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TOWARDS A PROCESS MODEL OF MEDIA USAGE IN GLOBAL VIRTUAL TEAMS

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Abstract

In the networked world of today, global virtual teams (GVT) are becoming a common form of work structure. The geographic dispersion in GVT has led to members' high reliance on electronic communication media for collaboration and task performance. With advancements in ICT, the range of media to choose from has increased considerably. This complicates the process of selection and usage of media to serve different communication needs in GVT. Therefore we are motivated to investigate how GVT members perform the process of media selection and usage. This is achieved through an in-depth case study of three GVT. We conducted template coding of the teams' communications logs and lessons learnt papers, followed by cognitive mapping to derive the GVT media usage process model. The model can provide a basis for further empirical validation and deriving practical implications for GVT management.

Keywords: Global Virtual Team, Media, Media Usage, Process Model.

1 INTRODUCTION

Groups of geographically dispersed members who carry out interdependent tasks and use electronic media to communicate much more than face-to-face communication are an increasingly common form of work structure nowadays. This phenomenon of global virtual teams (GVT) is attributed primarily to the need for specialized expertise and globalization (Alavi & Tiwana 2002). In GVT, electronic communication media become an indispensable tool. While advances in ICT imply more media to choose from, the process of selecting the media becomes more complex. Interest in the study of media usage in GVT has increased among researchers (e.g. Majchrzak & Rice & Malhotra & King & Ba 2000; Maznevski & Chudoba 2000). Apart from traditional black box studies where variance theories are formulated to predict levels of outcomes from levels of predictor variables, researchers in this area are beginning to propose process theories which focus on sequences of events and states over time in order to explain how and why particular outcomes are reached (Mohr 1982).

In explaining a process, one may adopt the sequence method, structuration analysis, or a cognitive mapping approach (Van de Ven 1992). The sequence method has been used to describe phases of the media appropriation process in inter-organizational virtual teams (Majchrzak et al. 2000). However, the study did not explicitly spell out “how” and “why” these phases occur. Structuration analysis, specifically Adaptive Structuration Theory (DeSanctis & Poole 1994), has been employed (Maznevski et al. 2000) to capture interactions between structural elements (e.g., group characteristics, available technology) and process elements (e.g., media appropriation for decision processes) with respect to GVT media usage. However, the separation of institutional properties and actions in structuration analysis can be construed as artificial (Jones & Nandhakumar 1993). While cognitive mapping can address the limitations of the sequence method and structuration analysis, due consideration has to be given to its potential for becoming complex easily. In this study, we make use of cognitive mapping analysis to identify influential relationships between factors in GVT media usage.

2 MEDIA USAGE THEORIES

Media usage theories can be divided into two general categories. First, *media traits theories* consider media selection to be a function of media traits and task or communication process characteristics. Second, *social construction theories* delineate social influences affecting media usage and show how users come to ascribe certain characteristics to media and tasks that influence media selection.

2.1 Media traits theories

Media Richness Theory (MRT)

Media richness refers to media’s ability to enable users to communicate and change understanding (Daft & Lengel & Trevino 1987). Richer media are those with immediate feedback, greater multiplicity of cues, language variety, and personalization. MRT proposes that media capable of sending “rich” messages are better suited to equivocal tasks, whereas less rich media are more suitable for uncertainty tasks (Daft et al. 1987). While empirical findings based on MRT have been consistent for traditional media (e.g., face to face or letter), MRT has not been as successful in explaining newer media usage (e.g., e-mail and voice mail) (e.g. Carlson & Davis 1998, Dennis & Kinney 1998, Dennis & Valacich 1999). Due to this inconsistency, recent media theories have revised MRT based on research on newer media.

Media Synchronicity Theory (MST)

Media synchronicity is the extent to which media allow individuals to work together on the same activity at the same time (Dennis et al. 1999). MST proposes that no media can be labelled “richest”. Instead, the richest media should be the one that provides the best set of characteristics needed by the situation. MST suggests that all tasks are composed of two fundamental communication processes:

conveyance and convergence. Conveyance refers to the exchange of messages, followed by deliberation on their meaning; whereas convergence is the development of shared meaning for messages. According to MST, matching the capabilities of five commonly used media to the needs of the fundamental communication processes (see Table 1) will result in communication effectiveness.

