Technology Acceptance Model: Worried about the Cultural Influence?

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Abstract. The Technology Acceptance Model (TAM) has shown in the USA that the Perceived Usefulness (PU) and the Perceived ease-of-use (PEU) determine the intention to use (IU) a specific technology or information system. In this research, the TAM model is validated in Chile, considering the cultural factors of this country, through an application of the model to university students. The results show that the TAM model works in Chile, regardless of the studied technology or the cultural aspects of the country. Finally, new questions arise related to this topic such as the influence of the intensity of use, familiarity with the technology and the individual's reference group for the technologies aimed to encourage communication among people.

Keywords: Technology Acceptance Model (TAM), Intention to Use, Information and Communication Technologies, Cultural Dimensions.

1 Introduction

In a globalized and highly competitive world, innovation and continuous improvement of processes in organizations is a key factor. That is the reason why the communication and information systems are so important. However, an organization is, basically, a group of people working together to achieve a specific objective. After that, it is not always possible to implement or to adopt technologies inmediately, or at least, it is difficult to guarantee the success of such measures without considering the human nature of the people composing the organization.

Some studies have concentrated its efforts to predict the intention to use a specific system based on the Perceived Usefulness (PU) and the Perceived Ease-of-Use (PEU) as the causal factors. This is known as the Technology Acceptance Model (TAM) (Davis, F., 1989). More recently, it has been proposed to validate this model in various countries considering the influence of cultural factors. (McCoy et al., 2007).

This research focuses on validating de TAM model in Chile considering the influence of the cultural dimensions (Hofstede, G. 2001) found in the country.

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2 Literature Review

2.1 Technology Acceptance Model, TAM

The Techonology Acceptance Model (Davis, F., 1989) is an adaptation of the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980) specially developed for the technology adoption case, in which two of the factors, known as PU and PEU, are presented as indicators of the intention to use the system or technology in question. Additionally there is a causal relationship, rather than a parallel, direct determinant of usage (Davis, F., 1989).

Through the last decades, researches have focused their attention to improve the predictive ability of the model. That is when the TAM2 model appeared, introducing the external or social influence to the model (subjective norm, voluntariness and image) and the cognitive process (job relevance, output quality, result demonstrability, perceived ease-of-use) as influential factors of the perceived usefulness and then the intention to use. The results showed a 60% effectiveness, but subject to a mandatory usage context to validate the external or social influence to the model (Venkatesh el al., 2000).

In the same way, several investigations have been carried out that try to validate or refute the TAM model in various environments and with different research subjects, such as students because they represent well the values and beliefs of individuals employed in a wide variety of occupations (Voich, D., 1995), obtaining results that converge and validate the model typically explaining 40% of the variance in usage intentions and behaviour (Venkatesh et al., 2000).

Naturally, the next step was to validate this model outside their country of origin, United States, and to evaluate the influence of certain factors typical of each country (McCoy et al., 2007).

2.2 Cultural Dimensions Theory

The Cultural Dimensions Theory (Hofstede, G., 2001) suggests identifying the culture of a specific country according to the following dimensions: Power Distance (PDI), Individualism vs Collectivism (IDV), Masculinity vs Femininity (MAS) and Uncertainty Avoidance (UAI).

2.3 Technology Acceptance Model, TAM, Outside USA.

To validate the TAM model outside the country of origin, the results obtained of the application of the TAM model were combined with the indicators of the cultural dimensions theory for each of the countries. In fact, for each of Hofstede's cultural dimension, two groups were created (high and low) leaving out the main 80%. The results showed that countries scoring low UA, high PDI, high MAS (high masculinity) and low IC (high collectivism), the relationships in the TAM model didn't work (McCoy et al., 2007).

