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Collaborative Technology Use in Organizations: A Typology

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ABSTRACT

Implementation of group support technologies is growing in terms of both spread and sophistication of capabilities. There is hence a strong need to understand the phenomenon better. One important aspect of understanding is to be able to adequately measure its use. This paper delineates a comprehensive yet practicable measure of collaborative technology (CT) use in organizations. Two parameters viz. scope and sophistication of use of CT are used and 2 x 2 grid has been developed. Qualitative data collected in two comparable organizations in the insurance industry in India is used to demonstrate the applicability of the typology. The purpose of the framework is to help researchers and managers in assessing and measuring CT use in organizations and adopt suitable mechanisms to shift to an appropriate level.

Keywords

Collaborative Technology, Adoption, Use, Case Study.

INTRODUCTION

Collaborative technology (CT) in an organization can be defined as a collective system of interactive computer-based tools that facilitate a variety of group tasks. Use of technology support for collaborative work is believed to increase productivity in organizations. With the growing implementation of group support technologies in different forms in organizations, there is a strong need to understand the phenomenon better. An enhanced understanding of use of a particular technological infrastructure arms us with the ability to monitor, control, support, thus manage the technology better. Without sufficient understanding of factors driving and impeding use of technology, organizations will fail in their attempts to wring the best out of technology investments. The first step towards such understanding is to clearly define a measure for technology use in organizations.

In this paper, an attempt is made to develop a comprehensive yet practicable measure of CT use in organizations. Using this measure, a typology of organizational task groups has been developed which would help organizations differentiate groups based on their level of use of CT.

LITERATURE REVIEW

The purpose of this literature review section is to provide a flavor of the different measures available in the existing research literature on IT use and specifically CT use.

Measuring IT Use

IT has the potential to create a strategic impact on organizations. But benefits from IT investments can be reaped only if users' unwillingness to accept and use available systems is mitigated (Bowen, 1986; Igbaria, Iivari and Maragahh, 1995). IS research has investigated individual, organizational and technological variables that influence IT adoption, acceptance or use [for a detailed review see Mahmood, Hall and Swanberg (2001)] thus emphasizing the need to measure use.

Lucas (1975) strongly encouraged the measurement of IS usage, because, if a system is not adequately used it cannot be considered successful. Many IS researchers have further extended this argument. Davis (1989), for instance, felt the need for a measure to predict and explain system use and proposed the Technology Acceptance Model (TAM).

IS Research has pointed out the need to segregate subjective versus objective measure of IT use (Straub, Limayem and Karahanna, 1995). While a combination of subjective and objective measures may prove more realistic, it is important to understand the implications of using either. In the next section we review select literature on CT adoption and use.

Author	Phenomenon Studied	Operational Measures	Measured	Objective/ Subjective
Mackay (1988)	Diversity in Email use	Frequency	Number of mail messages sent and received	QD
		Extent of use	Mail folders, Distribution lists	QD
		Purpose of use	Description of use	QD
Hart and Saunders (1997)	EDI Adoption and Use	Diversity	Number of Different types of transaction sets	Suggested
		Breadth	Number of EDI partners	Suggested
		Depth	Level of Network Connection	Suggested
		Volume	Percentage of Total EDI documents represented	Suggested
Lou and Scamell (1996)	Groupware Use (Lotus Notes)	Level of use	Average number of hours used	SRQ
		Level of use	Average Connection Time per week	CM
Kanungo (1998)	Network-based computer use	Application Portfolio	List of network applications	
		Frequency of Use	Number of times accessed	SRQ
		Duration	Average time spent	SRQ
		Geographical extent	Within same building/ city/ country etc.	SRQ
Staples and Jarvenpaa (2000)	Use of Collaborative Media	Proportion of Time	Estimated Proportion of Total Time spent	SRQ
		Frequency	to contact people and share information	SRQ
		Frequency	to search and gather electronic information	SRQ
		Frequency	of publishing and storing electronic information	SRQ
Eder and Igbaria (2001)	Diffusion and Infusion of Intranet	Diffusion	Departments implemented at least one intranet application	SRQ
		Infusion	Deployment Levels : High - interface to back-end applications Medium - groupware and collaborative applications Low - one-way communication	SRQ
Horton et al. (2001)	Intranet Usage	Intranet File Accessing	Actual Usage - Current, 2 months, 5 months Perceived Usage	CM SRQ
Dasgupta et al. (2002)	Use of E-Collaboration Technology	Usage Level (Prometheus) - Total	Total Usage of the system	CM
		Usage Level (Prometheus) - File	Usage of File Exchange Capabilities of the system	CM
		Proficiency Level	Advanced - Used Before / Novice - First timers	SRQ
Limayem and Hirt (2003)	IS Usage (Webboard)	Access	Number of times accessed	SRQ
		Use	Number of messages posted	SRQ

