INTERNATIONAL RESEARCH JOURNAL OF HUMANITIES AND INTERDISCIPLINARY STUDIES
(Peer-reviewed, Refereed, Indexed & Open Access Journal)

A brief study on role of Block chain for Industry 4.0

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Abstract:

Industry 4.0 is a "digital revolution", which hastening globalized impact of transformation and generate need of cost-effective smart manufacturing solutions for future; After COVID-19 pandemic, many employees started working from home; and many firms adopted digital business models to maintain operations and preserve some revenue flows and continue with producing high-quality products. In last two years, businesses which were unable to convert themselves in digital form were erased from the business world and not survived further. So adaptation of technology like Block chain is very essential for not only survival but also to generate optimized revenue from business. This research paper provides detailed study on role of block chain for evolution of Industry 4.0.

Keywords: Blockchain, Industry 4.0, Smart Contract, Supply chain management

1. Introduction:

The present modern industry has experiences vast changes since its initial iteration at the beginning of the industrial revolution in the 18th century. For centuries, most of the commodities including weapons, tools, food, clothing and housing, were manufactured by hand or by using work animals. As shown in figure 1, this changed in the late of the 18th century with the introduction of manufacturing processes using mechanical methods. This was the era of Industry 1.0, where the use of steam power and mechanization of production started and base of industry culture was deployed. the mechanized version achieved high volume of commodities in same time.

The next revolution, Industry 2.0 began in the 20th century through the discovery of

electricity and assembly line production. Concept of mass production caused revolution in the automobile production and many such industries. Now production of any automobile was not one station work. Assembly lines concept were introduced to produceany vehiclethrough multiple stations; different parts were produced on different stations and at the end assembling of all parts outputs the final product. This was the drastically changed in production methodologies and strategies which ignited the speed of production with quality product in lower cost.

The Third Industrial Revolution began in the Late of 20th century through partial automation using memory-programmable controls and electronics computation devices like computers. Electronics devices and automation technologies started replacement of human being with machines. Many robots and automated machines were generated which were able to worked without human intervention

We are at present implementing the Industry 4.0. This is characterized by the application of information and communication technologies to industry and is also known as "Industry 4.0"[2,3,4]. It builds on the developments of the Third Industrial Revolution. Production systems that already have computer technology are expanded by a network connection and have a digital twin on the Internet so to speak. These allow communication with other facilities and the output of information about themselves. This is the next step in production automation. The networking of all systems leads to "cyber-physical production systems" and therefore smart factories, in which production systems, components and people communicate via a network and production is nearly autonomous [12,13,14,15].

Industry 4.0 promotedinnovations and usability of revolutionary digital technologies like Internet of things (IOT), Artificial Intelligence, Cloud computing, Machine Learning, Data Science, Blockchain etc. For digital trading, Block chain platforms are suitable for providing transparency in transaction with security and privacy.

2. Blockchain –Crypto Trading Platform:

Block-chain is a technology that has gained much recognition due to its crypto- trading platform which ensures privacy, transparency and security. These characteristics of Blockchain provide enormous possibilities for enhancing the sustainability of trading over digital networks. Some fields have prospective benefits for block chain, like financial transactions applications in which block chain can provide trust. Different contributors, vendors and stakeholders can have linked to the block chain to understand the status of product manufacturing at its different assembly lines. block chain ensures tamper proof transactions and protect all the details of digital trading and product like sub-assemblies, parts, sales and storage, etc. Block chain enables manufacturer to gathered real time information in very short period [1-3]

"Block chain" as the name suggest is the Chain of Blocks. The Chunk of digital information (Blocks) which are connected through the public databases (Chain). It is nothing but the specialized replicated data structure for storing transactions details with pointer details of previous block.

Blocks stored digital information like actual record of any transaction, details of involve entities in the transaction, timestamps and other metadata of the transactions. Blocks also has unique id which is known as hash. Block chain technology is built using peer-to-peer networking. Anyone who is on network can access the blocks. There is no centralized community to control the Block chain. So, no one is the sole-owner of the block chain everyone has a copy of the block chain. With the concept of decentralization, it also needs to be ensured that everyone holds exactly the same copy of the block chain at the same instance of the time. In block chain technology it is known as "distributed consensus problem". To solve this problem, a special framework is identified, which acknowledged the authorized one, who can append new block on chain by providing "Proof of work", they are known as block miners; the peoples who lend their computing power to the network to solve the complex computation algorithm problems.

2. Literature Review:

It improves and provides privacy and security guarantees such as anonymous authentication, auditability, and confidentiality. It also improves the efficiency of financial processes [17,18].

