

Understanding the Implications of Hyperledger Fabric Blockchain Adoption for Healthcare Supply Chain Management: Bangladesh Perspective

M. Abid Hasan¹, Joyonty Bhattacharjee², Sanjida Akter³

Department of Accounting & Information System

University of Chittagong

Abstract

The blockchain technology is likely to become a buzzword of the new IoT applications within the framework of Industry 4.0. This technology has the probabilities of a huge success in Bangladesh especially in healthcare as it involves enhanced patient satisfaction together with the option of integrating several systems to enhance the EHR. This study is centered on the Hyperledger fabric blockchain technology within the sphere of Health Care SCM system in Bangladesh which is more secure and efficient blockchain. The current status of the health care system in Bangladesh is rather disadvantageous and affected by the lack of transparency in supply chain and excess stock. This research aims at identifying how the permissioned blockchain framework of Hyperledger Fabric can address such challenges by enhancing the degree of transparency, data confidentiality/interconnectedness, and reduced costs of time consumption. In this research, theoretical analysis assists in giving the proposed theoretical framework of Hyperledger Fabric in the context of Healthcare of Bangladesh. The research work, which includes the administration of questionnaires and interviews on the use of blockchain in the healthcare delivery chain with healthcare practitioners, administrators, patients and other stakeholders, establishes perceived suitability of blockchain implementation across various sectors of the healthcare system. The study suggests several advantages associated with Hyperledger Fabric implementation concerning

supply chain management, as well as reducing excessive spending on medical supplies and increasing the efficiency of the delivery process, as well as secure storage and supply chain traceability. The research also identifies the key concerns that hinder the adoption of blockchain technology in a developing country and offers recommendations to the policymakers and stakeholders to adopt the technology solutions.

Keywords:

Blockchain, Adoption, Implication, Hyperledger Fabric, Healthcare Supply Chain Management, Bangladesh Healthcare System

1. Introduction

1.1 Rationale

Traceability and transparency have become significant needs for digital health services due to disruptive changes and a gradual increase in breach incidents. In today's data-driven world, digital health services need to be equipped with digital tracking through technologies (Agarwal et al., [2018](#); Frøen et al., [2016](#); WHO, [2018](#)). The purpose of this paper is to illustrate the usage of Hyperledger Fabric framework of Blockchain technology in the healthcare sector of Bangladesh. The study intends to bridge the gap in healthcare data management by enhancing integrity, security, traceability and transparency. In this study, qualitative approach is conducted to collect data. The first phase of the paper will involve a literature review of relevant prior research and in detail discussion of the proposed framework. The second phase will include the methodology of the research and interviews with the stakeholders involved in the healthcare sector and the implementation of the framework. Lastly, the study concludes by exploring strategies to bridge the gaps in the conventional supply chain within the healthcare sector of Bangladesh through the results and findings related to Hyperledger fabric framework.

1.2 Aim of the Research

The aim of the research is to provide a thorough understanding of the roadmap for implementing blockchain technology in the healthcare supply chain of Bangladesh through Hyperledger fabric framework.

1.3 Background

Between FY 2016 and FY 2019, the medical sector in Bangladesh experienced an annual growth of 14.6%, which was the fastest growth globally. But Bangladesh experiences difficulties maintaining healthcare data due to a lack of digital record practice, fragmented data and regulatory limitations. This is where Hyperledger fabric framework of blockchain can help to mitigate the issues. It can enhance data security, integrity, transparency and traceability. It has immense potential in the healthcare sector, primarily because of its capability to seamlessly integrate different systems, thereby enhancing the precision of electronic health records. Enhanced infrastructure and technology investment might have significant effects on the nation's healthcare data management issue.

The overall score for Bangladesh, using Global Digital Health Index (GDHI) assessment, is four out of five which shows that the phase is in 'Scaling Up'. Therefore, the utilization of blockchain technology has the potential to pave the way for a transformative revolution in traditional healthcare systems.

1.4 Research Objectives:

The objectives of this research are:

- i. To identify and analyze the current challenges and inefficiencies in the healthcare supply chain management system in Bangladesh.
- ii. To examine the key factors driving and hindering the adoption Hyperledger fabric framework of blockchain technology in the healthcare supply chain of Bangladesh.
- iii. To evaluate the perceived benefits of using blockchain technology for various stakeholders involved in the healthcare supply chain in Bangladesh.
- iv. To analyze the impact of blockchain technology on efficiency, transparency and security to prevent fraudulent activities in the Healthcare Supply Chain of Bangladesh.
- v. To derive best practices and insights from global experiences with blockchain technology in healthcare supply chains that can be applied to the context of Bangladesh.
- vi. To provide recommendations for the future adoption and development of blockchain technology in enhancing healthcare supply chain management in Bangladesh.

