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The use of collaborative electronic media for information sharing: an exploratory study of determinants

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Abstract

This article reports an exploratory investigation of individual perceptions of factors that underlie the use of collaborative electronic media (electronic mail, World Wide Web, list serves, and other collaborative systems) for sharing information in a large state university in Australia. The model builds on the Constant et al.'s theory of information sharing. We propose that perceptions of information culture, attitudes regarding information ownership and propensity to share, as well as task and personal factors influence people's use of collaborative media. We found that task characteristics (task interdependence), perceived information usefulness and the user's computer comfort were most strongly associated with the person's use of collaborative media. Consistent with Constant et al.'s earlier findings, views of information ownership and propensity to share were significantly related to use. Interestingly, use of electronic media for sharing information and contacting people was weakly associated with a more structured, closed information culture. This implies that heavy users and sharers want more structured information flow in place, possibly due to their need to have reliable access to other individual's knowledge and information. Contrary to suggestions in the literature, a fully open, organic information culture may not always be most desirable. Implications for knowledge managers, practitioners and researchers are suggested. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Electronic media; Constant et al.'s theory; Task interdependence

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1. Introduction

Knowledge management rallies around developing an organizational capability to create and disseminate knowledge (Nonaka and Takeuchi, 1995). Organizational knowledge assets will only grow at the rate at which the individuals are willing to share their experiences, insights, and wisdom with others in their work group, organization, and across organizations (Kim and Mauborgne, 1998; Davenport and Prusak, 1998). Verkasalo and Lappalainen (1998) suggest that the knowledge utilization process starts by the provider being willing to share the knowledge they have. Motivation for the provider to be open and get involved is required for knowledge transfer. Along similar lines, one of the stages outlined by Gilbert and Cordey-Hayes (1996) in their knowledge transfer model is communication. This implies that one party is willing to give something or get something from the other party.

Since one party has to be willing to give something or get something from another party, information sharing is a necessary element of knowledge management in organizations (Ruggles, 1998). Information sharing embeds the notion of ‘willingness to share’. Volition distinguishes information sharing from involuntary information reporting. Information sharing is a “voluntary act of making information available to others... sharer could pass information on, but does not have to” (Davenport, 1995, p. 5). In the interorganizational context, voluntary information sharing has been found to be positively related to profitability and productivity and negatively associated with labor costs (Morishima, 1991). The potential of greater information sharing is not always reached, however. When asked about the difficulties in managing knowledge in organizations, the number one difficulty cited is “changing people’s behavior” (Ruggles, 1998). When asked about difficulties of information sharing, again ‘people issues’ and particularly culture are cited as the biggest impediments (Ruggles, 1998). Alavi and Leidner (1999) argue that organizations where culture does not value and support information sharing will face difficulties in integrating knowledge-based systems into their organizations. Empirical findings back up these arguments. Ciborra (1996) reports how deficient user perceptions of the media led to the disuse of a collaborative system. Orlikowski (1992) similarly describes how users tend to ‘fall’ into their traditional information values and forgo the possibilities introduced by the new collaborative system.

Organizations are investing in collaborative information and communication systems to encourage and facilitate the sharing of information (Davenport and Prusak, 1998). However, they often quickly find that technology alone does not motivate sharing (Orlikowski, 1992; Davenport, 1994, 1997). By use of collaborative technology, we refer to the use of a computer-based system to accomplish information activities such as accessing, searching, sharing, storing, and publishing information in a computer network within a person’s work unit/department/organization (i.e. internal information activities) as well as external to the person’s organization (i.e. external information activities). Computer-based collaborative systems (intranets, electronic mail, list serves) provide the promise of much increased information sharing within and across organizations. Such systems encourage sharing of ideas in a free-flowing manner as well as in a form of structured repositories. Collaborative information systems are used to exchange both knowledge and information. Although it is important to distinguish

between knowledge and information (Nonaka and Takeuchi, 1995), what gets transmitted electronically is either data or information. For information to be transformed to knowledge, it must be acquired by someone who can give it meaning and context, and used within the specific time span of its relevance and currency (Davenport and Jarvenpaa, 2000).

So far, few researchers have sought to understand the determinants of collaborative technology's use for information sharing (Finholt and Sproull, 1990; Constant et al., 1994, 1996). In a related area of technology acceptance and use, a wealth of studies have examined task-technology-related factors and personal attitudes. For example, the technology acceptance model (TAM) embeds the notion of perceived usefulness that captures the user's perception of the task-technology fit (Davis et al., 1989; Taylor and Todd, 1995). Computer playfulness is one personal attitude factor that is used to understand the way a user might interact with a technology (Webster and Martocchio, 1992). The recent extensions to the technology acceptance model go beyond task and personal factors to take into account broader contextual factors. Venkatesh and Davis (forthcoming) examined extensions to TAM including social influence processes (subjective norm, voluntariness, and image).

This study explores possible determinants of the use of collaborative technologies for information sharing. Using field based survey data, we explore the relative strength of information culture, and task and attitudinal factors on the use of collaborative media for information sharing. Our purpose in doing this is to identify factors that influence the use of electronic media for information sharing activities in order to provide guidance for high payoff areas for more directed studies and advice for knowledge managers. We will next advance the research model and hypotheses, followed by the research method, results, and implications for practice and future research.

2. Conceptual background and the development of hypotheses

Building on social exchange theory (Kelley and Thibaut, 1978), Constant et al. (1994) advanced a theory of information sharing. The purpose of the Constant et al. information sharing theory is to understand the factors that support or constrain information sharing in technologically advanced organizations. The theory goes beyond communications and information exchanges among friends and personal contacts to include "organizationally remote strangers they will never meet in person" (p. 401).

According to Constant et al. (1994), information sharing is affected by rational self-interest as well as the social and organizational context. Namely, they propose that "organizational culture and policies as well as personal factors can influence people's attitudes about information sharing" (p. 401). The more the person believes that information sharing is "usual, correct, and socially expected workplace behavior", the more they should be willing to share (p. 404). The sharing should also be higher when the technology attributes and conditions decrease the psychological costs of sharing (e.g. user-friendly systems). Finally, the more interdependent a person's work is on others, the higher the needs of self-interest and reciprocity are and hence the more likely the person is to share.

