

THE USE OF INFORMATION TECHNOLOGY IN HEALTH ORGANISATIONS PROCUREMENT

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Abstract

The adoption of information technology has been slower in the health industry compared to others. Moreover, the adoption of new technology does not always result in its widespread usage. This makes the search for the antecedents of successful implementation of IT technologies a relevant issue for research.

This paper investigates how the perceived usefulness managers assign to an information system for electronic purchasing and the goals associated relate to the effective usage of the information system. Data on purchases made by 16 Italian public health care districts from 2003 to 2008 was collected. This information was crossed with interviews made to the top senior purchasing managers. Results show that when the information technology is perceived as time or effort saving, its usage is enhanced. The opposite when the benefits of information technology are perceived as accruing to the organization as a whole and not the single member.

Keywords: public services, evaluation, usage, purchasing

Introduction

Use of Information Technology is increasing in all sectors and countries, bringing with it relevant changes in all the aspects of the life. One of the main changes related to information technology has been the possibility to collect and manage data to improve all the activities of enterprises.

Some scholars indicate a positive relationship between technology and performance (e.g. Diewert and Smith, 1994; Hitt and Brynjolfsson, 1995; Dewan and Min, 1997; Menon et al. 2000; Devaraj and Kohli, 2000; Kelley 1994, Siegel and Griliches 1992). Some others, detect no significant advantage from IT investments (e.g. Berndt and Morrison, 1995; Koski, 1999). Notably though, several studies have found a negative relationship between technology-related variables and performance (Barua et al. 1995; Strassman, 1990; Baily, 1986; Roach, 1987; Morrison and Berndt, 1991).

The positive effects of IT have been unequivocal and positively correlated to its usage (Trice and Treacy, 1988). In particular, some researchers have identified usage as the main discriminator on the impact of IT on performance (Deveraj and Kohli, 2003). People are often unwilling to change and to adopt Information Technology, even if it could improve their job performance, because they do not have sufficient knowledge of the technology or do not receive adequate support from the work environment. In several cases, the adoption of technology has been mandatory and the results have been strongly positive in terms of usage and performance. In some other cases, when usage has been voluntary, results have been contrasting (Nickerson, 1981).

Thus, it is relevant to investigate which are the antecedents of the usage of IT. This investigation is especially valuable in the public sector, where traditionally incentives towards performance improvement have been weaker than in the private sector. At the same time, the public sector has been the focus of dramatic changes in managerial practises and organizational structures (Osborne, 2006) which often need to be supported by IT implementation to be effective.

Several approaches and models already exist which help identify the antecedents of technology usage. Studies on how and why individuals adopt new information technologies represent a broad area of inquiry with different streams of research. According to this research a successful implementation depends mainly on: the quality of the IT going to be adopted; the support received for the adoption; and personal attitudes and perceptions.

Lucas (1978) provides some of the earliest evidence of the individual or behavioural factors influencing IT adoption. The first theoretical perspective to gain widespread acceptance was the Theory of

Reasoned Action (TRA) (Fishbein and Ajzen, 1975; 1980). It is derived from the social psychology setting, and it encompasses three general constructs: behavioural intention, attitude, and subjective norm. TRA states that a person's behavioural intention depends on the person's attitude about the behaviour and subjective norms. Behavioural intention measures a person's relative strength of intention to enact a behaviour. Attitude consists of beliefs about the consequences of performing the behaviour multiplied by his or her valuation of these consequences. Subjective norm is seen as a combination of perceived expectations from relevant individuals or groups along with intentions to comply with these expectations. This model has been largely applied in several fields, with surprisingly positive results.

Despite of this and of the large possibility of using it in different fields, TRA has been also questioned. The main weakness that has been pinpointed in TRA is the use of intentions to predict the results of behaviour. In fact, several constraints could hinder the accomplishment of the intention in a realized behaviour.

