Psychosocial Aspects of Technology Acceptance in Organizations

Matteo Curcuruto, Marco Giovanni Mariani
Dipartimento di Scienze dell'Educazione «Giovanni Maria Bertin»,
University of Bologna

This research takes inspiration from a socio-economic background in which the investments in information technology produce organizational results, as it is empirically proved; sometimes, though, this does not happen in an extremely rapid way. As several studies have demonstrated, human variables play a fundamental role in this process, especially with regard to the way in which users perceive ICT. Indeed, if on one side ICT added value is absolutely clear to the organisations, on the other side the consequences of using technology are not so clear to the end-users in terms of their individual experiences, satisfaction and influence on their performance. These issues are currently a matter of discussion among the experts. According to a bibliographical review by Dillon and Morris (1996), there are two theoretical macro-perspectives from which one may examine the issue of the relationship between man and information technologies. On the one hand, there are research trends which try to explain this phenomenon starting from designing processes, such as researches on human-machine interaction, the approach of socio-technical systems, the ergonomic perspective of software usability. On the other hand, there are perspectives which try to understand how psychological and social processes affect users' behavioural decisions about whether to use or not to use new technologies in carrying out their activities (e.i. the Socio-cognitive Theory, the Theory of Reasoned Action, the Technology Acceptance Model). Psychological sciences significantly contribute to both of the research trends mentioned above, both from a theoretical and from a methodological point of view. From the analysis of the cognitive compatibility between technologies and user's mind research has started addressing the issue of acceptability and the relationship between technologies, users and social context with reference to IT use.

In the last few years, several researches have mainly concentrated on **information technologies acceptance** focussing on those users technologies are originally meant for. In general, acceptance may be defined as the will of a group of users to employ information technology in order to carry out the tasks technology is meant to help (Davis, 1989; Dillon and Morris, 1996; Dillon, 2001). In detail, acceptance may be conceptualized as the outcome variable of a psychological process the potential users of a technology carry out in order to take decisions regarding the use of the technology itself. This decision-making process is unanimously considered, by experts in different fields, to be of fundamental importance in order to determine the success or failure of an information technology. In this theoretical frame, users are to be considered as active members of specific communities, who use technologies in specific social and material contexts, with regard to particular tasks mediated by specific technologies and tools, and who constantly question themselves about the possible uses of information technology, its advantages and disadvantages. According to Talamo (2002), from this perspective it is necessary to consider the IT tool according to its users and purposes. Indeed, the action of the human mind does not exist without tasks, which do not exist without tools. According to this logic, if an information technology is not seen to give real considerable advantages in performing working tasks, the end-users this technology was originally meant for will hardly chose to use it in the fulfilment of their working duties. In the light of all that we have said so far, one may easily deduce that the lack in users' acceptance is a major and serious obstacle to an efficient implementation of technological systems in the organizations. For this reason, the majority of the researches in literature regarding this issue investigate the way in which researchers and developers can predict the acceptance level for a given information technology, focussing on its determinants.

Among all the different theoretical models in literature, this research focuses on the following ones: the Technology Acceptance model (Davis, 1989); the Task-Technology Fit model (Goodshue and Thompson, 1994); the Trust in Information Systems Technology model (Lippert, 2002). We have chosen these three models because on one hand they are integrable, thanks to some similarities in their approach (indeed, they share the same predictive and explicatory aim) and, on the other hand, they are complementary, since they differ in terms of the dimensions considered. The TAM model aims to explain users' behaviour in using information technologies, focusing on their perceptions of technology usage and taking inspiration from the theory of Reasoned Action (Fishbain and Ajzen, 1974). This model suggests that perceived usefulness and perceived ease of use cause people intention to employ information technologies in their working activity. As far as the first variable is concerned, usefulness is especially considered in terms of advantages produced by new technologies in job performances and in the fulfilment of specific tasks. As far as the second variable is concerned, it refers to the degree to which a technology is believed to be free from effort. The TTF model focuses on the actual possibility for information technology to enhance individual job performances (Campbell, 1990; 1993), introducing in literature the issue of coherence between the specific technical details of the system and the tasks it needs to perform. Finally, the TIST model (Lippert, 2002) analyses how, during their usage experience, users develop expectations of predictability and reliability related to the way in which a system operates, and how these expectations positively influence users' reliability in the future performances of technology. By expectations of predictability we mean the degree to which technology performance seems constant (and therefore predictable by users) with reference to past experiences of use. The expectations of reliability can be defined as the degree to which the system is free from errors, delays or major problems. Technology trust is caused by the predictability and reliability of the system and this, in turn, produces the future use of technology, as per the interpretative pattern given by the expectation-confirmation / disconfirmation paradigm (Fishbain and Ajzen, 1974).

