INTEGRATED BLOCKCHAIN-BASED DIGITAL TRANSFORMATION CONFIGURATIONS FOR RESILIENCE, ENGAGEMENT, AND GROWTH

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by

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CERTIFICATE

This is to certify that the thesis titled "**Integrated Blockchain-based Digital Transformation Configurations for Resilience, Engagement, and Growth,"** submitted by **Subhadeep Mandal,** to the Indian Institute of Technology, Delhi, for the award of the degree of **Doctor of Philosophy (Ph.D.)**, is a bonified record of the research work done by him under my supervision. The content of this thesis, in whole or in parts, has not been submitted to any other institute or university for the award of any degree or diploma. Material, wherever borrowed, has been duly acknowledged.

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ABSTRACT

Digital transformation has become a critical priority in today's interconnected business environment, with blockchain technology emerging as a key enabler across industries. This thesis, titled "Integrated Blockchain-based Digital Transformation Configurations for Resilience, Engagement, and Growth," explores how blockchain can digitally transform production ecosystems by integrating supply chains, consumers, and organizations. The first study investigates blockchain's role in supply chain resilience during natural disasters, specifically in the aftermath of the COVID-19 pandemic. Using fsQCA analysis on responses from 290 participants across 140 food companies, it reveals that blockchain-based traceability and supply chain digitalization form indispensable configurations that help manufacturers and suppliers adapt and maintain continuity during crises. Building on these findings, the second study shifts focus to consumers, examining why users resist engaging with blockchain-based traceability systems despite their known benefits. Drawing from Innovation Resistance Theory and Status Quo Bias Theory, the study analyzes responses from 339 users of QR code-enabled traceability systems (powered either by blockchain or centralized platforms). Results show resistance stems from a combination of functional, psychological, system-related, and individual barriers, with key issues including perceived security risks and information overload, regardless of the backend system used. Motivated by these user-level barriers and the findings of the first study, i.e. the need to digitalize supply chains, the third study examines how organizations can drive digital transformation through workforce enablement. It introduces the GRAAS (Growth Hacking Routes for Achieving Age-based Scalability) framework, emphasizing the importance of employee skills in scaling blockchain adoption. This mixed-method study includes qualitative interviews with 32 recruitment experts, text mining of 3,000+ job postings, and an fsQCA-based survey of 334 managerial professionals. Findings highlight dynamic organizational catalysts such as ambidextrous leadership, entrepreneurial orientation, and skills in Generative AI-based acquisition, activation, revenue management, and blockchain-based retention and referral. These findings offer actionable insights for managers and policymakers to design targeted blockchain implementation strategies and develop user-friendly platforms for blockchain engagement. They highlight the need for employee reskilling, consumer awareness

programs, and regulatory support for secure, transparent supply chains—ensuring that digital transformation efforts are inclusive, resilient, and scalable across industries.

सारांश

डिजिटल परिवर्तन आज के आपस में जुड़े हुए व्यावसायिक परिवेश में एक महत्वपूर्ण प्राथमिकता बन चुका है, जिसमें ब्लॉकचेन तकनीक विभिन्न उद्योगों में एक प्रमुख सहायक के रूप में उभर रही है। यह शोध प्रबंध, जिसका शीर्षक है "लचीलापन, सहभागिता और विकास के लिए एकीकृत ब्लॉकचेन-आधारित डिजिटल परिवर्तन विन्यास", यह अन्वेषण करता है कि कैसे ब्लॉकचेन आपूर्ति श्रृंखलाओं, उपभोक्ताओं और संगठनों को एकीकृत करके उत्पादन पारिस्थितिक तंत्र को डिजिटल रूप से रूपांतरित कर सकता है।

पहला अध्ययन प्राकृतिक आपदाओं के दौरान, विशेष रूप से कोविड-19 महामारी के बाद, आपूर्ति श्रृंखला में ब्लॉकचेन की भूमिका की जांच करता है। 140 खाद्य कंपनियों के 290 प्रतिभागियों की प्रतिक्रियाओं पर आधारित fsQCA विश्लेषण से यह सामने आता है कि ब्लॉकचेन-आधारित ट्रैसेबिलिटी और आपूर्ति श्रृंखला डिजिटलीकरण ऐसी आवश्यक संयोजन स्थितियाँ हैं जो निर्माताओं और आपूर्तिकर्ताओं को संकट की स्थिति में अनुकूलन और निरंतरता बनाए रखने में मदद करती हैं।

