The Moderating Effect of Gender on mHealth Adoption in Thailand

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Abstract

The purpose of the research was to investigate the moderating impact of gender on the effects of the independent factors on the intention to use mHealth services. The study employed a quantitative research method. Data had been collected from 885 respondents who had experienced with mHealth services in Thailand. Structured equation modeling and multi–group analysis were used to analyze the data. The research instrument was a self–administered questionnaire. The study reveals that perceived ease of use, perceived usefulness, perceived health threat, and customer empowerment all have a substantial impact on mHealth adoption in Thailand. The results evidence customer empowerment is composed of the three key dimensions: personal, social, and medical dimensions in mHealth services. Additionally, gender responds differently in their concerns about perceived usefulness, perceived ease of use, perceived health threat, and customer empowerment in mHealth adoption. This study contributes to a better understanding of how men and women perceive the adoption of mobile health technologies in developing countries, particularly in Thailand. It demonstrates the significant role of customer empowerment in the acceptance of mHealth technologies context. Furthermore, this study is one of the first to investigate an integrated model of mHealth adoption in Thailand grounded on technology acceptance, health belief, and the customer empowerment model.

Keywords: gender, consumer empowerment, mHealth, adoption

Introduction

With the growth of information and communication technology, the healthcare sector has undergone dramatic changes in the majority of the world's countries. In developing countries, mHealth has revolutionized healthcare by providing access to previously unreached populations (Alam et al., 2020). Mobile health (mHealth) is described as medical and public health practices that are aided by mobile technology such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices, as well as other wireless devices (World Health Organization, 2018). In developing countries, healthcare systems are considered immature and often dysfunctional, and mHealth technology can improve the convenience, cost, and quality of healthcare for inaccessible populations (Ahadzadeh et al., 2015; Hoque, 2016).

Despite its potential advantages, the use of mobile health technologies has not increased at the rate predicted by experts, particularly in developing countries. There has been little research conducted to establish a systematic examination of the adoption of the use of mHealth in developing countries (Alam et al., 2020; Dou et al., 2017). This study examines the determinants that affect and contribute to mHealth adoption in Thailand, a developing country; more precisely, it examines the moderating effect of gender. Moreover, consumer empowerment has gained significant attention in the medical field recently (Almunawar & Anshari, 2014; Salgado, Tavares & Oliveira, 2020). Nowadays, a paradigm shift has occurred in healthcare, shifting from patients receiving care to people actively participating in their care. mHealth is regarded as one of the most effective methods for accomplishing this goal (Bradway, Arsand & Grottland, 2015). Numerous researchers have proposed customer empowerment as a theoretical framework for examining the antecedents of mHealth acceptance and usage (Almunawar, Anshari & Younis, 2015; Brew–Sam & Chib, 2020). Based on a review of the available research, the influence of customer empowerment on mHealth adoption has not been empirically examined in developing countries. Hence, this research provides new avenues for research by identifying the relationship between customer empowerment and mHealth adoption in Thailand that have not been explored. Importantly, this study is one of the first to establish and test this proposed conceptual model by integrating the Technology Acceptance Model (TAM), Health Beliefs Model (HBM), and Customer Empowerment Model (CEM). Additionally, the current study examines gender as a moderator of m–health acceptance in Thailand.

Research Objectives

The objectives of this study aim (1) to identify the factors impacting the adoption of mHealth in Thailand (2) to evaluate whether the conceptual model based on TAM, HBM, and CEM provides a strong theoretical framework for analyzing mHealth adoption (3) to investigate the moderating impact of gender in the effects of the independent factors on the intention to use mHealth services.

Scope of Research

The study focuses on collecting primary data through survey research. Data was gathered from Thai people who use mHealth apps in three major hospitals in Bangkok and the surrounding area. This study was conducted from August 20, 2021, through March 20, 2022. In this study, hypotheses testing was done using equation modeling (SEM).