Immediacy of feedback is the extent the medium enables the senders and recipients to give rapid bi-directional feedback on the information they receive (Dennis et al. 1999, Daft & Lengel 1986). It is important to convergence because faster feedback enables mid-course corrections in message transmission so that any misunderstanding in the message can be quickly corrected. Symbol variety is the number of ways in which a message can be communicated (Dennis et al. 1999). Convergence requires understanding of others' interpretation, something that can usually be communicated using a simpler symbol set. Parallelism is the number of simultaneous conversations that can exist effectively (Dennis et al. 1999). It is important for conveyance, since it enables all members to participate. In contrast, convergence generally benefits from low parallelism because the goal is to understand individual viewpoints. Rehearsability is the extent to which the media enables the sender to rehearse or fine-tune a message before sending (Rice 1987). This capability is negatively related with the immediacy of feedback feature (Dennis et al. 1999). Reprocessability is the extent to which a message can be reexamined or processed again within the context of the communication event (Rice 1987). Increased reprocessability is likely to improve understanding and thus, it is important for conveyance.

<i>Communication Needs</i>	<i>Media Capabilities</i>				
	<i>Immediacy of Feedback</i>	<i>Symbol Variety</i>	<i>Parallelism</i>	<i>Rehearsability</i>	<i>Reprocessability</i>
Conveyance	Low	As needed	High	High	High
Convergence	High	As needed	Low	High	Low to High

Table 1. Media Synchronicity Theory Propositions (Dennis et al. 1999)

Media Accessibility Theory (MAT)

This theory proposes that media have accessibility characteristics that would influence their use. Attributes of accessibility such as availability, reliability, and access speed were found important in determining usage (Carlson et al. 1998). Availability is the physical presence/absence of the media. Media reliability refers to the dependability and consistency of access and uptime of the media (Goodhue & Thompson 1995). Access speed is the promptitude of the media. Media traits theories, such as MAT only consider constant media traits for media selection. This limitation is addressed by social construction theories discussed below.

2.2 Social construction theories

Adaptive Structuration Theory (AST)

AST is a process theory that adopts Gidden's (1979) structuration analysis. It describes the interplay between technology structure, task and organizational environment, and group internal structure (DeSanctis et al. 1994). At the heart of AST is the role of technology and its iterative appropriation process by organizational members as they work together (Maznevski et al. 2000). Members can either faithfully or unfaithfully use technology structural features, use only some of the features, use technology in a fashion that is allowed by team's or organization's structure, or modify team's or organization's structure to appropriate the technology in an agreed upon manner.

Channel Expansion Theory (CET)

While AST is based on structuration analysis, CET employs cognitive mapping approach. It proposes that experience with the messaging topic, organizational context, a particular medium and communication partner can shape how an individual develops media perceptions. Later studies found that only the latter two experiences appear to influence the perceptions (Carlson & Zmud 1999).

As individuals gather experience in communicating with a specific partner, they may develop a knowledge base for that person, enabling encoding of messages tailored to that person and using cues relevant to him or her. As individuals garner experience in communicating using a specific medium, they may develop a knowledge base for better applying this medium. Their initial perception of the medium may be bound by their abilities to exploit the medium's functionalities. However, as the user's knowledge of the medium increases, this initial bound becomes less of a constraint and other factors begin to influence perception more strongly. Although it has been acknowledged that over time, users' experience will carry less influence and that other factors will begin to influence perception more strongly, these factors have not been identified (Carlson et al. 1999).

The objective of this study is to understand the process of GVT media selection and usage given the broad range of electronic media available. Are GVT members more inclined to choose a medium based on its traits alone, or is the usage a socially constructed process, or both? To achieve this objective, we performed a case study of three GVT. After patterns were built separately for each team, cross case analysis was performed to develop a process theory of GVT media usage. The replication logic of multiple cases helps increase the external validity of our proposed model (Yin 1994).

