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Applying Farmer Technology Acceptance Model to Understand Farmer's Behavior Intention to use ICT Based Microfinance Platform: A Comparative analysis between Bangladesh and China.

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Abstract: Bangladesh has been a pioneer in the microfinance movement since its inception in the early 1980s, and today this concept has been adopted by many countries including China, India, and Brazil. It is already proven as strong and useful poverty reduction tools by researchers worldwide. Conversely, Online Peer-to-Peer (P2P) lending, also known as online social lending is a new form of electronic commerce platform for the poor. Nowadays, the main concept has been exacerbated by MFIs towards achieving institutional benefits rather than alleviating poverty. The essence of ICT, which is widely used by middle and poor class farmer in Bangladesh, has not been incorporated with microfinance platform extensively. This paper describes farmers' perceptions about P2P microfinance platform in terms of applying the Farmers Technology Acceptance Model (FTAM). This study also proposed an integrated theoretical framework of farmer acceptance and intention to use ICT enabled product and services based on technology acceptance model (TAM). Total Eighty (80) households from both countries were surveyed with structured questionnaire during the FGD, and In-depth Interview sessions to know the perception about technology, and the motivations to use ICT Based Microfinance Platform in resolving agriculture needs by the rural farmers. In this study, analysis of field study data provides evidence of the reliability and validity of the proposed Conceptual Model. Finally, a comparative analysis is drawn based on empirical evidence, collected from both countries. The findings contribute to future research on external variables of TAM.

Keywords: Microfinance, Peer-to-Peer (P-to-P), Technology Acceptance Model (TAM), Social Influence, Innovativeness, Information and Communication Technology (ICT),

1. INTRODUCTION

Microfinance, also known as micro credit, has emerged as a movement in Bangladesh and in the larger part of the world including Pakistan, Brazil, Uganda and China. This country provides models of recognized global significance in several aspects of Microfinance, scale of operation, modes and practices of Microfinance, wider financial services, and poverty alleviation.

Conversely, P-to-P platform which is considered as ICT based microfinance platform, has been implemented in China by *creditease.com* and *wokai.org*, etc. for lenders and borrowers where investor can invest a minimum amount of money. However, Bangladesh has Microfinance system which is being operated by Banks and NGOs without any flavor of ICT, which is also appeared to be a manual system. ICT-based CB model is being implemented by Brazil in order to scale up microfinance services. In spite of the fact that repayment rate of microfinance in Bangladesh and P to P platform in China is almost universal, microfinance in Bangladesh lost its original objective which is always been poverty alleviation, in reducing poverty as projected. The entire management of MFI could be easier through the introduction of ICT based P-to-P tool for better transparency, accessibility, credibility, and accountability from the experience of China.

This study focuses on the development and adoption process of ICT enabled products and services by low-income group (farmer) fostering rural development of developing country like Bangladesh, and China based on the Technology Acceptance Model proposed by Davis in 1989. The results of this study may help MFIs make better decisions in using technology more effectively by the rural farmer. Moreover, it can help NGOs

introducing ICT based tools to obtain the core objective of Microfinance.¹

2. REVIEW OF RELATED LITERATURES AND STUDIES

2.1 Microfinance Bangladesh - a space to operate for the poor

Nearly half of the country's population lives below the poverty line. But the poor did not practically have any access to institutional credit, primarily because they are not considered credit worthy. In 1991 the top ten percent of landowners owned sixty percent of the land, while the bottom sixty percent of landowners had only one percent of the land^[1]. Therefore, poor cannot borrow adequate fund from banks or other financial institutions to meet their agricultural needs. The informal money markets including the traditional moneylenders provide loans, but they charge exorbitant rate of interest. As a result, the poor cannot be accessed to institutional credit facilities. Financial institutions provide loan for the purpose of commercialization and industrialization. The situation of the vulnerable farmers is exacerbated by the land erosion, drought, flood, deforestation and other natural calamities. These together with lack of access to finance reduce farmers' propensity to take risks ^[2]. Microfinance thus found a space to operate for the poor. The main concept of microfinance was exclusively proposed, and initiated by Dr. Muhammad Yunus.

