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Knowledge and information management practices in knowledge-intensive organizations: A case study of a Québec public organization[1]

Résumé : Cet article présente comment une organisation à haute intensité de savoir mobilise et maximise ses capacités informationnelles et du savoir. Les résultats indiquent qu'en termes d'utilisation de l'information, de culture et de gestion, les répondants estiment pouvoir utiliser efficacement l'information pour réaliser leur travail, qu'il est utile à l'organisation et que le partage de l'information est essentiel pour le réaliser. L'information consignée et les mécanismes formels de transfert d'information et de connaissances sont aussi perçus comme les plus importants.

Abstract: This paper examines how a knowledge-intensive organization mobilizes and leverages its knowledge and information capabilities. The results indicate that in terms of information use, culture, and management, the respondents believe that they can use information effectively to solve work problems, that their work benefits the organization, and that information sharing is critical to their being able to do their job. Recorded information and formal information and knowledge sharing mechanisms are also perceived as most important.

1. Introduction

With the knowledge-based economy comes an increased awareness of the value of information and knowledge as unique, vital resources and factors of production. However, there is a wide gap between this espoused theory and actual theory-in-use – that is, the capacity of an organization to leverage and fully exploit its information and knowledge base (Bergeron 1996, Detlor 2000, Schultze and Boland 2000).

To address this gap, we conducted a study to better understand how knowledge-intensive organizations – where the ability to find, share, and process information is critical to their operations – mobilize and leverage their knowledge and information capabilities. The study focused on actual practices as distinct from espoused procedures, policies, and rules. Formal and informal knowledge and information management practices were included, recognizing the importance of each as well as the importance of integrating the two forms of practices (Rice et al. 2001, Matarazzo 1994, Erdelez 1997).

More specifically, we examined the following research questions: (1) what are the information and knowledge management policies and strategies being adopted? (2) What information behaviors and values underpin information practices? (3) How do members perceive the outcomes of information use in their work contexts? (4) What effect do information behaviors and values have on the use of information and its outcomes? We studied three professional service organizations: two private organizations (law and

engineering firms) in Ontario and one public organization in Québec. This paper presents results from the Québec-based public organization.

2. Literature review

In this paper, our conceptual stance is to analyze organizations as information use environments (IUE) (Taylor 1986, 1991). This approach focuses on the user, the uses of information, and the contexts within which users make choices about what information is useful to them. It allows study of the immediate context that influences the information needs and uses of groups of users. This IUE occurs within a larger information environment (Davenport, 1997). In Davenport's (1997) model, this information environment is composed of information strategy, information politics, information culture, information management processes, information staff, and information architecture. We consider information behaviors as lying at the intersection of three sets of influences: information management, information culture, and information use (Bergeron 1996, Detlor 2004, Choo 2006). For the purposes of this paper, we concentrate on information management policies and strategies; information behaviors and values layer; and information use outcomes (see Choo et al. 2006 for definitions of the concepts used in this study).