3 METHODOLOGY

3.1 Case background

The three GVT in our study were made up of Master students from three universities (located in North America, Europe, and Asia) participating in a course on Global Project Coordination (GPC) over a duration of five months. Each team was assigned a global project that was formulated, monitored, and assessed by organizational sponsors under tight time constraints. Each team had a Global Engagement Manager (GEM) who acted as the sponsor representative to oversee team progress. Projects were assigned to team members by matching participants' interest and skills with project requirements. Involvement of sponsoring organizations, members' work experience, and project staffing in a way similar to organization virtual teams greatly added to the realism of the projects. An overview of the three GVT characteristics is shown in Table 2.

Team	Team Size	University Origin
A	7	3 Asia, 4 North America
B	11	2 Asia, 4 Europe, 5 North America
C	9	2 Asia, 3 Europe, 4 North America

Table 2. GVT characteristics

3.2 GVT media usage

All three GVT had options to use various electronic media i.e., email, teleconference, telephone, videoconference, web discussion board, ICQ and E-Circle. The web discussion board was a bulletin board linked to the course website where members of all teams could post text messages. E-Circle is a free, password-protected online community web space which allowed members to share information, hold discussions, share files and photos, plan group events, and maintain group calendars and group lists. An overview of GVT media usage is depicted in Table 3.

3.3 Data collection

Our data collection protocol was designed based on recommendations of qualitative researchers (Miles & Huberman 1994; Yin 1994; Eisenhardt 1989). Data was collected from multiple sources (observation, communication logs, and project documentation) over the five-month duration of the GVT projects. Teams were asked to archive all their e-mails and send the e-mail logs to the researchers. All web discussion board postings and ICQ logs were saved. Snap shots of E-Circle pages

were archived for Teams B and C. For synchronous communications that were not videotaped, team communication was inferred based on meeting minutes. All videotaped synchronous meetings were transcribed. All project documentation was archived including participants' lessons-learned papers.

	A	B	C
<i>Synchronous Media</i>			
Videoconference	None	None	3 meetings from beginning to middle of the project
Teleconference	5 meetings from middle to end of the project	9 meetings from beginning to end of the project	9 meetings from middle to end of the project
ICQ	5 meetings from beginning to middle of the project	1 meeting	None
<i>Asynchronous Media</i>			
Web discussion board (Number of postings)	54	None	94
E-Circle	None for the global project task (solely to share pictures)	High usage (Mainly for discussion and sharing files)	High Usage (Mainly for sharing files)
E-mail (Number of e-mails)	374	437	248

Table 3. GVT Media Usage

3.4 Data analysis

In this study, we propose a process model using cognitive mapping analysis. Cognitive mapping analyzes a process by identifying influential relationships between factors. We first conducted template coding that helps researchers begin the analysis process with more structure by developing apriori categories and sub categories (King 1998). Then, we conducted analysis within each case to allow patterns of each case to emerge (Eisenhardt 1989; Miles et al. 1994). Once we had captured the relationships among factors within cases, we attempted to generalize the patterns across cases, concentrating on team differences with respect to their media usage. Subsequently, we looked for larger patterns and patterns over time (Eisenhardt 1989; Yin 1994). Finally, we went back to previous literature to compare how our findings relate to the literature. This procedure helped to build internal validity, sharpen generalizability, and raise theoretical levels (Eisenhardt 1989).

Template Coding

We adopt elements from CET, MST, and MAT as the conceptual foundation for generating our original template. The reason for adopting these theories is that each of them provides a unique perspective on media usage that is not offered by the other theories. CET focuses on the influence of the social environment on individual's media perceptions (Carlson et al. 1999). The theory acknowledges that as experience with a medium increases, other factors are likely to determine media usage. In a GVT context where team collaboration is important, MST explains media capabilities to support team communication and collaboration (Dennis et al. 1999). Besides characteristics inherent in media, media accessibility may also affect media choice (Culnan 1984). In GVT, members across different locations may have considerably different access to various media, for example, those with relatively high access speeds may agree to communicate using videoconference while others may not. All these concepts are integrated into our original template shown in Table 4.