Literature Review

Technology acceptance model (TAM)

TAM is one of the most prominent theoretical models used in the study of technology adoption and use in information technology research (Davis, 1989). According to the TAM, customers' intentions to utilize technological items are influenced by the perceived ease of use and perceived usefulness (Venkatesh & Davis, 1996).

Perceived usefulness (PU)

PU is a term that refers to a person's belief that utilizing technology will improve the performance of his or her job (Davis, 1989). There has been substantial research demonstrating that PU and its mHeath adoption have a significant influence (Hoque, 2016; Zhao, Ni & Zhou, 2018). Deng et al. (2018) established that PU is a significant predictor of an individual's inclination to use mHealth services in China. According to Dutta, Peng and Sun (2018), PU is a powerful predictor of intention to use in mHealth records. Based on this, the author has framed the following hypothesis:

H1: Perceived usefulness has a positive influence on the intention to use mHealth services.

Perceived ease of use (PEU)

PEU is an abbreviation that refers to the degree to which a potential user anticipates the target system to be straightforward (Davis, 1989). Academics generally concur that PEU affects a

patient's intention to utilize mHealth (Hoque, 2016; Zhao, Ni & Zhou, 2018). As a result, the researcher is motivated to formulate the following hypothesis:

H2: Perceived ease of use has a positive influence on the intention to use mHealth services.

However, past research has recommended expanding TAM so that it can better explain an individual customer's adoption (Saheb, 2020; Zhao, Ni & Zhou, 2018). Thus, this study utilizes the TAM model as a basic model, coupled with additional variables from the HBM and CEM models.

Health belief model (HBM)

Health Belief Model (HBM) was used to forecast individuals' behavioral responses to treatments for acute or chronic disorders (Rosenstock, 1974). The HBM's fundamental premise is that, if there are no signs or symptoms, people will not adopt preventative or health actions unless they are mentally prepared (Champion & Skinner, 2008). HBM suggests that belief in health threats predicts the likelihood of engaging in health behavior. Perceived Health Threat (PHT) refers to a consumer's awareness and concern about a health issue and its prospective implications (Ahadzadeh et al., 2015). Patients who believe their health is at risk, in particular, are more inclined to use mHealth applications (Dou et al., 2017; Kim & Park, 2012). However, the topic of considering how perceived health threats can influence mHealth adoption has not been adequately empirically studied in developing countries, especially Thailand. Thus, the author proposes the following hypothesis.

H3: Perceived health threat has a positive influence on the intention to use mHealth services.

Customer empowerment model in mHealth context

Scholars have generally agreed that customer empowerment is an important concept in healthcare organizations (Skelton, 1997; Anshari et al., 2013). Customer empowerment (CE) is a term that refers to the process of acquiring influence or control over the events and results of patient–centered care in order to increase patient participation and improve health and well–being (Almunawar, Anshari & Younis, 2015). Customers can benefit from mHealth applications (Bradway, Arsand & Grottland, 2015). Almunawar, Anshari and Younis (2015) first developed a customer empowerment conceptual model (CEM) in mHealth services as a unique multi–dimensional approach composed of the three key dimensions: personal, social, and medical dimensions.

1) Personal empowerment (PE) is primarily concerned with facilitating personalization and enhancing the user's ability to identify his or her demands. Through their mHealth system,

customers may create accounts, manage privacy settings, manage personal information, and track health behaviors (Brew–Sam & Chib, 2020).

2) Medical empowerment (ME) is a technique that makes it easier for healthcare providers to communicate with their patients. Customers can use it to gain access to their medical records such as check–ups, outpatient treatment, and inpatient treatment.

3) Social empowerment (SE) provides a platform for patient–to–patient conversations and enables customers to communicate with one another to share information and experiences. Customers' connections in social networks contribute to the value of mHealth services.

Delgado et al. (2020) found that customer empowerment is composed of three dimensions within the context of mobile health for pregnancy support. Therefore, based on previous findings, the following hypothesis has been framed:

H4: Customer empowerment in mHealth services is a second–order dimension of three empowerments: personal, medical, and social.

