMaHub). It is open source, open access, private data, version management, LOCKSS and timestamp for authenticity.

6. DRM Technology- It refers to the technologies and processes that are applied to describe the digital content and to identify the users. DRM is used to present the abuse of digital content. The legal context for DRM is copyright, the USA copyright and the EU countries have their Digital Right Management system derived from WIPO copyright Treaty of 1996 (WCT). Most of the EU countries have private copyright provisions in their copyright laws, which allow consumers to create copies of legitimately obtained context for their own uses or that of family members. **(Rosenblatt, 2006)**

7. PUBLICA.Com- Publica.com is the company which provides the platform for authors for book publishing or academia research papers using blockchain Technology. Publica creates a book token (Pebbles PBL) as a access key for buyers on Publica`s e-reader app stays until you read or share or sell it to friend. Tokens are created using smart contract on Ethereum network and exchanges to apportion part of the resale price of the book to an author. Major benefits which provides Publica`s e-reader app is digital distribution, sales tracking, revenue sharing etc. If to lend the book or gift to friend it is easy to transfer and if to read it. Publica helps to expand the range of business model like crowd funding, public libraries, peer review, pay-as-your-read author receives sales price of published books. For more details kindly visit www.publica.com.

VIII. TOP ENTERPRISE BLOCKCHAIN PROTOCOL

1. Hyperledger- It is a framework which provides protocol (permissioned blockchain) which exchanges productivity with the help of framework, tools and libraries and offers collaborative approach.

2. Quorum- Invented by J.P Morgan developed to solve finance sector problems and it is open source available under LGPL 3.0 License and also benefits from Ethereum architecture.

3. Corda- It is built from scratch software best for banking financial transaction and validation utilizes distributed ledger system software along with consensus algorithm to ensure transparency traceability and transaction validation. It has five key architecture that are longevity, secure, stable, scale and inerrability.

4.Enterprise Ethereum- It is best for public blockchain platform smart contracts, decentralized applications that offer permission. It also offers a better privacy level with improved performance and scalability.

5.Ripple- Ripple Net can connect banks, organization, assets exchange and using their blockchain platform and focus on faster payment processing. It offers rapid deployment, high security, faster payment, modernizing of messaging.

IX. OPPORTUNITIES AND CHALLENGES OF BLOCKCHAIN TECHNOLOGY IN EDUCATION

Blockchain may serve to make these processes more available and transparent to learners, educators, researchers and other important stakeholders. We argue that blockchain might have the potential to democratize and automate administrative routines and work processes that are an integral part of research and educational processes at universities. The second challenge is within the field of governance of universities as organizations, where we argue that blockchain technologies can be used to redirect the focus towards research and education. **(Halvdan and Inger, 2019)**.The third challenge relates to the adoption of blockchain technologies in HEIs (Higher Education Information System). This raises the interesting question whether universities will transform their internal organization and change their priorities to adjust to a changing external environment, which is an ongoing trend in other larger organizations. Blockchain is currently a disruptive innovation that is closely monitored by organizations like banks, corporations and Internet-based companies, meaning that innovative uses of blockchain grows resilient as the "fail fast, fail forward" approach develops **(Halvdan and Inger, 2019)**.

In blockchain technology, multiple copies are stored, which helps users to store sensitive data at one place **(Sarmah, 2018)**. To fairly secure academic intellectual property rights, like course content, textbooks and research, they can be made assessable on blockchains by the use of smart contracts **(Halvdan and Inger, 2019)**. We believe that universities have the sufficient amount of trust to make academics make the trust leap that is required to share various kinds of intellectual properties with other stakeholders **(Halvdan and Inger, 2019)**.Today there are various widespread of learning apps, websites and services which malpractice fake university degrees and identify misuse management. Such practices can remove by the blockchain technology.

X. DISCUSSION AND CONCLUSION

The applications of blockchain are wide in concern to science and research, R&D and business model. Time is best answer to tell and some applications still under development and design. Only few educational institutions have started to utilize blockchain technology. This paper summaries and somewhere to some extent succeeded to aware about not only blockchain but also different blockchain applications. Also discuss about opportunities and challenges of blockchain technology in education sector.

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