Table 1: Sample Studies on the Use of Collaborative Technology

Collaborative Technology Adoption and Use

Orlikowski (1992) in her description of groupware implementation in an organization highlighted that implementation of groupware does not guarantee its use. Evolution of use of CT in organizations has been clearly pointed out by authors (see Karsten and Jones, 1998 for instance) where they mention that during the initial phases, the use of the groupware was fairly restricted, while in later phases CT use was higher.

To measure use of CT in organizations, studies have used multiple dimensions including frequency, geographical extent, time spent, application portfolio, average session length, connection time, number of messages sent, received or posted, amount of file accessing, type of use, group participation, purpose of use, proficiency level, deployment levels, etc. An illustrative list of studies is given in Table 1.

A comprehensive measure of CT use must include subjective and objective measures. Group task characteristics determine the extent and nature of potential CT support. Therefore, CT use has to be analyzed only in the context of specific group task. Based on these inferences, the following section delineates a measure of CT use in organizations.

A MEASURE OF USE

CT is used among members of an organizational group to perform various group tasks. For the purpose of this study, we define unit of analysis as the “task group”. A task group can be defined as a group of employees who are required by their organizational roles to communicate with each other in order to accomplish a given task. While the definition is not exhaustive and does not attempt to cover all groups which use CT for various purposes, it must be remembered that the purpose here is to be able to describe, measure and categorize CT use. In defining ‘task’ performed by groups therefore, the main focus is on decision tasks as they are likely to have greater potential for sophisticated technology support as they encompass information sharing, information analysis and management.

As mentioned earlier, CT in an organization can be defined as a collective system of interactive computer-based tools that facilitate a varied set of group tasks. The term CT thus includes the hardware, software, network and support infrastructure. It thus covers the entire spectrum of electronic mailing systems, bulletin boards, intranets and extranets, messaging systems, group support systems, decision rooms, computer conferencing tools, computer-based video-conferencing systems, etc. Extant literature has focused on either specific GDSS applications such as decision rooms, computer conferencing or on technology such as groupware, e-mail, bulletin boards, etc. There is absence of studies that have examined CT as a comprehensive class of IT applications. As a first step toward such a study, this paper attempts to develop a measure for CT use in organizational task-groups.

“Use of CT” refers to the extent of utilization of CT by group members to perform the task set before them. In order to be able to more clearly distinguish the level of use by different groups, two constructs can be used – Scope of Use and Sophistication of Activity performed. The following section presents two cases to illustrate and explain the development of the measure of CT use.

RESEARCH METHODOLOGY

In order to provide insights into the phenomenon of use of CT in organizations and to generalize, this study employed a research strategy of case studies. This methodology has been termed “collective case study” where cases provide a supportive role and facilitate the understanding of the said phenomenon (Stake, 2000). Choice of multiple case studies may help in better understanding and hence better theorizing. In this paper two descriptive case studies have been presented from two organizations. Data was collected mainly using in-depth interviews and where possible, corroborated using demonstrations of technology use. While the two dimensions of the framework have been measured largely through analysis of interviews, it is also possible to develop Likert-scale based measures to assess the same based on the lower level variables given.