Based on our findings from the three GVT (discussed in the next section), we refined the template by modifying or making some of the codes more specific to better represent the case data. We also added some codes as they were observed in the cases. Specifically, the 'enablers and motivators of media use' was explicated to include 'collective self-efficacy', 'positive past experience', and 'media accessibility'. Moreover, the 'perceived social influence' was modified to reflect 'social influence' as

its actual occurrence was observed from the cases. Lastly, ‘financial cost’, ‘media norms’, ‘seeking alternative media’ and ‘security needs’ were added due to their occurrence and effects observed in the cases. The final template based on the data analysis is presented in Table 5.

Codes	Definition
CET (Carlson et al. 1999) *In generating codes from CET, we will replace the term ‘channel’ with ‘medium’ in order to avoid confusion since they essentially refer to the same concept	
Enablers and motivators of media use	Factors that enable and encourage the use of a medium
Selection and use of media	The act of selecting and using a medium
Perceived social influence	The supposed understanding about environmental factors (such as supervisors and subordinates) that can affect the attitudes or behaviors of users
Experience in using media	The knowledge-base regarding a medium that is built up in the process of using that medium over time
Perception of media	The concepts or understanding formed about the characteristics of a medium
MST (Dennis et al. 1999)	
Communication process-medium fitness	A condition that occurs when a medium used is able to fulfil the needs of the communication process
MAT (Carlson et al. 1998)	
Media accessibility	The availability (physical presence/absence), reliability (dependability and consistency of access, and uptime) and access speed (promptitude) of a medium

Table 4. Original template

Codes	Definition
Media usage	The act of using a medium
Social influence	The environmental factors (such as supervisors and subordinates) that can affect the attitudes or behaviors of users. It can be influential pressures from the internal or external environment
Positive past experience	Refers to positive encounters with a medium in the past
Collective self-efficacy	The level of the perceived ability to execute a particular behavior of team members as a whole
Media accessibility	The availability (physical presence/absence), reliability (dependability and consistency of access, and uptime) and access speed (promptitude) of a medium
Financial cost	The economic cost incurred in using a medium
Media norms	Knowledge-base for better utilizing a medium that is built up over time, such as what to avoid when using a medium in order to obtain the optimal benefits from it
Perceived communication process-medium fitness	Supposed understanding of GVT members on the condition that occurs when a medium used is able to fulfil the needs of the communication process
Seeking alternative media	Process of looking for other media that can better fulfil the needs of the current communication process
Security needs	The needs for a medium to be secure or free from risk

Table 5. Final template

4 WITHIN-CASE FINDINGS

All three GVT had similar members’ experience with media to start with. All members had past experience with e-mail, some members had past experience with ICQ, but none of the members had used teleconference, videoconference, web discussion board, and E-Circle before they conducted the project.

4.1 Team A

We observed that in the beginning, Team A solely used e-mail for their communications. This selection of e-mail was influenced by three factors i.e., self-efficacy of members, positive past experience, and financial cost of using e-mail. One member noted: *Of utmost importance, every member has experience using it (e-mail) and finds it comfortably easy.* Another member also remarked that e-mail is relatively inexpensive. In their lessons learnt papers, four members highlighted cost as one of the factors considered when deciding on using a medium. After using e-mail for some time, team A started to build norms of using e-mail. A member mentioned in his e-mail: *We use TOO MANY E-MAILS. Email only for urgent, FILES ATTACHMENT and CONFIDENTIAL materials.* They also started to develop perceptions of e-mail characteristics and its fitness with their communication processes. Several members in Team A remarked: *(E-mail) works well to exchange thoughts or information within the whole team. Decision-making is difficult. Consensus or voting becomes cumbersome and time consuming.* A member commented: *(E-mail) is good for record keeping...(Yet) e-mails become voluminously unmanageable and disorganized.*