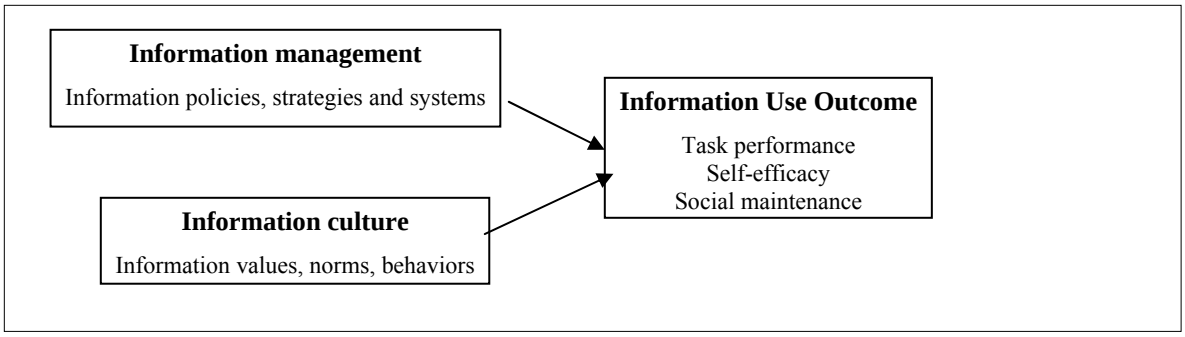

Figure 1. Conceptual framework of the study

3. Methodology

The method of data collection was a questionnaire survey. We developed a Web-based survey containing a 61-item questionnaire of closed and open-ended questions, organized into several sections. Most items were presented as statements to which respondents indicated their agreement on a scale of 1 (strongly disagree) to 5 (strongly agree), with a sixth category for "do not know." In the first section, 14 questions asked about the information use environment at the general level of the organization, and touched on areas such as information policy, formal procedures, training, and mentoring. In the second section, there were 28 questions covering information integrity, formality, control, transparency, sharing, and proactiveness. The third section contained 7 questions which polled participants' task-related outcomes where information is used to solve problems or innovate. Four open-ended questions were asked concerning the obstacles and incentives to information and knowledge (I&K) sharing in their organization, as well as information sources used (up to 10 sources). The last two sections included an open-ended question about I&K sharing mechanisms (and their rank of importance) plus demographics. Survey questions were based on items used in surveys on information and knowledge management conducted by the OECD (2002) and Statistics Canada (2001), as well as on items used by Marchand et al. (2001) in their survey on information orientation.

The organization for which results are presented in this paper is a public, Québec-based knowledge intensive organization in the health science field. Its role is to develop scientific knowledge in its area of responsibility and transfer this knowledge for use in health policy, research and training, to various areas of society, at local, national and international levels. A rather young organization, created less than ten years ago, it is the result of a merger of various existing institutions with longer histories. The organization is spread geographically amongst various buildings and cities. The organization works at building a common culture. At the time of data collection, the organization was working on developing a formal information strategy.

The data collection activity was conducted in January 2006. The CEO invited via email all employees of the organization to complete the online survey. A reminder email was sent after a week. In total, 190 people answered the survey, for a response rate of 34%.

We conducted a factor analysis of the closed questions of the three first sections to determine factors within the information management, information behavior and values, and information use domains. Correlation and regression analyses were then conducted to assess the strength of the relationships between significant factors found within each of these three domains. Open-ended questions were content-analyzed.

4. Results

We first offer a profile of the respondents. We then present the results of our findings according to our three main concepts of information management, information values and behaviors, and information use outcomes. For each concept we present a factor analysis of the questionnaire items and underline the dimensions identified by the responses. We end by detailing the results to the questions related to perceived obstacles and incentives to information and knowledge (I&K) sharing as well as information sources and I&K sharing mechanisms used by respondents.

4.1 Profile of respondents

There were 190 respondents, of which 161 (84.7%) provided demographic data. About half of them (n=96, 50.5%) are professionals including researchers. The rest are divided between technical (n=33, 17.4%) and support staff (n=16, 8.4%), manager/supervisor (n=11, 5.8%), and other (5, 2.6%). A majority are women (n=103, 54.2%), while 26.3% (n=50) are men, (note that 8 respondents (4.2%) chose "prefer not to answer").

The respondents are highly educated: 65.4% (n=124) hold a university degree, with 48.5% having completed graduate studies (Table 1). There are also 16.3% with a college (Cégep) degree, mostly technical. About 44% (n=83) are under 45 years old, while 37.4% (n=71) are 45 and older.

Highest degree obtained	N	%
University (masters degree)	71	37.4
College (Cégep)	31	16.3
University (bachelors degree)	29	15.3
University (doctoral degree)	19	10.0
High school	4	2.1
University (certificate degree)	3	1.6
University (post-graduate diploma)	2	1.1
Prefer not to answer	2	1.1
No answer	29	15.3
Total	190	100.0

Table 1. Highest degree obtained by the respondents

Close to half of the respondents (n= 91, 47.9%) are recent (5 years or less) in their current position. A majority (52.7%) has been in the organization 5 years or less. Eighty-seven respondents (46%) have ten years or more of work experience, while 74 (39%) have less than 10 years and 29% having 5 years or less.

The demographic data indicates that respondents to our survey are highly educated and are situated along an age and experience continuum. We now present the results in relation to the information and knowledge practices in the organization.

4.2 Information Management

An exploratory factor analysis of the questions related to the information management domain using principal component and scree plot analysis found that 10 of the 14 items loaded onto one underlying factor. This factor, with an eigenvalue of 5.025, accounts for 36% of the common variance. The 10 items are shown in Table 2, and we name the factor 'Information Management – General.' The Cronbach's α of these items is .88.