While this study is complete in all methodological aspects, it is currently aimed at addressing only a portion of the typology. The authors hope that subsequent work will cover the entire factorial design. The aim is to highlight the applicability of the framework in understanding the level of use of CT. A short description of the two cases is first presented and is followed by the development of the two constructs and the consequent typology arising from the constructs.

Company 1 – Cover Corporation of India (CCI):

Background

Cover Corporation of India (CCI) is among the larger insurance companies in India. The main business of CCI is retail life insurance. The organization is structured with a central office in Mumbai, 7 zones across the country, with each zone having around 18-22 divisional offices. Each divisional office further caters to around 18-20 branches. While every division is headed by a senior divisional manager or a divisional manager, he is helped by a marketing manager, manager-claims and accounts manager and other departmental managers. Each branch is headed by a branch manager and is manned by administrative officers and other administrative staff.

The main activity of CCI – selling and maintaining insurance policies of retail customers is handled by assistant branch managers along with Development Officers (DO) who are in charge of monitoring and introducing agents. While the entire field operation is outsourced to agents, the actual underwriting, finalization of policy, premium collection, claims processing etc. is handled by internal staff at the appropriate locations. Since agents and development officers are not employees of the organization, the branch and divisional managers are geared towards monitoring their performance.

The task group

The specific group chosen for study was the group consisting of a senior divisional manager, a divisional marketing manager and 2 branch managers. The group's main task was to monitor performance of individual branches by analyzing effectiveness of branches. This was accomplished through discussing and sharing related information.

Collaborative Technology Use at CCI

Information regarding premium collection, new business development, claims processing etc. is provided by the branches to the divisional office on a daily basis. The branches are connected to the WAN/MAN through VSAT/ leased line connectivity. The branches therefore send the data through email. Aggregated information on premium collection is available to the divisional manager on a weekly basis so as to enable him to be aware of the performance of the branches.

Some members who are more inclined to use CT for the task described, perform activities such as sending and receiving electronic mails along with file attachments, access intranets, and bulletin boards, etc. Further, the group does use IT for monitoring the performance of branches under a particular division but very infrequently. The preferred mode of information communication was the telephone and fax. Only when data needs to be transferred and when appropriate IT personnel are available, was CT used.

Company 2 – Secure Life Insurance Limited (SeLIL)

Background

SeLIL is in the insurance business since 2000 and mainly focuses on life insurance. SeLIL offers a broad array of life insurance coverage to both individuals and groups. The organization offers products in 18 cities in India and functions on the basis of four regions – North, East, West and South. While each region has a zone head, there are city heads for each of the 18 cities. Each city has multiple branches and each branch has a branch head who is assisted by Agency Development Managers (ADM) who are responsible for managing the business associates and agents in the agency network. Business Associates (BA) are non-SeLIL employees whose main job is to procure and retain agents who actually market and sell SeLIL's life insurance products.

The Task Group

The group consisted of a Zonal Head, City Head and the Head – Agency Administration along with 7 ADMs. The Head-Agency Administration was responsible for overseeing the smooth functioning of the ADMs, the agent network along with the Business Associates, specifically the availability of data support for ADMs and BAs through information technology. He also coordinated with the central IT department at HO-Mumbai to ensure the timely availability of all agent related information.

The main tasks performed by the specific group were management of activities of agents and BAs. The city-head, the agency administration, the respective ADMs and the BAs were involved in both the tasks.

Collaborative Technology Use at SeLIL

The IT infrastructure available includes a PC at the desk of all ADMs and common pool of PCs available for access through password protected network connection to all Business Associates and Agents. All managerial personnel also have access to the local area network through individual PCs available on their desks. Standard packages such as office productivity tools are available for use by all. In addition, access to agent-wise performance data is available to respective managers through the applications and through every-day reports prepared by the IT division. Each ADM can view his data and compare and view other ADMs' data also.

