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# Technology Adoption by Groups: A Valence Perspective*

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## Abstract

*While past research has contributed to an understanding of how organizations or individuals adopt technologies, little is known about how such adoption occurs in groups. Given the widespread acknowledgment that organizations are moving to group-based structures and that groups often utilize technologies for performing their tasks, it is critical that we understand how such collective social entities adopt technologies. Such an understanding can better guide investment and implementation decisions. In this paper, we draw on existing literature about groups, technology characteristics, and valence to conceptualize a model of technology adoption by groups (referred to as the TAG model). We view the TAG phenomenon as a process of communication and negotiation in which analytically distinct factors-such as the individual members' a priori attitudes toward the technology, the majority subgroup's opinion, high-status members' opinions, substantive conflict, and relevant characteristics of the technology play an important role. We develop several theoretical propositions regarding the nature of the contribution of these factors toward an adoption decision and discuss measurement tradeoffs and guidelines.*

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## Introduction

Consider the following scenario:

> A U.S. telecommunications company (TeleCorp) was recently involved in an initiative to transform its territorial organizational structure and culture, its antiquated business processes, and its legacy systems in order to survive in the hypercompetitive world of e-business. A reengineering group had been formed, drawing eight members from different levels and functional areas of the company. In addition, the group included an experienced individual from an internationally noted management consulting company. A key task confronting the group in the initial stage of the project was to choose a computer-based diagramming tool that could help the group document the envisioned processes and surrounding organizational components. Choosing an appropriate diagramming tool was extremely important for the team because this choice could have significant implications for the later phases of the reengineering initiative (affecting the quality of new information systems implemented, the speed of the systems development project, and the integration with existing IT platforms). One tool brought to the attention of the group by a member (a division director at TeleCorp) was CASE2000. An IT project group had used this tool for documenting processes and for systems design in an ongoing systems implementation project in his division. The consultant, on the other hand, indicated a strong preference for a relatively simple diagramming tool (DIAGRAMMER-1), which was also available in the company. It is worth mentioning, however, that many of the group members who were not from the IT department had never heard of DIAGRAMMER-1 or CASE tools such as CASE2000, and did not have a clear appreciation of their importance in supporting the goals of their project. For example, some of them wondered why hand-drawn diagrams would not be adequate. In any case, given the lack of preexisting consensus in the group on this issue, it needed to finalize whether it would adopt CASE2000, DIAGRAMMER-1, an alternate tool, or no tool at all. The adoption decision needed to be finalized within two weeks to complete the project successfully on time.
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> The meeting to decide which technology was to be adopted (if at all) turned out to be a complex exercise, with group members elaborating on features of the different technologies under consideration, enumerating and arguing the pros and cons, and convincing other members. Different group members focused on different technology features that they believed to be most relevant. Group members not comfortable (or familiar) with IT had to be educated about the benefits of the computer-based tools, which involved highlighting various characteristics of the technologies during the meeting. The director, who incidentally was the highest-ranking organizational member in the team (though not the assigned leader of the team), continued to press for the adoption of CASE2000 because he had seen the tool being used in his division quite effectively. Two other members continued to take the position that involving computer-based tools would complicate and distort the process-envisioning activities. As discussions continued, a significant majority of the group members appeared to support the adoption of DIAGRAMMER-1. They were persuaded by the consultant's arguments, whom they saw as having the necessary experience and expertise in reengineering. Eventually, after several meetings, the group as a whole developed a

more favorable orientation toward DIAGRAMMER-1 (compared to the other options) and decided to use the tool in the process-modeling stage of the initiative.[1]

The above hypothetical situation highlights a number of key points:

- Today, many organizational tasks, including business process redesign, need to be accomplished through coordinated (not isolated) human action, and through the co-construction and sharing of knowledge (Sarker and Lee, 2002; Davenport, 1993) . Consequently, organizations are increasingly relying on groups (Jehn and Mannix, 2001). Such groups are encouraged to use technologies to boost their task performance and value-added contributions (Ramarupa, Simkin, and Raisinghani, 1999). In many cases, organizational management provides the groups with a reasonable degree of autonomy in deciding which technology (if any) to adopt (e.g., Mustonen-Ollila and Lyytinen, 2004).
- Group members' individual *a priori* attitudes about a technology cannot be simply aggregated to predict whether or not the group will decide to adopt a technology, unless every member is in agreement. Thus, some of the current technology adoption models that focus on individual-level adoption do not adequately explain technology adoption by groups.
- When all members are not in agreement, a complex social group interaction process ensues, in which members discuss the specific features of the focal technology and attempt to influence others to form a group-level orientation toward it. This, in turn, leads the group to adopt (or not adopt) the technology.

While scenarios similar to the one discussed above are frequently encountered in organizational work life, no known research has yet examined the process (and the corresponding factors) that influence a *group's* adoption of a technology. A review of the current technology adoption literature (see Appendix A and Table 1), using two key dimensions of causal structures (i.e., causal agency and levels of analysis) outlined by Markus and Robey (1988), reveals two unmistakable patterns: (1) a bias toward providing normative explanations, primarily through the use of social factors surrounding the adoption context, and (2) a tendency to focus either on individuals or on organizations, leaving a void in the understanding of technology adoption within groups.[2] Our paper seeks to address this void in the literature.

Before proceeding, it may be useful to establish some of the *assumptions* and *key boundary conditions* of the theory proposed in this paper. *First,* we view the adoption of a technology by groups as a specific case of the adoption of any option[3] by groups. Thus, in this paper, we first develop a theoretical model explaining an adoption decision (of any option) by groups, and then particularize the model using potentially relevant characteristics of the technologies being considered for adoption. *Second,* we believe that technologies adopted by groups may be of various kinds. For instance, they could be group technologies (e.g., Group Support Systems being used, say, to brainstorm about a personnel issue) that are fundamentally designed for group use. They could also be technologies originally designed for individual use that can also be used by groups (e.g., individual productivity tools such as word processing or diagramming software). To

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[1] DIAGRAMMER-1 and CASE2000 are pseudo-names of the two tools that were being considered.

[2] Interestingly, even studies focusing on adoption of group technologies (e.g., GSS) have framed the adoption phenomenon at the individual or organizational level of analysis (e.g., Dennis and Reinicke 2004; Bajwa and Lewis 2003; De Vreede, Jones, and Mgaya 1998/1999).

[3] The adoption of an option would of course need to have significant consequence for the group.

provide an example, DIAGRAMMER-1, the diagramming software being considered by TeleCorp in the opening scenario, is not a *group* technology per se. However, in the interest of work process standardization, and to ensure that everyone in the group is able to contribute seamlessly to the creation of a diagram for which all the members may be responsible, the group often has to decide whether or not the tool should be adopted. *Third,* we assume that adoption of the technology by the group is voluntary and, to a reasonable degree, autonomous. This implies that technological infrastructure compatibility constraints, preordained standards in the organization, and top management mandate may affect, but do not *dictate,* the exclusion or selection of any of the technologies the group is considering.[4] Such situations abound in organizations, and are also documented in the IS literature. For example, a recent study of the adoption of IS process innovations found that project groups themselves make a majority of adoption decisions pertaining to tools and technologies because they have a deep understanding of the precise situation (Mustonen-Ollila and Lyytinen, 2004). Similarly, Bajwa and Lewis (2003, p. 42) concluded that work groups in large organizations are usually given the autonomy to "adopt a specific IT" because "it may better support their [heterogeneous] task needs." Further, Bajwa and Lewis (2003) argue that in such situations, the "adoption decision for a particular IT may be driven by the preference of users within a group in an organization." *Finally,* consistent with the reality in organizations, we assume that individuals within a group differ in their *a priori* predispositions regarding the technologies being examined and are open to considering others' views/arguments in favor of or against the adoption of the technologies.

**Table 1. Causal Structure of Theories & Models of Technology Adoption**

| Causal Agency / Levels of Analysis | Deterministic (Technological & Psychosocial Imperatives) | Sociotechnical (Interactional/Emergent) |
|---|---|---|
| Individuals | Critical Mass; Social Definition | Task-Technology Fit; TAM**; DTPB**; Classical Diffusion Model |
| Groups | Critical Mass*; Social Definition* | ? |
| Organizations | Critical Mass; Social Definition | Fragmented Innovation-Diffusion Studies ("adopter studies" and "diffusion modeling studies") |

The rest of the paper is organized as follows. First, we briefly review the literature on groups and the theoretical perspectives that underlie our model. We then present our model of technology adoption by groups (the TAG model) and develop its key propositions. Next, we provide suggestions regarding the measurement of the constructs used in the model. Finally, we conclude with a discussion of the model by revisiting the opening scenario.

[4] Further, the impacts of such technologies need to be local to the group, and if there is a potential for the impacts to be external to (or beyond) the group, we assume that the technology's outputs can be translated to fit the requirements of the larger surrounding context.

** Limited technology considerations; more focus on social factors.

* Does not provide constructs to capture the influence of group dynamics on adoption.