Factor and Items	1
Information management – general (α = .88)	
My organization has a formal policy or strategy for managing knowledge and information.	*.849*
My organization has a culture intended to promote knowledge and information sharing.	*.742*
My work unit has a culture intended to promote knowledge and information sharing.	*.494*
My organization has formal procedures to collect knowledge.	*.732*
My organization has formal procedures to share knowledge.	*.765*
My work unit encourages experienced workers to communicate their knowledge to new or less experienced workers.	*.626*
My organization has formal mentoring programs and/or apprenticeships.	*.563*
Knowledge and information in my organization is available and organized to make it easy to find what I need.	*.599*
Information about good work practices, lessons learned, and knowledgeable persons is easy to find in my organization.	*.504*
My organization makes use of information technology to facilitate knowledge and information sharing.	*.558*
Eigenvalue	5.025
Cumulative percentage of variance	35.89

Table 2. Information Management Factor Analysis

Table 3 displays the mean scores of the items in the 'Information management – General' factor. Respondents indicated their agreement with given statements about information management in the organization, using a scale with the anchor points of 1=Strongly Disagree, 3= Neutral, and 5=Strongly Agree. The means show that respondents agreed with the statements that "My organization makes use of IT to facilitate knowledge and information sharing" (4.19) and "My work unit has a culture intended to promote knowledge and information sharing" (4.03). Agreement is lowest with the statement that "My organization has formal mentoring programs and/or apprenticeships" (2.78, below Neutral) and "Information about good work practices, lessons learned, and knowledgeable persons is easy to find in my organization" (3.20).

Information Management Descriptive Statistics	**N**	**Mean**	**SD**
Information management – general			
My organization has a formal policy or strategy for managing knowledge and information.	147	3.48	1.167
My organization has a culture intended to promote knowledge and information sharing.	175	3.85	1.116
My work unit has a culture intended to promote knowledge and information sharing.	178	4.03	1.073
My organization has formal procedures to collect knowledge.	146	3.28	1.161
My organization has formal procedures to share knowledge.	155	3.40	1.126
My work unit encourages experienced workers to communicate their knowledge to new or less experienced workers.	170	3.47	1.255
My organization has formal mentoring programs and/or apprenticeships.	138	2.78	1.277
Knowledge and information in my organization is available and organized to make it easy to find what I need.	178	3.51	1.054
Information about good work practices, lessons learned, and knowledgeable persons is easy to find in my organization.	173	3.20	1.141
My organization makes use of information technology to facilitate knowledge and information sharing.	178	4.19	.943

Table 3. Information Management Descriptive Statistics

4.3 Information behaviors and values

Table 4 shows the results of the factor analysis (principal components analysis with varimax rotation) for the information behaviors and values domain. Factor loadings above .45, our cutoff point for including an item in a factor, are presented in italics. Our inspection of the scree plot and eigenvalues initially suggested five factors. The factor with the smallest eigenvalue ("Integrity") was subsequently dropped because of low factor loadings and unacceptable Cronbach's α. Three of the six factors postulated by the Information Orientation study (Marchand and al., 2001) were extracted and they collectively account for 45% of the common variance. These factors are: Transparency, Proactiveness, and Sharing. (Items that loaded on two factors for internal and external sharing were combined into Sharing, as suggested by theory.) (Factors as defined in Choo et al. 2006).

Information Behaviors and Values Factor Analysis	1	2	3	4	5
Transparency (α = .73)					
Managers and supervisors of my work unit encourage openness.	*.567*	.143	.133	-.020	-.342
The people I work with regularly share information on errors or failures openly.	*.773*	.037	.103	.114	-.039
The people I work with regularly use information on failures or errors to address problems constructively.	*.894*	.090	.024	.143	.286
Proactiveness (α = .73)					
I actively seek out relevant information on changes and trends going on outside my organization.	-.198	*.595*	.205	.032	.149
I use information to respond to changes and developments going on outside my organization.	-.023	*.969*	.133	.204	-.004
I use information to create or enhance my organization's products, services, and processes.	.178	*.458*	.028	.284	-.156
Sharing – internal (α = .64)					
I often exchange information with the people with whom I work regularly.	.232	.110	*.692*	.125	-.005
I often exchange information with people outside of my regular work unit but within my organization.	-.021	.205	*.451*	.330	.086
In my work unit, I am a person that people come to often for information.	.266	.071	*.716*	.061	.133
Sharing – external (α = .76); Sharing – internal and external (α = .71)					
I often exchange information with citizens, customers, or clients outside my organization.	.130	.174	.228	*.948*	.038
I often exchange information with partner organizations.	.187	.246	.217	*.606*	-.146
Integrity (α = .17; not used in analysis) (reverse coded)					
Among the people I work with regularly, it is common to knowingly pass on inaccurate information.	-.341	.115	-.191	.003	*.408*
Among the people I work with regularly, it is common to distribute information to justify decisions already made.	.004	.019	.029	-.115	*.484*
Eigenvalues	4.452	2.544	1.822	1.574	1.439
Cumulative percentage of variance	19.36	30.42	38.34	45.18	51.44

