Blockchain Technology: Unlocking the Business Model Maze for Evolving Businesses and Start-Up

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1 Introduction

Emerging new technologies often enable transformations on social, economic and business platforms [1]. Globally, digitalisation of economy is in process since 1960s. Earlier, technologies based on digitalisation were utilised to enhance procedural aspects of business via conveying the same output in a swift and secured manner. However, Blockchain technology offers an exchange of value which is completely distinct from previous technologies. As per 2018 technology trends, blockchain occupied a place among the top five such specific technologies, which are capable of revolutionising the business world [2].

International Data Corporation (IDC) anticipated expenditure on Blockchain to reach new heights of approximately 12 billion USD by 2022. Fundamentally blockchains' potential to revolutionised financial service industry has been exposed more; however, the influence of blockchain technology surpasses the financial sector and encircles any business practice that acts via mediator and draws economic gains as an intermediary in the value chain [3]. Hence, it is forecasted that blockchain will question traditional business models and furnish new opportunities of value creation. Constructive guidance with respect to various existing blockchain solution and their probable impact on businesses and business models is quite minuscule.

Despite the attention that Bitcoin receives, it is far from the only variant of blockchain technology. While it is quite serene to locate mediums that prop up the prospects of blockchain as disruptive technology, for example mobile, Internet, social media, email, etc., it is profoundly strenuous to perceive the literature regarding the

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range of blockchain based technology and their capabilities to add value to businesses and business models [4].

1.1 Business Models

Lately, Business Model is the most talked about concept of management studies. The first mention of the concept can be traced back to 1957 and often confused with the concept of business strategy, however not until the end of the twentieth century, the business model earned the interest of researchers [5]. Although in the recent times there is a significant development in the theory of business models, still researchers are unable to conceptualise the definition of BM that could capture its true essence and which is globally acceptable [6].

As a specific definition of BM yet to be found, it has been recognised as the 'story that explains how an enterprise works' or also as system for executing business. As per Osterwalder, theoretically a business model is an instrument which constitutes four major sectors of a business namely, Product: What is the business's product and what is their value postulation for the market? Consumer interface: Who are their consumers, how do they provide value to them, and how do they establish and sustain relationships with them? The infrastructure management: What infrastructure is required to provide optimal customer value? The financial aspects: What are the costs associated with the business, and how will the business, price its products or services to achieve a profit? [7].

Various constituents of business models and their elucidation are expressed with help of Fig. 1.

Elements	Constituents of Business Model	Elucidation
Product	Value Postulation	The value postulation is a transparent method of explaining what pains, concerns and needs, the enterprise resolve for its consumers.
Consumer Interface	Target audience	Describes the segment of consumers company wants to deliver value to
	Channel of Distribution	Describes the various means to get in touch with the consumers
	Consumer Association	Explains the kind of association the company wishes to establishes with various consumer groups
Infrastructure management	Value layout	Explains the configuration of resources and activities.
	Core competancy	Elaborates the competencies required to deliver the business model
	Partner Tieups	Presents the matrix of cooperative tieups with other companies to efficiently propose and monetise value
Financial aspects	Cost structure	Sumarises the monetory consequences of the method deployed in business model. The cost of delivering value.
	Revenue model	The way earning is made through variety of revenue flows.

Fig. 1 Constituents of business model

These four elements are further segregated among nine sub-segments, namely customer relationships, value propositions, revenue streams, channels, customer segments, key resources, key activities, key partnerships, cost structure as shown in Fig. 2 which are completely interrelated and capable of putting influence on a business model [8].

Nevertheless, value generation is the focal point in the interpretations presented by various academicians. As the definitions of business model were evolving, gradually the distinction between business strategy and business models also become more and more comprehensible. Where, business model explains the logic of how a company generates value, and business strategy's main objective is to enhance competitiveness by being distinct. Business model focuses on the process of consumers' estimation and value premise [6]. Where, framing of business strategy is a top management approach defining and explain modus operandi in competition; operational levels bring about business model explaining how to execute the business strategy [9].

To earn commercial success and substance in the market, the company needs to have a proper blend of both business strategy and business model. Logical and simple business model is the excellent one [10]. It should take into consideration human resources and physical resources as well.

