ปัจจัยที่มีผลต่อการใช้บริการทางการเงินผ่านโทรศัพท์เคลื่อนที่ในประเทศไทย

DETERMINANTS OF INTENTION TO USE MOBILE FINANCIAL SERVICES SYSTEMS IN THAILAND

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บทคัดย่อ

การพัฒนาเทคโนโลยีสารสนเทศและการสื่อสารได้เปิดใช้ระบบที่ให้บริการทางการเงินผ่านโทรศัพท์เคลื่อนที่เพื่อให้ธุรกิจและลูกค้าสามารถสื่อสารกันได้โดยไม่จำกัดเวลาหรือสถานที่ ดังนั้นจึงได้ทำศึกษาเกี่ยวกับปัจจัยที่มีผลต่อการใช้บริการทางการเงินผ่านโทรศัพท์เคลื่อนที่ของแต่ละบุคคลโดยได้แบบจำลองทางทฤษฎีมาจากการศึกษาวิเคราะห์ และพัฒนาโดยใช้ข้อมูลที่เก็บรวบรวมโดยแบบสอบถามจากผู้ใช้ระบบบริการทางการเงินผ่านโทรศัพท์เคลื่อนที่จำนวน 355 รายในกรุงเทพมหานคร ซึ่งมีผลการวิจัยหลายชิ้นจากการศึกษาก่อนหน้านี้มีข้อค้นพบใหม่ๆ ที่เกี่ยวข้องกับลักษณะเฉพาะของกลุ่มตัวอย่าง (เพศ อายุ ระดับการศึกษา รายได้และประสบการณ์การใช้งานบริการทางการเงินผ่านโทรศัพท์เคลื่อนที่) ผลกระทบเชิงสาเหตุโดยตรงระหว่างตัวแปรการเคลื่อนที่ การรับรู้ประโยชน์ของค่าใช้จ่าย ความซับซ้อน ความสามารถในการเข้าถึง ความเข้ากันได้ การรับรู้ความเสี่ยงและความตั้งใจที่จะใช้บริการทางการเงินผ่านโทรศัพท์เคลื่อนที่ซึ่งขัดกับผลการวิจัยที่รายงานในการศึกษาก่อนหน้านี้ และผลกระทบที่เห็นได้ชัดก็ต่อเมื่อมีการวิเคราะห์ผลกระทบทางอ้อมด้วยความสะดวกสบาย ความพึงพอใจทางสังคม ผลประโยชน์ทางเศรษฐกิจ ความซับซ้อน ความสามารถในการเข้าถึง ความเข้ากันได้ การรับรู้ความเสี่ยงและความตั้งใจที่จะใช้บริการทางการเงินผ่านโทรศัพท์เคลื่อนที่ ผลที่ตามมาของข้อค้นพบนี้ถูกนำเสนอในรูปแบบลำดับชั้นของวัตถุประสงค์เชิงปฏิบัติและดำเนินการที่เกี่ยวข้องซึ่งคาดว่าจะเป็นประโยชน์สำหรับผู้ที่รับผิดชอบในการออกแบบส่งเสริมและการดำเนินงานของระบบบริการทางการเงินผ่านโทรศัพท์เคลื่อนที่โดยเฉพาะอย่างยิ่งธนาคารต่างประเทศที่ดำเนินงานในประเทศไทยและบุคคลที่สนใจในการกำลังพิจารณาการยอมรับของระบบการใช้บริการทางการเงินผ่านโทรศัพท์เคลื่อนที่เหล่านี้

คำสำคัญ: โมบายไฟแนนเชียลเซอร์วิส โมบายแบงค์กิ้ง โมบายเพย์เม้นท์ ทฤษฎีการแพร่กระจายนวัตกรรม โมเดลการยอมรับเทคโนโลยี

Abstract

Developments in information and communication technologies have enabled the introduction of systems that provide Mobile Financial Services (MFS) allowing businesses and customers to communicate with each other without the limits of time or place. The study examines the determinants for an individual's intention to continue to use MFS systems. A theoretical model is derived from previous studies, analyzed, and developed using data collected by questionnaire from 355 users of MFS systems in Bangkok, Thailand. Many findings from previous studies are confirmed but new findings are presented related to: descriptive characteristics of the subjects (gender, age, level of education, income, and MFS experience); direct causal effects among the variables Mobility, Perceived Usefulness, Perceived Cost, Complexity, Reachability, Compatibility, Perceived Risk, and Intention to Use MFS which are contrary to findings reported in previous studies; and effects that are only evident when indirect effects are analyzed involving Convenience, Social Desirability, Economic Benefit, Complexity, Reachability, Compatibility, Perceived Risk, and Intention to Use MFS. The practical implications of the findings are presented in the form of hierarchies of practical objectives and associated actions which are expected to be of interest to those who are responsible for the design, promotion, and operation of MFS systems especially foreign banks operating in Thailand as well as individuals who are considering the adoption of these systems.

Keywords: Mobile Financial Services, Mobile Banking, Mobile Payment, Innovation Diffusion Theory, Technology Acceptance Model.

Introduction

There has been a steady increase in the role and importance of the digital economy in the global economics. Wireless communication devices have evolved to support methods to reach customers, increasing their choices, their convenience, and the speed of transactions. Participating in the digital economy creates competitive advantages for organizations. In particular, those enable banks and other financial institutions to focus on the importance of the growth of revenues and profits. They can conduct financial transactions 24 hours/day and this reduces the costs of location and staff. As well as being a modern media used to exchange information quickly. Mobile Financial Services (MFS) are comparable to a virtual bank where anyone can conduct financial transactions whether they are physically located in Thailand or elsewhere. The growth of MFS in relation to digital economies makes the understanding of the factors that affect their adoption and continued use by individuals an important issue.

The results of previous studies and reports had demonstrated advantages of using MFS. This practice allows for convenient payment, fast, and safe behavior and especially meets the needs of users in urban areas. However, MFS also plays an important

role in promoting access to financial services for users in remote or inaccessible areas where ATM machines are not necessarily convenient for access to financial services. Using MFS money changes hands more often and overall this impacts on economic growth as a whole [5]. At present MFS can be divided into two distinct categories: Mobile Banking (M-Banking) and Mobile Payment (M-Payment) [6].

