CULTURE AS AN EXPLANATION OF TECHNOLOGY ACCEPTANCE DIFFERENCES: AN EMPIRICAL INVESTIGATION OF CHINESE AND US USERS

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ABSTRACT

This article examines the issue of the acceptance of technology across two cultures. To do this an extended technology acceptance model was tested in China and the US. Over one hundred participants, across both cultures, were surveyed as to their perceptions regarding technology acceptance. Cultural values were also measured for each group. Structural equation modeling was used to assess the research model. In general, the model explained a more than adequate amount of variance and achieved acceptable levels of significance. Differences across the two cultures were explained utilizing the cultural values of the participants. Implications for both research and practice were provided.

INTRODUCTION

In the increasingly global business environment, there is a growing need to utilize information technology (IT) to achieve efficiencies, coordination, and communication (Laudon and Laudon, 2006; Porter and Miller, 1985). Business has become more international in today's society. Clearly cultural differences between countries may have an impact on the effectiveness and efficiency of IT deployment across national boundaries. Research can provide valuable insight into the nature of processes, obstacles, and opportunities present in cross-cultural IT environments and can enhance our understanding of the cultural factors relevant to the adoption and use of information technology. Technology acceptance and usage across cultures is a crucial factor for deriving IT benefits in multinational and transnational organizations.

RESEARCH OBJECTIVES

The intention of this article is to examine differences in the acceptance of technology across two cultures, that of China and the US. Cultural values will be used to provide an explanation these differences. The general research question is: How does national culture influence the adoption and use of an information technology? Specifically, this paper reviews the existing technology acceptance literature to extend the technology acceptance model (TAM) (Davis, 1989) by adding subjective norms. TAM was chosen as the basic model since it is a widely accepted yet parsimonious and robust model of technology acceptance. This model is then tested in the two cultures of interest. Next, based on cross-cultural research literature, Hofstede's (1984) widely cited dimensions of national culture are utilized to explain the results of the model testing. Implications for research and practice are then put forward as well as limitations and directions for future research.

LITERATURE REVIEW

Although the acceptance of technology has been a key component of information technology research and culture has been extensively studied in the anthropology and management disciplines little has been done to integrate these two areas. Additionally, culture's influence in the acceptance and use of technology, in the context of Asia, has not been comprehensively examined. This review will explain the current models of technology acceptance, provide an overview of how national culture is conceptualized, and look at the extant studies of technology acceptance that focused on Asia.

Technology Acceptance Models

A number of behavioural models have been utilized to study the acceptance of technology. (e.g. the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980), the Theory of Planned Behavior (TPB) (Ajzen, 1991), the Technology Acceptance Model (TAM) (Davis, 1986), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al, 2003)). These theories contain a number of similar constructs which are shown in Table 1a. An explanation of the relationships between the constructs of each model is shown in Table 1b.

TRA (Ajzen and Fishbein, 1980)	**TPB** (Ajzen, 1985)	**TAM** (Davis et al, 1989)	**UTAUT** (Venkatesh et al, 2003)
		Perceived Usefulness "the prospective user's subjective probability that using a specific application will increase his or her job performance within an organizational context" (p. 985).	*Performance Expectancy* "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" [p. 447]. This construct incorporates perceived usefulness, "extrinsic motivation" from motivational theory, "relative advantage" from innovation diffusion theory, and "outcome expectations" from social cognitive theory.
		Perceived Ease of	*Effort Expectancy* "the degree of

		Use "the degree to which the prospective user expects the target system to be free of effort" (Davis et. Al., 1989, p. 985).	ease associated with the use of the system" [p. 450]. This construct incorporates perceived ease of use, "complexity" from the model of personal computing utilization and innovation diffusion theory.
Attitude "an individual's positive or negative feelings of performing the target behavior" (p. 216)	*Attitude* – same as TRA	*Attitude* – same as TRA and TPB in the original TAM but later dropped.	
Subjective Norm "the person's perception that most people who are important to him think he or she should or should not perform the behavior in question" (p. 216)	*Subjective Norm* – same as TRA		*Social Influence*, "the degree to which an individual perceives that important others believe he or she should use the system" [p. 451]. This construct incorporates subjective norms, "social factors" from the model of personal computing utilization, and "observability" from innovation diffusion theory.
	Perceived Behavioral Control "reflects beliefs regarding access to the resources and opportunities needed to perform a behavior, or alternatively, to the intention and external factors that may impede performance of the behavior" (p.34).		*Facilitating Conditions* "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system" [p. 453]. This construct incorporates perceived behavioral control, "compatibility" from innovation diffusion theory, and "facilitating conditions" from the model of personal computing utilization.
Behavioral Intention – The strength of an individual's intention to perform a specified behavior.	*Behavioral Intention* – same as TRA	*Behavioral Intention to Use* – same as Behavioral Intention in TRA and TPB	

