Received on March 28, 2016 / **Approved on** August 05, 2016
Responsible Editor: Leonel Cezar Rodrigues, Ph.D.
Evaluation Process: Double Blind Review
E-ISSN: 2318-9975

doi> 10.5585/iji.v5i1.80

DIFFUSION AND ADOPTION OF TECHNOLOGY AMONGST ENGINEERING AND BUSINESS MANAGEMENT STUDENTS

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ABSTRACT

This study aimed to identify profiles of technology adoption amongst engineering and business management students based on Rogers' theory of diffusion of innovations and on Hirschman's studies of innovativeness, novelty seeking, creativity behavior and role accumulation. A systematic literature review was performed and an item pool was generated to measure the constructs found on theory. The questionnaire was presented to an experts' panel for content validity and to a sample of subjects in the population for semantic validity. The final research instrument was then submitted to 390 students from private and public universities in Brazil. Mean age of sample was 22.5 years (SD = 4.9) and was well distributed between males (50.6%) and females (49.4%). Data was analyzed using SPSS 22.0 and SmartPLS 2.0. A hypothetical model was specified and alternative models as well. Univariate and multivariate normality was tested and PLS-SEM was chosen due to the non-parametric nature of collected data. Final results proved that Roger's theoretical profiles (e.g.: innovator, early adopter, etc) are predictors of Hirschman's adoption typology and these findings are useful to understand the generational patterns of technology diffusion and adoption and to support corporate initiatives on technology deployment amongst employees.

Keywords: Diffusion of Innovations; Adoption of Innovations; Undergraduate Students; Structural Equation Modeling; Technology.

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DIFUSÃO E ADOÇÃO DE TECNOLOGIA ENTRE ESTUDANTES UNIVERSITÁRIOS DE ENGENHARIA E ADMINISTRAÇÃO

RESUMO

Esta pesquisa buscou identificar perfis de adoção de tecnologia entre estudantes universitários dos cursos de Engenharia e Administração de Empresas com base na teoria de Rogers sobre a difusão de inovação e os estudos de Hirschman sobre inovação, busca de novidades, comportamento criativo e acumulação de papéis. Foi realizada uma revisão sistemática da literatura e um conjunto de itens foi elaborado para a mensuração dos construtos encontrados na teoria. O instrumento de pesquisa (questionário) foi apresentado a um painel de especialistas para validação de conteúdo e para uma amostra dos sujeitos da população para validação semântica. A versão final do questionário foi submetida a 390 estudantes de instituições de ensino superior públicas e privadas no Brazil. A idade média da amostra foi de 22,5 anos (DP = 4,9) e a distribuição de gênero dos respondentes equilibrada entre masculino (50,6%) e feminino (49,4%). Os dados coletados foram analisados com os pacotes SPSS 22.0 e SmartPLS 2.0. Foram especificados um modelo de pesquisa hipotético e modelos alternativos. Testes de normalidade univariada e multivariada foram realizados e o modelo de equações estruturais baseado em mínimos quadrados parciais (PLS-SEM) foi escolhido em função da natureza não-paramétrica dos dados. Os resultados obtidos confirmam o modelo hipotético em que os perfis teóricos de Roger (ex.: inovador, adotante inicial, etc) são preditores da tipologia de adoção de Hirschman. Estas descobertas são úteis para compreensão dos padrões geracionais de difusão e adoção de tecnologia, bem como auxiliar iniciativas corporativas para disseminação de tecnologia entre os colaboradores.

Palavras-chave: Difusão de Inovações; Adoção de Inovações; Estudantes Universitários; Modelagem de Equações Estruturais; Tecnologia.

INTRODUCTION

The diffusion and adoption of technology, and technology or innovation understood here as the application of scientific knowledge or other practical tasks for the ordered systems involving people and organizations, productive skills, living things and machines (Dusek, 2006) is not a new theme or even an exclusive subject of contemporary society and its study or analysis can be applied to any period of history, as it encompasses different situations and needs.

Although the diffusion of innovation (DOI) model designed by Everett M. Rogers in 1962 is a hypothetical construction, laid the foundation of how we evaluate the stage at which an innovation is within a given social system and how the members of that system relate and interact with technology, defining concepts as innovators, early adopters, among others.