Mobile Banking involves banking transactions through mobile device. Users must register with the bank for financial services such as money transfers between bank accounts, checking account trading, and funding/setting automated alerts. Payment transactions and payment of invoices by the Mobile Banking is part of electronic Mobile Payment. Payment transactions are done via mobile phone where the funds used may be deducted from debit/credit bank accounts or from an electronic pocket (Mobile wallet/ Mobile money). These services are currently provided by non-financial institutions (i.e. Non-banks) by service providers using mobile networks to transfer funds using Mobile Money to pay merchants for goods and services [5].

It is seen that the value and volume of transactions with MFS in Thailand have been increasing across the period 2009 – 2013. The total transactions in 2013 amounted to 482 million items worth up to 775 billion but and compared with the previous year they grew by 32.5 percent and 69.2 percent, respectively [5]. The growth in MFS systems means a growth in competition and banks and other financial institutions have to adopt strategies to create competitive advantage. New offerings and services using technology are needed to attract and retain users. Users want convenience and speed for financial transactions. Banks have introduced mobile transaction services and other services that can be activated via mobile device anywhere at any-time. Table 1 provides information on Internet Banking and Mobile Banking in Thailand across the period 2011-2015.

Table 1: Payment transactions using Mobile and Internet Banking in Thailand 2011-2015

Year	2015	2014	2013	2012	2011
Payment transactions through Mobile Banking					
The number of customer accounts use the service	10,428,721	6,229,960	1,164,796	864,312	706,439
Transaction volume	248,112	109,350	57,199	36,285	19,942
Transaction value	2,570	1,364	752	440	187
Payment transactions through Internet Banking					
The number of customer accounts use the service	11,964,561	10,159,971	8,033,061	6,645,161	5,626,192
Transaction volume	203,321	188,409	161,784	125,277	83,841
Transaction value	23,882	20,500	19,548	14,112	8,780

Note: (a) Transaction volumes are measured in thousands; **(b)** Transaction values are measured in billions of baht

Source: Bank of Thailand, 2015

As presents in Table 1, there have been steady increases from 2011 to 2015 in Mobile Banking customer accounts (average 2.4 million per year), transaction volume (average 57 million transactions per year), and transaction value (average 596 billion baht per year) [5]. The number of Internet Banking customer accounts has increased on average by 1.6 million per year which is less than for Mobile Banking (2.4 million per year). The transaction volume per year has increased on average by 30 million per year which is less than for Mobile Banking (57 million per year). However, despite an average annual increase in the value of Mobile Banking transactions of 596 billion baht per year the value of Mobile Banking transactions in 2015 (2,570 billion baht) is only about 11 percent of the value of transactions using Internet Banking (23,882 billion Baht).

Technology adoption has been studied from several theoretical perspectives including the Theory of Reasoned Action (TRA) [14]; the Technology Acceptance Model (TAM) [11]; the Theory of Planned Behavior (TPB) [2]; and Diffusion of Innovation Theory (DOI) [37]. [45] notes that together with TAM and indirectly with TRA/TPB the DOI have one of the theories used most often to explain the adoption and continued use of technologies such as MFS. In this study, as discussed in the review of the related literature, DOI was central to the development of the theoretical model incorporating three groups of factors related to: access to MFS; psychological factors; and usage expectations.

Against this background the overall purpose of the study is to identify and understand the factors that determine an individual's continued use of MFS. The outcomes of this study are expected to contribute to a theoretical understanding of an individual's intentions to continue to use MFS and to provide practical advice for those who are responsible for the design, promotion, and operation of MFS especially foreign banks operating in Thailand as well as individuals who are considering the adoption of these systems.

Related Literature

The purpose of the review was to identify among recent studies the important variables which have been shown to influence an individual's intentions to use MFS. In line with the nature of this study the review focused on previous studies in developing nations which have used surveys to collect data and quantitative methods for analyses. An overview of related studies is presented first followed by a discussion of the important variables and their relationships which form the basis for the development of a theoretical model.

An Overview of Previous Studies

Table 2 presents a summary of previous studies of MFS in other countries including the focus of the study; the research approach and the data collection methods. From Table 2 it is seen that there have been a large number of studies on MFS worldwide conducted in nations at different stages of economic development and at different levels of maturity with respect to the use of information technologies. All of the studies in Table 2 have focused on personal use of MFS where the unit of analysis is an individual user. Less attention has been given to the more complicated corporate use of MFS.

Table 2: Previous studies of Mobile Financial Services (MFS)

Country	Project Focus	Research Approach	Data Collection Methods	References
United States of America	Segmenting the non-adopter category in Banking	Explanatory Quantitative	Questionnaire	Eun-Ju et al. [12]
	Personal innovativeness, social influences and adoption of wireless Internet service via mobile technology	Explanatory Quantitative	Questionnaire	June et al. [25]
	Understanding Mobile handheld device use and adoption	Explanatory Quantitative	Questionnaire	Suprateek and John [39]
	Innovation characteristics and Innovation adoption implementation of a meta- analysis of finding	Explanatory Qualitative and Quantitative	Interview and Questionnaire	Louis and Katherine [30]
Finland	Mobile Banking innovators and adopters about how they differ from other online users	Explanatory Quantitative	Questionnaire	Tommi [41]
	Exploring consumer adoption of Mobile Payment	Explanatory Qualitative	Interview	Niina [33]
Sweden	Consumer acceptance of Mobile Payment service	Explanatory Quantitative	Questionnaire	Peter and Rasmus [34]
	Mobile multimedia service	Explanatory Quantitative	Questionnaire	Lindqvist and Svensson [28]
Germany	Predicting young consumers take up of Mobile Banking Service	Explanatory Quantitative	Questionnaire	Nicole et al. [32]
	The acceptance and usage for condition of Mobile Payment procedures	Explanatory Quantitative	Questionnaire	Key [26]
Iran	Mobile Banking acceptance by the customer in Iranian Banks	Explanatory Quantitative	Questionnaire	Saidat et al. [38]
African	The unified theory of acceptance and use of technology combined with cultural moderators to understanding Mobile Banking	Explanatory Quantitative	Questionnaire	Goncalo and Tiago [16]
Saudi Arabia	Mobile Bank adoption application	Explanatory Quantitative	Questionnaire	Ibrahim and Sadiq [19]
Nigeria	Mobile Banking Adoption	Explanatory Quantitative	Questionnaire	Felix, Omolola and Irwin [13]
Bangladesh	Mobile Finance Service an overview of market development	Explanatory Quantitative	Questionnaire	Bangladesh Bank Officials [4]
China	Consumers attitudes toward online and Mobile Banking	Explanatory Qualitative and Quantitative study	Interview and Questionnaire	Sylvie and Xiaoyan [40]