While this theory of information sharing builds on the interdependence notions of social exchange theory, the original social exchange theory did not consider information exchange (Kelley and Thibaut, 1978). Constant et al.'s (1994) extension of the theory to this new context was based on the assumption that people in organizations treat information sharing like other exchanges that are influenced by their social and organizational context. The context is important because it differentiates information sharing from those simple exchanges where individuals act simply from rational self-interest ("I help you if you help me"). The interdependence notion in social exchange theory implies that organizational context causes people to rise above their self-interest rational impulses to consider the long-term impacts of their actions. That is, the social and organizational context regulates information exchange via concerns people have for maintaining future relationships, the balance of power, image, and so forth. The stronger the influence of the social and organizational context, the less likely people's behavior is driven strictly by task or personal determinants of information sharing and more by social and organizational determinants.

Constant et al. (1994) tested parts of the theory in a series of laboratory studies. The key findings were that attitudes about different types of information sharing (product versus expertise information) are associated with different antecedents, and that people's attitudes about sharing information are based on both rational self-interest and contextual factors. Specifically, Constant et al. found that attitudes toward social and organizational norms moderated the relationship between self-interest and attitudes toward information sharing.

In our study, we explore empirically a wider range of antecedents of information sharing than did Constant et al. (i.e. information culture, computer comfort and characteristics of computer-based information are antecedents in our study that were not part of Constant et al.'s study). We also study the extent to which collaborative technology is used. Information culture, organizational information ownership, propensity to share, task interdependence, computer comfort, and characteristics of computer-based information are the antecedents to the use of collaborative technology. The data collection occurs in a field study context to contrast the laboratory environment of the Constant et al.'s (1994) study. The variables and associated hypotheses are described below and are presented in Fig. 1.

2.1. Information culture

Although Constant et al. (1994) recognized the potential influence of cultural factors on information sharing behavior, they did not test it in their study. The Constant et al.'s (1994) model also does not distinguish between organizational and information culture although in knowledge management literature, such a distinction is often made. Similarly, in discussions on communication flows in distribution channels, there is a recognition of norms governing information behavior above and beyond organizational culture norms (e.g. Mohr and Sohi, 1995). According to Davenport (1997), information culture represents values and attitudes toward information and what 'to do' and 'not to do' related to information processing, publishing, and communication. Information culture originates from individual and organizational values and behavior related to information processing

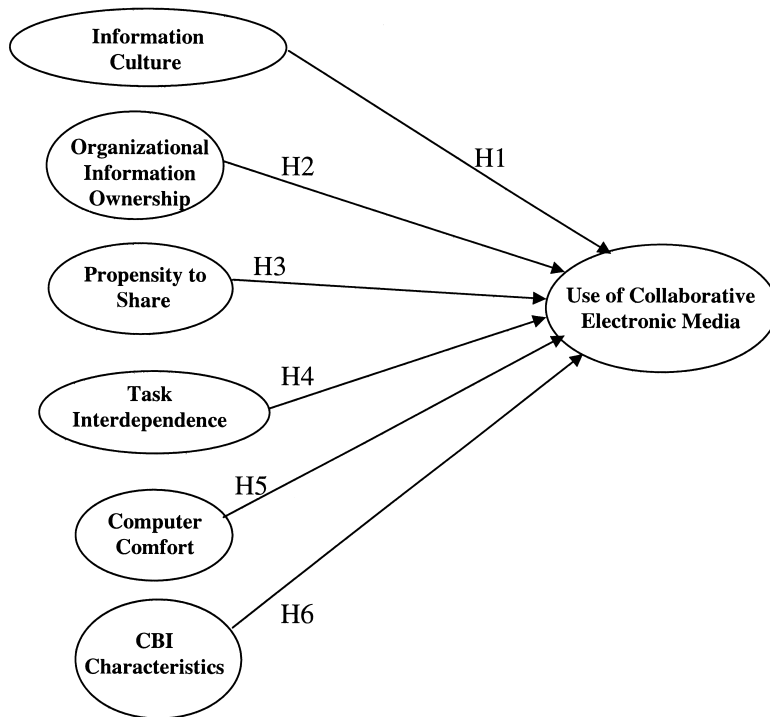


Fig. 1. The research model.

activities and leads to an implicit standardization device for dealing with information. Davenport (1997) describes several ways that information cultures can vary: open versus closed, factually oriented or rumor and intuition-based, internally or externally focused, controlling or empowering. Information culture also includes preferences for certain types of information channels or media (telephone, face-to-face, electronic mail, video). For example, electronic mail use is associated with information culture values that put less emphasis on the role of hierarchy and position (Finholt and Sproull, 1990).

In the marketing channel literature, information sharing between partners is argued to be affected by normative expectations that encourage an open, honest, dynamic, and frequent exchange of information (Mohr and Sohi, 1995). An implicit assumption in much of the writings on collaborative media and knowledge management is that organizations have a supportive information culture where information is viewed as an organizational resource that should be shared openly and freely without regard to the other person's hierarchy, function, or class. The work of Davenport et al. (1992) on information politics makes a compelling case for how information culture can inhibit information sharing in technologically advanced environments. Davenport et al. (1992) concluded that "In the most information-oriented companies we studied, people were least likely to share information freely — as perceived by these companies' managers." (p. 54). After all, "as people's jobs and roles become defined by the unique information they hold, they may be less likely to

share that information — viewing it as a source of power and indispensability — rather than more so” (Davenport et al., 1992).

Information technologies can be thought of as artifacts that reflect social values and norms (Robey, 1995). If the norms encourage open flow of information, then users would be expected to deploy the technology to enact the norm. Hence, we might expect open and organic information cultures to increase the use of collaborative information technologies. Open describes the degree to which members can get access to information and information flows without any restriction imposed by the organization or by members of the organization. Organic refers to the lack of formal structures and order for processing and sharing information (Scholz, 1990).¹ Organic and open can be expected to be co-existing. Hence, we hypothesize:

H1: Open and organic information cultures are associated with the use of collaborative electronic media for information sharing.