1.5 Significance of the study

Blockchain technology is a buzzword of the new Internet of Things applications in Industry 4.0. The study of the usage of blockchain technology in healthcare sector is a compelling research

interest due to its transformative potential across various facets of the industry. This study offers a decentralized and immutable ledger by ensuring the integrity of health records. This research paves the way of seamless data sharing and communication between providers and empowers stakeholders with greater control over their personal health data and improves the transparency and traceability of the healthcare sector. The study presents a framework of the usage of Hyperledger fabric framework of blockchain technology in the healthcare sector of Bangladesh and describes a way of eliminating the current issues regarding transparency and traceability of health data. Overall, this research illuminates blockchain's ability to create secure, transparent and efficient healthcare data management system, making it a highly relevant area of research.

2. Literature Review

2.1 Introduction

A Market Research shows that the global blockchain in healthcare market was approximately USD 0.76 Billion market at 2022 and is expected to grow up to USD 14.25 billion by the end of forecasted period of 2032. (Precedence Research) On the other hand, total Bangladeshi healthcare spending is over \$10 billion with medical devices, e-health and pharmaceuticals. Bangladesh's medical sector witnessed annual growth of 14.6% between FY 2016 and FY 2019, recording the fastest growth in the world. (bida.gov.bd) The challenges faced are- inefficiency, lack of transparency and wasteful processes in the supply chain of healthcare in Bangladesh. Hyperledger fabric is among the most effective blockchain solutions for improving supply chain transparency, efficiency, and security in performing various activities. This paper aims to review the literature based on supply chain management, blockchain, and Hyperledger Fabric for supply chain specifically in healthcare sector of Bangladesh.

2.2 Supply Chain Management

Supply chain management SCM entails identification, coordination, monitoring, and overseeing of the movement of products and related activities through various channels. SCM proves vital in the healthcare industry because delayed delivery of such needs can be fatal. However, SCM in healthcare is normally a complicated process that is frequently hampered by inefficiencies resulting from interactions with other stakeholders and stringent regulatory requirements. Various researchers have underlined the issues and problems in the healthcare SCM in Bangladesh such as ineffective inventory control, lack of integration among chain members, and ineffective tracking system. Ullash et al. (2023)

2.3 The Blockchain in Supply Chain Management

The decentralized, unalterable ledger of blockchain technologies yields many supply chain management advantages. Blockchain can improve the visibility and traceability of products in transit throughout its supply chain by enabling transparent, tamper-proof tracking on transactions. Multiple studies have demonstrated how blockchain can make supply chains more efficient, protect against fraud and guarantee that products are authentic . Kshetri, N. (2018). Using these technologies in healthcare can be effective to cope counterfeit drugs, supply chain delays and discrepancies etc. Saberi et al. (2019)

2.4 Inefficiencies in the Current Healthcare Supply Chain

The inefficient processes in the healthcare supply chain of Bangladesh leads to high wastages and costs. Outdated systems, no real-time data and lack of coordination between stakeholders are the primary reasons for these inefficiencies. Islam et al. (2023), stress a mismatch in demand over supply of medical supplies within the healthcare distribution channel which resulted into frequent stockout as well as issues with excess inventory stocking. Ullash et al. (2023), explores the disruptive impact of supply chain inefficiencies and inadequate infrastructure on access to quality healthcare in Chittagong.

2.5 Hyperledger Fabric Blockchain

Hyperledger Fabric is a permissioned blockchain framework developed for enterprise use, delivering a modular architecture with the requisite billing functionality. While public blockchains are open to all, enterprises can configure the permission and data; perfect for industries such as healthcare where privacy regulations require that certain types of information only be handled by specific organizations. Hyperledger Fabric has been found to facilitate increased transparency across a supply chain, improve data protection and efficiency, as per research. Chowdhury et al. (2023), Noha et al. (2023)

2.6 Potential of Hyperledger Fabric Technology to Improve Supply Chain Efficiency

Hyperledger Fabric in healthcare supply chain can result to high product effectiveness levels. Hyperledger Fabric avoids manual interventions and as the entire process can be automated through smart contracts, products can now always be tracked in real-time thus reducing time delays between producing/moving products lowers errors.(Patel 2019) Blockchain can accelerate this by making supply chains more responsive, ensuring that medical supplies are delivered where and when they are necessary, Noha et al. (2023) Moreover, the immutability of blockchain based on single truth record for all can reduce any inconsistencies and create trust among participants.