Table 2: (Continued)

Country	Project Focus	Research Approach	Data Collection Methods	References
Singapore	The moderating effect of gender in the adoption of Mobile Banking	Explanatory Quantitative	Questionnaire	Hernan and Rosa [18]
	The diffusion of Internet Banking among consumers	Explanatory Quantitative	Questionnaire	Philip and Barton [35]
Malaysia	The adoption of Mobile Banking	Explanatory Quantitative	Questionnaire	Hanudin et al. [17]
	Mobile Payment adoption a conceptual framework and modeling user trust	Explanatory Quantitative	Questionnaire	Uchenna et al. [43]
Indonesia	Understanding of the mediating role of trust in Mobile Banking Service	Explanatory Quantitative study	Questionnaire	Chulmo and Yulia [9]
Thailand	Mobile Banking adoption of behavioral, security and trust	Explanatory Quantitative	Questionnaire	Chat [8]
	Mobile Banking in Bangkok and comparison with other countries	Explanatory Qualitative and Quantitative	Interview and Questionnaire	Jiraporn et al. [23]
Taiwan	Mobile knowledge management understand of the behavioral intention to use	Explanatory Quantitative	Questionnaire	Jeung and Chihui [22]
	Analyse consumer behavioral intention to mobile text message coupons	Explanatory Qualitative and Quantitative	Interview and Questionnaire	Tsuen-ho et al. [43]
	The drives Mobile Commerce and an empirical evaluation	Explanatory Quantitative	Questionnaire	Jen-Her and Shu-Ching [21]
Korea	An empirical examination of factors influencing the intention to use Mobile Payment	Explanatory Qualitative and Quantitative	Interview and Survey (E-Mail)	Changsu et al. [7]
	Understanding dynamic between initial trust and usage intentions of Mobile Banking	Explanatory Quantitative	Questionnaire	Gimun et al. [15]
	Mobile Internet acceptance	Explanatory Quantitative	Questionnaire	Je Ho and Myeong-Cheol [20]
Hong Kong	Adoption of Mobile Commerce in role of exposure	Explanatory Quantitative	Questionnaire	Mohamed and Sammi [31]
Australia	Towards understanding of factors influencing user acceptance of Mobile Payment system	Exploratory Quantitative	Questionnaire	Agniesaka et al. [1]

Table 2: (Continued)

Country	Project Focus	Research Approach	Data Collection Methods	References
Brazil	Mobile Banking proposition of an integrated adoption intention framework	Explanatory Quantitative study	Questionnaire	Julio and Jose [24]
	Mobile Banking rollout in emerging market	Explanatory Quantitative	Questionnaire	Lineu et al. [29]
Multiple advanced and developing countries	A meta-analysis on adoption of Mobile Finance Service	Explanatory Quantitative	Questionnaire	Rajanish and Sujoy [36]
Based on online databases for journals and conferences	Mobile Payments research of past, present and future with a literature review	Explanatory Quantitative	Survey (online journal and conference databases)	Tomi et al. [42]

Objectives

Research Questions

Question 1: What are the main factors that affect an individual's intention to use MFS in Thailand?

Question 2: What are the relationships among these factors?

Question 3: Which factors have a significant causal effect on an individual's intention to use MFS?

Question 4: What are the theoretical and practical implications of the findings?

Methods

Research Design and Methodology

A cross-sectional field study approach was used to collect data by questionnaire. English and Thai language versions of the questionnaire were prepared and reviewed by a focus group of MFS users. Modifications were included in both versions of the questionnaire and the Thai version was used in a pilot study with 10 their job performance. As with ease of use, the influence of usefulness on user acceptance has been extensively validated in various studies of the Technology participants. Comments were incorporated into the questionnaires. The Thai version was used in the full study. The English version is in Appendix A1.

The target population was individuals at least 15 years of age with at least one month of experience using both Mobile Banking and Mobile Payment. This study focus these group because base on [5]. A purposive sampling method was used with a minimum sample size of 400 appropriate participants was achieved which represented a 95 percent confidence level and 5 percent precision in what was assumed to be a very large target population. This sample size satisfied the criteria for the statistical validity for the statistical techniques used in the study. It was analyzed and developed with Structural Equation Modeling

(SEM) methods using the maximum likelihood estimation technique available in Amos computer software and in accordance with [27]. Sampling was done in stages using an online site.

Results

Theoretical Model

Based on the findings from previous studies presented in the literature review the theoretical model in Figure 2 was developed. Figure 2 is notated (H1– H23) to the 23 research hypotheses associated with each of the direct causal effects in the model. Table 3 presents a statement of each of the 23 research hypotheses as well as identifying a previous study which motivated the formulation of the hypothesis.

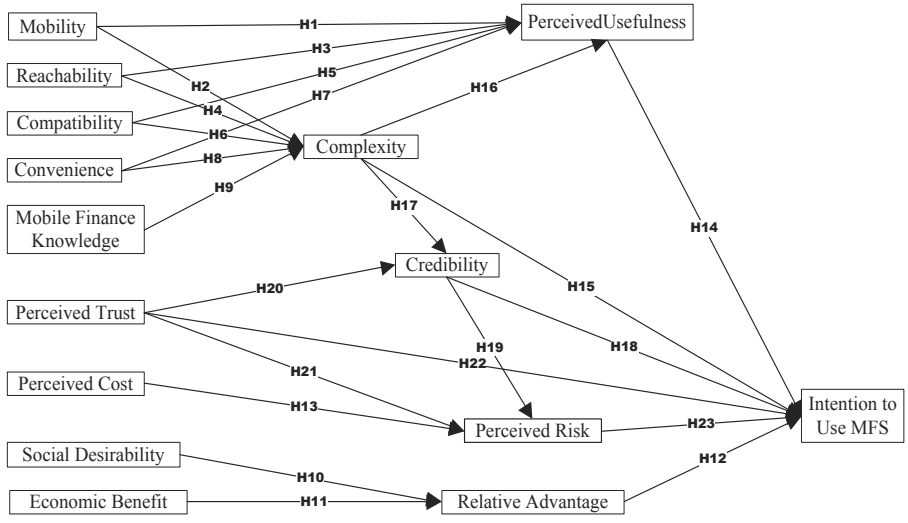

Figure 2: Theoretical model.