2.2. Organizational ownership of information

Constant et al. (1994) proposed that information sharing is affected by the organization norms of property rights. Organizational ownership of information differs from a social norm and represents an organization norm. The construct defines the relationship between an individual who has information and the organization that possesses that information. One might expect that if it is believed that information belongs to the organization, then it follows that employees should be ready to share it with others. The norm emphasizes the idea that information, even if a product of the employee’s hard labor, is not his or hers to give or withhold selfishly, but must be used for greater organizational benefit. The regard for the organization itself might be seen as the substitute for direct incentives or personal relationships in motivating people to share information. In a laboratory setting, Constant et al. (1994) distinguished between information as product versus information as expertise and found that people felt expertise was less of an organizational possession and more of a personal possession. Somewhat counter intuitive, people were willing to share expertise with others more freely than an information product. That is, people felt that expertise was more a personal possession and people appeared to be more willing to share this than an information product that they associated with an organization. Constant et al. (1994) explained the result by suggesting that people are more likely to share something that is theirs than a social good because the sharing of what they possess makes them feel needed, wanted and appreciated. Sharing is motivated by the power of self-expression and self-consistency.

The empirical results on information sharing via computer networks portray a more complex picture, however. Giving information can be related to general organizational benefit, but it can also be related to personal benefit and self-esteem. In a study where Constant et al. (1996) examined the exchange of technical information among distant employees (strangers) through a large computer system, they found that information

¹ Scholtz uses different labels (‘frankness’ and ‘order’) but the definitions are equivalent.

providers gave reasons of personal benefit as often as reasons related to general organizational benefits. That is, providing information to strangers helped advice givers to gain personal benefits. Sharing increased self-esteem and personal identification with the organization. In an institutional context where there is the absence of strong organizational norms of ownership, individuals might be therefore sharing information for the expression and consistency of the provider's identity and value. Hence, we expect that the more people hold beliefs that information/knowledge is owned by themselves, the more willing they are to share it because sharing positively reflects their identity and self-worth. By extension, we then expect the opposite when people hold beliefs that information/knowledge is owned by the organization. Hence, we hypothesize that:

H2: Beliefs about organizational ownership of information/knowledge held by the individual are associated with low use of collaborative electronic media for information sharing.

2.3. Propensity to share information

Constant et al. (1994) also proposed that people's propensities to share affects information sharing behavior, independent of the information possessor's personal feelings about his or her coworkers and found support for this in their study. Propensity to share information is part of prosocial transformation behaviors. Acts like sharing and volunteering are forms of prosocial behavior and are aimed at maintaining the well-being and integrity of others and the self (Brief and Motowidlo, 1986). Propensity to share information is a personal norm reflecting the costs and benefits of sharing. Beliefs that information sharing is expected workplace behavior could be acquired from, or reinforced by, information culture norms. That is, information culture relates to a broad social norm and the propensity to share information relates to a specific personal norm that is influenced by the greater context. A personal norm relates to "what one should do about it" or "whether this norm should be incorporated into my own belief system" (Osterhus, 1997). People who have a propensity to share information weigh more highly the social and personal good from sharing compared to the cost of sharing. We suggest the following:

H3: Propensity to share is associated with greater use of collaborative electronic media for information sharing.

2.4. Task interdependence

Constant et al. (1994) manipulated self-interest directly in their study. We will explore self-interest through the task interdependence construct. The theory of task-technology fit asserts that "for an information technology to have a positive impact on individual performance, the technology must be utilized, and the technology must be a good fit with the tasks it supports" (p. 213). The theory advocates that the greater the congruence between the characteristics of the technology and tasks, the lower the cognitive information processing costs and the greater the satisfaction and favorable outcomes toward

achieving individual and organizational goals (Vessey, 1991; Goodhue and Thompson, 1995). Support is found consistently in the IS literature for the effect of task-technology fit (e.g. Jarvenpaa, 1989; Goodhue and Thompson, 1995).

In the collaborative technology context, the theory implies that those whose work involves tasks that are interdependent of others should be motivated to use the collaborative (networked) technology more than those who act alone (Goodhue and Thompson, 1995). The characteristics of the technology match the nature of the work. Apart from the information culture that might promote sharing and a person's own propensity to share, pure rational self-interest suggest that benefits of reciprocity from communicating and sharing with others are increased when the person's work is dependent on the efforts of other people in and outside of their organization. People whose work highly depends on others might face frequent changes in their work including the type of information they need. The interdependence and subsequent change might increase their use of collaborative electronic media in their work environment. Hence, we hypothesize

H4: Task Independence is associated with greater use of collaborative electronic media for information sharing.

2.5. Computer comfort

Many have argued that attitudes toward computers have important effects on the usage of computer systems in general (Igarria et al., 1990). Those with more positive attitudes feel more inclined to try technology in the first place as well as explore more of its capabilities over time. It is also likely that those who use the technology develop positive attitudes toward it. Research on new technology adoption has consistently found attitudes about computers to be a significant determinant of adoption and use (Davis et al., 1989), although some studies have found the relationship to weaken as users gain experience with the technology (Thompson et al., 1994). Webster and Martocchio (1992) found that those who were playful with computers had more positive attitudes about computers. They also suggested that those who were most playful were the least likely to need organizational policies to sustain their computer usage. We extrapolate from this that those who are more comfortable using computers are more likely to use collaborative technology to share information. Constant et al. (1994) did not include issues such as computer comfort in their study; however, they did recognize that factors that reduce personal cost to share — including psychological cost — can promote information sharing. This recognition supports the inclusion of computer comfort as an antecedent in our study. Thus, we hypothesize

H5: Computer comfort is positively associated with greater use of collaborative electronic media for information sharing.

2.6. Perceived characteristics of computer-based information

On the basis of pure self-interest, one can expect that the more positively one perceives

information in computer networks, the more we can anticipate the use of the collaborative system including for information sharing purposes. The perceptions of information has been long recognized as an important influence on the use of computer-based information (Daft et al., 1987). People have the underlying expectation that information technology provides people with higher quality (more precise, new and up-to-date) information and greater accessibility to data (easy to get to, comprehend, and analyze). Kraemer et al. (1993) demonstrated that quality and accessibility are the most significant determinants of perceived usefulness of information. We have no reason to believe that those would not be significant determinants of information shared between two parties. The cognitive cost/benefit theory argues that individuals consider different approaches to completing their work as having different benefits (in terms of arriving at a desired outcome) and costs (in terms of effort expended on reaching the outcome (Payne et al., 1993)). Using a computer system requires effort and people have been found to conserve the expenditure of effort in computer mediated environments (Todd and Benbasat, 1994). Hence, people who do not hold positive perceptions of computer-based information are unlikely to use collaborative systems, independent of information culture, or their task interdependence, because such systems require effort. Hence, we hypothesize

H6: Positive perceptions of computer-based information are associated with greater use of collaborative electronic media for information sharing.

