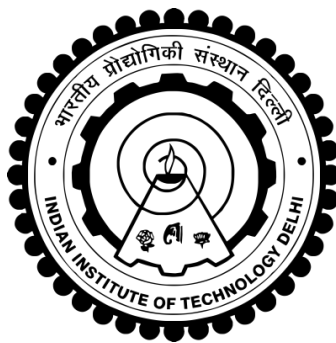


INFORMATION RISK ASSESSMENT FOR DIGITAL SERVICES IN SMART CITIES

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**DEPARTMENT OF MANAGEMENT STUDIES
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INFORMATION RISK ASSESSMENT FOR DIGITAL SERVICES IN SMART CITIES

by

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Department Of Management Studies

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CERTIFICATE

This is to certify that Thesis entitled “Information Risk assessment for Digital Services in Smart Cities” being submitted by Mr. Syed Ziaul Mustafa to the Indian Institute of Technology Delhi, for the award of the degree of Doctor of Philosophy (Ph.D.) is a record of *bona fide* research work carried out by him, He has worked under my guidance and supervision and has full filled the requirement for submission of this thesis, which has attained the standard required for Ph.D degree of this institute. The result presented in this have not been submitted in part or in full to any other university or institute for award of any degree or diploma.

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Syed Ziaul Mustafa

Abstract

In current times, cities, whether they are in developing or developed economies, are providing digital services to its citizens either through public or private organizations. It is observed that the digital services of smart cities are facing major challenge with respect to its people, economy, mobility, environment, living and governance. In this research the focus is on the different facets of information risks perceived by the customer towards the digital services available in smart cities. Literature review of the multi facets of the perceived risk (performance risk, financial risk, time risk, psychological risk, social risk, privacy risk and physical risk) has shown that there is need to map these emerging risks to the different types of digital services which is offered by the public and private organizations of the smart city. Other exploration may highlight the need for interaction-based studies which will provide insights on adoption and failure of digital services.

The study examines the conceptual model which explains the antecedents of information risk and perceived risk while sharing sensitive information for digital services. The model evaluates the information risk perceived by the consumer for sharing sensitive information while using digital services. A survey questionnaire has been administered to the experienced users of the digital service. Structural equation modelling (SEM) was used to analyze the data collected. This study provides a model to understand how much information risk is important for the end user to share their personal information while using digital services. The model highlights the importance of perceived reputation, perceived size, trust in digital service provider and perceived risk on the intent of users to provide sensitive information while using digital services. However, the limitation of this study is that data is collected from smart cities of India and thus the results may be generalizable only to emerging economies. Therefore, it would be interesting to validate the model in developed economies also. The study also provides more

in depth understanding about the determinants of information risk and its effects on the consumer to provide their sensitive information to use digital services. Also, it sheds insights on factors which affect the intent of consumers to share sensitive information for digital services. The study establishes that collectively, both information risk and perceived risk play an important role by the consumer to share the personal information online while using digital services.

Although success has been given a lot of attention in information systems (IS) research, failure has received lesser attention. The study empirically validates a model of digital service failure for consumers by integrating three dimensions from Tan's failure model and one dimensions from DeLone and Mclean information system success model. The factors have been mapped to Expectation Disconfirmation Theory (EDT). Experiential survey approach has been used to collect primary data from users who have experienced digital service failure in the past. Structural equation modeling (SEM) has been used for model testing and validation to measure the impact of information, system, functional and service failure of digital service on end users. The findings suggest that information, functional, system and service failure impact the outcome, process, cost and user satisfaction of digital service.

In this digital age, there is an increase in the usage of digital services. The aim of the study is to examine how different dimensions of risk like information risk, financial risk, psychological risk, physical risk and social risk affects the adoption of four different category of digital services namely technology-assisted, technology-facilitated, technology-mediated and technology-generated. The study develops hypothesis based on the existing theories and uses structural equation modeling to verify and validate the model. Experiential survey has been done from the consumers who are using digital services. A total of 309 responses has been collected and analyzed the conceptual model as per structural equation modeling process. The findings suggest that information risk is significant for all the four different categorizations of

digital services. Since the study has been done on four major smart cities of India, so the findings of the result are not generalizable for all the smart cities in developed countries.