2.2 Financial services for the poor through the appropriate use of ICTs

Microfinance operation in Bangladesh is operated manually by MFIs. Due to lack of education among borrowers of microfinance in Bangladesh, It has always been considered as a manual loan disbursement and repayment system. A simple MIS based information system has recently been suggested by academic researchers in order to minimize the intensity and extent of this operational difficulty. A simple web-based database that would contain only the borrower name, national identification number, loan providing organization, the date of disbursement and date of last repayment can mitigate the extend of overlapping in a considerable proportion.^[3]

Conversely, ICT with microcredit is highly adopted by Brazilian Banking industry. One of the most relevant ICT-related phenomena in the Brazilian banking industry in recent years has been the growth of correspondent banking arrangements as a means through which banks can downscale financial services outside of traditional bank branches, through partnerships with non-bank businesses such as supermarkets, lottery shops, drugstores, as well as with dedicated microfinance institutions(MFIs)^[4]. Value addition in agriculture requires technological, institutional ,and price incentive changes designed to raise the productivity of the small farms ^[5]Value can be delivered by using appropriate technology to increase the productivity.

Therefore, there is enough scope and need for applying the most modern production technologies with microfinance platform. This can create a force to enterprise development supported by microfinance. Modern technology, coupled with enterprise development, will create a new course of microfinance in Bangladesh ^[6].Currently, microfinance program in Bangladesh is not supported by modern technology. Microfinance with ICT can be a new era for Bangladesh and it can be helpful for both lender and borrower. Better financial services for the poor through the appropriate use of ICTs could help the microfinance providers do even better ^[7]

2.3 Agricultural and rural development in the course of ICTs

As , ICT diffusion started to grow in many developing countries, the application of ICT to agricultural and rural development began to receive the attention of researchers and policy makers. A number of studies have suggested that ICT could play a significant role in agricultural development. It has been claimed that through social networks, farmers can obtain information (e.g. on prices or the weather) that they can use to improve their farm income, and their lives, leading to rural development. It has been suggested that farmers in rural villages can use voice and data services over mobile telephones to benefit from such information ^[8].

CIS (Community Based Information System) initiated by Grameen phone in Bangladesh, and different value added services by Banglalink in order to provide access of information to rural community. ICT enabled product

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and service for farmer will create a new space for the poor to get the access of non institutional loan service.

2.4 P-to-P market place in China: Convenient and fast to transact between borrowers and lenders

Online P2P lending market as an emerging market operated in china, it is convenient and fast to transact between borrowers and lenders ^[9]. Online Peer-to-Peer (P2P) lending (also called online social lending) is a new form of electronic commerce first emerging in 2005 ^[10]. In addition, (P2P) lending is the marketplace where individuals can make unsecured online microloans to other individual borrowers. P to P as online new lending platform emerged in 2005. Due to a lack of trust; only a small fraction of borrowers can successfully get the required loan ^[11]. This trust matter can be improved by inputting proper ICT with the distribution system in a form of farmer loan card. Growth of P to P lending market can be achieved through incorporating web 2.0 technologies. Kiva's growth can be attributed to the application of Web 2.0 technologies into its operational model ^[12]. Meanwhile, other researchers discussed lenders' risk and return in the P to P lending market based on information utilization.

2.5 Development of IT adoption theories

The theoretical basis of the TAM model was based on Fishbein and Ajzen's Theory of Reasoned Action (TRA) ^[13]. Among the IT adoption theories, the most important and influential theories are theory of reasoned action (TRA) ^[13], technology acceptance model (TAM) ^[14], extended technology acceptance model (TAM2) ^[15], theory of planned behavior (TPB) ^[16], and most recently, the UTAU ^[17]. The theories of TPB, TAM, and UTAUT are all originated from the TRA ^[13] in 1975.

According to the TRA, the behavior of individuals can be predicted to a certain extent through behavioral intention (BI), which is the measurement of an individual's intent of doing something. Based on the TRA, Davis proposed the TAM ^[14], which argues that user's intent of use and behavior to use a new information system is determined by a user's perceived ease of use and perceived usefulness. Perceived ease of use is defined as the degree to which "a person believes that using the system will be free of effort" ^[14].

3. RESEARCH DESIGN AND THEORETICAL FRAMEWORK OF THE STUDY

A number of theoretical models have been proposed to facilitate the understanding of factors impacting the acceptance of information technologies. Among these studies, the Technology Acceptance Model (TAM) is one of the most influential and robust in explaining IT/IS adoption behavior. The key purpose of TAM is to provide a basis for discovering the impact of external variables on internal beliefs, attitudes, and intentions. Technology acceptance model (TAM), originally proposed by Davis in 1986. Two cognitive beliefs is postulated in TAM: perceived usefulness and perceived ease of use. According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention, and actual use through mediated effects on perceived usefulness and perceived ease of use.

