Communications of the Association for Information Systems

Volume 19 Article 23

April 2007

The Effect of Culture on User Acceptance of Information Technology

Kakoli Bandyopadhyay
Lamar University, Kakoli.Bandyopadhyay@lamar.edu

Katherine A. Fraccastoro
Lamar University

Communications of the Association for Information Systems

THE EFFECT OF CULTURE ON USER ACCEPTANCE OF INFORMATION TECHNOLOGY

Kakoli Bandyopadhyay
Department of Information Systems and Analysis
Katherine A. Fraccastoro
Department of Management and Marketing
Lamar University
Kakoli.Bandyopadhyay@lamar.edu

ABSTRACT

The UTAUT (Unified Theory of Acceptance and Use of Technology), a unified model of the acceptance of technology by workers in the United States, explains individual acceptance and usage decisions of a technology in organizations (R^2 up to 70 percent); its usefulness, however, has not been tested in settings outside the U.S. Other models of technology use, such as the Technology Acceptance Model (TAM), have been predictive within the U.S., but have been found to be less predictive when tested in countries outside the U.S., such as Switzerland, Japan, Arabic countries, and Hong Kong, suggesting that culture may play a significant role in Information Technology (IT) usage and adoption. No clear relationships, however, have been established between cultural variables and IT adoption factors. The UTAUT model includes social influence as a factor that explains some of the variance in users' acceptance of technology. One dimension of the social influence factor is culture. This study examines the effect of culture through the social influence variable of the UTAUT model on user acceptance of Prepayment Metering Systems - an Information Technology-based innovation in India. The findings indicate that social influence, along with performance expectancy and effort expectancy (R^2 = 72 percent), is a significant factor influencing consumers' intention to use the Prepayment Metering Systems. Social influence represents societal pressure on users to engage in a certain behavior. This social pressure for an individual to perform a behavior varies by culture. Our study confirms our proposition that the social influence based in culture will provide additional explanatory power concerning consumers' intention to use a technology.

I. INTRODUCTION

Multiple models have been used to attempt to explain or predict user acceptance of technology, most recently, the UTAUT [Venkatesh, Morris, Davis, and Davis 2003]. According to Chau [1996] and Hu, Chau, Sheng, and Tam [1999], many studies have examined user acceptance of technology and usage behavior and have developed theories to explain and measure the different empirical settings characterized by user group, technology, and organizational context. In addition, many studies proposed extensions and modifications to models such as TAM based on the theory of reasoned action, the theory of planned action, and the innovation diffusion theory. Jointly, research results suggest several models are capable of providing fairly adequate explanation and/or prediction of user acceptance of IT, with UTAUT being the most predictive [Chau 1996; Davis, Baggozzi, and Warshaw 1989; Hu et al. 1999; Venkatesh et al. 2003].

Most of these existing studies, however, were conducted in the United States and in Canada. When tested outside of North America, for example, in Switzerland, Japan, Arabic countries, and in Hong Kong, most models have been found to be less predictive [Rose and Straub 1998; Straub 1994; Straub, Keil, and Brenner 1997]. Culture is suggested as important in explaining IT usage behavior [Straub et al. 1997]. The existing studies, however, have not established clear relationships between cultural variables and IT usage determinants. Even when culture is examined, as in the UTAUT, it is generally the organizational culture that is considered. We propose to examine the effects of one's country culture in the existing UTAUT model and test it outside the U.S.

The country we have considered is India. India presents a new opportunity to test the acceptance of technology in a cultural setting that varies significantly from those in which the majority of technology acceptance models have been studied. Specifically, according to Hofstede [1980], India is a collectivist culture that may be affected by different factors than the typical individualistic culture, such as the United States, when it comes to IT acceptance. Second, since the 1990s, India's attempt at modernization has resulted in increased IT acceptance across industries [Tarafdar and Vaidya 2006]. Hence, the choice of India is appropriate since it allows us to test the UTAUT model in a country that widely utilizes a variety of technologies and that differs from the Western individualistic cultures.

There are several other advantages of conducting the technology acceptance study in India. The Indian market has become increasingly attractive for global marketers in recent years. Even though the overall per-capita GDP of the 1-billion-strong population of India is relatively low at $421 [Budhwar 2001], there are about 203 million middle-class consumers in the country who belong to well-educated households with salaries worth more than $5,000 in local purchasing power [Ramachandran 2000], an amount sufficient to sustain purchases of foreign consumer products. While India exports more than $6.4 billion in software and services, employing about 415,000 software professionals in more than 900 firms [Edwards and Sridhar 2003], the economic liberalization policies undertaken by the Indian government since the early 1990s have created great opportunities for foreign businesses to tap the potential of the huge Indian market as well. As a result, foreign direct investment (FDI) flow to India increased from a paltry $103 million in 1990-91 to $5.1 billion in 2000-01. Foreign marketers in diverse sectors, from Information Technology and consumer electronics to soft drinks and fast food, have entered the Indian market and are competing with domestic marketers.

While India's emerging market holds great commercial opportunities for U.S. IT firms, these firms need to gain a better understanding of the differences in consumers' perceptions and adoption of information technologies between the U.S. and India to be successful. Gaining access to India's markets will require careful analysis of consumer usage behavior. Our study can help understand the impact of culture on technology acceptance in India – the largest market in South Asia.

The UTAUT will be tested in the context of user acceptance of Prepayment Metering Systems in India. The Prepayment Metering System is an Information Technology-based innovation that involves the payment of electricity by consumers prior to its use [Ghosh 2002]. The consumer purchases credit and uses the electricity until the credit runs out. A Prepayment Metering System consists of three components: 1) an electricity dispenser; 2) a vending station; and 3) a system master station. An electricity dispenser is an intelligent meter with a built-in disconnecting device and a means of external inputs (smart card reader, keypad, etc.). The dispenser maintains the consumer's electricity credit account and disconnects the supply when the prepayment runs out. A vending station, managed by third-party agents, receives customer payments in advance and issues a coded set of information to be entered into the dispenser. A system master station communicates with various vending stations via electronic data linkages. It maintains a common database for reporting information on consumers, tariff changes, detailed customer sales and provides better administration and financial control.

The early prepayment meters were coin-like token-operated electromechanical meters. Tokens purchased by customers from the utility company were dropped into the holding bin of the meter

to activate the mechanical switching device allowing electricity to flow through the meter. When the electric consumption used up the money in the meter, the switching device interrupted the flow of electricity.