Company e-mail accounts are available to Business Associates and ADMs, executive and other managerial personnel. All internal communication is through e-mail and extensive use of this facility is encouraged. While daily performance reports are sent to all members of the chosen group through email by the Agency Administration, other communication such as information about new schemes, etc. are also sent through electronic mail system. Users also extensively use the scheduler, address book facilities available on the email system. They also browse through previous emails and use search facilities extensively. Most of the group members also maintain their own local stores of received files and share analyzed data amongst themselves.

While all PCs are connected through the LAN, OS-based file sharing is not common. Instead, members of the group are more comfortable sending files as attachments through email. Other collaborative technologies such as instant messengers etc. are not common. While no synchronous CT applications are used, asynchronous applications are fairly well used, especially for information sharing and information management. The group information management is done mainly by the support personnel.

In the following section two constructs are developed to enable us to measure CT use in organizations. In order to help us understand the constructs better, we use the above two illustrative cases. This, we hope will also highlight applicability of the constructs.

Scope of Use

Scope of Use represents intensity and spread of CT use. Groups differ on the scope of use of CT. In order to capture this difference, two variables can be used

1. Frequency of Use of CT for the task
2. Proportion of task performed using the CT

Frequency of use refers to regularity of utilization of CT by the group for the task. The second variable, "proportion of task performed using CT" refers to the extent of the task performed on the CT. We can reason that scope of use of CT by a group can be measured by the combination of the two variables - frequency of use and the proportion of task performed using CT. When value of any one of the two variables is "high", the scope of use can be considered "high". There would thus be four possible states of scope of use as depicted in Table 2.

Frequency	Proportion of Task	Scope of Use
Low	Low	Low
Low	High	High
High	Low	High
High	High	High

Table 2: States of Scope of Use

Operationalization of 'Scope':

The two variables which form part of the 'scope' construct can be operationalized in the following manner. The 'frequency' variable can be measured as the number of times the group uses CT towards performing the chosen task in a given period of time. While this variable can be measured objectively through computer generated reports, the variable can also be measured subjectively through perceived frequency measures.

The second variable 'proportion of task' captures the amount to which the group uses the CT to perform its task. A task may have multiple components/constituents of smaller tasks. While a group may choose to perform some constituents of the task through the CT, it may also perform some others through other media such as face-to-face or telephone. It is possible hence, to list the lowest level constituents of the group task and analyse the use of CT with respect to each of these group task constituents.

Application of the Construct

Let us now understand the application of this measure using the illustrative cases described above. In CCI, the frequency of use of CT is low as other media such as fax, telephone etc. are more preferred. Members of the group occasionally use CT when support personnel are available. They thus perform a very small or insignificant portion of the task on the CT. Since frequency and proportion of task performed on the CT are both "low", the overall scope of use can be said to be "low". On the other hand, in SeLIL, the group appears to be more comfortable with the use of CT in comparison to the group at CCI. The group at SeLIL uses CT very frequently to perform the group task and a moderately high proportion of the task is performed through the CT. The scope of use therefore is "high".

While the measure "Scope of Use" captures extent of use, it is quite possible that a group may use the technology to perform simple activities quite frequently. While such a group can be considered a set of frequent users, it cannot be considered a set of sophisticated or "high-level" users. For example, members of a particular group may send and receive e-mails very frequently, but may not use more advanced facilities such as synchronous messaging or file sharing. To capture this difference, we use the variable "Sophistication of Use".

Sophistication of Use

It is possible to define use of CT in the context of following types of group activities. This classification of activities is based on 'roles' played by managers (Mintzberg, 1973).