Different factors influence the diffusion and consequent adoption of innovations and technologies in addition to the aforementioned, as it is for the individual interaction and transformation of innovation into something present and useful in the sense used and belongs to the set of resources available to achieve their daily activities, thus validating innovation within their social system.

Considering that the individual, inserted in the society, influences and is influenced by technology and that in his relationship with her, there are factors that modulate their attitudes and conceptions, hypotheses are presented that converted into models and studied within a causal relationship point to the existence of antecedents and descendants in the dissemination and adoption of technology.

Although the adoption of an innovation is linked to the use or consumption of this innovation, Hirschman (1980) identified different forms of adoption that are not necessarily related to the use, as in the case of vicarious adoption, or even using a technology innovation, or without the previous adoption, characterizing the non-adopter user who uses pursuant to external factors and not necessarily by conviction or prior knowledge and mental development.

In order to exist a technological advance is necessary to have basic conditions such as the existence of social needs, social resources and a set of values (or ideology) friendly markets. These social needs are expressed to ensure the allocation of human and material resources in the production of innovation.

All the adoption of an innovation, understood as an idea or product that are perceived by potential adopters as new, even when they have obvious advantages is difficult and often requires a long period of time, since it become available to a widespread adoption The period between the initial knowledge of an innovation, the formation of an attitude about this, their adoption or rejection and the confirmation of this decision is one of the main elements in the diffusion process. Understanding the temporal process of adoption is critical to achieving the diffusion of an innovation (Blackwell; Miniard & Engel, 2001).

Diffusion of innovations model

The adoption process defined by Everett Rogers (2010) as diffusion is the innovation by certain communication channels over a given period of time between members of a social group. In order to communicate such innovations the existence of communication channels is required, and communication channel is defined as the means by which the messages (information) come from one individual to another, and communication is critical to the diffusion process.

The mass media are the most effective channels for the creation of knowledge about an innovation, however interpersonal relationships are more effective in forming and changing attitudes towards an idea, concept or product, contributed directly to the decision of an individual or social group to adopt or reject an innovation. As such, communication is critical to the diffusion process, but one of the most distinctive aspects of a communication process innovation is the existence of some degree of heterogeneity, here understood as the differences between two or more individuals interact for certain attributes such as beliefs, education, social position, etc. (Rogers, 2010).

The existence of this heterogeneity is usually applicant in the process of diffusion of innovation and consequently causes difficulties in achieving effective communication and the adoption or rejection of a particular innovation is generally affected by the social system to which individuals belong. A social system is a set of interrelated units that are engaged in joint problem solving to the achievement of a common goal. Members or units of a social system can be individuals, informal groups, organizations and / or sub-systems within a system.

The diffusion occurs within a social system, the greater the compatibility between innovation and values of members of the social system as well as the more homogeneous and the system, the faster will be the non-segmented diffusion rate (Mowen & Minor, 2006). According to Castells (2011), innovation is the paramount function of an economy based on knowledge, information and intangible factors such as image and connections. A good example is the cooperation and free access provided by the Open Source movement which facilitate the generation of knowledge, based on free access to information, online.

Most of the ideas in which innovation have been analyzed are technological, which leads to the use of the words innovation and technology as synonyms. A technology is the concept of an instrumental action that reduces the uncertainty of the causal relations involved in achieving a desired outcome. This reduction in the uncertainty of causal relations was defined by Rogers (2010) as the process of decision-innovation. This process does not occur instantaneously as it develops during a period of time and consists of a number of different actions.

The decision process for innovation begins when the individual (or other decision-making unit) is exposed to the existence of innovation and get some understanding of how it works. According to Blackwell, Engel & Miniard (2001), this stimulus can be social or physical and the way in which the individual or group receives and interprets knowledge is affected by personal characteristics.

The degree to which the innovation is perceived as better than the idea or concept that replaces is called comparative advantage. This degree of relative advantage can be measured economically, but also contribute to this analysis factors such as social prestige, convenience and satisfaction (Rogers, 2010), supported by Blackwell, Engel and Miniard (2001) where the concept of compatibility is related to how much the product, concept or idea is consistent with the practices, values, beliefs, experiences and needs of the individual or social group. An idea or concept that is not compatible with the values and norms of a social system will be adopted more slowly than those that are consistent with these principles.