In the 1980s, electronic token Prepayment Metering Systems were introduced. An electronic token-operated meter uses a magnetic stripe card or a smart card instead of a coin-like token. A magnetic stripe card has a magnetic stripe on one side of the card that holds all data. Customers can put money onto the card by taking it to a vending location. Vendors put the card into a card encoder and write the dollar amount of the purchase onto the magnetic stripe. Customers run the card through a magnetic card reader at home and transfer the purchase amount from the card to the meter. A magnetic stripe card token is a one-way token where the purchase amount is transferred to the home meter from the utility company. It, however, does not transfer information from the home to the utility company.

The smart card electronic token has a small memory chip inserted into the card instead of a magnetic stripe at one end. The memory chip enables the smart card to hold much more data than the magnetic stripe card and it is known as a two-way token system. In a two-way token system data can be transmitted in both directions between the utility company and the home meter.

The newest development in the Prepayment Metering Systems is the introduction of the token-less approach. The token-less prepayment systems utilize a keypad meter where the data from the vending station is transferred to the electricity dispenser by means of an encoded number that is given to the customer. The customer enters the encrypted number on the keypad of the dispenser to transfer the data. The electricity dispenser validates the purchase and puts the credit onto the meter. The display on the keypad shows the customer how much credit is available on the meter. The keypad system is a one-way system since it only transfers data from the utility company to the meter and not vice versa.

The Prepayment Metering System benefits both utility companies and consumers. Some of the advantages the Prepayment Metering Systems offer to the utility companies are: 1) improved customer service; 2) upfront payment; 3) no requirement of meter readers; 4) no requirement of billing systems; 5) elimination of bad debts; 6) complete revenue management; 7) fraud control; and 8) elimination of inaccurate meter readings. The prepayment system also offers a host of advantages to consumers: 1) electricity at one's convenience; 2) pay as you go; 3) no more shocking bills; and 4) putting one in control of electricity costs.

The current paper will begin with a discussion of the theoretical background of the study and develop the conceptual framework. The following sections present, successively, the research model, research design, survey, results, discussion of research findings, and implications, as well as the limitations of the study, directions for future research, and the conclusion.

II. THEORETICAL BACKGROUND

The Unified Theory of Acceptance and Use of Technology (UTAUT) model [Venkatesh et al. 2003] is the most recent work in the area of explaining and predicting the acceptance and use of information technology by end users. This theory examined eight different models and integrated the components of those models into a single, unified model that is more predictive than any of the individual models alone. UTAUT considered and integrated the theory of reasoned action (TRA), the technology acceptance model (TAM), the motivational model (MM), the theory of planned behavior (TPB), a model that combined the technology acceptance model and the theory of planned behavior (C-TAM-TPB), the model of PC utilization (MPCU), the innovation diffusion theory (IDT), and the social cognitive theory (SCT). The constructs of each of the individual models that contributed to the development of the UTAUT model are cross-referenced in Table 1.

The UTAUT model examined the determinants of user acceptance and usage behavior (performance expectancy, effort expectancy, social influence, and facilitating conditions) and

found that all contribute to the usage behavior either directly (facilitating conditions) or through behavioral intentions (performance expectancy, effort expectancy, and social influence). UTAUT does consider factors such as gender, age, experience, and whether or not use is voluntary.

Table 1 . UTAUT Constructs, Root Constructs, Relevant Models and References

UTAUT Constructs	**Root Constructs**	**Models**	**References**
Performance Expectancy	Perceived Usefulness	TAM	Davis, 1989; Davis, Baggozzi, and Warshaw, 1989
	Extrinsic Motivation	MM	Davis, Baggozzi, and Warshaw, 1992
	Job-fit	MPCU	Thompson, Higgins, and Howell, 1991
	Relative Advantage	IDT	Moore and Benbasat, 1991
	Outcome Expectations	SCT	Compeau and Higgins, 1995; Compeau, Higgins, and Huff, 1999
Effort Expectancy	Perceived Ease of Use	TAM	Davis, 1989; Davis, Baggozzi, and Warshaw, 1989
	Complexity	MPCU	Thompson, Higgins, and Howell, 1991
	Ease of Use	IDT	Moore and Benbasat, 1991
Social Influence	Subjective Norm	TRA, TPB, C-TAM-TPB	Ajzen, 1991; Fishbein and Azjen, 1975; Matheison, 1991; Taylor and Todd, 1995
	Social Factors	MPCU	Thompson, Higgins, and Howell, 1991
	Image	IDT	Moore and Benbasat, 1991
Facilitating Conditions	Perceived Behavioral Control	TPB, C-TAM-TPB	Ajzen, 1991; Taylor and Todd, 1995
	Facilitating Conditions	MPCU	Thompson, Higgins, and Howell, 1991
	Compatibility	IDT	Moore and Benbasat, 1991

In this model, social influence is representative of the social norm component. Venkatesh et al. [2003] find that social influence is moderated by gender and whether or not the act is voluntary. Their findings suggest that women tend to "be more sensitive to others' opinions," (pg. 453) and that social influence is more predominate in a mandatory setting mainly due to social pressure because of compliance (the fact that others have the ability to reward desirable behavior or punish undesirable behavior).

These results are understandable when the organizational culture is considered, but the individual's cultural background is not considered. This study did not consider if the data was from an individualistic culture, such as the United States, where the expectations of others make a difference in one's ability to make personal gains or in a collectivist culture, such as India, where one's belief structure is such that the gains of the many outweigh the gains of the individual. In an individualistic culture, the effects of compliance may be evident; however, the internalization (alteration of one's belief structure) and identification (an individual's response to potential social status gains) mechanisms may play an important role in the acceptance and use of technology in a collectivist culture [Agrawal and Haleem 2003; Gopalan and Stahl 1998; Marchese 2001; Van Slyke, Belanger, and Sridhar 2005]. Thus, while Venkatesh et al. [2003] did not find any social influence in a voluntary setting, it may be due to the culture in which the test was conducted.

Differences in national cultures have been found to explain some variation in perceptions and adoption of information technologies [Png, Yan, and Wee 2001; Tan, Watson, and Wee 1995; Straub 1994] and several studies have made similar comparisons between the U.S. and India [Chau, Cole, Massey, Montoya-Weiss, and O'Keefe 2002; Jarvenpaa and Tractinsky 1999; Straub 1994: Straub et al. 1997].The UTAUT model was chosen because we are dealing with the introduction of a new technology to a consumer population in a collectivist country. The majority of the studies related to technology acceptance has been researched in the United States or other individualistic cultures and has not considered the culture in which the study is conducted.