Development of business model often faces three major hurdles. Firstly, there are compatibility issues between business model and real market situations; secondly, most of the time business model tend to constitute only a fragment of business strategy; lastly the main aim of business model is value hypothesising rather than capturing the true value [11]. New ventures show more vulnerability towards these hurdles. An appt business model could facilitate a start-up to align of its resources according to consumers' needs and wants.

Besides the concepts of value creation, business process and strategic approach, now a days BMs delineated a concrete and strong connect with technology [12]. Particularly, the era of early 2000 shows the advent of designing many BM supportive tools [13]. Business Model Canvas (BMC) is among the industry's best known and commonly used tools for modelling, designing and analysing business models.

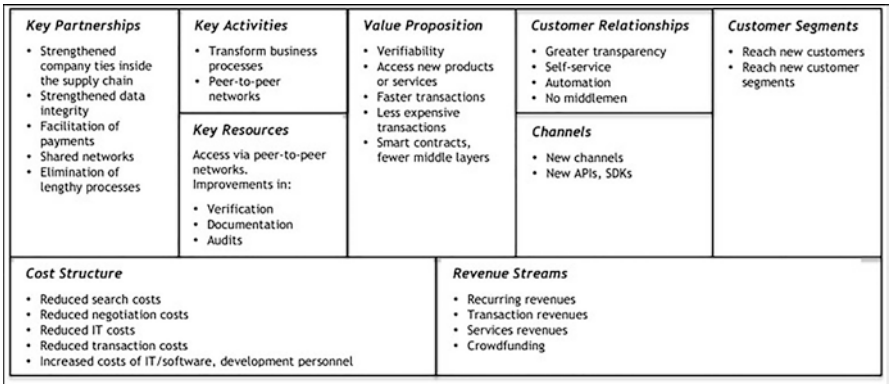

Fig. 2 Sub-segments of business model canvas

In BMC, a quick description of the business model is provided in the form of short, informative texts, often in the form of 'post-it' notes. Using the BMC is a highly agile way of discovering challenges and opportunities, making it possible to render and change the business model as the company grows. The design and purchase organisations need to understand fundamental relationship between BMs and IT [14]. Technological advancements and innovations alone cannot secure and assure the any firms. In order to gain competitive advantage, BMs have to arbitrate between economic value creation, ever growing technologies and firm's performance [15]. It is necessary to apprehend the value created by an innovation and assure its success commercially [16]. The analysis of relationship between technological advancements and BMs becomes more relevant, when introduction of technological innovations and advancements are industry specific. Inertly going by longstanding belief system and not incorporating technological innovations and advancements in BMs of companies have proven to bring consequences that are fatal for businesses [17].

1.2 Blockchain Technology

The genesis of blockchain begins when the white paper was written by Satoshi Nakamoto in 2008. Nakamoto inaugurated bitcoin as a peer-to-peer kind of electronic cash that permits payments to be sent amongst parties and do not need any centralised financial institution as intermediaries. Nakamoto also conceived the ledger while implementing bitcoin, which he named a 'chain of blocks' [18]. This sequence of blocks assists the novel kind of electronic cash and subsequently came to be known as blockchain. Initially blockchain implementations were intended to deliver an alternative trust mechanism between transacting parties based on cryptography [19]. Further, blockchain technology facilitates a collective bookkeeping system (ledger), which permits participants to reach an agreement on the acceptance of a transaction via a mathematical function (hash function). Each transaction is recorded in a separate 'block'. In a chronological order, these blocks are added to the computers of all participants of the network after they are reviewed and verified by the network. Afterwards, the network is provided with a distributed ledger of verified transactions of a particular unit.

Mainly blockchain is of two types of public or private blockchain. Public blockchain also known as open blockchain permits anybody to interconnect with other party while transacting. The identity of two parties is either entirely anonymous (i.e. parties who are entering into the transaction do not know each other before the transaction) or even pseudonymous [20]. A public blockchain implies very little privacy in transactions, which means that each and every participant can see each and every transaction. A public blockchain also needs a considerable computational capacity which is a requisite to maintain a distributed ledger on a very large scale [21]. In order to attain consensus in public blockchains, each and every node in a matrix requires to resolve a resource-intensive cryptographic, complex complexity known as proof of work to make sure that each and every node of the blockchain is

properly in sync. Public blockchain comprises of Litecoin (a cryptocurrency designed to be faster and more efficient in comparison of Bitcoin), Bitcoin and Ethereum (which is processed unlike Litecoin and Bitcoin) and is fundamentally utilised for smart contracts.

