

An understanding of the components that drive effective implementation of block chain in Healthcare Industry: The case of IBM- Digital Health Passes

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ABSTRACT

The research provides an overview of the components of the blockchain ecosystem development using a case study research methodology. The intention is to generate evidence-based findings that contribute to the development of a thematic understanding for a blockchain development in healthcare for improving patient/user experiences. The current study has highlighted IBM Digital Health Pass, as an example for effective block chain implementation in health care where in , data analytics is highlighted as a component, suggesting a data-driven approach to understanding the consequences of blockchain implementation in healthcare. The IBM Digital Health Pass is presented as an example of a socio-technology solution that streamlines workflows, reduces costs, and enhances efficiency. The research highlights how technology, particularly blockchain through digital health passes, can enable businesses to adapt, collaborate effectively, streamline operations, and address health and safety concerns during external disruptions, all while considering regulatory and ethical factors and individual willingness to engage with these technologies. The study emphasizes the significance of strategic partnerships, especially those involving socio-technical collaboration and the importance of integrating both technological and social aspects in the implementation of blockchain in healthcare. The emphasis is on understanding the components that drive effective implementation of block chain, with a broader goal of contributing to the improvement of health ecosystems globally.

Keywords: Blockchain, Digital Health Pass, socio-technical, collaboration, data analytics Introduction, Nvivo

INTRODUCTION

Many businesses have had to adapt rapidly to the changing landscape brought about by various external factors, such as the COVID-19 pandemic. Technologies are gaining importance for organizations to stay agile in this environment (Deroncele-Acosta, A., Palacios-Núñez, M. L., & Toribio-López, A. 2023) These technologies are providing collaboration which is crucial, not just within an organization but also beyond its boundaries. This implies working closely with partners, suppliers, and customers to achieve common goals. Also, businesses are constantly seeking ways to optimize their operations and processes (Renu N 2021). This might involve streamlining workflows, reducing costs, or improving efficiency. Technology solutions are thus acting as tools that facilitate transformation rather than hindering it. Technology should be an enabler, not a barrier to change. Keeping the context of technology as an enabler for businesses, in today's changing times, healthcare industry remains one of the most promising areas of technology evolutions and implementations, indeed, the ongoing global pandemic has underscored the importance of innovative solutions in healthcare and life sciences (Hasan, Mohammad & Deng, Shiming & Sultana, Neegar & Hossain & Muhammed Zakir. 2021). Blockchain technology has proven its value in addressing various challenges faced by these industries, and it continues to be a key player in providing solutions (Fang ML, Walker M, Wong KLY, Sixsmith J, Remund L & Sixsmith A 2022). As the healthcare and life sciences

sectors continue to evolve, blockchain technology is likely to play an increasingly significant role in addressing complex challenges and contributing to the development of more resilient, efficient, and patient-centric healthcare systems. However, it is essential to carefully address regulatory considerations, interoperability, and collaboration among stakeholders for successful blockchain implementations in these fields (*Lacity, M. C 2022*).

A case study research methodology has been adopted in the current study, making use of some of the most relevant and authoritative literature produced on this approach from the lens of industry experts like IBM (Rebolj, A. Biba 2013). A single case study approach has been adopted which allows the researcher to explore diversity of context, providing an approach through evidence-based findings to develop a theme. The paper firstly understands blockchain as a technology and evolves to develop the applications of the technology in healthcare by explicating the advantages of blockchain in healthcare. Thereafter, the paper references or analyses some well-regarded case studies from industry to illustrate and explain various aspects of blockchain applied and its consequences on health care services especially with the use of IBM-Block chain services with the application of data analytics on patient centric health care solutions. The case study illuminates the significance of strategic partnerships involving socio-technical partnerships. The intent of

the study is to understand the various components that drive an effective blockchain implementation in healthcare industry by adopting a collaborative and holistic approach, integrating technology, analytics, and social enablement's. The overarching goal is to contribute to the creation of smarter and more efficient health ecosystems on a global scale. The study enables to provide an socio-technical assemblage framework where in Digital Health Passes as a case in the study are explored to derive innovative solutions that leverage blockchain concepts in the health industry. The research describes a system where individual (social/patient) data is collected and stored in a single repository using blockchain technology. Blockchain is known for its secure and transparent nature, making it a suitable choice for handling sensitive health data. In this scenario, various stakeholders contribute to this repository, and companies like Salesforce utilize data analytics to generate valuable insights from the collected information. Overall, the integration of blockchain, data analytics, and innovative solutions like Digital Health Passes has the likely to transform the healthcare industry by refining data management, safety, and accessibility for various stakeholders involved in patient care.