We now describe how the research model, summarized in Fig. 1, was tested.

3. Method

This section describes the sampling method, construct measures, and analysis methods employed.

3.1. Sample

A university was selected for the survey setting. Universities are often characterized as knowledge organizations (Goffee and Jones, 1996). Large, state universities house many different disciplines and work environments with possibly differing information cultures, and use of collaborative technologies. The large state university selected for this study prided itself on having a well developed IT infrastructure. Virtually all office-based staff (i.e. our target population) had PC's with network connections. There was considerable interest and influence from the central administration to make the university more accessible to its external stakeholders through investments in web-based technologies. There was also a drive to eliminate paper from administrative operations and create a more collaborative research atmosphere in the university. In our study, the unit of analysis was an employee in a department.

Questionnaires were sent to all academic staff (2550 people) and all general staff who had administrative duties (1703 people), so a total of 4253 employees received the questionnaire. To stimulate responses, a reminder letter was sent out two weeks later and respondents were given the option to participate in a draw for ten prizes of \$100 each

Table 1
Sample demographics

		Count	Column (%)
Age	30 or younger	293	26.2
	31–40	360	32.1
	41–50	288	25.7
	51–60	165	14.7
	61 or older	14	1.3
Gender	Male	475	42.4
	Female	645	57.6
Educational background	Secondary or High School	83	7.4
	Diploma/certificate	92	8.2
	Undergraduate degree	255	22.8
	Postgraduate diploma	178	15.9
	Graduate degree	511	45.7
Time with University	Less than 1 year	158	14.1
	1–5 years	481	42.9
	6–10 years	255	22.8
	11–20 years	156	13.9
	Over 20 years	70	6.3
Time in present position	Less than 1 year	293	26.2
	1–2 years	304	27.2
	3–5 years	266	23.8
	Over 5 years	256	22.9

(most people who completed the survey chose to participate). Completed questionnaires were received from 1125 individuals. Seventy-one questionnaires were returned unopened due to various reasons such as the person had left the university or was on leave. Therefore, an overall response rate of 27% was achieved (1125/4182). While this was a reasonable response given it was an unsolicited survey and it was fairly lengthy (i.e. 12 pages), it does raise the potential for non-response bias. Use of the procedure suggested by Armstrong and Overton (1977) indicated no significant differences between respondents and non-respondents on a variety of demographic variables included in the questionnaire. Table 1 summarizes the demographic characteristics of the respondents.

3.2. Construct measurement

The questionnaire contained multiple measurement items relating to each of the constructs in the research model. A pre-test, using faculty, graduate students trained in questionnaire design, and administrative staff, was carried out as suggested by Dillman (1978). Where possible, scales that had demonstrated good psychometric properties in previous studies were employed. Appendix A lists the questionnaire items used to measure each construct and their sources. For three constructs (use of collaborative electronic media, information culture, and task interdependence) sets of items were generated based on reviews of previous relevant literature and expert opinion.

Use of collaborative electronic media was measured in the model with three scale scores. The first measure, created by summing the eight items listed in Appendix A, captured the frequency of using electronic media to contact people and share information within the respondent's university and outside the university. The second measure captured the frequency that respondents searched for and gathered electronic information and the third measure captured the frequency that respondents published and stored electronic information. To assess information culture, a nine-item semantic differential scale was developed based on Scholz's (1990) six types of information behavior and three types suggested by Davenport (1995). Higher scores reflect greater perception of having an open, organic information culture.

Following the work of Constant et al. (1994), organizational ownership of information and propensities to share were assessed in this study through vignettes. Vignettes are used to elicit social judgments on subjects that are sensitive and difficult to observe. A vignette provides a "short, concrete story to which the subject responds in a variety of formats" assuming the role of a fictitious character (p. 403). Vignettes also have drawbacks as they ask people about hypothetical situations that they may have never encountered (Constant et al., 1994). The results from four vignettes were collapsed into two items to measure organizational ownership of information and four items of propensity to share information. See Appendix A for details of the vignettes and the corresponding measures.

An eight-item scale was developed to assess task interdependence. Five questions assessed how much the respondent's work depended on others. Three questions dealt with the nature of the information used (i.e. degree of equivocality) since using information with higher levels of ambiguity could potentially increase the need for interacting with others.

An eight-item scale was constructed to assess the comfort level respondents felt using information technology. The scale captured aspects of both computer anxiety and computer playfulness. Four items were from the short form of the Computer Anxiety Rating Scale (Heinssen et al., 1987) developed by Compeau (1992) and four items were from the computer playfulness scale developed by Webster and Martocchio (1992). Higher scores reflect greater comfort with computers.

A short form (seven items) of the Kraemer et al. (1993) Characteristics of CBI (computer based information) scale was used. This scale asks a series of questions about perceived quality of CBI, accessibility to CBI, and cost of CBI use. In our study characteristics of computer-based information that were both within the respondents' university and outside their university, was assessed. Higher scores reflect greater perceptions of CBI-based information being valuable.

3.3. Analysis

A structural equation modeling technique called Partial Least Squares (PLS) was chosen for analyzing the research model (Wold, 1985). PLS is a technique that uses a combination of principal components analysis, path analysis, and regression to simultaneously evaluate theory and data (Pedhazur, 1982; Wold, 1985). The path coefficients in a PLS structural model are standardized regression coefficients, while the loadings can be interpreted as factor loadings. PLS is ideally suited to the early stages of theory

development and testing — as is the case here — and has been used by a growing number of researchers from a variety of disciplines (e.g. Birkinshaw et al., 1995; Green et al., 1995; Higgins et al., 1992). A detailed discussion of the implementation of PLS in an information systems context is provided by Barclay et al. (1995), who also compare PLS and LISREL.