2.7 Reduction of Wastage Through Blockchain Implementation

Huge wastage in its healthcare supply chain — oversupply, expiration of products and poor distribution practice. However, blockchain technology in the form of Hyperledger Fabric can help one avoid going through this mess by giving insight into inventory on real-time and auto-reordering based upon actual demand. Blockchain can reduce this wastage by allowing supply of products only when they are really required, thereby reducing the risk of perishability and overstocking (Kshetri 2018). Furthermore, the transparency established by blockchain can also reveal where inefficiencies exist within a supply chain so stakeholders may supplement and continue to do business sooner.

2.8 Comparative Analysis of Blockchain Adoption in Healthcare Supply Chains

These comparative studies provide an insight into the opportunities and challenges of blockchain adoption in healthcare supply chains for Bangladesh as well. Similarly, Chowdhury et al. 2023) conducted a comparative study of blockchain adoption in healthcare supply chains- Bangladesh as well India where both the countries may have some common challenges, however regulatory environment existing in Bangladesh further impact implementation. Similarly, Anam et al. (2023) investigate the effect of blockchain on transparency and risk management in supply chain, indicating that adopting this technology could result in substantial gain for Bangladesh with respect to reducing frauds as well as improving healthcare quality.

3. Research Methodology

Our study depicted a qualitative methodology, with a primary focus on qualitative data. We have conducted a detailed analysis by reviewing the findings of numerous related research papers, case studies, financial reports, and other sources of data to discover blockchain related solutions in healthcare industry following the thematic analysis with interviewing, to better understand adoption in Bangladesh.

3.1 Research Type and Source of Data

We have mainly conducted qualitative research for this study. Our main source of data is different research papers and case studies. We have also collected information from Healthcare papers, government websites, international websites, newspapers, Healthcare papers, and other reliable sources. We will explore their findings, review, and analyze them and then propose a standard model.

We have also conducted interview as primary source of data to better understand the perspective of this country. In qualitative research, there is hardly any answer to a question like how many respondents are asked to gather information on having a panoramic picture of the blockchain technology in Bangladesh based on thematic analyses (Robinson, 2014; Fugard & Potts, 2015).

Both the perspective of Bangladesh and other countries have been taken into account for analysis, evaluation and finally proposing blockchain model for healthcare industry in Bangladesh.

3.2 Data Collection Methods

This research heavily relies on secondary sources of data. We have concentrated mostly on theoretical analysis. But alongside we have also collected primary data to support this research on Bangladesh perspective. Interviews were conducted to understand and evaluate the Implementation from healthcare professionals and patient perspective about proposed system in Bangladesh regarding the research, as per there is no existing blockchain implementation in this industry is ongoing according to govt report.

A. Primary Data:

The primary data generated for this study was from the semi-structured interviews which provides scope to explore and understand participants' opinions and experiences, with flexibility in further probing based on their responses. The interviews were focused on three main stakeholder groups:

Healthcare Professionals: Who are the key healthcare professionals included with supply chain management within a health care facility.

Healthcare Staff: These can include logistics or supply chain managers called to purchase, stock and deliver medical supplies as well patient information.

Patients: Understanding about their apprehensions and expectations with respect to transparency as well as safety of the medical supplies that they are provided, use of health data etc.

B. Secondary Data:

We have gathered secondary data from the following sources:

- i. Research papers
- ii. Case studies

- iii. Healthcare reports, research and journal
- iv. Govt. Websites & reports as like: National blockchain Strategy: Bangladesh etc.
- v. Online portals and Statistics websites
- vi. Academic journals, industry reports

3.3 Data Analysis Technique

As we are focusing on qualitative research, it will be heavily based on the more descriptive and narrative aspect of the research, as currently Block Chain technology have not been applied, so there is not enough data available around it in Bangladesh, other than the government report, where there is planning on executing the Block Chain in Healthcare Industry and business strategies existing in the country. The data and information being stored online will make the business model to be more efficient. This research will make the concept more approachable.

This approach of our research is not similar to any of the prevailing research and reports. So, the research report prepared is from our understanding of the business strategy. Our research is mainly the Normative analysis as mostly based of secondary data and proposing a recommended implementation. Alongside for its implementation and adoption perspective understanding, we have also done thematic analysis on the primary sources of data.

3.3.1 Sample Selection:

Purposive sampling was used to select the participants in order to support a substantive group of individuals with direct experience and knowledge related on healthcare supply chains. We interviewed (50) 50 individuals. The sample size included 20 healthcare professionals, 10 medical staff members and 20 patients.

3.3.2 Interview Process

The meetings being held face to face or online, based on participants' availabilities and preferences. These interviews generally lasted 20 minutes to half an hour each. All interviews were audio recorded, and transcriptions used in analysis. The interview guide captured the open-ended questions formulated around-

-Challenges facing the healthcare supply chain.