The paper thus contributes by highlighting the ways in which technology using blockchain can be synthesised through community /social information using data analytics and mobile computation to develop health innovative solutions. This provides a framework of synthesis of various components of socio-technical nuances if brought together for health services which can define many more such user/patient centric solutions that can reform the health industry, and prepare human mankind for many forthcoming pandemics in a much more combating and systemised manner.

II. THEORETICAL OR CONCEPTUAL FRAMEWORK

A Blockchain as a technology

Blockchain is a Distributed Ledger Technology (DLT) and enterprise blockchain which plays a crucial role in enabling trusted data exchange and workflow automation beyond traditional boundaries. These technologies offer a decentralized and secure way to record and verify transactions across multiple parties. The fundamental concepts of blockchain technology have been highlighted in order to understand the ingredients of technology for its applications (Yaga, Dylan & Mell, Peter & Roby, Nik & Scarfone, Karen. 2019). Blockchains are digital ledgers that are designed to be tamper-evident and tamper-resistant. This means that once data is recorded on the blockchain, it is very difficult to alter or delete it, providing a high level of security and trust. Blockchains operate in a distributed and decentralized manner (Miah, M. & Rahman, Mashiour & Hossain, Md. Saddam & Rupai, Aneem. 2019). They do not rely on a central repository or a central authority, like a bank or government. Instead, they are maintained by a network of participants (nodes) who work together to validate and record transactions. The primary function of a blockchain is to record transactions in a shared ledger. This ledger is maintained by the community of users participating in the blockchain network. Blockchains use cryptographic mechanisms to secure and protect the data on the ledger. This cryptographic protection ensures the integrity and security of the recorded transactions. The concept of blockchain was combined with other technologies and computing concepts to create modern cryptocurrencies. These digital currencies are protected through cryptographic mechanisms instead of relying on a central authority or repository. Bitcoin was the first cryptocurrency to be built on a blockchain (Boshkov, Tatjana. 2018). It utilizes blockchain technology to represent electronic cash. Users can digitally sign and transfer ownership of this digital cash to others, and the blockchain records these transactions in a public and

transparent manner. This decentralized nature, along with cryptographic mechanisms, ensures the security and resilience of the blockchain. Attempts to modify or forge transactions are difficult and easily detectable by the network (Zheng, Zibin & Xie, Shaoan & Dai, Hong-Ning & Chen, Xiangping & Wang, Huaimin. 2017).

In summary, blockchain technology is a fundamental innovation that empowers secure, transparent, and tamper-resistant record-keeping without the need for a central authority. It forms the basis for modern cryptocurrencies like Bitcoin, which leverage the block chain's features to create a decentralized and secure digital currency system.

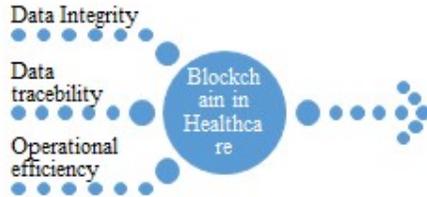


Fig. 1.

Fig. 2. **Fig.1.** Advantages of Blockchain in Healthcare

B Blockchain as a technology: Advantages in Healthcare

The advantages of blockchain technology in healthcare can be categorized in to :

- Data Integrity
- Data Traceability
- Operational efficiency

Figure 1 defines the advantages of using block chain with the use of technology in healthcare.