According to Hofstede's work [1980,1991], national cultures vary on five dimensions: power distance, uncertainty avoidance, individualism, masculinity, and time orientation. According to Nelson and Quick [2003], power distance is "the degree to which a culture accepts unequal distribution of power (p.39)." Uncertainty avoidance is "the degree to which a culture tolerates ambiguity and uncertainty (p. 39)." Individualism is "a cultural orientation in which people belong to loose social frameworks, and their primary concern is for themselves and their families (p.38)." Masculinity is "the cultural orientation in which assertiveness and materialism are valued (p. 39)." Time orientation is "whether a culture's values are oriented toward the future (long-term orientation) or toward the past and present (short-term orientation) (p. 39)." Similar definitions based on Hofstede's research [1980, 1991] are found throughout the business literature in organizational behavior texts, international business texts, and multiple journal articles. The country (India) used in the study varies significantly on Hofstede's [1980, 1991] cultural dimensions from the U.S., especially on power distance, individualism versus collectivism, and time orientation (See Table 2).

Table 2. Hofstede's Dimensions of Culture for India and U.S.

Dimension	**Score**		**Rank**	
	India	U.S.	India	U.S.
Power Distance	77	40	10/11	38
Individualism	48	91	21	1
Uncertainty Avoidance	40	46	45	43
Masculinity	56	62	20/21	15
Time Orientation	61	29	7	17

The UTAUT has been found to provide as much as 70 percent of the variance in intention to use technology. As such it is very promising in terms of helping to determine what factors are important to consider when introducing a new technology to workers. It does include a mechanism for considering cultural influence (albeit organizational culture) on intentions to use technology. However, it is possible that consideration of additional factors, such as one's cultural background, may improve the predictive capability of this model. As such, one area where additional considerations are warranted deal with the subjective norm area (social influence in UTAUT). Thus, some additional explanation of the use of the social norm component for this study is warranted.

SOCIAL INFLUENCE

Although Davis et al. [1989] believe the subjective norm component has no effect on technology acceptance, Venkatesh et al. [2003] believe social influence is only influential in mandatory settings. However, with a consumer population, a variation of the subjective norm component linked to the culture may actually influence attitude toward using the technology. In Warshaw [1980], the subjective norm in TRA has been altered to represent societal pressure called "felt pressure from others." Warshaw [1980, p. 169] noted that "Fishbein's SN usually has weak predictive power and high multicollinearity with Ab (Attitude toward the behavior)." However, the "felt pressure from others" component had significantly higher predictive power and weakly correlated with other predictors. The "felt pressure from others" component is a more general normative measure that assesses the net influence a consumer perceives about pressure to engage in a certain behavior. It includes "the general social pressure on the person to perform the behavior," which Lutz [1976, p.472] felt was "the essential conceptual content which must be captured by SN."

We propose that this general social pressure for an individual to perform a behavior (as described above) is partly influenced by cultural differences. In a more individualistic society, for instance, general social pressure to perform a behavior is likely to be less than in a more collectivist society. This is represented in the individualism versus collectivism component of Hofstede's [1980, 1991] cultural factors. This dimension indicates that in more individualistic cultures, a person is less concerned with the thoughts and opinions of others and, thus, feels less pressure to conform to any specific behavior. In more collectivist cultures, where the group tends to be more important than the individual, the person is more likely to be concerned about the thoughts and opinions of others and, thus, more likely to conform to behaviors deemed important to the group. The social influence construct in this study represents social pressure felt by the individual to perform a specific behavior by assessing the influence other people may have on the respondent's behavior. The development of the social influence construct is outlined in Table 3.

Based on the cultural dimension of individualism versus collectivism, it is likely that culture may have some effects on attitude toward the technology use in a voluntary consumer application. In a discussion of the use of subjective norms and attitude toward the act in TRA (in TAM it is the two components perceived usefulness and perceived ease of use), Lee and Green [1991] state that "the relative importance of these two components (SN and A_{act}) in determining BI (Behavioral Intentions) is expected to vary with the situation and individual differences between persons." One of the situational variables is culture. Most of the studies utilizing technology acceptance models and the subjective norm component have found no evidence that the subjective norm component has any effect. However, Lee and Green [1991] found that when examining the Fishbein model in a cross-cultural setting, the subjective norm component did have significant explanatory value concerning behavioral intentions between the two societies.

Table 3. Foundations of Social Influence

Construct	Definition	References
Subjective Norm	General social pressure on the person to perform the behavior	Lutz, 1976
Subjective Norm	Belief of the consumer concerning the expectations of significant others about the behavior multiplied by the consumer's felt need to comply with those expectations	Ajzen and Fishbein,1980; Ajzen and Madden, 1986; Taylor and Todd, 1995
Societal Norms	Felt pressure from others	Warshaw, 1980
Social Factors	The individual's internalization of the reference groups' subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations.	Triandis, 1980
Social Influence	The general social pressure (in an organizational cultural setting) for an individual to perform a behavior	Venkatesh et al., 2003
Social Influence	Societal pressure (based on country culture) for an individual to perform a behavior	Current study

Additionally, Agrawal and Haleem [2003] found that cultural factors do play an important role in successfully implementing computer-based information systems/business process reengineering projects. Van Slyke et al., [2005, p. 24] found that "Indian and American consumers perceive relative advantage, ease of use, compatibility, and the demonstrability of results of e-commerce differently." In these instances as well as others [Chau et al. 2002; Jarvenpaa and Tractinsky 1999; Straub 1994: Straub et al. 1997], the researchers considered the differences between a collectivist culture and an individualistic culture.

In this study we propose that performance expectancy and effort expectancy will affect behavioral intentions, and the social influence, which includes the subjective norm based in culture, will provide additional explanatory power concerning consumers' intentions to use technology. The moderating variables are gender, income, age, experience, and voluntariness of use of technology.

III. RESEARCH MODEL

The research model employed in this study incorporates three distinct but related issues: 1) performance expectancy; 2) effort expectancy; and 3) social influence. The research model for the consumers' intentions to use Prepayment Metering Systems is presented in Figure 1.