One of the main models developed from TRA and applied to explain technology usage is the Technology Acceptance Model or TAM (Davis, 1986). TAM posits that perceived usefulness and perceived ease of use directly influence technology usage behaviour and, in addition, that perceived ease of use indirectly (via perceived usefulness) influences usage. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989).

TAM is acclaimed for its parsimony and predictive power, which make it easy to apply in different situations. Its pros make the TAM one of the most used tool to investigate the antecedents of usage technology till now (e.g. Bendoly and Cotteleer, 2008; Teo et al., 2009). However, there have been some reservations. In particular, researchers questioned that:

- intentions are a predictor of actual behaviour (Straub et al., 1995);
- attitudes and norms can influence behaviour directly (Benler and Speckart, 1979; Songer-Nocks, 1976);
- TAM should be tested on actual usage instead of usage intentions (Venkatesh, 2000).

This last test was carried out by Taylor and Todd (1995) with positive results.

TAM has been extended through TAM2, by including subjective norm as an additional predictor of intention (Venkatesh and Davis, 2000). In particular, TAM2 adds to TAM several antecedents of the

perceived usefulness. Among these: the job relevance, the quality of the outputs, the demonstrability of the results and the organization image. The last is influenced by subjective norms. Moreover, the authors propose that the effects of subjective norms on perceived usefulness could be substituted by the experience and/or the lack of voluntariness (Davis et al.,1989). Although gender was not included in both TAM and TAM2, Venkatesh and Morris (2000) demonstrated that perceived usefulness is more salient for men, while perceived ease of use is more salient for women. Subjective norms are more relevant for women in the early stage of experience.

A competing model with respect to TAM, which also maintains a broad range of applications is the Theory of Planned Behaviour, or TPB (Ajzen, 1985; 1989). Three are the main antecedents of technology usage identified in this model: attitudes, in terms of behavioural beliefs and outcome evaluations; subjective norms, in terms of normative beliefs and motivation to comply; perceived behavioural control or PBC, in terms of control beliefs and perceived facilitation. For a comparison among all these models see Venkatesh et al. (2003).

Drawing from the TAM literature, and taking the hospital sector as a case study, this paper investigates how the perceived usefulness purchasing managers assign to an information system for electronic ordering and the goals associated with such a system are related to the effective usage of the information system for hospital procurement. Data on orders made through the electronic system by 16 Italian public health care districts and hospitals from 2003 to 2009 has been collected. This information has been crossed with interviews made to the top senior purchasing managers in charge of the acquisitions of services and goods.

The hospital sector is a good vantage point for studying IT usage since it has been one of the fastest changing public services, and one in which IT adoption (primarily in the medical field and then also in administration) is highly recommended as a way to improve the quality of services provided to patients (Devaraj and Kohli, 2003).

With respect to previous literature, we distinguish between usefulness from the point of view of the organization (such as organizational innovation, enhanced efficiency), and competitiveness, and usefulness from the point of view of the system user (such as reduced time for procedures, reduced time for data search, reduced times for budget reviewing). Results show that when the information technology is perceived as time or effort saving, its usage is enhanced. The opposite when the benefits of information technology are perceived as accruing to the organization as a whole and not the single member.

The remains of the paper is organised into three sections: the first presents the methods of data collection and the questionnaire

developed, the second present the results of estimation, and the final one discusses the findings and the implications of our research.

Methods

The study of the link between perceived usefulness and the usage of the electronic system for placing orders for goods and services has been carried out by collecting data from all the 17 hospitals and health districts (units hereafter) inside a Local Health Care Authority in Italy, the AUSL 3. Anyway only data from 16 units have been considered for the analysis due to missing data.

The Local Health Care Authority 3 (AUSL 3), supplies comprehensive health care to the whole population residing in the province of Catania (Italy). It encompasses an area of almost 3.600 km², embraces 58 local councils and counts a population of 1,115,000 inhabitants. AUS 3's territorial area is divided in 11 Health Districts and includes six hospitals. Health Districts aim to provide primary health service covering the needing of the territory aiming to decentralize such services to avoid differences in accessibility of basic service among the community. Hospitals provide specialized services concentrating them in fewer places in order to contain costs.

