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A MODEL FOR MEASURING THE INTERNET BANKING INTERFACE QUALITY

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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DEDICATIONS

I would like to dedicate this thesis to

Professor Datuk Dr. M Nasir Shamsudin

on his amiable support and intelligent decisions made by him during my PhD journey in Universiti Putra Malaysia

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

A MODEL FOR MEASURING THE INTERNET BANKING INTERFACE QUALITY

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MAHGOUB ELRADI AHMED SIDDIG

November 2018

Chairman: Rusli Haji Abdullah, PhD
Faculty: Computer Science and Information Technology

Internet Banking Service Quality (IBSQ) measurement is still an evolving research area in the field of service quality measurement. Service quality measurement still remains one of the competitive strategies for Internet banking (IB) service providers in order to achieve higher performance and an increase in adoption by users. IBSQ provides platform for evaluating services provided by IB service providers based on consumption experience(s).

Literature study conducted shows that the existing IBSQ measurement models includes different Service Quality (SQ) dimensions, which are insufficient in measuring Internet Banking Interfaces (IBIs) service quality. Thus, user experience for ensuring customer satisfaction, user–friendliness, and loyalty due to lack of human face–to–face communication are not adequately measured. Moreover, these models do not have mechanism that provide adequate response to particular concerns and requests of individual users. In addition to IBIs service quality measurement associated problems, different existing methodological approaches used in the development of IBSQ measurement models, also have their associated problems. Thus, in this research work, we propose a method that have a holistic and rigorous measurement model that addresses such limitations. The proposed model address the associated problems with IBSQ measurement by analyzing, identifying and categorizing those dimensions for measuring IB services quality, which have an impact on users' attitudes and intentions for continuous use of IBIs.

An empirical study using a survey questionnaire was conducted among 494 respondents from IB users to validate the IBSQ dimensions, and further propose the Internet Banking Interface Quality Model (IBIQM). In this respect, two dif-

ferent tests were carried out to validate the proposed model. The first test carried out was targeted towards collecting feedback from experts while the second test collect responses from end-users. The prototyped interface was evaluated using an extended Technology Acceptance Model (TAM) test that make use of a survey conducted among 23 undergraduate students. This extended TAM test comprises of five main constructs, which include perceived enjoyment, perceived ease of use, perceived usefulness, attitude toward, and intention to use interface.

The results of the empirical study demonstrates the validity of the proposed model. The prototype was validated by an experts from academics and professionals in the banking sector. The result of expert review confirmed the applicability of prototyped interface for the future development of IBIs. This research shed light on the improvement of IBSQ in a way to effectively evaluate IBIs with Malaysia context as an empirical case study. According to the performance limitations of the SQ dimensions, an IBIQM was proposed with an emphasis on Virtual Reality (VR) integration as an effective solution.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

MODEL UNTUK MENGUKUR KUALITI ANTARA MUKA PERBANKAN INTERNET

Oleh

MAHGOUB ELRADI AHMED SIDDIG

November 2018

Pengerusi: Rusli Haji Abdullah, PhD
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Pengukuran Kualiti Perkhidmatan Perbankan Internet (IBSQ) masih merupakan penyelidikan yang berkembang dalam bidang pengurusan kualiti perkhidmatan. Pengukuran kualiti perkhidmatan masih menjadi salah satu strategi persaingan kepada penyedia perkhidmatan perbankan Internet (IB) demi mencapai prestasi dan peningkatan penggunaan yang lebih tinggi oleh pengguna. IBSQ menyediakan platform bertujuan menilai perkhidmatan yang disediakan oleh pembekal perkhidmatan IB berdasarkan pengalaman penggunaan.

Kajian literasi yang telah dijalankan mendapati model IBSQ yang sedia ada menggunakan dimensi Kualiti Perkhidmatan (SQ) yang berbeza, dan ianya tidak mencukupi dalam mengukur perkhidmatan Antaramuka Perbankan Internet (IBI). Oleh itu, pengalaman pengguna untuk memastikan kepuasan pelanggan, keramahan pengguna, dan kesetiaan kerana kurangnya komunikasi bersemuka manusia tidak dapat diukur secukupnya. Tambahan pula, model-model ini tidak mempunyai mekanisme yang memberikan tindak balas yang mencukupi terhadap kebimbangan dan permintaan tertentu pengguna individu. Di samping masalah pengukuran kualiti perkhidmatan IBI yang berkaitan, pelbagai kaedah metodologi yang sedia ada yang digunakan dalam pembangunan model pengukuran IBSQ. Oleh itu, penyelidikan ini mencadangkan satu kaedah yang mempunyai model pengukuran holistik dan ketat bagi menangani batasan tersebut. Model yang dicadangkan menangani masalah berkaitan pengukuran IBSQ dengan menganalisis, mengenalpasti dan mengkategorikan dimensi tersebut untuk mengukur kualiti perkhidmatan IB, yang memberi kesan kepada sikap dan niat pengguna untuk penggunaan berterusan IBI.