Surprisingly, the role of customer empowerment on the adoption of mHealth has not been empirically examined in developing countries. According to Brew–Sam and Chib (2020), customer empowerment could be expected to function as an antecedent to the adoption of mHealth technologies.

H5: Customer empowerment has a positive influence on the intention to use mHealth services.

Behavioral intention to use behavior

When it comes to the technology adoption model, academics are generally in agreement that the intention to use impact the actual usage of mHealth technology (Alam et al., 2020; Saheb, 2020). Therefore, the author proposes the following hypothesis:

H6: Intention to use has a positive influence on the actual use of mHealth services

Gender differences.

Past researches have found that women and men hold different attitudes and behavioral intentions regarding the acceptance of eHealth service (Assadi & Hassanein, 2017; Hoque, 2016; Khan et al., 2019). Recent literature utilized gender as a moderator in the use of TAM in mHealth adoption (Khan et al., 2019; Dutta, Peng & Sun, 2018). Zhang et al. (2014) found that gender has a significant moderating role in m–Health Adoption. Hoque (2016) indicated gender moderates the influence of perceived usefulness and perceived ease of use on the intention to use mHealth

adoption, which was higher among men than women. Gao et al. (2020) found males outperformed females on the perceived usefulness of internet healthcare. Brew–Sam (2020) discovered that women are more likely to use internet health services than men. Previous studies found that women have a higher perceived health risk than men (Ahadzadeh et al., 2015). Thus, the author has incorporated gender as a moderator variable into the model and proposes the following hypothesis:

H7: Gender will moderate the relationships among (a) perceived usefulness (PU), (b) perceived ease of use (PEU), (c) perceived health threat (PHT), and (d) customer empowerment (CE) and intention to use mHealth services.

Based on the literature review, the author presents a conceptual model based on TAM, HBM, and CEM. This is illustrated in Figure 1 with the conceptual framework for the study.

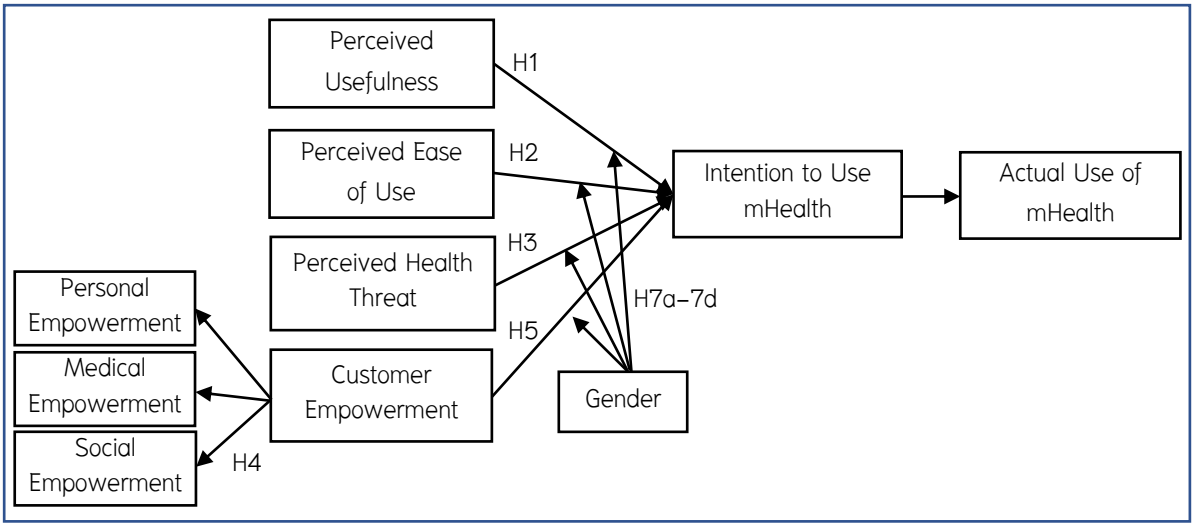

Figure 1: The Conceptual framework of the study

Research Methodology

Sample and data collection

The sample was obtained from Thailand's population who were currently utilizing mHealth services. The researcher conducted an on–site survey in three major hospitals in Bangkok and the surrounding area. Purposive sampling was used to obtain data using a self–administered questionnaire. Permission was sought from hospitals to approach patients. Individuals interested in participating will get an information sheet outlining the project and their ability to withdraw at any time. In total, 900 questionnaires were distributed among respondents who had the experience of