## Foundation for Understanding Technology Adoption by Groups

### *Conception of Groups in the TAG Model*

Shaw (1981, p. 8) defines groups as “two or more persons who are interacting with one another in such a manner that each person influences and is influenced by each other person.” Similarly, McGrath (1984, p. 7) defines groups as “social aggregates that involve mutual awareness and potential mutual interaction.” While we recognize that many different forms of groups exist, in this paper we focus on “work groups” (Brilhart, 1978; Schminke, Wells, Peyrefitte, and Sebora, 2002) whose members work on a common set of tasks, influence each other through interactions, and engage in behaviors acceptable to the group as a whole. Our objective is to theorize about how such work groups collectively decide on adoption (or non-adoption) of a certain technology. We emphasize that a “group exists as something apart from the persons who constitute membership” (Fisher and Ellis, 1990), and draw upon Brilhart’s (1978, p. 21) principle of groupness, which he defines as follows:

> “Groupness” emerges from the relationships among the people involved, just as “cubeness” emerges from the image of a set of planes, intersects and angles in specific relationships to each other. One can draw a cube with twelve lines (try it), but only if assembled in a definite way. Any other arrangement of the lines gives something other than a cube. Likewise, one can have a collection or set of people without having a group.…

We believe that this principle of “groupness” prevents us from predicting technology adoption in groups by *merely aggregating the individual members’ preinteraction adoption preferences*. We do not deny that “human beings constitute the group” or that their individual preferences are important; however, they are not the *only* issues that deserve analysis (Fisher and Ellis, 1990). When there is no discrepancy among the members—that is, when uniformity exists in the group members’ orientations—an aggregation of the individual preferences may accurately reflect this groupness (Festinger, 1953). However, because such a situation rarely occurs, it is important to understand how this *groupness* develops.

Group researchers argue that interaction (i.e., communication and negotiation) is the medium through which this groupness or group orientation develops (Festinger, 1953; Fisher and Ellis, 1990; Roloff, Putnam, and Anastasiou, 2003). Based on this principle, we view technology adoption by groups as consisting of *a process of communication and negotiation about the technologies being considered*. This process leads to a collective orientation (i.e., groupness) toward a focal technology, and thereafter, leads to an adoption (or non-adoption) decision. To understand this formation of “groupness,” we turned to the communications literature. Specifically, we apply the valence theories, which were primarily developed to explain how groups make an adoption decision from a set of options. Below, we provide a brief review of the valence theories.

### *Valence Theories*

*Valence* is defined as the degree of positive or negative feeling toward a certain option. Valence has been studied at three different levels (Meyers and Brashers, 1999), with different though interrelated theoretical perspectives pertaining to each level: the Social Comparison Theory for individuals (Baron and Roper, 1976; Sanders and Baron, 1977), the Distributive Valence Model for subgroups (McPhee et al., 1982), and the Group Valence Model for groups (Hoffman, 1979; Hoffman and Kleinman, 1994). The model proposed in this paper synthesizes key tenets of all three levels of valence research within one unifying framework.

The Social Comparison Theory (SCT) emphasizes the importance of individuals' *a priori* preferences on the group decision processes. Specifically, SCT suggests that individuals adopt an initial stance on the issue faced by the group. During the group discussion, each member is exposed to other members' views regarding that issue, and tends to compare his/her own preferences with those of the other members. This ensuing comparison results in social influences, which may cause members to change their initial position and move toward a group-level consensus (Meyers and Brashers, 1999; Sanders and Baron, 1977).

The Distributive Valence Model (DVM), on the other hand, holds that the valence of key subgroups has the greatest influence on any group decision. The group's adoption of a final decision would be a function of the valence of the different coalitions as determined through "combinatorial" rules such as "the majority rule" (Meyers and Brashers, 1998; Poole, McPhee, and Seibold, 1982). This idea is consistent with the views of Festinger (1953), who (among others) has argued that any group that requires "uniformity of opinion" is affected not only by the members' own prior attitudes but also by the opinions of the majority of the members.

Lastly, the Group Valence Model (GVM) holds that the strongest indicator of a group's adoption decision is the group's overall valence toward that choice. Within GVM, group valence refers to the positive or negative orientation of a group toward each option (Hoffman and Maier, 1964; Hoffman and Kleinman, 1994). The GVM perspective further contends that when a group needs to adopt one of several options available, the option with the highest (i.e., most positive) group valence will be adopted. Next, we discuss the primary variables in the TAG model.

### *Primary Variables in the Model*

McGrath (1984, p. 12) argues that "there are many different perspectives from which one can view a group" and suggests that researchers should adopt a "frame of reference, a map" that would help model the various parts of the topic. He proposes a "Conceptual Framework" for the study of groups and states that the "group interaction process is the centerpiece of the model" (p. 12). The group interaction process is affected by a number of factors such as *group-member characteristics* (e.g., traits, beliefs, and attitudes that members bring into the group interaction), the *group structure* (e.g., relationship among group members, whether one person exercises social influence over others), *the task of the group*, and *the environment* that surrounds the group. The interaction process leads to outcomes for the group, such as changes in the group members' characteristics/behaviors, structure, or task performance. It is important to note that the Conceptual Framework is a "metatheory" that informs researchers about "what sets of variables are likely to be important." Given that one "cannot study everything at once," it is important to select those variables that are most relevant, using families of substantive theories (McGrath, 1984, p. 12). A similar sentiment has also been expressed by McGrath and Hollingshead (1994), who argue that in any study of groups, "there are a plethora of potentially relevant factors," often "far too many to incorporate in a given study." In such situations, it has been suggested that the researchers' goal should to be to include those that seem most pertinent (Weber, 2003; McGrath and Hollingshead, 1994). In the process of developing our theoretical model, McGrath's Conceptual Framework sensitized us to the various clusters of potentially relevant variables. Consistent with McGrath's view, we conceptualize group interaction as the "centerpiece" of the TAG model through which a positive/negative orientation toward a particular technology is seen to emerge. We see factors such as the group members' prior attitudes toward the technology, the group structure issues (influence of leaders, conflict, etc.), and characteristics of the technology as having a significant influence on the process. Finally, we view the interaction process as also having a strong influence on the group's outcome (i.e., the adoption decision). The valence "family of theories" (i.e., SCT, DVM, and GVM) allowed us to focus on particular variables and hypothesize relationships between/among them.

Based on the SCT and the DVM, it can be argued that group members' *a priori preferences* regarding the technology in question, along with the *opinion of the majority,* will play a significant role in shaping the group interaction and the group's ultimate decision regarding the technology adoption. Further, drawing on the GVM, it could be argued that the strongest indicator of a group's adoption decision will be the group's overall valence toward the technology. Consequently, *group valence* takes on a central position in our theoretical model, and the individual and subgroup orientations act to influence the group's valence. The construct of group valence may be seen as a form of "groupness" that is central to any group decision-making process (Festinger, 1954; Fisher and Ellis, 1990). In addition, many researchers emphatically assert that during the group interaction process, the social structure of the group has a significant effect (Fisher and Ellis, 1990; McGrath and Hollingshead, 1994; Poole, 1999). In other words, individuals with high status (i.e., leaders, experts) seem to play an important role in the group process by significantly enhancing the pressures toward conformity (Hoffman and Maier, 1967; Schminke et al., 2002). Further, group researchers consistently report that whenever group members need to reach a consensus about a certain issue, yet have incompatible views surrounding that issue, conflict occurs; and this has important implications for group dynamics (McGrath and Hollingshead, 1994; Fisher and Ellis, 1990; McGrath, 1984). Hence, *influence of high-status members* as well as *conflict* is included in the model. Finally, given that relevant technological features would undoubtedly influence a group's decision to adopt or not adopt a particular technology, key *characteristics of the technology* have been incorporated into the proposed TAG model.

To summarize, we view technology adoption in groups to unfold as follows (see Figure 1 for a process-based view, and Table 2 for the definitions of the constructs).

- Individual members of a group faced with the responsibility of selecting a technology have certain initial attitudes toward the technology. Drawing on SCT, it can be argued that when there is almost no discrepancy in the attitudes of the group members about the technology, the group's final attitude can be assessed by "averaging .. individual's judgments" (Forsyth 2000, p. 83). However, when such uniformity does not exist in a group, the individual members' *a priori* attitudes serve as just one factor determining the overall group's orientation toward the technology.
- When such discrepancies exist in the group, a process of communication and negotiation regarding the technology characteristics occurs, which results in the group developing a "groupness" or group orientation toward the technology. This groupwide view is different from "a sum of the individual parts" of the group members (Fisher and Ellis, 1990) and is captured as the "group valence" within the TAG model.

- Within the group process, as individuals discuss relevant features of the technology in detail, the differing perspectives of members result in the formation of coalitions and thus give rise to majority/minority opinions.
- The group's orientation toward the technologies is formed through a synthesis of psychosocial factors (e.g., opinion of the majority and high-status individuals, level of conflict within the members), and the characteristics of the technologies being considered.
- Once a group orientation (i.e., group valence) develops regarding the technology, it becomes the primary determinant of the group's final adoption decision.

