Adoption of the Paperless Environment by Knowledge Workers

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Abstract

This work-in-progress paper focuses on the problem of the increasing use of paper documents by knowledge workers. The problem seems to exist despite the fact that many companies adopted technologies enabling the paperless environment. The paper identifies factors that influence the adoption of paperless environment by knowledge workers. It develops a new theory and proposes an experiment designed to verify this theory.

1. Introduction

Many attempts to understand the issue of individual acceptance and use of technology have been made for over the past decade (Agarwal, 1997; F. D. Davis, 1989; F. D. Davis, Bagozzi, & Warshaw, 1989; Mathieson, 1991; Taylor & Todd, 1995; Thompson, 1994). The idea of the "paperless office" dates back to the mid 1970s. At that time, when information technology was quickly gaining popularity, many believed that by the year 2000 companies would entirely change the way of conducting their processes and that there would be practically no paper in their activities. Instead, electronic means of communication, storing and retrieving information would be utilized. Today, although all the necessary technology is available and has been "successfully" adopted and used, the situation is practically opposite to what was expected (Carr, 2005; Sellen & Harper, 2002); the use of paper increases every year, along with the increase of the number of available information sources (Lyman & Varian, 2000). Although many companies have been using document management systems for efficient administration of documents in a digital format, they found themselves at the redundancy stage, storing substantial portion of information in both electronic and paper forms (T. Davis, 2005).

One may think about many reasons for people's resistance to giving up paper. They range from basic conveniences of paper (e.g. portability), through the insufficiency of available technology, to people's habits, or some characteristics of the work process itself, sometimes enforcing the use of paper. Information systems have been designed to perform and manage tasks without the necessity

for printing any paper documents. The practices of creating a paper document system parallel to the paperless one may lead to inefficiencies in work processes which, in turn, may influence company's performance (Sellen & Harper, 2002) in certain aspects. First, there is a high risk of loosing the coherence in the document system. Often, entire files are kept in the paper format and over time both systems, i.e., the electronic system and the parallel one based on paper documents, drift away in different directions. As a result, efficient information retrieval is virtually impossible and processes are decelerated, as they become more and more dependent on paper. What is more, a full electronic backup copy of documents can not be made and a potential risk of loosing important files increases. Documents stored in a paper format may be easily lost. Increasing consumption of paper and office space are also a concern.

The problem of moving toward a more paperless environment has recently been raised by practitioners as a serious concern which motivated this study. This research attempts to examine the reasons why people still prefer to print electronic documents while document management systems are widely accepted and used in business. Factors that underlay individual decisions about giving up paper are analyzed.

Virtually all studies in this field analyze the adoption problem from the perspective of computers, system software, the Internet or specific systems (either business process applications, communications and collaboration systems, or office applications) (Jasperson, Carter, & Zmud, 2005). The unique characteristics of paper and its persistence in today's business (despite technology development) make the problem of moving toward a paperless environment different from other approaches to technology adoption.

2. Literature Review

A vast majority of technology adoption models developed in the subject literature (Agarwal & Prasad, 1998) is based on, or refers to, the technology acceptance model (TAM), introduced by Davis (1989). TAM builds on a more general theory, i.e., the theory of reasoned action (TRA). TRA provides the theoretical basis for specifying causal links between the two key beliefs: perceived usefulness and perceived ease of use. These beliefs influence attitudes towards information technology. The TRA model originates from social psychology. It states that one's behavior is determined by his or her behavioral intention to perform some behavior, which in turn is jointly determined by this person's attitude and a subjective norm concerning this behavior. Some researchers emphasize differences in the determinants of adoption and postadoptive usage (F. D. Davis et al., 1989; Jasperson et al., 2005; Karahanna, Straub, & Chervany, 1999; Parthasarathy, 1998; Thompson, 1994). They differentiate between pre- and post-adoption stages in the process of technology adoption, which allows analyzing the process over time. Individual beliefs about technology use have been indicated to have a great impact on decisions