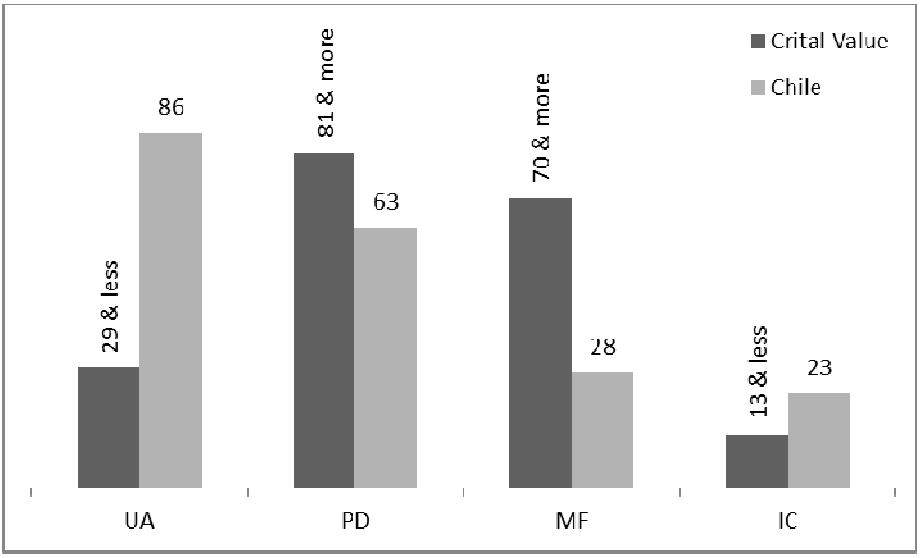

Fig. 1. Chile's Cultural Dimensions versus Critical Values for TAM (Source: Self made)

In Chile, people rely on moderate rates in all cultural dimensions. In fact, we have Power Distance (63), Individualism vs Collectivism (23), Masculinity vs Femininity (28) and Uncertainty Avoidance (86) (Hofstede, G., 2001).

When this is evaluated in Chile, the attention must be concentrated especially on the behaviour of the model according to the Power Distance Index (63) that represents a slightly high value and the Individualism vs Collectivism (23) that represents a slightly low value.

2.4 Used Technologies

The following technologies were used in our research:

SMS: Short text Messaging Service, is a text messaging services that can be used as a means of communication between mobile phones.

IM: Instant Messaging is a real time communication technology based on text, between two or more people. Both people must be connected to the same network or protocol and use a specific client of instant messaging.

Email: Electronic Mail is an online service that allows people to send and receive messages from different people through the Internet.

SIGA: Sistema de Información de Gestión Académica, is a technology developed in Universidad Técnica Federico Santa Maria, which main goal is to provide a platform that allows managing the academic information of the entire University community. Among the services available can be mentioned the registration of courses, personal schedule, teacher survey, career plans, student's personal record.

SGDI: Sistema de Gestión del Departamento de Industrias. This technology was developed aiming to simplify those tasks related to the teaching, investigative and extension activities of the Departamento de Industrias. Among the services available, we have, enrollment practices, publication of job offers, and management of courses in areas such as: calendar, mail tasks, forums, news and documents.

3 Developed Theoretical Model

The developed model corresponds to the Technology Acceptance Model (TAM) and applied in Chile in which people can find the following relations: Perceived Usefulness with Intention to use, Perceived ease-of-use with Intention to use and Perceived ease-of-use with Perceived Usefulness. These causal relations give rise to some hypotheses.

Perceived Usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance (Davis. F, 1989). If we consider the significance of the job performance, a technology perceived as useful will have a major intention to use.

H1: The Perceived Usefulness positively influences Intention to Use of a particular information system or technology.

Perceived ease-of-use is defined as the degree to which a person believes that using a particular system would be free of effort (Davis, F., 1989). If we consider effort as a limited resource that must be assigned to multiple tasks, a technology that does not require efforts when it is used is going to have a major intention to use.

H2: The Perceived Ease of Use positively influences Intention to Use of a particular information system or technology.

To the extend that a system or technology requires less effort in being used, and understanding that the effort is a limited resource, more effort can be assigned to other tasks. That way, the productivity or job performance will grow.

H3: The Perceived Ease of Use positively influences Perceived Usefulness of a particular information system or technology.

Chile presents moderated values for the cultural dimensions of Hofstede and only two of the cases are important for observations: Power Distance Index (63) considering that when an authority figure recommends or requests the use of a system in a high PD culture, users will not need the added attraction of usefulness and ease of use to make use of the system. (McCoy et al., 2007).

The other case is Individualism vs Collectivism (23), considering that people who focus on Collectivism are more willing to suffer with lower usability to accomplish the goals valued by others. They would focus less on their own effort and more on what seems to be valued or needed by others (McCoy et al., 2007).

H4: The values that cultural dimension takes in Chile do not affect the performance of the TAM model.

