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Understanding Sophistication in Collaborative Technology Use

by

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ABSTRACT

Collaborative technology is an IT-based infrastructural application which enables organizations to increase operational efficiencies and effectivene

INTRODUCTION

Organizations today are increasingly facing challenges from their environment and are therefore being forced to adopt various technologies and management mechanisms which aid them in responding to such challenges. One such technology which is believed to increase productivity, and enable faster and easier work execution is collaborative technology.

Collaborative technology has become an important medium of group work in organizations mainly due to the rapid dissemination of networks and the internet (Sarker, Valacich & Sarker,

The purpose of this paper is to present the results of an exploratory investigation of how and why individuals and therefore groups vary in their use of collaborative technology. In the context of collaborative technology, use can be defined as *employment of one or more features of a system by the members of the group to perform the group task.* We define the term collaborative technology to include the hardware, software and network infrastructure which support a variety of group tasks in the organization. It thus covers the entire spectrum of electronic mailing systems, bulletin boards, intranets and extranets, messaging systems, group support systems,

problem solving, increasing involvement of individuals (Nosek, 1998) and thus their commitment to the organization.

The coming of computer based networks in the 80s, and the Internet in the 90s provided groups in organizations, with technology support for their tasks. The following section examines literature on the use of collaborative technology.

Use of Collaborative Technology

Any IT-infrastructural technology or application has the potential to be used in a myriad of ways. The manner in which the user utilises the capabilities of the technology is restricted largely only by his or her imagination and the broad spectrum of facilities and features provided by the technology.

environmental variables and excess dependence on experimental research approaches (Qureshi and Vogel, 2001; Powell, Piccoli and Ives, 2004; Lewis, Bajwa, Pervan, King and Munkvold, 2007).

Factors affecting Use

In an attempt to understand the various causal factors influencing use of collaborative technology, models developed for technology adoption and use in general and IT use in particular, have been variedly applied in the context of collaborative technology. TAM, for instance has been applied and tested for collaborative technology such as intranets (Horton, Buck, Waterson & Clegg, 2001), emails (Burton-Jones & Hubona, 2005), courseware management tools (Dasgupta, Granger & McGarry, 2002) and negotiation support systems (Lim, 2003). Going beyond TAM, structuration theories (DeSanctis & Poole, 1994) have argued that use of technology (created by an interaction of the organizational factors and the technology) is structured by the context over time. Van den Hooff, Groot & de Jonge (2005) presented a meta-analysis of various studies and theories on adoption and use of communication technologies.

Three broad areas of focus emerge when examining literature related to use of collaborative technology. These include task characteristics (see for instance, Pinsonneault & Kraemer, 1990; Maznevski & Chudoba, 2000), technology characteristics (such as in Sarker et al., 2005) and group related aspects (Turner & Turner, 2002; Lerouge, Blanton & Kittner, 2004; Sarker et al., 2005). Group related aspects studied have also included social and cultural variables (Zack & McKenney, 1995) highlighting the importance of the social context and the paramount role of an organization's cultural environment in influencing adequate and appropriate use of groupware (Orlikowski, 1992; Lim, 2003). A more recent study examined barriers to adoption and use of collaborative technology and suggested that barriers such as organizational incentives to use, cost of using the technology, complexity of the technology itself, absence of perceived benefits and compatibility with existing meeting methods and power structures were amongst the more significant issues (Lewis, et. al., 2007). Many authors have also suggested ways of improving use of collaborative technology, such as through training, support (Orlikowski, 1992; Vandenbosch & Ginzberg, 1996), enhancing employee willingness (Yen, Wen, Lin & Chou, 1999) and cultural fit (Vandenbosch & Ginzberg, 1996).

Based on various issues raised in existing literature, we identified possible research issues and an appropriate research method to analyse and understand the factors influencing sophistication of collaborative technology use by groups.

Site 1 – National Finance & Investments

National Finance & Investments (NFI) is a large bank, set up in the early 90s, having a network of close to 200 branch offices and 1200 ATMs. The group chosen for study is the Product Development Group which is responsible for developing, evaluating, executing and monitoring credit and non-credit loans offered to small and medium scale enterprises. Customized products are specifically developed and evaluated for particular clients. The task essentially involves ascertaining clients' requirements, analyzing client and project related information and evaluating the risks involved. Finally a decision is taken on whether to extend credit and if so, the type of credit.

transfers, etc. The organization relies on individual discretion on what may be considered acceptable norms for collaborative technology use.