-Working with Hyperledger Fabric Blockchain Technology and its understanding

Supply Chain Insider

Volume 12, Issue 01, 201. 10-10-23 ISSN: 2617-7420 (Print), 2617-7420 (Online)

supplychaininsider.org Page 8

- Advantages of Adoption the Blockchain Technology in Healthcare Supply Chain
- Aspects of practicality and possible adoption obstacles.

3.3.3 Data Analysis

Analysis for the interview data was done via thematic analysis. The process was streamlined to through the following steps;

1. Familiarization: Read and re-read the transcripts in sample to familiarize ourselves with the data. We have used recording in mobile phone and used google audio transcribe for the transcription process.
2. Detailed reading: Keywords and patterns were drawn and coded manually. However, due to the iterative nature of qualitative study, more patterns and words that failed to evoke the appropriate emotions were continuously sought. Long V and Macmclean J. (2008)
3. Coding: Macro level of coding was obtained after which I focused on a specific sample of 5 to 10 questions. It enabled us to considers what the responses say about implementation. Subsequent coding was performed at the micro level to get the actual implementation.
4. Results: The themes were interpreted by checking with literature on blockchain technology in healthcare supply chain management. It specifically aimed at establishing relationships between the respondents' points and possible implications of Hyperledger Fabric on healthcare supply chain in Bangladesh.
5. Ethical Considerations: The study provided participants with written information about the purpose of the research, method, and their rights. Before the interviews, each participant gave written informed consent. Participants were anonymized when data was stored in the interview transcripts and confidentiality ensured.

3.4 Limitations

The limitations include the relatively small sample size which may not be sufficiently representative of all views within the Bangladeshi healthcare sector. This phenomenon gives the knowledge that can act as a base to carry out more research in this field. The research methodology is meant to extensively investigate the acceptance and consequence of Hyperledger Fabric Blockchain Technology in the healthcare supply chain system in Bangladesh. This study will be conducted through qualitative interviews with key stakeholders to develop a detailed

understanding of these drivers and provide rich insight into both the potential benefits, challenges that are associated as well some practical considerations related to implementing blockchain technology in this crucial sector.

3.5 Research Design

Qualitative research design is employed in this study to explore the adoption and impact of Hyperledger Fabric Blockchain Technology healthcare supply chain management in Bangladesh. It explores the perceptions, exposures and musings from different stakeholders in health care system doctors, other healthcare staff as well patients. This method is adopted since it allows to gain a deep understanding of the prospect on how Hyperledger Fabric can support improve efficiency, effectiveness and overall performance in health care supply chains within Bangladesh.

Gantt Chart

Timeline	25 May	15 June	02 July	03 August	18 August
Research Preparation & Data Collection					
Literature Review					
Primary & Secondary Data Collection and Analysis					
Developing Model					
Completing the Research					

4. Proposed Framework: Hyper Ledger Fabric Blockchain in the Healthcare System

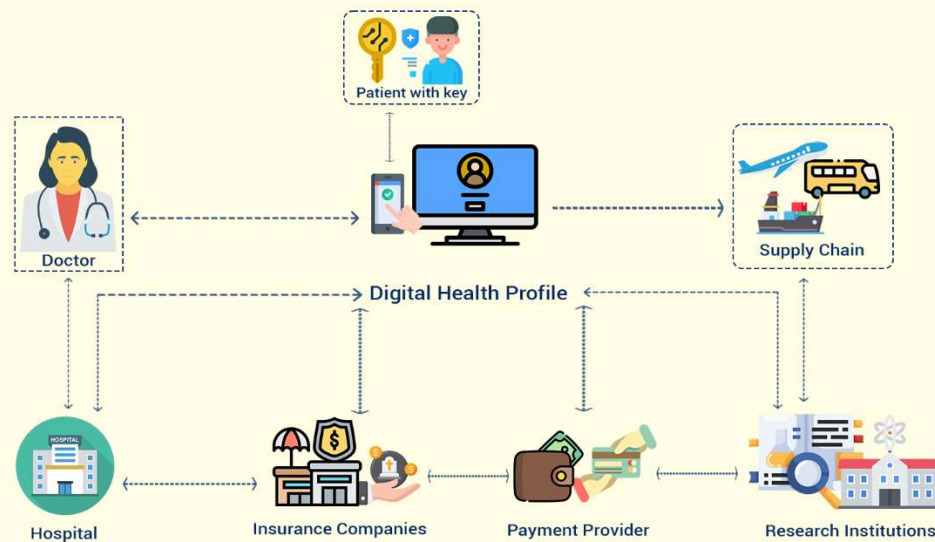


Figure: Permissioned Blockchain in Healthcare supply chain

Hyperledger Fabric is a permissioned blockchain framework meant to work within supply chains, such as the healthcare-industry. Unlike public blockchains, where anyone can see and take part in the processing of transactions (mining), Hyperledger Fabric restricts this to known participants hospitals, pharmaceutical companies and insurance providers for privacy and regulatory reasons. The Hyperledger fabric is helpful at giving real-time access to the data and making it easy to trace in healthcare, therefore facilitating an effective supply chain. For example, this tracking can follow pharmaceuticals from the time of manufacture to distribution in order to validate their use and lower counterfeit risks. These transactions are registered on the blockchain which is secure, transparent and unforgeable.