concerning technology adoption. One common theme underlying technology adoption models is the concept of perceptions of technology as key independent variables. However, to the best of our knowledge, very few studies attempted to analyze in detail the external factors influencing these perceptions. TAM mentions that there exist external variables that influence attitudes through changes in one's belief structure. Davis (1989) lists: system design characteristics, user characteristics, task characteristics, nature of the development or implementation process, political influences, organizational structure among these external variables. These variables, although mentioned in Davis' paper, remained beyond its scope. The majority of subsequent studies expanded the technology acceptance models in multiple directions, generally neglecting the construct of external variables (Venkatesh & Davis, 1996, 2000). Among several attempts of examining this subject one example is the study of Lewis, Agarwal et al. (2003), who focused on individual, social and institutional factors driving perceived usefulness and ease of use.

Regardless of adopting more and more advanced digital document management technologies, the constantly growing amounts of paper stored became a serious issue for many organizations. Many sources indicate that the use of paper in business processes may lead to inefficiencies. According to Liu et al. (2000), knowledge workers in the 1990s were spending about 60% of their daily working time handling paper documents flowing into their offices. What is more, in 1995 approximately 3% of all documents in organizations were incorrectly filed and 7.5% of documents were lost forever. The executive time loss due to "hunting for mislabeled, misfiled or lost documents" was estimated for three hours per week. In support of these findings, Carr (2005) reported the results of the national filing survey in the U.K., according to which, every day over one million pounds are wasted to find the lost files. The survey estimates that the cost of poor filing practices for U.K.'s businesses reached 1.2 million pounds every working day. About 55% of the missing documents are misfiled, 48% are on the desks of other members of staff, 13% are found on managers' desks, and 2% are never found.

Taking all of the above into account it is not surprising that the subject of a truly paperless environment is of increasing managerial interest.

3. Research Model

The conceptual model, concerning moving toward a paperless environment, builds upon the general theory of technology adoption by considering factors influencing the adoption decision. The factors taken into account in this study are human-, task-, technology- and organization-related.

Introducing the paperless environment in an organization does not mean removing all the paper. Instead, the focus is on minimizing the paper use, so that major inefficiencies may be eliminated. Moreover, the decision about working with less paper is not a one-time decision. Whenever individuals intend to

perorm a particular task, they chose a certain way of executing this task. Therefore, time is an important notion in this context, as it may influence such elements as, for instance, human habits. The conceptual model of our study is presented in Fig. 1.

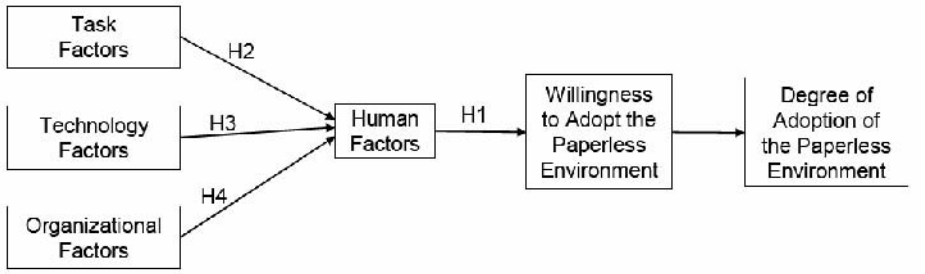

Figure 1. Conceptual model of factors influencing decisions about adopting the paperless environment

Willingness to adopt the paperless environment in our model reflects the individual's positive or negative evaluations of performing some behavior, which, in turn, may influence on the degree of adoption of the paperless environment. The impact factors on the willingness to adopt the paperless environment analyzed in this study will be finally reflected in the actual amount of paperless work. Thus the *degree of adoption of the paperless environment* in the model relates to the percentage of tasks executed without using any paper, to the amount of paper used in executing work, and to the amount of paper stored.