Recognizing the problem of information overload and unsuitability of e-mail for certain communication processes, Team A sought for alternative media that can address the limitations of e-mail. E-Circle was one of their initial choices. However, due to its low access speed for some members, they decided not to use it. Instead, they started to use the web discussion board heavily for files uploading. Another alternative medium sought was ICQ. Although none of the members had used web discussion board and ICQ before, over time their self-efficacy increased and they began to use these media fruitfully. Some members noted: *(Web discussion) can put several documents (and is) easy to use.* After a successful first attempt at using ICQ with four windows, they started to use ICQ more confidently by opening more than 4 conversation windows. Gradually, Team A began to develop norms towards the usage of web discussion board and ICQ. If a new file was posted on the web discussion board, members notified each other by e-mail. For ICQ, a member noted: *We established basic rules to ensure that everybody would share his or her thoughts and to “e-raise their hand” to take the floor and speak.*

Team A was also observed to form perceptions of communication process-media fitness. For example, because there was no “uploading notification” in the web discussion board, they perceived this medium as having low immediacy of feedback. They also perceived the medium to have low text-based symbol variety and high parallelism, rehearsability and reprocessability, which fitted in with conveyance communication needs. Team A also began to feel that ICQ had low reprocessability (if more than two members were chatting at the same time, it was difficult to trace the conversation). The unfitness of ICQ again led Team A to try other available media. Their choice was teleconference. Some members claimed: *(It) is very good (fast) for delegating tasks and planning next course of action. Speaking is definitely faster, more convenient and less tedious than typing.* However, due to cost considerations, team A decided to use teleconference for weekly meetings only. As they began to use this medium, members' self-efficacy increased. They built “teleconference norms” i.e., designated one moderator in each location, set one person to take notes, and sent the notes immediately after the meeting to all members to minimize uncertainty of what has been decided. They found teleconference to have high immediacy of feedback and verbal cues, low parallelism, rehearsability and reprocessability, which fits the requirements of convergence communication process.

Having tried several media, Team A finally settled for three media: e-mail for daily communication (conveyance), web discussion board for sharing ideas and findings (conveyance) and teleconference for weekly decision-making meetings (convergence). A member commented: *Noteworthy, no single mode of communication reigns over the others. They serve to complement one another.*

4.2 Team B

Initially, team B used e-mail because it was recommended by their GEM and because dominant members from North America also pushed the idea of using e-mail. This dominance of North

American members in the team was evident from an interview with a member done after the project: *We think us (Asian members) and the European group always feel that the North American group takes the lead.* Thus in Team B, social influences primarily impacted their initial media usage. Gradually Team B built norms of using e-mail. A member wrote in her lessons learnt paper: *Don't bombard people with emails, be succinct and avoid group e-mails when individual emails suit the situation better.* They also formed perceptions of e-mail's fitness with communication processes. As mentioned by a member: *If there are few e-mails, the importance could be sensed and every word read, but with so many going across the 11 of us, it became difficult to read every mail thoroughly.* Team B was observed to perceive e-mail as having medium parallelism and high rehearsability characteristics. A member from Team B noted: *By using e-mail, you can structure up the information that you want to convey.*

Team B chose ICQ to address the limitations of e-mail. All members had similar accessibility to ICQ. Over time, their self-efficacy in using ICQ increased. A member mentioned, *It's easier and faster to send short messages through ICQ than with (e-mail).* Team B also developed norms in using ICQ. A member commented: *(ICQ) works well with up to three persons.* Subsequently, the team used ICQ mainly for small group discussion. With longer use however, they recognized that ICQ had low reprocessability capabilities for conveyance. One member noted: *Having a three way ICQ conference is very difficult as ones split vision is limited so it is hard to keep track of what being typed down if two of the three of the conference members are typing at the same time.* Recognizing the limitations of ICQ, Team B chose E-Circle to fulfil their reprocessability communication needs. A member noted, *we have been able to overcome such barriers through the use of tools such as E-circle, which has aided us tremendously in sharing files, comparing calendars and updating lists of company contacts, among other activities.* As team members' self-efficacy with E-circle increased, they even created another E-Circle group. Over time norms in using E-Circle were developed and E-Circle was perceived to have high parallelism, rehearsability and reprocessability capabilities, which fitted their conveyance communication needs.