Hyperledger Fabric enables insurance companies to share patient data and claims history securely. Through smart contracts, insurance claim functions might be able to automate fraudulent transactions that lead to faster payouts. A decentralized and unified system to which hospitals and healthcare providers can share patient records as well as supply chain data that relies on the trust between each party involved, hence lowering redundant errors in medical record keeping; enabling all beneficiaries of timely access for necessary equipment pesticides. Modules in Hyperledger Fabric make customization possible to address the unique needs of healthcare, thereby making it scalable solution which enables integration between different stakeholders along with high data privacy and security features complying with health sector regulations. As a result, the drugs they paid for is still safe — and then some to convince them of that fact along with physicians and other healthcare stakeholders involved in the entire buying process.

Supply Chain Insider

Volume 12, Issue 01, 201. 10-10-23 ISSN: 2617-7420 (Print), 2617-7420 (Online)

supplychaininsider.org Page 11

4.1 Basic Algorithm term in Proposed Systems

The platform is based on the Hyperledger Fabric blockchain framework created and maintained by IBM for business applications, with a scalable modular architecture that can support permissioned access.

Initialization: The healthcare supply chain network is initialized on the pre-existing Hyperledger Fabric platform, providing roles and permissions for all participants (e.g., manufacturers, suppliers, healthcare providers regulators).

Transaction Submission: Every transaction (e.g., a testing batch creation, shipment or delivery confirmation) is individually proposed to the blockchain network.

Endorsement: The proposal is endorsed by peers (nodes) in the network with predefined smart contracts ensuring that the transaction respects established rules.

Commit: The transaction is now committed to the blockchain ledger, a permanent and transparent record open for all authorized participants.

Transparency: All participants can check the history of transactions at any time.

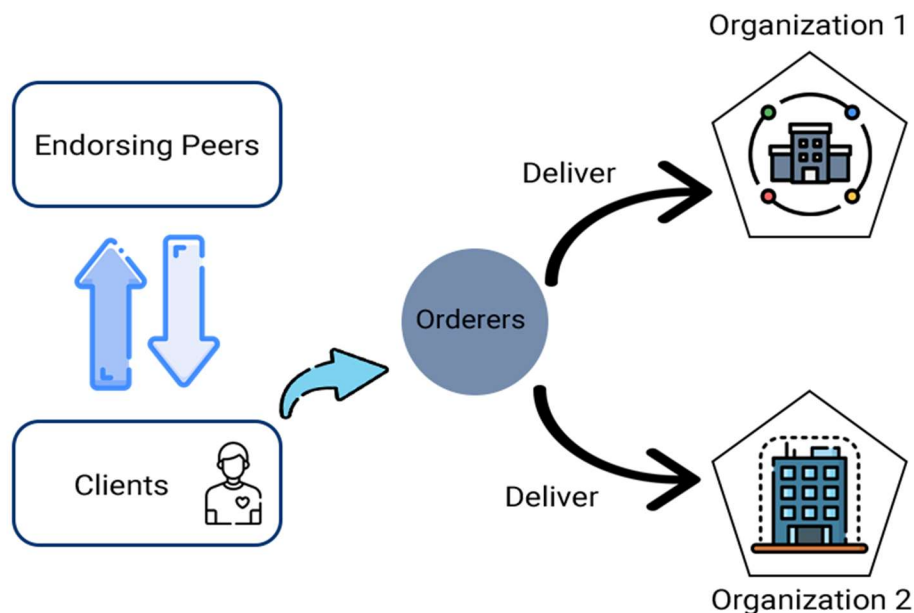


Figure: Hyperledger Fabric Blockchain working Process in simplified way

1. The patient comes to the hospital with their identity.
2. ID of the hospital admin get the necessary information from blocks (Which is a technology use in hyper ledger fabric)
3. Directed the patient to the physician.
4. The physician open Blocks platform, validate using their login id and password to view medical history, personal information according to that hospital's doctor etc.
5. And then the current diagnosis and prescriptions are updated in Blocks of hyper-ledger fabric system by physician.
6. Block system – This provides a platform where the patient's current health care data is monitored and promptly obtained by all stakeholders.