Table 4. Information Behaviors and Values Factor Analysis

Table 5 shows the mean scores of respondents who indicated their agreement with given statements about their information behaviors and values on a scale where 1=Strongly Disagree, 3=Neutral, and 5=Strongly Agree. The scores indicate moderate levels of agreement with most items on Sharing, Proactiveness, and Transparency. Agreement was highest with statements relating to Sharing: 'I often exchange information with the people with whom I work regularly' (item 7, mean=4.56), 'In my work unit, I am the person that people come to for information' (item 9, mean=4.21). However, the situation was different when sharing with citizens, customers or clients outside the organization (item 10, mean=3.24). There was also agreement with statements on Proactiveness, with respondents indicating that they used information to enhance their organization's products, services and processes (item 6, mean=4.17). Mean responses for the Transparency items showed moderate agreement with statements that managers and supervisors encourage openness, and that information on failures or errors was acknowledged and addressed (items 1-3).

Items	Information Behaviors and Values - Descriptive Statistics	N	Mean	SD
	Transparency			
1	Managers and supervisors of my work unit encourage openness.	169	3.87	1.232
2	The people I work with regularly share information on errors or failures openly.	175	3.71	1.120
3	The people I work with regularly use information on failures or errors to address problems constructively.	173	3.79	1.178
	Proactiveness			
4	I actively seek out relevant information on changes and trends going on outside my organization.	176	3.46	1.251
5	I use information to respond to changes and developments going on outside my organization.	161	3.57	1.197
6	I use information to create or enhance my organization's products, services, and processes.	175	4.17	1.025
	Sharing			
7	I often exchange information with the people with whom I work regularly.	180	4.56	.778
8	I often exchange information with people outside of my regular work unit but within my organization.	180	3.36	1.213
9	In my work unit, I am a person that people come to often for information.	180	4.21	.973
10	I often exchange information with citizens, customers, or clients outside my organization.	174	3.24	1.360
11	I often exchange information with partner organizations.	174	3.33	1.310

Table 5. Information Behaviors and Values - Descriptive Statistics

4.4 Information Use Outcomes

Although Information Use Outcome questions consisted of only five items, we conducted factor analysis as part of scale development and validation. Inspection of the scree plot and principal component analysis suggested that the items load on only one factor with eigenvalue = 2.164, and this factor accounted for 43.3% of the common variance between items, with $\alpha = .66$ (Table 6).

Items	
I can quickly recognize the complexities in a situation and find a way of solving problems.	Principal component analysis extracts only one component with eigenvalue = 2.164; 43.27 percent of common variance)
My work tasks demand new, creative ideas and solutions.	
My work benefits my organization.	
I have influence over what happens within my work unit.	
Sharing information is critical to my being able to do my job.	
α = *.66 (Information Use Outcomes)*	

Table 6. Information Use Outcomes Factor Analysis

Table 7 shows the mean scores of respondents who indicated their agreement with given statements about information use outcomes on a scale where 1=Strongly Disagree, 3=Neutral, and 5=Strongly Agree. The scores indicate agreement (means greater than or close to 4.0) with all the statements on being able to solve problems (task performance), the work benefiting the organization (self-efficacy), and sharing information (social maintenance). (All items were negatively skewed, i.e. a long tail to the left; with positive kurtosis in most items, i.e. a pointed distribution.)