Table 1a – Technology Acceptance Constructs

Model Relationships:	*Model Relationships*:	*Model Relationships*	*Model Relationships:*
Attitude and Subjective Norms influence Behavioral Intention	Attitude, Subjective Norms, and Perceived Behavioral Control influence Behavioral Intention	Perceived Usefulness, and Perceived Ease of Use influence Behavioral Intention to Use. Perceived Ease of Use also influences Perceived Usefulness.	Effort Expectancy, Performance Expectancy, Social Influence, and Facilitating Conditions influence

Table 1b – Technology Acceptance Relationships

Of these models, Davis's TAM is arguably the most widely accepted yet parsimonious model of the phenomenon. It has been shown that it has equal predictive power to TRA and TPB, yet it is the most economical of the three (Taylor and Todd, 1995, Mathieson, 1991). Venkatesh et al's. (2003) UTAUT incorporates the constructs from TAM and has received widespread support but was unfortunately not published at the time of the data collection. The model tested in this paper examines four constructs that have been well accepted in previous technology acceptance studies (perceived usefulness, perceived ease of use, subjective norms, and behavioral intention to use). All of these constructs, however, are incorporated into the constructs of UTAUT.

Although attitude was initially included in TAM (Davis, 1986, Davis, et. al., 1989) recent conceptualizations have tended to omit this construct. In keeping with past research we posit that perceived usefulness, perceived ease of use, and subjective norms influence behavioral intention to use and that perceived ease of use influences perceived usefulness. The hypotheses relating to perceived ease of use and perceived usefulness have been studied by a number of TAM researchers (please see Venkatesh, et. al., 2003 for a review). However, TAM in its initial form did not include subjective norms which are a major variable in the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980), the theory of planned behavior (TPB) (Ajzen, 1991), TAM2 (Venkatesh and Davis, 2000), and UTAUT (Venkatesh et al., 2003). Subjective norms have been examined in a number of studies focusing on the acceptance of technology (Karahanna and Straub, 1999; Taylor and Todd, 1995; Thompson et al., 1991; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000; Venkatesh et al., 2003).

Hypotheses are as follows and the research model is shown in Figure 1.

- Hypothesis 1: Perceived usefulness positively influences an individual's behavioral intention to use a technology.
- Hypothesis 2: Perceived ease of use positively influences an individual's behavioral intention to use a technology.
- Hypothesis 3: Subjective norms positively influence an individual's behavioral intention to use a technology.
- Hypothesis 4: Perceived ease of use positively influences an individual's perceptions of usefulness of a technology.

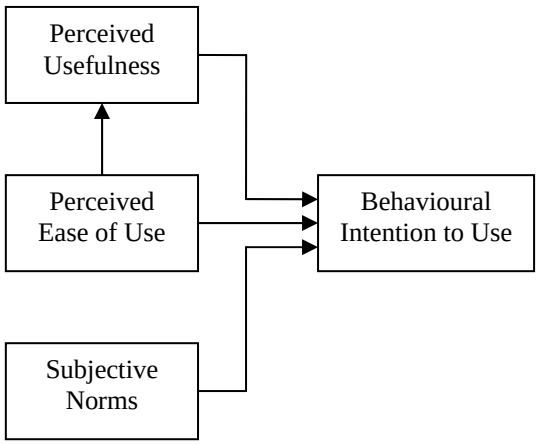

Figure 1 – Research Model

In addition to a basic technology acceptance model this article intends to examine its impact across two cultures, China and the US. Hence a brief review of culture and how it is measured along with some specifics as to how these issues apply in an Asian context follow.

National Culture

Researchers have defined culture in different ways. Most definitions boil down to culture being a common set of characteristics shared by a group of people. In anthropology, for instance, "Culture consists of patterned ways of thinking, feeling and reacting, acquired and transmitted mainly by symbols, constituting the distinctive achievement of human groups, including their embodiments in artifacts; the essential core of culture consists of traditional (i.e., historically derived and selected) ideas and especially their attached values" (Kroeber and Kluckhohn, 1952, p. 86). Hofstede defined culture as "the collective programming of the mind which distinguishes the members of one human group from another" (1980, p. 260). For a more through review of cultural definitions please see Straub et al. (2002). In this study we employ Hofstede's (1980) definition since it has been widely cited and used in many cross-cultural studies. In addition to an overall definition of culture research in this area is often done though the use of a set of bounded cultural constructs, such as dimensions. The use of dimensions allows researchers to better measure and examine culture.

Hofstede (1980) proposed a widely cited set of national cultural dimensions. He defined the following four dimensions: Individualism/collectivism, power distance, uncertainty avoidance and masculinity/femininity. These four dimensions are shown in Table 2 below.

Individualism/Collectivism	"societies in which the interests of the individual prevail over the interests of the group" versus "societies in which the interests of the group prevail over the interest of the individual" (Hofstede, 1991, p. 50).
Power Distance	"The extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally (Hofstede, 2001, p. 98).
Uncertainty Avoidance	"the extent to which the members of a culture feel threatened by

	uncertain or unknown situations" (Hofstede 1991, p. 113).
Masculinity/Femininity	"Masculinity stands for a society in which social gender roles are clearly distinct… Femininity stands for a society in which social gender roles overlap (Hofstede, 2001, p. 297).

