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Review on the Applications and Challenges of Blockchain in Saudi Arabia

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ABSTRACT
Blockchain technology has seen rapid growth since its first successful implementation in the making of the world's first cryptocurrency, bitcoin. the technology has seen many applications in fields such as banking and finance in the decentralization of records which has led to the lowering of costs associated with centralized database maintenance. Cryptocurrencies have also grown in popularity around the world and the success of bitcoin led to the development of other cryptos like Coinbase and Ethereum. Governments have also adopted blockchain technology in the issuance of e-passports and electronic identification systems. Privacy concerns have been the leading challenge facing cryptocurrency, while it might sound like a contradiction since blockchain is primarily a security system. Several high-profile hacks have exposed some weak links in the chain as discussed below.

Keywords: — Blockchain – Cryptocurrencies- Blockchain challenges- FinTech- internet of things (IoT)-Privacy

I. INTRODUCTION

Blockchain can be defined as a database where participating parties have their transactions documented in a safe system. Blockchain was initially popularized in 2008 and used by Nakamoto to form a basis for Bitcoin, the world's first cryptocurrency in 2009. Blockchain has seen widespread use in the development of another cryptocurrency over the years and in various industries like banking, healthcare, and education, among others. The uptake of Blockchain can be attributed to the privacy and anonymity it provides. Blockchain is simply a computer algorithm that enables the communication between a peer-peer network of subscribed members. These networks perform transparent transactions between their members.

Blockchain technology has many advantages and implementations. The integration of devices connected to the internet has enabled many operations that would have otherwise been impossible to accomplish. Uses of blockchain technology range from home cameras and automation of home systems to applications in the defense industry in flying unmanned aerial vehicles. The encryption levels and security systems that are associated with blockchain have led to the development of systems that are trusted by the public.

The implementation of blockchain technology can be seen in home automation devices like Alexa and google home. This paper seeks to identify the applications of blockchain in various industries and explore how various sectors like government institutions can benefit from the application of blockchain technology. To achieve this, we explore the literature done on the topic of blockchain technology and successful case studies (like bitcoin). This paper aims to incorporate various studies into one to create a comprehensive view of the applications of blockchain technology. The research can serve as a future roadmap for aspiring developers to have a choice of products and market niche to develop products. In addition, we highlight the main challenges and opportunities to be considered when adopting blockchain technology in Saudi Arabia. Figure 1 exhibits the research activities.