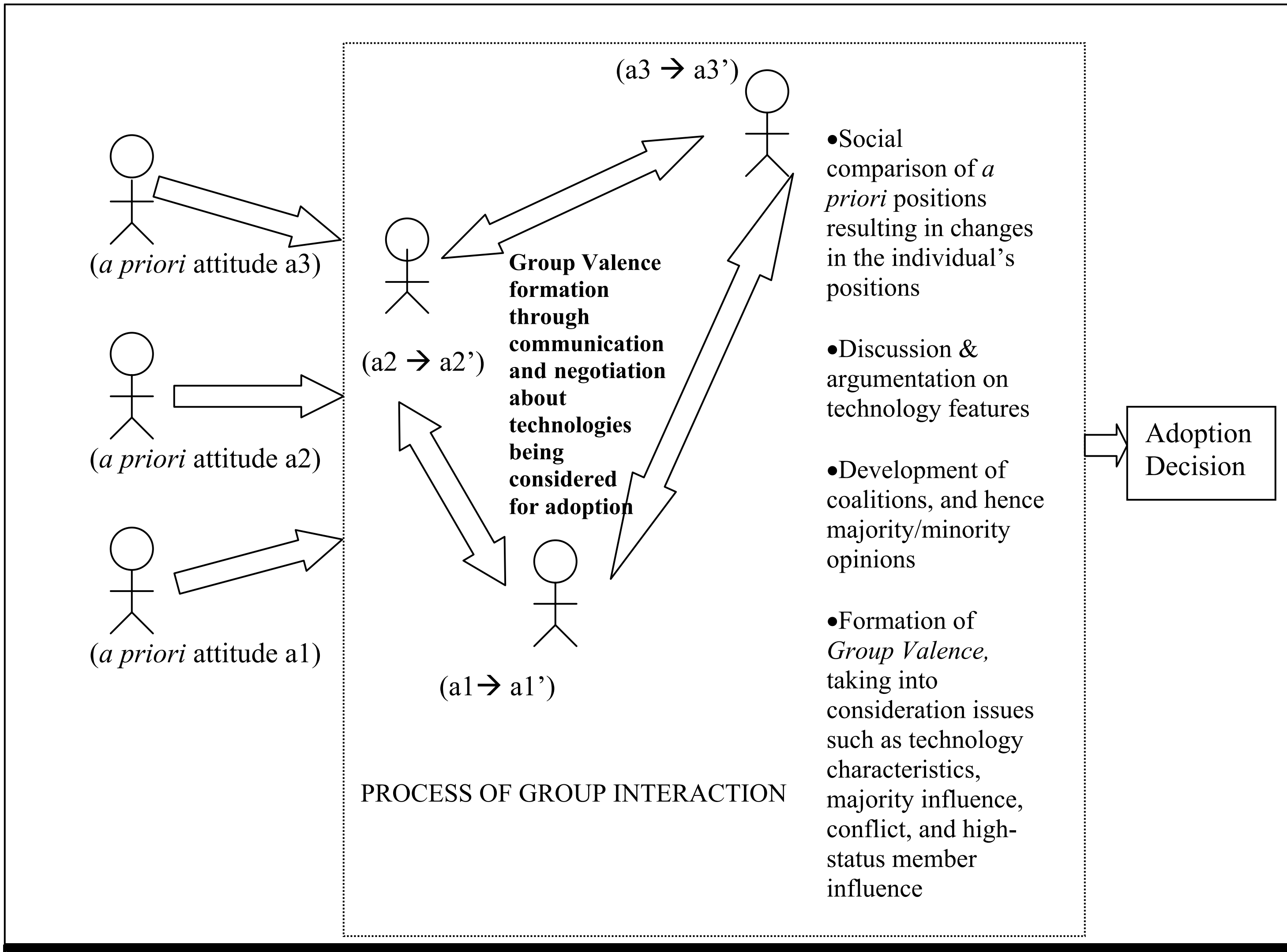


**Figure 1. Technology Adoption by Groups: A Process Perspective**

**Table 2. Core Concepts in the TAG Model**

| Concepts | Sub-Dimensions | Brief Description (within the context of the TAG model) |
|---|---|---|
| Groups (or "work groups") | None | Social entities within work organizations consisting of two or more individuals who are mutually interdependent, work on a common task, influence each other through verbal and other forms of interaction, and engage in behaviors that are collectively acceptable to each of its members. |
| Technology | None | Hardware or software applications (e.g., CASE tool, groupware, mobile devices, shared computing infrastructure for specialized applications). |
| Technology adoption by (in) groups | None | Adoption decision regarding a certain technology made collectively by the group through a process of communication and negotiation (leading to some degree of consensus among members regarding the adoption decision). |
| Individual members' *a priori* attitudes toward a technology | None | Attitudes of individual group members with respect to a technology (being considered for adoption by the group) prior to group interactions |
| Influence of high-status individuals arising from . . . | Structural power | The ability of an individual member to shape his/her group's orientation toward a technology owing to the structural position held by the individual within the group or related social system (e.g., a pre-assigned leader). |
| | Personal power | The ability of an individual member to shape his/her group's orientation toward a technology owing to certain personal characteristics (e.g., unique knowledge/skills/expertise in an area relevant to the group). |
| Substantive conflict | None | Adversarial environment and disagreements among group members arising from differences of opinions regarding the technology being considered for adoption. |
| Majority influence | None | The ability of the choice preference of the largest subgroup/coalition within the group to shape the group's overall orientation toward a technology being considered for adoption. |
| Group valence | None | Positive or negative orientation of a group as a whole toward a technology being considered by the group for adoption. |
| Technological characteristics | Multiple | See Table 3 |
| Adoption decision | None | The group's extent of commitment to adopt a particular technology. |

In the following section, we develop the propositions for the TAG model (see Figure 2).

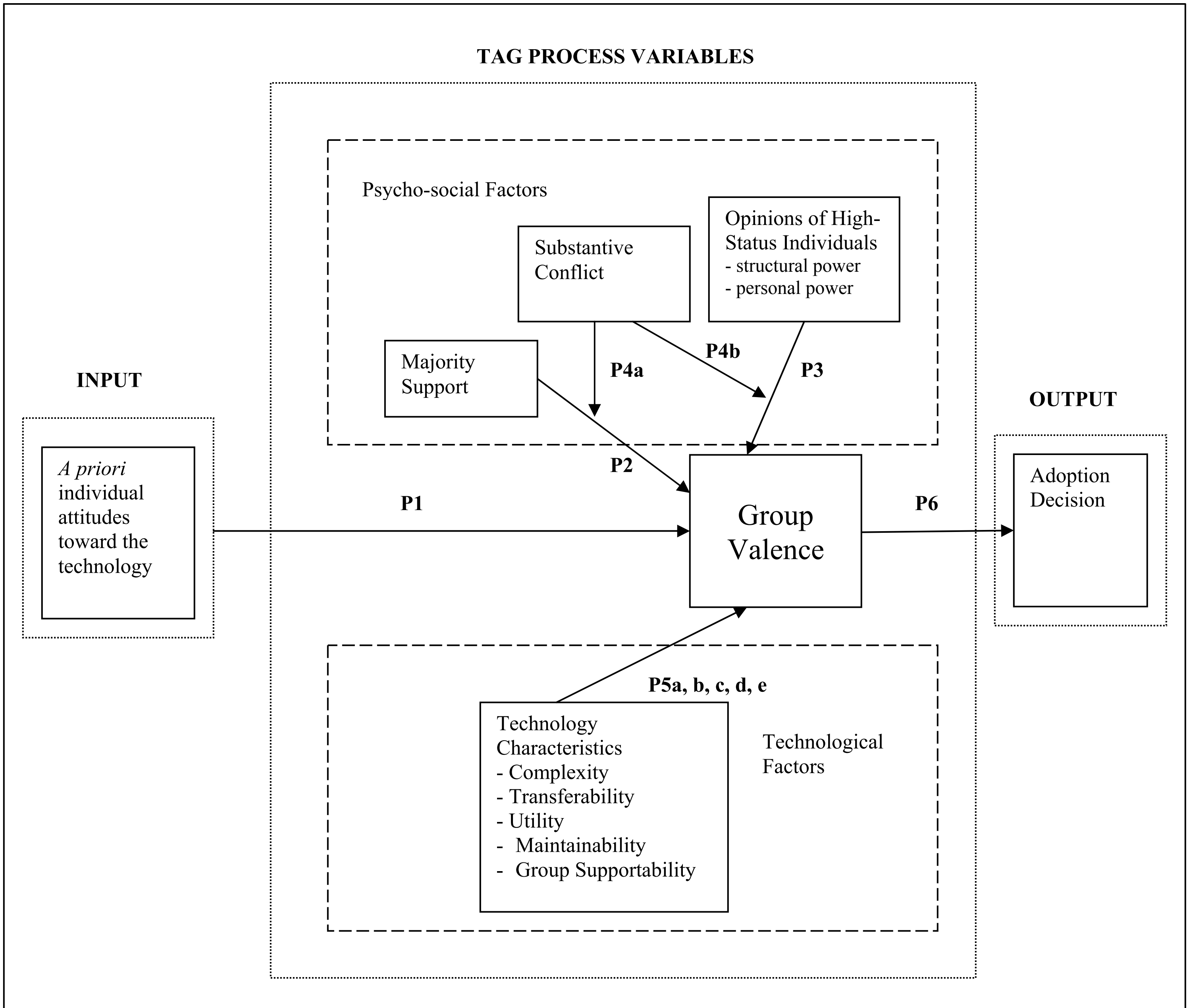


**Figure 2. Technology Adoption by Groups: A Variance Perspective**

## A Model of Technology Adoption by Groups (Tag)

Reflecting the sociotechnical character of the IS discipline (e.g., Benbasat and Zmud, 2003; Sarker and Lee, 2002), the proposed model consists of *psychosocial* as well as *technology-related* components, both of which are seen to contribute to the formation of the group valence (see Figure 2).