Table 3: Operational definitions and measurement of model variables

Variable (Symbol)	Operational Definition	Indicators	Reference
Mobility (MB)	The extent to which the system is available for use anytime and anywhere.	MB1,MB2,MB3	Rajanish and Sujoy [36]
Reachability (RB)	The extent to which the mobile devices make it possible for people to be contacted anytime and anywhere, providing users with the choice to limit their reachability to particular people or times.	RB1,RB2,RB3, RB4	Changsu et al. [7]
Compatibility (CB)	The degree to which a service is perceived as consistent with users' existing values, beliefs, habits, and present and previous experiences.	CB1,CB2,CB3, CB4,CB5	Ibrahim and Sadiq [19]

Table 3: (Continued)

Variable (Symbol)	Operational Definition	Indicators	Reference
Convenience (CV)	The extent to which the prospective user perceives that the mobile financial service increases their convenience in the service process.	CV1,CV2,CV3, CV4,CV5,CV6	Rajanish and Sujoy [36]
Social Desirability (SD)	The extent to which the user considers that their use of the system is socially desirable in relation to other people such as members of their family, friends, or colleagues who are non-adopters.	SD1,SD2,SD3, SD4	Philip and Barton [35]
Economic Benefit (EB)	The extent to which the user considers that using the system has a financial benefit to them.	EB1,EB2,EB3	Philip and Barton [35]
Relative Advantage (RA)	The extent to which the system offers greater value to them than existing systems such as improvements in: economic benefits; social desirability; personal image; convenience; and satisfaction.	RA1,RA2,RA3, RA4,RA5	Rajanish and Sujoy [36]
Perceived Cost (PC)	The user's perceptions of the costs of using the system which include direct transaction costs and fixed costs of usage plus the cost of the technical infrastructure for the user.	PC1,PC2,PC3, PC4	Key [26]
Mobile Finance Knowledge (MK)	The amount of the user's prior mobile finance experience in using a similar class or type of technology	MK1,MK2,MK3, MK4	Rajanish and Sujoy [36]
Perceived Usefulness (PU)	The user's perception of the extent to which the system fulfils the purpose for which they use the system.	PU1,PU2,PU3, PU4,PU5	Changsu et al. [7]
Complexity (CP)	The extent to which the system is perceived as not easy to understand and operate.	CP1,CP2,CP3	Ibrahim and Sadiq [19]
Credibility (CR)	The extent to which the user has trust in the institution and the system infrastructure.	CR1,CR2,CR3	Nicole et al. [32]
Perceived Trust (PT)	The extent to which the user perceives that the system is trustworthy.	PT1,PT2,PT3, PT4,PT5,PT6	Uchennal et al. [44]
Perceived Risk (PR)	The extent to which the user perceives that using the system is free from risk related to: inconsistency between a user's judgment and real system behavior; technology failing to deliver its anticipated outcome with consequent losses; and a fear of loss or theft of stored data.	PR1,PR2,PR3	Ibrahim and Sadiq [19]
Intention to Use MFS (IN)	The extent of a user's willingness to continue to use MFS.	IN1,IN2,IN3, IN4,IN5	Rajanish and Sujoy [36]

Data Preparation and Preliminary Descriptive Analyses

A sample of 513 completed questionnaires was obtained. There were no missing values for any of the questions and when a randomly selected 10 percent were checked for data entry errors none were found. One hundred and thirteen where discarded because the respondent was less than 15 years of age or did not have at least one month experience with MFS systems. A further 45 questionnaires were removed because they included at least one outlier value. The final sample included 355 questionnaires.

Principal Component factor analysis was used to test the construct (discriminant and convergent) validity of the measures of the latent model variables and Cronbach alpha coefficients were used to assess the equivalence reliability. The results are displayed in Appendix Table A1. The three indicators for Credibility (CR1, CR2, and CR3) loaded significantly onto Perceived Trust with six indicators (PT1 – PT6). The three indicators for Mobile Finance Knowledge (MB1, MB2, and MB3) loaded significantly onto the variable Perceived Usefulness with three indicators (PU1, PU2 and PU3). The three indicators PU4, PU5, and CV6 did load significantly onto any component and so they were deleted. The decisions were to delete Credibility and Mobile Finance Knowledge from the model and retain Perceived Usefulness). The Cronbach alpha coefficients associated with the final sets of indicators were very satisfactory and could not be improved by the removal of any more indicators.

The deletions of Credibility and Mobile Finance Knowledge from the theoretical model (Figure 2) need to be revised: hypotheses H9, H17, H18, H19, and H20 were removed; and a new hypothesis H24 that Complexity has a significant positive direct effect on Perceived Risk was added. This new direct effect is also referenced by [32] because the direct effect in hypotheses H24 is a replacement for the two direct effects specified in hypotheses H17 and H19 both of which were motivated by the findings in [32]. The changes to the theoretical model in Figure 2 produced the modified theoretical model shown in Figure 3 which is notated to indicate the revised set of research hypotheses.

The deletions of Credibility and Mobile Finance Knowledge from the theoretical model (Figure 2) meant that the research hypotheses need to be revised: hypotheses H9, H17, H18, H19, and H20 were removed; and a new hypothesis H24 that Complexity has a significant positive direct effect on Perceived Risk was added. This new direct effect is also referenced by [32] because the direct effect in hypotheses H24 is a replacement for the two direct effects specified in hypotheses H17 and H19 both of which were motivated by the findings in [32]. The changes to the theoretical model in Figure 2 produced the modified theoretical model shown in Figure 3 which is notated to indicate the revised set of research hypotheses.