Closed or private blockchains permit only those groups of individuals or individuals which are pre-validated to access the ledger for the purpose of entering and viewing data. In closed blockchain, identities of users are known to each other prior to entering into transaction. Consortium or federated prototype is a variant in which the closed blockchain work under the guidance of a group. In this variant of closed blockchain, permission regarding uses of blockchain network by new entrants varies, only already existing members can choose the future entrants. There is a regulatory authority or a consortium which gives users licenses to new members and make decisions regarding their participation.

Private blockchain tends to provide greater privacy to the transaction, involving critical and sensitive data (e.g. the transfer of financial or medical data). The authority to read the private blockchain might be allowed for some or completely no permission to even members. Closed blockchains are capable of cutting down costs, enjoy feature of significant transactional throughput and easy to scale up. In addition, it also comprises of merits like added reliability and security and greater trust, because only those members are allowed to commence new node in the blockchain which are pre-verified [22]. For examples Linux-based Hyperledger, which provide the collaborative and collective evolution of blockchains and tools in supply chain, IoT, manufacturing technology, finance, banking and R3.

A distributed ledger technology company R3 guides a consortium of over 200 plus firms and engaged in development of various applications for commerce and finance [20].

Though the differences between open and closed blockchains are many, both of them also have some common benefits to offer. Both the types of blockchains offer decentralised peer-to-peer networks, within which every member sustains a replication of a shared transaction of append-only ledger with digitally signatures; both the blockchains keep the duplicates which are properly synchronised through a protocol called consensus; private and public blockchains facilitate certain level of guaranteed stability of the ledger, when even some network members are engaged in malicious or faulty activities [22].

Today, blockchain has been put forward as a solution for a wide range of transactions, from transferring funds across currencies (remittances, micro payments) to real-time payments between two parties (swift settlement and without the requirement of a bank account), and digital assets (records of ownership stored in digitalised manner). The influence of blockchain technology may go far beyond than just bringing simple modifications to processes and introduction of some new services and products. A number of market researchers and academicians believe that the repercussions of blockchain technology might be far reaching and could affect the entire setup of BMs [23]. Blockchain's influence on BMs proves to be exemplary comprehensive potential of IT. Blockchain's distributed ledger technology (DLT), has sparked great attraction amongst Information Systems (IS) practitioners and

communities in context of cryptographic features and trust, procedures and their suggestions, and various matters in relation to virtual currencies as well [17].

2 Influence of Blockchain on Business Models

Traditional incumbents are threatened directly by blockchain technologies, which offer the possibility of creating entirely new businesses. Conventional business models that assume an organisation acts as an intermediary between two transacting parties should reflect on whether and how such technologies put influence on their efforts of value propositions, how they operate in the market and face competition. Several pilot projects are undergoing in number of industries like, application of blockchain to track goods within industrial logistics, smart contracts application to ensure swift, secure and reasonable transactions regarding property and evaluate blockchain's efficiency to allow consumers to send funds overseas without the involvement of any unnecessary time-consuming activities or immoderate exchange fees. Today business organisations need to consider and evaluate the influence of booming blockchain applications on their business models. This section chapter outlines blockchain technologies influence on eight components of business model canvas.

2.1 Customer Segments

According to Osterwalder and Pigenur, a customer segment refers to various classes of consumers or organisations which an enterprise looks out to serve. Blockchain technology permits organisations to concentrate on existing market segments. An experimental pilot program backed by ChromaWay will allow people to purchase and sell real estates in Sweden using blockchain technology. Blockchain is ideally suited to serve diversified, niche and mass consumer markets, same as traditional enterprises could. Although there is one unique aspect of blockchain technology that makes it possible for businesses to reach a previously inaccessible market, at the same time creating new customer section [24].

2.2 Value Proposition

A value proposition embraces all those activities of the firms which are designed to create a value for its consumers [25]. Theodore Levitt famously claimed: 'People don't want to buy a quarter-inch drill, they want a quarter-inch hole'. Specifically, consumers do not buy products; they purchase a solution. Customers will derive more value by emphasising the significance of a task and by being satisfied with the

alternatives currently available, and their price [26]. Through blockchain technology, consumers can gain access to products and services previously unavailable or only accessible after spending a significant amount of time and money. Furthermore, blockchain-based transactions are commonly faster and less expensive than traditional business transactions.