using mHealth services, and after removing the incomplete questionnaires, 885 questionnaires were used for analysis. This study had been approved by the research ethics committee of the King Mongkut's University of Technology Thonburi.

Research instrument and data analysis

The items used to measure the constructs were taken from previous research. A total of 26 items were taken from prior studies. The customer empowerment (CE) scale was adapted from Almunawar, Anshari and Younis (2015). This construct was conceptualized as a second-order construct consisting of three dimensions: personal empowerment (PE), medical empowerment (ME), and social empowerment (SE). Each dimension had three items to reflect its construct. Perceived usefulness (PU) was measured with three items, while perceived ease of use (PEOU) was measured with three items, which were adapted from the study of Davis (1989). Perceived health threat (PHT) with four items was adapted from the research of Dou et al. (2017). The intention to use mHealth (INT) with four items was adapted from the work of Venkatesh et al. (2003). Finally, the actual use mHealth (ACT) was assessed with three items, which were adapted from the study conducted by Venkatesh et al. (2003). A five-point Likert scale ranging from strongly disagree (1) to strongly agree (5) was used for all questions.

The data were analyzed using structural equation modeling (SEM). A measurement model and structural modeling were applied to test the proposed model. Second-order factor analysis was utilized to verify the validity and reliability of the customer empowerment construct in the measurement model. Next, the multi-group analysis was conducted to examine the moderating effect of gender.

Results

Measurement model

The model's reliability and validity were assessed in the first step of the analysis. Table 1 summarizes the factor loading, CR, and AVE results. Confirmatory factor analysis (CFA) was performed to assess the construct validity of the proposed model's eight constructs. Composite reliability (CR) was utilized to assess the reliability of the constructs. All constructs had CR values greater than 0.70, as stated by Hair et al. (2010), signifying good reliability and consistency for

each construct's measurement items. Convergent validity was demonstrated by the fact the standardized factor loadings exceeded the 0.7 thresholds and were statistically significant. The results showed that 26 items had standardized factor loadings higher than 0.7, which revealed a good convergent validity. For AVE, Hair et al. (2010) recommended that the value of AVE be more than 0.50. The average variance extracted (AVE) for each construct was more than 0.5, indicating that all constructs met the convergent validity criterion.

Next, discriminant validity was investigated. When evaluating discriminant validity, Hair et al. (2010) recommended that the square root of the AVE of the construct be more than the estimated correlation between the construct and the other variables in the model. According to the analysis, AVE square root values for each construct were greater than the construct's correlation values, satisfying the criteria for discriminant validity. Therefore, the measurement model test results fulfilled the required validity and reliability criteria.

Table1 : Result for first–order constructs

Construct	Items	Standardized loading	CR	AVE
Personal Empowerment	3	0.71–0.88**	0.75	0.55
Medical Empowerment	3	0.72–0.80**	0.77	0.57
Social Empowerment	3	0.73–0.81**	0.79	0.59
Perceived Usefulness	3	0.72–0.85**	0.82	0.66
Perceived Ease of Use	3	0.83–0.89**	0.86	0.63
Perceived Health Threat	4	0.77–0.83**	0.8	0.61
Intention to Use mHealth	4	0.71–0.82**	0.87	0.64
Actual Use mHealth	3	0.75–0.86**	0.89	0.68

Significance:**$p< 0.01$

Moreover, customer empowerment was conceptualized as a second–order latent construct. Second–order confirmatory factor analysis was performed to estimate the reliability and validity of customer empowerment of three sub–constructs. Table 2 shows the results of the second–order construct. The results demonstrated that the estimated model provided an acceptable fit to the observed data (χ^2 /df = 1.269; CFI = 1.00; RMR = 0.018; RMSEA = 0.020). AVE of CE equal 0.72, and first–order constructs that were PE, ME, and SE have AVE equal 0.72, 0.80, and 0.64 respectively. Additionally, as demonstrated in Table 2, each first–order construct factor loading has a strong and significant correlation with the second–order constructs. The results confirmed that

customer empowerment was a second–order dimension of three dimensions: personal, medical, and social. Thus, hypothesis 4 was supported.