Data Integrity: Assuring data integrity across multiple parties is a critical concern, particularly in scenarios where organizations need to confirm the health status of customers and employees. Blockchain networks can play a significant role in addressing this challenge by providing a secure and transparent environment for data management. Block chain's core feature is its immutable ledger. Once data is recorded in a block and added to the chain, it cannot be altered or deleted. This ensures that the information related to health status remains tamper-proof and retains its integrity over time. The blockchain acts as a single version of the truth. All network participants share the same record of data, eliminating discrepancies and ensuring consistency (J. Golosova & A. Romanovs 2018) . This is particularly valuable when confirming health statuses, as all parties can trust the accuracy of the information stored on the blockchain. Blockchain networks contribute to the creation of a secure and reliable infrastructure for confirming health statuses and exchanging related information. This not only helps organizations make informed decisions based on trustworthy data but also fosters collaboration and confidence among network participants (Pandey, S., & Sen, C. 2022).

Data Traceability: Recording pharmaceutical products on a blockchain as they move through the supply chain offers several advantages, particularly in enhancing traceability, reducing counterfeiting, and enabling rapid response to recalls. Each transaction related to a pharmaceutical product is recorded as a block on the blockchain (Nallaperumal, Ramachandran & Nalukandathil, Shiju & Suresh, Salini & Jain, Anubha. 2022). The immutability of the blockchain ensures that once a transaction is recorded, it cannot be altered. This creates a transparent and tamper-proof audit trail of the product's journey through the supply chain. The blockchain's decentralized and transparent nature allows stakeholders in the supply chain to trace the entire history of a pharmaceutical product. From its origin through each step in the supply chain to its destination at a pharmacy or retailer, the complete journey is recorded. This traceability helps in verifying the authenticity of the product and ensures that it has not been compromised. The traceability provided by the blockchain is a powerful tool in preventing counterfeiting. The immutable records make it extremely difficult for counterfeit products to enter the supply chain unnoticed. Any attempt to introduce fraudulent products can be quickly identified by comparing the blockchain records with the expected legitimate path of the product. In the event of a product recall, blockchain enables rapid and precise identification of affected batches.

Operational efficiency: Smart contracts have the potential to revolutionize various industries by automating processes and streamlining transactions. In business transactions or contractual agreements, smart contracts can be programmed to automatically trigger dispute resolution processes when predefined conditions are met. This can include automated negotiation, mediation, or escalation procedures, reducing the time and costs associated with manual dispute resolution. Smart contracts can automate various steps in the supply chain. For example, when a set of medical images is uploaded to a system, a smart contract can automatically route the images to the

appropriate reviewing physician or specialist based on predefined criteria (Konashevych & Oleksii. 2020). Smart contracts can enforce compliance with regulations and contractual obligations by automatically checking and validating data against predefined rules. This ensures that all parties involved adhere to the agreed-upon terms and conditions. By automating these processes, smart contracts not only enhance speed and efficiency but also reduce the need for intermediaries and the potential for errors or disputes. However, it is crucial to design smart contracts with precision, considering all possible scenarios and ensuring that the code accurately reflects the intended business logic (Iyer, Shankar & Seetharaman, A. & Ranjan, Bhanu.2021).

C. Blockchain technology and Healthcare: The way forward:

The COVID-19 pandemic has indeed brought forth a host of new and urgent challenges across various sectors, including healthcare, supply chain management, and pharmaceuticals which are highlighted as per IBM data. These challenges have pushed various industries, including healthcare, pharmaceuticals, and supply chain management, to innovate and adapt rapidly to address the evolving needs and demands brought about by the pandemic. Solutions may include the application of technologies like blockchain for supply chain traceability, advanced data analytics for vaccine development, and enhanced regulatory measures to combat counterfeiting. Some of the challenges encountered by Healthcare Industry currently are Interoperability, Privacy, Supply Chain Traceability, Adapting to Pandemic Challenges, Health Data Leveraging, Supply Chain Traceability, Efficient Data Sharing, Data Security and Privacy and Trust and Collaboration (Anderson, B., & Gonzalez-Wertz, C. 2017). As the healthcare and life sciences industries continue to evolve and face new challenges, blockchain technology is positioned as a potential solution to these longstanding and emerging issues by providing a secure, transparent, and interoperable infrastructure for data management and collaboration.