4.2 Data Transfer System

The proposed Hyperledger Fabric blockchain is capable to transfer data among patients, healthcare service vendors, regulators and administrators accurately determined by the secured process in a private manner (between buyer/supplier), it helps for supply chain stakeholders where ever applicable. The key elements include:

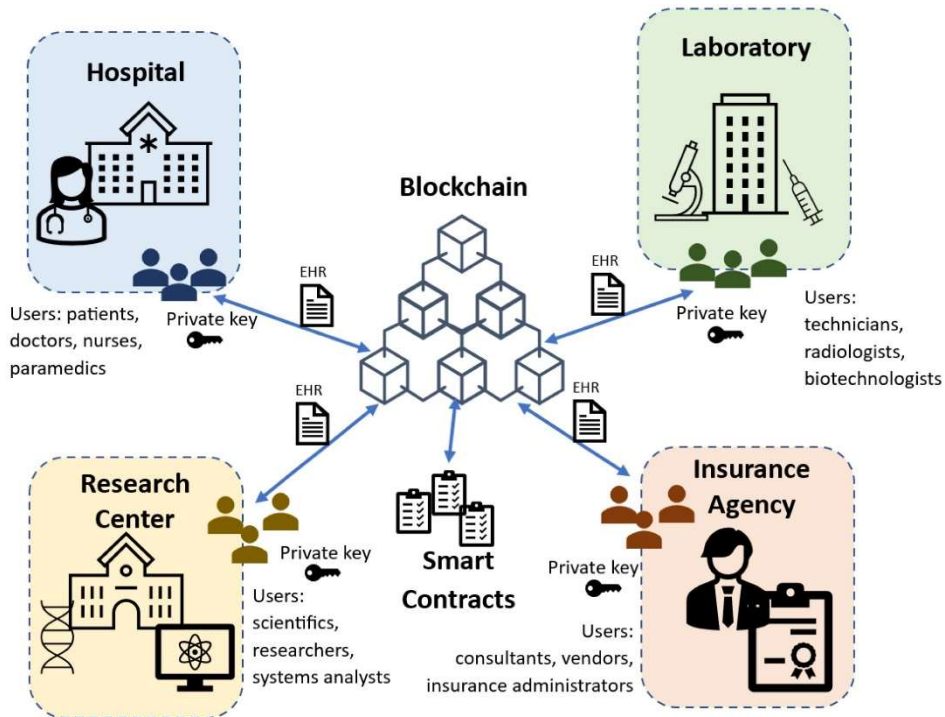


Figure: Basic concept and terms used in Hyperledger Fabric integration

Secure data transfer via encryption: All of the data that flows through this network is encrypted by advanced cryptographic methods to prevent confidentiality and security.

Network Layer (P2P): Data is shared over a decentralized P2P network layer to limit single point of failure / redundancy.

Smart Contracts: Controlled by math instead of lawyers, smart contracts automate the process and enforcement such that all conditions must be met before any data transfer takes place.

Tamper-Proof Ledger: Each transaction is written into an unchangeable digital ledger, guaranteeing data integrity and blocking unauthorized amendments.

4.3 The Working & Transaction Process

1. Hyperledger Fabric is used to set up the block-chain network.
2. Organization 1 is created
3. Organization 2 is created

4. Whenever any patient/user/client/peer approaches the organization. Unique patient ID comes from hash code. MSP (Membership Service Provider) issues a certificate and verify that pair to join the organization.

Encrypted data - Ledger

ID of patient - Registry

5. Orderer makes the channel across all these peers among several organizations.

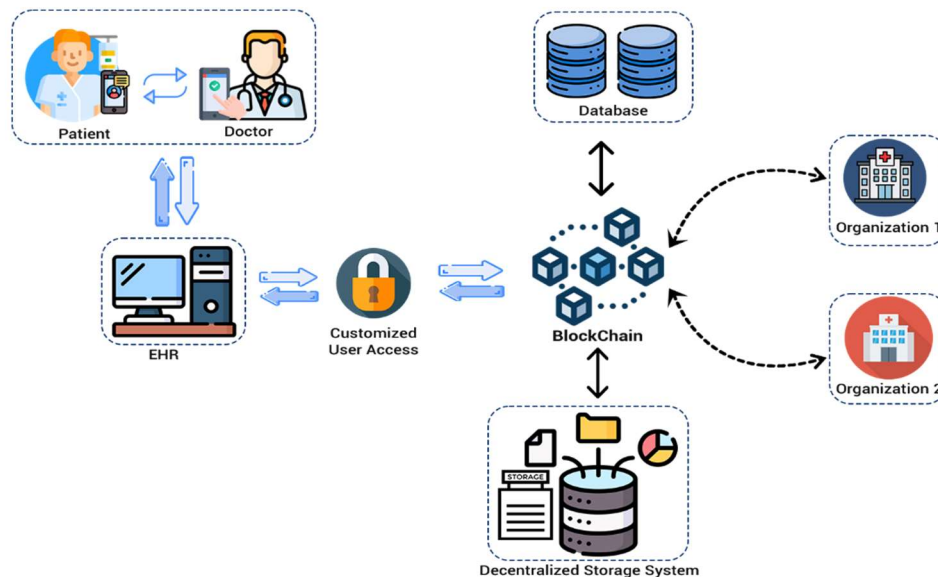
6. The consensus protocol allows the organizations to do that incontrovertibly.