सार

वर्तमान समय में, शहर, चाहे वे विकासशील या विकसित अर्थव्यवस्थाओं में हों, सार्वजनिक या निजी संगठनों के माध्यम से अपने नागरिकों को डिजिटल सेवाएं प्रदान कर रहे हैं। यह देखा गया है कि स्मार्ट शहरों की डिजिटल सेवाओं को अपने लोगों, अर्थव्यवस्था, गतिशीलता, पर्यावरण, रहने और शासन के संबंध में बड़ी चुनौती का सामना करना पड़ रहा है। इस परियोजना में हमने ग्राहक (मुख्य रूप से), साथ ही संगठन, स्मार्ट शहरों में उपलब्ध डिजिटल सेवाओं के लिए सूचना जोखिमों के विभिन्न पहलुओं पर ध्यान केंद्रित किया है। कथित जोखिम (प्रदर्शन जोखिम, वित्तीय जोखिम, अवसर / समय जोखिम, मनोवैज्ञानिक जोखिम, सामाजिक जोखिम, गोपनीयता जोखिम, शारीरिक / सुरक्षा जोखिम और समग्र जोखिम) के बहु पहलुओं की साहित्यिक समीक्षा से पता चला है कि इन उभरते जोखिमों को मैप करने की आवश्यकता है जो की विभिन्न प्रकार की डिजिटल सेवाओं को स्मार्ट सिटी के सार्वजनिक और निजी संगठनों द्वारा पेश की जाती हैं। अन्य अन्वेषण बातचीत आधारित अध्ययन की आवश्यकता पर प्रकाश डाल सकते हैं जो डिजिटल सेवाओं को अपनाने और विफलता पर अंतर्दृष्टि प्रदान करेगा।

अध्ययन में वैचारिक मॉडल की जांच की गई है जो डिजिटल सेवाओं के लिए संवेदनशील जानकारी साझा करते समय सूचना जोखिम और कथित जोखिम के बारे में बताता है। मॉडल डिजिटल सेवाओं का उपयोग करते समय संवेदनशील जानकारी साझा करने के लिए उपभोक्ता द्वारा कथित सूचना जोखिम का मूल्यांकन करता है। एक सर्वेक्षण प्रश्नावली को स्तरीकृत नमूना पद्धति का उपयोग करके डिजिटल सेवा के अनुभवी उपयोगकर्ताओं को प्रशासित किया गया है। एकत्र किए गए डेटा का विश्लेषण करने के लिए संरचनात्मक समीकरण मॉडलिंग (SEM) आयोजित किया गया था। यह अध्ययन यह समझने के लिए एक मॉडल प्रदान करता है कि डिजिटल सेवाओं का उपयोग करते समय अंतिम उपयोगकर्ता के लिए अपनी व्यक्तिगत जानकारी साझा करने में कितना जोखिम है। यह मॉडल डिजिटल सेवाओं का उपयोग करते समय संवेदनशील जानकारी प्रदान करने में उपयोगकर्ताओं की मंशा पर कथित प्रतिष्ठा और आकार, डिजिटल सेवा प्रदाता में विश्वास, कथित जोखिम, कथित सूचना गोपनीयता चिंता और सूचना प्रकार के महत्व पर प्रकाश डालता है। हालांकि, इस अध्ययन की सीमा यह है कि डेटा भारत के स्मार्ट शहरों से एकत्र किया जाता है और इस प्रकार परिणाम केवल उभरती अर्थव्यवस्थाओं के लिए सामान्य हो सकते हैं। इसलिए, विकासशील और विकसित अर्थव्यवस्थाओं में भी मॉडल को मान्य करना दिलचस्प होगा। यह अध्ययन सूचना जोखिम के निर्धारकों और उपभोक्ता पर उनकी संवेदनशील जानकारी प्रदान के प्रभावों के बारे में गहराई से समझ प्रदान करता है। इसके अलावा, यह उन कारकों पर अंतर्दृष्टि डालता है जो उपभोक्ताओं की मंशा को प्रभावित करते हैं जब वे ऐसी सेवाओं में संवेदनशील जानकारी साझा करते हैं। अध्ययन यह स्थापित करता है कि डिजिटल सेवाओं का उपयोग करते हुए व्यक्तिगत जानकारी को ऑनलाइन साझा करने में सामूहिक रूप से सूचना जोखिम और कथित जोखिम दोनों उपभोक्ता के लिए महत्वपूर्ण भूमिका निभाते हैं।

हालांकि सूचना प्रणाली (आईएस) के अनुसंधान में सफलता को बहुत अधिक ध्यान दिया गया है, विफलता पर कम ध्यान दिया गया है। यह अध्ययन टैन की विफलता मॉडल से 3 आयामों को और DeLone और