Research Objectives and Hypothesis

In this frame, the main research objective is to contribute to the validation of a model in which variables deriving from different theoretical contributions are integrated and which is able to predict and explain the phenomenon of technology acceptance in different organizational contexts, as per the conceptual diagram below.

A number of hypotheses have therefore been formulated, regarding the dependent variable "intention to use a technology". The **intention to use** an information technology (figure 1):

- (H°1) is positively influenced by technology perceived usefulness (as suggested by the TAM model);
- (H°2) is positively influenced by technology perceived ease of use (as suggested by the TAM model);
- (H°3) is positively influenced by the degree of task-technology fit (as per the TTF model);
- (H°4) is positively influenced by the degree of trust in technology future operation (as per the TIST model).

- The **perceived usefulness** of an information technology:

- (H°5) is positively influenced by technology perceived ease of use (as suggested by the TAM model);
- (H°6) is positively influenced by the degree of task-technology fit (as per the TAM2 model);
- (H°7) is positively influenced by technology perceived reliability (as per the TAM2 model);

- The **perceived ease of use** of an information technology:

- (H°8) is positively influenced by technology perceived predictability (as suggested by the TIST model);

- Information technology **trust**:

- (H°9) is positively influenced by technology perceived predictability (as suggested by the TIST model);
- (H°10) is positively influenced by technology perceived reliability (as suggested by the TIST model);

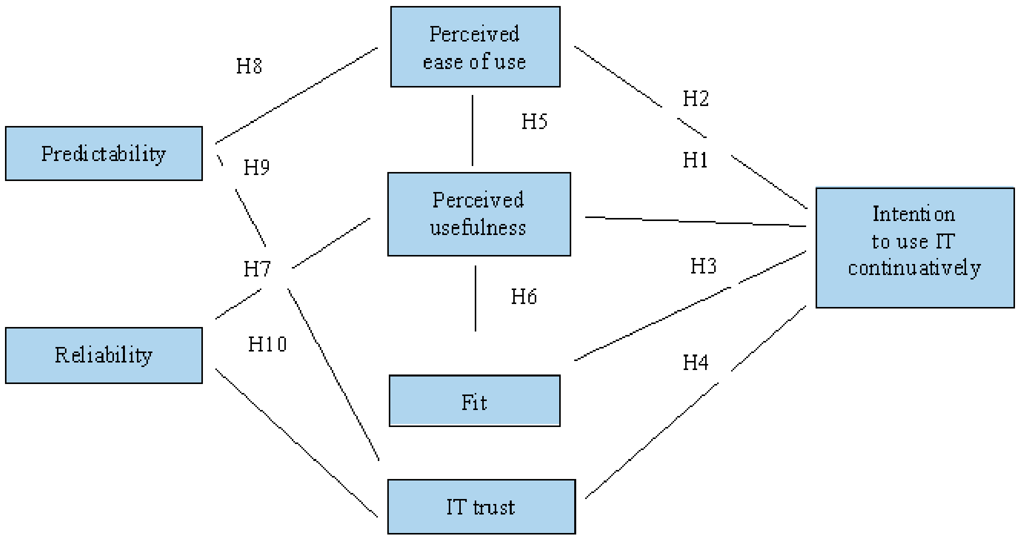

Fig. 1 – Hypotheses of the research

Research Methodology

Sample

Four hundred and eighty people from eight organizations* took part in this survey, 49.9% of which are women. The average age is 38 years (min. 21 years, max. 65 years; DS 8.52). Around 54% of the interviewees graduated from secondary school (41% have a university degree). The interviewees have used the computer for an average of 11.9 years (DS 6.5) for a daily average of 6.3 hours (DS 1.7). As far as the length of employer-employee relation is concerned, it is possible to assert that the majority of the employees have been working in the organization for less than 7 years (47.8%). The remaining part of the interviewees is composed of employees who have been working for their company for a period of time between 7 and 14 years, and employees who have worked for more than 14 years. As far as working sectors are concerned, one third of the participants are employed in administration and human resources (33.4%) while the second largest group is employed in the technical sectors of the companies (28.6%).