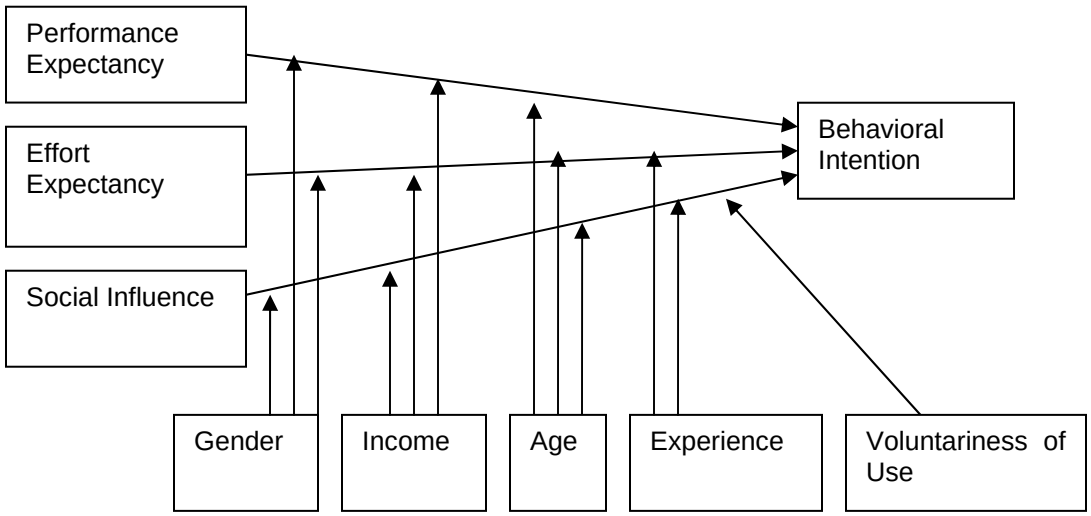

Figure 1. Research Model

PERFORMANCE EXPECTANCY

Performance expectancy is defined as the degree to which a consumer perceives the Prepayment Metering Systems to be more useful in accomplishing the electricity account management tasks than using the conventional metering system. The Prepayment Metering Systems involve customer purchase of electricity prior to use. The conventional metering systems use an energy meter to measure the amount of electricity supplied to a customer's residence. The customers are billed for their consumption periodically. The electricity account management tasks include purchasing and budgeting for electricity and controlling and monitoring electricity usage/consumption.

The relationship between performance expectancy and behavioral intention is moderated by gender, income, and age. Prior research has suggested that accomplishment of tasks, as measured by performance expectancy, is affected by gender differences and age [Minton and Schneider 1980; Morris and Venkatesh 2000]. The effect of performance expectancy on behavioral intention has been found to be stronger for younger men [Venkatesh et al. 2003]. We propose that performance expectancy is also moderated by income. In our context, the consumers' use of Prepayment Metering Systems depends on the usefulness of the technology to allow consumers to budget, control, and monitor their electricity consumption. Hence, it is logical to theorize that people with less income will be more interested in the usefulness of the technology.

EFFORT EXPECTANCY

Effort expectancy is defined as the degree of ease that a consumer associates with using the Prepayment Metering Systems to accomplish the electricity account management tasks. Consumer perceptions about the clarity, understandability, flexibility, and ease of using the system are taken into consideration.

The relationship between effort expectancy and behavioral intention is also moderated by gender, income, age, and experience. Research has shown that gender differences, age, and experience have a moderating effect on the ease of using the technology, as defined by effort expectancy; the effect being stronger for older women with limited experience [Morris and Venkatesh 2000; Venkatesh et al. 2003]. We propose that effort expectancy is also moderated by income. We expect those professionals who earn more to be busy individuals and theorize that they would be averse to spending much time learning a new technology.

SOCIAL INFLUENCE

Social influence is defined as the social pressure felt by a consumer to use the Prepayment Metering Systems for electricity account management tasks. The social pressure generated from those individuals that the consumer perceives to be important influences the decision of a consumer to use the Prepayment Metering Systems.

The effect of social influence on behavioral intention is moderated by gender, income, age, experience, and voluntariness of use of technology. Prior research has shown that the effect of social influence, which is defined as the general social pressure for an individual to perform a behavior, is moderated by gender, age, experience, and voluntariness [Venkatesh et al. 2003]. The effect of social influence on behavioral intention has been found to be stronger for older women with limited experience and under conditions of mandatory use. We propose that income will also have a moderating effect on social influence. We expect people who earn more to be less sensitive to what others think about the use of a new technology.

IV. RESEARCH DESIGN

OPERATIONALIZATION OF CONSTRUCTS

The measures used to operationalize the constructs were taken from relevant prior studies. A thorough review of technology acceptance literature was conducted to identify studies in which constructs similar to the ones used in our study were operationalized. Adapting existing measures isomorphically to the context of the study, metrics for the study variables were generated. Table 4 summarizes the relevant prior research that served as the basis for construct operationalization in this study. The items in the various scales in the questionnaire are listed in Appendix 1.

Table 4. Relevant References for Research Model Constructs

Performance Expectancy (PE)	Chau and Hu (2001), Davis (1989), Venkatesh et al. (2003)
Effort Expectancy (EE)	Chau and Hu (2001), Davis (1989), Venkatesh et al. (2003)
Social Influence (SI)	Chau and Hu (2001), Taylor and Todd (1995), Venkatesh et al. (2003)
Behavioral Intention (BI)	Chau and Hu (2001), Davis (1989), Venkatesh et al. (2003)

V. SURVEY

A team of eight trained and skilled investigators under four supervisors conducted the fieldwork in India. Each supervisor reported to three experienced (ten to twelve years of experience in handling various research techniques and methodologies) field controllers. Each interviewer made at least two to three mock interviews prior to the commencement of the study. At least one interview was to be conducted correctly before the interviewer was allowed to conduct interviews on his/her own. The supervisors observed all mock interviews initially. Thus, in the first two or

three days, the supervisors accompanied each interviewer for the mock interviews. Thereafter, the supervisors monitored the day-to-day activities, quality of fieldwork, and assisted sampling.

Purposive sampling method was used for this study. Purposive sampling method searches for a specific profile based on target respondent definition for the concerned survey. The target respondents for this study were:

- primary decision makers regarding the payment of electricity bills (electricity bill is paid by self, and not paid by the organization for which he/she works)
- professionals/self employed belonging to the middle and upper levels of management

Target respondents were contacted randomly at their office/work place (e.g. educators were contacted in universities, doctors at clinics and hospitals, lawyers at courts, etc.) at which time the concepts of Prepayment Metering Systems and electricity account management (EAM) were explained. Then, the respondents were administered the detailed questionnaire on the acceptance of Prepayment Metering Systems for electricity account management. In order to ensure authenticity of the respondents, a business card for each respondent was attached with the respective questionnaire.

A pilot test was conducted initially by randomly selecting 100 respondents. The pilot study revealed no problems or confusion about the survey instrument, confirming the suitability of the instrument.

VI. RESULTS

The empirical results of the study are presented in a description of relevant general characteristics of the survey respondents, an analysis of the measurement model, an analysis of the structural equation model, and an assessment of the psychometric properties of the final model.

GENERAL CHARACTERISTICS OF RESPONDENTS

The relevant demographic and other characteristics of the respondents are presented in different tables that follow.