Site 2 – Eastern News Express

Eastern News Express (ENE) is a large media house with firms operating in print, television and radio media industries. The focus of our study is a content team of ENE whose main task is to ensure availability of adequate, appropriate and verified content for ENE's flagship newspaper from various sources. The team is composed of senior reporters and a chief reporter. Each

Site 3 – Harp Cooling Towers

Harp Cooling Towers (HCT) is in the business of manufacturing, selling and servicing industrial cooling towers, a high-value accessory for manufacturing industries such as – chemicals, power generation, oil, foundries, refrigeration, pulp and paper mills etc.

The group chosen for our study – the Materials Planning Group (MPG) - consists of the Materials Manager, Purchase Manager, Finance Manager and the Manager - Factory. The MPG's main task is to ensure availability of materials required for manufacturing. When an order is procured for manufacture, a delivery date is fixed and the marketing/sales department provides the details of the order – specifications, customer details and the delivery details - to the respective factory. The factory manager then in conjunction with the materials manager at the factory, the manufacturing engineers and the stocks assistant, decides the details of materials required including materials available in the stores and those that need to be freshly procured. While some of the inventory details are available online in the factory site inventory database, the Factory Manager prefers to recheck the availability of materials manually so as to avoid a mismatch. The process of materials planning is done on an order-to-order basis and on time basis – i.e. beginning of every month. The details of materials required to be purchased is then communicated to the purchase manager at the head office, who in consultation with the factory manager decides on the purchase details such as vendor, specifications of product, requirement date, quantity etc.

The company has been progressing quite slowly in its IT investments.   While the top-management's orientation towards IT is not negative, it is not exceptionally encouraging. But the company has been consistently investing in IT resources, and now has a full-fledged IT department in place. The IT department has developed many IT applications in-house and maintains these applications, trouble-shoots users' problems and entertains their requests for improving the applications. As a result of the top-management's reactive approach to IT, a conscious strategic IT plan is not in place, but certain IT policies and plans have been framed and implemented by the middle-level managers and the IT department. The adoption and use of collaborative technology has also followed the same path.

The organization has provided internal electronic mail access to executives and managers and select administrative staff at the head office and for select managerial staff at different factory locations. While communication between factories and head office is also through snail mail, telephone and facsimile; electronic mail is very regularly used. Factory data are transferred to the head office on a frequent basis using email file attachments. A large amount

Using both existing literature on the use of IT and collaborative technology and our analysis of the field data, we created a classification of group information activities. This presents a natural and meaningful context for defining the use of collaborative technology along the 'sophistication' dimension. The types of group information activities include:-

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

The classification of activities is based on 'roles' played by managers. Managers play three dominant roles in organizations. They are interpersonal, informational and decisional (Mintzberg, 1975). Definitions of the above listed four types of group information activities and examples of the same are specified in Table 2.

These four classes of activities are in the increasing order of complexity. A group that performs an activity on collaborative technology at a higher level of complexity can be considered a more sophisticated set of users of the technology. Th

required; and the *interdependence across members* which refers to the relationship between the activities of different people as greater interdependence across different people's activities requires greater amount of coordination. Table 4 describes the member complexity of the four group information activities.

Table 5: Dimensions of Coordinative Complexity – Iterative Complexity

Complexity Dimension / *Class of Activity*	*No. of Iterations*	*Interde-pendence*	*Iterative Complexity*
Targeted Information Sharing	Low	Low	Low
Information Management	Low	Low	Low
Group Information Management	High	Low	High
Group Decision Making	High	High	High

Iterative complexity on the other hand refers to the complexity arising out of the repetitive nature of some activities. Iterative complexity can be measured using two dimensions, the *number of iterations* and the *interdependence across iterations* in a manner similar to member complexity. Table 5 describes the iterative complexity of the four group information activities. Table 6 combines member and iterative complexity into overall coordinative complexity.