The block chain is run and maintained by a network of computerscalled nodes, so there is no single-point-of-failure, and information canbe accessed in real-time. The industry is correctly in line with the conceptof the influence on the market of Blockchain technologies [12,19,20]. Its crypto graphic primitives like Hash function, digital signature and smart contract allows users to preserve their exclusive and immutable identity documents, without their permission that nobody can read or view. Many block chains are developed and utilized for supply chain management in manufacturing process [21]. Blockchain is also very effective tool for tracking and tracing the product [23]. Exploitation of Blockchain in various service sectors like Healthcare [22], Ecommerce [24], Smartcontracts [25] and automotive industries.

Some of the Blockchain platforms are summarized in table 1

### Table 1: Different Blockchain platform summary

S n	Blockchain platform	Name	Year	Decentralized implementation concept	Application Areas
1	Bitcoin	SantoshiNakamoto	2008	Mining	Money transfers, Financial exchanges

2	Ethereum	VitalikButerin Gavin Wood	2005	Smart Contracts	Ethereum is a decentralized blockchain platform for building and running autonomous smart contracts over a network of nodes, secured by Proof-of-Work (PoW)
3	Ripple	Chris Larsen, Brad Garlinghouse	2005	Consensus protocol,via a group of bank-owned servers, to confirm transactions.	The purpose of XRP is to serve as an intermediate mechanism of exchange between two currencies or networks—as a sort of temporary settlement layer denomination.
4	Solana	Anatoly Yakovenko , Greg Fitzgerald, Stephen Akridge , Raj Gokal	2019	smart contract	Solana is a blockchain platform designed to host decentralized, scalable applications.
5	Binance Coin	Changpeng Zhao	2017	consensus and delegated proof-of-stake	Money transfers, Financial exchanges
6	Tether	Brock Pierce, Reeve Collins, and Craig Sellars	2014	Track U S Dollar. TRON,OMNI,ETH BLOCKCHAIN	Tether is a blockchain-based cryptocurrency that is backed by the U.S. dollar
7	Avalanche	Emin Gün Sirer, Kevin Sekniqi,	2020	smart contract	AVAX is used to pay transaction processing fees and secure the Avalanche network
8	Yearn. finance	Andre Cronje	2020	Yearn. finance (YFI) is an Ethereum token that governs the Yearn. finance platform	lending aggregation, yield generation, and insurance on the Ethereum .
9	elrond	Despre Beniamin Mincu	2020	smart contract	Contributing to reach the necessary economic security threshold, and earning rewards while delegating or running a validator node.
10	Raven Coin	Tron Black	2018	Raven coin is based on a fork of Bitcoin, and the project	Raven coin is a peer-to-peer blockchain, handling the efficient creation and transfer of assets from one party to another.

				offers token issuers an alternative to smart-contract-centric block chains	

3. Implementation of Blockchain in various sectors:

Industry 4.0 advocated the use of digital data and exploitation of new technologies like IOT, data science, robotics and AI. Industry 4.0 revolutions are pushing its limits to give rise to smart companies, in which Block chain technology and applications have significant share [5,6,7]. In online trading and business blockchain technology is providing suitable platform to transact, exchange, and transfer data at the same time as retaining a trusted atmosphere. Many blockchain applications have been already deployed for bridging the gap of online trading and offline business traits [2]. Ad-hoc applications are developed for solving problems of different sectors like healthcare, supply chain, automotive, education, finance and public sectors (figure:1).

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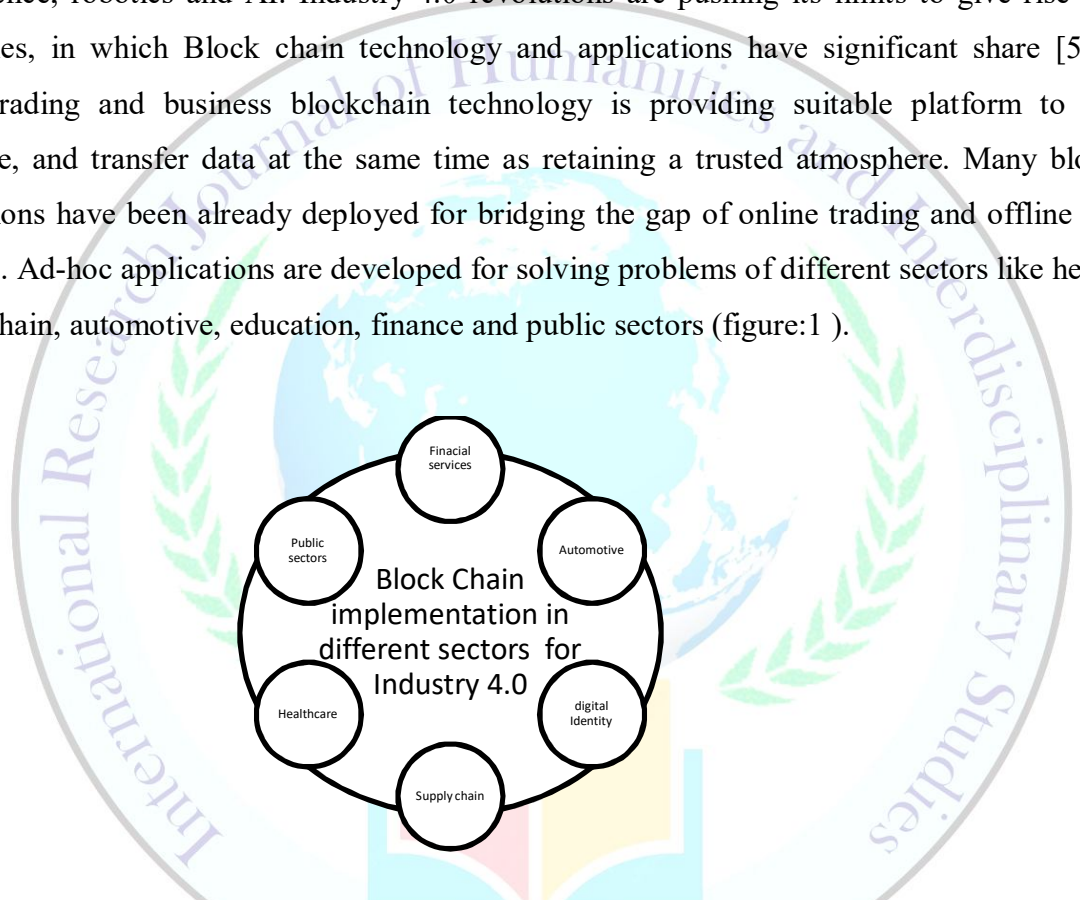
Figure 1: Block Chain implementation in different sectors for Industry 4.0