Table 5. Gender

Gender	Frequency	Percent	Cumulative Percent
Female	31	6.2	6.2
Male	471	93.8	100.0
Total	502	100.0	

Table 6. Qualification

Educational Qualification	Frequency	Percent	Cumulative Percent
Bachelor	330	66.1	66.1
Doctorate	33	6.6	72.7
Higher Secondary	9	1.8	74.5
Master	127	25.5	100.0
Total	499	100.0	

Table 7. Income Groups

Income Groups	Frequency	Percent	Cumulative Percent
Rs. 5,000 -10,000	81	16.1	16.1
Rs. 10,001 – 15,000	170	33.9	50.0
Rs. 15,001-20,000	131	26.1	76.1
Rs. 20,001 – 25,000	56	11.2	87.3
Rs. 25,000 +	64	12.7	100.0
Total	502	100.0	

Table 8. Occupation

Occupations	Frequency	Percent	Cumulative Percent
Accounting	39	7.8	7.8
Artist	13	2.6	10.4
Banking	15	3.0	13.4
Business	85	17.0	30.5
Defense	1	.2	30.7
Education	54	10.8	41.5
Engineering	65	13.0	54.5
Government	68	13.6	68.1
Information Technology	52	10.4	78.6
Law	43	8.6	87.2
Medicine	64	12.8	100.0
Total	499	100.0	

ANALYSIS OF THE MEASUREMENT MODEL

The overall measurement model was first evaluated by confirmatory factor analysis using AMOS 5.0. The overall goodness of fit of the model was assessed by six measures: chi-square/degree of freedom, goodness-of-fit index, adjusted goodness-of-fit index, normal fit index, comparative fit index, and standardized root mean square residual. The model-fit indices observed are listed in Table 9.

Two of the six measures did not satisfy their respective common acceptance levels. This led to the reexamination of the overall model by assessing each of the four measurement models (one for each model construct).

The measurement model of the construct Performance Expectancy was evaluated. A summary of the model fit measures is listed in Table 9. These measures suggest a poor fit of the measurement model. The modification indices for items PE1 and PE2 (Appendix 1) were the largest. Also, the large negative standardized residual for items PE1 and PE2 indicates that the model overestimates the covariance between the variables and the model being modified by eliminating the corresponding paths. Therefore, the measurement model was respecified and the

goodness-of-fit measures of the revised model which achieved the recommended values are listed in Table 9.

Table 9. Overall-Fit of the Measurement Model

Model-Fit Indices	Overall Model	PE	PE Modified	EE	EE Modified	Recommended Values
Chi-square /Degree of freedom	3.69	18.395	2.1	5.60	2.01	<=3.0
Goodness-of-fit index	0.885	0.89	0.99	0.967	0.99	>=0.9
Adjusted goodness-of-fit index	0.852	0.752	0.97	0.924	0.98	>=0.8
Normal fit index	0.949	0.95	0.99	0.982	0.99	>=0.9
Comparative fit index	0.962	0.96	0.99	0.985	0.99	>=0.9
Standardized root mean square residual	0.073	0.186	0.04	0.096	0.045	<=.10

The measurement model of the construct Effort Expectancy was assessed next. A summary of the model-fit measures is listed in Table 9. Except for the overall goodness-of-fit, all measures surpassed the acceptable levels. The AMOS output indicated that two of six items (EE1 and EE5) used to measure the construct have internal consistency reliabilities less than 0.70. These two items were dropped and the model reestimated. All goodness-of-fit measures of the respecified model achieved the recommended values and are listed in Table 9. The goodness-of-fit measures of the measurement models of constructs Social Influence and Behavioral Intentions achieved recommended values.

ANALYSIS OF THE STRUCTURAL EQUATION MODEL

The causal model was evaluated after incorporating modifications based on the analysis of the measurement model. The model-fit indices are listed as follows:

	Recommended Value:
Chi-square/Degree of freedom: 2.513	<= 3.0
Goodness-of-fit index: 0.931	>= 0.9
Adjusted goodness-of-fit index: 0.905	>= 0.8
Normal fit index: 0.966	>= 0.9
Comparative fit index: 0.979	>= 0.9
Standardized root mean square residual: 0.055	<=.10

All measures of the modified model exceeded the acceptable levels thereby exhibiting that the Structural Equation Model presented a good fit with the data. Table 10 and Figure 2 show the detailed model test results.

Table 10. Dependent variable: Behavioral Intention

Explanatory Power	Values
R^2_{BI}	.72
R^2_{Gender}	.011
R^2_{Age}	.005
$R^2_{Experience}$	.014
$R^2_{Voluntariness}$	.012
R^2_{Income}	.026

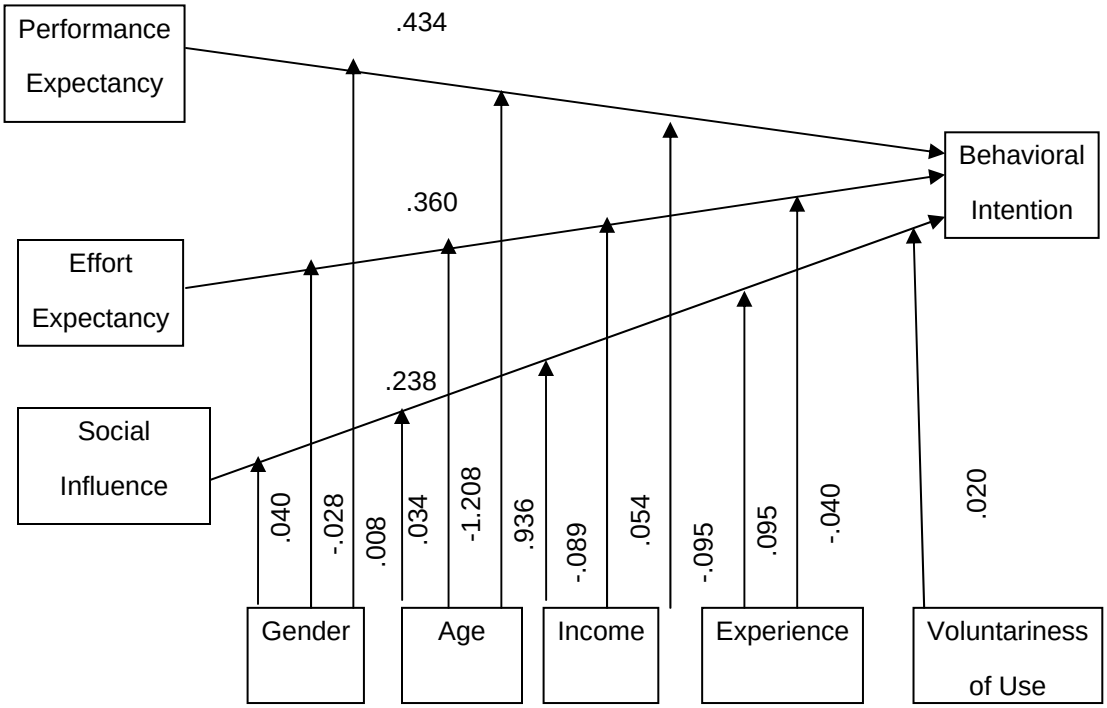

Figure 2. Total Effects on Behavioral Intention

The significance and strength of individual paths in the form of path coefficient are listed as follows:

PE → BI .434 **

EE → BI .360 **

SI → BI .238 *

* p-value < .01 ** p-value < .001

The explanatory power of the model is examined using the R^2 value for Behavioral Intention. The combination of Performance Expectancy (PE), Effort Expectancy (EE), and Social Influence (SI) accounted for 72 percent of the variances observed in consumers' intention to use the Prepayment Metering Systems technology. The path coefficients from PE, EE, and SI are all significant at p < .001 level. Even though PE, EE, and SI are all significant determinants of BI, PE exhibited the strongest direct and total effects on BI.