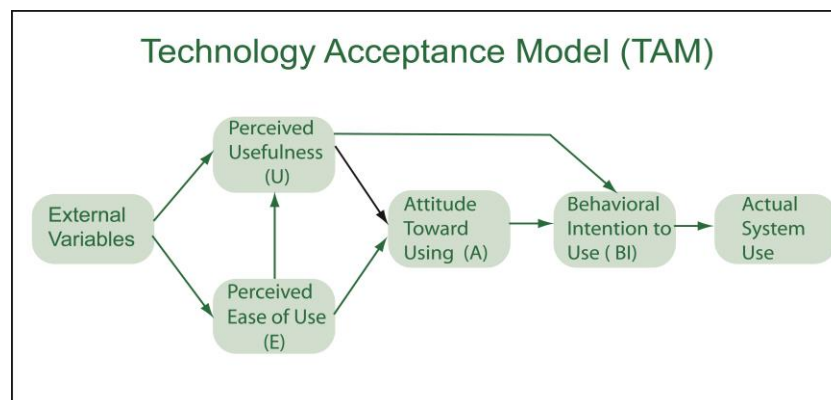


Figure 1. Original Technology Acceptance Model (TAM)

To design Theoretical Framework of this study, researchers used TAM as a basic model. The nature of the study is highly associated with technology adoption of a particular IS. TAM was used to design Consumer Acceptance of Technology (CAT) model, proposed by Kulviwat. Consumer Acceptance of Technology (CAT), is comprehensive yet parsimonious and, thereby, more powerful in describing and predicting consumer adoption of technology [18]. Based on the facts, it can be argued that TAM is more appropriate theoretical base to design a Farmer Technology Acceptance Model for Developing Country. Some external variables have been incorporated into TAM in order to design the Farmer Technology Acceptance Model for developing countries, such as Bangladesh, china. TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use [19]

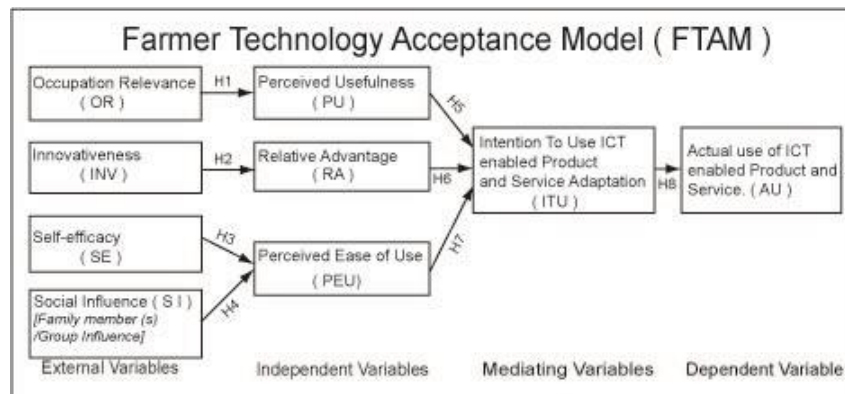


Figure 2. Farmer Technology Acceptance Model (Developing Country)

Figure 2: represents a theoretical model to be tested and analyzed. The design of the theoretical framework of the study is based on literatures, studies, and researcher prior field experience. The arrows linking constructs specify hypothesized causal relationships in the direction of the arrows. Perceived ease of use, Relative advantage, and Perceived usefulness can be considered Independent variables. Meanwhile, the attitude towards ICT enabled product and services and intends to use ICT enabled product and services could be regarded as mediating variables which is also connected with Actual use of ICT enabled product and services, considered as Dependent variables. In the model, Occupation relevancy, Innovativeness, Self-efficacy, Social Influence considered as External variables.

4. HYPOTHESIS DEVELOPMENT

In accordance with the previously stated objectives, consistent with IS/IT related literatures, and researcher prior field experience, this study tested the following hypotheses:

H1: Specific Occupation Relevancy of a farmer has a positive relationship determining perceived usefulness about Specific ICT enabled product and services

H2: Innovativeness of ICT based product and service is positively associated with Relative advantage

H3: General mobile phone self-efficacy of a farmer has a positive relationship determine her or his perceptions of ease of use about specific ICT enabled product and services

H4: Social Influence (Family member Influence or Group influence) of a specific system has a significant impact in determining perceived ease of use of a system without direct hands-on experience with the system.