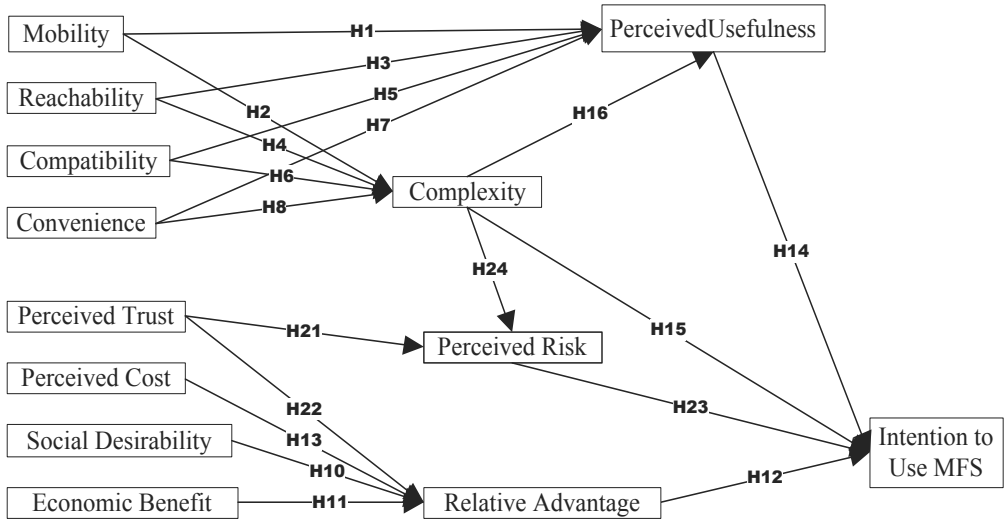

Figure 3: Modified theoretical model.

Characteristics of Respondents

Most of the subjects (56 percent) are female and 78 percent are Thai citizens. On average they are 37 years of age and 47 percent are aged 35 years or older. Almost half (49 percent) have a master degree as their highest level of formal education and a further 41 percent have a bachelor degree as their highest level of education. On average the subjects have a monthly income of about 50,000 baht and 79 percent have a monthly income of 25,000 baht or more. On average they have seven months experience with Mobile Banking systems and six months of Mobile Payment systems experience while 65 percent have seven months or more Mobile Banking experience and 63 percent have seven months or more of Mobile Payment systems experience.

In summary, the subjects have personal characteristics and MFS systems experience which indicate that they are well placed to be able to provide valid and reliable responses to the questionnaire items.

Descriptive Statistics

A range of descriptive statistics for each model variable is displayed in Appendix Table A2. In particular, it is noted that the magnitudes of the values for skewness and kurtosis are within the acceptable limits of 3 and 7, respectively, required for the use of maximum likelihood estimation in SEM analyses [27].

t-Test showed that on average the subjects have expressed statistically significant ($p \leq 0.005$) positive opinions about all of the factors that have a desirable influence on intention to use MFS with the exception of Perceived Risk. For example, the means for Perceived Cost and Complexity are significantly below the neutral value of 3 and, with the exception of some aspects of Perceived Risk, the means of all of the other factors are significantly greater than the neutral value of 3. For Perceived Risk on average subjects are significantly concerned about the overall security of MFS used via mobile phones (PR1, mean = 3.273,

$p < 0.001$). However, for the other two indicators PR2 and PR3, which relate to accuracy and access codes, and the overall single scale measure of Perceived Risk the means are not significantly different from the neutral value of 3 ($p < 0.05$).

t-Test were used to examine the difference between the means for males and females among three of the profile variables (Age, Monthly Income, Education, Mobile Banking Experience, and Mobile Payment Experience) and the single scale measures of the model variables. There were five variables where there was a statistically significant difference between the means for males and females ($p < 0.05$): Relative Advantage; Social Desirability; Complexity; Perceived Trust; Perceived Risk. In each case the mean for the males was significantly greater than the mean for the females. However, despite these significant differences between males and females an examination of the means revealed that both groups considered MFS systems: provide strong relative advantage, are very socially desirable; not difficult to use; trustworthy, and do not pose significant risks for users.

Correlations among model variables and the five profile variables (Age, Monthly Income, Education, Mobile Banking Experience, and Mobile Payment Experience) are displayed in Appendix Table A3. It is evident from Table A3 that: (a) All of the correlations among the model variables are statistically significant and have the same directions as the corresponding causal effect with only two exceptions (Reachability → Complexity and Compatibility → Complexity). Although, the directions for these two causal effects and the corresponding correlations are negative and in agreement; (c) Among the statistically significant correlations involving profile variables (Age, Monthly Income, Education, Mobile Banking Experience, and Mobile Payment Experience): (i) Not surprisingly Age, Education, and Monthly Income are significantly positively correlated;

(ii) Compared to the younger subjects the older subjects tend to have lower levels of experience with both Mobile Banking and Mobile Payment systems but they perceive these systems to be less complex and to involve less risk. They place a higher value on the mobility, reachability, economic benefit, and usefulness of MFS and they consider their use of MFS to be very socially acceptable. They have higher levels of trust in MFS, and stronger intentions to continue to use MFS in the future; (iii) Subjects with higher levels of education consider MFS systems to be easier to use, and they have stronger intentions to continue to use MFS in the future; (iv) Compared to subjects with lower monthly incomes those with higher incomes find MFS to be easier to use, to involve lower levels of risk, and they have stronger intentions to use MFS in the future;

(v) Individuals with higher levels of mobile banking experience also have higher levels of experience with mobile payment systems. They place lower levels of importance on the reachability, social desirability, economic benefits, the usefulness of MFS, and they have lower levels of trust in MFS. In particular, those with higher levels of experience with mobile banking systems are likely to consider

MFS to involve higher risk and they have lower intentions to use MFS in the future. It is important to note from the discussion above that although subjects may be described as having a low score on particular model variables the mean values of those variables were significantly greater than the mid-point neutral value of 3 on the measuring scales and that was true for males and females.

Model Analysis and Development

SEM Analysis of the Modified Theoretical Model

SEM Analysis of the Modified Theoretical Model is the modified theoretical model in Figure 4 was analyzed using Amos software. The results for the direct effects are shown in Figure 5. The notation used in Figure 5 and in following sections for the effects indicate: first the unstandardized effect and its statistical significance where *, **, ***, or NS represent statistical significance at a level of 0.05, 0.01, 0.001, or not significant at 0.05 level or less, respectively; followed in parentheses by the standardized effect and its magnitude classified as small (S); medium (M), or large (L) which mean that the magnitude is less than or equal to 0.1, between 0.1 and 0.5, or greater than or equal to 0.5, respectively [10]. The fit statistics for the modified theoretical model recommended by [27] are displayed in Table 4.

