

Factors influencing the adoption of Location Based Identification in Kurdistan Regional of Iraq

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Abstract— This study examines the factors that affect the adoption of Location Based Identification LBI in the developing countries and more specific in Kurdistan Regional of Iraq (KRI). LBI has different names in different countries such as postcode in the United Kingdom and zip code in the United States. As a base model, the Technology Acceptance Model (TAM) and the Decomposed Theory of Planned Behaviour (DTPB) have been used to model the adoption factors of LBI in KRI. The latent variables used in this study are government support (GS), self-efficacy (SE), perceived usefulness (PU), perceived ease of use (PEU), compatibility (COM), Family and friends (FF), attitude (A), subjective norm (SN), perceived behaviour control (PBC) and behaviour intention (BI). A survey was conducted involving a total of 250 respondents. By using these models, the adoption of LBI system by the citizen of KRI has been proven. The results encourage the Kurdistan Regional Government decision makers to develop strategies that will lead to the adoption of LBI system in the region.

Keywords-component; Decomposed theory of planned behaviour (DTPB); Location Based Identification (LBI); Kurdistan Region of Iraq (KRI); Technology acceptance Model (TAM).

I. INTRODUCTION

The evolution of technology innovation in the last few decades has had a major effect on LBI systems in developed countries. LBI has contributed to this technology evolution in many fields as evidenced by mailing systems, satellite navigation systems, government tax collection, online shopping and parcel delivery, tourism and other similar sectors. The reliance on LBI has led to productivity improvement, accelerating services, flexible working practices and hence, many cost savings. In many developed countries, LBI has been successfully utilised in organizing the daily life of society and individuals. Mailing systems, marketing, tax collection and many other activities of government or the private sectors rely on LBI [1].

In KRI where this study was conducted, a new method for LBI (SR_LBI) has been proposed as an alternative to the recently implemented system in Erbil city. SR_LBI technique depends on the direction and distance of any defined point from the city or area

centre. The technique works on dividing the area into circular or rectangular zones around the area centre. Then the area divided axially into four main sections (North, South, East and West) based on the available streets in the area. SR_LBI has been explained and discussed as a new method in the literature 'Designing a Postcode System for Erbil City Iraq'[2]. The main purpose of proposing this method is due to having three different LBI systems in the main three cities of the KRI. Each of the three current LBI systems are designed by each of the local city Governorates and do not cover the rural areas in the region. In the last decade, LBI systems in the KRI area have been subjected to three consecutive changes without any notion of applying a unique system for the region.

In this study the SR_LBI has been justified against the factors influencing LBI reliance. Both TAM and DTPB models have been used. The purpose of using TAM is to test the system acceptance by the citizens based on the perceived usefulness and ease of the use of LBI. The purpose of using DTPB is to highlight the reasons behind an ineffectiveness of LBI being implemented in KRI. This problem can be addressed using Decomposed Theory of Planned Behaviour (DTPB) as the latent variable of PBC decomposed to government support. The importance of government support is highlighted as an issue in persuading people to use an effective LBI system.

For this project, 250 participants took part in a questionnaire, of which 236 questionnaire forms have been completed fully. The results have been analysed using IBM SPSS statistic 22 and AMOS graphic. The results show that the data is a reasonable fit against the DTPB model and a better match against the TAM model.

II. MODELS OF BEHAVIOUR

To investigate and examine the factors influencing the acceptance of the technological importance of LBI, several technology-based models have been proposed and developed to study user acceptance, reliance, and usage behaviour. The theoretical technology models utilized to study user acceptance, reliance, and usage behaviour include the Theory of Reasoned Action (TRA) proposed in 1975 by Fishbein and Ajzen, which consists of attitude towards behaviour, subjective norm and behaviour intention[3][4]. The Technology Acceptance Model (TAM) is based on ease of use and

usefulness of the system which affects attitudes towards the behaviour. This leads to a behavioural intention to use any particular system [5][6][7][8]. Further, the Theory of Planned Behaviour (TPB) is an improved version of TRA [9]. TRA is based on attitude and subjective norm. However, TRA, comes with a perceived behaviour control factor, which affects the behavioural intention towards using a system as an external factor [12][13]. The TPB model has been updated by Taylor and Todd into the Decomposed Theory of Planned Behaviour DTPB by specifying indicators for each latent variable. As such, DTPB is a more robust model than TPB [14].