Instruments

The data gathering process consists of a quantitative phase in which a questionnaire is used in order to detect users' perceptions regarding the features of information

* This survey has been conducted in eight different organisations based in a Northern Italian city, belonging to different working sectors, from public administration to digitalization companies, together with a pharmaceutical company and a publisher's graphics firm.

technology. The questionnaire starts with some preliminary questions regarding the use of computers and software in accomplishing working tasks. The interviewees are then presented the item scales regarding the measurement of the different psychological constructs taken into account in this survey. The questionnaire ends with the gathering of socio-demographic data (gender, age, education level) and information regarding the relation with the organization (length of the relation, working sector in the organization). The table below shows some information regarding technology perceived dimensions, the authors of the scales and the original models, together with the results obtained from the factor analyses and the reliability analyses carried out with the objective of evaluating the validity and internal consistency of the scales used in the questionnaire. The results refer to the analyses carried out on the final sample of the research, which consisted of 480 applicants. The dimension "reliability" has highlighted the presence of two factors which have been labelled "system availability/functionality" and "lack of problems", with reference to the items saturated in it. The properties of both the factors are shown in the table. All the scales in the questionnaire show very positive values of internal consistency (Table 1).

Tab. 1 - Analysis of the psychometric properties of the scales in the questionnaire.

Variables	*Model*	*N. Item*	*Explicit variance*	*Cronbach's Alfa*	*Mean*	*DS*
PERCEIVED USEFULNESS (Davis, 1989)	**TAM**	6	63.03	.91	4.14	.69
PERCEIVED EASE OF USE (Davis, 1989)	**TAM**	6	59.94	.90	3.59	.83
PREDICTABILITY (Lippert, 2002)	**TIST**	6	58.32	.91	3.70	.85
RELIABILITY I - *Availability/Functionality* (Lippert, 2002)	**TIST**	3	50.43	.83	3.92	.83
RELIABILITY II - *Lack of problems* (Lippert, 2002)	**TIST**	3	12.75	.82	3.38	1.16
TASK-TECHNOLOGY FIT (Venkatech e Davis, 2000)	**TTF**	3	57.42	.80	4.00	.87
TECHNOLOGY TRUST (Lippert, 2002)	**TIST**	4	71.98	.90	3.78	.87
INTENTION TO USE TECHNOLOGY (Venkatech e Davis, 2000)	**TAM2**	3	69.70	.88	4.22	.78

Data Processing

Factor analyses and reliability analyses have been carried out in order to verify the psychometric properties of the scales contained in the questionnaire. As far as the factor analyses are concerned, we have employed the extraction method "principal axis factoring" and the "direct oblimin" axes rotation method. The first step taken has been the factor analysis of the scales by using the Kaiser's rule (which allows the extraction of factors with eigenvalues equal to or greater than one). Reliability analyses have been carried out calculating the coefficient known as Cronbach's Alfa. In order to validate the research model proposed and test the experimental hypotheses of the research, hierarchical multiple regression analyses have been carried out after testing the statistical assumptions. Analyses of variance and t-tests have been subsequently carried out with the objective of verifying the presence of considerable differences among the groups identified according to a number of parameters taken into account in the research. The software SPSS has been used to carry out all the analyses mentioned.

Results

In order to test the hypotheses formulated and contribute to the validation of the research model proposed, we have carried out four statistical hierarchical multiple regression analyses with the aim of investigating the variance explained by the model, with reference to the following dependant variables: intention to use technology, perceived usefulness, ease of use, trust in information systems technology. The results of the regression analyses* will be quoted below.

Explaining the intention to use technology. In the light of the empirical data collected, three major research hypothesis are confirmed: perceived usefulness (H°1), the degree of task-technology fit (H°3) and the trust in the operation of technology (H°4) positively influence the intention to use information technology in the future for accomplishing working tasks. The hypothesis H°2, instead, which theorizes the positive impact of perceived ease of use on the intention to use technology, is not confirmed by empirical data. Since multicollinearity statistical tolerance values are rather high (between .74 and .89) it is possible to assign to each predictive variable a definite portion of the overall variance explained in the model which, as a whole, is equal to an R^2 value of .42 ($F(4,496) = 89.34$, SIG. = .000) (Table 3).

Tab. 2 - Intention to use IT in the future. Descriptive statistics and intercorrelations (N = 480).