H5: The higher the perceived usefulness of an ICT enabled product and services, the more positive the Behavioral Intention to use the ICT enabled Product and Service

H6: The higher the perceived relative advantage of an ICT enabled product and services, the more positive the Behavioral Intention to use the ICT enabled Product and Service.

H7: The higher the perceived ease of use of an ICT enabled product and services, the more positive the Behavioral Intention to use the ICT enabled Product and Service

H8: There will be a positive relationship between Behavioral Intention to use the ICT enabled Product and

Service and Actual use of ICT enabled Product and Service

5. RESEARCH METHODS, QUESTIONNAIRE, AND STASTICAL TREATMENT OF DATA

Primary data was collected through questionnaires completed by the rural farmer during FGD and In-depth sessions. Total eighty (80) households were surveyed from Bangladesh, and china to know the perceptions about the technology, and their motivations to use Peer-to-Peer (P2P) Microfinance Platform. Data was collected through questionnaires completed by the rural farmer during FGD and In-depth sessions organized by the researcher. The research study consists of views of key person or individual of a Household. Therefore, data collected from the key person of the household was considered as household data.

Forty (40) households were selected and surveyed to know the perceptions about the ICT based microfinance platform in Bangladesh. Due to non-availability of P-to-P lending platform in Bangladesh, Bangladeshi farmers were considered as non-experienced user, therefore only non-user of P-to-P category was focused for selecting respondents. Due to resource limitation, Bogra city was prioritized for investigation. Researcher personally visited the concerned person to conduct the interview along with one research assistant nominated by a researcher. All questionnaires were supported by standard local language (Standard Bengali).

Conversely, P-to-P microfinance platform is widely been used by Chinese farmers, hence, Chinese farmers were considered as experienced user. Forty (40) households were selected and surveyed to know the perceptions about the ICT based microfinance platform in china. Due to resource limitation, Hangzhou, and its near cities were prioritized for investigation. Researcher approached random individuals' farmers who appeared to have time and willingness to participate within the decided sample extent and sample frame. All questionnaires were supported by standard local language (Simplified Chinese).

Each individual was asked to indicate the extent of agreement with statements about the adoption of ICT, using a seven-point Likert scale ranging from (1) Strongly Disagree to (7) Strongly Agree for each factor.

The collected data was coded by using SPSS program for Statistical Analysis. In addition, qualitative data that was gathered through interviews, questionnaires, documentary materials, and other channels was also being analyzed and interpreted. In order to test the hypotheses by structural equation modeling (SEM), SMART PLS 2.0 was employed.

6. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA (BANGLADESH AND CHINA)

6.1 Reliability and Validity Analysis:

The results of Reliability and Validity Analysis of the data collected from Bangladesh and China are shown in Table: 1. A reliability analysis was conducted for the scales using Cranach's Alpha. As summarized in Table 1, all scales that represent in the FTAM constructs appear to have a good degree of reliability since each computed statistic is above .70.

Table 1. Reliability Analysis (n=80)

	AVE		Composite Reliability		R Square		Cronbachs Alpha		Commonality		Redundancy		No. of Items
	BD*	CN**	BD	CN	BD	CN	BD	CN	BD	CN	BD	CN	
Actual use	0.8737	0.7084	0.9540	0.8790	0.9218	0.6848	0.9274	0.7940	0.8737	0.7084	0.8003	0.4628	3
Innovativeness	0.3337	0.7491	0.5960	0.9227	0.2840	0.3644	0.7075	0.8902	0.3337	0.7491	0.0744	0.2518	4
Intention to use	0.9531	0.8295	0.9839	0.9359	0.5903	0.5463	0.9754	0.8973	0.9531	0.8295	0.5088	0.0204	3
Occupation Relevance	0.6710	0.6947	0.8905	0.8997	0.0000	0.0000	0.8376	0.8466	0.6710	0.6947	0.0000	0.0000	4
Perceived Ease of Use	0.8385	0.7731	0.9541	0.9316	0.5369	0.6641	0.9359	0.9023	0.8385	0.7731	0.3800	0.2320	4
Perceived Usefulness	0.8190	0.8520	0.9475	0.9584	0.4412	0.6063	0.9264	0.9422	0.8190	0.8520	0.3568	0.5100	4
Relative advantage	0.8404	0.7742	0.9404	0.9114	0.0716	0.1600	0.9048	0.8541	0.8404	0.7742	0.0604	0.1225	3
Self-efficacy	0.5567	0.5593	0.8546	0.8617	0.3212	0.5891	0.7925	0.8002	0.5567	0.5593	0.1683	0.3154	5
Social Influence	0.7902	0.6802	0.9376	0.8879	0.5156	0.6614	0.9130	0.8205	0.7902	0.6802	0.3828	0.4493	4

*BD: Bangladesh **CN: China

In addition, according to Henseler [20] the composite reliability as a measure of internal consistency should be higher than 0.6. From the above Table 1, researcher can conclude that all (9) nine reflective

constructs have high levels of internal Consistency reliability.