As expected, the effects of PE, EE, and SI are moderated by gender, age, experience, income, and voluntariness to use the technology. In particular, the effect of PE was moderated by gender, age and income, the effect being stronger for older men earning less. The effect of EE was moderated by gender, age, income, and experience, the effect being stronger for younger women with more income and little experience. The effect of SI was moderated by gender, age, experience, income, and voluntariness to use the technology, the effect being stronger for older men with experience and less income under conditions of voluntariness.

ASSESSMENT OF THE PSYCHOMETRIC PROPERTIES OF THE FINAL MODEL

Table 11 displays the items used to measure each construct, estimated error variances, item reliability, and factor loadings. Based on these numbers, the convergent and discriminant validity of the final model were assessed and presented in Tables 12 and 13.

Convergent Validity

The convergent validity of the instrument was assessed by three measures: item reliability, construct reliability, and average variance extracted [Chau 1997]. An item reliability of at least .70 for each item is considered to be evidence of convergent validity [Nunnally and Berstein 1994]. None of the item reliabilities was less than .70. Construct reliability was calculated as follows: (square of summation of factor loadings)/{(square of summation of factor loadings) + (summation of error variances)}. Construct reliability for all the factors in the final model were above .80, a suggested minimum for evidence of convergent validity [Nunnally and Bernstein 1994]. Finally, the average variance extracted measures were calculates as follows: (summation of squared factor loadings)/{(summation of squared factor loadings) + (summation of error variances)}. If the average variance extracted is less than .50, the convergent validity of the construct is weak. The average variance extracted for each construct is greater than .70 for the final model. Thus, there is strong empirical support for the convergent validity of the research variables on all three measures.

Discriminant validity

Discriminant Validity was evaluated by comparing the squared correlation between two constructs with their respective average variance extracted. Discriminant validity is demonstrated if the average variance extracted of both constructs are greater than the squared correlation [Chau 1997]. The squared correlations between constructs PE and SI, EE and SI, and EE and PE are .66, .48, and .72 respectively. As the average variance extracted for each of the three constructs PE, SI, and EE are .72, .80, and .67 respectively, there is evidence that the construct SI exhibited high discriminant validity of itself from constructs PE and EE. However, the discriminant validity between EE and PE is inadequate.

Table 11. Psychometric Properties of the Final Model

Construct	Error Variance	Item Reliability	Factor Loadings
Performance Expectancy (PE)			
PE3	.43	.80	.89
PE4	.35	.82	.91
PE5	.33	.84	.92
PE6	.18	.91	.95
Effort Expectancy (EE)			
EE2	.33	.82	.91
EE3	.44	.75	.87
EE4	.27	.84	.92
EE6	.51	.74	.86
Social Influence (SI)			
SI1	.17	.93	.97
SI2	.18	.93	.96
SI3	.31	.88	.93
Behavioral Intention (BI)			
BI1	.21	.92	.95
BI2	.11	.96	.98
BI3	.16	.93	.96

Table 12. Convergent Validity

Construct	Construct Reliability	Average Variance Extracted
Performance Expectancy (PE)	.91	.72
Effort Expectancy (EE)	.89	.67
Social Influence (SI)	.92	.80
Behavioral Intention (BI)	.95	.85

Table 13. Discriminant Validity

Constructs	Squared Correlation
EE <-> PE	.72
PE <-> SI	.66
EE <-> SI	.48

VII. DISCUSSION OF RESEARCH FINDINGS

On the basis of the total effects on behavioral intention, all three (performance expectancy, effort expectancy, and social influence) determinants of intention to use the technology (Prepayment

Metering Systems) were found to be significant. The moderating influences of gender, age, income, experience and voluntariness of users were also observed. The model accounted for 72 percent of the variance in behavioral intention. A summary of the findings is presented in Table 14.

Performance expectancy was found to be the most important factor for technology acceptance in India. This finding is in agreement with the results from prior studies on technology acceptance. In our context, it implies that the consumers' use of Prepayment Metering Systems depends on the usefulness of the technology for electricity account management. Electricity account management allows consumers to budget, control and monitor their electricity consumption. Also, the effect of performance expectancy was stronger for older male users with less income.

Table14. Summary of Research Findings

Dependent Variable	Independent Variable	Moderators	Explanation
BI	PE	Age, Gender, Income	Effect stronger for older male users with less income
BI	EE	Age, Gender, Income, Experience	Effect stronger for younger female users with more income and limited experience
BI	SI	Age, Gender, Voluntariness, Experience, Income	Effect stronger for older male voluntary users with experience and less income

Effort Expectancy was found to have a significant direct effect on the consumers' intention to use Prepayment Metering Systems in India. The effect is stronger for younger female users with more income and limited experience in using a similar technology indicating that women consider the ease of use factor particularly important. The studies in the past have shown mixed results. The ease of use of a new technology will influence its acceptance in India.

Social influence was found to be another factor influencing consumers' intention to use the Prepayment Metering Systems. This finding confirms our belief that culture indeed plays an important role in technology acceptance. In the past studies, TAM was never successfully tested outside of North America. Studies have suggested that the exclusion of cultural variables in TAM may be a reason for its failure [Straub et al. 1997]. Social influence represents societal pressure on users to engage in a certain behavior. This social pressure for an individual to perform a behavior varies by culture.

Our study confirms our proposition that the social influence based in culture will provide additional explanatory power concerning consumers' intention to use a technology. In the context of the study, the results indicate that the effect of social influence will be stronger for older male voluntary users with less income and experience in using a similar technology. This finding is interesting in that it is contrary to the general belief that women tend to be more sensitive to what others think and are more likely to comply with others' expectations. However, it may be noted that the target respondents for this study were 1) primary decision makers regarding the payment of electricity bills; and 2) professionals/self employed belonging to the middle and upper levels of

management. Professionally qualified women may not be as sensitive to the opinions of others as compared to women in general.