### The Psychosocial Variables

***Influence of the members' a priori attitudes****:* Social comparison theory (SCT), as the name suggests, is "rooted in the principle of comparison" (Forsyth, 2000, p. 82). It suggests that individuals may try to guess where others stand on various issues and accordingly adopt a stance based on this assessment (Meyers and Brashers, 1999). During the group discussion, each member is exposed to other members' preferences regarding the issue at hand. Through this process, *individual* members are able to compare their own *a priori* positions with those of the other members, thereby creating social influences. Since in every group there is a "pressure toward uniformity," especially because uniformity is "either desirable or necessary for a group to move toward some goal" (Festinger, 1953, p. 191–192), the social influences cause members to change their opinions and move toward a group-level consensus (Sanders and Baron, 1977). Following the logic of SCT in our context, it may be argued that during group interactions, members will compare their own *a priori* attitudes against other members' disclosures of their attitudes toward the technologies. This comparison process creates social influence, which results in members compromising on their own opinions and experiencing an "averaging effect" on their attitudes. The group's orientation (i.e., valence) is partly formed through this process (Forsyth, 2000; Festinger, 1954). From this, we suggest:

> *Proposition 1: The mean of the individual group members' attitudes toward the technology prior to group interaction will have a significant effect on the group's valence towards the technology.*

***Majority influence****:* The Distributive Valence model (DVM) holds that the valence of the relevant subgroup, rather than just the attitudes of individual members, has a critical determining influence on a group's choice of an option (McPhee et al., 1982). According to the DVM, each member in a group develops a positive or negative valence toward an option that a group may be considering (Meyers and Brashers, 1999), and through the group interaction process, coalitions of individuals with compatible views start to form (McPhee, Poole, and Seibold, 1982). The group's adoption of an option is seen to be dependent on the different coalitions' orientations toward a certain option (Poole, McPhee, and Seibold, 1982). McPhee et al. (1982) recommended the use of different combinatorial rules for explaining the influence of subgroup valence, of which the *majority rule* has been empirically shown to be a good predictor of group choice. Thus, this rule appears most applicable to the TAG phenomenon, where the focus is on predicting/explaining how a group makes a technology adoption decision from a set of options.

The majority rule suggests that the orientation of the largest coalition explains the group's choice. With the convergence of the GVM and the DVM theoretical traditions, scholars argue that the valence of the majority toward a certain option helps to move the entire group's valence toward the majority subgroup's preference (McPhee et al., 1982). It is thus argued that in the context of the adoption of a technology, the orientation (or valence) of the subgroup holding a majority will significantly influence the group's valence toward the technology. This leads to the following:

> *Proposition 2: Majority valence toward a technology will have a significant effect on the group's valence toward the technology.*

***High-Status Member Influence*****:** A status hierarchy inherently exists in every group (Fisher and Ellis, 1990) and is another important contributor in shaping the technology adoption process. Status hierarchy, or differential power in groups, is reflected in some individuals' "ability to influence other group members" (Fisher and Ellis, 1990, p. 223–224). Researchers have highlighted different types of power. Improving upon French and Raven's (1959) conceptualization, Fisher and Ellis (1990) argued for two types of power: *structural* (a person has certain power because of a position), and *personal* (a person has power because of the possession of certain qualities such as expertise and knowledge). We view high-status individuals in the group with structural power as the "leaders" (often "preassigned leaders"), and those with exceptional knowledge/skills in a relevant area as "experts." In the context of the TAG phenomena, we believe that either or both "leaders" and "experts" (in the domain of the group's tasks at hand and technologies being considered) may exist in a group faced with the responsibility of adopting a technology. Bass (1990, p. 178) argues that "groups are likely to be persuaded by the perceived expert, to accept both publicly and privately the expert's opinion." Literature also suggests that high-status individuals with structural and legitimate authority (as held by the leader) can significantly influence other group members' opinions regarding a certain issue (Bass, 1990). Specifically, Hoffman and Maier (1967), examining the role of valence in predicting the adoption of solutions by groups, concluded that leaders had a significant influence on the group valence. Thus we argue:

> *Proposition 3: The opinion of high-status individuals within the group (such as those possessing structural and/or personal power) regarding a particular technology will significantly affect the group's valence toward the technology.*

***Substantive Conflict Influence*****:** Group researchers suggest that conflict is "an active ingredient of the group process" (Fisher and Ellis, 1990, p. 262). While the literature documents a number of different types of conflict (e.g., intergroup, cognitive, and interpersonal), interpersonal conflict (i.e., conflict "directly observable through sequences of communicative behaviors performed by members of the group") (Fisher and Ellis, 1990, p. 257) is most relevant to an intragroup process of communication and negotiation (as in the TAG model). Such conflict may be categorized as affective or substantive. Affective conflict arises from procedural disagreements, while substantive conflict arises from incompatibility among group members associated with the content of ideas and issues related to the goal. We narrow our focus to substantive conflict, considered to be most pertinent to group processes (Gouran, 2003).

Substantive conflict can play a positive or a negative role in a group process, depending on the nature of the group's goal (Gouran, 2003; Jehn and Mannix, 2001). Sometimes, substantive conflict may be useful in "ensuring that task requirements are satisfied" (Gouran, 2003, p. 853). However, if the group's goal is to generate *consensus regarding a certain issue* (as in the case of the TAG model), conflict may hinder the generation of consensus (Fisher and Ellis, 1990). A separate study by Knight et al. (1999) also concluded that conflict in groups negatively affects agreement seeking and thereby causes a lack of consensus within the group. Similarly, Priem and Price (1991) have seen that in groups exhibiting conflict, members are less inclined to arrive at a consensus or accept the decision of the group. McGrath (1984) holds a view that conflict or differing viewpoints within a group are often very hard to resolve. Moreover, Fisher and Ellis (1990) suggest that excessive conflict often leads to multiple subgroups, with each exerting strong opposing forces on the others. These multiple subgroups "adopt a competitive orientation and distributive approach," which tends to lower the influence of each subgroup and ultimately deters consensus building (Gouran, 2003; Fisher and Ellis, 1990). Based on these studies, we argue that in the case of technology adoption in a group that needs to come to a consensus, substantive conflict will dampen the effect of any subgroup's influence. Through the emergence of an adversarial environment among the coalitions and group members, conflict tends to reduce the influence of the majority subgroup on the overall group's valence.

*Proposition 4a: Substantive conflict within the group will lower the influence of the majority subgroup's opinion regarding the technology on group valence.*

While substantive conflict may reduce the influence of the majority subgroup, we propose that it has an amplifying effect on the influence of high-status individuals (e.g., the leader). In times of group conflict or tension, individuals in high-status positions tend to take on a more central role in the group. Owing to this central position, such individuals are usually "in a neighboring region to every other member" and thus are able to influence everyone more strongly (French, 1953, p. 131). Theorists offer yet another reason for this amplification of high-status members' effects. Fisher and Ellis (1990) refer to the concept of "encapsulation," a method that groups resort to in situations where there is apparently no way to resolve conflict. Groups tend to *encapsulate conflict,* not by eradicating it, but by dealing with it through the "governance of an agreed-upon set of rules" (Fisher and Ellis, 1990). A common encapsulation tactic used by members is to rely more heavily on a high-status individual within the group to help meet the group's goal, thereby increasing the influence of such individuals on the group during times of conflict. Based on this we argue:

*Proposition 4b: Substantive conflict will increase the influence of high-status group members on group valence.*

### *The Technology-Related Variables*

As mentioned earlier, we view technology adoption by groups as a phenomenon that can be understood only by carefully considering the role of different technology features,[5] in addition to the psychosocial factors. Researchers have attempted to unearth the conceptual properties of technology that tend to influence adoption decisions made by individuals/organizations (e.g., Aiman-Smith and Green, 2002; Chau and Tam, 1997; Kurnia and Johnston, 2000; Kwon and Zmud, 1987; Lai and Guynes, 1994; Leonard-Barton, 1988; Thong, 1999; Rogers, 1995; Tornatzky and Fleischer, 1990). Many of these characteristics are also relevant to understanding technology adoption by groups.

It is important to note that technologies are socially constructed artifacts, and thus their properties cannot be isolated from the social context within which they are assessed. Consequently, we conceptualize technology characteristics not as absolute or universal, but based on the negotiated collective view of group members (Fichman, 2000). An important implication of this point is that the preferences and pressures of the surrounding context within which a group is embedded (say, an organization) implicitly enter the consideration of adoption decision makers through the characteristics of technology. For example, when a group judges the transferability of a technology, it does not actually focus only on the within-group preferences, but also considers: (1) whether IT staff exists in the organization who can support the adoption requirements, and (2) whether the IT staff, who may have the technical capability, would be actually willing to support the

[5] We note that the inclusion of this construct in the TAG model is consistent with our goal of theorizing about the *technology adoption* decision in groups (and not merely about *any* group decision) and avoids the "errors of exclusion" (Benbasat and Zmud 2003).

adoption process, especially in the presence of organizational constraints that could be linked to a variety of causes, including history, policies, and even politics.

From the literature, as well as through observations of groups in action, we posit five clusters of characteristics of technology potentially relevant to the TAG phenomenon: *Complexity*, *Transferability, Utility, Maintainability, and Group Supportability.* The first four are relevant characteristics in technology adoption scenarios, irrespective of the level of the adopting social unit (i.e., individual, group, or organization). Prior studies, including those by Karahanna et al. (1999), Kwon and Zmud (1987), Leonard-Barton (1987), and Rogers (1995), have identified these or variations of these above-mentioned characteristics as relevant in technology adoption situations. In addition, we have added a fifth characteristic, namely, group supportability, which we believe is extremely pertinent in an adoption context where a technology adoption decision is being made for *group-level* use. We would like to emphasize here that the relevance of different technological characteristics (and subcharacteristics) will vary depending on the particular context of a study.