Items	N	Mean	SD
I can quickly recognize the complexities in a situation and find a way of solving problems.	178	4.01	.809
My work tasks demand new, creative ideas and solutions.	180	4.04	1.051
My work benefits my organization.	173	4.24	.812
I have influence over what happens within my work unit.	177	3.92	1.049
Sharing information is critical to my being able to do my job.	180	4.56	.771

Table 7. Information Use Outcomes Descriptive Statistics

4.5 Multivariate analysis

To create an aggregate score for information use outcome, item scores pertaining to the information use factor (Table 7) were summed. To create aggregate scores for each of the three information behaviors and values (Transparency, Sharing, Proactiveness), item scores pertaining to each factor were summed. Similarly, aggregate scores for IM-General were formed by adding their respective item scores. As indicated in the conceptual framework, we looked for relationships between the variables of Information Management, Information Culture (Information Behavior and Values), and Information Use Outcomes. Table 8 shows the correlations between these variables. Information Use Outcomes is significantly correlated with each of the three Information Behavior and Values. All correlations are in the expected direction (positive), with Sharing showing moderately strong correlation with Information Use Outcome. IM-General is positively but weakly correlated with Information Use Outcome.

	Use Outcome	Sharing	Transparency	Proactiveness	IM_General
Use Outcome	1	.461**	.364**	.331**	.268**
Sharing	.461**	1	.300**	.356**	.253**
Transparency	.364**	.300**	1	.049	.348**
Proactiveness	.331**	.356**	.049	1	.088
IM_General	.268**	.253**	.348**	.088	1

** Correlation is significant at the 0.01 level (2-tailed).

Table 8. Correlations between Information Use, Information Behaviors and Values, and IM variables

In order to examine the effect of each variable while controlling for the effect of the others, multiple regression of Information Use Outcome on the three Information Behavior and Values was performed. Table 9 shows the results. The model's adjusted R^2 is .29, and the F value for the model R^2 is significant at $p<.01$. The standardized regression coefficients of Sharing, Transparency, and Proactiveness are significant at $p<.05$. The coefficient of Sharing is the largest (*std* $\beta = .31$, $p<.01$). Table 10 shows a second regression model that includes IM - General: the *std* β of this new variable is not statistically significant.

Dependent Variable	Independent Variables	*Std* β	Sig.	Model Adj. R^2	F	Sig.
Info Use Outcome	Sharing	.314	.000	.292	25.520	.000
	Transparency	.260	.000			
	Proactiveness	.199	.004			

Table 9. Information Use Regression Model-1

Dependent Variable	Independent Variables	*Std β*	Sig.	Model Adj. R^2	F	Sig.
Info Use Outcome	Sharing	.300	.000	.295	19.613	.000
	Transparency	.234	.001			
	Proactiveness	.198	.004			
	IM – General	.087	.204			

Table 10. Information Use Regression Model-2

4.6 Obstacles

Respondents (87.3%) were asked to identify the obstacles to I&K sharing with the following question: "In your organization, what is the greatest impediment to sharing information and knowledge?" The 166 (87.3%) respondents who answered the question identified 217 obstacles (Table 11). No one major obstacle stands out in this organization. The two most mentioned factors are information difficulties (n=62, 28.6%) and lack of time (n= 48, 22.1%). Information difficulties is a category that groups seven factors dealing with difficulties in handling information such as the lack of I&K sharing between and within groups; information is power (e.g: use of information for personal advancement); information overload; information retrieval problems ("the left hand does not know what the right one is doing"); and the lack of competencies in using information products or services. Lack of time is a "single" category; therefore, while lack of time is the most unique cited obstacle by respondents, it does not stand out as being "the" factor.

Obstacles	**N**	**%**
Information difficulties	62	28.6
Lack of time	48	22.1
Organizational characteristics	33	15.2
Organizational culture	20	9.2
Problematic I&K sharing mechanisms	15	6.9
Problematic organizational procedures	13	6.0
Respondent doesn't know	5	2.3
Nature of information	4	1.8
None	3	1.4
Other	11	5.1
Coder doesn’t know	3	1.4
Total	217	100.0

Table 11. Perceived obstacles to I&K sharing

4.7 Incentives

Respondents were asked the following question: "In your organization, what is the greatest incentive to sharing information and knowledge?" The 164 respondents (86.3%) who answered the question identified 205 incentives. The presence of I&K mechanisms, such as formal face-to-face mechanisms, informal communication, information product/service/systems, mentoring, working in teams, and performance appraisal, were most often mentioned (n=94, 45.9%) (Table 12).