Adopters of any innovation tend to prefer those that are easier to understand, with the least complexity (Sheth, Mittal & Newman, 1999), since complexity is a significant barrier to the adoption of a new technology including the use of computers or shopping online. The visibility of the adoption stimulates discussion among peers, so that the bystanders of a adopters are always looking for information on the evaluation of innovation.

Roger's model of diffusion of innovation established a conceptual framework to understand the process along a period of time and to define some characteristics of different profiles within a given social system. This theoretical model influenced the comprehension of diffusion of innovations in the last 50 years and impacted different disciplines such Sociology, Management, Marketing and Engineering, specifically when is related to product development and market penetration.

Not all individuals in a social system adopt an innovation at the same time. Among the determinants of adoption are included the individual's personality, his aversion or acceptance of risks, their social status and their level of education, in addition to the role in the family, that cause different types of adopters behave differently during the different stages of decision-making (Blackwell; Miniard & Engel, 2001).

According to Rogers (2010), the adopters of an innovation can be classified into categories based on the moment we first used a new idea, concept or product. Each category consists of people who have similar degree of adoption of innovation. The criterion used to categorize adopters is the degree of initial adoption of an individual in relation to an innovation compared with other members of the same social group.

The categories of Rogers' adopters are ideal types, concepts based on observations of reality, outlined to allow comparisons. However, the ideal types are not merely the average of observations within each category, also include the exceptions found.

By define five profile of adopters, Rogers (2010) brought to the scholarly environment new concepts that were incorporated in several discussions and became the standards to define people's behavior along a innovation adoption process as:

(1) innovators (2.5% of all adopters) - the ones who tend to be more adventurous, this trend is almost an obsession among innovators, what drives them to seek relationships outside groups to their community;

(2) early adopters (13.5% of all adopters) - tend to be a more integrated part within social systems. This adopters category is terminating the highest degree of opinion leadership among all categories. To continue to deserve the esteem of others and maintain its central position in the network of social communication system, it is necessary that the first-time adopter is quite judicious in their decisions about the innovations, which causes uncertainty about an innovation decrease due to its adoption, which serves as a stamp of approval for the other adopters;

(3) early majority (34% of all adopters) - adopts innovations after deliberate extensively, and most often no leaders and followers, and is composed of one of the numerous categories of adopters and play an important role in connecting the previously adopted (innovators and early adopters) and that do later (late majority and laggards);

(4) late majority (34% of all adopters) - the adoption process can be characterized by both an economic necessity as by increased peer pressure and the social system. Innovations are assessed with caution and skepticism. Because of its limited resources, it is necessary that most of the uncertainties about the new idea, concept or product has been removed before they feel safe and comfortable in adopting innovation and;

(5) laggards (16% of all adopters) - they also tend to suspect everything that is new because of their limited resources and want to be sure that innovation will not fail after they adopt.

Although the innovation diffusion concept originally proposed by Everett Rogers in 1962 has become the most widely used construct to evaluate the process of adoption of innovations or technologies, research conducted by Moore and Benbasat in 1991 showed that the research instruments and scales developed to date lacked the psychometric perspectives of reliability and validity (Moore and Benbasat, 1991).

Although the results obtained by Moore and Benbasat (1991) have achieved yhe objective of developing a research instrument with psychometric property of satisfactory validity and reliability, the measurement of technology adoption from the diffusion approach does not allow the development of an instrument research, therefore, is based on a measurement that takes place *ex post facto*. The broad construct "Diffusion of Innovation" coined by Everett Rogers then assume the adoption itself or the construction of scenarios where adoption is present for its measurement and analysis.

This is corroborated by Midgley and Dowling (1978) that claim to be observable only the act and the time of adoption of an innovation or purchase of a new product or technology. Innovation as such is a hypothetical construct, postulated to explain or predict certain phenomenon that exists only in the abstract mental formulation of the researcher.