*Complexity:* This has been cited as one of the most important characteristics of technology (e.g., Aiman-Smith and Green, 2002; Kwon and Zmud, 1987; Leonard-Barton, 1988; Rogers, 1995; Taylor and Todd, 1995; Tornatsky and Fleischer, 1990) that is inherently applicable to all levels of analysis, including groups. For the purpose of the TAG model, we define complexity of a technology *as the perceived degree of difficulty that group members collectively anticipate in using and adapting to it.* Different researchers have highlighted the importance of complexity in its various forms. For example, Leonard-Barton (1987) found that the complexity arising from the number and extent of the work-process elements to be altered as part of the technology adoption process is important. Similarly, Aiman-Smith and Green (2002, p. 423) concluded that the complexity of the technology (which they defined as the "number, novelty, and technological sophistication of new features and concepts in a new technology") is a critical determinant of adoption. We refer to this feature as the radicalness of the technology. Theoretical perspectives such as the Technology Acceptance Model (TAM) and the Decomposed Theory of Planned Behavior (DTPB) have also incorporated complexity (represented by the construct of "ease of use") as a key determinant of adoption (Venkatesh and Davis, 1996; Taylor and Todd, 1995). Another source of complexity is "interpretive flexibility" (Orlikowski, 1992), which refers to the level of openness with which one can interpret the features of contemporary information technologies. Interpretively flexible technologies are likely to be understood and appropriated differently by group members, often in ways that may not have been foreseen (DeSanctis and Poole, 1994). The difficulty in forming a uniform understanding in the group regarding the capabilities and limitations of the technology is likely to result in divided opinions among members, and hence lower valence.

> *Proposition 5a: Complexity of the technology will negatively affect the group's valence toward the technology.*

*Transferability:* This characteristic of technology, while somewhat related to complexity, has distinct implications for adoption (Leonard-Barton, 1988). In the context of the TAG model, we define transferability as *the collectively perceived degree of readiness with which a technology may be routinely used by the group members*. A key factor contributing to readiness is the degree of communicability, which is defined as codified knowledge about the technology in the form of documentation of the features and exemplars for use in similar circumstances (e.g., Leonard-Barton, 1988). In addition, the presence of supportive infrastructure (Armstrong and Sambamurthy, 1999; Scupola, 2003), including in-house/external consultants and compatible hardware/software available to the group, can enhance the transferability of a technology. A high level of transferability makes technology adoption less onerous and thus is likely to create a positive orientation within a group regarding the technology (Leonard-Barton, 1988). Thus, we have:

> *Proposition 5b: Transferability of the technology will positively affect the group's valence toward the technology.*

*Utility:* This is another technological characteristic that is likely to influence group valence. In the TAG model, we draw on prior research (e.g., Iacovou, Benbasat, and Dexter, 1995; Rogers, 1995; Scupola, 2003; Taylor and Todd, 1995) and define utility of the technology as the *relative advantage of adopting it as collectively perceived by the group*. Utility may be judged in terms of the *functional benefit* (or cost) and *symbolic benefit* to the group, and the *individual benefit* of adopting a technology. Functional benefits have been studied in terms of a technology's strategic and efficiency-oriented implications (Chau and Tam, 1997; Tornatzky and Fleischer, 1990) and its "perceived usefulness" (Venkatesh and Davis, 1996). A related cost perceived by many groups arises from the "surveillance capability" of technology (Mason, Button, Lankshear, and Coates, 2002). Given the capability of contemporary IT to act as a panopticon, there has been increased concern about ubiquitous observation and control (Zuboff, 1988), with implications for human privacy rights (Mason et al., 2002). We argue that higher surveillance capability of a technology will tend to increase the perceived personal cost for group members and hence reduce its utility from the group's perspective. In addition to functional benefits (or costs), technologies can also provide important symbolic benefits for groups within organizations (e.g., Davenport, 1993; Kaarst-Brown & Robey, 1999; Ling, 2000). For example, according to Davenport (1993, p. 216), one of the "paramount" dangers associated with the failure of a reengineering group to adopt advanced technological tools is that it sends a (negative) message regarding the group's seriousness and competence and consequently tends to undermine the importance of the group's functions. Similarly, studies of handheld mobile devices have revealed that favorable symbolism associated with the technologies created a positive orientation among users, prompting adoption (e.g., Ling, 2000; Sarker and Wells, 2003). Finally, we believe that the individuality of a technology (Leonard-Barton, 1988), defined as the extent to which the technology has the potential for beneficial use for individual output by the group members independent of the current group task(s), can have a positive influence on group valence. For example, certain aspects of a collaborative writing tool being considered for adoption by a group, if viewed as valuable by *individual group members* for composing their *own personal* documents, can lead to a more positive group-level orientation.

> *Proposition 5c: Utility of the technology will positively affect the group's valence toward the technology.*

*Maintainability*: This is another important technological characteristic that may have a strong effect on the adoption decision, given that a technology is rarely adopted for one-time use. Whenever there is an expectation of continued usage of a technology, maintainability, which is related to the social entity's concern regarding the post-adoption phase (and beyond), becomes a critical issue. In the context of the TAG model, maintainability refers *to the extent to which group members collectively perceive a* *technology as fixable and malleable to changing requirements such that the group is able to use it for an acceptable time period.* For technologies that need to evolve with a group's requirements over time, the viscosity, reflecting a system's "resistance to change" to shifting conditions, acts as a negative contributor to maintainability (Budgen, 2003). Another key issue related to maintainability is the perceived continuity in the availability of technical support from the vendor (or relevant agents). Clearly, a software development group would not be very positively inclined toward an otherwise suitable development tool if it perceives that the vendor may withdraw technical support because of resource constraints or for strategic reasons.

> *Proposition 5d: Maintainability of the technology will positively affect the group's valence toward the technology.*

*Group supportability:* This technological characteristic, which is particularly relevant when a *group* is faced with a technology adoption decision, refers to the *extent to which a technology is perceived to support group processes*, including group task performance. Group supportability may be assessed based on the capability of the technology to enable parallelism, transparency, and sociality within the group context. While most tasks undertaken by groups have some degree of interdependence, an individual (or a subgroup) often needs to undertake subtasks independently for greater efficiency, before the results of the efforts of the entire group can be integrated (e.g., McGrath, 1984; Van de Ven and Delbecq, 1971). This suggests that technologies adopted by groups often need to have the features to enable the group members to perform tasks in parallel within a shared framework (Nunamaker, Dennis, Valacich, Vogel, and George, 1991). While many of the group collaborative systems have *parallelism* built-in (Dennis and Garfield, 2003; Nunamaker et al., 1991), for technologies that are not "group technologies" but are individual-level technologies being considered for adoption by a group, parallelism can still be an important issue. In many instances, when the subtasks cannot easily be segregated and substantial interdependence between the subtasks exists, the capability to support viewing and modification of other group members' outputs, if necessary in real time, can become an important feature of technology that positively influences group members' orientation (Sarker and Sahay, 2004). We term this characteristic *transparency,* which signifies the perceived ability of a technology to make individual group members' work easily visible and modifiable by other group members (e.g., Mark et al., 2003; Sarker and Sahay, 2004). In many technologies, group memory provides some degree of transparency (Nunamaker et al., 1991). Finally, groups are likely to value the perception that a technology can help members to "socialize and develop relationships" and thereby establish a "strong knowledge network" where it is possible to know "who knows what" (e.g., Dennis and Reinicke, 2004). We refer to this characteristic as *sociality*, and argue that higher levels of sociality along with parallelism and transparency will contribute to the group valence.

> *Proposition 5e: Group Supportability of the technology will positively affect the group's valence toward the technology.*

We summarize the relevant technology characteristics (and their subdimensions) in Table 3.

**Table 3. Technology Characteristics and Sub-Characteristics**

| Characteristic | Brief Definition | Sub-Dimension (with effect on group valence) | Brief Description of Sub-Dimensions (within the context of the TAG model) |
|---|---|---|---|
| Complexity | Perceived degree of difficulty that group members collectively anticipate in using the system and adapting to it. | Alterations in work processes required (-) | The extent to which the work-process elements of the group will need to be altered in order to use the technology. |
| | | Radicalness (-) | The degree of technical sophistication, novel features, and new concepts associated with the technology. |
| | | Interpretive flexibility (-) | The level of openness with respect to the interpretation of features of a technology and the variations in which groups members could potentially appropriate the system. |
| Transferability | Collectively perceived degree of readiness with which a technology may be routinely used by group members. | Communicability (+) | The extent of availability of appropriate codified knowledge about the technology in the form of documentation of the features and exemplars for use. |
| | | Supportive organizational infrastructure (+) | The extent of availability of in-house or external consultants and compatible hardware/software infrastructure to the group. |
| Utility | Relative advantage of adopting a technology as collectively perceived by the group. | Functional benefits/costs (+)/(-) | The level of benefits such as the increase in efficiency and strategic position, and perceived usefulness; also includes costs such as surveillance capability. |
| | | Symbolic benefit (+) | Extent to which the technology is believed to have the capacity to enhance the group's image. |
| | | Individuality (+) | Extent to which the technology has the potential to be used for individual output by the individual group members independent of their current group task. |
| Maintainability | Extent to which technology is collectively perceived by the group to be fixable and malleable to changing requirements such that the group is able to use it for a longer time. | Viscosity (-) | The degree of resistance to change of the technology to changing conditions. |
| | | Perceived continuity (+) | The extent of continuity expected in the availability of technical support from the vendor or other appropriate agents. |
| Group supportability | Extent to which the technology is collectively perceived to support the process and the tasks involved in group work. | Parallelism (+) | The degree to which the technology is capable of enabling group members to perform tasks in parallel, within a shared framework. |
| | | Transparency (+) | The degree to which the technology is capable of making individual group members' work visible and modifiable by other group members. |
| | | Sociality (+) | The degree to which the technology is capable of enabling members to build social relationships and knowledge networks. |