Table 2: Customer empowerment second–order construct

Second–order factor	First–order factor	Loadings	CR	AVE
Customer	Personal Empowerment	0.84**	0.88	0.72
Empowerment	Medical Empowerment	0.80**		
	Social Empowerment	0.64**		

Significance: **p< 0.01

Structural model testing

The structural model was examined. The structural model's fit indices were evaluated and found to be within an acceptable range(χ^2 /df = 1.227; CFI = 1.00; RMR = 0.014; RMSEA = 0.013). Therefore, the overall fit statistics indicated that the model was adequately fitted. Next, hypotheses were tested using structural equation modeling, which show in Table 3. It was found that perceived usefulness (β_{PU} = 0.53; p < 0.01), perceived ease of use (β_{PEU} = 0.26; p < 0.01), perceived health threat (β_{PHT} = 0.32; p < 0.01) and customer empowerment (β_{CE}=0.48; p < 0.01) were found to be significant predictors of mHealth adoption. Moreover, The intention to adopt mHealth (β_{INT} = 0.78; p < 0.01) has a statistically significant influence on actual mHealth use. The results supported hypothesis 1 to 6.

Table 3: Hypothesis testing

Relationship	Beta	P–value	Result
H1: Perceived Usefulness ⟶ Intention	0.53**	0.004	Supported
H2: Perceived Ease of Use⟶ Intention	0.26**	0.006	Supported
H3: Perceived Health Threat ⟶ Intention	0.32**	0.005	Supported
H5: Customer Empowerment ⟶ Intention	0.48**	0.003	Supported
H6: Intention ⟶ Actual Use	0.78**	0.001	Supported

Significance: **p< 0.01

To assess gender's moderating effect, the sample was separated into two groups (males = 460 and females = 425) and metric invariance was tested. This study demonstrates that the factor structure is consistent across both responder groups. The results demonstrate that metric invariance is satisfied, indicating that the two groups are equal in terms of factor structure (Unconstrained:

χ^2=85.12, df=107; Fully constrained χ^2=78.49, df=101; $P > 0.05$). Additionally, the model's good fit suggests that the configural invariance criteria have been met. Following that, the author conducted an invariance study using a two–value comparison between the overall model and the constrained model. Significant differences are revealed as a result of the analysis. Table 4 displays the results of the invariance analysis. As a result, testing for model path differences is possible.

Table 4: Results of invariance analysis

Model	χ^2	df	χ^2 /df	*P*–value	CFI	RMESA
Unconstrained Model	118.71	97	1.224*	0.012	1	0.021
Constrained Model	78.05	62	1.259*	0.015	1	0.018
Comparison Test	40.66	35	0.031**	0.003		

Significance:*$p< 0.05$, **$p< 0.01$

A multi–group analysis has been used to determine the moderating influence of gender in the proposed model. Using gender as a moderator in a multi–group analysis, the results are shown in Table 5. This study indicated that gender has a substantial impact on the adoption of mHealth. Men were more likely to utilize mHealth than women in terms of perceive usefulness (β_{PU*M} = 0.77> β_{PU*FM} = 0.73). The results supported hypothesis 7 (a). For perceived ease of use, it was found to be significant only for males (β_{PEU*M} = 0.17) but not for females (β_{PEU*FM} = 0.06, p <0.1). The result partially supported hypothesis 7(b). Besides, female had a higher level of mHealth adoption than males in terms of perceived health threat (β_{PHT*FM} = 0.34> β_{PHT*M}= 0.22) and customer empowerment (β_{CE*FM} = 0.62> β_{CE*M} = 0.31). The results supported hypothesis 7 (c) and hypothesis 7(d).