The TAM Model has been extensively applied in several areas by predicting typically 40% of the use of a system (Legris et al., 2003). Consequently, it is expected that the model is going to give values close to the typical trend for the five cases studied in this research.

H5: The technology acceptance model operates independently of the technologies used for study.

User evaluations such as PU and PEU are updated sequentially with target system experience. (Kim and Malhotra, 2005). After that, it is expected that the TAM model will explain a large number of the changes in the results of intensive users.

H6: The Intensity of use of a technology affects relationships within the technology acceptance model.

4 Methodology

The study considered a sample of 427 students from different courses of the Universidad Técnica Federico Santa María where they participated in exchange for a grade to the course they were taking. At first, an exploratory research was carried out to analyze knowledge around the TAM model in depth, and the validity of this model outside USA. On the same path, researches were carried out to investigate more about Hofstede cultural dimensions and the clasification of Chile according to these rates. A concluding investigation was carried out, that focused on a univariate analysis aiming to know the profile of the survey respondent to determine the representation of this model regarding the students of the university. This stage also intends to establish some a priori links of the variables of the TAM model. After that, an exploratory factor analysis was conducted to see how the variables were grouped around the exogenous factors of the TAM model. Subsequently, a structural equations analysis, a confirmatory factor type, was carried out, analysing the results in relation to Hofstede cultural dimensions of Chile. Finally, an analysis was conducted according to the intensity of use of the different evaluated technologies (SMS, IM, Email, SIGA, SGDI) with the aim to establish differences in the results of the model according to the associated segments of the intensity of use.

5 Analysis and Results

From the first analysis, a consistent survey respondent profile was obtained, in which 69% were male, 61.6% of the survey respondents have an average age of 23 years old, a 70.5% have no work experience in a full time job and 23.4% have only one year of work experience. Regarding the regions of residence of the family group, 47.1% of them live in the Región Metropolitana (Santiago) and a 23.2% live in the fifth region (Valparaíso). In terms of socioeconomic level, 47% of the survey respondents were classified on the ABC1 segment and 41% of them on the C2 segment. This confirms the representativeness of the sample for the students of the university, considering that the respondents were from the Campus Santiago and the Casa Central (Valparaíso), also that they were from the second year of study onwards, so that respondents have a degree of knowledge of information systems, as the SIGA and SGDI.

Therefore, an analysis of the intensity of use measured in hours and amount of times during a week where a determined technology is used was carried out. Also an analysis of the perceived complexity of system information for each treatment was conducted. From this, a direct relation between the perceived easy of use and the intensity of use in four of the five technologies was obtained. In fact, the technologies

used most and the ones felt as the easiest to use were IM and Email. In the same way, the least used technologies and the ones people considered as the more complex were SIGA and SGDI. From these results, it was suggested that the SMS were mainly regulated by the other construct: Perceived usefulness.

Table 1. Indicators of the exploratory factor analysis

Variable	Factor 1	Factor 2
P1: I find (technology) easy to use.	[0,885 – 0,937]	-
P2: Learning to operate (technology) is easy for me.	[0,861 – 0,918]	-
P3: It is easy for me to become skillful at using (technology).	[0,722 – 0,880]	-
P4: I find it easy to get (technology) to do what I want them to do	[0,563 – 0,784]	-
P5: (Technology) are simple technologies to use.	[0,866 – 0,912]	-
P6: Using (technology) improves my performance.	-	[0,853 – 0,910]
P7: Using (technology) improves my effectiveness.	-	[0,885 – 0,908]
P8: Using (technology) improves my productivity.	-	[0,866 – 0,912]
P9: I find (technology) useful.	[0,535 – 0,843]	-

Source: Self-made with information from the rotated factor matrix of each used technology.