Kajian empirikal menggunakan tinjauan soal selidik telah dijalankan dalam

kalangan 494 responden dari pengguna IB untuk mengesahkan dimensi IBSQ dan seterusnya mencadangkan Model Kualiti Antara Muka Perbankan Internet (IBIQM) untuk mengukur IBI. Matlamat utama adalah untuk membangunkan prototaip antara muka IB. Dua ujian berbeza telah dijalankan untuk mengesahkan prototaip yang dicadangkan. Ujian pertama dijalankan untuk mendapatkan maklum balas daripada pakar manakala ujian kedua mengumpulkan maklum balas dari pengguna akhir. Antaramuka prototaip telah dinilai menggunakan ujian Technology Acceptance Model (TAM) lanjutan melalui kaji selidik dalam kalangan 23 orang pelajar sarjana muda. Ujian TAM lanjutan ini terdiri daripada lima pemboleh ubah utama, iaitu keseronokan yang dirasakan, kemudahan penggunaan yang mudah, kegunaan yang diharapkan, sikap terhadap, dan niat untuk menggunakan antara muka.

Hasil kajian empirikal menunjukkan kesahihan model yang dicadangkan. Prototaip ini telah disahkan oleh ahli akademik dan profesional dalam sektor perbankan. Hasil ulasan pakar mengesahkan penggunaan antara muka prototaip untuk pembangunan masa depan IBI. Kajian ini berupaya untuk memberi penerangan mengenai penambahbaikan IBSQ untuk menilai secara berkesan IBI dalam konteks Malaysia sebagai kajian kes empirikal. Berdasarkan kekangan prestasi dimensi SQ, IBIQM telah dicadangan dengan penekanan kepada integrase reality maya sebagai penyelesaian yang berkesan.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy.

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LIST OF ABBREVIATIONS

2D	Two Dimensional
3D	Three Dimensional
AGFI	Adjusted Goodness of Fit Index
AMOS	Analysis of Moment Structures
AR	Augmented Reality
AVE	Average Variance Extracted
B2B	Business –to –Business
B2C	Business –to –Consumer
BNM	Bank Negara Malaysia
C2B	Consumer –to –Business
C2C	Consumer –to –Consumer
CB-SEM	Covariance Based Structural Equation Modeling
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
Chi-Sq.	Discrepancy Chi Square
CR	Construct Reliability
DOI	Diffusion Of Innovation
EBSE	Evidence-based Software Engineering
e-Commerce	Electronic Commerce
e-Service	Electronic Service
e-SQ	Electronic Service Quality
GFI	Goodness of Fit Index
GUI	Graphic User Interface
HTTP	Hyper Text Mark-up Language
IB	Internet Banking
IBIs	Internet Banking Interfaces
IBIQM	Internet Banking Interface Quality Model
IBSQ	Internet Banking Service Quality
ICT	Information Communication Technology
IFI	Incremental Fit Index
IS	Information Systems
ISI WOS	Institute of Scientific Information Web Of Science
IT	Information Technology
KMO	Kaiser-Meyer-Olkin
LR	Literature Review
m-Commerce	Mobile Commerce
MIS	Management Information Systems
MM	Measurement Model
MRT	Media Richness Theory
MUVEs	Multi-User Virtual Environments
NFI	Normed Fit Index
PCA	Principle Components Analysis
PEOU	Perceived Ease Of Use
PhD	Degree of Doctor of Philosophy
PIDM	Person-Item Differential Map
PLS-SEM	Partial Least Squares Structural Equation Modeling
PoC	Proof of Concept

PQM	Product Quality Measurement
PRT	Perceived Risk Theory
PU	Perceived Usefulness
QES	Quality of Electronic Service
RMSEA	Root Mean Square of Error Approximation
RUMM	Rasch Unified Measurement Method
SCT	Social Cognitive Theory
SEM	Structural Equation Modeling
SIDE	Social Identity De-individuation Effects
SLR	Systematic Literature Review
SM	Structural Model
SPSS	Statistical Package for the Social Sciences
SQ	Service Quality
SRS	Simple Random Sampling
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behavior
UI	User Interface
UTAUT	Unified Theory of Acceptance and Use of Technology
VR	Virtual Reality
VREs	Virtual Reality Environment(s)
WWW	World Wide Web

DEFINITION OF TERMS

Internet Banking Interfaces (IBIs) refers to Internet portals through which users can use different kinds of IB services ranging from bill payment to investing (Pikkarainen et al., 2004).

