Model for digital healthcare ecosystem based on blockchain technology: a pilot study

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***Abstract*— The aim of this study is to identify crucial factors that influence the acceptance of a digital healthcare ecosystem based on blockchain technology. Theoretical framework for the proposed model relies on the theory of stakeholders, TAM theory, and concept of readiness for changes. Statistical analysis was performed on the basis of Structural Equation Modeling (SEM). The proposed model may facilitate the use adoption of the healthcare ecosystem based on blockchain technology.**

Keywords*— *blockchain technology, acceptance factors, digital ecosystem, healthcare

I. INTRODUCTION

Blockchain technology is one of the most significant technological innovation in the recent years in the field of digitization of secure ownership of assets. The technology is founded upon the concept of a distributed ledger, a way of decentralized cataloging, and for accounting of large volumes of data [1]. Blockchain is disruptive technology that will revolutionize business and redefine companies and economies [2]. Many sectors, like finance, medicine, manufacturing, and education, use blockchain applications to profit from the unique bundle of characteristics of this technology [3]. Over the past decade, the practical implementation and integration of eHealth systems have been scaled drastically. Many developed nations utilize eHealth technologies, which makes a real difference in improving patient care and provision of efficient and effective healthcare services [4]. The future development in healthcare sector will be based on blockchain technology because [5]:

- by decentralizing data, securely encrypted, we avoid single points of failure,
- by making the data broadcasting permissionless, anyone can contribute to the democracy,
- by demanding consensus, the most probable version of the truth may be created,
- by time stamping, a fully transparent, auditable chain of events is ensured,
- by cryptographic hashing and crypto-economics, the record censorship is made free and is incentivize good behavior.

Literature review revealed some of the most important influential factors for adoption of blockchain technology in the healthcare sector [6]: data security, patient privacy, recognition of technological benefits, relative advantages, perceived low risk, trust factors, etc.

TAM (Technology Acceptance Model) is one of the most popular and widely used models to study the social mechanisms of technology adoption, which has been modified from time to time [7].

However, it is necessary to emphasize the importance of the concept of readiness for changes because of its possible influence on the acceptance of technological novelties. The concept of readiness for changes consists of at least two factors: individual readiness to change and the organizational readiness for changes [8].

The main aim of this study is to identify crucial factors for acceptance of a digital healthcare ecosystem based on blockchain technology. Model for digital healthcare ecosystem based on blockchain technology is proposed.

II. METHODOLOGY

A. Study design

The study presents a discussion of the factors that may influence implementation and acceptance of a digital healthcare ecosystem among stakeholders. The key stakeholders in healthcare are: patients, physicians, medical technicians, non-medical staff, management staff, suppliers, pharmacies, and health insurance companies.

The proposed model is based on the TAM theory and on the construct of readiness for changes. For the construction of the model we used the literature review, the method of exploring the possible factors among stakeholders in the healthcare sector, with a structured Likert type questionnaire for assessment of the readiness for changes, along with the questions about the blockchain technology and acceptance of digital healthcare ecosystem based on it.

The total number of participants in this pilot study was 70, involving the stakeholders in the healthcare sector. The

statistical analysis was performed on the basis of Structural Equation Modeling (SEM), using AMOS.

III. RESULTS

Out of the total of ten tested relationships in the final SEM model, seven of them were found to be statistically significant ($p \leq 0.05$). These findings indicate that the independent constructs explained 65.7% of the variance in the behavioral intention of use ($R2 = 0.647$).

The results revealed importance of all the tested factors, and the possible influence of the proposed digital healthcare ecosystem based on blockchain technology among stakeholders on the potential use in the health sector in Serbia (Table 1):

- Knowledge about blockchain (1),
- Awareness of cybersecurity (2),
- Perceived ease of use (3),
- Perceived credibility (4),
- Compatibility (5),
- Social influence (6),
- Readiness for changes (7).

TABLE I. RESULTS OF EQUATION – DEPENDENT VARIABLE: USE

Factor	SEM analysis	
	beta coef.	*t-statistics*
1	0.498	5.71
2	0.384	4.54
3	0.381	3.11
4	0.329	2.64
5	0.293	3.72
6	0.317	3.98
7	0.526	6.27

significance level: $p \leq 0.05$

FIG. 1 SHOWS ALL IDENTIFIED FACTORS IN THE PROPOSED MODEL.

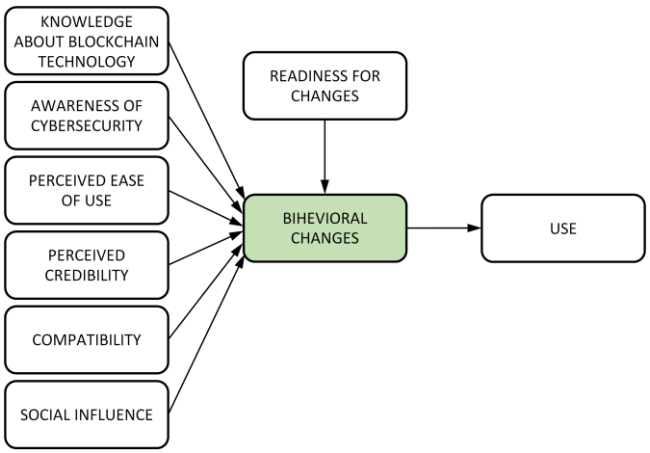

Fig. 1. Model for implementing a digital healthcare ecosystem based on blockchain technology

The most important factors in the model are: knowledge about blockchain technology, awareness of cybersecurity and the construct of readiness for changes. On the basis of the presented model, the implementation of the proposed digital healthcare ecosystem based on blockchain technology may be introduced into the e-business of the healthcare facilities in Serbia. Each identified factor should be more explored for the well-tailored strategy of implementation process.

IV. CONCLUSION

The blockchain technology is the future of modern data transfer technology in healthcare systems. The qualitative issues of the blockchain technology enhances flexibility, security issues, and data transfer processing due to its convincing advantages. But, the process of adoption of this novel technology and influencing factors still remain under investigation. We pointed out that the following factors: knowledge about blockchain, awareness of cybersecurity, perceived ease of use, perceived credibility, compatibility, social influence, and readiness for changes may influence the process of development of a digital healthcare ecosystem based on blockchain technology.

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