Variables	Mean	DS	1	2	3	4
Intention to use IT in the future (variable criterion)	4.22	.78	.52**	.36**	.35**	.50**
Perceived usefulness	4.14	.69	--	.34**	.33**	.39**
Perceived ease of use	3.59	.83		--	.10**	.44**
Task-technology fit (relevance of technology)	4.00	.87			--	.13**
Technology trust	3.78	.87				--

*p < 0,05; **p < 0,01.

* The following report excludes the regression analyses regarding technology perceived ease of use because we have not noted that the variable "ease of use" has any statistically positive influence on the intention to use technology.

Tab. 3 - Intention to use IT continuatively. Regression analysis (N=480).

Variables	B	SEB	β	R2	ΔR2
Step 1 **Perceived usefulness**	.59	.04	.52**	.27**	--
Step 2 **Perceived ease of use**	.19	.04	.20	.31	.04
Step 3 **Task-technology fit** (relevance of technology)	.19	.04	.21**	.36**	.05**
Step 4 **Technology trust**	.29	.04	.32**	.42**	.06**

Key: B = Unstandardized Beta Coefficient; SEB = Standard Error Beta; β = Standardized Beta Coefficient

R2= Coefficient of Multiple Correlation; ΔR2= Differential of the Regression Coefficient. *p<0,05; ** p<0,01

Perceived usefulness. The results obtained from the analyses highlight a significantly positive impact of the variables antecedent to the variable "perceived usefulness", namely perceived ease of use, task-technology fit, reliability of performances. The explication of the variance in the criterion variable reaches the overall value of .34 (F(4,459) = 41.67 , SIG.= .000) for R^2adjusted Multicollinearity statistical indicators (between .82 and .99) confirm the validity of the model (Table 5).

Tab. 4 - IT perceived usefulness. Descriptive statistics and intercorrelations (N=480).

Variables	Mean	DS	1	2	3	4	5
Perceived usefulness (variable criterion)	4.14	.69	.34**	.33**	.37**	.33**	.12**
Perceived ease of use	3.59	.83	--	.10**	.37**	.28**	.06**
Task-technology fit	4.00	.87		--	.15**	.10**	.-35**
Technology reliability/Availability	3.92	.83			--	.30**	.15**

*p<0,05; ** p<0,01

Tab. 5 - IT perceived usefulness: Regression analysis (N=480)

Variables	B	SEB	β	R2	ΔR2
Step 1 **Perceived ease of use**	.20	.04	.24**	.14**	--
Step 2 **Task-technology fit** (relevance)	.21	.03	.26**	.22**	.08**
Step 3 **Technology reliability/Availability**	.23	.04	.27**	.27**	.05**

Key: B = Unstandardized Beta Coefficient; SEB = Standard Error Beta; β = Standardized Beta Coefficient.

$R2$= Coefficient of Multiple Correlation; Ä$R2$= Differential of the Regression Coefficient; *p<0,05; ** p<0,01.

Technology trust. All the factors which have been supposed to be at the basis of the explanation of the variable "trust" have a statistically significant impact. As we had supposed, the perception of technology predictability has a strong effect upon the variable criterion; similarly, also the availability factor associated to the dimension of perceived reliability has a statistically significant impact on trust. The second factor, the lack of problems, does not present statistically significant effects on the variable criterion. Again, in this case the statistical tolerance parameters of multicollinearity reach satisfactory values (between .56 and .82) but they are rather lower if compared to the previous analyses (Table 7).

Tab. 6 - Trust in Information Systems Technology: Descriptive statistics and intercorrelations (N=480).

Variables	Mean	DS	1	2	3	4
Technology trust (variable criterion)	3.78	.87	.74**	.73**	.44**	.61**
Perceived predictability	3.70	.85	--	.66**	.43**	.64**
Perceived reliability (first factor: system availability)	3.92	.83		--	.44**	.56**
Perceived reliability (second factor: lack of problems)	3.38	1.16			--	.31**

p<0,05 ; **p<0,01

Tab.7 - Trust in Information Systems Technology. Regression analysis (N=480).