III RESEARCH GAP

From the literature review of the factors impacting efficiency and efficacy using blockchain technology in healthcare services accounted for mostly structural factors like data integrity, data portability and data traceability. However, there have been few studies that have accounted for technology-enabled factors which ascertain the tools / technologies and the framework of use of digital technologies that would describe the entire ecosystem as an outcome of blockchain implementation in healthcare services. The significant gap visible from past literature has been that most of the studies have been exploring block chain from a perspective of organizational productivity not much exploring the patient perspective towards socio-technical enablement’s for a greater enabled medical experience which the technology can provide which has been explored through the case. This paper demonstrates through the exploration of digital technology of data analytics as a variable of study to evaluate the potential socio-material arrangements in healthcare industries using block chain (Orlikowski, W.J. 2010).

3. RESEARCH METHODOLOGY

The current study adopts Case study research which is a qualitative research method that involves a detailed and in-depth analysis of a specific case or cases (Priya, A. 2021). The case has studied an organization, as a unit of analysis. This methodology is particularly useful when researchers aim to gain a deep understanding of the context, processes, and dynamics surrounding a particular phenomenon. The research questions which reflect the areas of in-depth understanding in the current research are addressed in the Table 1 below.

TABLE I. **Table 1:** Research Gaps Emerging From Review of Literature

S. No.	Research Gap(s)	Research Question(s)
1	Lack of understanding of the variables social, technical, and structural for an implementation of block chain especially in healthcare industry (from patient perspective)	RQ1.What was the understanding of social, structural and technology variables for an effective block chain implementation for a healthcare industry solution from a patient perspective.
2	There is lack of understanding of the technology tool / technologies which are used for block chain to evaluate a more effective solution to designing a block chain especially health care industry as a case in the current study.	RQ2. What are the technology factors that influence the effective deployment of data analytics and its advantages for developing solution for health care efficiency?

To resolve the above research questions and their solutions, a descriptive case study approach has been adopted to ‘describe’ a phenomenon (block chain in healthcare) in detail in its real-world context (Baxter, Pamela & Jack,

Susan. 2010).

IV. CASE STUDY: HEALTHCARE AND BLOCKCHAIN: DIGITAL HEALTH PASS A CASE

A Introduction

The goals and potential of blockchain initiatives in the healthcare and life sciences industries is primarily for empowering patients with data control. A primary goal of blockchain initiatives in healthcare is to provide patients with a comprehensive view of their medical information. This 360-degree view ensures that patients have control over who can access their data and when. Block chain’s secure and permissioned nature can facilitate this control, allowing patients to share their health data as needed while maintaining privacy. In addition to patient-focused goals, blockchain is also utilized to connect all participants in the supply chain ecosystem. This facilitates end-to-end tracking of products and information, from their origin to the ultimate recipient (the patient). Supply chain transparency is critical for ensuring the authenticity and safety of pharmaceuticals, medical equipment, and other healthcare products. Blockchain has the potential to improve the delivery of healthcare by streamlining data access and sharing while enhancing patient control. This can lead to faster and more accurate diagnosis and treatment.

B Problem Definition

Understanding technology solutions through blockchain technology that can lead to easier, convenient, and faster patient / medical information disclosure especially post pandemic to reflect medical histories of patients to various stakeholders in the environment. Also exploring the socio-technical enablement’s that block chain technology provides for effective implementations.

C Solution

One such interesting solutions provided by implementation of blockchain in health care is the IBM Health Pass. A Digital Health Pass by IBM is a technology-driven solution that serves as a tool for organizations to efficiently verify the COVID-19 vaccination and testing status of employees and customers. It is particularly useful for controlling access to various stakeholders and locations, including offices, stores, stadiums, airplanes, universities, government buildings, and other public spaces. The IBM Digital Health Pass is a technology solution designed to assist organizations in verifying the COVID-19 test results or vaccination status of individuals/patients who are entering their premises. This can include a wide range of locations, such as sports stadiums, airplanes, universities, government buildings, or workplaces.