The reasons for people's choice of dealing with tasks without giving up paper are quite complex. In this study we differentiate among the following human factors:

- *Perceived usefulness* – the degree to which a person believes that the use of technology will enhance his or her job performance. It can be expected that possessing knowledge about the potential benefits offered by a particular technology will influence person's willingness to use it (F. D. Davis, 1989).
- *Perceived ease of use* - the degree to which using technology is free from effort (F. D. Davis, 1989). This notion relates to personal experience with technology. Working in a more paperless environment may generate the need for technological solutions which offer more portability. The use of such devices, however, may require additional skills.
- *Personal innovativeness* – the willingness to try out an innovation (Agarwal & Prasad, 1998). Of two people, perceiving the technology equally desirable, the more innovative person may be actually more willing to adopt a particular technology, taking into consideration the risk and uncertainty related to the process.

- *Personal preferences and habits* are related to individual practices to which one is accustomed while executing working tasks. Many people feel more comfortable reading long portions of text printed rather than displayed on the computer screen. Although the new devices have many advantages, still some advantages of paper make it more preferable in some situations (Liu & Stork, 2000; Sellen & Harper, 2002). This may be because both paper and work practices co-evolved over the years, and became dependent on each other. Changing these existing patterns usually means not only changing the process structures but also habits.

People in their workplaces constantly make choices of combining the use of available tools to their best advantage. For example, they usually use computers whenever they need a flexible tool for writing. On the contrary, many people turn to paper for a flexible reading task (Sellen & Harper, 2002). Thus, one can say that the choice between paper and digital technology may depend of the task characteristics. Based on the number of field studies analyzing the use of paper in organizations, Sellen et al. (2002) propose six types of tasks related to the stages of the document life cycle. Both digital tools and paper have some characteristics useful in executing various tasks. Table 1 presents the tasks along with supporting characteristics of paper and digital tools.

Table 1. Classification of Tasks Related to Working with Documents.

Type of the Task	Digital Tools Support	Paper Support
Information Extraction and Organization	• Quick searching through information repositories • Quick information extraction • Quick links to related materials • A variety of sorting and viewing possibilities	• Browsing through familiar documents helps remind their content • Arranging documents in space supports thinking, planning and note taking
Creating and Editing documents	• Flexible updating, modifying, recalculating and formatting • Integrating data from different sources • Reuse of existing documents	• Note taking and making plans for writing • Comfortable cross referencing during writing • Proofreading and analyzing the sense of the structure
Reading/ Consuming Information	• Comfortable reading across multiple documents • Possible viewing and use of multimedia and interactive materials	• Comfortable reading of longer documents for deep understanding, reading while writing, note taking
Distribution and Retrieval	• Fast replication and distribution to different people and sites • Quick retrieval of necessary documents	• Delivery of information when social processes are important
Collaborative Activity	• Real-time or asynchronous remote collaboration • Sharing information on meetings	• Comfortable medium for face-to-face interactions and meetings • Team coordination
Filing and Archiving	• Fast, widespread, remote access to documents • Backup • Little space necessary	• Comfortable temporary storage for recently or currently used files • Controlled access to knowledge • Easy integration of different kinds of documents received in the paper format

Technology factors relate to the degree to which technology is suitable for executing a particular task that one wants to carry out. In the case of adopting the paperless environment, technology should provide an incentive for people not to

print documents but work on them using the digital format. However, the advancements in interconnectivity and print technology appear to be important drivers of paper consumption increase (Sellen & Harper, 2002). Along with the growth of information available and exchanged by people, increases the need of printing this information. Moreover, with-low costs and high-speed printers, this task became quite easy. On the other hand, despite of encouraging the use of more paper, new technologies enable more effective work with digital documents. Word-processing devices become increasingly portable and ergonomic. Word-processing applications provide a comfortable environment for working with documents. Most of the existing directories, dictionaries, technical documentations, forms, catalogs, newsletters and magazines are now available in electronic format. This enables information retrieval which, in turn, allows accessing the necessary information in a quick and precise manner. Moreover, much of the communication between companies takes place in the electronic format, e.g. via the Internet. Easy information sharing and transferring as well as retrieval are among the perceived benefits of the paperless environment (Liu & Stork, 2000) . Although the technology becomes more and more sophisticated, Liu and Stork (2000) list several concerns articulated by knowledge workers: security, malfunctioning or lack of backup system, lost files, delays due to slow response time, power failures, lack of full portability and lack of sufficiency of electronic files for the daily operations. In fact, a pencil and a highlighter still remain the simplest and fastest ways of taking notes. Sellen and Harper (2002) identify several technology characteristics which may be viewed as enablers of the paperless work environment: flexible navigation, cross-document use, annotation while reading, interweaving reading and writing. Some of the above characteristics are well supported by the contemporary technologies, other, however, are to be developed in the future.