इन निष्कर्षों के आधार पर, दूसरा अध्ययन उपभोक्ताओं पर केंद्रित है, यह जांचते हुए कि उपयोगकर्ता ज्ञात लाभों के बावजूद ब्लॉकचेन-आधारित ट्रैसेबिलिटी सिस्टम से जुड़ने में क्यों संकोच करते हैं। इनोवेशन रेजिस्टेंस थ्योरी और स्टेटस क्को बायस थ्योरी के सिद्धांतों पर आधारित यह अध्ययन 339 उपयोगकर्ताओं के क्यूआर कोड सक्षम ट्रैसेबिलिटी सिस्टम (जो ब्लॉकचेन या केंद्रीकृत प्लेटफार्म से संचालित हैं) की प्रतिक्रियाओं का विश्लेषण करता है। परिणाम बताते हैं कि प्रतिरोध कार्यात्मक, मनोवैज्ञानिक, सिस्टम-संबंधित और व्यक्तिगत बाधाओं के संयोजन से उत्पन्न होता है, जिनमें प्रमुख समस्याएँ हैं सुरक्षा जोखिम की धारणा और जानकारी की अधिकता, चाहे बैकएंड प्रणाली कोई भी हो।

इन उपयोगकर्ता-स्तरीय अवरोधों और पहले अध्ययन के निष्कर्षों (आपूर्ति श्रृंखलाओं के डिजिटलीकरण की आवश्यकता) से प्रेरित होकर, तीसरा अध्ययन यह विश्लेषण करता है कि संगठन कर्मचारी-सक्षम रणनीतियों के माध्यम से डिजिटल परिवर्तन कैसे चला सकते हैं। इसमें GRAAS (Growth Hacking Routes for Achieving Age-based Scalability) रूपरेखा प्रस्तुत की गई है, जो ब्लॉकचेन अपनाने को बढ़ाने के लिए कर्मचारी कौशल के महत्व पर बल देती है। इस मिश्रित-प्रणाली आधारित अध्ययन में 32 भर्ती विशेषज्ञों के साथ गुणात्मक साक्षात्कार, 3000+ नौकरी विज्ञापनों का टेक्स्ट माइनिंग और 334 प्रबंधकीय पेशेवरों के

fsQCA-आधारित सर्वेक्षण शामिल हैं। निष्कर्ष बताते हैं कि एम्बिडेक्स्ट्रस लीडरशिप, उद्यमशील झुकाव और जनरेटिव एआई-आधारित अधिग्रहण, सक्रियता, राजस्व प्रबंधन, तथा ब्लॉकचेन आधारित रिटेंशन और रेफरल जैसे कौशल डिजिटल रूपांतरण के लिए गतिशील संगठनात्मक उत्प्रेरक हैं।

ये निष्कर्ष प्रबंधकों और नीति निर्माताओं को लक्षित ब्लॉकचेन कार्यान्वयन रणनीतियाँ तैयार करने, तथा उपयोगकर्ता-अनुकूल प्लेटफॉर्म विकसित करने में व्यावहारिक अंतर्दृष्टि प्रदान करते हैं। ये यह भी दर्शाते हैं कि कर्मचारी पुनः-प्रशिक्षण, उपभोक्ता जागरूकता कार्यक्रम, और सुरक्षित व पारदर्शी आपूर्ति श्रृंखलाओं के लिए विनियामक समर्थन आवश्यक है—ताकि डिजिटल परिवर्तन प्रयास समावेशी, लचीले और उद्योगों में मापनीय बन सकें।

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

Acronym	Full Form
FSS	Food Safety and Security
BBT	Blockchain-based Traceability
CCT	Company-owned cloud-based traceability
IRT	Innovation Resistance Theory
SQBT	Status Quo Bias Theory
FB	Functional Barriers
PB	Psychological Barriers
SRB	System-related Barriers
INB	Individual Barriers
STS	Sociotechnical Systems
FsQCA	Fuzzy set Qualitative Comparative Analysis
RBV	Resource-based View
GH	Growth Hacking
QRCBT	QR code-based traceability
I5.0	Industry 5.0