So we should not consider the adoption, dissemination or acceptance of technology as something alien to the environment but as an integrated and inclusive process, and thus the questioning becomes about which technology will be adopted or accepted within an already present reality either in the educational environment and the social environment.

Adoption of innovations

Although they may apparently be regarded as synonymous, and often the literature promotes this confusion, diffusion and adoption of innovations are distinct phenomena since the diffusion requires a continuous flow of a social system over a given period of time and adoption refers to the act itself. This differentiation is important because it helps the researcher to better define their research object: the process or act.

Hirschman (1980) empirically conceptualized the adoption of innovations ("the Act") and proposed 3 adopters classification possibilities for innovation: the user adopter, the non-adopter user and vicarious adopter.

The adopted innovation was defined in the literature as the purchase of a product or idea and has always been the dominant aspect of the research. For Midgley and Dowling (1978, p. 230) this approach is only one measurement of an isolated behavior (buying) and not the expression of the individual cognitive construction.

Through vicarious the individual innovation can, in essence, adopting the concept of innovation without the need for their effective implementation. This condition allows the individual to store the information on innovation in his memory to have them available at the time of decision, thus avoiding the costs and risks inherent in the effective adoption of the product. Or, expanding their knowledge of situations of use and consumption of innovation through the vicarious trial of these situations. As an example the individual can read about the tire change on a car, without necessarily having carried out this exchange (Hirschman, 1980).

In turn, the novel use relates to the use of a product or innovation in a manner not intended by the manufacturer, using the product in many ways or revising / changing the product. For Hirschman (1980) that concept must be measured from two components: (a) the number of times that the new use has occurred and (b) the degree of novelty that characterized each new use.

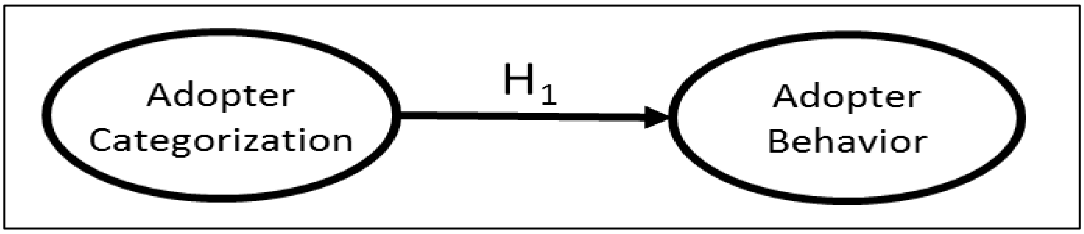
In this sense, considering that the relationship an individual has with the the diffusion and adoption of innovations can be set from the process (diffusion of innovations), which is perennial and possibly constant, or from the act (adoption of innovations) that is contextualized and timely, we propose the following hypothesis:

H_1 = individuals classified according to the adopters' categorization proposed by Rogers (process based) will behave differently on Hirschman's categories (act based)

The model in Figure 1 presents the conceptualized relationship between the adopters' categorization proposed by Rogers (process based category) and the acts performed on Hirschman's categories

Figure 1

Conceptual Model



Method

Sample

A sample survey approach was used to collect information about the aforementioned adopter categorization and its behavior. From 5 large universities (2 public and 3 private), 390 undergraduate students completed an “innovative style” survey. After scale validation and reliability analysis (a more detailed discussion of this is provided in the next section) we conducted our data analysis. The mean demographic characteristics of the sample were: 22.5 years (SD = 4.9) and was well distributed between males (50.6%) and females (49.4%).

Measures and validation

Rogers’ categorization of adopters

In 1962 Everett M. Rogers defined the categories of ideal types adopters as members of a social system which, within a given period of time, tend to adopt a new technology or prematurely innovation (innovative) or the end of period of time in question (laggards).

Since then various authors have developed scales to measure innovation consumers, favoring one or another specific aspect of the adoption process and using as independent variables in the model factors such as gender, age, education, income, etc. Vandecasteele (2010) identified 11 different scales to measure innovation in the individual consumer. These scales have general or specific approaches to innovation in the global consumer, the willingness to innovate or even criteria of social innovation and hedonic innovation. In addiction to Vandecasteele's identification, 6 more scales were added to the analysis by the authors.