Some research studies investigate the factors affecting non-technology system acceptance and as such, are not based on technology models. LBI as a non-technology system is used in many technology systems such as satellite navigating system, online application (bills payments, shopping delivery), finding tourist attractions and other sectors. Thus the DTPB and TAM are the preferred models for this field. In this study both the computer technology model DTPB [14] and TAM [5] have been used to prove the LBI system acceptance in KRI.

The advantage of DTPB model over the other models is that it identifies specific significant beliefs that may influence system usage [10]. The purpose of proposing this model is to improve the predictive power of that provided by other traditional models. The main improvement of DTPB is presented in terms of an increased explanatory power and a better, more precise, understanding of the antecedents of behaviour when compared with TPB [14]. However, Taylor and Todd argued that if the sole goal is the usage prediction, then TAM might be preferable. The main feature of decomposed TPB is to provide the full understanding of usage behaviour, intention and effective guidance to researchers.

III. RESEARCH MODEL

The proposed model for this project has been designed based on the integration of TAM and DTPB as shown in Fig 1. Fig. 1 shows the proposed model which the research questionnaire. The designed model explains the constructs that have positive or negative effects on people's attitude toward using LBI. The constructs include: perceived usefulness, perceived ease of use, compatibility, family and friends, self-efficacy and government support as independent variables. The dependent variable constructs include attitude, subjective norm, perceived behavioural control and intention to use. The strength of the hypothesized relationships has been tested and embedded in the proposed model Fig 1. In addition, the robustness of the model in predicting citizens' intention to adopt LBI in KRI has been confirmed in this study.

Fig. 1 represents the used model including both TAM (the circular variables) and DTPB (as the whole model). TAM consists of perceived usefulness (PU) and perceived ease of use (PEU) as independent variables in addition to using attitude towards behaviour (A) and behaviour intention (BI) as depended variables. Based on the TAM latent variables

the model can be tested to what extent the LBI system is acceptable and usable by the KRI citizen. However, DTPB consists of ten construct variables in which this research hypotheses (research questions) are based upon. These construct variables include perceived usefulness (PU), perceived ease of use (PEU), compatibility (COM), family and friends (F&F), self-efficacy (SE), government support (GS), attitude (A), subjective norm (SN), perceived behaviour control (PBC) and behaviour intention (BI) as presented in Fig 1. Based on these variables, the LBI acceptance could be investigated.

Based on the quantitative method, an online

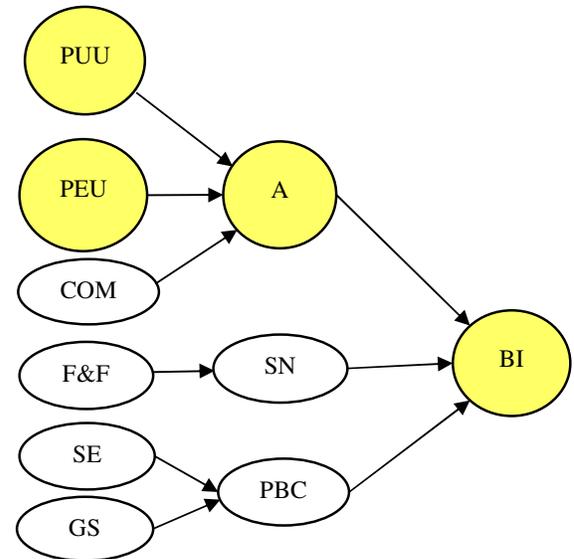


Figure 1. The proposed research model

questionnaire has been designed as shown in Appendix 1. Based on TAM factors (PU and PEU) a number of questions have been prepared. For example, to which extent the LBI system is easy to use and its usefulness. Based on the TAM part of the questionnaire results, the LBI system acceptance has been proved. Moreover, the study uses DTPB factors to produce all the questions of the same questionnaire. In addition to the TAM related questions, the DTPB questions are designed based on compatibility, family and friends, self-efficacy, government support as independent variables and subjective norm, perceived behaviour control as depended variables. Adding government support as an indicator to perceived behaviour control is to highlight this factor as a backbone of successfully implementing the LBI system in KRI. By using the DTPB results the weak reasons behind the inactiveness of LBI is established.