Table 2 – Hofstede's Dimensions of Culture

This study examined the above cultural dimensions on the research model across two cultures, that of China and the US. In particular, the model was tested separately in both cultures. Participant's scores on each of the cultural dimensions were then utilized to explain differences across the results. Unlike many previous studies that simply reused Hofstede's country scores that were initially published in the 1980s, and were based on research done considerably earlier, the participants of this study were surveyed as to their perceptions of national culture.

Technology Acceptance and the Asian Culture

The previous section discussed some of the dominant definitions and measures of culture that are used in cross-cultural research. This section will review the Asian cross-cultural research that has been done relating to the area of technology acceptance. Unfortunately there has been little direct research linking the field of technology acceptance and national culture. What little research there is will be discussed followed by a review of Asian cross-cultural research in the in the broader area of information technology.

The sole major study of technology acceptance in Asia was by Rose and Straub (1998) who examined technology acceptance in five Arab cultures, three of which were technically in Asia (Jordan, Saudi Arabia, and Lebanon), the other two (Egypt and the Sudan) in Africa. The authors examined the following TAM relationships: Perceptions of ease of use and perceptions of usefulness were posited to influence actual usage and perceptions of usefulness to mediate the effect of perceptions of ease of use on actual usage. The authors found support for all three hypotheses and suggested that TAM is supported in the Arab world. Their findings were consistent with the majority of TAM findings in the US. No cultural dimensions were measured and no direct comparisons were made between different cultures.

In addition to the above study a number of studies that were tangentially related to the area of technology acceptance are shown in Appendix I. The appendix shows the authors of the study, the year, and the countries/regions studied.

METHOD

Data were collected using student subjects at a large university in the southeast of the US. Foreign students from China were contacted at an international student orientation during the first week of their first semester in attendance. A random sample of US nationals was also contacted. This method ensured sufficient variance in the dimensions of culture and that the perceptions of the foreign nationals were collected soon after they left their home country and before having spent any considerable amount of time in the US.

Data were collected using surveys. Validated scales from Davis (1989) were used to measure perceived ease of use, perceived usefulness, and behavioral intention to use. Individualism/collectivism, uncertainty avoidance, power distance, and masculinity/femininity were

assessed using scales derived from Hofstede (1980) and Dorfman and Howell (1988). Subjective norms were measured using TRA guidelines (Fishbein and Ajzen, 1975) measuring both normative beliefs, i.e., an individual's beliefs of what relevant others expect the him or her to do with respect to using PCs, as well as his or her motivation to comply with these. The referent groups used to measure subjective norms were family, friends, and classmates. As per TRA, normative beliefs for each referent were multiplied with the respondent's motivation to comply with those referents to derive a single score for each referent group. Behavioral intention to use focused on the participant's intention to use personal computers (a technology that was common to all participants). The survey instrument went through two rounds of pilot testing. The technology acceptance and subjective norms constructs were found to have acceptable psychometric properties. The culture constructs were initially found to be somewhat problematic in terms of cross-loadings and low reliabilities. These items were refined for the final instrument. Appendix II shows the final items used in the study. A total of 101 individuals participated in the study (29 Chinese and 82 Americans). Due to the nature of the data collection a response rate was unable to be precisely calculated. However, this study was part of a larger research program with a response rate of 24%.

It should be noted that data was collected on the four constructs of the research model (perceptions of usefulness, perceptions of ease of use, subjective norms, and behavioral intention to use) as well as on the four dimensions of culture (individualism/collectivism, power distance, uncertainty avoidance, and masculinity/femininity). The cultural data will be used to provide an explanation for differences observed across cultures but will not be directly incorporated into the research model due to sample size considerations.

DATA ANALYSIS

Validity and Reliability Assessment

The total sample was split into two groups (Chinese and US) and analysed separately. PLS was used to assess the discriminant validity and internal consistency (reliability) of the constructs in the research model. Although only the technology acceptance constructs of perceived usefulness, perceived ease of use, subjective norms, and behavioral intention to use were directly incorporated into the research model reliability and validity were also established for the cultural dimensions as they were utilized to provide an explanation of the results.

Confirmatory factor analysis results for the final items are presented in Tables 3a (Chinese) and 3b (US). Item loadings greater than .70 are considered acceptable (Fornell and Larker, 1981). As can be seen the scales mostly meet this guideline with the exception of PU1 (Chinese sample) and SN1 (US sample). Since these items did not cross-load, were above the cut off in one of the two studies, and were fairly close to the .70 cut-off it was decided to retain them in the analysis.

