Is Using Blockchain Technology to Secure Patient Data Economically Reasonable?

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Identification of Subject

My research spans the areas of technology and health. In this context, my analysis examines specifically the usefulness of implementing blockchain technology in healthcare. I focus primarily on the use of blockchain to secure and store patient data. In order to evaluate whether blockchain is a good solution economically for digitizing a patient's health history, I examine technical, financial, and environmental aspects.

Personal Motivation and Rationale

My original motivation stems from my interest in digitalization and healthcare. After an initial literature search, I was particularly interested in the field of electronic health records (EHR). A large component of the current literature from this area is the development of an EHR system that is based on blockchain technology. However, economic aspects are often neglected when evaluating the technology. My research aims to close this gap by assessing the usefulness of blockchain technology from an economic perspective. This includes a comprehensive literature review and the use of the SWOT framework for final assessment.

Research Question

My central research question is whether using blockchain technology to secure patient data is economically reasonable. In the current literature about the use of blockchain in the field of healthcare, many authors focus on the advantages such as increased security and interoperability. However, a closer examination of the technology and its efficiency suggests that the disadvantages may outweigh the benefits.

Literature Review

Patient data consists largely of personal information. This includes birth dates, medical histories, social security numbers, and financial information (Gopinath and Olmsted, 2022). These sensitive data of an individual are aggregated by medical institutions into a patient record. The record thus provides information about a patient's clinical situation and development during the treatment process (‘Richtlinie 2011/24/EU’, 2011). This patient record is often stored in paper format (Workneh, Adem and Pradhan, 2018). However, with the progress of digitalization, the number of electronic patient records is growing (Bonomi, 2016). While the physical patient record can only capture data internal to the healthcare

institution, the electronic health record contains the patient's entire health history and thus serves as medical documentation (Kohli and Tan, 2016; Lux, 2017). To ensure the usability and expandability of the health history, the patient data must be stored digitally. In traditional electronic health record systems (EHRS), a centralized network acts as the storage location (Grover and Kushwaha, 2022). However, this centralized storage method has disadvantages, including security and transparency issues (Yaeger *et al.*, 2019; Attaran, 2022). For this reason, current literature discusses the use of decentralized networks for storing patient data (de Oliveira *et al.*, 2019). One of these systems is the blockchain (ibid.). The technology was originally developed for the secure processing of transactions and was first used in the context of the cryptocurrency Bitcoin (Yaga *et al.*, 2018). However, the transactions can process many types of data and therefore also offer areas of application in healthcare (Yaga *et al.*, 2018; de Oliveira *et al.*, 2019). Among the advantages of blockchain is the combination of decentralization and cryptography, which significantly complicates the tampering of stored data (Piscini, Dalton and Kehoe, 2017). Other strengths besides immutability include increased security, privacy, and transparency (Fusco *et al.*, 2020; Khujamatov *et al.*, 2022).

However, the consequences of the blockchain's complex design include not only increased security, but also several disadvantages. Among the weaknesses of blockchain are poor scalability and a large amount of required memory (Siyal *et al.*, 2019; Attaran, 2022; Khujamatov *et al.*, 2022). Both weaknesses largely result from the decentralized structure of the technology. This requires all data to be stored on several servers simultaneously (Yaga *et al.*, 2018). Thus, as the number of patient data increases, the storage space required also increases by a multiple (Khujamatov *et al.*, 2022). Moreover, the performance of the network deteriorates as the number of servers increases (ibid.). This results from the constant exchange between the individual nodes of the network, which is essential for the functioning of the blockchain (Monrat, Schelén and Andersson, 2019). The growth of blockchain is thus associated with large costs in terms of storage space and processing power. Despite the multitude of disadvantages, the use of blockchain in the field of electronic patient records is much discussed in the literature. However, it is noticeable that the focus is often on the advantages. In addition, the use of blockchain is mostly discussed from a social or technical perspective, economic factors are frequently missing. Therefore, my research will economically assess the usefulness of blockchain for storing patient data based on the existing literature. In doing so, I will attempt to provide a holistic and realistic assessment of the potential of blockchain for EHR systems.

Methodology

My methodology consists of three parts in total. In the first part, I explained the basics of patient data, electronic health records, and blockchain. I specifically focused on the use of blockchain to implement EHR systems. In the second part of my methodology, I analyzed the security of blockchain using selected literature. The security analysis included, among other topics, an examination of the economic

impact of security breaches. In the final part, I will expand the analysis to include other important economic aspects and organize them into a SWOT framework for the final assessment.

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Keywords

Blockchain: A decentralized, immutable ledger for documenting transactions, through which any type of data can be tracked and more trust can be established. (*What is Blockchain Technology - IBM Blockchain | IBM*, no date)

Electronic Health Record (EHR): A digital repository for patient data that provides security and information sharing among authorized individuals. It supports a continuum of health care. (*ISO/TR 20514:2005*, 2005 cited by Häyrinen, Saranto and Nykänen, 2008)

Patient Data: Personal data about the physical or mental health of a natural person, including the provision of health services, which provides information about their health status (*Art. 4 GDPR - Definitions*, 2018, p. 4).

SWOT Framework: A framework for analyzing the strengths, weaknesses, opportunities and threats of a company, technology, etc.