VIII. IMPLICATIONS

We believe that this research has much potential. First, the Prepayment Metering System is an emerging technology in many countries, including the U.S. Prepayment systems, however, have been in use in the United Kingdom for more than 70 years. With the advancement of technology, there has been an upsurge of interest in using Prepayment Metering Systems in recent times and more than 40 countries throughout the world are experimenting with such systems. At present, there are over 6 million prepayment installations around the world which clearly indicates that prepayment metering is already considered as a viable alternative to credit purchase of electricity. Therefore, understanding what may facilitate the large scale user acceptance of the prepayment systems is of interest.

Second, the implications of this study will potentially benefit IT managers in a global environment. IT managers can design IT acceptance strategies that promote IT usage ultimately. The usefulness and the ease of use of a technology are significant, but equally important is the role played by culture in the form of social influence in the design of an Information System.

Third, this study indicates some of the effects of culture on technology acceptance in India - a big emerging market that holds great commercial opportunities for U.S. IT firms. In this context, the results of this study can benefit businesses wanting to capitalize on the Indian market. The findings show that cultural differences do influence consumers' intentions to utilize different technologies and that this influence varies with individual difference factors such as income and experience. From a marketing perspective this information can be used to develop beneficial offerings for consumers that have a higher likelihood of adoption. Finally, from the academic standpoint, this study aims to contribute to IT acceptance research by advancing the understanding of user technology acceptance in a non-U.S. culture.

IX. LIMITATIONS

As with most survey research, this study also has several limitations. Despite the high goodness-of-fit values for the final model, there are still discriminant validity problems with the modified survey instrument. Also, investigation of a consumer adoption of technology within a purchase is new. This study focused on the user acceptance of Prepayment Metering System which involves credit purchase of electricity in India. Thus, caution must be taken in generalizing the findings for other technologies and other nations.

X. FUTURE RESEARCH

Utility companies throughout the world are now experimenting with Prepayment Metering Systems. While there are several million prepayment installations around the world, there are only a few thousand in the U.S. The acceptance of the system, however, is growing in the U.S. As utilities invest in Prepayment Metering Systems, consumer acceptance of the technology becomes an increasingly critical management issue. Consumer acceptance of the Prepayment Metering Systems becomes an essential organizational challenge facing utility companies considering heavy investment in prepayment systems. Therefore, understanding what may facilitate the large scale user acceptance of the prepayment systems is of interest. In the future, an investigation of the factors that influence the user acceptance of the Prepayment Metering Systems in other countries including the U.S. and a comparison of the results are planned. This will also enable a test of the UTAUT model across cultures. Given the global environment in which the IT managers operate, it would be interesting to note if the UTAUT model has the same predictive power across cultures.

XI. CONCLUSION

In the past, several researchers have suggested that culture may play a role in the acceptance of technology. No clear relationships, however, were established between cultural variables and IT acceptance factors. This study has some significant contributions in that it tries to fill a void in Information Systems research by establishing that the social influence based in culture has significant explanatory value concerning behavioral intentions to use a new technology. The validation of the predictive power of social influence is of value to practitioners also. It will enable the IT managers operating in a global environment characterized by the proliferation of emerging technologies to implement systems successfully.

REFERENCES

Agrawal, Vijay K. and Abid Haleem. (2002). "Culture, Environmental Pressures, and the Factors for Successful Implementation of Business Process Engineering and Computer-Based Information Systems," *Global Journal of Flexible Systems Management.* (4)1/2, pp. 27-48.

Ajzen, I. (1991). "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes*. (50)2, pp. 179-211.

Ajzen, I. and M. Fishbein. (1980). *Understanding Attitudes and Predicting Social Behavior.* Englewood Cliffs, NJ: Prentice-Hall,.

Ajzen, I. and T. J. Madden. (1986). "Prediction of Goal-directed Behavior: Attitudes, Intentions and Perceived Behavioral Control," *Journal of Experimental Social Psychology. (*22), pp. 453-474.

Budhwar, P. (2001). "Doing Business in India," *Thunderbird International Business Review.* (43)4, pp. 549-568.

Chau, P. Y. K. (1996). "An Empirical Assessment of a Modified Technology Acceptance Model," *Journal of Management Information Systems*. (13)2, pp. 185-204.

Chau, P. Y. K. (1997). "Reexamining a Model for Evaluating Information Center Success Using a Structural Equation Modeling Approach," *Decision Sciences.* (28)2, pp.309-334.

Chau, P. Y. K., M. Cole, A. P. Massey, M. Montoya-Weiss, and R. M. O'Keefe. (2002). "Cultural Differences in the Online Behavior of Consumers," *Communications of the ACM.* (45)10, pp. 138-143.

Chau, P. Y. K. and P. J. Hu. (2001). "Information Technology Acceptance by Individual Professionals: A Model Comparison Approach," *Decision Sciences.* (32)4, pp. 699-719.

Compeau, D. R. and C. A. Higgins. (1995) "Computer Self-Efficacy: Development of a Measure and initial Test," *MIS Quarterly*. (19)2, pp. 189-211.

Compeau, D. R., C. A. Higgins, and S. Huff. (1999). "Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study," *MIS Quarterly*. (23)2, pp. 319-339.

Davis, F. D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Technology," *MIS Quarterly.* (13)3, pp. 319-340.

Davis, F. D., R. P. Baggozzi, and P. R. Warshaw. (1989). "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science.* (35)8, pp. 982-1003.

Edwards, K. and V. Sridhar. (2003). "Analysis of the Effectiveness of Global Virtual Teams in Software Engineering Projects," Proceedings of the HICSS Conference. Hawaii (January 6-9).

Fishbein, M. and I. Ajzen. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.* Addison-Wesley, Reading, MA.

Ghosh, K. (2002). "Prepayment Metering: The Indian Context," Proceedings of the International Seminar on Energy Conservation, Audit and Metering, Mumbai, India.

Gopalan, Suresh and Angie Stahl. (1998.) "Application of American Management Theories and Practices to the Indian Business Environment: Understanding the Impact of National Culture," *American Business Review*. (16)2, pp. 30-42.

Hofstede, G. (1980). *Culture's Consequences: National Differences in Thinking and Organizing.* Sage Press, Beverly Hills, CA.

Hofstede, G. (1991). *Cultures and Organizations: Software of the Mind.* McGraw-Hill, New York.

Hu, P. J., P. Y. K. Chau, O. R. L. Sheng, and K. Y. Tam, (1999), "Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology," *Journal of Management Information Systems.* (16)2, pp. 91-112.

Jarvenpaa, S. L. and N. Tractinsky. (1999). "Consumer Trust in an Internet Store: A Cross-Cultural Validation," *Journal of Computer-Mediated Communication*. (5)2. Retrieved from www.ascusc.org/jcmc/.