6.2 Correlations Analysis:

Table 2 provides a summary of a Latent Variable Correlation analysis to test the relationships among the FTAM construct. It appears that the data collected from Bangladesh, do not support a significant relationship between occupation relevance and perceive usefulness. In addition, data do not support a significant relationship between innovativeness and relative advantage.

Table 2. Latent Variable Correlations (n=80)

	AU		Inv		ITU		OR		PEU		PU		RA		SE		SI	
	BD*	CN**	BD	CN	BD	CN	BD	CN	BD	CN	BD	CN	BD	CN	BD	CN	BD	CN
Actual use(AU)	1	1																
Innovativeness(Inv)	0.7415	0.6173	1	1														
Intention to use(ITU)	0.9601	0.8275	0.7306	0.4234	1	1												
Occupation Relevance(OR)	0.462	0.6901	0.5330	0.6036	0.4461	0.6625	1	1										
Perceived Ease of Use(PEU)	0.7533	0.6833	0.5559	0.7327	0.7389	0.4902	0.5842	0.7206	1	1								
Perceived Usefulness(PU)	0.2089	0.7228	0.1513	0.5230	0.2405	0.6922	0.6642	0.7787	0.5568	0.6576	1	1						
Relative Advantage(RA)	0.3895	0.7287	0.2675	0.4000	0.4084	0.7185	0.6457	0.7311	0.6938	0.5900	0.8804	0.8295	1	1				
Self-Efficacy(SE)	0.6499	0.7430	0.5668	0.7675	0.6652	0.6358	0.5225	0.8125	0.7050	0.7357	0.5279	0.7320	0.6675	0.6943	1	1		
Social Influence(SI)	0.4487	0.6436	0.4422	0.6814	0.4752	0.5294	0.6786	0.7393	0.6452	0.8023	0.8201	0.6783	0.8320	0.5535	0.7181	0.8133	1	1

*BD: Bangladesh **CN: China

Conversely, data collected from China do not support a significant relationship between occupation relevance and perceive usefulness. In addition, data do not support a significant relationship between innovativeness and relative advantage.

6.3 Testing Research Hypotheses

After reviewing the T statistics shown in Table 3 researchers can conclude that, five of the eight path coefficients in the inner model of FTAM (Bangladesh) are statistically significant. Conversely, six of the eight path coefficients in the inner model of FTAM (China) are statistically significant.

As we know that when the size of the resulting empirical t-value is above 1.96, we can assume that the path coefficient is significantly different from 0 at a significance level of 5 percent ($\alpha = 0.05$; two-sided test). The critical t-values for significance levels of 1 percent ($\alpha = 0.01$; two-sided test) and 10 percent ($\alpha = 0.10$; two-sided test) probability of error are 2.57 and 1.65, respectively.

Table 3. Bootstrapping Results

Hypothesized path	Standard Deviation (STDEV)		T Statistics (O/STERR)		Total effect		Result of hypotheses	
	BD*	CN**	BD	CN	BD	CN	Bangladesh	China
Innovativeness -> Relative advantage	0.3197	0.1579	0.8367	2.5326	0.2675	0.7787	Not Supported	Supported
Intention to use -> Actual use	0.0337	0.0451	28.5011	18.3421	0.9601	0.8275	Supported	Supported
Occupation Relevance -> Perceived Usefulness	0.2441	0.0575	2.7217	13.5506	0.6642	0.7787	Supported	Supported
Perceived Ease of Use -> Intention to use	0.3374	0.2819	2.5017	0.0913	0.8442	0.0258	Supported	Not Supported
Perceived Usefulness -> Intention to use	0.2900	0.3046	1.6610	1.6643	0.3267	0.2944	Supported	Supported
Relative advantage -> Intention to use	0.3203	0.1740	0.3445	2.6388	0.1104	0.4591	Not Supported	Supported
Self-efficacy -> Perceived Ease of Use	0.2179	0.1673	2.2900	1.4676	0.7050	0.7357	Supported	Not Supported
Social Influence -> Perceived Ease of Use	0.2308	0.1734	1.2433	3.4761	0.2869	0.6026	Not Supported	Supported

*BD: Bangladesh **CN: China

7. COMPARATIVE ANALYSIS BETWEEN BANGLADESH AND CHINA

Comparative analysis is based on the initial information needed to assess Structural equation modeling (SEM) results. This includes outer model loadings, construct reliability, convergent validity, inner model path coefficient sizes and significance, and descriptive analysis. The initial results indicate the FTAM model findings are meaningful.