Incentives	N	%
I&K Sharing mechanisms	94	45.9
Work results	57	27.8
Supportive culture	18	8.8
Respondent doesn't know	8	3.9
Knowledge market	8	3.9
None	7	3.4
Other	12	5.9
Coder doesn't know	1	0.5
Total	205	100.0

Table 12. Perceived incentives to I&K sharing

4.8 Sources

Respondents were asked to identify at least one and up to three most important information sources for them to do their job. One hundred sixty-eight (168) respondents (88.42%) identified at least one source, 139 (73.1) identified at least two sources and 105 (55.2%) identified three sources. A total of 424 sources were identified. The most cited sources in this organization were information products, services and systems, which refer to recorded information such as online databases, intranet, corporate library, scientific literature, etc. (Table 13).

Generic sources	Specific sources	N	%
Information products, services, systems	Externally produced information products, services, systems	164	38.7
	Internally produced information products, services, systems	66	15.6
	Information products, services, systems not specified	10	2.4
	Total	240	56.6
Human sources	People inside the organization	95	22.4
	People outside the organization	30	7.1
	Self	4	0.9
	Total	129	30.4
Mechanisms		39	9.2
Other		3	0.7
Coder doesn't know		13	3.1
Total		424	100.0

Table 13. Most important sources

4.9 Information and knowledge sharing mechanisms

Respondents were asked to list the formal and informal ways that information and knowledge is shared in their organization and to indicate how useful each method was to them, from not very useful (1) to extremely useful (5). Respondents could identify up to 10 mechanisms. One hundred sixty-three (163) respondents (85.7%) identified at least one mechanism. Only 4 respondents identified up to 10 mechanisms. A total of 796 I&K sharing mechanisms were identified. Again, information products, services and systems were cited most often with Web information systems (intranet, Internet, email) being the most cited in that category (30.15%) (Table 14). Formal meetings were also cited, much more than informal/casual conversations.

Categories	N	%
Information products, services, systems	351	44.1
Meeting	244	30.7
Conversation	114	14.3
Miscellaneous	40	5.0
People	31	3.9
Other	14	1.8
Coder doesn't know	2	0.3
Total	796	100.0

Table 14. I&K sharing mechanisms

5. Discussion and conclusion

We may summarize the results of the study in terms of information use, information culture, and information management as follows. Employees of the organization believe that they can use information effectively to solve work problems, that their work benefits the organization, and that information sharing is critical to their being able to do their job.

These perceptions are rooted in an information culture of strongly held values relating to Sharing, Proactiveness, and Transparency. Together these three information values account for a significant proportion (29%) of the variance in information use outcomes. Sharing has the largest effect on information use outcomes. Employees perceive the organization as pursuing information management with a strong focus on the use of information technology and a work unit culture that promotes information sharing. The open-ended results support these findings. Information Management – General is significantly correlated with information use outcomes, although the coefficient is small (r = .27, Table 7). However, when included in a regression model on information use outcomes, the coefficient of the information management factor is not statistically significant.

If we compare the results of this organization with another one (a law firm) also studied, we observe that only one general factor of IM came out in this public organization. In the law firm, respondents identified a distinction between IM-Tacit and IM-Explicit (Choo et al. 2006). In the law firm, a fourth factor of information behaviors and values, Informality, came out in addition to Sharing, Transparency, and Proactiveness (Choo et al. 2006). The results to all closed and open-ended questions indicate the importance of recorded information and formal mechanisms for I&K transfer and sharing in this public organization. They also show how essential I&K sharing is to the employees' capacity to get their work done.

We can hypothesize that these results, as well as the differences observed between this organization and the law firm, reflect a scientific culture in a public organization, meaning that there is a need for valid information in addition to the necessity to formalize information and knowledge sharing practices and processes since, as a public organization, it is accountable to many stakeholders and thus subject to scrutiny. This suggests a difference in epistemic approach between the two organizations, resulting in contrasting information practices. We can also hypothesize that this organization might be moving towards a "hypertext organization" (Nonaka and Takeuchi, 1994): a synthesis of bureaucracy (which is appropriate to accumulate and exploit I&K and efficient) with the flexibility of work groups that facilitate I&K creation and sharing.

This study also supports Taylor's (1986, 1991) and Davenport's (1991) models of information use environment and information environment. It also provides support for the concept of informational culture. On a practical level, the picture that emerges of the information culture, values and behaviors of the organization can serve as a starting point to guide the development of its information strategy.

6. Notes

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