Lee, C. and R. T. Green. (1991). "Cross-Cultural Examination of the Fishbein Behavioral Intentions Model," *Journal of International Business Studies.* second quarter, pp. 289-305.

Lutz, R. (1976). "Conceptual and Operational Issues in the Extended Fishbein Model," Advances *in Consumer Research.* (3).

Marchese, Marc C. (2001). "Matching Management Practices to National Culture in India, Mexico, Poland, and the U.S.," *The Academy of Management Executive*. (15)2, pp.130-133.

Mathieson, K. (1991). "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior," *Information Systems Research.* (2)3, pp. 173-191.

Minton, H. L. and F. W. Schneider. (1980). *Differential Psychology*. Waveland Press, Prospect Heights, IL.

Moore, G. C. and I. Benbasat. (1991). "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innvoation," *Information Systems Research*. (2)3, pp. 192-222.

Morris, M. G. and V. Venkatesh. (2000). "Age Differences in Technology Adoption Decisions: Implications for a Changing Workforce," *Personnel Psychology*. (53)2, pp. 375-403.

Nelson, D. L. and J. C. Quick. (2003). *Organizational Behavior: Foundations, Realities, and Challenges*. Fourth Edition, Mason, Ohio: Thomson Southwestern,.

Nunnally, J. C. and I. H. Bernstein. (1994). *Psychometric Theory*. Third Edition, New York: McGraw-Hill.

Png, I. P. L., B. C. Y. Yan, and K. L. Wee. (2001). "Dimensions of National Culture and Corporate Adoption of IT Infrastructure," *IEEE Transactions on Engineering Management*. (48)1, pp. 36-45.

Ramachandran, R. (2000). "Understanding the Market Environment of India," *Business Horizons.* (43) January-February, pp. 44-52.

Rose, G. and D. W. Straub. (1998). "Predicting General IT Use: Applying TAM to the Arabic World," *Journal of Global Information Management.* (6)3, pp. 39-46.

Straub, D. W. (1994). "The Effect of Culture on IT Diffusion: E-Mail and Fax in Japan and the U.S.," *Information Systems Research.* (5)1, pp. 23-47.

Straub, D. W., M. Keil, and W. Brenner. (1997). "Testing the Technology Acceptance Model across Cultures: A Three-Country Study," *Information & Management.* (33), pp. 1-11.

Tan, B. C. Y., R. T. Watson, and K. L. Wee. (1995). "National Culture and Group Support Systems: Filtering Communication to Dampen Power Differentials," *European Journal of Information Systems*. (4)2, pp. 82-92.

Tarafdar, M. and S. D. Vaidya. (2006). "Challenges in the Adoption of E-Commerce Technologies in India: The Role of Organizational Factors," *International Journal of Information Management*.. 26(6), pp. 428-441.

Taylor, S. and P. A. Todd. (1995). "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research.* (6)2, pp. 144-176.

Triandis, H. C. (1980). *Beliefs, Attitudes, and Values.* Lincoln, NE: University of Nebraska Press, pp. 195-259.

Thompson, R. L., C. A. Higgins, and J. M. Howell. (1991). "Personal Computing: Toward a Conceptual Model of Utilization," *MIS Quarterly.* March, pp. 125-143.

Van Slyke, Craig, France Belanger, and Varadharajan Sridhar. (2005). "A Comparison of American and Indian Consumers Perceptions of Electronic Commerce," *Information Resources Management.* (18)2, pp. 24-41.

Venkatesh, V., M. G. Morris, G. B. Davis, and F. D. Davis. (2003). "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly.* (27)3, pp. 425-478.

Warshaw, P. R. (1980). "A New Model for Predicting Behavioral Intentions: An Alternative to Fishbein," *Journal of Marketing Research.* (17)2, pp. 153-172.

APPENDIX I

DESCRIPTION OF SCALE ITEMS

Performance Expectancy (PE)

PE1. I can accomplish my Electricity Account Management (EAM) tasks more quickly using Prepayment Metering Systems than using conventional metering.

PE2. I can accomplish my EAM tasks more easily using Prepayment Metering Systems than using conventional metering.

PE3. Using Prepayment Metering Systems can enhance my effectiveness in managing electricity consumption.

PE4. Using Prepayment Metering Systems can improve my EAM.

PE5. Using Prepayment Metering Systems can increase my productivity in EAM.

PE6. Overall I will find Prepayment Metering Systems useful for my EAM.

(EAM includes purchasing and budgeting for electricity and controlling and monitoring electricity usage/consumption and Prepayment Metering Systems involves credit purchase of electricity.)

Effort Expectancy (EE)

EE1. Learning to use Prepayment Metering Systems would be easy for me.

EE2. I would find it easy to use Prepayment Metering Systems to accomplish my EAM tasks.

EE3. My interaction with Prepayment Metering Systems would be clear and understandable.

EE4. I would find Prepayment Metering Systems to be flexible to interact with.

EE5. It would be easy for me to become skillful at using Prepayment Metering Systems.

EE6. Overall I believe that Prepayment Metering Systems would be easy to use.

Social Influence (SI)

SI1. Those people who are important to me would support my using Prepayment Metering Systems rather than conventional metering for EAM.

SI2. I think that those people who are important to me would want me to use Prepayment Metering Systems rather than conventional metering for EAM.

SI3. People whose opinions I value would prefer me to use Prepayment Metering Systems rather than conventional metering for EAM.

Behavioral Intention (BI) to Use the Prepayment Metering System

BI1. I would use Prepayment Metering Systems rather than conventional metering for EAM when it becomes available to me.

BI2. I intend to use Prepayment Metering Systems rather than conventional metering for EAM when it becomes available to me.

BI3. Given that I had access to Prepayment Metering Systems, I predict that I would use Prepayment Metering Systems rather than conventional metering for EAM.

ABOUT THE AUTHORS

Kakoli Bandyopadhyay received her Ph.D. from The University of Texas at Arlington and is currently an associate professor of Information Systems at Lamar University, Beaumont, Texas. Her research interests include cross-cultural technology acceptance, healthcare information systems, disaster recovery planning, electronic commerce, and information technology risk management. She has published several referred papers on these and related issues in conference proceedings and journals such as the *Journal of Strategic Information Systems, Health Care Management Review, International Journal of Internet and Enterprise Management, Management Decision, etc.*

Katherine Fraccastoro received her Ph.D. from Louisiana State University and is currently an assistant professor of Marketing at Lamar University, Beaumont, Texas. Her research interests include consumer behavior related to product pricing, cultural acceptance issues, entrepreneurship, and marketing education. She has published several referred papers on these and related issues in conference proceedings and journals such as the *Journal of Consumer Behavior, Marketing Letters,* and *Journal of Higher Education Policy and Management.*

Communications of the Association for Information Systems

ISSN: 1529-3181