Furthermore, in addition to the demographic questions applied in this study questionnaire, some relative questions have been asked. One of these questions relates to the participant's preference to choose one address style between two choices; (a proposed alpha-numeric address or an available numeric address in KRI). The results of this questionnaire has been analysed and discussed in Table I.

IV. RESEARCH HYPOTHESIS

Based on the proposed model, which is based on both TAM and DTPB Fig 1, nine different hypotheses have been formulated as presented in Fig 2. The first three hypotheses (H1, H2 and H3) are proposed based on both TAM and DTPB, whilst hypotheses (H4, H5, H6, H7, H8 and H9) are based only on DTPB. The hypotheses and the mathematical equations behind dependent variables have been presented in the following subsections.

A. Attitude (A)

Most information technology acceptance models include a factor of attitude towards behaviour. This attitude examines the positive or negative feelings of individuals towards behaviour intention [10][3]. Based on Taylor and Todd the core constructs of behaviour, as illustrated in equation 1, are attitude toward behaviour (A), subjective norm (SN), and perceived behaviour control (PBC). Based on TAM, attitude is decomposed into perceived usefulness and perceived ease of use as shown in equation (2). While in DTPB attitude will be decomposed into perceived usefulness, perceived ease of use and compatibility as shown in equation (3).

$$B \cong BI = w_1A + w_2SN + w_3PBC \quad (1)$$

$$A_{TAM} \cong w_4PU + w_5PEU \quad (2)$$

$$A_{DTPB} \cong w_4PU + w_5PEU + w_6COM \quad (3)$$

Note: w_i has been evaluated as a weight for each factor in the questionnaire. In which, the value of w_i for each question can be determined based on the answer (1 strongly disagree, 2 disagree, 3 neutral, 4 agree or 5 strongly agree).

This decomposition gives more detail about the reasons of feeling positively or negatively towards the system. By improving the system based on these factors PU, PEU and COM the probability of positive attitude will increase and leads towards encouraging the use of the system.

Perceived usefulness and ease of use are important factors for technology adoption determinants in the technology acceptance model [5][11]. In the present study, these factors have been taken into consideration. Davis et al. (1989) defined perceived usefulness as the extent of a person's belief regarding the effect of using a specific system on her/his job performance [6]. Perceived ease of use is the level of effort needed for using the new system by the user [5]. Further, compatibility is defined as the level of system fit with the potential existing values and experiences [15]. The following hypotheses have been proposed based on attitude toward behaviour.

H1. Attitude has a positive effect on intention to use LBI system.

H2. Perceived usefulness has a positive effect on citizen attitudes toward using of LBI system.

H3. Perceived ease of use has a positive effect on citizen attitudes toward using of LBI system.

H4. Compatibility has a positive effect on citizen attitudes toward using the LBI system.

B. Subjective norms (SN)

Subjective norms refer to "the person's perception that most people who are important to him/her think he/she should or should not perform the behaviour [3] page 302. A subjective norm is the important factor when the users have limited experience towards developing attitudes. This happens prior to / or in the early stages of innovation implementation [14][16]. As such, SN is a combination of both peer influence and superior influence as shown in Equation (4). According to Chua, some groups will potentially influence adoption such as the adopter's friends, family, and colleagues [17].

$$SN = w_7PI + w_8SI \quad (4)$$

Based on subject norms, the following hypotheses have been formulated.

H5. Subjective norm has a positive effect on citizen behaviour intention to use LBI system.

H6. Family and friends has a positive effect on subjective norm to use LBI system.

C. Perceived behavioural control (PBC)

Perceived Behavioural Control refers to the user's perception of his/her ability to achieve system usage [14]. The perceived difficulty, as it is related to internal constraints, is one of the most important factors that should be taken into account as evidenced by Sparks et al. [18]. In this study, PBC is evaluated by summation of self-efficacy and government supports as shown in equation (5).

$$PBC = w_9SE + w_{10}GS \quad (5)$$

Self-efficacy is a people's confidence and predictions in their ability to perform a particular behaviour [19]. The adoption of any new system is based on the range of the support provided by the government, which plays an important role in the diffusion of innovation [20]. The following hypotheses are based on PBC.

H7. Perceived behaviour control has a positive effect on citizen's behaviour intention to use LBI system.

H8. Self-efficacy has a positive effect on perceived behaviour control towards using LBI system.

H9. Government support has a positive effect on perceived behaviour control.