Table 5: Results of multi–group analysis

Relationship	Male		Female		Results
	Beta	P–value	Beta	P–value	
H7a: PU ⟶ Intention	0.77**	0.007	0.73**	0.006	Supported
H7b: PEOU⟶ Intention	0.17*	0.021	0.06	0.074	Partially Supported
H7c: PHT⟶Intention	0.22**	0.008	0.34**	0.009	Supported
H7d: CE ⟶ Intention	0.31*	0.038	0.62*	0.012	Supported

Significance:*$p<0.05$, **$p<0.0$

Discussion

The current study empirically validates a comprehensive model to investigate the antecedents of intention to use mHealth services in developing countries. The data analysis results provide support for the conceptual model. The results indicate that perceived usefulness, perceived ease of use, perceived threat to health, and customer empowerment all affect mHealth adoption. This study's findings are consistent with previous research, which revealed that Intention to use is a substantial predictor of actual usage of mobile health services (Alam et al., 2020; Saheb, 2020).

Regarding TAM– related variables, the findings indicate that perceived usefulness and perceived ease of use both have a substantial effect on the intention to use mHealth services. This finding is congruent with what's been identified in the literature, which indicates that the usefulness of systems and their ease of use are critical for mHealth (Hoque, 2016; Zhao, Ni & Zhou, 2018). Regarding the HBM related variable, the research findings reveal that perceived health threat has a significant effect on mHealth adoption. This demonstrates that when consumers gain awareness of potential health problems, they will be more receptive to using mobile health applications to manage and solve them. Perceived health threat, as demonstrated by Dou et al. (2017) and Kim and Park (2012), predicts the chance of engaging in healthy behavior.

Moreover, this study provides new research avenues that empirically examine the relationship between customer empowerment and mHealth adoption in developing countries. The customer empowerment construct that we incorporated in the model demonstrated its significance for the study by having a statistically significant positive effect on behavior intention to use mHeath in the overall model. This finding is in accordance with the literature of Brew–Sam and Chib (2020) stated that customer empowerment is likely to be an antecedent to mHealth adoption. When mHealth application can be a medium for interaction among patients and between doctor and patient, the users will decide to adopt mHealth service. Besides, this study also confirms that customer empowerment in mHealth service is based on the three dimensions, personal, medical, and social, which are congruent findings with past research of Almunawar, Anshari and Younis (2015).

Concerning the moderating effect of gender on mHealth adoption, men and women have expressed different levels of concern about perceived usefulness, perceived ease of use, perceived health threat, and consumer empowerment. The impact of perceived usefulness is stronger and more significant for males than for females. This confirms the results obtained in previous studies that showed males are dominant over females in mobile health services (Hoque, 2016; Gao et al.,

2020). The influence of perceived ease of use on the intention to use mHealth is significant only in males and non–significant in females. This finding is congruent with Hoque's research (2016) that males are more influenced by perceived ease of use; however, it seems not to be important for females. Furthermore, this study shows the congruent result of past literature by Ahadzadeh et al. (2015). The perceived health threat by women will definitely increase their intention to adopt mHealth more than in the case of men. Women are more receptive than men to threat–related cues. They make an effort to obtain medical advice, preventive measures, and cures. As a result, when faced with potential health risks, females may be more proactive in preventing health threats and staying safe than men. Furthermore, the study's findings address a gap in the existing literature by demonstrating that the influence of customer empowerment on mHealth adoption services is greater among women than among men. As supported by Brew–Sam (2020), the influence of customer empowerment on the inclination to adopt mHealth services varies by gender.