Variables	B	SEB	β	R2	ΔR2
Step 1					
Technology predictability	.76	.03	.74**	.54**	--
Step 2					
Technology reliability/Availability	.45	.04	.43**	.64**	.10**
Technology reliability/Lack of problems	.06	.02	.41*	.65*	.01*

Key: B = Unstandardized Beta Coefficient; SEB = Standard Error Beta; â = Standardized Beta Coefficient

$R2$= Coefficient of Multiple Correlation; Ä$R2$= Differential of the Regression Coefficient; * p<0,05; ** p<0,01

Discussion of the Results

In brief, it is possible to assert that the empirical data obtained in the research have proved the validity of the majority of the original hypothesis (Figure 1), highlighting the fact that IT perceived usefulness, the degree of task-technology fit and trust in IT operation answer for a notable percentage of variance in the variable "intention" as far as the sample of participants is concerned.

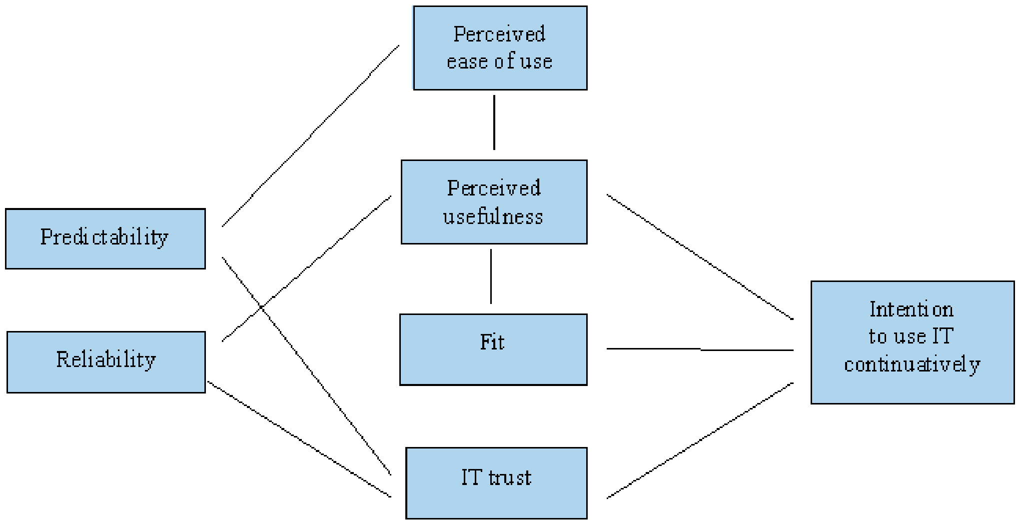

Fig. 2 – Results of the research.

The influence of perceived usefulness and of the degree of task-technology fit is to be referred to extrinsic motivational processes which can be easily defined with regard to the expected outcomes of using technology for performing specific tasks and fulfilling specific working purposes. One may talk about *absolute usefulness* and *relative advantages* following the use of information technology in working activities. The role played in the research model by the trust in information systems technology, refers to both extrinsic motivational processes connected to the possibility of performing working activities, and intrinsic motivational processes, mainly connected to technology specific operation dimensions perceived by users.

In accordance with several researches carried out in the perspective of technology acceptance, technology **perceived usefulness** in working activities is the main determinant of the participants' intention to use technology in the future. It is positively influenced by the perceived ease of use (according to the acceptance model and, in a wider perspective, to the expectancy-value models), by the degree of technology fit related to the working tasks a subject actually needs to perform, and by the perceived reliability of the performances of the tool in terms of functionality and accuracy, according to the cognitive-instrumental mechanisms described by the TAM2 model (Venkatesh and Davis, 2000). According to this research, the variable **task-technology fit** (Goodhue and Thompson, 1995; Dishaw and Strong, 1999) has a direct influence on both technology effective use and intention to use technology in the future; in addition, it also influences perceived usefulness (according to feedback modalities), differently from what is suggested by TAM2 and the theory of Reasoned Action (Fishbain and Ajzen, 1974).

The empirical results of this research support the hierarchic structure of the model of **technology trust** proposed by Muir and developed by Lippert: expectations of performance predictability and expectations of technology reliability answer for a significant component of the variance in the dimension "trust", which is the expression of the degree of reliability that the user has on technology. These results support the structure of the TIST model, which is a hierarchical model where each variable determines the level of the logically following variables while the experience goes on. Considering that the majority of the participants say they do employ the type of technology indicated in the questionnaire, it is possible to suppose that the construct "perceived ease of use" loses its significance while the individual experience goes on, and it acquires a cognitive-instrumental meaning as far as the expectations of performance maximisation are concerned, as it is asserted in Venkatech and Davis (2000) and in the literary reviews by Han (2003) and Morris and Dillon (2003), and differently from the trust-intention relationship which acquires importance in the course of time.