### Group Valence

So far, we have highlighted key psychosocial and technological factors that influence group valence. Two issues are worth noting at this point. First, we discuss the psychosocial and the technological factors as distinct constructs for analytical convenience. In reality, both sets of factors are intricately linked and difficult to separate (Walsham, 1997). For example, high status influence, formation of coalitions, and conflict are not independent of the technology characteristics. Similarly, the technology characteristics are very much reflective of the psychosocial context of adoption. For example, maintainability assessments would depend on how much faith the group had on a particular vendor, and this faith could be based on selective perceptions of past experiences, on views of high-status individuals (internal or external to the group), or maybe on media coverage. The second point is partly a consequence of the analytical separation of the fundamentally inseparable psychosocial and technological factors. In our model, we treat their effects on a group's valence as additive rather than multiplicative. This additive effect may be understood simply by considering the following situation: If a group finds a technology to have relatively high levels of, say, transferability, utility, maintainability, and group supportability and a low level of complexity, a majority support for the technology would further increase the group valence. Likewise, even when the properties (e.g., transferability, utility, and maintainability) of a technology are favorable, high status individuals' lack of positive orientation toward that particular technology would, as a result of their significant social influence, tend to reduce the group's valence toward that technology (Hoffman and Maier, 1967; Bass, 1990).

***Influence of group valence on the group's adoption decision:*** Current studies on adoption tend to make a distinction between the "adoption decision" and the "adoption response"[6] (Leonard-Barton, 1988; Rogers, 1995; Tornatsky and Fleischer, 1990). Given that the technology adoption response often depends primarily on a variety of external/macro organizational and institutional level factors and can only be imperfectly determined even after prolonged longitudinal examinations, we focus our attention on explaining how a technology "adoption decision" unfolds in a group context. Thus, the TAG model can be seen as an attempt to explain technology-adoption-related decision making by groups. We note that our choice of "adoption decision" as the final outcome variable is consistent with many prior adoption studies (e.g., Venkatesh et al., 2003; Thong, 1999; Lai and Guynes, 1997).

As mentioned earlier, GVM scholars have posited that group behaviors can be predicted using the group's valence (Hoffman and Maier, 1964; 1967; Hoffman, 1979). Hoffman and Kleinman (1994), for example, suggest that the greater the group valence toward an alternative, the higher the likelihood that the alternative will be adopted. Applying the same line of reasoning to the adoption of technology by groups, we theorize that at the end of the communication and negotiation process, if the group develops a favorable orientation toward a technology (i.e., develops a high group valence), a positive adoption decision will result. Thus, we conclude (see Figure 2):

> *Proposition 6: Group valence will have a significant positive effect on the group's technology adoption decision.*

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[6] Adoption response is also termed as implementation or routinization.

## Measurement of the TAG Constructs

We believe that the proposed model may be used either as a conceptual framework for organization and interpretation of qualitative data, or as a blueprint for empirical quantitative research on this topic. We provide the following discussion on measurement with the quantitative empirical research tradition in mind.

### *Selecting an Appropriate Level of Measurement*

A key issue related to the elaboration of the proposed TAG model is choosing an appropriate level of measurement for the constructs. Drawing on Bar-Tal (1990), scholars such as Gibson, Randel, and Earley (2000, p. 68–69) argue that in selecting an appropriate measure of a group construct, ideally, four different criteria need to be satisfied: (1) the construct to be measured should reflect the entire group, as opposed to individual members as separate entities; (2) group members should agree on the construct; (3) the construct should be able to differentiate among groups; and (4) the construct should "reflect the processes of interaction that occur within a group." There are numerous approaches to measuring group-level constructs, and researchers advocate different heuristics depending on their preferences. For example, according to Zigurs (1993), a "common practice" among group researchers (including those in the field of IS) is to collect individual-level data and aggregate them across group members to receive group-level data of a certain phenomenon. Gibson et al. (2000) point out that this type of measurement approach does not satisfy all of Bar-Tal's (1990) criteria, and specifically fails to reflect the complex group processes that accompany each group activity. Recognizing such complications, researchers have called for another technique, namely the use of a group discussion procedure for measuring group constructs (e.g., Guzzo et al., 1993). In studies using this procedure, each group is presented with an instrument scale and asked to discuss and provide a single response to each of the items. The group discussion procedure is better able to incorporate intramember agreement than are statistical calculations (Gibson et al., 2000).

Researchers investigating computer-mediated groups have observed that there are merits to measuring group variables at both the individual and the group levels and have called for triangulating the two measurements when possible (e.g., Gallupe and McKeen, 1990). However, since the TAG model may be tested in a wide range of contexts, such a measurement strategy may become too burdensome (Zigurs, 1993). We now provide some recommendations regarding the operationalization of the constructs.

### *Measurement: Preliminary Guidelines*

In this subsection, we elaborate on the measures of each of the constructs in the TAG model. These guidelines should not be viewed as rigid instructions but rather as a flexible guide to measurement that can be tailored to different technology adoption contexts involving groups.

Group valence (the core construct of the TAG model) may be measured at a *group level by using an "observation system"* or *a "discussion method*." The observation system, traditionally the preferred method of measuring group valence, involves independent raters/coders who observe discussions among members and make judgments regarding the group's valence (Hoffman and Maier, 1967; Hoffman and Kleinman, 1994). However, in some studies, it may become logistically infeasible to observe a large number of groups or to get reliable independent coders for categorizing the positive and negative comments in the group, especially after a flurry of communication and negotiation. In such a circumstance, the use of the discussion method may be more appropriate. In this approach, the group should collectively complete items that attempt to capture different aspects of the group valence, such as the “acceptability of the technology” and “the extent to which the group has a positive orientation toward the technology.” Given that there are no known scales measuring group valence, we have attempted to provide some sample items in Appendix B.

Two other constructs in the TAG model, adoption decision and technology characteristics, may also be measured at the group level. Adoption at the individual level has been measured mostly by using items that capture an individual’s intention to use a system (e.g., Karahanna, Straub, Chervany, 1999). At the organizational level, adoption has been measured using various types of items and methods. Some researchers have used items capturing the intention to adopt (Teo, Wei, and Benbasat, 2003). Others have used dichotomous variables to examine whether an organization has adopted a certain technology in a given period of time (Thong and Yap, 1995; Keister, 2002). On similar lines, Chau and Tam (2000), in their study of the adoption of open systems, used a single item (whether or not “the organization had already developed a migration plan for open systems”) as a measure of the organization’s adoption decision. However, in light of Bayer and Melone’s (1989) criticism of the use of binary variables to measure adoption, many researchers have used Likert scales to examine variables such as swiftness and intensity as measures of adoption (Ravichandran, 2000). We recognize that the measure of an adoption decision may depend on the technology context being studied; however, based on criticisms pertaining to the binary variable, we recommend the use of multiple items (e.g., the extent to which the group has decided to adopt the technology and plans to use the technology) as measures of the adoption decision (see Appendix B for sample items).

As in the case of the two constructs discussed above, multiple methods have also been used to measure the characteristics of the technology. While Leonard-Barton (1988) used case studies and observations to judge various technological characteristics, others have proposed and utilized scales (e.g., Green, Gavin, and Aiman-Smith, 1995; Karahanna et al., 1999; Moore and Benbasat, 1991; Rogers, 1995). We believe that items from many of these scales may be adapted to capture the technology characteristics (i.e., complexity, transferability, utility, maintainability, and group supportability) suggested in this paper. We provide some sample items in Appendix B.

The constructs that we recommend be *measured at the individual level* (and then aggregated if necessary to form a group-level measure) are: *individual’s a priori attitudes* toward the technology, the *influence of high-status members*, the *effect of conflict*, and *majority influence*. Given the vast body of knowledge on attitudes within and outside the field of IS, there are numerous existing instruments for examining attitudes. Some of them have used semantic-differential scales with anchors such as good/bad (Davis et al., 1989; Taylor and Todd, 1995; Karahanna et al., 1999). Attitudes toward technology have also been measured using 7-point Likert scale items (Moore and Benbasat, 1991). However, given the prominence of the semantic-differential scales in the literature on technology adoption, we recommend the use of the same in measuring the individual group members’ *a priori* attitudes toward the technology (Davis et al., 1989).