In order to improve the organization's accountability and administrative efficiency, an informatic system (IS) was implemented in several steps. The first step has been implemented in 1995, with functions limited to the management of salaries and basic financial tools. In 2000 the system extends its capabilities to the patients care management, collecting info about patients (fig. 1). Basic ideas underpinning the project of the IS has been the possibility to create a database in which all the info about employers, purchasing, consuming, patients cared, kind of cures applied could be integrated, aiming also to monitor costs and revenues. The software has been developed internally in order to customize it to each unit needs, thus favoring the process changes.

Data on the number of orders placed through the system by each unit for each year for the period 2003-2009. Information on the total value of orders placed through the system was also available. In addition, each unit collected data on the total number and value of orders (both electronic and "manual") throughout the period analyzed.

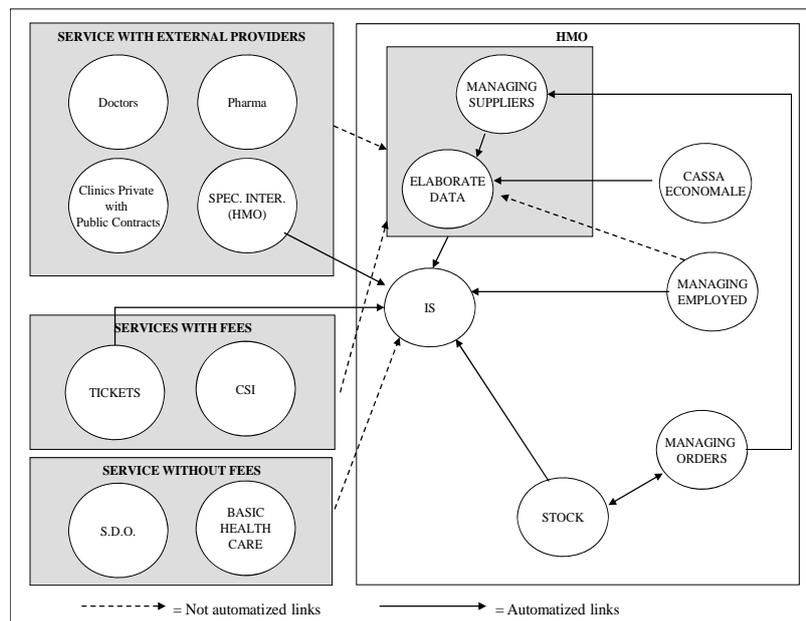


Figura 1 - Scheme of relations in the IS implemented by AUSL3.

The information concerning the perceived usefulness of the IT system was directly collected by means of face-to-face interviews to the senior purchasing managers in charge in each unit (in several cases the Director), in the periods February-March 2007 and September-November 2009. The interviews were conducted using a set of semi-open questions, which were organized into three main sections. The first two sections consisted of general questions concerning the unit and the degree of knowledge of the IS.

In the third section, respondents were asked to assess their perceptions about the relevance of the gains achievable with the application of the IS. Following the TAM literature, and drawing from Davis (1989) and Straub et al. (1995), in particular, we build two types of propositions: perceived usefulness (PU) propositions and perceived ease of use (PEU) propositions. Respondents were asked to rate on a 5-point Likert scale their degree of agreement/disagreement with the following ten items:

- C1: information technology influences efficiency;
- C2: information technology improves hospital's prestige;
- C3: the information system reduces hospital's costs;
- C4: the information system reduces times for procedures;
- C5: the information system improves control on activities;
- C6: the information system reduces times for budgets reviewing;
- C7: the information system allows for the provision of new services;

- C8: the information system reduces bureaucracy inside the hospital;
- C9: the current IS makes it easy to place and check orders;
- C10: the current IS is fast enough to search data.

All of these, except C9 are PU propositions. Propositions were build in such a way as to try to separate perceived usefulness for the direct user from perceived usefulness for the organization.