The explanatory power of the model is tested by examining the size, sign, and statistical significance of the path coefficients between constructs in the model. The statistics for the paths are generated using a jack-knifing technique (Fornell and Barclay, 1983). The predictive capacity of a PLS model can also be evaluated by examining the variance explained (i.e. R^2) in the dependent (or endogenous) constructs. The objective of a PLS analysis is to explain variance in the endogenous constructs, rather than to replicate the observed covariance matrix as is the case with covariance structure techniques (such as LISREL). One consequence of using a variance-minimization objective is the absence of overall fit statistics for PLS models (Hulland, 1999).

4. Results

The results of the measurement model analyses are presented first. This is followed by a formal test of the hypotheses.

4.1. Measurement model assessment

Two separate analyses were performed. An initial PLS run was carried out to identify items that were weak and should be discarded. This was done to ensure that the measurement model was adequate before proceeding with assessment of the structural model. Items that had either weak loadings (i.e. generally less than .50) or showed poor discriminant validity were discarded. It was felt that it was reasonable to relax the rule of thumb of accepting items with loadings of .70 or better, due to the exploratory nature of the work. Factor loadings in excess of 0.45 can be considered fair and loadings in excess of 0.55 can be considered good, according to Comrey (1973). The trimmed model was rerun and re-assessed.

Seventeen items of the original 51 items were identified as being weak and were dropped from the initial analysis (Appendix A lists the items used in the final analysis). Table 2 reports the resulting number of items per construct, internal consistency values, and average variance extracted (a measure used to assess discriminant validity). Table 3 presents the inter-correlations of constructs. Table 4 presents the loadings of each item on each construct. Both Tables 3 and 4 can be used to assess the discriminant validity of the constructs. All the constructs had acceptable reliability and validity.

4.2. Assessment of the structural model

Assessment of the structural model was done in two steps. The predictive power of the model was assessed first, followed by an analysis of the hypothesized relationships among the constructs. The results are summarized in Fig. 2 and Table 5.

Table 2
Internal consistency of the constructs

Construct	Number of items	Internal consistency ^a	Cronbach's alpha	Average variance extracted
Use of collaborative electronic media	3	0.88	0.78	0.71
Information culture	3	0.74	0.78	0.52
Organizational ownership of information	2	0.84	0.75	0.72
Propensity to share	4	0.72	0.77	0.42
Task interdependence	6	0.86	0.80	0.46
Computer comfort	8	0.85	0.79	0.42
Characteristics of computer-based information	8	.91	.88	.55

^a Internal consistency is assessed using the Fornell and Larcker (1981) measure. The Fornell and Larcker (1981) internal consistency value is preferred for PLS analyses since it uses the observed loadings to more accurately reflect the relative importance of each of the underlying measures. Also, it is calculated independently of the number of items employed for a construct, resulting in a more robust assessment of internal consistency. Cronbach's alpha values are presented for comparison. A value of 0.70 or larger for both Cronbach's alpha and the Fornell and Larcker measure indicates adequate internal consistency. All the constructs in this study meet that criteria.

4.2.1. The predictive power of the model

The model explained 29.2% of the variance in the use of collaborative electronic media construct. Overall, the amount of variance explained by the model appeared reasonable. The exogenous variables would likely be only some of many things affecting the endogenous construct, resulting in the relatively modest R^2 value.

4.2.2. Hypothesis testing

Table 5 contains a summary of the hypotheses, the path coefficients obtained from the PLS analysis of the initial model, and the t -statistic values for each path. All six of the paths were statistically significant. Five of these significant paths were in the directions hypothesized, supporting the associated hypotheses. These results are discussed in the next section.

Table 3

Discriminant validity analysis (The bold diagonal elements are the square root of the variance shared between the constructs and their measures (i.e. the square root of the average variance extracted). Off diagonal elements are the correlations between constructs. For discriminant validity, the diagonal elements should be larger than any other corresponding row or column entry. Since this is the case for all of the constructs, discriminant validity of the measurement model is satisfactory)

Construct	1.	2.	3.	4.	5.	6.	7.
1. Use of collaborative electronic media	0.844						
2. Information culture	-0.055	0.718					
3. Organizational ownership of information	-0.074	-0.006	0.850				
4. Propensity to share	0.093	0.035	0.149	0.648			
5. Task interdependence	0.325	0.001	0.038	0.070	0.681		
6. Computer comfort	0.342	0.014	0.097	0.020	0.115	0.647	
7. Characteristics of computer-based information	0.399	0.113	0.066	0.096	0.129	0.290	0.743

Table 4

Cross-loading matrix (The bolded items indicate the items that are designed to load on the construct in the respective columns. See Appendix A for the wording of the questionnaire items)

Items	Use of collaborative electronic media	Information culture	Organizational ownership of information	Propensity to share information	Task interdependence	Computer comfort	Characteristics of CBI
SEARCH	0.894	-0.036	-0.054	0.081	0.304	0.318	0.434
EUSEACC	0.839	-0.065	-0.072	0.054	0.193	0.344	0.321
PUBSTORE	0.796	-0.042	-0.064	0.106	0.329	0.188	0.223
IC 1	0.017	0.404	0.012	0.042	0.041	0.051	0.069
IC 2	-0.046	0.930	0.005	0.044	0.001	0.007	0.110
IC 3	-0.022	0.721	-0.016	0.023	0.031	0.055	0.090
OWN 1	-0.079	-0.017	0.958	0.141	-0.034	-0.093	-0.073
OWN 2	-0.033	0.022	0.725	0.114	-0.032	-0.071	-0.025
PTSINTPD	0.096	0.032	0.131	0.982	0.059	0.012	0.090
PTSINTEP	0.024	0.044	0.177	0.610	0.087	0.065	0.075
PTSEXTPD	0.005	-0.009	0.089	0.442	-0.003	0.032	0.015
PTSEXTEP	-0.011	0.028	0.120	0.383	0.027	0.062	0.022
TASKI 1	0.217	-0.020	-0.002	0.025	0.735	0.077	0.067
TASKI 2	0.260	0.035	-0.005	0.046	0.790	0.092	0.080
TASKI 3	0.178	0.030	-0.032	0.086	0.504	0.111	0.104
TASKI 4	0.243	-0.022	-0.028	0.047	0.562	0.098	0.154
TASKI 5	0.249	0.010	-0.075	0.028	0.809	0.061	0.085
TASKI 6	0.213	-0.030	-0.016	0.075	0.803	0.053	0.055
COMPC 1	0.178	0.036	-0.099	-0.012	0.121	0.555	0.254
COMPC 2	0.226	0.043	-0.101	0.000	0.111	0.704	0.254
COMPC 3	0.181	-0.020	0.024	0.086	0.050	0.520	0.137
COMPC 4	0.231	-0.041	-0.143	0.022	0.097	0.577	0.153
COMPC 5	0.242	0.046	0.007	0.052	0.085	0.684	0.192
COMPC 6	0.244	0.002	-0.027	-0.009	0.038	0.716	0.153
COMPC 7	0.259	0.005	-0.046	-0.004	0.025	0.733	0.177
COMPC 8	0.182	-0.003	-0.134	-0.025	0.087	0.649	0.200
CCBI 1	0.363	0.059	-0.021	0.125	0.181	0.202	0.729
CCBI 2	0.320	0.059	-0.082	0.063	0.152	0.201	0.687
CCBI 3	0.271	0.114	-0.057	0.070	0.090	0.249	0.731