2.3 Channels

Channels are the processes through which a business communicates with and attain its consumer segments in order to carry out its value proposition. Channels may comprise the company's website, sales force, or stores of the company's wholesalers or partners. Application of blockchain-based options provide ease to business execution. By eliminating stipulated time and personnel needed for a validity check or transaction, this can be accomplished. Within the company, new types of channels can be introduced as a result of utilising common codes [27].

2.4 Consumer Relationship

An organisation's customer relationship building block explains the variety of relationships it has with specific segments of its customers. A company might build these relationships for a variety of reasons, such as to gaining and keep consumers, or boosting of sales. A number of categories of relationships exist, such as dedicated and personal assistance, automated and self-services, creating communities, etc.

2.5 Revenue Streams

By 2023, blockchain projects are expected to generate $10.6 billion in revenue, primarily from sales of software and services [28]. Companies which are administering services of professional level via blockchain-related technology generate revenue from agreement level services with enterprises or fees for providing software-as-a-service (SaaS) contracts. However, maximum earning of revenue from blockchain technology is obtained from crypto crowdfunding, via utilisation of initial coin offerings (ICOs). In contrast to private equity firms, venture capital and banks that are well known for providing equity and capital debt, ICO's raise depends on the utilisation of cryptocurrencies and trading based on blockchain to raise funds. An ICO offers tokens instead of shares as a reward for early investors. An aftermarket for these tokens is available, and all transactions are verifiable on a blockchain platform.

2.6 Key Resources and Activities

Key resources are those resources or assets which are critical to fabricate a business model. These resources are the one which define a value proposition, markets outreach, nurture relationships with customers, and generate revenue. Resources can be financial, human, intellectual or physical. An organisation's key activities include all those undertakings which are essential to deliver value, which means all those processes which result in the metamorphosing of resources and assets into value. Companies need to review the key resources that comprise their business model in order to incorporate blockchain technologies. There are several facets of blockchain technology that put their impact on activities and resources. Firstly, there is a possibility of increasing resource flexibility, enabling firms to resettle from conventional ownership structures and acquire resources only when they are needed. Specifically, relevant opportunity is the implementation of public blockchain technologies, where anyone can enter into transaction and negotiate with other member on a peer-to-peer network. Sometimes, a firm may not need to invest in building IT infrastructure or maintenance since public blockchains provide these resources and processes. Further, both the private and public/federated blockchain applications allow businesses to automate processes which were previously handled manually, for example audit reporting, documentation and verification, allowing human resources to concentrate on other value-added tasks. Secondly, blockchain technologies can influence organisation's resources and activities, when users assist in providing various key resources and processes and employ blockchain technologies to facilitate resource exchanges, for example while transacting in real estate segment via smart contracts, resources such as human capital (e.g. experience, knowledge, skills) and physical capital like assets are provided by the parties involve in transactions, while peer-to-peer exchange of these resources are aided by blockchain technologies [25].

2.7 Key Partnerships

A business model is built around a network of partners and suppliers. Partnerships can take the form of joint ventures, strategic alliances, or purchase and supplier relationships to secure authentic supply. A potential application of blockchain could reduce the role of conventional intermediaries (currency exchanges, banks, notaries, etc.) or modify financial institutions (credit card companies, etc.). Blockchain can ease up the joining of new members, like IT companies which create application programming interface (API) and software development kits (SDK) and sustain the transaction algorithms. In addition, blockchain allows businesses to form peer-to-peer partnerships, thus supporting and expanding supply chains.

2.8 Cost Structure

The cost structure explains each and every cost which is associated with operating a business model. By eliminating the costs of intermediaries and negotiation costs, blockchain implementations can reduce transaction costs. According to Gregario, blockchain is expected to enable cost savings of $15–20 billion in the financial services industry by 2022 [29]. The savings were achieved via the reduction of cost of information technology infrastructure and the abolishing non-value appending manually performed processes. A blockchain implementation for managing financial transfers could reduce the authorisation holds currently used in banking and credit card processing. Funds can take several days to get clearance from holds of authorisation body. With public blockchain protocols, these holds can be reduced to a matter of minutes. A private blockchain reduces these holdings to milliseconds [30]. With blockchain technology, data aggregation, amendment, and sharing are simplified, and regulatory reporting and audit materials are produced with less manual steps. Consequently, employees can focus on tasks that contribute to greater revenue generation, while consumers save time and money.