Results

Data collected outline that all directors were in their position from a limited amount of time, and their age was between 45 and 60 years (Table 1). Moreover, they declared a large use of the IS. Despite a lack of assistance and training course, purchasing managers and their subordinates improved their knowledge and skills mainly autonomously or thought the help of some colleagues. Some managers are not able at all to use the IS. Nevertheless, it is recognized that the IS is important and its relevance is going to increase in the future (Tables 1 and 2).

Most of the purchasing managers recognized the control on activities as the main aim of the IS. Secondarily, but still important, are IT influence on effectiveness and on reducing bureaucracy. On the contrary, the Directors do not perceive, in general, any strong impact on hospital's prestige, on cutting costs, on reducing time for procedures, and the possibility to allow new services for the customers. Moreover, the higher deviation in the replies is about the constructs about reducing time for procedures and speed to search data, these differences could be the results of different attitudes and personal skills related with the IS.

In order to analyse the relationships among the actual usage of IS and its perceived usefulness, we estimated a linear panel model with random effects. The random effect specification was chosen as most of our regressors did not vary through time but was unit-specific. The dependent variable used was the number of orders placed through IS. The main regressors of interest were the scores respondents had assigned to the different propositions concerning perceived usefulness. Other control variables were a time trend for the year in which the order was placed, the number of beds, the number of employees.

Table 1 - Section 1 of the questionnaire

Personal Data	Options available	Results
Age	30< age <44	0
	45< age <60	15
	<60	1
From how many years are you in the position?	<5	9
	5-10	4
	>10	3
Use and Knowledge of the IS		
How many times did you use the IS during last year?	Never	0
	1	0
	Every month	1
	Often	6
	Always	8
Is there any employer dedicated to the IS?	Yes, totally	4
	Yes, partially	5
	No	7
Do you learn the IS through	Consulent	2
	Courses	1
	Colleagues	5
	Autonomously	6
	Other	2: never learned
Do the dedicated employer learned the IS through	Consulent	0
	Courses	4
	Colleagues	1
	Autonomously	5
	Other	1: I don't know

Table2 - Section 2 of the questionnaire

	1	2	3	4	5
Personal Knowledge IS	1	0	10	5	0
Employer Knowledge	2	3	8	2	1
How do you judge the development inside the AUSL3	2	6	3	2	1
How relevant is the IS in the structure that you coordinate?	0	4	5	6	1
How relevant is the IS in the future?	0	0	1	9	5

Note: 1 means scarce – 5 means excellent

Results of the estimation are reported in Tables 3 and 4. Table 3 reports estimated coefficients, standard deviations and statistical significance, showing that not all the perceived improvements attached to the information system enhance effective usage. Some measures of goodness of fit are reported in Table 4.

Table 3 - Panel Model Estimate

DEP.VBL:	# IS Orders	Coeff.	Std. Err.	z	P> z 	95% Conf.	Interval	Mean	Dev.Std
Year		86.75365	17.36329	5.00	0.000	52.72221	120.7851		
Beds		6.638321	2.870899	2.31	0.021	1.011462	12.26518	38,77	55,7
Employees		1.705081	1.2648	1.35	0.178	-.7738815	4.184044	184,04	99,2
C1 information technology influences efficiency		-193.710	91.96721	-2.11	0.035	-373.962	-13.4577	3,5	1,28
C2 information technology improves hospital's prestige		283.3212	132.6605	2.14	0.033	23.31137	543.3311	2,125	1,17
C3 the IS reduces hospital's costs		-144.731	59.78672	-2.42	.015	-261.91	-27.5513	2,19	1,29
C4 the IS reduces times for procedures		395.8898	148.2985	2.67	0.008	105.2301	686.5494	2,25	1,49
C5 the IS improves control on activities		-264.6627	119.9974	-2.21	0.027	-499.8532	-29.4721	3,81	1,34
C6 the IS reduces times for budgets reviewing		230.537	114.4028	2.02	0.044	6.311604	454.7625	3,25	1,35
C7 the IS allows for the provision of new services		-501.2833	222.6525	-2.25	.024	-937.6742	-64.8923	1,93	1,20
C8 the IS reduces bureaucracy inside the hospital		405.1502	166.282	2.44	0.015	79.24354	731.0569	3,37	1,5
C9 the current IS makes it easy to place and check orders		-379.4485	178.5147	-2.13	0.034	-729.3309	-29.5661	3	1,28
C10 the current IS is fast enough to search data.		131.3611	78.11976	1.68	0.093	-21.75079	284.473	3,56	1,6
cons		-173948.6	34849.17	-4.99	0.000	-242251.7	-105645		