	IC	PD	UA	MF	PU	PEOU	SN	BIU
IC1	.807	-.376	.485	.048	.091	.387	.191	.125
IC2	.895	-.414	.220	.187	.189	.271	.452	.097
PD1	-.420	.820	-.350	-.026	-.157	-.481	-.129	-.084
PD2	-.334	.807	-.283	-.146	-.099	-.298	-.402	-.232
UA1	.390	-.390	1.000	.269	.315	.406	.358	.219

MF1	.109	-.119	.237	.976	.184	-.016	.274	.171
MF2	.220	-.033	.284	.781	.039	-.020	.110	.004
PU1	.187	.075	.231	.158	.678	.341	.284	.350
PU2	.299	-.086	.331	.176	.737	.465	.276	.268
PU3	.047	-.102	.176	.116	.838	.516	.477	.441
PU4	.031	-.309	.229	.050	.744	.515	.456	.568
PEOU1	.205	-.225	.294	-.133	.619	.756	.394	.588
PEOU2	.256	-.369	.392	.016	.453	.823	.452	.536
PEOU3	.333	-.592	.267	.127	.415	.744	.412	.356
PEOU4	.416	-.402	.351	-.040	.489	.895	.442	.565
SN1	.382	-.320	.366	.104	.407	.454	.890	.540
SN2	.294	-.071	.227	.230	.583	.405	.836	.611
SN3	.333	-.411	.315	.292	.324	.477	.822	.628
BIU1	.157	-.283	.154	.083	.371	.602	.596	.890
BIU2	.076	-.072	.236	.162	.618	.557	.663	.908

Table 3a - PLS Confirmatory Factor Analysis – Chinese Sample

	IC	**PD**	**UA**	**MF**	**PU**	**PEOU**	**SN**	**BIU**
IC1	.954	.271	.065	-.169	.013	-.165	-.134	-.093
IC2	.951	.267	.035	-.249	-.089	-.116	-.145	-.072
PD1	.162	.960	.019	-.259	-.356	-.045	.119	-.311
PD2	.465	.779	.043	-.191	-.151	-.056	.061	-.239
UA1	.053	.029	1.000	-.332	-.101	-.141	.111	-.147
MF1	.085	.170	.326	-.760	-.138	.052	.057	-.012
MF2	.248	.263	.272	-.938	-.263	-.050	.043	-.177
PU1	-.146	-.305	-.138	.239	.774	.168	-.353	.445
PU2	.049	-.147	-.132	.230	.788	.342	-.156	.594
PU3	-.119	-.435	-.048	.286	.794	.107	-.180	.318
PU4	.061	-.185	.012	.041	.803	.279	-.262	.490
PEOU1	-.181	-.043	-.105	-.049	.162	.821	.171	.182
PEOU2	-.122	.025	-.134	-.019	.317	.927	-.025	.365
PEOU3	.000	-.019	-.175	.032	.240	.883	.042	.319
PEOU4	-.217	-.148	-.084	.076	.287	.872	-.008	.342
SN1	.019	-.100	-.060	.089	.067	-.082	-.695	.050
SN2	.176	-.077	.021	-.048	.243	.074	-.764	.151
SN3	.109	-.093	-.169	.088	.286	-.077	-.849	.276

BIU1	-.091	-.301	-.169	.069	.559	.390	-.243	.917
BIU2	-.064	-.273	-.091	.186	.521	.242	-.204	.886

Table 3b – PLS Confirmatory Factor Analysis – US Sample

To assess discriminant validity two additional criteria need to be met (Chin, 1988). First, indicators should load more strongly on their corresponding construct than on other constructs in the model. Looking at Table 3a (Chinese sample) and Table 3b (US sample) we can see that the loadings of items on their respective constructs are higher than the cross-loadings of the items on other constructs. Second, the square root of the average variance extracted (AVE) (leading diagonal in Tables 4a and 4b) should be larger than the inter-construct correlations (implying that all constructs share more variance with their indicators than with other constructs). Since both criteria were met we concluded that the constructs exhibited adequate discriminant validity across both samples. Finally, to assess the reliability of the scales internal composite reliabilities (ICRs) were calculated. As shown in Tables 4a and 4b, these range from .797 to .930 and are above the .70 recommended level (Fornell and Larcker, 1981). Taken together these results suggest that the scales used in the study exhibited adequate psychometric properties. It should be noted that due to issues of cross-loading uncertainty avoidance had to be measured with a single item scale and hence no measure of discriminant validity or reliability can be calculated.