7. The request of viewing the patient's data is raised when same patient visits Hospital in organization 2 after the permission granted by patient.

Decrypt data - Ledger

ID of patient -Registry

8. Achieves transaction privacy.



For Blockchain network we will use Hyperledger fabric technology. By using orderer an organization 1 is created with its network infrastructure. Similarly, organization 2 is also created. During a patient visit to hospital in organization 1, every time new pat ID is generated by any of the hash algorithm. Then, MSP gives certificate to the patient and also makes that peer belongs in organization. After the medical data of the patient are encrypted and cryptographically signed, they

will then be put in a ledger using smart contracts. The patient ID is saved in the organization 1's Patient registry.

The data is then sent over to the client face of the network. Client generate a transaction and send it to the endorsing peer. Endorsing peer is the one that will endorse (mark as OK) or reject a transaction, when it will be proposed. Once the transaction is approved, it will be sent to blockchain with endorsement. Validating peer verify the transaction, signature and simulate it. If successfully endorsed by the participants, it then sends this transaction to client with endorsement signature. If the transaction is approved, client will send the transaction to ordering service. If not the transaction is canceled. The order processor will then sort transaction in a defined manner and sent it to block for further process, later move it to the anchor peers. Suppose, any transaction is to be committed here, then everyone has done the same sequence of instructions from his/her initial state. The above process is called Consensus Protocol.

High performance of consensus algorithm Performance involves more than just consensus on the ordering of transactions. Hyperledger Fabric particularly showcasing this difference. It occurs natively in the stages of its transaction flow. That is from Proposal & Approval, through Ordering to Fulfillment and Provisioning. In other words, consensus can be described as complete validation of the accuracy of blockified transaction sets. Patient's data sharing can be done only with patient permit in our proposed system. This implies that if patient data is stored in one organization, another will not be able to access this information. How Hyperledger gives better performance. If we want to change the data of any block, then it should be changed from all other blocks which are connected with this block. It keeps attackers away from some of the blocks! Hospitals have their ledger of all data related to patient visiting for different hospitals and hence they can share that with other hospitals under organization after setting up Hyperledger fabric.

5. Adaptation

Building from the previous section and leveraging Hyperledger Fabric as a background, we can implement blockchain in healthcare supply chain appropriately with:

Facilitators Stakeholder Engagement: All stakeholders (manufacturers, healthcare providers, regulators) need to be involved and motivated during the implementation.

Training and Capacity Building: Offering training to all participants on the principles of blockchain, Hyperledger Fabric specifics and usage.

Tailoring the System: This involves customization of the system in compliance with local laws and standards particular to Bangladesh health sector, thus Bentham adheres within regulation as we deal under this framework tweaked for Bangladeshi healthcare landscape.

Pilot Testing: To do a pilot test of the system in controlled environment to identify and rectify any probable problem before actual implementation.

Full Deployment: Launching the platform within a healthcare supply chain network, with ongoing monitoring and fine tuning for operational readiness and peak performance.

6. Implication

The utilization of Hyperledger Fabric blockchain technology in the medical sector supply chain management (SCM) system could revolutionize and revamp its operations, distinctly evident through Bangladesh Dental Industry use-case. Hyperledger Fabric facilitates a decentralized, permissioned ledger that adds clear traceability and visibility to the supply chain (in this case medical supplies) layer of tracking information right from manufacturers till end consumers. This higher level of transparency then guarantees healthcare institutions that they are getting access to the products in a way more immediate, direct and original than its current system counterpart, which is one plagued by problems like counterfeit drugs as well as quality control. Additionally, the blockchain can automatically instigate processes like smart contracts which minimizes human error and increases speed whilst decreasing paperwork; simplifying operations to become more efficient. Such technology has the potential to make a big difference in Bangladesh, as it does not have enough financial resources to meet its health needs. Hyperledger Fabric integration would save on waste by making certain there is the right number of products, allow online in real-time demand monitoring and automated re-order when necessary. According to Astra, this would reduce the number of overstocked and stockouts of essential medical products while also improving resource management in turn making sure healthcare services are not interrupted due to supply chain failures. Blockchains are secure and immutable, which can reduce fraud or non-authorized tampering with sensitive patient and supply chain data.