Based on the survey, researchers can conclude that farmers of Bangladesh tend to have a secondary occupation to improve the standard of living. As, farming is seasonal activities performed by Bangladeshi farmer, it is necessary to have a secondary occupation. In terms of ownership of land, it can be seen that only fewer farmers have own land for farming. The majority falls in the categories of poor and middle class farmer. Microfinance is playing quite significant role towards improving the standard of living of Bangladeshi farmers.

Farmers of Bangladesh actively seek innovative product, provide encouragement to others. Hence, society of Bangladesh is highly Innovative and supportive. Strong evidence can be found from the above data about the transformation of skills and knowledge from one technical object to another ICT based services. Cell phone operation plays a crucial role for developing necessary skills, and technical knowledge towards using more complex IS/IT solutions. Farmers believe that IS/IT based solutions are highly relevant to farmers occupation. It will enhance their chances of getting better agriculture productivity and output, as a result they are eager to accept any sort of IS/IT solutions in resolving agriculture financing problem.

In addition, Bangladeshi farmers are influenced by co-worker, the village leader, educated person of the family. Overall, the educated person in the family has a strong influence to motivate others. In addition, Bangladeshi community is supportive enough to the use of ICT enabled Product and Services for agriculture financing. A strong social influence existed in Bangladeshi farmer community. Therefore, Bangladeshi farmer's intention to-words ICT enabled Product and Services for agriculture financing is relatively positive. They are intended to use such kind of service, if appropriate chance is given by the NGO. Also, they are intended to use ICT product and Services frequently in their agricultural work. Bangladeshi farmers would definitely use ICT enabled product and service to fulfill their agricultural financial needs, if they have access to such kind of services. Despite of the fact that ICT enabled products and services is difficult to operate; Bangladeshi farmers will continue using ICT enabled products and services in resolving agriculture needs.

On the other hand, Chinese data show relatively similar result. The consequences of the study are based on data gathered during the investigation phase in China. Based on the above evidence gathered from china, researcher can conclude that ICT based product and service is highly relevant to farmers' occupation. It will enhance their chances of getting better agriculture productivity and output. The people of China actively seek innovative product, and provide encouragement to others. Hence, society of China is also highly Innovative.

In addition, evidence supports that Chinese farmers are also influenced by co-worker, the village leader, educated person of the family. Overall, the educated person in the family has a strong influence to motivate others. In addition, the Chinese community is supportive enough to the use of ICT enabled Product and Services for agriculture financing. A strong social influence existed in Chinese farmer communities. The IS / IT concept is totally clear and understandable to the farmers, and It will be easy for them to become skillful at it. Strong evidence supports that, necessary skills and knowledge are existed among Chinese farmer in order to adopt complex IS/IT application. Also, they are intended to use ICT product and Services frequently in their agricultural work.

8. CONCLUSION

Similar to earlier studies, this study aimed to confirm TAM to be a useful theoretical model in helping understand and explain farmers of developing countries behavioral intention to use IS/IT services. Based on TAM, the researcher developed and tested FTAM in developing China after incorporating some constructs, such as Social influence, Innovativeness, Occupation Relevance, and self-efficacy, and Relative advantage as an independent variable. All constructs of the FTAM have enough theoretical support. The result of the study demonstrated that some TAM constructs had a direct and indirect effect on IS/IT adoption and intention to use IS/IT by the rural farmers of developing countries.

In the context of Bangladesh, both occupation relevance and self efficacy play an important role in affecting intention to use ICT enable product and service. Self-efficacy is considered as an intrinsic motivational factor that could help local farmer to adopt IS/IT solution. On the other hand, Endogenous constructs, neither

innovativeness nor social influence had a significant direct effect on intention.

In the context of china, both occupation relevance, innovativeness, social influence play important role in affecting intention to use ICT enable product and service. Conversely, Self efficacy which is considered as an intrinsic motivational factor that could help local farmer to adopt IS/IT solution, could not directly affect on perceived ease of use. On the other hand social influence positively affected perceived ease of use.

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