Table 6: Dimensions of Coordinative Complexity

Complexity Dimension / *Class of Activity*	*Member Complexity*	*Iterative Complexity*	*Coordinative Complexity*
Targeted Information Sharing	Low	Low	Low
Information Management	Low	Low	Low
Group Information Management	High	High	High
Group Decision Making	High	High	High

Dynamic complexity refers to the extent of changes in information cues or in the relationships between different steps or acts in the activity. In collaborative work, synchronicity of activities increases the dynamic complexity because the more synchronous the group activities are, greater is the need to process information cues. Among the various group information activities, Group Decision Making activities exhibit 'high' dynamic complexity whereas the other three, i.e. information sharing, information management and group information management do not.

Table 7: Overall Complexity of the Group Information Activities

	Component Complexity	Coordinative Complexity	Dynamic Complexity	Overall Complexity

But in dynamic organizational environments, the uncertainty is likely to lead to increased need for faster responses and therefore greater coordination requirements. Use of collaborative technology may be seen as a means of meeting the demands of a dynamic situation, by rendering possible increased coordination and faster responses by groups. This was especially seen in the product development group at National who were pressured for quick responses, by clients who had alternative options. A senior reporter from ENE's content team explained – "*content team at any newspaper firm is under tremendous pressure to create the finished product as quickly as possible. Life of news is very short and competition is intense*". On the other hand the MPG at Harp and the BAT at Vie had relatively less response time requirements.

Geographic Dispersion

Geographically dispersed units or divisions are fairly common amongst larger organizations today. With the growing geographic dispersion, communication infrastructure has become a necessity (Sarbough-Thomspon & Feldman, 1998). This is also a result of distribution of organizational tasks. When the spatial differentiation of the organization is high and as a result, internal processes of the organization are spread geographically, there is a need for members of the organization to use technology to collaborate and communicate laterally. Alternatives to the use of such communication technology would be co-location of members or intentional introduction of redundancy, both of which may be less cost-effective.

Members of the BAT at Vie are geographically dispersed though within the same large city, while members of the content team at Eastern are very often temporally and geographically separated. A reporter at Eastern said "*this is a newspaper firm. You never know when anyone is awake! There is tremendous mismatch in work times especially with reporters in the news site. We needed a technology that allows us the freedom to put in our stories when we are done with them from wherever we are*". The MPG at Harp is dispersed across locations while the members of the PDG at National are located across buildings within a single area.

The need for technology support therefore can arise from one or more of the above factors. A group experiencing pressures due to any one of these reasons is likely to be coerced into using collaborative technology for supporting the group task. Thus,

> *Proposition 1: Higher the need for technology support, higher is the level of sophistication of use of collaborative technology.*

Cultural Orientation

Group culture

It is quite common to find groups which vary in their level of collectivistic orientation. Some groups have a tendency to be more collaborative in their approach to task execution than others. A group's culture may exhibit passive, negative or positive orientation towards collaboration. Groups exhibiting a passive group culture towards collaboration tend to work cohesively only

need to be covered. Sometimes the situation is intense, but when roles are clear we are more collaborative." At Harp, the materials planning group is less competitive and the decision making style can be classified as, at best, cooperative. The decision making style of the BAT at Vie can also be classified as cooperative as a manager put it "*we all understand that ultimately it's the agents' performance we have to monitor. To that effect we tend to be collaborative in arriving at various means to achieve success*".

Organization Culture

Group's cultural orientation is not determined solely by the group's own characteristics. It is also affected by the organizational environment in which the group functions, through the formal and informal incentives for collaboration. An organization's culture also influences technology assimilation (Hoffman & Klepper, 2000). A senior person at ENE said "*We need to have an optimal level of designated IT use for communication, but the choice of the media is largely based on a combination of the task and the* [organization] *culture*". Some organizations tend to encourage and create environments which are suitable for team work and group interactions, much more than some others which emphasise individual work. While explicit indications of such support may be available in the form of formal requirements and rewards for teamwork etc., implicit indications include perceived privileges such as membership in specific teams, degree of freedom and responsibility given to individuals. An organization culture that promotes collaborativeness encourages use of collaborative technology (Orlikowski, 1992).