Successfully deploying Hyperledger Fabric has the potential to change healthcare supply chains for better, building trust between different parties and a more robust system. Over the long term, this would result in a more resilient healthcare infrastructure capable of providing rapid responses to public health needs (which might mean less expensive or simply better access to essential services). Along with improving patient care, and its sustainability in the Bangladesh healthcare landscape for better health outcomes.

7. Conclusion

With the use of blockchain technology, mainly Hyperledger Fabric (delve deeper), Bangladesh health care can be completely revolutionized by helping to solve critical issues like transparency, tractability and integrity. Blockchain, in fact can go a long way to help improve healthcare delivery by lowering the risk of counterfeit products delivered reducing wastage and also increasing efficiency across health supply chain spectrum. The study shows that the decentralized and permissioned aspect of Hyperledger Fabric can provide finer data protection as well much better operational economy, which makes it especially suitable due to increasing demand for digital

Supply Chain Insider

Volume 12, Issue 01, 201. 10-10-23 ISSN: 2617-7420 (Print), 2617-7420 (Online)

supplychaininsider.org Page 17

health solutions. These devices have potential to streamline the purchase and allocation of medical supplies, especially in poorly equipped healthcare systems or regions which are underfunded. But, making the use of blockchain technology in healthcare supply chains successful will be possible overcoming various challenges such as existing technical infrastructure, legal and regulatory issues or ensuring a proper level of investment. Furthermore, partnership among unique actors together with government companies, fitness establishments and generation businesses are needed to make blockchain turn out to be part of the quite natural device. In sum, although blockchain offers a new pathway to upgrade the healthcare supply chain in Bangladesh, support from empirical study conducting pilot project and policy-making is essential for translating theoretical footings into practical outcomes.

References:

1. Agarwal, R., Dugas, M., Gao, G., & Khuntia, J. (2018). Emerging digital health services: Health care for the internet generation. *MIS Quarterly*, 42(1), 9-17.
2. Anam, K., Mostafiz, M. B., Shah, S., Dhar, R. C., & Ahmed, S. (2023). Multi-Criteria Decision Making for Fresh Mango Supply Chain Risk Management: An ISM & TOPSIS-Based Approach. *Supply Chain Insider*, 11(1).
3. Blockchain In Healthcare Market Size, Share, and Trends 2024 to 2034. Retrieved from <https://www.precedenceresearch.com/blockchain-in-healthcare-market>
4. Chowdhury, N., Mohammad, N., Tasif, M. A., & Tasnim, K. N. (2023). Explaining the Impact of Supply Chain Transparency on Sustainable Consumption. *Supply Chain Insider*, 11(1).
5. Directorate General of Health Services (DGHS). (2024). Global Digital Health Index (GDHI). Retrieved from https://dghs.portal.gov.bd/sites/default/files/files/dghs.portal.gov.bd/page/4124d18a_a_b99_40e2_8fef_ff4052948739/2024-04-23-07-09-48541d4dd55108137e50961ebcba0477.pdf
6. Frøen, J. F., Friberg, I. K., Lawn, J. E., Bhutta, Z. A., Pattinson, R. C., Allanson, E. R., ... & Kinney, M. V. (2016). Stillbirths: Progress and unfinished business. *The Lancet*, 387(10018), 574-586.
7. Healthcare and Medical Devices, Bangladesh Investment Development Authority. Retrieved from bida.gov.bd

8. Islam, S., Shill, A. C., Alam, S., Asha, A. A., & Hossain, R. (2023). Silk industry supply chain complexity: A comparative study on finding the gap between demand and supply. *Supply Chain Insider*, 11(1).
9. Kshetri, N. (2018). Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80-89.
10. Noha, B. J., Ali, A., Shah, P. K., Tamang, P., & Khan, N. J. (2023). Circular Economy Practices in Supply Chains of Bangladesh. *Supply Chain Insider*, 11(1).
11. Patel, V. (2019). A framework for secure and decentralized sharing of medical imaging data via blockchain consensus. *Health Information Science and Systems*, 7(1), 1-10.
12. Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117-2135.
13. Ullash, M. S. S., Noor, R. L., E-Elahi, Q. M., & Juber, H. (2023). Sustainable Agricultural Supply Chain Management in the Chittagong Hill Tracts: A Roadmap Towards Development. *Supply Chain Insider*, 11(1).
14. World Health Organization. (2018). A health sector roadmap: Ensuring global health security in the 21st century. Geneva: WHO.