3 Segments Facilitating Blockchain Development and Implication

In this chapter, an attempt has been made to discuss eight specific segments where blockchain use was found, namely crypto currency services, asset management services, crowd funding service, digital identity services, other financial services, contract management services, blockchain development services, traceability services healthcare, supply chain, energy, banking, which are extensively described below.

3.1 Crypto Currency Services

The fundamental technology that supports cryptocurrencies is blockchain. Cryptocurrency is an alternative form of monetary setup which is virtual and beyond any monetary authority regulated by the government such us Litecoin, Ethereum, Bitcoin, etc. The cryptocurrency talked about a novel economy which is not definite and therefore beyond the influence of any legal and political construct and geographic areas as well. Cryptocurrency is a decentralised ledger, permitting peer to peer transfer of funds without requiring bank as third party.

3.1.1 Implication and Start-Ups

Blockchain technology enables generation of cryptocurrency which is authentic and legally tradable in nature. The first and foremost acknowledged application of blockchain was with Bitcoin cryptocurrency. As the time passes by, many more cryptocurrencies have come up besides Bitcoin, namely Gridcoin, Ethereum, Ripple etc., by far till today Bitcoin enjoys the lion's share in the world. Cryptocurrencies can also be an incentive apparatus for suggesting proposals performed by cross-functional group. Smart contracts are performed to complete the whole process and groups that turn up with the finest proposals with pre-established offerings of digital coins are decently rewarded automatically [31].

3.2 Asset Management Services

The concept of asset management services controls the ownership of an asset or property (non-physical like company share and physical like house, cars, etc.) as a smart property via smart contracts using blockchain. Blockchain technology encodes property and convert it into smart property which is transactable through smart contracts and further thus enables trust-less trading and lending of property.

3.2.1 Application and Start-Ups

The applicability of block chain in the segment of asset management has been via supervising smart property through smart contracts, and SwanCoin is one such start-up which deals with smart property where 121 artworks of physical world, fabricated on 30 × 30 cm varnished plywoods are available for buying purpose, and monetary transfer happen through the Bitcoin blockchain [4]. Another start-up, namely Ownage, an Ethereum-based platform, collects, distributes and trades content of digital game. Smart property setup could also be used with several other blockchain application, for example digital identity which facilitates easy access of identity credentials to use it as in the case of a smartphone or to operate the doors of physical assets like homes and cars. Coloured coins are one of its kind implementations in smart property where some explicit bitcoins are tagged or coloured in correspondence to a certain asset.

3.3 Crowd-Funding Services

Platforms based on blockchains allow start-ups to raise funds through their websites. They can also create digital currencies and sell 'cryptographic' shares to early backers, and investors receive a token representing their share of the company they support [4].

3.3.1 Applications and Start-Ups

Another application is in crowd-funding services to raise funds for blockchain-based projects using blockchain technology. FunderGrowth is a start-up that offers investors the opportunity to invest in Blockchain start-ups using blockchain technology. The start-up Swarm is another great example of a cryptocurrency incubator that has given birth to various funded projects extending from the development of a decentralised cryptocurrency workplace to smart personal drone matrix [4].

3.4 Digital Identity Services

Permanence and security features of Blockchain make it a great technology to be applied for securing and verifying one's digital identity. Its benefits are proven by the fact that all the users of 33 cryptocurrencies have their personalised e-wallet, and their wallet addresses could be further utilised to verify the user if at all required.

3.4.1 Application and Start-Ups

One of the basic applications of blockchain in digitalised identity services has been the availability of identity verification online. It incorporates an identity verification of an individual to a website employing verification via blockchain. BitHandle and OneName are two famous start-ups facilitating such services. These start-ups facilitate decentralised and trustless services so that one's digitalised identity goes beyond the control of central institution, that's how these start-ups secure more authentication to websites than social media sites for the same. Another successful application of the concept is in insurance sector where any asset or property which is registered under blockchain concept of smart property can be used to verify and provide owner's digital authentication. Blockchain-based digital identity services are also used in verifying and checking other blockchain-based transactions like smarty property, cryptocurrency and smart contracts in order to substantiate the parties taking part in the transactions [4].