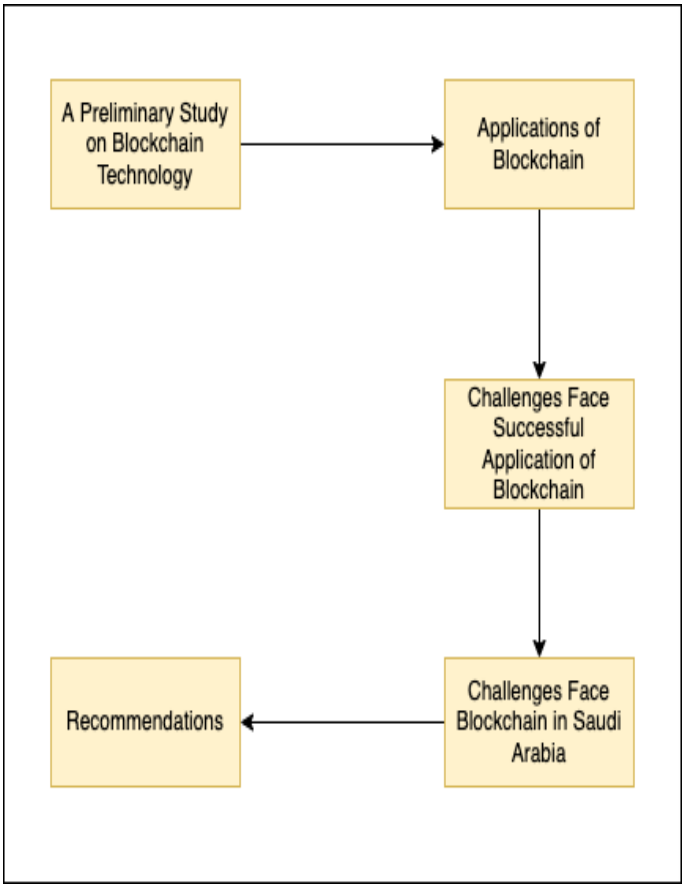

Figure 1: Research Structure

II. LITERATURE REVIEW

There have been numerous researches done in the field of blockchain. Blockchain as technology was first suggested in the mid-twentieth century but did not see any implementation until the advent of blockchain. The adoption of blockchain technology saw initial resistance from the public, which was skeptical of the security in a decentralized system. The mainstreaming of blockchain technology saw a scramble of legislation from governments and the development of privacy-enabling tools from technology companies. The development of open-PDS, a recently developed framework, has led to automated development of PDS, thus returning data computation instead of raw data on requests made. However, many companies prefer deploying custom authentication software to help them save as the centralized authority, thus creating trust. The rise of blockchain has led to companies changing their business models and developing frameworks that are compatible with the future of Blockchain technology. This is evident in adopting bitcoin, a cryptocurrency with no tangible value, to the New York stock exchange (NYSE) [16]. this paper seeks to identify the industries that have adopted blockchain technology, the challenges they face in the implementation, and success stories attributed to the blockchain.

III. APPLICATIONS OF BLOCKCHAIN

The effective implementation of blockchain structure in the making of bitcoins and its ensuing success led to an interest in many industries that saw the potential of blockchain technologies. Over the past decade, blockchain technology has seen use in industries like banking/ finance, cryptocurrency, IoT, government operations, and identification [11]. In this part, we will discuss how all the industries listed above have implemented blockchain technology in their operations.

I. Finance/ banking industry

Financial technology (FinTech) can be described as combining the financial sector and technological advancements. Blockchain is vital for the evolution of finance hence the rapid adoption of the technology into fintech. The biggest addition that blockchain has brought to the table of financial institutions is the decentralization of records and transactions [2]. Traditionally, a third party, such as a bank, was needed to verify and process transactions on behalf of clients [14]. This made the transactions susceptible to errors since the transactions involved several uncoordinated parties that kept and adjusted records. The intricacies of managing all the records and keeping them uniform made the entire process slow and costly [8],[22]. Blockchain technology solves this by providing a decentralized ledger where miners use “proof-of-work” to verify transactions [6],[7]. Individual nodes in the blockchain have an updated duplicate of the updated block, thus creating transparency about transactions. This makes the entire chain immutable once a block with a verified transaction is added. This makes for difficult for hackers to manipulate transactions once they have been logged in the system. In the event of conflicting data within the blocks caused by branching within the chain, then miners are advised to follow the longest choice since it is more reliable. Robust verification and secured communications improve the financial sector's blockchain [9]. The above-discussed advantages can be credited for the huge uptake of blockchain technology. It should also be noted that in an instance where more than 50% of participants have malicious intentions, then the chain will be vulnerable to attacks.

II. Blockchain and Cryptocurrencies

The very mainstream use of blockchain was in the development of cryptocurrency, bitcoin in particular. Cryptocurrencies hold a market share of billions of USD, with Bitcoin trading in the NYSC [16]. Bitcoin, developed by Satoshi Nakamoto, uses cryptographic practices that allow recipients to receive money without securely needing a third party. Bitcoin relies on blockchain technology to perform its transactions [15]. The public ledger allows bitcoin to generate blocks by performing a consensus algorithm like proof of work. The security associated with blockchain technology makes it impossible to get a person’s private key by using their public key thus preventing a hacker from conducting an impersonation attack.to perform a transaction, the client software completes a mathematical operation to aid in combining the buyer’s public key, the source’s private key and the amount of cryptocurrency to be transacted [15]. The transaction is then broadcasted to other platform users online (with the exemption of transacting parties), who then confirm whether the actual owner sent the money by exploiting the values of the mathematical equations discussed above. The manipulation of these values is possible at the user level since the open transaction logs are kept in the computers of each user thus making the files decentralized.

III. Blockchain and government operations

Governments can use blockchain technology to improve operations and streamline service delivery through the creation of transparency in conducting their operations. The salient features in blockchain make it possible for governments to be accountable and transparent, thus fostering trust between officials and the civilians of a country [19]. Technologies brought about by blockchain can be applied in the field through the procurement of government contracts [20]. The security provided by blockchain technology ensures that there is no corruption of data in the process, thus enabling accountability and ensuring only the best bids get approved for government contracts without favoritism.

Blockchain has also been extensively used in the issuance of identification documents like passports and ID cards. For example, the issuance of birth, marriage, and death certificates is important in keeping track of an individual’s status and thus enables the government to grant rights according to the

individual's chronological status. These rights include employment, education, and divorce settlements. Keeping such records using traditional methods can be expensive, and the records can be prone to loss or damage. Issuing digital passports has also helped curb the counterfeiting of such documents since the authentication method used to identify the owner is encrypted through blockchain, thus making it hard to fake or tamper with [21].