Service Quality (SQ) refers to the subjective comparison that customer makes regarding the quality of the service they want to receive and what they get (Gefen, 2002).

Internet Banking Service Quality (IBSQ) refers to the overall subjective judgment/evaluation of service quality offered by IB service providers based on consumption experience(s), where various types of emotions can be elicited (Roy et al., 2015).

Technology Acceptance Model (TAM) suggests that the IB adoption is affected by perceived ease of use (PEOU), and perceived usefulness (PU) which consequently specify the attitudes toward behavior that influence behavioral intention to use and finally the actual IB interface use (Davis et al., 1989).

Diffusion of Innovation (DOI) Theory refers to the degree to which IB interface is perceived better than traditional bank branch (Rogers, 1983).

Perceived Ease of Use refers to the degree to which person believes that using a particular system would be free of effort (Davis et al., 1989).

Perceived Usefulness refers to the degree to which a person believes that using a particular system would enhance his or her job performance (Davis et al., 1989).

Attitude Toward Behavior refers to the degree to which IB users' agreement or disagreement ratings toward IB interface SQ dimensions (Fishbein and Ajzen, 1975).

Behavioral Intention refers to the degree to which IB user's belief that he or she will continue to use the IB interface(Venkatesh et al., 2003).

Virtual Reality (VR) or Three–Dimensional (3D) Technology refers to a multi–user virtual environments (MUVEs) computer technology which simulates the physical interface and user's physical presence in a virtual or imaginary

environment (Mennecke et al., 2008).

Virtual Reality Internet Banking (VR IB) Interface refers to a multi–user virtual environments (MUVEs) computer technology which simulates the physical bank interface and user's physical presence in a virtual Bank's environment (Mennecke et al., 2008).

Media Richness Theory (MRT) refers to IB users' performance which can be improved by matching media characteristic to the needs of information processing tasks (Daft and Lengel, 1986).

Flow Theory refers to an user experience with a IB interface in which the user becomes engaged in a IB interface if he/she experience the effects of flow. If not, they will suffer anxiety and boredom (Hoffman and Novak, 1996; Koufaris, 2002).

Presence Theory refers to the extent to which an IB user feels present in a 3D virtual reality IBI rather than in a physical bank interface (Novak et al., 2000).

Proof of Concept (PoC) is a demonstration, the purpose of which is to verify that certain concepts or theories have the potential for real–world application. POC is therefore a prototype that is designed to determine feasibility, but does not represent deliverables.

CHAPTER 1

INTRODUCTION

1.1 Research Background

There has been a tremendous change in business and commerce in recent time as a result of the applications of Internet Technology. According to the report by Stats (2016), the number of Internet users worldwide has reached 3.6 billion as at the end of June 2016. This number represents almost 50% of the world's population. Consequently, people are becoming more willing to shop online rather than going to off-line physical stores.

Several types of electronic Commerce (e–Commerce) business models have emerged because of the revolution of the Internet Technology applications. However, the important types of e–commerce applications generally have been categorized into four categories namely, Business –to –Consumer (B2C), Business –to –Business (B2B), Consumer –to –Consumer (C2C), and Consumer –to –Business (C2B). In the recent years, the new trend of mobile commerce (m-Commerce) are newly-visible for the delivery of e-Commerce abilities directly into user's mobile device, anywhere, using wireless technology. In the context of B2C e–commerce applications, numerous models have been developed to facilitate trading in products and services. For example, online banking, online shopping and order tracking, electronic tickets, payment systems, and social networking.

In both contemporary and traditional business environments, the most profitable services provided to the users become an academic area attracting growing research interest. These academic research areas include Marketing, Management, and Information Systems (IS). Therefore, it has become imperative for academic researchers, service providers, and users to realize the importance of qualitative services offered by banks through effective and efficient banking interfaces. The Service Quality (SQ) and profitability become interdependent yard sticks for the promotion and success of businesses globally. Thus, the benefits extend to Service Providers and Users.