3.5 Other Financial Services

Associating cryptocurrencies with financial market and conventional banking system is considered to be the major area for blockchain applications. Blockchain empowers several financial services with speedy international fund transfer, that too with quick transfer at less transfer cost.

3.5.1 Applications and Start-Ups

The main application of blockchain in financial service segment is in facilitating quick and low-cost payment in cryptocurrency, covering the entire blockchain across several business enterprises. One of the major start-ups in this financial service segment is Ripple, which permits direct foreign exchange and fund transfer transaction amongst banks. Remitsy is another such start-up which provide funds transfer internationally. There are start-ups which are assisting payments in cryptocurrency to other conventional market and financial payments applications like GoCoin and Coinbase and PayPal in the case of Bitpay which is a processor of payment for.

Cryptocurrency trade is an additional application in cryptocurrency. Cryptocurrency trade obtains cryptocurrency from customers and then trade it with other parties as per current cost of the currency, as it happens in solutions, namely Coinbase and Bitpay. Start-ups by the name Kraken also provide banking assistance in lending services and saving services of digitalised currency for bitcoin. TeraExchange and BTCiam start-ups are assisting users in getting same kind of services.

Chain.com is another application of blockchain that assists NASDAQ in exercising private equity exchange, which is not only fast with efficient tracking system but also far more effective in terms of stock value creation compared with conventional ways of trading in stocks.

Bitshare, Blockstream and Medici are some start-ups which uses blockchain solutions in providing securities exchange services.

3.6 Contract Management Services

A smart contract is a process of entering into the agreements with people through the blockchain. In smart contract, an individual using the main blockchain decides whether or not a particular blockchain operation, such as payments, should be allowed. The smart contract permits transacting members to design self-regulating and self-evaluating contracts codes, exhibiting an autonomous status once they have been placed in the blockchain.

3.6.1 Applications and Start-Ups

The application of blockchain in contract management services is in the form of smart contracts, in which member party can come up with self-regulating and self-evaluating contract code, Ethereum being the leading start-up involved with smart contracts. It is a stateful user-created virtual machine based on a blockchain platform. For the creation and publication of distributed ledger, Ethereum is a foundational programming language and a complete infrastructural platform. Ethereum functions like amalgamated development platform for all blockchains and protocols as well. The blockchain-based Ethereum platform is already being utilised in a wide array of early applications via smart contracts such as trading and settlement of financial derivatives, keyless access, governance, crowdfunding, autonomous banks [32].

3.7 Blockchain Development Services

Many blockchain development service projects are initiated which are not only facilitating development of blockchain protocols for their own application and processes but provide help in creating the same for others.

3.7.1 Applications and Start-Ups

This service provides opportunity to projects that are involved in the development of new protocol to come up with such blockchain based technology which is widely acceptable and popular. Start-ups namely Ethereum, Ripple, etc. are the ones which are involved in the development of protocol for their own blockchain and corresponding application, whereas start-ups namely, NXT, open transactions, etc. create cover blockchain platforms for bitcoin. Start-ups for example Stellar and chain and Blockchain.info propose development of application programming interface protocol for them.

3.8 Traceability Services

Blockchain facilitates authenticity of entity and anti-counterfeiting via fabricating immutable ledger and sharable consensus base and enables tracing of the origin and the modification an entity has undergone by generating a formal registry which in turn help in the tracking and identification of entity ownership.