Constructs	**Composite Reliability**	**IC**	**PD**	**UA**	**MF**	**PU**	**PEOU**	**SN**	**BIU**
IC	*.841*	**.852**							
PD	*.797*	-.464	**.814**						
UA	*NA*	.390	-.390	**1.00**					
MF	*.876*	.149	-.104	.269	**.884**				
PU	*.838*	.171	-.158	.315	.158	**.752**			
PEOU	*.881*	.374	-.481	.406	-.018	.618	**.807**		
SN	*.886*	.396	-.324	.358	.250	.510	.527	**.850**	
BIU	*.894*	.128	-.193	.219	.138	.556	.643	.701	**.900**
Diagonal elements in the "correlation of constructs" matrix are the square root of the average variance extracted. For adequate discriminant validity, diagonal elements should be greater than corresponding off-diagonal elements.									
Composite Reliability = $\rho_c = (\Sigma\lambda_i)^2/[(\Sigma\lambda_i)^2+\Sigma_i var(\varepsilon_i)]$, where λ_i is the component loading to an indicator and $var(\varepsilon_i) = 1- \lambda_i^2$									

Table 4a - Inter-Construct Correlations – Chinese Sample

Constructs	**Composite Reliability**	**IC**	**PD**	**UA**	**MF**	**PU**	**PEOU**	**SN**	**BIU**
IC	*.952*	**.953**							
PD	*.865*	.282	**.874**						
UA	*NA*	.053	.029	**1.00**					
MF	*.841*	-.218	-.263	-.332	**.853**				
PU	*.869*	-.039	-.324	-.101	.251	**.790**			
PEOU	*.930*	-.148	-.053	-.141	.016	.297	**.876**		
SN	*.814*	-.147	.111	.111	-.054	-.296	.036	**.772**	
BIU	*.897*	-.087	-.319	-.147	.136	.600	.356	-.249	**.902**

Diagonal elements in the "correlation of constructs" matrix are the square root of the average variance extracted. For adequate discriminant validity, diagonal elements should be greater than corresponding off-diagonal elements.
Composite Reliability = $\rho_c = (\Sigma\lambda_i)^2/[(\Sigma\lambda_i)^2+\Sigma_i var(\varepsilon_i)]$, where λ_i is the component loading to an indicator and $var(\varepsilon_i) = 1- \lambda_i^2$

Table 4b – Inter-Construct Correlations – US Sample

Table 5 presents the descriptive statistics of both the Chinese and US samples. The demographics are, in general, consistent with those of the university. The average age of university students is fairly similar to that of the sample since it included students in the bachelor's, master's, and doctoral programs. The number of years of computer use did vary when comparing the Chinese sample to that of the US. However, it was not surprising that students from the US had considerably more computer experience than their Chinese counterparts. The gender split was approximately that of the university as a whole (44.4% male, 55.6% female). It should also be noted that the Chinese had a considerably wider variability in years of computer use. Finally, it should be observed that both samples came from a well-distributed cross-section of majors and colleges.

	China	**US**
Age	Mean = 27.03 Years Standard Deviation = 4.63 Years	Mean = 25.49 Years Standard Deviation = 7.65 Years
Computer Experience	Mean = 7.10 years Standard Deviation = 3.46 Years	Mean = 10.44 Years Standard Deviation = 5.32 Years
Gender	48% male, 51% Female	42% male, 58% Female
Major	15 Majors Across the University	22 Majors Across the University

Table 5 - Descriptive Statistics

MODEL TESTING

PLS was also used to test the research model. PLS is a latent structural equation modeling technique that uses a component-based approach to estimation. Because of this approach, it places minimal demands on sample size and residual distributions (Lohmoller, 1989; Fornell and Bookstein, 1982; Chin, 1988).

Loadings of measures of each construct can be interpreted as loadings in a principal component factor analysis. Path coefficients are interpreted as standardized beta coefficients in a regression analysis. The path coefficients and explained variances for the model are shown in Figures 2a and 2b. The significance of the path coefficients was determined using the T-statistic calculated with the bootstrapping technique. All constructs were modeled as reflective. The final model is shown in Figures 2a and 2b.

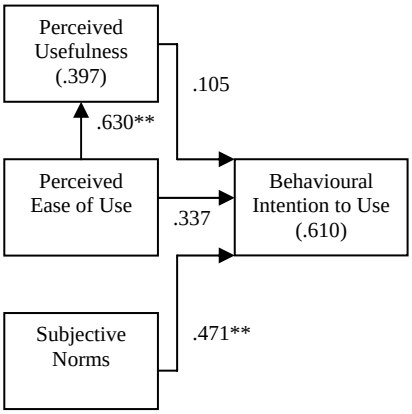

Figure 2a – PLS Results – Chinese Sample

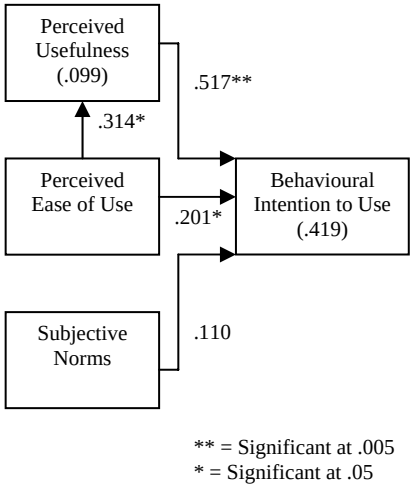

Figure 2b – Results – US Sample

Since a holistic approach to scale validation was taken, the loadings of the items are those presented in Tables 4a and 4b. Because PLS breaks models down into segments, the sample size needs to meet the demands of the most complex regression in the model. Accordingly, the sample size needs to be either seven-to-ten times the greatest number of indicators in any construct, or seven-to-ten times the greatest number of antecedents to a construct (Chin, 1998). With 29 Chinese and 82 US respondents and a maximum of 4 indicators per construct and 3 antecedents per construct the Chinese and US samples meets both the guidelines for using PLS (4*7=28).