After analysis of the 17 scales found we opted for the adaptation of the scale developed by Goldsmith and Hofacker (1991) due to its popularity and was developed as a scale for self-assessment of the individual innovation. Thus, to measure the construct **Innovative Behavioral Style** (IBS), the Goldsmith and Hofacker scale was subjected to the process of translation and re-translation and its contents analyzed by the judges.

In its original version the scale was applied to a sample of 309 subjects, 151 male and 157 female and one respondent no indication of sex, with a mean age of 21.6 years. The original data collected were analyzed using Cronbach's alpha coefficient and showed a value of 0.82, resulting in a preliminary scale with two sets of 11 items each, allowing the scale can be applied in two ways: a positive approach and an approach negative. As an example, item 1 of the scale can be presented as the respondent being the "first" class to buy new technologies or, in scale with less positive approach, as the "last" of the class to buy new technologies. The final version of their scale was validated for 6 items only, both to be used in the "positive" or the "negative" approach,

For this study we chose to use the positive version of the preliminary scale (11 items), thus emphasizing the innovative behavior, since the scale was premised be a tool for self-assessment of innovation, understood by the authors as the predisposition to learn about new products and adopt them in a specific area within the consumer behavior. (Goldsmith & Hofacker, 1991)

Hirschman's adopter behavior

When developing a favorable or unfavorable attitude toward innovation, the individual can imagine the idea applied in its reality or anticipate future situations before deciding to adopt. This vicarious testing involves the ability to think hypothetically (Rogers, 2010). To this attitude has been assigned the construct **Adoption Profile** (AP).

The emphasis on socio-economic aspects and previous practices in the AP construct, are due to the theory proposed by Hirschman (1980) of vicarious innovation, innovation adopted and used innovation. For this theory, the vicarious innovation occurs when the concept behind the innovation is incorporated into the individual's repertoire but has not yet existed the adoption or trial. Socio-economic factors can influence the adoption process as restrict access to innovation and experimentation for use, but do not limit the level of knowledge about an innovation that someone may have, even without possessing it.

Already used innovation with regard to that which was made available to the individual regardless of their interest or need and whose continued use consolidates the repertoire of previous practices that may influence your decision making process.

From the empirical conceptualization of Hirschman (1980) concerning the adoption of innovations, Hartman, Gehrt and Watchravesringkan (2004) developed a scale to measure three dimensions proposed, namely: (a) adopted innovation; (b) vicarious innovation; and (c) innovative use, considering that this three-dimensional conceptualization is needed to capture the full manifestation of innovation.

The original instrument was distributed to 330 respondents, 42% male and 58% female, mean age of 12.7 years. Of the 330 questionnaires, 309 were considered valid (Hartman; Gehrt & watchravesringkan, 2004). Data were analyzed using Cronbach's alpha coefficient for the three sub-scales (adopted innovation, vicarious innovation and innovative use) and for the scale as a whole. Further exploratory factor analysis was performed for each of the three sub-ranges.

With these procedures the scale was reduced and showed Cronbach's alpha coefficient of 0.86 and factor loadings greater than 0.5. The three subscales after cleared presented the following Cronbach Alpha coefficients: adopted innovation = 0.66, innovation vicarious = 0.80 = 0.71 and innovative use. (Hartman; Gehrt & watchravesringkan, 2004)

Data were also subjected to confirmatory factor analysis, with the following results: GFI = 0.94, RMSEA = 0.036, AGFI = 0.91, = 0.88 NFI and CFI = 0.96, all indicative of the fit of the data to hypothetical model. (Hartman; Gehrt & watchravesringkan, 2004)

The instrument developed by Hartman, Gehrt and Watchravesringkan (2004) was translated and re-translated and submitted to the scrutiny of the judges for analyzing the test content.

From the original set of 20 items, four were eliminated since they were already reflected in the Goldsmisth & Hofacker's scale. Both scales were presented in a five point Likert-style scale, anchored as 1 being total disagreement and 5 total agreement.