Apart from E-Circle, Team B also considered videoconferencing as an alternative media to e-mail and ICQ. However, due to accessibility problems, they decided not to use it. Alternatively, they proceeded to use teleconferencing. However, their primary reason for using teleconference was not because it was available and affordable, but because they had problems in keeping in contact with the GEM through e-mail. Here again, social influence was observed to affect team media usage. The use of teleconference increased members' self-efficacy with the medium. As mentioned by a member: *Teleconference's efficiency and simplicity easily weighed up the advantages of videoconference.* Some norms they developed for teleconference use include: *Rules for telephone conferencing (from past experience): only one person from each location to speak at a time, wait until the person speaking is done, DO NOT hog airtime, keep comments concise & to the point, DO NOT interrupt.* One member commented that teleconferencing is good for decision-making and another member mentioned: *We experienced that this is the best way to communicate 3-way with smaller groups.* Thus, they perceived teleconferencing as having high immediacy of feedbacks and low parallelism, which fitted the requirements of convergence communication process.

Team B finally settled with E-Circle for file sharing, holding discussions, and performing group scheduling and teleconference for reaching consensus, update of progress and communicating with the GEM.

4.3 Team C

Similar to the other two teams, all members in Team C had positive past experience with e-mail. Consequently, Team C was observed to use e-mail for their communications initially due to their high collective self-efficacy of using e-mail. In addition, e-mail was also chosen due to its availability and its low cost. A member in Team C claimed that e-mail is the most economic way to communicate among people. Team C also considered using ICQ, but they decided not to because one member said

that he had negative past experience with ICQ. After Team C had used e-mail for some time, they were observed to have evolved at least two e-mail norms. Two members in Team C mentioned that they refrained from sending too large messages because if the message is too large, some of their teammates' mailbox may be flooded. They also avoided sending too many emails because the receiver of numerous mails will have trouble sorting out their urgency and importance.

Realizing the unfitness of e-mail for convergence communication process (similar to Team A and B), Team C sought for videoconference as an alternative. However, since it was not easily available, they resorted to the more available teleconference. With usage, members' self-efficacy towards teleconference increased. Furthermore, they began to develop norms of using teleconference as mentioned: *Limit the data amount sent, be selective and make summaries, limit the workload for the other members, make summaries and let them decide what to focus on.* With experience built up, teleconference was perceived to have high parallelism, which is not fit for convergence communication. A member noted: *It is difficult to synchronize discussion (using teleconference).* Due to unsuitability of teleconference for convergence, Team C sought for another available alternative (ICQ). However, they did not think that ICQ could overcome the limitations of teleconference and abandoned it.

As for conveyance communication, Team C tried to make use of the available web discussion board as an alternative to e-mail. Gradually they increased their self-efficacy towards it and developed usage norms (e.g., web discussion board is only for sharing non confidential information). Perceptions of communication process fitness evolved. Team C perceived web discussion board to have text-only symbol variety, low immediacy of feedback, high parallelism, rehearsability, and reprocessability, thus fitting with conveyance communication process requirements. Although they perceived a fit, team C still sought for other more-secure alternatives. E-Circle was chosen, but it had poor access speed for some members. As commented by a member: *The download speed of e-circle is so slow; I don't know what happens. Maybe it's because I'm far away from the site.* However, due to the need to have a secure medium, they still decided to give it a try. As members' self-efficacy towards it increased, they even created two types of E-Circle i.e., one for sharing interview results and the other for sharing all files so as not to flood their e-mails. Team C developed the norm that E-Circle was only used for confidential information. One member mentioned: *E-circles has proved to be invaluable in group file sharing.* The team perceived E-Circle to have the same fitness as web discussion board for conveyance communication with the qualification that E-Circle was more secure i.e., the team chose E-Circle not to address the limitation of web discussion board but rather for security reasons.