An example of a use of digital health pass system designed to manage and verify health credentials, particularly in the context of vaccine administration is as follows Figure 2 illustrates the process flow of using a digital health pass:

Process of Digital Healthpass	Issuance of Verifiable Health Credential
	IBM Digital Health Pass
	Encrypted Digital Wallet
	Individual Control and Privacy
	Secured, Verifiable, and Trusted Sharing
	Organization's Unique Needs
	Selective Data Sharing
	Flexibility for Organizations

Fig. 3. **Fig.2:** The process of using a digital health pass by a patient/ general user

The explanation to each of the steps have been highlighted below. Here are some key points and features highlighted in the Figure 2:

• **Issuance of Verifiable Health Credential:**

After receiving a vaccine, individuals are issued a verifiable health credential. This credential serves as digital proof of the individual's vaccination status.

• **IBM Digital Health Pass:**

The solution is referred to as the "IBM Digital Health Pass." This suggests that IBM has developed a digital platform to facilitate the issuance, storage, and verification of health credentials.

• **Encrypted Digital Wallet:**

The health credential is stored in the individual's encrypted digital wallet on their smartphone. Encryption adds an additional layer of security, protecting the integrity and privacy of the health information.

- **Individual Control and Privacy:**

Individuals have control over what they share, with whom, and for what purpose. This emphasizes the importance of user autonomy and privacy.

- **Secured, Verifiable, and Trusted Sharing:**

The digital wallet allows individuals to share their health pass in a way that is secured, verifiable, and trusted. This ensures the reliability and authenticity of the shared health information.

- **Privacy-Centric Solution:**

Privacy is highlighted as a central aspect of the solution. This aligns with the growing emphasis on ensuring that digital health solutions prioritize user privacy and comply with relevant privacy regulations.

- **Selective Data Sharing:**

The solution allows individuals to share their health pass without exposing the underlying personal data used to generate the credential. This selective data sharing enhances privacy and security.

- **Flexibility for Organizations:**

The solution is designed to be flexible, this flexibility is likely to support integration with diverse healthcare systems and organizational requirements.

- **Organization's Unique Needs:**

The flexibility mentioned in the description suggests that the solution can be customized to meet the specific requirements and preferences of different organizations.

- **Mobile-Based Implementation:** The digital wallet is implemented on smartphones, which aligns with the increasing prevalence of mobile solutions for health-related services.

Overall, this example illustrates a digital health pass solution that prioritizes individual control, privacy, and security in the context of managing and sharing health credentials. Such systems can play a crucial role in verifying health status, especially in situations like vaccine administration and public health management.

D. Advantages of Using the IBM Digital Health Pass

Here are some key features and components of the IBM Digital Health Pass:

- Verification Tool
- Applicability
- Digital Alternative
- Security Measures
- Voluntary and Secure
- Privacy and Data Control
- Efficiency and Accessibility

Overall, the IBM Digital Health Pass (Samha, Amani & Alrashdi, Addal & Alshammri, Ghalib. 2022) is part of a broader effort to leverage technology for health and safety in the context of the COVID-19 pandemic for patients / public using blockchain to get accesses to various public locations/ premises without the hassle of carrying documents, verifications and the same time makes the needed authorities aware of the generative consequences of health histories of patients to others in general in the premises of entry of those locations. It provides a secure and efficient means for organizations to verify and manage the health status of individuals entering their premises while also giving individuals the option to maintain control over their health data. There are various advantages of using this Digital Health like Verification of Vaccination and Test Status, Efficiency, Digital Health Credential, Sharing with Organizations, Safety and Compliance and Contactless Solution.

Overall, Digital Health Passes have become a valuable technology solution in the context of the COVID-19 pandemic, providing a secure and efficient way to manage access to various locations and ensure compliance with health protocols (Sun X, Wandelt S and Zhang A 2021). They are part of the broader efforts to leverage technology for public health and safety. Thus, with blockchain technology in the Health Digital Pass can help generate secure COVID-19 vaccination and test credentials through a network of labs and providers, such as Healthcare IT Leaders. Multiple types of COVID-19 health credentials, in addition to the IBM Digital Health Pass, such as Good Health Pass, SMART Health Card and EU Digital COVID Certificate, can be verified with the IBM Digital Health Pass Verify app with its multi-credential verification capability.