Analysis and results

In order to define the best approach to analyze the data, normality tests (univariate and multivariate) were performed: Komolgorov-Smirnov (K-S) test for univariate normality and Doornik-Hansen test for multivariate normality. In both cases data were proved to be non-normal, with p values below 0.01.

The scale was validated using Confirmatory Factor Analysis (CFA). CFA is useful to test hypothesis based on past evidence and/or theory and requires a strong knowledge of observed measures that define the latent variable. Conversely from Exploratory Factor Analysis (EFA), CFA provides a greater emphasis on theory testing and also offers a robust set of analytic procedures, not available on EFA (Brown, 2006).

Since CFA is focused only on the link between the factors and their measured variables, in the context of a Structural Equation Modelling (SEM) represents the measurement model (Byrne, 2009). PLS-SEM was used for model measurement and the constructs were hypothesized as reflective. Reflective models are the most used measurement model in social sciences and have its roots on classical test theory. This measurement model is useful when the hypothesis of causality is generated from the construct to the indicators. Data were analysed using SmartPLS 2.0 (M3) (Ringle; Wende & Will, 2005).

Results

The estimation of a measurement model imply in the definition of relationships between the indicators (observed variables) and the construct (the latent variable). To perform the assessment of a certain measurement model, several criteria of reliability and validity must be evaluated. The complete assessment of a measurement model includes the composite reliability to evaluate internal consistency, individual indicator reliability and average variance extracted (AVE) to check convergent validity, Fornell-Larcker criteria and cross-loadings to assess discriminant validity. (Hair Jr.; Hult; Ringle & Sarstedt, 2014)

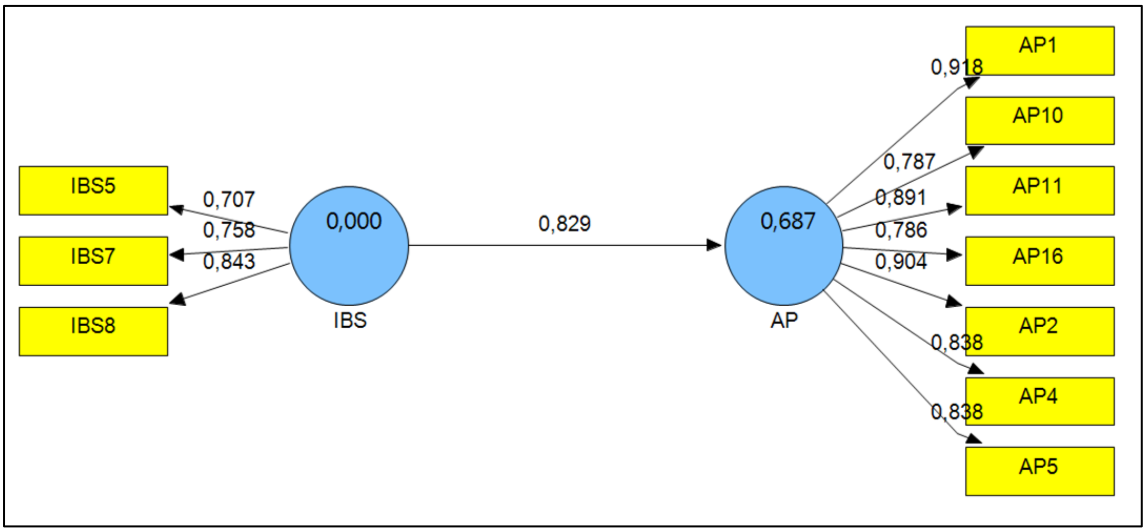
Composite reliability (ρ_c) is measured from 0 to 1 and higher values are equal to higher levels of reliability. As a rule of thumb values between 0.7 and 0.9 are considered satisfactory. Indicator reliability and AVE are common measures of convergent validity. Indicator reliability is measured by its outer loading and the expected measure is above 0.7. According to Hair et al. (2014), the average variance extracted (AVE) is a common measure to establish convergent validity on the construct level. Values of AVE above 0.50 means the construct explains more than half of the variance of its indicators.

Finally discriminant validity is assessed by two measures: Fornell-Larcker criteria and cross-loadings. Fornell-Larcker criteria compares the squared root of the AVE of each construct to the correlations with other latent variables (or constructs) and the value of AVE should be greater.