V. METHODOLOGY AND ANALYSIS

The current study depends on a quantitative based research method (an online questionnaire). Both SPSS and AMOS Graphic programs have been used to analyse the collected data. A structured questionnaire has been designed to investigate several aspects of LBI such as behavioural intention, attitude, subjective norms, perceived behavioural control, perceived usefulness, perceived ease of use, compatibility, family and friends, self-efficacy and government support. The questionnaire, as shown in Appendix 1, started with demographic questions. The survey was conducted in

order to answer the research hypotheses discussed in section III. Other than the demographic questions, the responses measure the questions on a five point Likert-scale 1 (strongly disagree), 2 (disagree), 3 (state of unsure or neutral), 4 (agree), and 5 (strongly agree).

A. Sample profile

Google Form has been used to design the online questionnaire and has been published in December 2014. The questionnaire was distributed via professional social media groups, such as overseas postgraduate students, and sent via emails to people who have knowledge of LBI or have used this type of system. Data collection took approximately three months and the last data accepted was at the end of February 2015. The majority of the respondents are either studying or living in countries such as the United Kingdom and Germany where LBI systems are active. A total of 250 responses were returned of which 236 of them were completely answered and considered in the present study. The participants were composed of 80.5% male and 19.5% female. The age range of 72.9% of the total respondents were between 26 and 35 years old; 15.3% were between 36–45, 10.6% were between 18-25 years old and only 1% were above 56 years of age. 74.2% of the respondents were MSc/PhD degree holders, 22.9% of them were Institute/University degree holders and 2.5% of them were holding secondary degree. About 64% of the total participants do not use LBI in their daily basis and the majority of them, 97%, preferred the alpha-numeric format of LBI when they asked to choose between two samples of numeric and alpha-numeric codes. The above results and additional data are presented in Table I.

TABLE I SAMPLE DEMOGRAPHICS.

Means	Value	Frequenc y	Percentage (%)
Gender	Male	190	80.5
	Female	46	19.5
Age	18-25	25	10.6
	26-35	172	72.9
	36-45	36	15.3
	46-55	1	0.4
	>55	2	0.8
Educational level	Secondary	6	2.5
	Institute/Univer sity	54	22.9
	MSc/PhD	175	74.2
Using LBI	No	151	64
	Yes	83	35.2
Prefer address	44001207123	7	3
	A2 1BQ	229	97

B. Measurement Model Test

The data analysis was realized by using structural equation modelling (SEM) to examine the measurement model to assess convergence and hence determine validity. The measurement model has been evaluated in terms of reliability and convergent validity.

Cronbach's alpha values have been considered to test the data reliability as shown in Table II. The values of Cronbach's alpha should exceed 0.5 as a minimum

acceptable level of data reliability. Most of these values are greater than 0.8 except for Attitude towards behaviour and Perceived behaviour control which are 0.67 and 0.71 respectively.

To ensure that the measures of a given construct should be highly correlated among themselves, a convergent validity factor has been considered. The evaluation in terms of convergent validity has been made, based on the two criteria proposed by Fornell and Larcker [21][23]. The first criteria indicates that the all indicator factor loadings should exceed 0.7 and the second criteria indicates that the average variance extracted (AVE) for each construct should exceed the variance due to measurement error for that construct (i.e., should exceed 0.50). The results, presented in Table II, show that the first criteria has been met as the most exhibited loading factors are higher than 0.7. The only exception is for Attitude towards behaviour as the factor loading is 0.64. Furthermore, the symbol (/) in table II represent the null value of factor loading because TAM model has only limited factors as discussed in section (II). The AVE results, as shown in Table II, are ranged between 0.54 and 0.93. The minimum value of AVE is greater than variance due to measurement error (0.5). As both mentioned criteria have been met, the convergence validity for the measurement model has been proved.