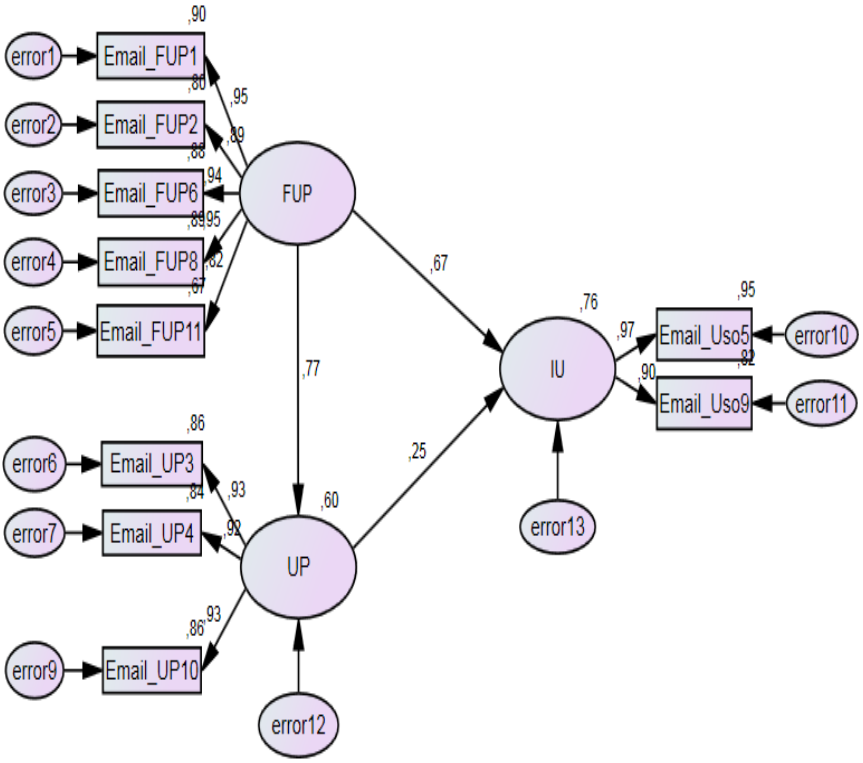

Fig. 2. TAM model applied to email (Source: Self-made with IBM SPSS Amos 20)

Subsequently, an exploratory factor analysis was conducted, in which it was possible to validate the existence of two factors compound by observable variables, that according to the theoretical base, were measured on one hand by the perceived usefulness and on the other hand by the perceived ease-of-use. The results were consistent in all the five evaluated technologies.

The previous table shows the variation of the correlation of each variable regarding the factor that relates better with it. This corroborates the independence of technology acceptance model with respect to the information or technology system studied.

In addition, the study gave satisfactory and coherent results for the composition of the two proposed dimensions. The exception to the rule was the question *I find (technology) useful,* that showed a major correlation with the Perceived Ease of Use factor considering that it was created to measure Perceived Usefulness. It should be noted that this variable also presented a low communality in all five conducted studies.

After that, a confirmatory analysis was carried out, a structural equations modelling, SEM. The results of the proposed model showed an unsatisfactory fit; as a consequence, it was decided to modify the model by eliminating the variable associated to the question *I find (technology) useful*, considering that in the previous analysis it showed low communality and a better correlation with the wrong factor, all together with the problem of goodness of fit in the proposed model and considering that the existent theory explains the TAM model inside USA. Thus, a proper fit was achieved for the model TAM justifying the validity and reliability of the model according to the results exhibited by the SEM method.

Finally, an analysis was conducted establishing segments regarding the intensity of use of the survey respondent. From this, it was obtained that there are differences depending the intensity of use, mainly in technologies aimed to communicate.

Table 2. Standardized Coefficients of the Confirmatory Analysis

Relation	SMS	IM	Email	SIGA	SGDI
UP←FUP	0,055	0,499	0,774	0,218	0,651
IU←FUP	0,146	0,668	0,667	0,034	0,291
IU←UP	0,647	0,161	0,246	0,599	0,520
P1←FUP	0,923	0,959	0,936	0,918	0,925
P2←FUP	0,800	0,919	0,946	0,833	0,899
P3←FUP	0,623	0,900	0,893	0,667	0,806
P4←FUP	0,461	0,790	0,817	0,582	0,771
P5←FUP	0,891	0,927	0,949	0,877	0,890
P6←UP	0,859	0,936	0,916	0,815	0,923
P7←UP	0,860	0,913	0,928	0,870	0,910
P8←UP	0,868	0,897	0,927	0,869	0,921
P10←IU	0,881	0,963	0,974	0,919	0,958
P11←IU	0,901	0,922	0,904	0,856	0,936

Source: own production with data from the SEM analysis

6 Discussion

The proposed model showed to be valid and reliable regarding the validity and reliability tests to which it was subjected based on the structural equation modelling. In both, a measure model level (relation between observable variables and latent variables) and the structural model (relation between proposed factors or latent variables). In fact, the results show the existance of the proposed connections between the Perceived Ease of Use, Perceived Usefulness and Intention to use (H1, H2, H3).