In the service providing sectors of which Internet Banking (IB) is a typical example, the use of Internet Technology is essential. Before the emergence of Internet Technology, there has been an existing banking service through "bricks–and–mortar" physical bank branches. The introduction of the Internet Banking Interfaces (IBIs) complements the existing off-line bank services through effective mutually beneficial user–service provider relationships regarding quality services for the users and consequently profitability for services providers. IB as

part of online banking is the most popular delivery channel for banking services operated through the Internet (Aladwani, 2001; Cheng et al., 2006; Tan and Teo, 2000).

Moreover, it is now one of the most profitable online banking applications and has provided benefits to both customers and banks respectively (Kundu and Datta, 2014). Consequently, several Internet Banking Service Quality (IBSQ) models have been developed to allow the bank's users to carry out both transactional and informational tasks such as fund transfers, bill payments, viewing account balance, ordering cheque books (Tan and Teo, 2000). Therefore, as a consequence of fierce competition and the large market of IB service, the analysis and measurement of IBSQ issues has become an area of growing interest for both researchers and practitioners ((Bauer et al., 2005; Jayawardhena, 2004; Wu et al., 2012).

In sum, several studies have investigated the indicators for monitoring IBSQ. These studies established a basic understanding of IBIs dimensions regarding services categories such as functional quality aspects, customer SQ aspects, hedonistic quality aspects, and banking SQ aspects. These dimensions of IBSQ have been adopted based on both the traditional and e–SQ literature that provided the theoretical frameworks & models, measurement scales (Loiacono et al., 2007; Parasuraman et al., 1988, 1985; Santos, 2003). Nevertheless, there are limitations for these studies, e.g., it depends fundamentally in web site's technical quality rather than human-aspects of SQ such as competence, enjoyment, and empathy. Therefore, the guidelines and indicators for IBSQ monitoring is necessary to address these limitations.

1.2 Research Motivation

IBIs as part of the B2C e–commerce applications poses the challenges of how best these interfaces deliver a higher level of SQ to satisfy users' needs and demands. It is also an essential factor for IB service providers to survive in the competitive e–commerce environment, and to improve profitability as well. Existing IBSQ models proven to be insufficient for the users (Herington and Weaven, 2009; Khan and Mahapatra, 2008).

Therefore, an effective and efficient IBSQ control is needed to address some challenges. **First**, identification of SQ dimensions that include the human–related aspects as well as technological aspects to satisfy the users' needs efficiently and accurately. **Second**, resolves the problem of lacking human contact in IBIs by prototyping a Virtual Reality (VR) IBIs that simulate the physical bank's branch. **Third**, simulates the feeling of being in the physical banking interfaces (off-line branches) to give users more confidence in carrying out banking transactions.

Fourth, offer the similar experience to IBIs users as in physical bank branches. **Finally**, attracts, retains users and encourage them to continue using IBIs.

In sum, existing IBIs cannot completely resolve these challenges, and hence SQ provided by such interfaces are not sufficient and still not being fully satisfied from IB user's perspective (Walker and Johnson, 2005; Kundu and Datta, 2014).

1.3 Problem Statement

In the existing literature, various IBSQ models have been developed, in different countries, from four research points of view that include Finance, Marketing, IS, and Service Management (Hanafizadeh et al., 2014). These models comprise different SQ dimensions for measuring IBIs quality (Kundu and Datta, 2014; Wu et al., 2012). Therefore, various SQ models with different dimensions are applied to measure IBSQ in different country-contexts. Furthermore, several previous studies have demonstrated that the relationships existed between SQ dimensions and the users' anticipated attitudes, behavior, and behavioral intention response such as satisfaction, trust, and loyalty (Ayo et al., 2016; Amin, 2016; Kundu and Datta, 2015).

The SQ models of existing Internet banking interfaces are still insufficient regarding quality and user experience for ensuring customer satisfaction, user–friendliness, and loyalty due to lack of human face–to–face communication (Amin, 2016; Gupta and Bansal, 2012; Akinci et al., 2010; Walker and Johnson, 2005). Moreover, these models may not be sufficient to respond adequately to particular concerns and requests of individual users. Hence, the service models cannot personalize the service encounter and respond to complaints, and also cannot replace the ability of a service representative in a physical bank branch who listens, empathize, and provides a customized and personalized response to individual users' need and demand (Walker and Johnson, 2005). Therefore, the development of holistic and rigorous measurement models based on both Internet SQ and IBSQ to measure IBIs is needed (Kundu and Datta, 2014).

In the previous literature, different methodological issues such as country-context, type of research methods, dimensionality analysis procedure, psychometric properties, and the type of inferential analysis have been applied in the development of IBSQ measurement models (Ladhari, 2010; Wu et al., 2012). However, there have been limitations associated with these models (Ladhari, 2010). The identification of the limitations associated with these methods represent a basic guideline which in turn yields a rigorous research methodology for the development of IBSQ models for measuring IBIs.