- a. Information sharing
- b. Information Management
- c. Group Information Management
- d. Synchronous Group Decision Making

Definitions of the above listed four types of group activities and examples of the same are specified in Table 3. While prior research on group tasks (McGrath, 1984; Zigurs and Buckland, 1998) have focused on the objectives of the task performed, this classification is based on lower level activities performed by the group. Hence we believe, this classification is more generic and therefore applicable to a larger set of group tasks encompassing the taxonomies in existing research.

Operationalization of 'Sophistication':

The four classes of activities mentioned above are in increasing order of complexity. A group that performs a higher level of activity on CT can hence be considered a more sophisticated set of users of the technology. The complexity of these classes of activities arises from three dimensions component complexity (referring to the number of information cues and number of distinct acts performed), coordinative complexity (referring to the number of members involved and number of iterations involved) and dynamic complexity (referring to the level of synchronicity in the performance of the activity). These dimensions have been dealt with in detail in Wood (1986) and subsequently adapted with variations in Campbell (1988) and Zigurs and Buckland (1998). Adapting these to group activity, we present here a theoretical analysis of the overall complexity of the group activity based on these dimensions as described in Table 4. Due to limitations on space, detailed explanations of these dimensions are not provided in this paper, but can be made available on request.

Activity	Definition	Examples
Information Sharing	Refers to those group activities where group members communicate with each other and share task-related information through asynchronous technologies such as electronic mails or electronic bulletin boards	Sending electronic mails: One to One
		Sending electronic mails: One to Many
		Sending electronic mails: One to One, One to Many, with file attachments
		Sending electronic mails using a mail group
		Pasting notices on an electronic bulletin board
Information Management	Pertains to those activities performed by an individual group member in order to organize the current and archival information generated through group interactions in the course of the performance of the task.	Accessing and Reading mails or notices
		Filing cabinet and work-in-progress
		Receiving data and classifying them
		Redirecting mail
		Making rules for easy storing of messages
Group Information Management	Refers to activities that help organize and administrate the group and information about and for the group.	Searching for previous mails
		Creating the online group and maintaining the group address book
		Group meeting scheduler
		Group data maintenance and group administration
		Accessing data from other computers
Synchronous Group Decision Making	Refers to the group communication, analysis and decision making activities that are performed online in a synchronous manner	Maintaining one's own data to be shared with other group members
		Synchronous group discussions
		Group voting on issues
		Group data analysis
		Group model building

Table 3: Types of Group Activities

Complexity Dimension Class of Activity	Component Complexity	Coordinative Complexity	Dynamic Complexity	Overall Complexity
Information Sharing	Low	Low	Low	Low
Information Management	Medium	Low	Low	Low/Medium
Group Information Management	Medium	High	Low	Medium/High
Synchronous Group Decision Making	High	High	High	High

Table 4: Complexity of Group Activity

In order to objectively measure the sophistication of use of CT, one can observe the performance of the various activities listed in table 3. Using this detailed listing of activities performed, it is possible to precisely arrive at the group’s level of sophistication of use. Given below, is a brief application of the construct to the illustrative cases described above.

Application of the Construct

At CCI, if and when members use the CT their use is largely restricted to email and sending files as attachments. In our classification of activities their use is restricted to “Information Sharing”. Their sophistication of CT use therefore can be described as “low”. In contrast to this, the sophistication of use at SeLIL is low/medium. CT at SeLIL is used not only for email, but also for information sharing activities and some information management activities as described above. The sophistication therefore can be described as “low/medium”.

As illustrated above, groups differ in their “Scope of Use” of CT and “Sophistication of Use”. The importance of using these two constructs over other constructs used in existing literature is three-fold. First, “scale” and “sophistication” depict “quantity” and “quality” (or nature of use) respectively. Second, while other measures described in literature aim to measure the level of use, these two constructs only aim to broadly grade the use of CT using a continuum, the main purpose being to judge the extent of use so as to determine the antecedents of such level of use. Third, CT can be considered a specific instance of end-user computing (EUC) and quality and quantity of CT use are expressions of evolution and diffusion of the corresponding EU activity (Vaidya, 1991). Given these three specific reasons, the two constructs “scope” and “sophistication” seem appropriate and apt in describing the level of use of CT by task groups in organizations.