It was found that in Vie, the general organization culture was one that was passive towards collaboration. While the organization did not offer any explicit incentives for collaboration, it did not offer any disincentives either. But at Eastern, Harp and National, employees were actively encouraged to collaborate. At Eastern, there were adviser teams which helped establish better one-to-one relationship between young reporters and senior reporters. Similarly at National, incentives were provided whenf tboss-sellig rf

Technology Drive

Users' IT Drive

A user's IT drive can be described as the inclination of the individual towards the use of IT. Individual demographic characteristics such as age, seniority, education and IT literacy level (Burton-Jones & Hubona, 2005), are highly likely to impact the group members' inclination to use IT. Individual users' IT orientation is also a result of other group members' interest in initiating colleagues into IT. This is especially true in the case of end-user computing (EUC) environments. End-users have been found to often learn faster to use the technology if 'taught' by peers and colleagues. This is more applicable in group-oriented technology environments

collaborative technology was advantageous. A senior reporter said "*information is our life blood. The content team's task is focussed on collation of information from various sources. Use of such a system is therefore, no doubt, tremendously advantageous*". On the other hand, members of BAT at Vie and MPG at Harp were far less convinced of any significant advantage that the collaborative technology offers over other technologies and media such as telephone or facsimile. A manager at Harp said "*we do see significant advantages from maintaining data on inventory. But since we are not really a massive organization where minor inconsistencies or discrepancies create huge losses, we are yet to see any significant benefits from IT-based collaborative technology applications. We still use the telephone and facsimile to keep track of day-to-day operations*".

Organizational IT Maturity

'Organizational IT Maturity' refers to the level of sophistication of use of IT, the evolutionary stage of IS in the organization and the extent of use of IT applications for strategic decision making. In other words, organizational IT maturity is a result of IT professionalism which refers to the level of 'professionalism in terms of technical competence and business understanding of IT' (Vaidya, 1990) exhibited by the organization. An organization exhibiting high IT maturity is characterised by high levels of awareness and knowledge about latest information technologies amongst employees, presence of powerful IT champions who actively encourage use of IT, existence and prevalence of innovative IT applications and solutions developed by organization members and high degree of comfort with the use of IT, in general.

Amongst the four research sites, National exhibited a high level of organizational IT maturity. Availability of IT-related services, drive to use IT and understanding of the potential strategic benefits of IT to the organization were visible in this case. On the other hand, at Vie, BAT members and IS professionals were far less knowledgeable about potential benefits from information systems for their organization and a clear understanding of possible IT support for their task was absent. At Harp, top management was hesitant to support IT investments and projects but was gradually changing. Finally, at Eastern, IT maturity of the organization was quite high especially since, Eastern was making an attempt to gain strategically from the use of IT. A senior person at Eastern said "*IT is a part and parcel of the organization, almost like an embedded fabric. Most of our organizational activities are IT-enabled.*"

A group's technology drive determined by the individual users' IT drive, the relative advantage of using collaborative technology as perceived by the group and the overall organizational IT maturity. Technology drive influences the group's level of sophistication in the use of collaborative technology as in

Proposition 3: Higher the technology drive, greater is the level of sophistication of use of collaborative technology.

DISCUSSION AND CONCLUSIONS

Collaborative technology has the potential to be

integrative framework of collaborative technology use is essential to understand the phenomenon. We have attempted to bridge the gap using a framework to understand the factors which influence the sophistication of use including the need for technology support, cultural orientation and
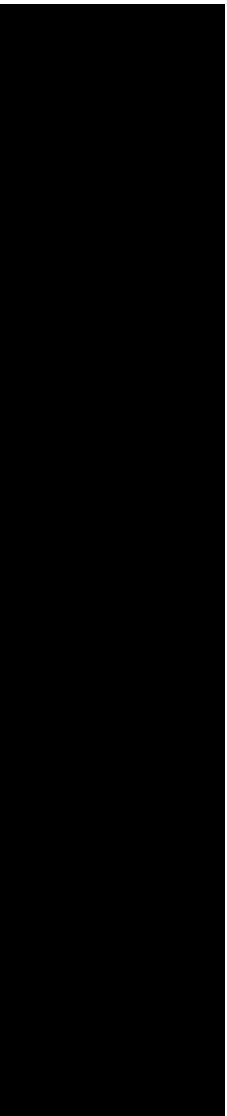
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