Therefore, the dimensions differentiated in the concept of technology factors in our model are *technology suitability*, denoting the ability of executing the tasks people want to carry out, *technology portability*, standing for the ability of providing people with one of the basic and most crucial characteristics of paper, and *technology security*, related to the protection of information.

The decision of moving toward a paperless environment must be taken not by an individual knowledge worker, but also (if not first of all) on the organizational level. Only in such case the potential for necessary adjustments in processes can be created. Hence, one of the aspects of the organizational role in the process of going paperless is company policy concerning the use of paper. This policy may be articulated either by leaving the decisions of the paper use entirely to individual knowledge workers, or by explicitly introducing some regulations and standards as to the use of paper. Consequently, another related aspect is process adjustability, which may be defined as the ability to reorganize internal processes, so that the number of paper documents produced and stored within the company is reduced.

4. Hypotheses

The proposed conceptual model attempts to capture the broad picture of factors influencing the adoption of the paperless environment. Due to the constraints of the study, a restricted number of relationships among the factor dimensions are going to be tested. The hypotheses formulated in this study are presented below.

H1: (a) Perceived usefulness and (b) perceived ease of use influence willingness to adopt paperless environment.

H2: Human factors for adopting paperless technology are influenced by task factors.

H3: Human factors for adopting paperless technology are positively influenced by the technology portability.

H4: Human factors for adopting paperless technology are positively influenced by the company policy.

5. Research Design

A sample organization is going to be simulated for this study. The subjects will be recruited from graduate and undergraduate college of business students with knowledge work experience. The major participants' characteristics captured in the experiment will include gender, age, and computer skills.

For a two-week period each of the participants will be asked to individually execute a series of simulated assignments, characteristic for knowledge workers' tasks that require working with documents. Desktop computers will be provided. Further, the participants will be divided into four groups, each group executing the same set of tasks. One of the groups will be strongly urged not to use any paper, unless necessary. This will enable to control for the organization policy factor. For the next group of participants desktop computers are going to be exchanged for laptops, as a result of manipulating the technology factors. The third group of subjects will participate in a workshop designed to improve their abilities to execute tasks in a more paperless way. This will enable to manipulate the impact of perceived usefulness and perceived ease of use, the two human factors. The last group of participants is a control group.

At the beginning and after each week of the study the participants will be asked to fill in a questionnaire containing measurement scale items for the independent and dependent variables. Further, the amount of paper used each day by each participant will be monitored, which will enable to test the relationship between the willingness to adopt and the degree of adopting the paperless environment.

In order to examine the relationships in the conceptual model several statistical analyses will be conducted. Analysis of variance will be carried out to check the differences among groups. In this way, the impact of different factors on willingness to adopt the paperless environment will be examined. Further,

multiple regression analysis will enable identifying the relationships among factors as well as answering the question, how factors determine willingness to adopt paperless environment. Additionally, the relationship between willingness to adopt and the actual degree of adopting will be examined. Also, the sample characteristics, such as age, gender and perceived computer capability (related to the concept of ease of use) will be examined by means of descriptive statistics.

6. Conclusions and Managerial Implications

This work-in-progress paper describes factors influencing the adoption of the paperless environment by knowledge workers. It develops a new theory and proposes an experiment designed to verify this theory.

Managerial implications of this research result from the need for a better understanding of why knowledge workers refuse to give up the use of paper in executing their tasks; the problem expressed by many practitioners (T. Davis, 2005; Liu & Stork, 2000). This may facilitate the adjustments of company processes to the needs of the paperless environment. It may also help in developing better hardware and software characteristics, combining best features of paper with advantages of electronic document processing, storage and retrieval.

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