Table 4 (continued)

Items	Use of collaborative electronic media	Information culture	Organizational ownership of information	Propensity to share information	Task interdependence	Computer comfort	Characteristics of CBI
CCBI 4	0.259	0.109	−0.055	0.037	0.102	0.237	0.733
CCBI 5	0.278	0.073	−0.064	0.082	0.054	0.190	0.757
CCBI 6	0.299	0.074	−0.039	0.057	0.060	0.211	0.758
CCBI 7	0.277	0.106	−0.038	0.062	0.041	0.221	0.760
CCBI 8	0.266	0.094	−0.041	0.055	0.050	0.219	0.789

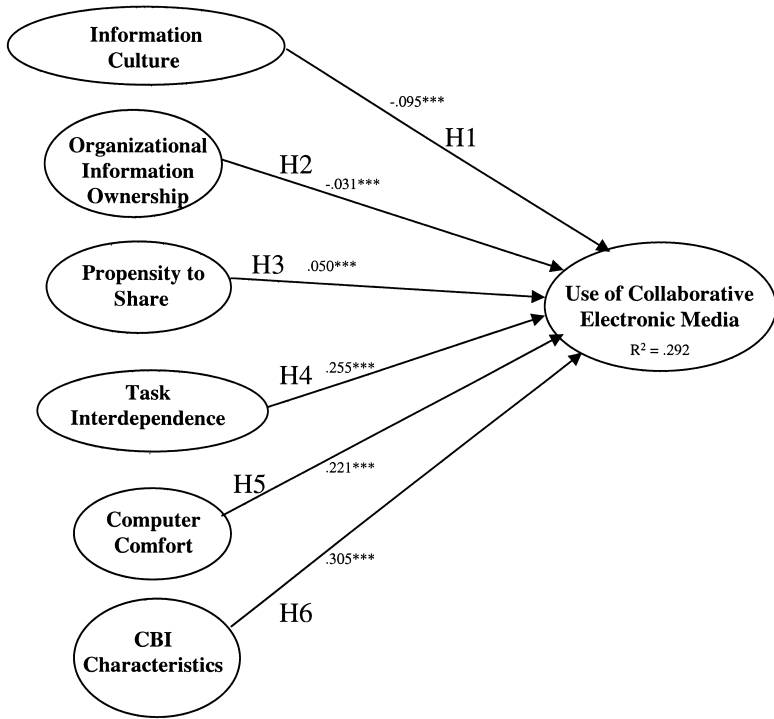


Fig. 2. Testing the research model.

Table 5

Summary of path coefficients and significance levels (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (2-tailed test))

Hypotheses and corresponding path(s)	Expected sign	Path coefficient	<i>t</i> -value (df = 373)	Support for H?
H ₁ : Information culture to use of collaborative electronic media	+	-0.095	-3.64***	NO
H ₂ : Attitudes about organizational information ownership to use of collaborative electronic media	-	-0.031	-5.96***	YES
H ₃ : Propensity to share information to use of collaborative electronic media	+	0.050	3.86***	YES
H ₄ : Task interdependence to use of collaborative electronic media	+	0.255	5.98***	YES
H ₅ : Computer comfort to use of collaborative electronic media	+	0.221	8.99***	YES
H ₆ : Characteristics about computer-based information to use of collaborative electronic media	+	0.305	6.02***	YES

5. Discussion

The study explored what influences the use of collaborative electronic media in an organization. We extended the Constant et al.'s (1994) model of information sharing to include the use of collaborative media. We will discuss the findings related to each hypothesis in turn.

Hypothesis 1. We had hypothesized that an open, organic information culture would be positively associated with the use of collaborative electronic media but the results suggest a negative association. The weak negative association implies people who believe they have a more structured, hierarchic information culture, use electronic media more. Possibly the hierarchy requires more use of the media, or perhaps the media is used as one way to get around the closed internal information culture to access information that is not freely shared by nearby colleagues. This finding is contradictory to those in the literature that suggests an open information culture facilitates sharing activities. Also, it is possible that the individuals who are using the media find the structured information culture facilitates the exchange of information. As far as we could determine, information culture has not been operationalized before so future studies are needed to both verify the psychometric properties of the measure and the relationship information culture has with other constructs.

Hypothesis 2. Consistent with Constant et al.'s (1994) findings, we found that people who believed the information belonged to the organization were less likely to use collaborative media for sharing information. This supports Constant et al.'s suggestion that people share information and knowledge more readily when they believe it is their own since they get more personal satisfaction out of doing so.

Hypothesis 3. As hypothesized, strong feelings of the likelihood to share information were associated with the actual use of the media for information sharing activities. This finding was as we expected that the attitudes and behavior are conceptually similar and reinforcing. These results, along with those for hypothesis 2, indicate that significant benefits result if an organization can influence their employees' views of the ownership of information and their attitudes towards sharing.

Hypothesis 4. The higher the interdependence of the respondents' tasks, the more they used electronic media to share information, as predicted by the task-technology fit theory. This relationship was among the two most substantive in the model suggesting that rational self-interest plays a critical role in information sharing. Collaborative technologies allow people to easily exchange information and knowledge in both structured and ad hoc fashion facilitating interdependent operations among two or more people. If the capabilities of the computer systems match the task needs of their users, they are more likely to be used.