CLASSIFICATION OF GROUPS

It is possible to map groups using CT onto a grid, depending on whether the values of Scope of Use and Sophistication of Use are ‘high’ or ‘low’. The bases for defining the classes of groups are the following:

1. The two dimensions of Level of Use of CT, that is, Scope and Sophistication of Use;
2. The two possible values for each of these dimensions, that is high and low.

Using the combination of these two aspects, it is possible to arrive at four distinct categories of groups which reflect four types of CT use. These can be represented as in Figure 1 below. A more detailed description of the individual classes/types follows.

Class 1: Amateurs

Low Scope/ Low Sophistication: This group performs certain activities, which are inherently low in complexity, using CT. Also, the group uses CT quite infrequently. A good example would be a group where the members may occasionally send emails to each other or post occasional notices on a bulletin board. Such groups are likely to have alternative media of group task execution such as face-to-face or telephone. This type of groups is likely to be found in relatively small organizations, organizations that are not geographically spread, or organizations which do not have a strong orientation toward using IT. A few public sector organizations or large, mature traditional organizations particularly in developing countries would have groups which still prefer face-to-face meetings or telephonic conversations to the use of CT either due to cultural considerations or due to low inclination to use information technology.

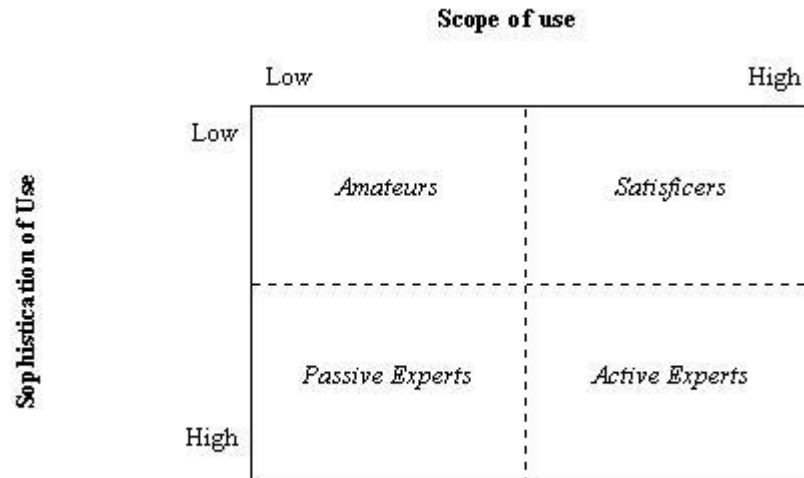


Figure 1: Classification of Groups

Class 2: Passive Experts

Low Scope/ High Sophistication: A group in this state uses CT for performing more complex tasks but not frequently. The group is also likely to perform a relatively low proportion of the entire group task through CT. But whatever proportion of task is performed on the CT, the group uses the CT to a high level of sophistication. A typical example would be a group where members perform network file sharing, group data analysis or synchronous group decision making. While high levels of positive orientation towards CT may be the reason, it is quite possible that the group may experience low pressures for frequent use or the task may have low potential for greater scope of use.

Class 3: Satisficers

High Scope/Low Sophistication: This group is a frequent user of CT but performs less complex group activities. Where the use of CT is mandatory and/or a significant portion of the group task related information is communicated through the technology, members are likely to be frequent users but perform less complex activities. A typical example would be a group which is geographically or temporally dispersed but not too technology-savvy. Such a group would hence be forced to use the CT but the members' low inclination would restrain them from performing more complex activities on the technology.