To interpret some of the advantages sighted for the digital health pass, some of the reviews collected online on

users of digital health pass were evaluated using N-vivo cloud analysis which has been shown below.

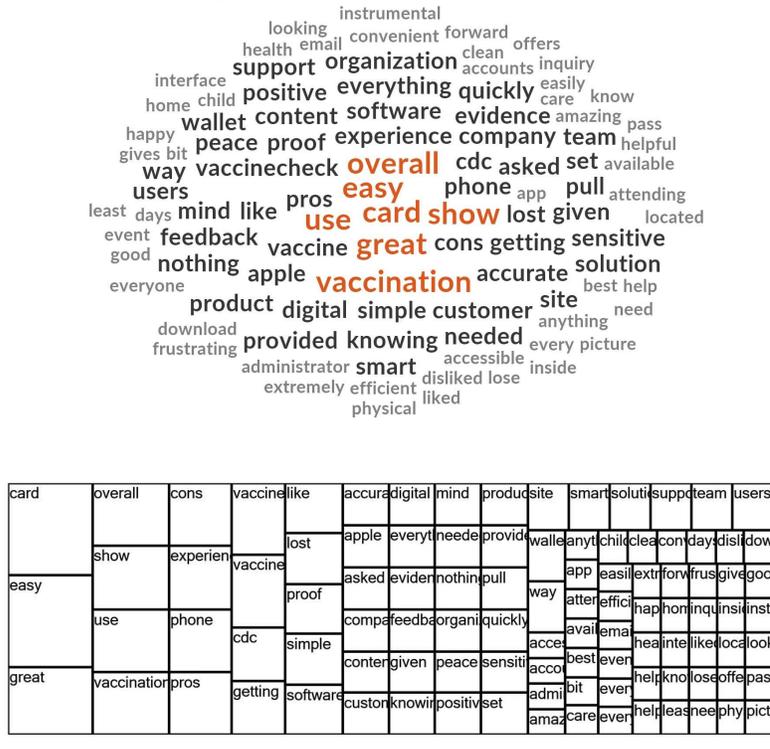


Fig.4: Nvivo cloud analysis and tree map analysis on reviews on Digital health passes

As is seen from the cloud analysis over all the service of digital health pass was found to be convenient and great for vaccination protocols. It was found to be quick, smart, sound proof, positive and organization support centric for the users.

As seen from the tree map analysis, benefits of using the digital health pass card was the accurate digital support that it provides the users. Its easy to use mobile app provides evidence based vaccine information creating great customer experiences.

E. Technology applied

IBM Watson Health was implemented as a strategic partner for the health industry, emphasizing its role in providing data, analytics, and technology solutions for the Digital Health Passes. The core mission is to contribute to the development of smarter health ecosystems. This involves using technology and analytics to enhance the efficiency, effectiveness, and intelligence of healthcare systems. IBM Watson Health aims to contribute to the generation of better insights related to patient care. This could involve leveraging data and analytics to enhance clinical decision-making and improve patient outcomes. The IBM Watson Health provides as a technology partner with a holistic approach, combining technology, analytics, and expertise to contribute to building smarter and more efficient health ecosystems. Figure 4 illustrates the integration solution of the analytics (by Sales force), blockchain (IBM Watson) and mobile application as a technology solution for Digital Health passes.