RESULTS

As can be seen from Figures 2a and 2b a number of relationships were supported. Although generally significant, the TAM model showed some interesting differences when compared across the two samples. In both China and the US perceptions of ease of use significantly affected perceptions of usefulness and behavioral intention to use. However, in the Chinese sample the relationship between perceptions of usefulness and behavioral intention to use was not significant while the relationship between subjective norms and behavioral intention to use was. The opposite held true with respect to the US sample. A more than adequate amount of variance in the dependent variable (behavioral intention to use) was explained by the determinants (r^2 = .610 for the Chinese sample and r^2 = .419 for the US sample). Perceived ease of use also explained a reasonable amount of variance of perceived usefulness.

As noted earlier this article will utilize the data collected on the participant's cultural values to provide an explanation for the differences observed across to two samples. In addition to establishing validity and reliability for the cultural dimensions scores were also calculated (by summing and averaging) for each dimension in both samples. These scores are shown below in Table 6. Additionally t-tests were conducted to determine if there was a significant difference between the two samples for each of the dimensions. As can also be seen in Table 6 there were no significant differences between the scores of the Chinese and US respondents in terms of

uncertainty avoidance and power distance. However, the Chinese were significantly more collectivistic and masculine than their US counterparts.

	China	**US**	**p-Value**	**Significance**
IC (1=ind, 7=coll)	4.00	2.75	0.0001	Significant
PD (1=low, 7=high)	2.68	2.63	0.8180	Non-Significant
UA (1=low, 7=high)	3.36	3.44	0.8452	Non-Significant
MF (1=fem, 7=mas)	3.91	2.74	0.001	Significant

Table 6 – Culture Scores & T-Test Results

These results would, to some extent help explain the differences across the two models. One of the major differences in the models was in the relationship between subjective norms and behavioral intention to use. In the Chinese sample this relationship was significant, while in the US sample it was not. Since the Chinese are more collectivistic it is not surprising that the influence of salient others such as family friends and classmates would be stronger.

The second major difference in the two models deals with the influence of perceived ease of use on behavioral intention to use. This relationship was significant only in the US sample. It can be argued that cultures that are more feminine will be more concerned with the ease of use of a technology. As defined by Davis, perceived ease of use is "the degree to which the prospective user expects the target system to be free of effort" (Davis et. al., 1989, p. 985). The idea of effort-free use or effortlessness in a technology is less concerned with instrumental goals. If a technology requires less effort to use it might be more widely used because it is pleasant to work with and results in less frustration. Masculinity/femininity values concern the extent of emphasis on work goals and assertiveness, as opposed to personal goals and nurturing. Hofstede (1984) sees personal goals as having a greater emphasis on cooperation, employment security, a friendly atmosphere, an environment where work is less central, and where achievement is defined in terms of human contacts. Hofstede (1984) defines work goals to include an emphasis on earnings, recognition, advancement, challenge, greater work centrality, and achievement defined in terms of wealth. Cultures that are less masculine might be more concerned with perceived ease of use which places less emphasis on instrumental goals and more on quality of life.

A final difference between the two models concerns the relationship between perceived usefulness and behavioral intention to use. In the Chinese sample this relationship was non-significant while in the US sample it was significant. Given the argument in the previous paragraph the opposite would hold true. In a more masculine culture, such as that of China, it would be expected that perceptions of a technology's usefulness would be more significant than in a less masculine culture, such as that of the US. Unfortunately the exact opposite occurred in this study. These contrary results, while interesting, are not readily explained by differences in cultural values. It is possible that some other, unmeasured, construct is impacting this relationship such that it overwhelms the effect of masculinity/femininity. Potential candidates for this inhibitor could be computer self-efficacy, quality of life, or perceived behavioral control factors such as accessibility or cost. One other possible explanation is that individual beliefs such as perceived usefulness and perceived ease of use are less important in a collectivistic culture. Additional research is needed to explore this issue.

LIMITATIONS AND FUTURE DIRECTIONS

Although the findings of this study, and our conclusion that some of the differences in the acceptance of technology across cultures can be attributed to differences in individualism/collectivism and masculinity/femininity in the samples, represent an increase in our knowledge the study does not directly measure the influence of the various dimensions of culture on perceptions of usefulness, perceptions of ease of use, and subjective norms. Given the size of our sample and the number of paths necessary results from such a model could be potentially spurious as this would be beyond the heuristic of the analysis method. However, in the interest of exploratory research results from this model are presented as Appendix III, but care should be taken when examining the paths and attributing significance to the sample. Future studies should be conducted with a larger sample to allow direct measurement of the impact of cultural values on technology acceptance.