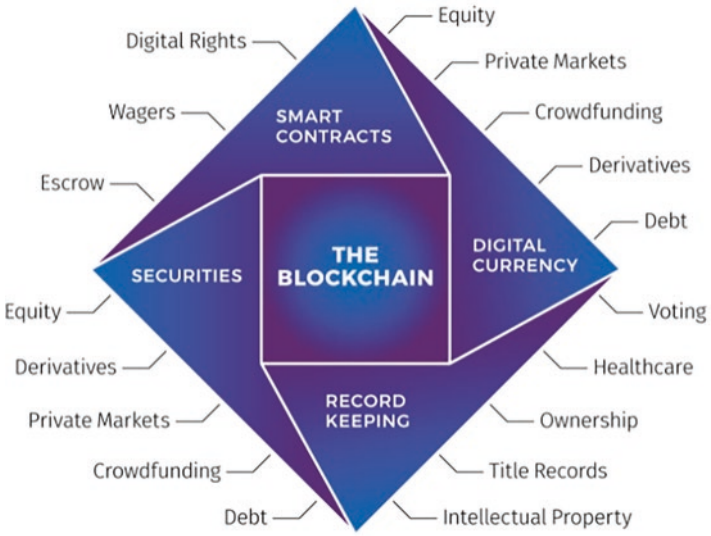

Fig. 3 Implementation of blockchain in business

3.8.1 Applications and Start-Ups

Among the many applications for this technology, the most prominent one is in the supply chain management process. Blockchain-based start-up Everledger develops a permanent ledger for the certification of diamonds and records the history of transacted diamond.

Similarly, BlockVerify is an anti-counterfeit startiup that is using blockchain technology for its anti-counterfeit solutions in luxury products, diamonds, pharmaceutical and the electronic sector. In addition to traceability services, blockchain can be used as proof-of-existence. Blockchain can be envisioned to be such digital platform where all legal documents, notaries, private securities, health records, etc., can be placed [33]. Several other implications of blockchain technology are shown in Fig. 3.

4 Discussion

Blockchain adoption has not yet reached a critical mass. Most blockchain projects have not progressed beyond the pilot stage. A recent Gartner study shows that only 1% of responding CEOs are using blockchain, and only 8% are planning short-term and pilot projects [34]. Deloitte was quite hopeful. As per Deloitte report, although 74% of respondents said their companies are dubious about the merits of blockchain technology, but not less than 34% of respondents admits that their company has already started deployment of blockchain based technology, Deloitte also observed

that there is a presence of many stumbling blocks which hinder the mainstream acceptance of blockchain technology:

- The blockchain's operating system is considered slow. In spite of its capability to provide remarkable gains in comparison to delayed clearance by banks and credit card companies, still on public distributed ledger system performing operations based on consensus is a time taking exercise. In order to keep data confidential, additional obfuscation and encryption are required. This puts negative impact on the creation of consumer value, as business organisations and consumers both expect almost instant service.
- Blockchain applications require specialised developers and complex integrations: the cost of developing blockchain applications to customer specifications is high.
- Managers have a quite discouraging viewpoint regarding data security feature of blockchain platforms, as there are events of contravention of data on cryptocurrency platforms, and corporates require data security in a wide range of blockchain-supported platforms.
- There is no standardisation of blockchain construct. GitHub in 2018 listed over 6500 blockchain based projects, covering a variety of protocols, consensus protocols, privacy protocols, and coding languages.
- Due to the lack of standardisation in blockchain construct, it is difficult to establish business relations between firms by using them, since this requires integrating a variety of constructs and protocols.
- Finally, a critical mass of users is required in order for blockchain technology to be widely adopted. The blockchain is being used to address the needs by projects like Everest's humanitarian initiatives, which was performed on large platform. Utilisation of the blockchain for disenfranchised like in Everest's humanitarian initiatives could help accelerate the use of the technology throughout the world [35].

Nevertheless, contemporary evolution in the blockchain constructs, regulatory framework and alliances amongst organisations resulted in the removal of many of such obstacles. Figure 4 represents the progressive picture of blockchain technology adding value to businesses in coming future.

- Blockchain-based technologies namely Hyperledger, R3, Ripple and Stellar are using new mechanisms of achieving consensus which in turn facilitates gaining higher throughput, easy implementations and better performance, and also allowing processing time to be reduced from minutes to milliseconds. Blockchain consensus refers to the mutual acknowledgment of the validity of recorded transactions.
- The process of standardisation continues. The number of blockchain consortiums initiating projects is now over 60. In these consortiums, hundreds of companies and government agencies are interested in exploring the possibilities of blockchain applications. Blockchain matrix developers create applications and develop technologies, as well as develop use cases and standards. Others provide