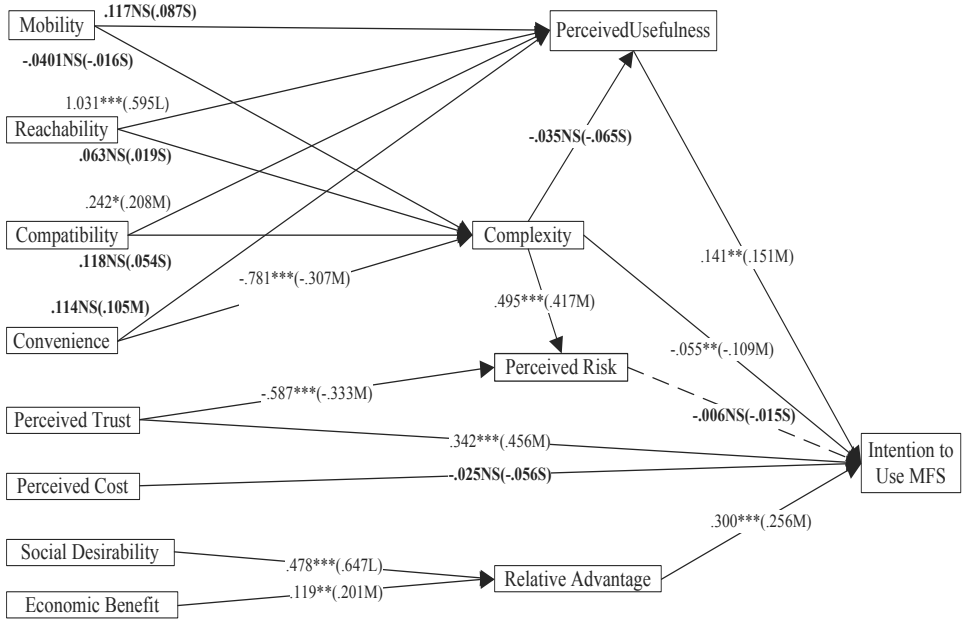

Figure 4: Direct effects in the modified theoretical model using Amos software.

As Figure 4 presents there are eight direct effects highlighted which are small in magnitude and not statistically significant. It may be possible to produce a simpler model if these direct effects were removed. As seen in Table 6, the fit statistics GFI, AGFI, and NFI are not at least 0.9. It may be possible to improve these fit statistics by modifying the mode.

Table 4 presents the values of the range of fit statistics for the theoretical model in Figure 4 as recommended by [27].

Table 4: Fit statistics for the modified theoretical model

Model	Sample Size	NC (χ2/df)	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA
Modified Theoretical Model	355	2272.034/1278 = 1.778	.034	.812	.799	.851	.929	.928	.047
		R^2: Complexity (0.078), Relative Advantage (0.632), Perceived Risk (0.314), Perceived Usefulness (0.748), Intention to Use MFS (0..675)							

Note: R^2 is the proportion of the variance of each endogenous variable that is explained by the variables affecting it.

Development of the Model

The eight direct effects in Figure 5 that are small and not statistically significant were made optional forming a hierarchy of 2^8 = 256 models which were analyzed using the Specification Search facility available in Amos software. Following the recommendation by [27] the model in this hierarchy with the smallest value for the fit statistic Normed Chi-square (NC) was selected as the final model. The direct effects in the final model are shown in Figure 5 and the fit statistics for the final model are shown in Table 5.

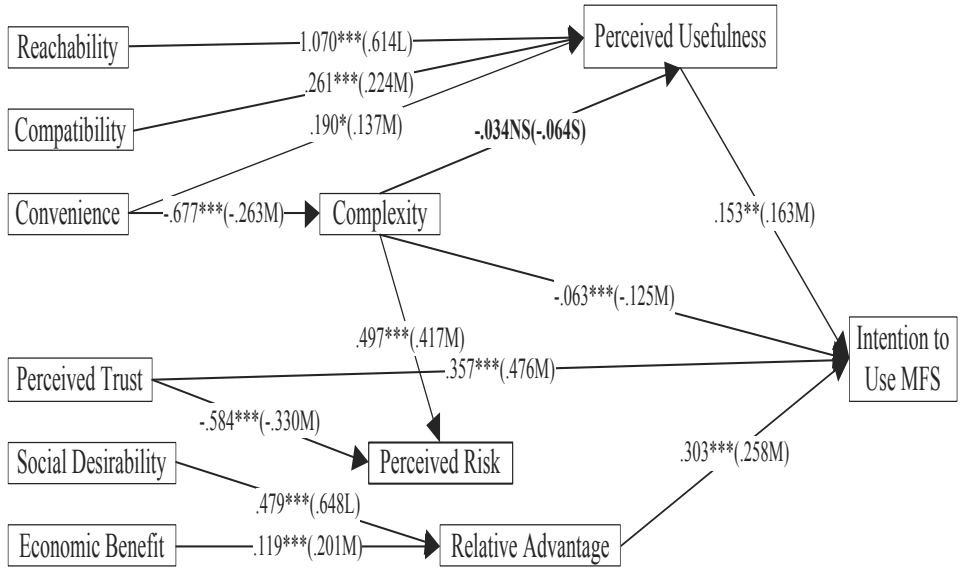

Figure 5: Final model.

Table 5: Fit statistics for the final model

Model	Sample Size	NC (χ^2/df)	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA
Final Model	355	2276.015/1284 = 1.773	.028	.911	.901	.910	.930	.929	.050
		R^2: Complexity (0.178), Relative Advantage (0.633), Perceived Risk (0.319), Perceived Usefulness (0.753), Intention to Use MFS (0.676)							

Note: R^2 is the proportion of the variance of each endogenous variable that is explained by the variables affecting it.

As shown in Table 5 the final model has improved very satisfactory fit statistics. The final model is simpler than the modified theoretical model in Figure 5 and contains only one direct small effect (Complexity → Perceived Usefulness) which is not statistically significant at a level of 0.05 or less while all of the other direct effects are at least medium in magnitude. Notably, Perceived Risk has become a dependent variable affected directly by Perceived Trust and Complexity and indirectly by Convenience.