Sample size can also be seen as an indicator of another limitation. With only twenty-nine Chinese participants it is possible that this small sample could be responsible for some of the non-significant relationships observed. However, this does not detract form the significant relationships that were found.

The use of student subjects can sometimes be problematic in terms of students not being representative of their populations due to higher levels of education, and in the case of foreign students studying in the US, having a more international outlook. It should be noted, however, that the subjects of this study came from a wide variety of programs (undergraduate, graduate, and doctoral) and academic backgrounds (15+ major programs of study). This increase in variability combined with research that has shown that students and workers have essentially the same values and beliefs (Voich, 1995) should alleviate some of the concerns regarding student subjects.

IMPLICATIONS FOR RESEARCH AND PRACTICE

As noted previously there have been very few studies that examined both technology acceptance and national culture and hence very little work has been done to integrate these two topics. This study examined these two areas and focused on the particular culture of China. This integration is particularly relevant given the international proliferation of the internet and other information technologies as well as the rise in the globalization of business in general and the increase of multinational teams operating at a single site as well as dispersed across several time zones, countries, or continents.

TAM has generally been seen as a parsimonious and well-accepted model that predicts acceptance of an information technology. TAM has mostly been tested (as well as developed) within the US. This study added subjective norms to TAM which enhances its use in settings involving cultures other than that of the US, where the influence of salient others might be more pronounced, and allows for the assessment of the technology acceptance model across multiple cultures.

Results from this study also have some direct managerial implications. In general this study has shown that national culture affects the acceptance and use of information technologies. Although managers with experience in multiple national cultures may understand this implicitly, all managers should recognize the cultural aspects of technology acceptance. This awareness may affect how a

manager chooses to handle the planning, design, introduction, and implementation of new technologies. The support of peers with different national backgrounds and the reactions from subordinates from other cultures to new technologies can vary. Cultural awareness should be part of the training process for IT managers and planners.

Reactions to IT implementation can have cultural variations. Resistance to a planned technology implementation may signal some cultural dimension that needs to be addressed. Strategies, that take culture into account, can be developed to overcome resistance and to learn from the different reactions. It may also be beneficial to consider different implementation strategies in different cultures. For instance, group-based training in the technology and round-table discussions might be more appropriate in a collectivistic culture while individual on-line training could work better in individualistic cultures.

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APPENDIX I – CROSS-CULTURAL IT STUDIES IN ASIA

adapted from Gallivan and Srite (2005) and Karahanna, Evaristo, and Srite (2005))

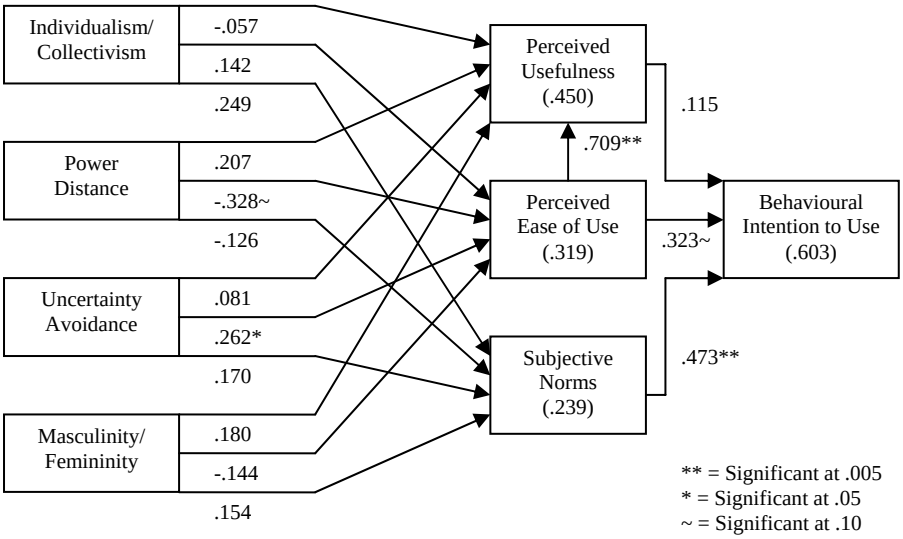
Authors	**Year**	**Cultures**
Barrett and Walsham	1995	Jamaica and India
Burn	1995	Hong Kong, Singapore, and China
Burn, Saxena, Ma, and Cheung	1993	Hong Kong, Australia, Europe, India, Singapore, and US
Burn, Tye, and Ma	1995	Hong Kong and US
Chau, Cole, Massey, Montoya-Weiss, and O'Keefe	2002	Hong Kong and US
Chung and Adams	1997	Korea and US
Foley-Curley, Meyer, and Sorenson	1996	Japan, Europe, and US
Harrison and Farn	1990	Taiwan
Hill, Loch, Straub, and El-Sheshai	1997	Jordan, Egypt, Saudi Arabia, Lebanon, and the Sudan
Lally	1994	Singapore, France, and US
Loch, Straub, and Kamel	2003	Arab business professionals
McLeod, Kim, Sounder, Jones, Schreel, and Estrada	1997	Korea, Mexico, and US
Milberg, Burke, Smith and Kallman	1995	UK, Canada, Australia, France, Japan, India, New Zealand, Thailand, and US
Moores	1996	Hong Kong, Taiwan, and US
Palvia and Hunter	1996	Singapore, Europe, and US
Rose and Straub	1998	5 Arab countries
Slaughter and Ang	1995	Singapore and US
Straub	1994	Japan and US
Straub	1994	Japan and US
Straub, Keil, and Brenner	1997	Japan , Switzerland, and US
Straub, Loch, and Hill	2001	5 Arab countries
Tai and Phelps	2000	Hong Kong and US
Tan, Smith, Keil, and Montealegre	2003	Singapore and US
Tan, Wei, Watson and Walczuch	1998	Singapore and US
Tan, Wei, Watson, Clapper and McLean	1998	Singapore and US
Thanasankit	2002	Thailand
Walsham	2002	Jamaica and India
Wan and Lu	1997	China
Wang and Khan	1994	China
Watson and Brancheau	1991	Australia, Europe, Singapore, and US
Watson, Ho, and Raman	1994	Singapore and US
Watson, Kelly, Galliers, and Brancheau	1997	Australia, Estonia, Europe, Hong Kong, India, Slovenia, Taiwan, UK, and US