IV. The internet of things

The big number [18] of interconnected devices which also have internet access is called the internet of things (IoT). IoT, though relatively new, has seen public acceptance with its adoption in technologies like home automation [17]. Security and privacy are paramount to executing a trusted home automation system. Blockchain ensures that the information transferred between devices is safe from corruption or access by a third party.

IV. CHALLENGES FACING BLOCKCHAIN TECHNOLOGY

Reference [1] theorized that blockchain-based systems are not entirely safe. This is largely due to the successful robberies involving both bitcoin and Ethereum, with the companies losing nearly six hundred million since 2009. Reference [13],[23] concludes attacks on a blockchain network are possible in a situation where miners are self-centered [10]. Reference [3] claims that the vulnerability of blockchain technology exists at 51%, where the miners control the most significant part of the network [12]. In 2014 Mt. Gox announced the theft of 850000-bitcoins together with user accounts and company accounts. Since Mt. Gox was the largest bitcoin trading platform, the theft raised the privacy issues surrounding submitting private data in blockchains. Additionally, in 2018, a Japanese exchange noted the theft of bitcoins worth 500,000,000 USD [1]. Privacy leakage is quite a big problem that touches on user data security [4],[5]. However, methods implemented to improve anonymity within the blockchain ecosystem have not been entirely successful. For instance, privacy is still a big concern for people using blockchain, especially after Several high-profile hacks over the years [24]. Another problem facing blockchain technology is high energy consumption. The development of blockchain technology presently depends on the bitcoin framework that requires proof of work as a consensus algorithm. To facilitate the communication is a blockchain network, therefore, translates to more electricity usage as miners try to verify transactions. High computation power is also needed for blockchain technology thus the technology becomes limited by the level of computation and electric power available. additionally, the lack of regulations to govern the use of blockchain technology has led to the issue of security thereby limiting the widespread applications of the technology in controlled industries like banks and defense. The lack of regulation has seen several countries ban the use of cryptocurrency in their territories [1]. Transaction speed is a factor in every transaction. However, transactions taking place over blockchain technology have been observed to take more time compared to conventional modes of payments. This can be attributed to the complex verification and encryption system adopted in the technology. the lack of fast and instant processing especially in payments has made the technology viable for large transactions only. Finally, the lack of public knowledge about blockchain technology has seen the technology fail to gain traction with the general public. The association of cryptocurrency with illegal activities in the dark web has seen people reluctant to adopt blockchain as a whole [4].

V. CHALLENGES AND OPPORTUNITIES OF ADOPTING BLOCKCHAIN IN SAUDI ARABIA

Reference [26] stated that investment in digital infrastructure in Saudi Arabia is a key in development. Saudi Arabia is a development country that seeks to an advanced position in digitizing all services. Education and business were not stopped or delayed during Covid 19. High internet speed, free services, opening cell spectrum, amendment of network management, help remote learning, and continuity of business services were served by the government. Studies (for example: [25]) show that many people use E-government applications comfortably with less fear as information and data are secured and managed by policies provided by the Saudi Arabia government. Although the increased number of electronic attacks around the world, Saudi Arabia offered improvements and took a good position globally among other countries in securing data and protecting privacy. However, applying polices in a controlled and centralized model with multi-governmental agencies makes it more complicated to deal with processes.

Figure 2: Challenges and Opportunities of Adopting

blockchain in Saudi Arabia

Figure 2 shows the main challenges that face the adoption of Blockchain technology in the Saudi Arabia. Mainly, decentralization, lack of trust, and restructuring policy. On the other hand, the promising development toward digitizing services, adopting a strong measurement of security, and establishment of an internet and E-services infrastructure are considered the main opportunities that lead to high successful rate of adopting Blockchain in KSA.

VI. CONCLUSION

While the adoption of blockchain has seen the development of successful platforms in different industries, like banking, insurance, IoT, cryptocurrency, and even in government agencies, security and privacy have always been a limitation of the technology. Lack of legislation has also led to the lack of faith in the blockchain system among users. As the uptake and implementation of blockchain technology continue to increase, governments worldwide are racing to enact legislation that will help blockchain technology become mainstream. The development of several frameworks has also helped in increasing privacy and security. Even with all of the above-discussed limitations, I have concluded that the benefits associated with the use of blockchain greatly outweigh the limitations. These challenges have been reflected on the adoption of blockchain technology in Saudi Arabia to understand which of these are ongoing challenges and which are opportunities that lead to the successful adoption. Saudi Arabia should pay attention to promote trust level, restructure and re-define policies, and support the infrastructure to overcome the challenges of decentralization. Further, continuous evaluation of security and adopting a recent measurement to assure the highest level of internet services security. Finally, Saudi Arabia's promising progress toward digitizing service should continue to achieve its goals.

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