Table 5 provides a complete analysis of the final model which includes direct and indirect effects and the totals of indirect and all effects. Previous studies rarely mention indirect effects or total effects and this is not considered to be an appropriate way to report the findings of the analysis. Total effects highlighted in the shaded cells are discussed and identify new findings as well as informing the practical implications of the findings

Discussion of the findings

This section discusses the decisions for the research hypotheses related to direct effects and three groups of new findings from the study. Throughout the discussions the findings are compared to those from previous studies. Finally, the practical implications of the findings are discussed.

Research Hypotheses for Direct Effects

The theoretical model in Figure 2 was structured on the basis of the 23 research hypotheses derived from previous studies. As a result of data preparation procedures the theoretical model was modified in Figure 3 to include only 19 of these research hypotheses. The findings regarding these 19 hypotheses based on the final model are summarized. The hypotheses were fully supported by the findings a direct statistically significant causal effect reported in the previous studies was not found but instead there was considered to be partial support for a statistically significant relationship between the two variables evidenced by a statistically significant correlation between the variables in the hypotheses which had the same direction as that proposed for the causal effect. The hypotheses for which there was no support, it is seen that 12 of the 19 research hypotheses related to direct causal effects were fully supported and in each case the correlation between the two variables

was statistically significant with the same direction as specified in the significant causal effect. All of these 12 hypotheses have been reported in the previous studies.

Overall, the findings provide full or partial support for 17 of the 19 research hypotheses concerned with direct effects reported in previous studies.

Total Effects in the Final Model

The shaded cells in Table 6 identify the nature of effects in the final model that are only direct and these have been discussed in relation to the research hypotheses in section above. The findings in Table 6 are based on the totals of direct and indirect effects. Findings from previous studies have focused on only direct effects with no discussion of indirect effects. Consequently, compared to the findings from these previous studies the findings in Table 6 identify new results, which are reported below in section new findings, and in some cases add further support to the importance of direct effects identified in the research hypotheses discussed section research hypotheses for direct effects above.

Table 6: Summary of the total effects in the final model

Variable		Intervening			Dependent	
		Complexity	Perceived Usefulness	Relative Advantage	Perceived Risk	Intention to Use MFS
Exogenous	Reachability	Nil	Large, positive, only direct	Nil	Nil	Medium, positive, only indirect
	Compatibility	Nil	Medium, positive, only direct	Nil	Nil	Small, positive, only indirect
	Convenience	Medium, negative, only direct	Medium, positive, only direct	Nil	Medium, negative, only indirect	Small, positive, only indirect
	Perceived Trust	Nil	Nil	Nil	Medium, negative, only direct	Medium, positive, only direct
	Social Desirability	Nil	Nil	Large, positive, only direct	Nil	Medium, positive, only indirect
	Economic Benefit	Nil	Nil	Medium, positive, only direct	Nil	Small, positive, only indirect
Intervening	Complexity	Nil	Small, negative, only direct	Nil	Medium, positive, only direct	Medium, negative, mainly direct
	Perceived Usefulness	Nil	Nil	Nil	Nil	Medium, positive, only direct
	Relative Advantage	Nil	Nil	Nil	Nil	Medium, positive, only direct

New Findings

Table 7 describes new findings based on descriptive analyses of the characteristics of the subjects and the model variables.

Table 7: New findings: characteristics of the subjects and the model variables

Gender of Subjects: The mean value for males was significantly greater than mean value for females for the model variables: Relative Advantage, Social Desirability, Complexity, Perceived Trust, and Perceived Risk.
Age of Subjects: Compared to the younger subjects the older subjects tend to have lower levels of experience with both Mobile Banking and Mobile Payment systems but they perceive these systems to be less complex and to involve less risk. They place a higher value on the mobility, reachability, economic benefit, and usefulness of MFS systems and they consider the use of MFS systems to be very socially acceptable. They have higher levels of trust in MFS systems, and stronger intentions to continue to use MFS systems in the future.
Level of Education: Subjects with higher levels of education consider MFS systems to be easier to use, and they have stronger intentions to continue to use MFS systems in the future.
Monthly Income: Compared to subjects with lower monthly incomes those with higher incomes find MFS systems to be easier to use, to involve lower levels of risk, and they have stronger intentions to use MFS systems in the future.
Mobile Banking and Mobile Payment Experience: Subjects with higher levels of Mobile Banking experience also have higher levels of Mobile Payment experience. They place lower levels of importance on the reachability, social desirability, economic benefits, and usefulness of MFS systems and they have lower levels of trust in MFS systems. In particular, those with higher levels of experience with Mobile Banking systems are likely to consider MFS systems to involve higher risk and they have lower intentions to use MFS systems in the future.
Correlations among Intentions and Model Variables: Intention to Use MFS systems is significantly: **(a)** Positively correlated with: Mobility, Reachability, Compatibility, Convenience, Relative Advantage, Social Desirability, Economic Benefit, Perceived Usefulness, and Perceived Trust; **(b)** Negatively correlated with: Perceived Cost; Perceived Risk; and Complexity.

The new findings in Table 7 emerged from the descriptive analyses of the characteristics used to develop a profile of the subjects and the measures of the model variables. These findings are not reported in previous studies and although they are tentative and descriptive they do suggest hypotheses concerned with the use of MFS that need to tested rigorously in future studies.

Table 8: New findings related to direct causal effects

New Finding (Direct Causal Effects)	Comment
Mobility does not have a significant positive direct effect on Perceived Usefulness	This new finding is contrary to that reported by Au and Kauffman [3]. However, a significant positive correlation was found.
Mobility does not have a significant negative direct effect on Complexity	This new finding is contrary to that reported by Changsu et al. [7]. However, a significant negative correlation was found.
Perceived Cost does not have a significant negative direct effect on Intention to Use MFS	This new finding is contrary to that reported by Jen-Her and Shu-Ching [21]. However, a significant negative correlation was found.
Complexity does not have a significant negative direct effect on Perceived Usefulness	This new finding is contrary to that reported by Julio and Jose [24]. However, a significant negative correlation was found.
Perceived Risk does not have a significant negative direct effect on Intention to Use MFS	This new finding is contrary to that reported by Ibrahim and Sadiq [19]. However, a significant negative correlation was found.
Reachability does not have a significant negative direct effect on Complexity	These new findings are contrary to those reported by Changsu et al. [7] and in both cases no significant correlations were found.
Compatibility does not have a significant negative direct effect on Complexity	

The new findings in Table 8 are related to the research hypotheses concerning direct effects which were only partially supported or not supported at all. In each case these seven new findings are contrary to those reported in previous studies and need to be tested in further studies. Four of these new findings highlight four unimportant direct effects involving Complexity: three effects on Complexity due to Mobility, Reachability, and Compatibility; and the effect of Complexity on Perceived Usefulness. In addition, Perceived Cost and Perceived Risk have little influence on Intention to Use MFS. These results are compatible with the subjects' perceptions that MFS are not complex and do not involve significant costs or risks. The subjects are quite experienced with the use of MFS and have strong intentions to continue to use MFS. Characteristics of MFS associated by Mobility have very little influence on them while Reachability and Compatibility are only influential in increasing their positive perceptions of the usefulness of MFS.