Hypothesis 5. The hypothesized relationship between computer comfort and the dependent variable was supported. The path from computer comfort to use of electronic collaborative media for sharing information was positive and statistically significant. This implies that having adequate computer skills is important to facilitate information sharing and communication in an electronic media environment.

Hypothesis 6. This hypothesis was strongly supported. The use of electronic media for communicating and sharing was strongly associated with the beliefs that computer based

information systems provide valuable information in an effective way. These findings suggest that organizations should enhance the perceived value of their computer-based information in order to increase the amount it is used and shared.

5.1. Limitations

Our results found significant associations between all the constructs in the research model. Of course, such findings ultimately need to be replicated across other settings and over time before they can be fully accepted. For example, our study was in one setting and while universities are thought of as knowledge organizations, the generalizability from a university setting to private industry may be questionable. We also did not control for professional sub-cultures (e.g. academic function versus administrative function). Since several of the measures used for the constructs were developed specifically for this study, further work in this area also will help strengthen the construct validity of the measures used.

Even though our theoretical model suggests directions of the paths, making causal statements is beyond the scope of our analysis and study. The cross-sectional nature of our survey design limits our ability to draw causal inferences. Although such a survey is useful for identifying what set of relationships exist, it does not address why they exist. Future research efforts such as in-depth case studies would be valuable to expand our current understanding of information sharing and the role of the various constructs.

5.2. Implications

Theoretically, our study builds on Constant et al.'s (1994) theory of information sharing and extends it by demonstrating that contextual factors, such as information culture and task interdependence, influence the use of electronic media for information sharing activities. A need to use the media, seeing value in the information provided through the media, and having a reasonable level of comfort in doing so are important in leading to more usage and sharing. Having a positive propensity to share and a belief that the information is your own property also leads to more media use and sharing of the information, consistent with Constant et al.'s findings.

Our results should be useful to focus future research efforts on the Constant et al.'s (1994) model. There is a need to extend the understanding of the organizational context factors in general and organization culture in particular. Information sharing is likely to be a much more context-dependent process than we have given it credit here. In their field study paper, Constant et al. (1996) note that "it seems unlikely that, in the absence of a culture that supports information sharing ...the kinds of information exchanges ... we observed could be sustained for long" (p. 131). Organizational culture has long been argued to affect the consequences from information technology (Robey, 1995). Markus (1984) found that political and cultural barriers can play a significant role in the adoption of technologies that alter the information flows in an organization. When information is shared, it has traditionally tended to occur more within rather than across functions. Ashburner (1990) found that the power position of the personnel function was related to the benefits from the personnel information systems. Kanungo (1998) studied the influence of organizational culture on computer-mediated communication and information

access. He found that in organizations with task oriented cultures versus people oriented cultures, user satisfaction of the communication and information access was greater. Orlikowski (1992) found that “in competitive and individualistic organizational cultures — where there were few incentives or norms for cooperating or sharing expertise — groupware did not engender collaboration” (p. 362).

We also encourage extending the model to take into account organizational information policies. Notably Constant et al. (1994) questioned whether it is realistic to assume that organizations could supervise or sanction information policies. Nevertheless, Davenport (1997) encourages organizations to take a proactive approach to changing the shared social norms of sharing by instituting organization policies. The suggested policies include creating a committee or assigning responsibility to addressing information use issues, clarifying the organization’s objectives for using and sharing information, and communicating what information should or should not be shared. Davenport (1997) speculates that the information policies that organizations adopt may range from more to less controlling depending on the existing organization’s culture. The marketing channel literature supports this proactive view to information sharing. Normative expectations can encourage higher frequency and more open flow of information (Heide and John, 1992). Institutionalized rules and routines for sharing information were found to promote greater frequency and bi-directionality in information sharing (Mohr and Sohi, 1995).

Additional variables that might be considered include national culture and organizational performance. For example, compared to businesses in Japan, it is argued that information is shared more in the US for emotionally satisfying or power related reasons (Bozman, 1991). The model might also benefit from including more situational variables. Research on interorganizational information sharing also has found that sharing increases with perceived level of organizational task accomplishment and slack (Schermerhorn, 1977), suggesting that in times of distress, information sharing might be decreased both internally and externally — just when such sharing could prove especially beneficial. Overall, we hope that our results are useful in encouraging future research to extend the Constant et al.’s (1994) model including adding variables, as well as closer examination of why the relationships exist in the model.

Practically speaking, firms that are trying to become knowledge-based organizations can use our results to focus their efforts on activities that will have the greatest impact on increasing the sharing of information. Our results speak to the role that the perceptions of CBI play in the use of media. Actions organizations could take to increase perceptions in the value of CBI systems would include training and designing web sites and systems such that the effort to use them was minimized. Increasing aptitude with the systems (i.e. computer comfort) used to retrieve and share information will also facilitate use. Our results on organizational ownership of information imply that if organizations want to increase the use of collaborative systems for sharing activities, they should promote activities that encourage people to take personal ownership of the information that they possess and possible give them incentives and recognition for their sharing activities. Managing these variables effectively can lead to greater sharing of information via electronic media, a crucial step in the process of extracting value from organizational knowledge.

6. Conclusion

In conclusion, our results speak to the value of the Constant et al.'s (1994) theory of information sharing. The Constant et al. theory is an important piece of work that has yet to receive the attention it deserves in information and knowledge management literature. We have found very few articles that make reference to the Constant et al.'s (1994) theory of information sharing and have been unable to locate any substantive extensions to the work. Constant et al.'s (1994) theory accommodates both organizational context factors as well as psychological factors including feelings, values, and self-identities. The model can be used to examine why people are or are not sharing their best information as well as knowledge regardless of the amount of technology, organizational mandate, or financial incentive. It can be used to present a cultural driven approach to information and knowledge sharing. It can also be a basis of an emotional driven understanding of information sharing processes. Understanding and appreciating the role of human emotion is likely to be critical in moving beyond information sharing to knowledge sharing because without people feeling that they are part of the community that cares for them, they will not share their best knowledge.