The influence of high-status members (such as leaders) may be measured in multiple ways. Moehle and Thibaut (1983) recommend asking individuals whether there was a leader in their group. They further recommend the use of another item (e.g., "to what extent did you accept the idea and the decision suggested by the leader") to capture the influence of the high-status member. Organizational researchers have widely advocated such perceptual measures of influence of higher-status individuals (e.g., Salancik and Pfeffer, 1974). Still others have recommended the use of the Social Power Inventory (SPI) to measure the various bases of power held by certain individuals and their influence on others (Pearce II and Robinson, 1987). Drawing on the above-mentioned literature (Moehle and Thibaut, 1983; Pearce II and Robinson Jr., 1987), we recommend measurement of the influence of high-status members on group valence in the context of the TAG model using the following three steps: (1) asking each individual member if there was a high-status individual (say, a leader or an expert) in their group, and if so, to identify the individual, (2) asking each member the extent to which this identified individual(s) had influence over the group's orientation toward the technology, and finally, (3) validating the power and influence exerted by the identified individual by using items from the Social Power Inventory scale.

While several scales exist for measuring substantive conflict, we recommend use of the scale developed by Miranda and Bostrom (1993–94), given its popularity among IS researchers.

The measurement of the majority's influence on the group's valence may be inherently difficult, given that there is "no clearly-justified method of measuring valence" at this level (i.e., subgroup) (McPhee et al., 1982). We recommend measuring the influence of the majority by the following two steps: (1) asking each member (at the conclusion of the group interaction) whether he or she supports the adoption decision regarding the tool chosen by the group, and then (2) using these responses to judge whether there was majority support for the technology adopted by the group.

We recommend that while conducting an empirical study, researchers ask the group to respond to the group valence, technology characteristics, and adoption decision items for *each of the technologies* considered by the group (i.e., the technology that was adopted and the technologies that were considered but not finally adopted). Similarly, individual members should also respond to the items measuring the members' *a priori* attitudes toward *each of the technologies* in the group's consideration set. We summarize our suggestions regarding the measurement of constructs in the TAG model in Table 4. Further, for the constructs where we recommend using new scales, we have provided some sample items in Appendix B.

## Discussion and Future Directions

The existing literature provides substantial understanding of the factors that explain technology adoption by individuals (e.g., Venkatesh et al., 2003) and by organizations (e.g., Fichman, 2000; Rogers, 1995). However, efforts to develop a theory explaining how *groups* adopt technologies have been lacking, despite the obvious importance of this phenomenon, as the real-life scenario of TeleCorp (described in the introduction) highlights. In this paper, we intend to fill this gap by proposing a new model that explains technology adoption by groups. To illustrate how our model works, we briefly revisit how technology adoption occurred in TeleCorp using the TAG model as a theoretical lens (see Table 5).

**Table 4. Constructs of TAG and Suggested Measures and Measurement Techniques**

| TAG Constructs | Suggested Measure(s) | Administration Technique(s) |
|---|---|---|
| Individual members' *a priori* attitudes toward the technology | Existing 7-point semantic differential scales for measuring attitudes (Karahanna et al. 1999; Davis et al. 1989, etc.) | Individual level (prior to group-interaction) |
| Group valence | New items attempting to capture "acceptability of" and "the extent to which the group has positive orientation" toward a technology solution on a 7-point Likert scale (see Appendix A for sample items). | Ideally, group-level measure obtained using the "discussion method," or the "observational system method" (after group interaction); an alternate but less preferred approach is to aggregate individual responses to relevant items. |
| Technology characteristics | Modified versions of existing items measuring a variety of technological dimensions (Karahanna et al. 1999; Rogers 1995; Green, Gavin, and Aiman-Smith 1995; Moore and Benbasat 1991) along with new items (see Appendix A for sample items). | Group level, using the "discussion method" (after group interaction); an alternate but less preferred approach is to aggregate individual responses to appropriately modified items. |
| Influence of high-status individuals | Three step strategy (drawing on Moehle and Thibaut 1983 and Pearce and Robinson 1987):<br>• Each individual member asked to respond whether there was a leader and (or) an individual with expertise in the technology in their group and who was it,<br>• Each individual then responds the extent to which the opinion of such high-status individuals had influence over the group, and, finally,<br>• Validate the power and influence exerted by them by using the items from the SPI. | Individual level (after group interaction). |
| Substantive conflict | Modified version of Miranda and Bostrom's conflict scale (1993-94) | Individual level (after group interaction). |
| Majority influence | Two-step strategy:<br>• Each individual member (after group interaction) is asked indicate whether they supported the use of the tool chosen by their group.<br>• Based on the responses provided by individual members, calculate a binary measure of whether majority supported the adoption of the tool or not. | Derived attribute calculated based on individual members' responses (after group interaction). |
| Adoption decision | Multiple items capturing whether group has decided to adopt the technology (see Appendix A for sample items) | Group level using the "discussion method." This is the final piece of data collected from groups. An alternate but less preferred approach is to aggregate individual responses to appropriately modified items. |

**Table 5. Application of the TAG Model in the Hypothetical TeleCorp Scenario**

| **Constructs in TAG** (with the direction of hypothesized influence on Group Valence) / **Tools considered by the reengineering group in TeleCorp** | | **DIAGRAMMER-1** | **CASE2000** | **HAND-DRAWN** |
|---|---|---|---|---|
| **Individual members' *a priori* attitudes (+)** | | Strongly preferred by one member; other members divided in their views | Strongly preferred by one member; other members divided in their views. | Strongly preferred by two of the eight members (non-IT) |
| **High-status member (+)** | *Structural Power* (moderate structural power held by the director) | N.A. | Very positive orientation | N.A. |
| | *Expert Power* (very high expert power held by the consultant) | Very positive orientation | N.A. | N.A. |
| **Technology Characteristics** | *Complexity (-)* | Low<br>Technological features not perceived to be too sophisticated or difficult to use; the diagramming conventions were seen to be relatively intuitive. | High<br>Technological features too sophisticated for a number of non-IT team-members; low perceived ease of use | Very low |
| | *Transferability (+)* | Moderate-High<br>Documentation and infrastructure available. | Moderate<br>While documentation & infrastructure available, the technology and associated diagramming conventions were seen as "radical" by team-members. | High |
| | *Utility (+)* | Very High<br>Moderate functionality and high perceived usefulness; moderate-high symbolic utility; high individuality as some members felt that DIAGRAMMER-1 skills acquired could be useful for accomplishing other tasks that they had been assigned (unrelated to the group's tasks). | High<br>Very high functionality though perceived usefulness moderate (many of the CASE2000 features not seen as useful); very high symbolic utility; not seen to have high individuality | Low<br>Unsatisfactory functionality and perceived usefulness– no diagramming aids, changes difficult to incorporate; low symbolic utility |
| | *Maintainability (+)* | Moderate<br>Vendor support available; not amenable to change easily. | Moderate<br>Vendor support available; not amenable to change easily. | N.A. |
| | *Group Supportability (+)* | Moderate<br>Moderate parallelism; low transparency due to lack of shared repository; moderate sociality possible, especially if group members focused on shared meaning rather than standardized representation alone. | Moderate<br>High parallelism and transparency due to shared repository; moderate sociality possible, especially if focus was on shared meaning rather than standardized representation alone. | Low<br>Very low parallelism; low visibility unless all group members worked together; high sociality possible, if true collaboration could be encouraged among group members, otherwise low sociality. |
| **Conflict** | | Somewhat present, but not a significant factor in shaping the group dynamics | | |
| **Majority (+)** | | Preferred | | |
| **Group Valence** | | High | Low | Very Low |
| **Adoption (Decision)** | | High (Yes) | Low (No) | Very Low (No) |

As is the case in many organizational groups, the reengineering team in TeleCorp was also made up of a diverse set of individuals, each having different *a priori* attitudes toward the technologies being considered for adoption. Many of the group members were from non-IT departments and thus had a generally negative initial attitude toward DIAGRAMMER-1 and CASE2000 (the two technologies being considered) and had a hard time understanding why hand-drawn process maps would not be sufficient. The consultant, who was experienced in business process change initiatives (i.e., he held very high personal power), had a strong preference for DIAGRAMMER-1, while the high-ranking manager at TeleCorp (the individual with some level of structural power in the team) seemed to lean toward CASE2000, a technology that another group at TeleCorp used recently. Given the team members' diversity in attitudes, the meetings dedicated to the selection of a particular process-modeling technology thus witnessed considerable negotiation. In the meetings, the group explored and evaluated the technology characteristics of the various process-modeling options being considered (DIAGRAMMER-1, CASE2000, and hand-drawn). DIAGRAMMER-1 was seen as a tool with low complexity, moderate degrees of maintainability and group supportability (especially in terms of parallelism and transparency), moderate to high degrees of transferability, and very high utility. On the other hand, CASE2000 was seen to have high utility and moderate degrees of transferability, maintainability, and group supportability, but the group perceived it as having very high complexity. After much deliberation, the group ultimately developed a substantially positive orientation toward DIAGRAMMER-1, largely because of its favorable (technological) characteristics (Propositions 5a–e), the strong preference of the consultant (the individual who was clearly the high-status member of the team) (Proposition 3), and the support of the majority of the group members (Proposition 2). In addition, the disagreements among group members helped to increase the influence of the high-status member (i.e., the expert) (Proposition 4b). We note that the characteristics of the technologies, notably complexity, transferability, and utility (especially individuality), played a significant role in shaping the group's valence through the group interaction process (Propositions 5a, 5b, and 5c), which, in turn, led to the adoption decision in favor of DIAGRAMMER-1 (Proposition 6).