The TAM model proved to be applicable in Chile because, according to Hofstede's multidimensional model, this country has moderated indicators for each of the dimensions: Uncertainty avoidance (86), Femininity (28), Individualism (23) and Power Distance (63). The last one was the only dimension that requires more attention considering that a high rate of Power Distance implies that some connections of the TAM model do not work. However, the results prove that this dimension was not influential (H4).

The TAM model works independent of the studied technology (H5) since it showed similar results in terms of the R2, or the variance explained by the model, for SMS (0.45), IM (0.58), Email (0.76), SIGA (0.37) and SGDI (0.55) that additionally go in the same line, and better, than the historical results (40%).

The TAM model is an excellent tool to predict and explain the behaviour or the Intention to use of a technology. However, it is not solid enough when a comparison between different systems is required. This becomes evident when you see that SGDI shows better indicators of adjust, reliability, estimators and coefficients of determination than the SIGA. Both technologies were mainly created to be mandatory used by the students of the university and designed with similar objectives and functioning. The biggest difference between SGDI and SIGA lies on the intensity of use with each system. SGDI was created to be used daily and that is why it is not strange to think that there is a higher level of familiarity regarding the SIGA of which seasonal use presents peaks during the student's courses registration periods. In this way, it can be seen that the results of the TAM model vary according to the degree of use or the familiarity regarding the system (H6).

Also, it was shown that when the Perceived Ease of Use has a large importance in the model, there is a causal connection between PEU and PU. That was the case of the IM (0.5), Email (0.77) and SGDI (0.65). Therefore, and understanding that the effort is a limited resource that must be dessignated to multiple tasks, an easy to use technology requires less effort which must be allocated to other tasks increasing the productivity of an individual. As productivity is important in the job, this will increase the intention to use of the technology in question.

In case of the SMS, the intention to use mainly comes from the Perceived Usefulness. That makes sense when considering technologies that have replaced the SMS nowadays. In fact, applications like Whatsapp displays possibilities such as group conversations, sending and receiving pictures and videos, an organized history of each conversation, while they keep as an inherited characteristic the functioning over mobile phones. This results in a greater use of this application in comparison to SMS in the sense of the amount of things that allow increasing the productivity of an individual.

In case of the IM, the Intention to use mainly comes from PEU. This makes sense when considering the characteristics of the most popular application in 2013 (Facebook Chat) compared with the leader a few years ago (Windows Live Messenger).

In fact, Facebook chat does not required to be installed, it has a clean and simple interface and to communicate with someone else, people just need to know the name of the person they want to communicate. This results in a higher PEU. In contrast, a possible problem was discovered in the formulation of the questions that intended to measure PU when measuring in a communication technology like IM or SMS, considering that the survey respondent can be answering that the use of IM decreases his productivity, effectiveness and performance, due to the fact that it represents a distraction source to their tasks or pending works. This information was confirmed by making a comparison of the results according to the intensity of use: the more intensity of use, the less weight of the Perceived Usefulness for the technologies aimed to communication (H6).

Based on these conclusions, some recommendations arise for future studies related to the same topic. It is suggested to evaluate the impact of the next variables regarding the functioning of the TAM model.

Intention to use explains the difference exhibited when analizing the same technology based on how intensive is the use of the surveys respondents. The level of familiarity with the studied technology, as a consequence of the intensity of use, can also be used to explain the differences between similar technologies under the same contexts but that differ in the intensity of use.

Unfortunately, we cannot compare mandatory versus voluntary use pattersns, as technologies cannot be compared if the contexts of use are different. However, technologies for information purpose compared to technologies used for communication purpose can be evaluated. In this case, there seems to be a greater weight of PEU in the case of technologies for communication purposes (SMS, IM), while a greater weight of PU when it is about technologies for information purposes (SIGA, SGDI).

In terms of subjective norms, reference groups are influential mainly for technologies aimed at communication. It is reasonable to think that a technology can have a high level of PEU and PU, and a low Intention to use if the family and friends of the respondents do not use that technology.

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