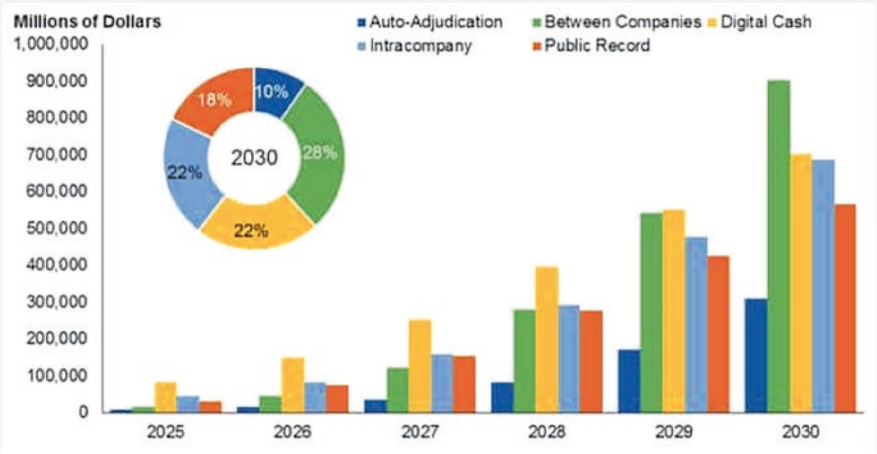

Fig. 4 Forecasted business value add of blockchain

their members with educational opportunities or research. Deloitte explained that the increasing number of users shall increase the value of a network. The Hyperledger Foundation with more than 250 organisations and Enterprise Ethereum Alliance with 600 plus organisations are amongst this industry's consortiums. Collaboration between companies outside the consortia is growing as well.

- There has been a decline in both the complexity and the cost of blockchain implementations. Microsoft, IBM, and Amazon provide cloud-based implementations of blockchain technology and templates that are less expensive than specialised development. Utilising these templates will enable organisations to minimise costs of these initiatives and shorten establishment times. The regulatory environment of many countries is improving. A number of states in the USA have passed legislation facilitating the adoption of blockchain technology for certain medical applications [36].

5 Conclusion

As industries capitalise on digitalisation, the fourth industrial revolution (Industry 4.0) is revolutionising how business is conducted across business value chains [37]. Industrial sector is in the process of becoming increasingly 'smart' with the use of data exchange intensives, predictive analytics Internet of Things (IoT) technologies, etc. [38]. Optimisation and automation of business processes have several merits like reduction in overhead costs, enhancement of productivity, production at high pace, and as a matter-of-fact major reduction of errors [39]. The majority of industry experts consider this as a positive development, as recent PwC and BCG reports

predict that Industry 4.0 will deliver 15–20% efficiency boosts and generate 20% of revenue growth in the next coming 5 years. There are substantial opportunities to innovate business models using digital technologies in a business to business (B2B) setup, and simultaneously generating new value and revenue opportunities [40]. Companies which are able to enhance their efficiency of digital modification make better use of big data analytics will excel more than their peers, on the parameters of operating productivity and revenue growth [41]. Many organisations in order to gain perceived opportunities and benefits of blockchain technology are experimenting with innovational business models based on the same technology [42]. The recent developments in blockchain technology are attributed to the growth of collaborations and the formation of consortia. In order to demonstrate proofs of concepts, organisations are launching pilot projects to evaluate the blockchain movement. Moreover, blockchain tokens are being issued and sold by entrepreneurs and at the same time reconstructing entrepreneurship and bringing innovations in ways of raising fund, community building, investments and open sourcing [43]. In order to carry out blockchain projects, companies must decide which blockchain model they want: public or private? Both the types of blockchains enjoy different market preposition. While private blockchains are advantageous in terms of time and cost savings, public blockchains may disrupt the financial setup of an industry through disintermediation, for example a case of cryptocurrencies and Bitcoin, or by offering and creating completely new business models [44]. Identification, selection, and execution of customised blockchain innovations that are beneficial to a company's operations is a key challenge as discussed above for many companies. Furthermore, the need to analyse, customise, sell or buy intangible products or services is another challenge. This is apparent from business models via blockchain supportive advanced service, where the offer consists not of a product or a service but of an assurance to provide a specific outcome to consumers [45]. In order to be competitive and provide long-term value to consumers, blockchain technology and innovations in business model are navigating the need for continuous improvement.

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