Unlike the theoretical structure of Davis's technology acceptance model, which mainly focuses on the perceptions developed during the initial stages of use of information technology, the TIST model answers for the development of users' expectations depending on their IT experience, in a perspective of confirmation/disconfirmation of the expectations. The theoretical structure of the TIST model can accurately explain the relationship between trust and the variables proposed by TAM: ease-predictability, usefulness-reliability. In particular, the TAM2 model (Venkatesh and Davis, 2000) refers to the issue of output quality and, implicitly, to lack of errors and reliability when it refers to output quality related to variables antecedent to perceived usefulness. This variable gains a higher significance in terms of its interactive effects with the perception of the importance of the tasks performed. Similarly, it is possible to claim that also reliability gains a higher significance for users, depending on the importance of the tasks technology can support (and therefore depending on the variable task-technology fit). Finally, the results obtained by Roberts and Henderson (2000) are shown, according to which **working satisfaction** is positively influenced by technology reliability while it does not depend on technology perceived usefulness. The lack of errors in the performance of the system may then act as a variable which mediates intrinsic motivational factors (perceived working quality, technology playfulness of use and flow/stream experience).

Differences among the groups have been detected as far as the variables gender and education are concerned, with regard to the components of the TIST model, which confirms the results of a number of previous studies (Pietrosi et. Al., 2004). The differences between the mean figures of the groups are actually very slight and this is in accordance with the fact that the reality described is rich in variables which actively influence it. We have not detected any considerable difference ascribable to the various types of technologies employed or to variables connected to the organization (working sector, length of working relation). These results, along with the numerousness of the sample, may be considered as positive generalization indexes of the results collected and the model proposed.

In brief, the integrated research model proposed is:

1. suitable to test new technologies acceptance in real working contexts, allowing its integration with those variables considered to be significant in influencing the actual behaviour of the subjects who took part in the research.
2. successful in discriminating, among all the factors considered, the most important ones (usefulness, task-technology fit, technology trust) in influencing new technologies acceptance within an extremely complex reality.

Limits of the research. Among the *limits inherent to this study*, first we identify the non-consideration of the aspects connected to **playfulness of use**, which in several researches has been regarded as the main intrinsic motivational factor linked to technology usage for working purposes, correlated to the perceived flow/stream experience. Secondly, we observe the non-consideration of the aspects connected to mechanisms of **social influence**, linked to the general dimension of the subjective norm. Thirdly, while the importance of the variable task-technology fit has been strongly stressed, this study has not given the same importance to another similar dimension, that is **person-technology fit** related to processes of cognitive comparison between important working goals and consequences following technology use. All these dimensions are to be considered like indicators of future research paths and in-depth analyses. Fourthly, the transversal and non-longitudinal character of this study must be observed, along with the numerousness and heterogeneity of the sample. In addition, the proposed model does not focus on *specific* information systems; while it has been possible to prove the lack of considerable differences among the groups due to the *general type of technology used*, it has not been possible to exclude differences linked to specific technologies. Another limit of this research lies in the actual impossibility to compare the working activities of participants coming from different companies. An additional limit of the sample is connected to the dimension of experience: the majority of the participants claim they have been using the technology indicated in the questionnaire at least for six months. In terms of operationalization of the constructs, the variable task-technology fit has been referred to a *generic* information technology due to the heterogeneity of the sample in comparison with technology types.

The ***practical implications*** deriving from the analysis of the results can be summarized as follows:

When an application software or a websites are designed, they need to be able to perform clearly definite tasks, so that the organizational outcomes can benefit from them. The more an application software is seen to provide positive advantages in job performances, thanks to the importance of its outcome related to concrete needs and tasks, the more perceived usefulness and the intention to make use of technology in the future are enhanced.

In designing a software, other conditions being equal (i.e. executable tasks), it is important and useful to take into account factors such as understandability, ease of interaction and cognitive predictability of the operating status of the technology.

A suitable training activity, if present, should enhance individual performances through the acquisition of a higher awareness of the tasks to be carried out and an increased level of self-efficiency with regard to computer use. For this reason, learning strategies should be developed which take into account the starting individual differences of the groups of users (previous experiences, needs) aiming to a higher compatibility perceived by the user between the needs of the organizations and the opportunities granted by technology.

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