Eventually Team C used e-mail for daily conversation, updating purpose, and letting members know that files had been uploaded in the web discussion board (all of which are conveyance communication processes). Web discussion board was used for sharing ideas and text-based non-confidential information, E-Circle for word-format confidential information (file attachment), and finally, teleconference for convergence communications.

5 CROSS-CASE FINDINGS

The following cross-case findings are derived based on analytical generalization (Yin 1994).

5.1 Initial medium usage

All members had past experience with e-mail prior to the project. For both teams A and C, there was evidence that positive past experience influenced their initial medium usage through collective self-efficacy. Teams A and C also considered medium accessibility (MAT) and financial cost before deciding on using e-mail as their communication media. Evidence from both teams provides literal replication of these relationships. Although team B members also selected e-mail as their initial communication medium, they had different reasons for doing so. Team B's initial medium usage was mainly affected by external and internal pressures. Although these findings seem contradictory, they

are actually consistent with what is predicted by CET i.e., both experience in using the media and/or social influence may influence selection and use of media (Carlson et al. 1999). Thus, we propose:

P1: Positive past experience with a medium is positively related with collective self-efficacy

P2a: Collective self-efficacy is positively related with GVT's initial medium usage

2b: Social influence is positively related with GVT's initial medium usage

2c: Financial cost is negatively related with GVT's initial medium usage

2d: Medium accessibility is positively related with GVT's initial medium usage

Using a medium over time, Carlson et al. (1999) claimed that the ability to exploit the medium's functionalities becomes less of a constraint and "other factors" begin to influence medium perception more strongly. Based on our findings, we propose that these "other factors" are the medium traits. MST explains media's capabilities to support team collaboration (Dennis et al. 1999). Judging from its capabilities, MST suggests that e-mail may not perfectly fit with convergence communication needs (Dennis et al. 1999). Interestingly, we also found that after using e-mail for some time, all teams began to realize the weaknesses of e-mail, particularly for convergence communications. In addition, all teams built "e-mail norms" after using it for some time. Hence, we propose:

P3a: The usage of medium over time is positively related with the emergence of GVT's medium norms

3b: The usage of a medium over time is positively related with the emergence of GVT's perceived communication process - medium fitness

5.2 Searching for alternative media

Realizing the unfit of e-mail for convergence communication process, all teams sought for alternative media. For these new media, both positive past experience and social influence did not affect their choice. Instead, the accessibility, as predicted by MAT and financial cost impacted their decision. Although they started off with low collective self-efficacy towards these new media, over time the teams managed to boost up their self-efficacy. Moreover, they also started to develop norms of using the medium and most importantly, they started to criticize the fitness of the medium with their communication needs. Consequently, the loop of searching for alternative media started all over again until the team came to a final consensus of using certain media for certain kinds of communication.

There was an incongruity in team C's effort to search for alternative media. Although team C perceived web discussion board to fit with conveyance communication needs, due to security reasons, they still sought for other more-secure alternatives. Although E-Circle had poor access speed for some members, because it is relatively secure, they still decided to give it a try. Hence, GVT may choose an alternative medium not to address the limitations of their current medium, but rather because of additional special needs. Such needs may have priority over other considerations such as accessibility, cost, social influence, and self-efficacy. Hence, we propose:

P4a: GVT's perceived communication process - medium fitness is negatively related with their effort in seeking alternative media

4b: GVT's additional needs e.g. security, is positively related with their effort in seeking alternative media

P5: Seeking alternative media is positively related with GVT's alternative medium usage

P6: GVT's additional needs can negatively moderate the relationship between medium accessibility, financial cost, social influence, collective self-efficacy and GVT's alternative medium usage

P7: The usage of alternative medium over time is positively related with GVT collective self-efficacy towards the medium

All these propositions are captured in Figure 1 below.