Several authors (Nunnally & Bernstein, 1994; Anderson & Gerbing, 1988; Netemeyer, Bearden & Sharma, 2003) also support the usage of disattenuated correlation as an evidence of discriminant validity in cases of multidimensional scales or to compensate the measurement errors in behavioral sciences.

The conceptual model was calculated to check the causality relations among the constructs IBS and AP. The initial results indicated that the variables IBS2, IBS3, IBS4, IBS6, IBS10, AP3, AP6, AP7, AP9, AP12, AP13, AP14 and AP15 presented factorial loads inferior to 0.50 and therefore were eliminated from the model. **Figure 2 shows** the final model considering the indicators with factorial loads above 0.50, following the guidelines proposed by Ringle, Silva and Bido (2014).

Figure 2
Final adjustment of conceptual model



As a general result of the model fit, suitable values were considered for assessing the quality adjustment that fitted or exceeded the minimum threshold for the measurement model. **Table 1** shows the values found, including AVE, composite reliability and Cronbach's alpha, communality and discriminant validity assessment.

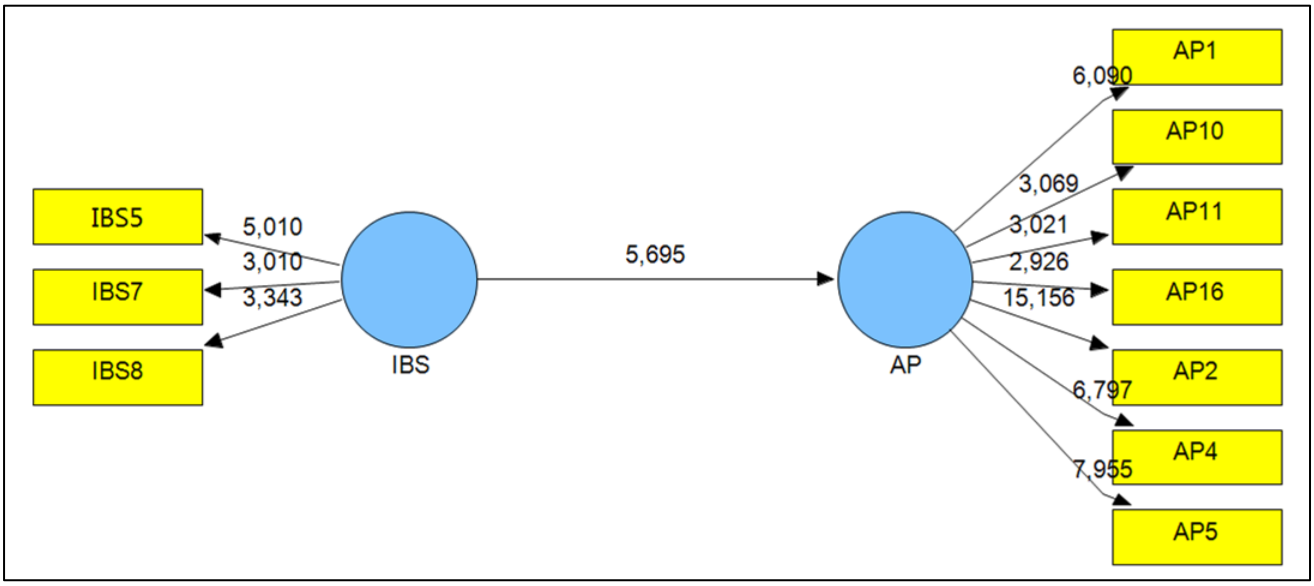
Table 1: Value of the fit tests of proposed measurement model

Construct	*AVE*	*Composite Reliability*	*Cronbach's Alpha*	*Communality*
IBS	0.728	0.949	0.937	0.728
AP	0.595	0.814	0.658	0.595
Reference Values	> 0.50	> 0.708	> 0.70	> 0.50
Discriminant Validity	Fornell-Larcker Criteria $\sqrt{AVE} >$ correlation amongst factors		Correlation IBS – API = 0.687	$\sqrt{AVE}$ IBS = 0.853 APS = 0.771
Discriminant Validity	Disattenuated Correlation $r'_{12} = \frac{r_{12}}{\sqrt{(CC_1) \times (CC_2)}}$		r_{12} = 0.687 CC_1 = 0.949 CC_2 = 0.814	r'_{12} = 0.781
Reference Values				< 1.00

Following the analysis of the proposed model, the next step is assess the tests for the structural model: size and significance of path coefficients, coefficients of determination (R^2), predictive relevance (Q^2) and effect sizes (f^2).