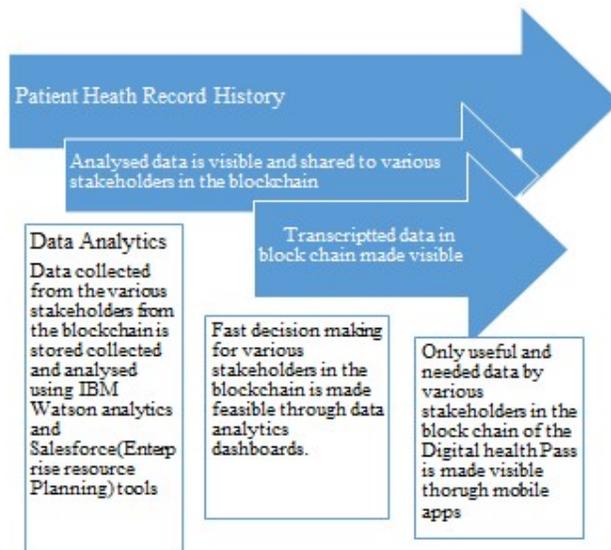


Fig.4: Block chain, analytics and mobile application integrated in the Digital Health Pass.

The IBM Watson as technology was further augmented with block chain in to data analytics tool called salesforce so that the data collected from the blockchain framework can be used for analytics and dashboard visualization using the descriptive tool called salesforce so that informative insights could be derived. These insights were then used for driving user centric operations using Health Pass Apps in organizations for control of health information of users by informing them of their vaccination delays, upcoming immunizations, and other healthcare services through the data insights discovered through analytics.

The study is motivated by the perceived lack of design knowledge in the field of systems design for collaborative services especially required in the field of health services sector. The study introduces a framework for developing service design goals and strategies specifically aimed at fostering collaboration within a community using block chain, data analytics and user/patient centricity to develop solutions at large for community health care development .

V. CONCLUSIONS AND UNDERSTANDINGS:

The above case study underscores the importance of adopting a sociotechnical conceptualization of innovation, emphasizing the interplay among various actors and elements which encompasses different types of actors; individuals and organizations, visions and concepts, and technological artefacts (Sinha C. & Bali. N & Duggal T. & Sinha R & Sujatha.R & Mutsuddi. I, 2022). The term "different types of actors" suggests that innovation involves a diverse range of contributors. This includes individuals and organizations, indicating that innovation is a collaborative effort that extends beyond the contributions of single entities (Boeing, A. A., Jorristma, K., Griffin, M. A., & Parker, S. K. 2020). The emphasis on "linkages among" implies that there are intricate connections and relationships between the various actors involved in the innovation process. These linkages are essential for fostering collaboration, communication, and the exchange of ideas. The collective contributions of individuals, organizations, visions, concepts, and technological artefacts serve as the means for innovation to occur. This implies that a combination of social and technical elements is necessary for successful innovation (Mutsuddi, I., Bali, N., Sinha, C., & Sinha, R. 2023).

The amalgamation of the collective contributions of individuals, organizations, visions, concepts, and technological artefacts in the current context of the case has been illustrated in Figure 5 below.

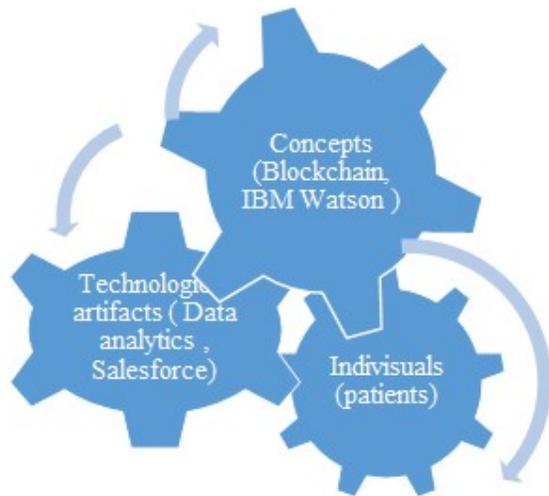


Fig.5. IBM Watson Digital Health passes as an integrated solution of socio-technical implementations

The individual (social/patients) data is brought in to a single repository through the various stakeholders with the use of blockchain as a concept, which further uses data analytics sourced by companies like Salesforce which provides generative outputs that can be consumed by various stakeholders for providing helpful services to patient care. Digital Health passes are one such innovative solutions that provide social benefits through concepts of block chain in health industry.

The study conceptualizes blockchain as a socio-technical assemblage. This perspective suggests that blockchain is not just a technological system but a combination of social, technological, and cultural elements.

