Chapter 13
Blockchain Pharma:
A Prospective Overview

Francisco Ribeiro de Sousa
ISEG, Lisbon School of Economics and Management, University of Lisbon, Portugal

ABSTRACT

Blockchain, a distributed ledger technology (DLT) that sustained the creation of the first digital currency, Bitcoin, crosses many business areas, including healthcare, to promise better economic solutions. Blockchain generalized implementation is already a reality in Estonia, perhaps the most digitally advanced country globally, with proven healthcare results for its citizens. From a pharmaceutical industry perspective, blockchain offers solutions as diverse as the structuring of clinical trial protocols, the traceability of medicines along the supply chain, and intellectual property rights. Additionally, the DLT's cryptographic protocol, whose main characteristics are immutability, consensus, security, and transparency, may support both the web's decentralization and the transition to a Semantic Web, which is recognized by many as highly recommended.

INTRODUCTION

"The physician patient relationship is forever changing. Now more than ever with the rise of access to data" David Schanger, CEO of Progyny

This chapter's primary purpose is to address the impact of digitalization on health systems and the pharmaceutical industry, emphasizing blockchain technology (BT).

BT aggravates the dilemma between data centralization and the original vision of a decentralized internet, namely because it brings to the Internet the required trust to transact value in the absence of intermediaries.

Throughout this chapter, the aim is to examine the eventual shift towards a health system where the patient is the legitimate owner of their medical records. Initiatives will be presented where the patient can profit from sharing their medical records, such as the partnership between a genomic sequencing company and a biopharmaceutical company interested in developing biological drugs (Grishin, 2019).

DOI: 10.4018/978-1-7998-7363-1.ch013

As it will be seen, Estonia, the most digital country globally, stands out as an example of the modernization of health systems. Using BT, these technological advances have allowed the implementation of an innovative alert system for drug interactions (Kõnd & Lilleväli, 2019).

BT's versatility can be demonstrated by the growth of many solutions serving the most diverse business areas. This chapter discusses blockchain's structural characteristics (immutability, transparency, and security) that it is thought will justify its wide use by the pharmaceutical industry. In the pursuit of greater process rationality and simplification, blockchain is applied in diverse areas as supply chain, clinical trials, and R&D (Premkumar & Shrimati, 2020).

Counterfeit drugs are a severe problem at the supply chain level. Ways to more effectively trace the drugs from their origin to the final consumer are discussed (Clark & Burstall, 2018). The authors will present existing solutions that allow the end consumer to verify provenance and authenticity using a smartphone app (Saxena et al., 2020).

Clinical trials will also be discussed, considering that their current form raises doubts about outcomes' reproducibility. In this sense, existent options are presented, including smart contracts to make study protocols more transparent (Benchoufi & Ravaud, 2017).

Finally, it will be observed how BT can play a crucial role in R&D, notably in protecting intellectual property rights.

BACKGROUND

Blockchain, a distributed ledger technology (DLT) popularized in 2009 by Satoshi Nakamoto while creating "Bitcoin" cryptocurrency, is the basis of a progressive digital revolution. The exact semantics of the word "blockchain" helps to understand its meaning: "block" represents a unit that contains encrypted information, which is in turn inserted into a "chain" that represents a database (Yaga et al., 2018). However, a blockchain differs from a common database in the way information is structured: each new piece of information is encrypted and inserted into a block until it is filled (these have a limited storage capacity), at which point it is submitted to a validation process carried out by different network participants (nodes); the block is aggregated to the end of the existing chain, in case it is consensually validated, ensuring a chronological order (Conway, 2020).

Cryptography is an integral and inseparable element of BT, guaranteeing the ledger's immutability, the security of transactions, and the safeguarding of players' identities. Cryptography can be defined as a method of ensuring a communication process's privacy and integrity by converting plaintext (standard text) into a ciphertext (random sequence of characters) using a mathematical algorithm, thus preventing outsiders from accessing private information. Two types of cryptography are essentially used in BT: asymmetric cryptography and hash function. In asymmetric cryptography, a public key (which can be openly shared) and a private key (which must be kept a secret) is used to encrypt and decrypt the ciphertext. The sender uses his private key and the recipient's public key to encrypt the text, and then the recipient uses his private key and the sender's public key to decrypt the text, thus resulting in a highly secure process. In turn, the hash function is a type of encryption that uses a mathematical algorithm to convert any information into a fixed-size string of characters. This type of one-way encryption means that it is impossible to retrieve the plaintext through the ciphertext. A given input always corresponds to the same output, and any change in that same input significantly changes the output, a determining characteristic for data integrity checking (Pasala et al., 2020).

Related Content