Table 4 - Panel Model Estimates

Numb obs	112
Numb grps	16
Numb obs per grp	7
R-sq:	
within	0.1808
between	0.9441
overall	0.5683
Wald chi2(17)	77.84
Corr(u_i, X)	0
Prob>chi2	0
sigma_u	129.46048
sigma_e	347.53867
rho	.1218528

A detailed analysis of regression coefficients shows that the number of orders placed through IS has been increasing in the period considered. The time trend variable has a positive and statistically significant coefficient. Among the control variables (beds and employees) considered, the number of beds has a positive and significant effect on the number of orders. Since health districts typically have no beds, this variable tells us that usage is higher in hospitals than in districts. Coming to the variables of direct interest for our study, all of them exhibit statistically significant coefficients, but some of the coefficients are negative. Most notably, a positive coefficient is displayed by variables C2 (impact on prestige), C4 (impact on times for procedures), C6 (time for budget reviewing), C8 (reduces bureaucracy), and C10 (improves data search). All of these variables, except C2, clearly indicate that the higher the perceived benefits of the IS which accrue to the single user (in terms of time and effort savings) the higher the usage. This result is in line with existing TAM evidence that the higher perceived usefulness the higher the usage. C2 can be considered too as a benefit accruing to the user to the extent that in the case of IS, the person responsible for order placing is the Director, who probably benefits in terms of status and future job prospects from working in an organization with a high level of prestige. The other explanation for the positive coefficient of C2 may be related to the fact that users of IS enjoy more prestige than those who do not (Venkatesh and Davis, 2000). Since a proposition of this sort was not introduced in our interviews, we cannot verify its validity.

Conversely, a negative coefficient is exhibited by variables C1 (impact on efficiency), C3 (impact on cost reduction), C5 (impact on increase in control), C7 (new service provision), C9 (ease of order

placing). All of these, except C9, capture perceived benefits of the IS which accrue to the hospital/district and not to the system user. Thus, when the pros of IS are recognized as affecting some higher entity or generically the organization, the incentive to use the system is reduced.

DISCUSSION

This paper has investigated the way perceived usefulness is linked to the effective usage of an information system for purchasing in a health organization. Our conceptual framework has been provided by the TAM (Davis, 1989), which offers a behavioral based explanation of technology usage.

Our results are consistent with an economic model based on individual utility maximization: since using the system is costly in terms of the effort required to learn it, this effort is justified only when the user can obtain personal benefits. In the literature the divide between organizational and individual goals is explained either as the result of the competition for power between peripheral managers and the general management, or by a lack or insufficiency of rewards for pursuing the organizational objectives. In the context under analysis, hospital managers at all levels experience a climate of budget cutting, so that hindering the effective application of the electronic purchasing system may be a way for purchase managers to avoid excess control. In addition to this, it should be considered that several of the purchasing managers interviewed came from the medical profession, that has traditionally been suspicious towards the pursue of goals such as cost reduction and improved efficiency (Buetow and Roland, 1998). Thus, rather than an "unethical" position towards the organization they belong to, the negative relation between usage and the expected usefulness for the organization may simply reflect different cultures and values of the purchasing managers with respect to those of the general management.

Given this setting, a voluntary usage of such information system can only be detrimental to the performance of the organization, and mandatory usage is to be recommended.

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