VI.CONCLUSION

(Yin, R. 2014), states that “statistical generalizations may not be appropriate for a single case the case study approach allows for analytic generalizations which allows researchers to apply theoretical insights to the specific context of the case”. Addressing the research questions RQ1 and RQ2 of the current research:

RQ1.What was the understanding of social, structural and technology variables for an effective block chain implementation for a healthcare industry solution from a patient perspective.

The three perspectives namely social, structural and technology variables that constitute a healthy blockchain concept for patient health care are:

Social:

The need for human intervention in any innovative solution is the key or central asset, as the need for a particular solution is driven by people related problems which require addressal, creating opportunities’ for development of concepts of block chain and IBM digital health pass. To develop such concepts, require people data/ patient data which can be used for the welfare of development of such dynamic innovations (Sharma S, Singh G, Sharma R 2022). Hence people would remain central to any technological advancement. The balance of people (social) interactions with technology requires frameworks like blockchain that act as a facilitator for integration.

Structural:

The various structural uses of Blockchain networks for patient data are its features of immutable ledger of transactions. This means that patient data cannot be altered or deleted once it is recorded. This ensures data integrity, making it highly reliable for organizations looking to confirm the health status of patients. It establishes trust among network participants, allowing them to share information while controlling who has access to it. Block chain’s transparent and unchangeable ledger allows for a complete audit trail. This traceability is especially valuable in supply chain management, as it enables the tracking of patient’s health records from their origin to their destination (Sharma,2020). The use of Smart contracts are self-executing contracts with predefined rules and conditions. They can be used in various scenarios, such as resolving disputes, automating supply chain processes, and expediting the transfer of medical data or images for patient sanctity of no chances of misuse of data and application of patient discretion in making his/her data records visible to others. When conditions are met, smart contracts automatically trigger actions, streamlining operations, reducing the need for intermediaries, and enhancing efficiency.

Technology: The use of data analytics for deriving insights in to patient's/people data, with the framework of an ecosystem created by blockchain creates for understanding the vital contributors to the growth or generative solutions by various stakeholders from the use of analytical skills on patient's data. The data mining procedures on the data collected through the framework of blockchain helps to derive meaningful insights for progressive patient and organizational developments.

Thus, implementation of block chain solutions for deriving a health care need necessities by collaborating three major components of the framework which are social, structures and technology which can be generalized for a development of another innovative solution for patient care in health care solution development.

RQ2. What are the technology factors that influence the effective deployment of technology (data analytics) and its advantages for developing solution for health care efficiency?

The role of IBM Watson Health as a data, analytics, and technology partner in the health industry is reflective from the current research by IBM. The conclusive statement as generalizations from such technologies in health care implies a holistic health solution technology which provides expertise in data, analytics, and technology solutions. The blockchain developed as an ecosystem for healthcare with various stakeholders can evolve in to greater meaning and applied solutions if a blockchain is integrated with data analytics solutions. The overarching commitment is to contribute to the development of smarter health ecosystems requires leveraging technology and analytics to create intelligent and efficient healthcare systems. The actionable insights derived from data and analytics of the patient collected through various stakeholders in a blockchain provides for improving healthcare processes. IBM Watson Health is described as one such example from healthcare industry which collaborates with clients and partners in healthcare to derive an innovative solution which is patient centric. The goal is to help patients achieve simpler processes in healthcare operations. This could involve streamlining administrative tasks, reducing complexity, and improving overall operational efficiency. The partnership aims to contribute to the generation of better insights related to patient care. This could involve leveraging data and analytics to enhance clinical decision-making and improve patient outcomes. And above all, the overarching goal is to contribute to improving the experiences of patients worldwide. This involves a commitment to the broader mission of enhancing the global health outcomes which is patient experience's (Srivastava, Gautam & Parizi, Reza & Dehghantanha, Ali. 2020).

In summary, the research enlightens on the strategic partnerships between socio technical enablement's which provide a holistic approach, combining technology, analytics, and industry expertise to contribute to building smarter and more efficient health ecosystems globally.

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