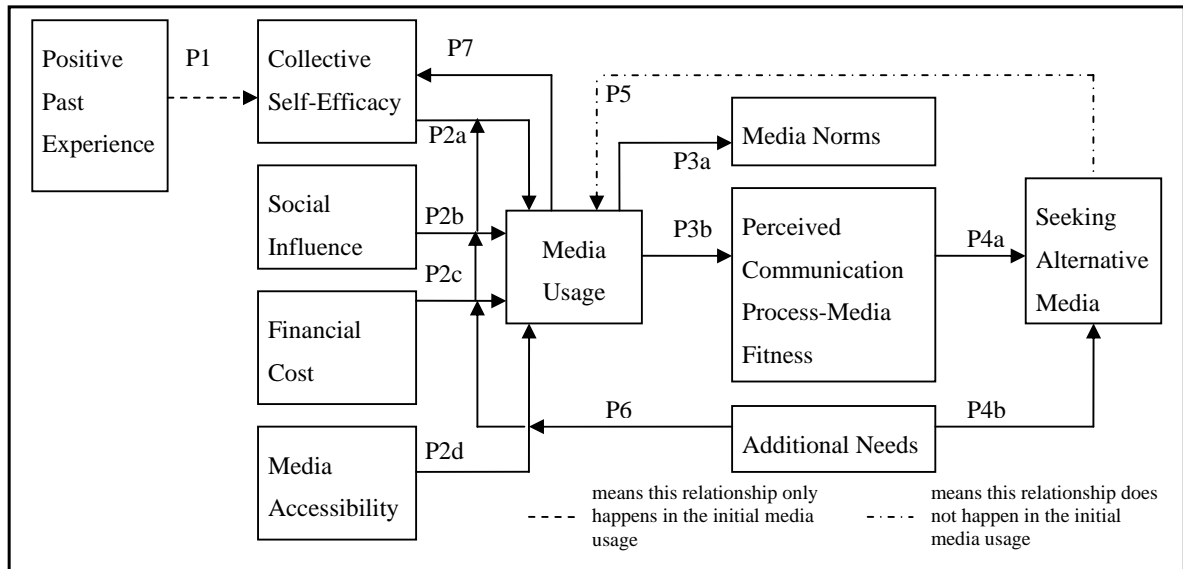


Figure 1. A Proposed Process Model of GVT Media Usage

6 CONCLUSION

One of the problems faced by the media selection field is that a hierarchy of importance of the multitude of variables proposed to influence media selection and use has been difficult to construct and validate. This research contributes towards constructing such a hierarchy. Moreover, our study contributes to theory by elucidating the process of group media usage, particularly ‘why’ and ‘how’ the process is performed (the majority of past studies have concentrated on media usage at the individual level (e.g., Straub & Karahanna 1998)). It also sheds light on media usage in GVT, which are burdened by the plethora of electronic communication media available to them and their heavy reliance on these media. Finally, we also noticed that social influence may come from outside as well as within the team. In the case when it came from within (i.e., for Team B), it was exercised by those members with relatively higher individualism index than the rest (Hofstede 1991). However, since the usage of a particular medium is a network externality phenomenon, our findings showed that this kind of forceful influence only happened in the initial collaboration process. Over time, the team would come together to select which medium is appropriate for which communication process.

Our proposed model can provide guidelines for effective GVT media usage. Being aware of the antecedents of media usage, GVT management can influence media usage to better match GVT communication needs. For instance in addition to other staffing criteria, GVT members can be selected with the appropriate media experience and self-efficacy to make use of newer media. Appropriate training can be provided to increase members' positive media experiences. Hard constraints such as cost and accessibility must be considered when deciding which media to provide to GVT. Additional needs such as security can also be taken into consideration when providing media to support GVT communication and thereby shorten the process of seeking alternative media.

The initial model proposed in this study needs to be further validated across a larger number of teams in organizational as well as inter-organizational settings. Also more generalizable surveys need to be conducted to operationalize and empirically test the model. Nevertheless we believe that this preliminary framework will be useful in guiding further research and practice on GVT media usage.

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