The new findings in Table 8 involve show the total effects in the final model which included indirect effects. Other effects which were only direct are not shown but have been discussed above.

Table 9: New findings based on total effects involving indirect effects1

Variable		**Dependent**	
		Perceived Risk	Intention to Use MFS
Exogenous	Reachability	-	Medium, positive, only indirect
	Compatibility	-	Small, positive, only indirect
Exogenous	Convenience	Medium, negative, only indirect	Small, positive, only indirect
	Social Desirability	-	Medium, positive, only indirect
	Economic Benefit	-	Small, positive, only indirect
Intervening	Complexity	-	Medium, negative, mainly direct

The three strongest influences on Intention to Use MFS are due to the direct effects of Perceived Trust, Relative Advantage, and Perceived Usefulness. However, when total effects that include indirect effects are taken into account the new findings in Table 9 emerge and indicate that in order Social Desirability, Complexity, and Reachability have the next most important medium effects on Intention to Use MFS. These are followed by the small unimportant effects due to Convenience, Economic Benefit, and Compatibility. The strongest effects in decreasing order of magnitude on Perceived Risk are due to Complexity, Perceived Trust, and Convenience. The first two are only direct effects but the third medium effect of Convenience is only indirect.

These findings based on total effects that include the determination of indirect

effects are new and demonstrate important results which are not evident when only direct effects are analyzed.

Practical Implications of the Findings

The results of the complete analysis of the final model in Table 8 were used to determine hierarchies of practical objectives and associated actions where for each objective the actions are organized in accordance with a decreasing level of impact that they have on achieving the stated objective. For simplicity, in developing the actions small total effects have been excluded. Because there are two independent variables in the final model (Perceived Risk and Intention to Use MFS) Table 10 addresses the practical objectives and actions designed to decrease perceptions of risk in using MFS while Table 11 addresses the practical objectives and actions designed to increase intentions to use MFS.

Table 10: Hierarchies of practical actions for reducing perceptions of risk

Objective	Action	Model Variable
Primary Objective: To Decrease Perceived Risk	**1.** Decrease the complexity of MFS systems (see **Secondary Objective 3**).	Complexity
	2. Increase the perception of trust in MFS systems.	Perceived Trust
	3. Increase the perception that MFS systems are convenient.	Convenience

Table 11: Hierarchies of practical objectives and actions for increasing intention to use MFS

Objective	Action	Model Variable
Primary Objective: To Increase Intention to Use MFS	**1.** Increase the perception of trust in MFS systems.	Perceived Trust
	2. Increase the relative advantage of MFS systems (see **Secondary Objective 1**).	Relative Advantage
	3. Increase the social desirability of MFS systems.	Social Desirability
	4. Increase the perceived usefulness of MFS systems (see **Secondary Objective 2**).	Perceived Usefulness
	5. Decrease the complexity of MFS systems (see **Secondary Objective 3**).	Complexity
	6. Increase the reachability of MFS systems.	Reachability
Secondary Objective 1: To Increase Relative Advantage	**1.** Increase the social desirability of MFS systems.	Social Desirability
	2. Increase the economic benefits of using MFS.	Economic Benefits
Secondary Objective 2: To Increase Perceived Usefulness	**1.** Increase the reachability of MFS systems.	Reachability
	2. Increase the compatibility of MFS systems.	Compatibility
	3. Increase the convenience of MFS systems	Convenience
Secondary Objective 3: To Decrease Complexity	**1.** Increase convenience of MFS systems.	Convenience

In practice it may not be feasible or affordable to perform all of the actions specified in the hierarchies in Tables 10 and 11. Consequently, for each objective the sequence of actions specified ranges from most effective to the least effective in relation to achieving the objective. Thus, if only limited resources are available for actions then choices can be made among a sequence of actions with full awareness of the level of effectiveness of the action.

Many of the actions in Table 10 and 11 may be decomposed into tasks that collectively relate to the action. These tasks are implicit in many of the definitions of the model variables in Table 3. For example, increasing the effect of Social Desirability means increasing positive attitudes to MFS systems among: family members; friends; and colleagues who are non-adopters of MFS.

Conclusion and Discussion

From a theoretical perspective the study has identified the factors which have a significant effect on the intention of individuals to continue to use MFS systems. Overall, the findings provide full or partial support for 17 of the 19 research hypotheses concerned with significant direct effects which have been reported in previous studies. In addition, the study identified new findings related to analyses of descriptive characteristics of the subjects and the model variables which suggested hypotheses to be examined in further studies; direct causal effects among model variables which were contrary to findings reported in previous studies and findings that are only evident when total effects which include indirect effects are analyzed (Table 9). In each case the new findings must be validated by further studies.

In addition, the analysis of total effects enabled practical implications of the findings to be presented in the form of hierarchies of practical objectives and associated actions which may be decomposed further to the level of specific tasks (Tables 10 and 11). These practical implications are expected to be of interest to those who are responsible for the design, promotion, and operation of MFS systems particularly foreign banks operating in Thailand as well as individuals who are considering the adoption of these systems.

There are limitations on the study and the external validity can only be improved by repeating the study noting that Credibility and Mobile Finance Knowledge were deleted from the theoretical model because of unsatisfactory construct validity of their measurement. Furthermore, future studies may: incorporate other variables and relationships in the model; use samples with different characteristics or from different geographical regions; and examine and compare cross cultural samples.

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