TABLE II MEASUREMENT ANALYSIS RESULTS

Constructs	items	Factor loading TAM	AVE	factor loading DTPB	Cronbach alpha
Perceived usefulness	PU1	0.9	0.64	0.76	0.838
	PU2	0.77		0.86	
	PU3	0.74		0.78	
Perceived ease of use	EOU1	0.88	0.74	0.88	0.89
	EOU2	0.9		0.89	
	EOU3	0.79		0.8	
Compatibility	COM1	/	0.6	0.73	0.831
	COM2	/		0.78	
	COM3	/		0.81	
Family and friends	FF1	/	0.77	0.86	0.886
	FF2	/		0.9	
Self-efficacy	SE1	/	0.64	0.83	0.855
	SE2	/		0.81	
	SE3	/		0.76	
Government support	GS1	/	0.82	0.88	0.901
	GS2	/		0.93	
Attitude towards behaviour	A1	0.75	0.55	0.8	0.672
	A2	0.7		0.64	
Subjective norm	SN1	/	0.72	0.87	0.836
	SN2	/		0.83	
Perceived behaviour control	PBC1	/	0.55	0.84	0.71
	PBC2	/		0.7	
Behaviour intention	BI1	0.97	0.93	0.97	0.964
	BI2	0.96		0.96	

C. Structural Model Test

The procedure of fitting the statistical prediction model with the observed data is known as the goodness-of-fit. In other word, the observed data should fit the model prediction. To identify goodness-of-fit, many fit indices have been designed to support structural equation modelling. Five common indices have been used in the present study. These are chi-square/degrees-of-freedom (χ^2/df), comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), and root mean square error of approximation (RMSEA). Both models, TAM and DTPB, have been compared based on the mentioned measurements as illustrated in Table III. As shown, the fit statistics outcomes of CFI, NFI and IFI for both TAM and DTPB are greater than or equal to 0.9 and RMSEA values are ranged from 0.05 to 0.08, which indicate a good model fit [22][23][24].

Overall, the result of TAM shows a better model fit than DTPB by using the same sample size. This difference is due to reasons, such as higher number of observed variables and existence of government support in DTPB, which are the main sources of measurement error.

Based on the result of the fit indices explained above, TAM gives a better model fit than DTPB with the same sample size. Furthermore, the result of Akaike's Information Criterion (AIC), 137.15 for TAM and 724.15 for DTPB, is further evidence that TAM has a better model fit than DTPB as the lower value of AIC indicates the better model fit [23][24].

TABLE III CHI-SQUARE RESULTS AND GOODNESS OF FIT INDICES FOR

Fit indices	Norm	Obtained value TAM	Obtained value DTPB
Absolute indices			
Scaled CMIN (CMIN/DF)	>1 and <5	2.238	2.334
Root mean square error of approximation (RMSEA)	< 0.08	0.073	0.075
Incremental indices			
Comparative fit index (CFI)	>0.9	0.977	0.928
Normed fit index (NFI)	>0.9	0.96	0.9
Incremental fit index (IFI)	>0.9	0.977	0.929
Parcimonie indices AIC	The lower by comparison	137.15	724.15

REVISED MODEL

D. Hypotheses testing

From the proposed model, the standardized parameter estimation is depicted in Fig. 2. H1 Attitude is significantly and positively influencing behaviour intention to use an LBI system ($\beta=0.32$, $p=0.01$), thus, H1 is supported. The second hypothesis H2 is supported as the results show that the perceived

usefulness is significantly and positively affecting attitude toward LBI ($\beta=0.41$, $p<0.001$).

H3 has also been supported as the results ($\beta=0.56$, $p<0.001$) prove that the perceived ease of use is significantly and positively related to attitude to use LBI. Furthermore, H4 is supported as the compatibility is significantly and positively affecting attitude toward using LBI ($\beta=2.78$, $p<0.005$). H5 has been supported, as the subjective norms are significantly and positively influencing behaviour intention to use LBI ($\beta=0.15$, $p<0.05$). Family and friends are significantly and positively affecting subjective norm to use LBI ($\beta=0.81$, $p<0.001$) hence, H6 is supported. H7 perceived behavioural control is supported, which is significantly and positively influencing behaviour intention to use LBI ($\beta=0.62$, $p<0.001$). Self-efficacy, H8, is supported which has significant and positive effect on perceived behavioural control to use LBI ($\beta=0.87$, $p<0.001$). The significant and positive influences of government support (H9) on perceived behavioural control to use LBI, as the final hypothesis, have been supported by the results of ($\beta=-0.11$, $p<0.05$).