APPENDIX II – FINAL ITEMS USED

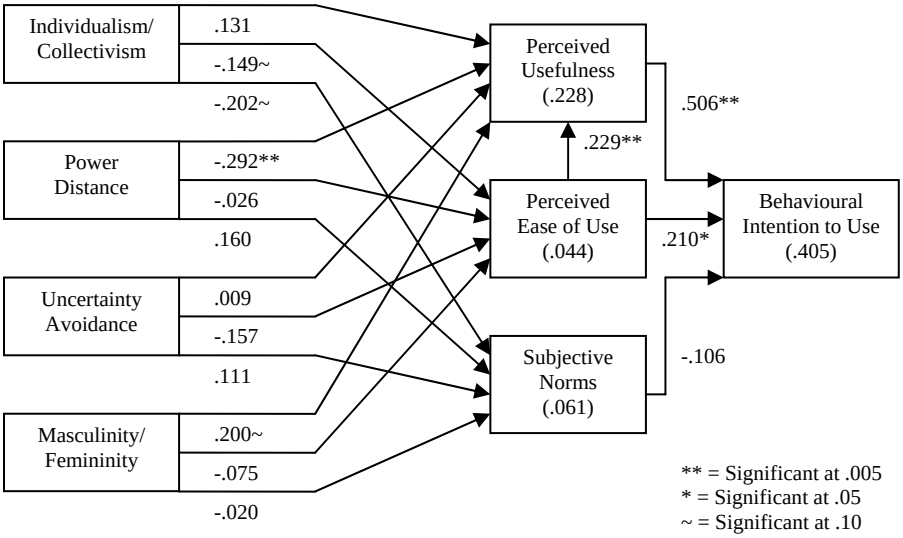
Perceived Usefulness	
PU1	Using computers enhances my productivity in college
PU2	I find computers useful in my college activities
PU3	Using computers enhances my effectiveness in college
PU4	Using computers improves my performance in college
Perceived Ease of Use	
PEOU1	It is easy for me to become skillful in using computers
PEOU2	I find computers easy to use
PEOU3	I find it easy to get a computer to do what I want it to do
PEOU4	Learning to operate a computer is easy for me
Behavioral Intention to Use	
BIU1	I intend to use a PC during my studies
BIU2	I intend to use a PC frequently during my studies
Subjective Norms	
SN1	I believe that my relatives think I should use a computer * The opinions of my relatives are important to me
SN2	I believe that my friends think I should use a computer * The opinions of my friends are important to me
SN3	I believe that my classmates think I should use a computer * The opinions of my classmates are important to me
Masculinity/Femininity	
MF1	There are some jobs in which a man can always do better than a woman
MF2	It is more important for men to have a professional career than it is for women to have a professional career
Individualism/Collectivism	
IC1	Being accepted as a member of a group is more important than having autonomy and independence
IC2	Being accepted as a member of a group is more important than being independent
Power Distance	
PD1	Employees should not question their manager's decisions
Uncertainty Avoidance	
UA1	Rules and regulations are important because they inform workers what the organization expects of them

APPENDIX III – CULTURAL DIMENSIONS AS DIRECT ANTECEDENTS TO TECHNOLOGY ACCEPTANCE

Chinese Sample



US Sample



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