1.4 Research Questions

This section presents the research questions and sub–questions. The four research questions are derived as follows:
RQ1. What are the existing SQ dimensions/indicators of the IB interfaces in previous literature that have influences on the users' adoption and acceptance of IB services?
RQ2. What are the major IB services quality models for the measurement of IB interfaces?
RQ3. How to measure IB service quality effectively and efficiently?
RQ4. What is the methodological limitations for the development of Internet Banking Service Quality (IBSQ) models?

For research Q1and Q3, three sub–questions are derived and there as follows:

RQ1a. What are the important SQ dimensions for measuring IBSQ?
RQ1b. How will these dimensions support in IBIs?
RQ3a. How to develop a comprehensive and distinctive instrument to measure IBSQ?

1.5 Research Objectives

The aim of this research is to develop a measurement model to measure Internet banking interfaces (IBIs) services' quality. In other words, the objectives of this thesis are as follows:

1. To analyze the dimensions for measuring Internet banking service's quality which has an impact on users' attitudes and intentions to continue in using IB services.
2. To identify and categorize the dimensions for measuring Internet banking service quality.
3. To propose Internet Banking Interface Quality Model (IBIQM) for measuring Internet Banking Interfaces (IBIs) services' quality.

1.6 Research Scope

This study mainly focuses on the development of IBSQ model which identified the SQ dimensions to measure IBIs. This research also focuses on the validation of proposed IB interface in Virtual Reality Environment (VRE) by using a Proof of Concept (PoC) technique.

1.7 Operational Definitions of Service Quality Dimensions

The nine IBSQ dimensions/indicators used in the present study were operationally defined to give a clear understanding and direction.

1. **Response and Contact Dimension** refers to the ability of IB interface users to get help if there is any problem or question (problem handling). The contact is availability of IBIs assistance through telephone, chatting, email or online representatives (Parasuraman et al., 2005; Wu et al., 2012).
2. **Reliability Dimension** refers to the ability of IB interface to perform the promised service dependably and accurately (Parasuraman et al., 1988).
3. **Ease of Use Dimension** refers to the degree to which IB interface design quality is easy to use such as easy navigation, a speed of response, a well organized/structure and ease of completing an online transaction (Jun and Cai, 2001; Yang et al., 2004).
4. **Security and Privacy Dimension** refers to the degree of IB user credibility as to whether the IB interface is secure and if personal information protected (Parasuraman et al., 2005; Yang et al., 2004).
5. **Efficiency Dimension** refers to the degree to which users of IB interface completing banking transactions quickly and efficiently with a minimum effort which involves login/pages download speed and fast communication with the bank's representatives (Gupta and Bansal, 2012; Parasuraman et al., 2005).
6. **Product and Service Portfolio Dimension** refers to the range of products and services that are offered to the users by IB interface (Jun and Cai, 2001; Yang et al., 2004).
7. **Enjoyment Dimension** refers to the degree to which IB interface is enjoyable (Davis et al., 1992; Novak et al., 2000).
8. **Competence Dimension** refers to the degree to which bank's employees ability to answer user questions, their ability to resolve problems that arise, and compliance with customer request (Yang et al., 2004).

9. **Relative Advantage Dimension** refers to the degree to which IB interface is perceived better than traditional bank branch regarding aspects of convenience, security, cost, and control for the user's banking activities (Gerrard and Barton Cunningham, 2003).

1.8 Thesis Organization

The overall structure of the thesis is organized into seven chapters as follows:
Chapter 1: is the introductory chapter presenting the research background of the study, problem statement, research questions, and research objectives, the scope of research, research contribution, the definition of terms, and organization of thesis.
Chapter 2: Presents the literature review regarding the following issues: the concepts of SQ, the IBSQ models, VR and VR commerce research, the gap analysis, and the conceptual/theoretical model of IBSQ for measuring IBIs.
Chapter 3: Explains and covers the structure of the methodology for this thesis.
Chapter 4: Explains and covers the result of preliminary study.
Chapter 5: Describes the hypothesized IBSQ model. This chapter discusses the model's components in details.
Chapter 6: Describes the prototype development for the Proof of Concept.
Chapter 7: Presents results and discussions of research model regarding model development and prototype development results.
Chapter 8: Presents the conclusions, research contributions, and suggested future works.

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LIST OF PUBLICATIONS

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