

Comprehensive Framework for Blockchain Technology Adoption in Saudi Public Hospitals

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Certificate of Original Authorship

I, Adel Abdulrahman Khwaji declare that this thesis, is submitted in fulfilment of the requirements for the award of PhD, in the School of Computer Science/Faculty of Engineering and Information Technology at the University of Technology Sydney. This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. This document has not been submitted for qualifications at any other academic institution. This research is supported by the Australian Government Research Training Program.

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List of Abbreviations

AGFI	Adjusted Goodness of Fit Index
AMOS	Analysis of Moment Structures
API	Application Programming Interface
AVE	Average Variance Extracted
BI	Behavioral Intention
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
Chisq/df	Chi-square/degree of freedom
CR	Composite Reliability
EHRs	Electronic Health Records
EMRs	Electronic Medical Records
GFI	Goodness-of-Fit Index
HIPAA	the Health Insurance Portability and Accountability Act
HIS	Healthcare Information System
HL7	The Health Level Seven
IFI	Incremental Fit Index
MoH	Ministry of Health
MSV	Maximum Shared Variance
NFI	Normed Fit Index
PBFT	Practical Byzantine Fault Tolerance
PHC	The Primary Health Care
PoET	Proof of Elapsed Time
PoS	Proof of Stake
PoW	Proof of Work
PNFI	Parsimony Normed Fit Index
RMSs	Remote Monitoring Systems
RMSEA	Root Mean Square Error of Approximation
RNI	Relative Noncentrality Index
SEM	Structural Equation Modelling
SLR	Systematic Literature Review
SPSS	Statistical Package for the Social Sciences
SRMR	Standardized Root Mean Residual
TOE	Technological, Organisational and Environmental framework
TLI	Tucker Lewis's Index
VIF	Variance Inflation Factor

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Abstract

Background: Blockchain has great potential and promise in the healthcare sector, even though it has not yet seen widespread adoption. Blockchain is able to address most concerns in healthcare such as security, privacy, interoperability, data sharing and counterfeit medicines. As part of the Saudi Vision 2030, the Ministry of Health established strategic goals aimed at enhancing healthcare services and transforming the healthcare system. The main challenge with blockchain adoption is to ensure that users will accept this new technology.

Aims and Objectives: The aim of this study is to empirically examine the determinants that affect blockchain adoption in public hospitals in Saudi Arabia. It is apparent that there is scant research examining issues related to the adoption of blockchain in developing countries and Saudi Arabia in particular. It is essential to identify and understand the determinants of intentions to use blockchain technology to identify key areas for interventions aimed at enhancing future use. In this thesis, the perspectives of IT employees are taken into consideration. A conceptual framework for the successful adoption of blockchain technology is subsequently proposed based on the technological, organisational and environmental (TOE) framework. This research also investigates IT employees' preferences towards moving healthcare information system (HIS) applications to blockchain technology and proposes a set of guidelines to encourage public hospitals to adopt blockchain technology.

Methods: Quantitative research data were collected via a cross-sectional questionnaire survey from IT employees who work in Saudi hospitals and 363 responses were considered valid. The data were analysed using SPSS and AMOS software. Confirmatory factor analysis was employed to test reliability and validity. Structural equation modelling (SEM) was carried out to test the proposed hypotheses and to identify the determinants that derive the technological, organisational, environmental and human dimensions which influence blockchain adoption in the Saudi hospitals.

Results: A descriptive analysis revealed that about 70 percent of the participants had little knowledge of blockchain technology. 81% of the variance in Behavioral intentions was explained by the adapted research framework ($R^2 = 0.81$). The results of the path analysis showed that all the determinants had a significant influence at the level of 0.05 ($p < 0.05$). Standardised path coefficients showed that government support ($\beta = 0.28$, $p < 0.001$) had the greatest significantly positive effect on IT employees' Behavioral intention to adopt blockchain.

Conclusion: This study provides theoretical empirical evidence based on the TOE framework regarding Saudi healthcare IT employees' attitudes towards blockchain technology. It also presents evidence of the empirical validity of a new extension to the TOE framework by adding two context-specific determinants, namely decision-maker innovativeness and technical competence with their respective measurement scales. The practical implications of the research are offered to governments, hospitals and decision makers so they can achieve a high level of acceptance and usage of blockchain technology