Because of its grounding in one of the fundamental theories of social psychology, social exchange theory, we believe that Constant et al.'s (1994) theory is a robust basis to develop not just an information sharing theory, but moreover, a knowledge sharing theory. This theory complements the more economic perspectives to information sharing that deal with the logic of economic self-interest. Social exchanges of information and knowledge are similar to economic exchanges in the sense that there is an expectation of some future return for sharing, but unlike economic exchanges there is no understanding of the value of what has been shared and no clear expectation of exact future return. Particularly in the knowledge-sharing context, the value of what is being shared can be often determined only after it has been shared, at which point the receiver has it without any cost. The economic explanations do not adequately address situations where "individuals can go the extra mile even at the expense of their own personal self-interest" (Kim and Mauborgne, 1998, p. 324). People have been found to share expertise in situations where individuals were to receive unfavorable decision outcomes, for example, sharing information to help reengineer a process when it was clear that they would be reengineering themselves out of the job. Rumelt (1991) called for disciplines other than economics to reveal insight into situations of coordination and accumulation of knowledge that went beyond simple exchanges and individual incentives. The Constant et al.'s theory is a useful starting point of understanding social and psychological processes in knowledge sharing. Sharing knowledge is a critical step in developing intellectual capital and benefits for organizations. We look forward to future extensions of Constant et al.'s (1994) model.

Appendix A. Questionnaire items

Item label	Item wording
	USE OF COLLABORATIVE ELECTRONIC MEDIA
SEARCH	<p>Items used to create the searching and gathering dimension measure (Cronbach's alpha = 0.83)</p> <p>These questions immediately followed those above and the instructions given to respondents were: "The following is a list of ways that individuals could use the above computer-based information system(s). Please circle the response that best describes on average how you currently use your system(s) to deal with your department/work group information or with university information."</p> <p>I use my computer-based information systems to:</p> <ul style="list-style-type: none"> Search for information within my department/work unit Search for information within my university (outside of my department) Gather information (e.g. download) within my department/work unit Gather information within my university (outside of my department) Search for information from sites outside of my university Gather information from sites outside of my university
EUSEACC	<p>Items used to create the frequency of use of electronic media dimension measure (Cronbach's alpha = 0.77)</p> <ul style="list-style-type: none"> I use e-mail to contact people/access information WITHIN my organization/school I use my web browser to contact people /access information WITHIN ... I use list servers to contact people /access information WITHIN my organization/school I use a collaborative system other than the web to contact people / access information I use e-mail to contact people /access information OUTSIDE my organization/school I use my web browser to contact people /access information OUTSIDE ... I use list servers to contact people /access information OUTSIDE my organization/school I use a collaborative system other than the web to contact people / access information...
PUBSTORE	<p>Items used to create the publishing and storing dimension measure (C. alpha = 0.79)</p> <p>I use my computer-based information systems to:</p> <ul style="list-style-type: none"> Publish information that will be of use to members of my department/work unit

(continued)

Item label	Item wording
	Publish information that will be of use to other departments at my university
	Store information in the network for general access in my department
	Store information in the network for general access in my university
	Publish information that will be of use to people outside my university
	Store information in the network for general access by people from outside my uni

INFORMATION CULTURE — source: Scholz (1990) and Davenport (1995)

The instructions given to respondents were: “How would you describe the attitudes and behaviour relative to information in general (i.e. all types) **in your department?** (**circle** one number in each line)” A scale, ranging from 1 to 7, was positioned between the two anchor labels, with 4 being labeled “neutral” so respondents indicated, by circling one number, where they felt their department was on the scale.

- IC 1 Open vs. closed info behavior (reverse coded)
- IC 2 Fact vs. rumor/intuition (reverse coded)
- IC 3 Confident vs. suspicious (reverse coded)

ORGANIZATIONAL OWNERSHIP OF INFORMATION — source: Constant et al. (1994)

Four vignettes (i.e. short stories) were developed and participants were asked their views of the ownership of the information/knowledge in these four situations. Two items were used to measure the construct since they demonstrated adequate internal consistency.

- OWN 1 & 2 I would feel the material/knowledge belongs to me (reverse coded)

PROPENSITY TO SHARE — source: Constant et al. (1994)

The four vignettes described above were used to assess propensity to share. The three questions below were asked for each vignette. These questions were in turn summed to create a score for each scenario and these four scores were used in the study to measure the propensity to share construct. Internal consistency of the items that were combined was reasonable (e.g. Cronbach’s alphas ranged from .74 to .79).

- How appropriate is it for Leslie to ask you for a copy of your report notes/help?
- How justified would you be in refusing to give Leslie a copy of the report/help? (reverse coded)
- All told, what is the likelihood you would give a copy of the report/help to Leslie?

(continued)

Item label	Item wording
PTSINTPD	Propensity to share tangible/product information within the organization
PTSINTEP	Propensity to share intangible/expertise information within the organization
PTSEXTPD	Propensity to share tangible/product information outside the organization
PTSEXTEP	Propensity to share intangible/expertise information outside the organization

TASK INTERDEPENDENCE

TASKI 1	My work is often completed with staff from other departments
TASKI 2	My work often involves sharing information with other departments
TASKI 3	The results of my work is dependent on the efforts of people from within my department
TASKI 4	The information I need is often subject to change
TASKI 5	My work often involves using information from other departments
TASKI 6	The results of my work is dependent on the efforts of people from other departments

COMPUTER COMFORT — source: Compeau (1992) and Webster and Martocchio (1992)

COMPC 1	It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key (reverse coded)
COMPC 2	I hesitate to use a computer for fear of making mistakes that I cannot correct (reverse coded)
COMPC 3	I feel apprehensive about using computers (reverse coded)
COMPC 4	Computers are somewhat intimidating to me (reverse coded)
COMPC 5	Computers make work more interesting
COMPC 6	I enjoy interacting with computers
COMPC 7	I use computers for fun
COMPC 8	Working with computers is fun

CHARACTERISTICS OF COMPUTER-BASED INFORMATION

— source: Kraemer et al. (1993)

CCBI 1	Computer-based information systems (CBIS) provide me with more up-to-date information than that available in manual files
CCBI 2	CBIS make new information available to me that was not previously available
CCBI 3	CBIS save me time in looking for information
CCBI 4	CBIS have made it easier for me to get the information I need that was previously available but hard to find

(continued)

Item label	Item wording
CCBI 5	CBIS provide me with more up-to-date information from outside my university than that available in manual files
CCBI 6	CBIS make new information available to me from outside my university that was not previously available
CCBI 7	CBIS save me time in looking for information from outside my university
CCBI 8	CBIS have made it easier for me to get the information I need from outside my university

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