McClean सूचना सफलता मॉडल से एक आयाम को एकीकृत करके उपभोक्ताओं के लिए डिजिटल सेवा विफलता के एक मॉडल को मान्य करता है। कारकों को एक्सपेक्टेड डिस्कोनफ़ॉर्मेशन सिद्धांत (EDT) की अपेक्षा में मैप किया गया है। प्रायोगिक सर्वेक्षण दृष्टिकोण का उपयोग सूचना प्रणाली उपयोगकर्ताओं से प्राथमिक डेटा एकत्र करने के लिए किया गया है जिन्होंने डिजिटल सेवा विफलता का अनुभव किया है। संरचनात्मक समीकरण मॉडलिंग (एसईएम) का उपयोग मॉडल परीक्षण और सत्यापन के लिए किया गया है ताकि अंत उपयोगकर्ताओं पर सूचना, प्रणाली, कार्यात्मक और डिजिटल सेवा की विफलता के प्रभाव को मापा जा सके। निष्कर्ष बताते हैं कि सूचना, कार्यात्मक, प्रणाली और सेवा विफलता डिजिटल सेवा के परिणाम, प्रक्रिया, लागत और उपयोगकर्ता की संतुष्टि को प्रभावित करती है।

इस डिजिटल युग में, डिजिटल सेवाओं के उपयोग में वृद्धि हुई है। इस अध्ययन का उद्देश्य यह जांचना है कि सूचना जोखिम, वित्तीय जोखिम, मनोवैज्ञानिक जोखिम, शारीरिक जोखिम और सामाजिक जोखिम जैसे विभिन्न आयाम डिजिटल सेवाओं की चार अलग-अलग श्रेणियों को अपनाने में कैसे प्रभावित होते हैं, जैसे कि प्रौद्योगिकी-सहायता, प्रौद्योगिकी-सुविधा, प्रौद्योगिकी-मध्यस्थता और प्रौद्योगिकी-जनित। यह अध्ययन मौजूदा सिद्धांतों के आधार पर परिकल्पना विकसित करता है और मॉडल को सत्यापित करने और मान्य करने के लिए संरचनात्मक समीकरण मॉडलिंग का उपयोग करता है। जो उपभोक्ता डिजिटल सेवाओं का उपयोग कर रहे हैं, उनसे प्रयोगात्मक सर्वेक्षण किया गया है। संरचनात्मक समीकरण मॉडलिंग प्रक्रिया के अनुसार कुल 309 प्रतिक्रियाओं को एकत्रित किया गया है और वैचारिक मॉडल का विश्लेषण किया गया है। निष्कर्ष बताते हैं कि डिजिटल सेवाओं के सभी चार अलग-अलग वर्गीकरणों के लिए सूचना जोखिम महत्वपूर्ण है। चूंकि अध्ययन भारत के चार प्रमुख स्मार्ट शहरों पर किया गया है, इसलिए परिणाम के निष्कर्ष सभी स्मार्ट शहरों के लिए सामान्य नहीं हैं।

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List of Abbreviations

AGFI	Adjusted Goodness of Fit Index
AHP	Analytic Hierarchy Process
AMOS	Analysis of Moment Structures
ANOVA	Analysis of Variance
ANT	Actor-Network Theory
ATM	Automated Teller Machine
AVE	Average Variance Extracted
B2C	Business to Consumer
CB-SEM	Covariance Based Structural Equation Modelling
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CR	Construct/Composite Reliability
EDT	Expectation Disconfirmation Theory
EFA	Exploratory Factor Analysis
FF	Functional Failure
FR	Financial Risk
GANP	Generalized Analytic Network Process

GDP	Gross Domestic Product
GFI	Goodness of Fit Index
GISA	General Information Security Awareness
HDI	Human Development Index
ICT	Information and Communication Technologies
IF	Information Failure
IR	Information Risk
IS	Information System
ISO	International Standard Organization
ISR	Information Security Risk
ISRA	Information Security Risk Assessment
ISRM	Information Security Risk Management
IT	Information Technology
KMO	Kaiser-Meyer-Olkin
MAMCA	Multi-Actor Multi-Criteria Analysis
MSV	Maximum Shared Variance
MVWSSA	Multi-View Work System Security Assessment
NDMC	New Delhi Municipal Corporation
NEC	Network Environment Characteristics

NT	Network Trust
OPCU	Output, Process, Cost and User Satisfaction
PhR	Physical Risk
PIPC	Perceived Information Privacy Concern
PLS	Partial Least Square
PR	Perceived Risk
PROMETHEE	Preference Ranking Organization METHod for Enrichment of Evaluations
PRS	Perceived Reputation and Size
PsR	Psychological Risk
R&D	Research and Development
RMSEA	Root Mean Square Error of Approximation
SE	Standardize Estimate
SeF	Service Failure
SEM	Structural Equation Modelling
SIDC	Sensitive Information for Digital Service
SR	Social Risk
SyF	System Failure
TA	Technology-Assisted

TF	Technology-Facilitated
TG	Technology-Generated
TM	Technology-Mediated
TSP	Trust in Service Provider
UDS	University Digital Signage