Conclusion

This study develops the conceptual model to explain mHealth adoption factors in Thailand. More specifically, it examines the moderating effect of gender. Of all the elements affecting mHealth adoption, perceived usefulness is the most significant, followed by consumer empowerment, perceived health threat, and perceived ease of use. Regarding the customer empowerment construct, this study also confirms that customer empowerment as a second–order construct consists of three dimensions: personal, medical, and social. Furthermore, gender, as predicted, has a moderating relationship between the determinants of mHealth adoption and behavioral intentions to use mobile health services in Thailand.

Suggestion

There are a few limitations to this study, which provide potential directions for future research. Only Thai customers were included in the data collection. As a result, the findings should not be generalized to other countries without careful consideration. Moreover, other moderating factors apart from gender are not considered in this study. Future research could examine the age groups as the moderating variable in mHealth adoption.

Knowledge from Research

This research contributes to knowledge of both theoretical and managerial implications. From a theoretical point of view, no study has yet conducted an empirical examination of the influence of various factors on mHealth adoption in developing countries by combining the TAM, HBM, and Empowerment theory together. The results have shown that this proposed model is a valid model for understanding the adoption of mHealth in Thailand. This research also contributes to empowerment theory by revealing that customer empowerment is an antecedent influencing mHealth adoption in Thailand. Moreover, the findings of the study fill the gap in the existing literature by verifying how gender can moderate the effects of perceived health threats and customer empowerment on mHealth adoption. As shown by the bar graph in Figure 2, men were more concerned with perceived usefulness and perceived health threat, whereas women were more concerned with perceived health threat and customer empowerment.

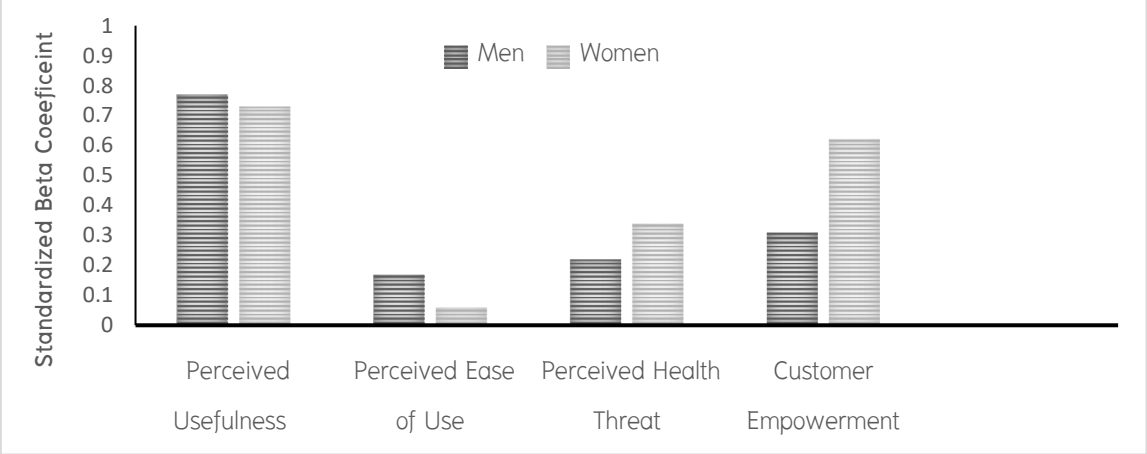

Figure 2: The effects of genders difference in mHealth Adoption in Thailand

From a managerial point of view, first, this study has found that perceived usefulness is the most relevant factor in predicting mHealth adoption. Therefore, marketers need to persuade consumers by communicating the benefits of using mHealth. Second, mHealth developers may design mHealth with user–friendly interfaces. Health care services ought to provide online training or support customers during customer implementation mHealth. Third, our findings indicate that customer empowerment is a critical factor in mHealth adoption. mHealth features should be created not only to provide customers a large involvement in their health decision–making process but also to allow them to engage with other professionals, such as doctors and advisors. Fourth, mHealth

providers could educate patients about the disease's dangers and emphasize the benefits of using mHealth. Lastly, mHealth providers may consider different marketing practices and strategies based on gender differences.

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