Class 4: Active Experts

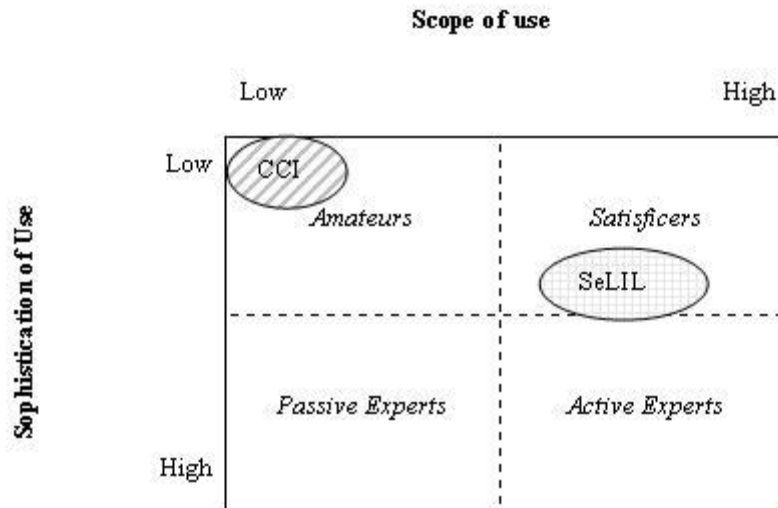
High Scope/High Sophistication: Such a group is usually an "expert" group, where members of the group extensively use CT to perform activities which can be considered as highly complex in nature. A very good example of this class of groups would be a virtual software project or consulting team which uses CT to its maximum potential. They perform activities such as file sharing, application sharing, group data analysis, group model building and synchronous discussions very often and through such activities perform most of the group task.

The four classes of groups named Amateurs, Passive Experts, Satisficers and Active Experts, thus reflect the four possible levels of CT use.

Classification of illustrative case groups - CCI and SeLIL:

The previous sections on the two constructs described the "scope" and "sophistication" of the two illustrative case groups. The CCI group was found to have a "low" scope in their use of CT while the SeLIL group was found to have a "high" scope of use of CT. On the other hand, along the dimension "sophistication", CCI group can be categorized as "low" as they mainly perform information sharing activities. Information sharing, some information management and some group information management activities are performed by the group at SeLIL. The group can therefore be categorized as being "low/medium" in their sophistication of use.

Using the grid to position the two groups, one can possibly classify the group at CCI and the group at SeLIL as "Amateurs" and "Satisficers" respectively. Figure 2 plots the two groups in the typology grid highlighting differences between the two in their level of use of CT.



The typology thus helps us analyze the level of use of CT by organization task groups. While further analysis may be required to decipher specific reasons for positions on the grid, it can be said that although specific task characteristics play a dominant role in effecting the level of use of IT support, organizational characteristics such as culture, IT orientation, etc. also influence it.

CONCLUSION

This paper presents a framework to classify organizational task groups on the basis of the scope and sophistication of their use of CT. The framework has important implications for IS researchers and practitioners. On the one hand, it would help researchers measure and analyze use of CT by organizational groups. On the other, managers can utilize the framework to map their task groups in particular and departments in general on the grid. Such a mapping is essential to be able to determine the causal factors that force the group to its current position on the grid. A further analysis would help managers adopt certain measures and mechanisms to enhance and improve use of CT among group members.

POSSIBLE DIRECTIONS FOR FUTURE RESEARCH

As mentioned earlier, it is necessary to identify groups belonging to the other two categories for which case studies have not been described in this paper. A comparative analysis of all four types will then be possible. This will aid in unearthing the reasons for the position of groups on the grid and diagnosing and predicting levels of CT use in organizations. In order to completely understand the phenomenon of CT use, it is important to be able to describe the basic factors that determine the use of CT by groups. There is thus a need for a comprehensive framework. Further, we also need to delineate the management mechanisms that influence adoption of CT and augment its use among organizational groups. This is an important step in enhancing the effectiveness of groups using CT.

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