I. CONCLUSIONS AND DISCUSSION

The Technology Acceptance Model has been used in the present study to test the acceptance of a non-technology system such as LBI. Both TAM and DTPB models have been used to examine the adoption of LBI system in KRI. The reasons behind using two different

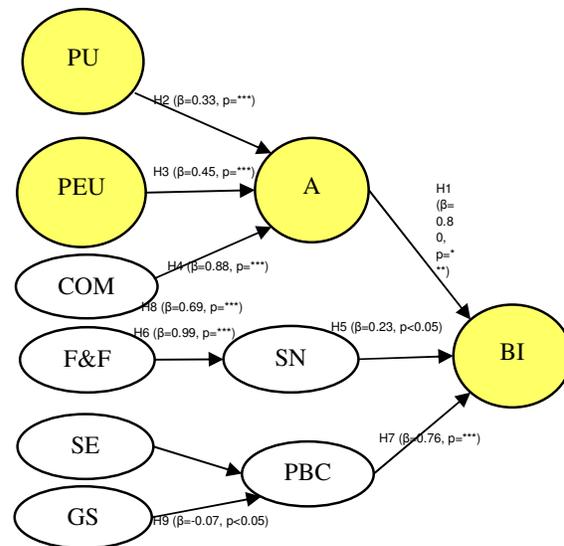


Figure 2. Research Hypothesis

models are to concentrate on the effects of government support (GS) for activating LBI system in KRI by using DTPB and comparing with the results of TAM. Furthermore, TAM focuses on PU and PEU factors that have positive effects on attitude toward using LBI system that gives better results when compared with DTPB. This result shows that the proposed model has a good explanatory power and confirms its robustness to predict the intention of the citizens to accept and use an

LBI system. However, this type of system has been neglected so far due to the absence of government support, which has led to lack of community awareness towards using the LBI in the private sectors. The research hypothesis results show that the p value of GS is less than 0.061 while the overall p value is less than 0.001. Perceived usefulness is found to be a significant determinant in predicting the behavioural intention to use LBI in the both models of TAM and DTPB. This study clearly demonstrated that the perceived ease of use has a significant effect on attitude toward LBI. The results of DTPB show that compatibility, family and friend, self-efficacy, subjective norm and perceived behaviour control have positive effects on attitude towards using the system.

To design an accepted LBI system by KRI citizens, the results of this study can be useful. The designed system, preferred by those who completed the survey, has features of ease of use. The preferred system uses a short code with a constrained number of alpha-numeric characters as described in [2] rather than long series of 13-digit as currently used in KRI. Replacing the classical governmental system, to the modern system is a key factor toward utilising LBI. Community support in terms of awareness and advertisements may help to increase confidence in using LBI in daily life.

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Appendix 1: The questionnaire used in the present study

Questions	1	2	3	4	5
Perceived Usefulness					
PU1: Using the addressing system would enable me to accomplish my tasks more quickly.					
PU2: Using the addressing system would make it easier for me to carry out my tasks.					
PU3: Using the Addressing system in my life increases my productivity.					
Compatibility Relative advantage					
COM1: Using the Addressing system will save time.					
COM2: Using addressing system allows me to manage my work more effectively.					
COM3: Using addressing system gives me greater control over my work.					
Ease of Use					
EOU1: Addressing system is easy to learn.					
EOU2: Addressing system is easy to operate.					
EOU3: Interaction with addressing system does not require a lot of mental effort.					
Family and Friends					
FF1: My family would think that I should use Addressing system.					
FF2: Most people would think that I should use the Addressing system					
Efficacy					
EF1: I would feel comfortable using the Addressing system on my own.					
EF2: I am confident of using addressing system even if I have never used such a system before					
E3: I am confident of using addressing system if I have just seen someone using it before.					
Government Support					
GS1: The government supports using Addressing system in Kurdistan Regional Government.					
GS2: Kurdistan government is active in setting up the facilities to activate addressing system.					
Attitude					
A ₁ : Using the Addressing system is a good idea.					
A ₂ : Using Addressing system is a wise idea.					
Subjective Norm					
SN ₁ : People who influence my behaviour would think that I should use the Addressing system.					
SN ₂ : People who are important to me would think that using the Addressing system is a wise idea.					
Perceived Behavioural Control					
PBC ₁ : I would be able to use the Addressing system.					
PBC ₂ : Using the Addressing system is entirely with my control.					
Behavioural Intention					
BI ₁ : I plan to use the Addressing system if available.					
BI ₂ : I intend to use the Addressing system to send, receive post and other applications within the next 3 months if available.					