Path coefficient size has standard values between -1 and +1. As shown in Figure 2, the path coefficient IBS → AP is 0.829 but the assessment of its significance depends on standard error. To assess significance of path coefficient in PLS-SEM the technique used is the boostrapping and the report is an empirical *t* value. Despite of the empirical *t* value is higher than the critical value, is customary accept the value at a certain siginificance level for two-tailed tests (e.g.: 1.65, 1.96 and 2.57). The values of *t* values found are shown **in Figure 3**.

Figure 3
t values for the conceptual model



To measure and evaluate any structural model the most used value is the coefficient of determination (R2) and it ranges from 0 to 1. R2 values for endogenous latent variables, as a rule of thumb, can be considered weak (R2 = 0.25), moderate (R2 = 0.50) and substantial (R2 = 0.75). In the proposed model the value of R2 is 0.687, what can be considered a moderate to substantial predictive accuracy.

Both values of predictive relevance and effect size are obtained using the blindfolding process in SmartPLS. **Table 2 shows** the results and the reference values.

Table 2: Value of predictive relevance and effect size of structural model

Construct	Q^2	f^2
IBS	0.392	0.583
AP	0.201	0.201
Reference values	Predictive relevance > 0.00	Effect size small = 0.02 medium = 0.15 large = 0.35

Hypothesis testing

H_1 = this hypothesis stated that individuals classified according to the adopters' categorization proposed by Rogers (process based) would behave differently on Hirschman's categories (act based). The structural equation model proposed supported the hypothesis were Rogers' categorization of adopters (the process of adoption along the time) differentiate individuals during the act of adoption (Hirschman's model).

Discussion

The purpose of this study was to gain an understanding on the effects of Rogers' adopters categorization into technology adoption and usage amongst undergraduate students of Management and Engineering.

Considered the most disseminated concept on innovativeness since its publication in 1962, the Diffusion of Innovations model of Everett Rogers is widely employed by practitioners from several fields in Management and Engineering as a relevant predictor of product development, consumer acceptance and planned obsolescence. Despite the criticism about the model, is still valid and defined an excellent framework.

On the other hand, the model of innovativeness adoption proposed by Hirschman (1980) has the benefit to translate a process into an act and is also used by practitioners to evaluate product acceptance and usage. Most of the models of technology acceptance from an IS perspective have such roots on Hirschman's construct.

Considering that Rogers' model is process based and Hirschman's model is act based, the hypothesis formulated was confirmed by a structural equation modeling, where adopters' categories have different behaviors when using and adopting innovations.

Although this conclusion seems obvious at first glance, no empirical research was conducted so far to help predict behaviors of specific target consumers on technology. The sample chosen of undergraduate students in Management and Engineering has a dual purpose: (1) identify the average profile of future practitioners; and (2) provide insights about the future consumers since the students will become the next generation of customers.

Future research could advance the findings by expanding the sample beyond undergraduate students to include professionals with different backgrounds (income, marital status, family life cicle, etc) to provide more elements to both academia and industry on how different people behave during a process of diffusion and adoption of innovations.

The proposed model was tested and considered valid based on all parameters required to assess a structural equation model based on variance (PLS-SEM) and the pool of items used were also validated to future use by other researchers.

The results found show that both models of Rogers and Hirschman are relevant to understand the phenomena and suggest that a combined use of both models would lead to a better development of theory and practice.

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Cite it like this:

Gabriel, M., & Silva, D. (2017). Diffusion and adoption of technology amongst engineering and business management students. *International Journal of Innovation, 5*(1), 20-31. Doi: http://dx.doi.org/10.5585/iji.v5i1.80