Healthcare Services:

Blockchain very useful for creating innovative solutions in various sectors, including healthcare. A Blockchain network not only allowed to maintained and accessibility of patient medical records but at the same time encouraging for protect and exchange patient data through hospitals, testing laboratories, pharmacy firms, and doctors. This empowered patient to have greater control over its personal information and assist to be safe from fake physician practices.

Healthcare practitioners and medical providers are recognizing Ethereum Blockchain technology very useful for medical data management, patient data management, drugs and treatment practices updating and convenient to access data among several stakeholders.

Finance:

With the huge publicity of Bitcoins, many blockchain applications are widely developed for financial- sector [1]. At present, the finance and payments sector be inclined to act as a critical corporate of block chain and the pace of adoption in many other industries. Implementation of blockchain technologies for financial services solved many problems like slow payment settlement process, limited transparency and security vulnerability issue. These block chain based applications improve end user experiences, help to generate optimized revenue and reduces risk in business operations.

Public Sector:

Due to centralized execution of many processes of public sectors is very slow, tedious and required labor work, whereas blockchain technology based applications endorsed decentralization and offer more secure, agile and cost-effective structures

Application of blockchain technology in the land registry answered many problematic questions that are arises due to keeping a centralized record. As blockchain is a distributed tamper proof ledger handling technology which facilitate keeping of historical records of all transactions that have taken place across a peer-to-peer network.

Digital identity:

The traditional identity systems like Aadhar / Ration card details driving license, etc. are fragmented, insecure and continue to lack complete ownership and control over their identities.

Peoples had experiences of frequent hacks, which forces a lifetime of fraud mitigation for the end-user. Blockchain identity management systems could be used to eliminate such identity issues. AsBlockchain technology is based on decentralized system, it can be allowing for users to create and manage digital identities for identity management with proper encryption system to make it more accessible with security. Asynchronous encryption system will be utilized through which person can have public and private key for secure identities at the same time ensure tamper proof accessibility of it.

Supply chain:

Many of the Business experts areunleashing Blockchain technology for supply chain management systems for answering present challenges in business systems. Supply chain data is not always visible, available or trusted. Blockchainbased applications for supplychain management facilitatesstakeholders to share and availability of trusted data.Blockchain supports to have confidence on supply chain transparency, authenticityand traceability of the products and its quality. Blockchain based, supply chain can supportstakeholders to record price, date, location, quality, certification, and other metadata moreeffectively.

Automotive:

The automotive industry is also leveraging the potential of blockchain for maintaining records of automobile insurance, driving license regarding data and facilities, location tracing of automobile, payment and servicing details of vehicles. Blockchain based supply chain for automotive industry ensures the proper coordination of production, shipping and supplies.

Massive data of automotive industry like vehicle component production and delivery status, its bill records, updating and coordination of assembly line.

4. Conclusion and future scope:

Blockchain technology can aid in scaling up in cross domain application development and also can assist to deploy and framing many government and non-government worldwide systems. Industry 4.0 and its innovative technologies are stepping up blockchain at next level. Its feature like proof-of storage and proof-of-existence are evolved with many new applications. Blockchain technology provides virtual shared infrastructure for integrates multiple blockchain based platforms, which helps to access platform specific benefits to successfully completed and complex transaction. It also helps any country to integrate its diversified government services which can be further utilized to verification and assist to remove the loop whole of processes and reduce chances of fraud and malfunctioning.

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