Thus, our model, through its view of adoption as a communication and negotiation process, is able to highlight and clarify the psychosocial and technological factors while describing the complex interplay through which the adoption of technologies in *groups* occur. Consequently, the model can inform practitioners seeking to predict or influence a group's technology adoption behavior. Of course, the next step would be to refine and validate the model in a variety of empirical settings. Certainly, case studies could be a useful vehicle initially for clarifying constructs and validating the hypotheses (e.g., Sarker and Lee, 2002). In addition, the model can also be subjected to empirical testing using field and lab studies, with some additional development. Given that the primary objective of this paper is to articulate a theoretical model, we have focused most of our efforts to this end. However, we have included some discussion of the appropriate level of measurement and sample instruments. Our intent has been to provide some basic guidelines to enable future researchers to take the first step toward empirical validation of the proposed model. We would like to caution researchers, however, that the propositions, as well as the instruments presented here, will need to be adapted to fit the research methodology and the adoption context selected for investigation.

While we have attempted to incorporate potentially salient psychosocial and technological variables and their relationships, we have treated the two groups of variables as distinct. An IS scholar critical of this analytical separation could argue that propositions pertaining to the technology factors are relevant to our discipline; on the other hand, those pertaining to the psychosocial factors are not of central interest. One way to move forward would be to develop and test hypotheses about the interactive effects of different technology characteristics and psychosocial factors; it could be a productive avenue to comprehend the TAG phenomenon even better. Such an effort would address important questions, such as: Are there certain technology characteristics that make the effect of *a priori* individual attitudes on group valence more salient? Is the role of majority or high-status individuals nullified or minimized in the communication and negotiation process when certain technology characteristics are prominent? While at this stage such an endeavor appears theoretically challenging, we can see the value of this line of thinking and wholeheartedly invite future work in this direction.

## Conclusion

In this paper, we have argued the need for a theory distinctively geared toward providing an understanding of how groups adopt technologies. Rooted firmly in the existing literature on groups, communication, and IT adoption, this paper introduces and elaborates on a theoretical model that incorporates both technological and psychosocial factors. At the core of the model is *group interaction*, which we frame as *a process of communication and negotiation* among members leading to the adoption decision. This encompasses four subprocesses:

- Social comparison of *a priori* positions resulting in changes in the individual's positions
- Discussion and argumentation on technology features
- Processes of social influence (e.g., majority influence and high-status member influence)
- Formation of *Group Valence,* which in turn leads to a certain technology adoption decision by the group.

Given the variety of theories and models seeking to explain adoption, a very legitimate question that readers may ask is: *Under what circumstances is the TAG model applicable?* The discussion on boundary conditions in the introductory section provides some guidance in this regard. Specifically, we would like to reiterate that the TAG model seeks to explain *technology adoption decision making by groups* when *there is considerable freedom of choice available to the group*. In other words, adoption situations that are mandated or imposed on a group and do not involve participation of group members are beyond the scope of the proposed model. Further, as explained earlier, the proposed model does not seek to explain adoption response, but rather the adoption decision.

We have attempted to motivate the paper using a scenario in which a group is involved in choosing the technology to adopt for *itself*. We must emphasize that this is not the only type of situation in which the TAG model may be applicable. Groups are often entrusted with technology adoption decision-making responsibilities, when the adoption decision has far-reaching consequences for a variety of constituents (i.e., *beyond* the decision-making group). Under such circumstances, leaving the entire technology adoption decision to one person may not be a wise practice, and thus, a committee or task force (i.e., a group) is often entrusted with the decision-making process. For example, at many universities (including ours), initiatives for rethinking and redesigning the Information Systems curriculum are ongoing, and one critical decision faced by many is whether to adopt and use predominantly Microsoft .NET technologies for all courses in the program or to adopt a collection of technologies that are not vendor-specific. Clearly, given the serious nature of implications for a variety of stakeholders (e.g., students, employers, and university fund-raising), a group of faculty members rather than the department chair alone will more than likely make the adoption decision. The proposed model, with minor modifications to the constructs, can shed light on such scenarios as well.

The TAG model was developed by adopting a valence perspective within McGrath's framework for the study of groups. This revealed a number of key variables in the model, those of individuals' *a priori* attitudes, majority support, substantive conflict, and the role of high-status individuals (i.e., leaders and experts). In addition, we identified a number of technological characteristics as potentially salient in the decision-making process. We would like to note that the relevance of different factors identified within the model could vary depending on the specific instance of the TAG phenomenon being studied. For example, the technological characteristic of group supportability may be less relevant for adoption situations in which group collaboration using the technology is not intended. Similarly, group members with little experience with and/or direct interest in the technology may not have any *a priori* views about the technology, and even after the discussions, they may not be in a position to evaluate (or even be concerned with) maintainability and transferability. Also, in a group where the leader is extremely strong, his or her views may become the sole determinant of group valence.

Nevertheless, the model proposed here does address a void in the literature on this topic of current relevance and seeks to present a generalized view of the process and the factors influencing the TAG phenomenon. While the definitive "theory" of *technology adoption by groups* remains elusive, we feel that this paper, to draw on one of Weick's many elegant expressions (1995), documents the result of a significant "interim struggle" in "theorizing" about a complex phenomenon that needs our immediate attention.

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# APPENDIX A
# A Brief Overview of Contemporary Technology Adoption Theories/Models

| Theory and its Brief Description | Sample References | Applicability In Predicting Technology Adoption by Groups |
|---|---|---|
| Technology Acceptance Model (TAM)—beliefs regarding the ease of use and usefulness affect the intentions to use the technology, which in turn affects the use of the technology. | Davis, Bagozzi, and Warshaw (1989); Venkatesh and Davis (1996); Agarwal and Prasad (1999); Karahanna and Straub (1999); Venkatesh and Davis (2000); Venkatesh et al. 2003. | Explains technology adoption of individuals. Does not provide constructs to capture the influence of group dynamics on adoption. |
| Decomposed Theory of Planned Behavior (DTPB)—intentions to use a technology are affected by beliefs regarding the technology, subjective norms, and perceived behavioral control. | Taylor and Todd (1995). | Same as above |
| Task-Technology Fit (TTF)—technology usage is a result of the fit between the features of the technology and the nature of the task the individual has to perform. | Goodhue and Thompson (1995); Dishaw and Strong (1999). | Same as above |
| Classical Diffusion Model—technology adoption is dependent on the technology features such as compatibility and trialability, and the adopter characteristics such as education, age, and job tenure. | Rogers (1995). | Same as above |
| Studies on Innovation/Diffusion—characteristics of the innovation, the organizations (e.g., size, structures, characteristics of leaders, and communication channels), the adoption environment (e.g., R&D intensity, competitiveness, and rate of technical change), and the technology-organization fit combine to explain organizational technology adoption. | Leonard-Barton (1988); Cooper and Zmud (1990); Moore and Benbasat (1991); Teng, Grover, and Guttler (2002). | Explains technology adoption by organizations. Does not provide constructs to capture the influence of group dynamics on adoption. |
| Critical Mass Theory—adoption of a certain technology depends on the existence of sufficient number of initial/existent users. | Markus (1987); Markus (1990); Rice (1990). | May be applicable at all levels of analysis including groups (due to the theory's flexibility in terms of level of analysis); however, does not provide constructs to capture the influence of group dynamics on adoption. |
| Social Definition Theory—technology adoption depends on whether a key member (such as leader, supervisor, etc.) of the organization "sponsors" or advocates its adoption (Goodman, Bazzerman, and Conlon 1980). | Schmitz and Fulk (1991); Markus (1994). | May be applicable at all levels of analysis including groups (due to the theory's flexibility in terms of level of analysis); however, does not provide constructs to capture the influence of group dynamics on adoption. |
| Fragmented studies on the adoption of "group technologies." | De Vreede, Jones, and Mgaya (1998/1999); Bajwa and Lewis (2003); Dennis and Reinicke (2004). | Seeks to explain group technology adoption from an individual or organizational perspective. Does not provide constructs to capture the influence of group dynamics on adoption. |

# APPENDIX B
## *Sample* items for measuring *selected* constructs in the TAG model

**Group Valence**

1. To what extent does your group have a positive orientation toward “the technology”[7]?
2. To what extent does your group have a good feeling about “the technology”?
3. To what extent does your group consider “the technology” acceptable for use?
4. Indicate the extent of attractiveness of using “the technology” to your group?

**Technology Characteristics**

***Complexity*** (items capturing the *radicalness* and *interpretive flexibility* of the technology, and the extent to which *alterations to work processes* are necessary)

1. To what extent is “the technology” going to be difficult for your group to use?
2. To what extent are the features of “the technology” too sophisticated for the group to use?
3. To what extent would your group have to alter the way you work in order to optimally use “the technology”?
4. To what extent can the features of “the technology” be interpreted in multiple ways?

***Transferability*** (items capturing the *communicability* of the technology and the extent to which it has *supportive organizational infrastructure*)

1. To what extent is “the technology” readily available for your group to use?
2. To what extent will your group have access to documentation necessary to use “the technology”?
3. To what extent does your group have access to training and support necessary to use “the technology”?
4. To what extent will the existing technological infrastructure have to be changed to make “the technology” readily available for your group to use?

***Utility*** (items capturing the *functional benefits/costs*, *symbolic utility*, and the *individuality* of the technology)

1. To what extent would “the technology” be useful for your group?
2. To what extent would “the technology” make it easier for your group to complete your task/project?
3. To what extent would “the technology” allow supervisors to observe and control your group?
4. To what extent would “the technology” make the completion of your group’s task/project more efficient?
5. To what extent would the use of “the technology” increase the status of your group in your organization?
6. To what extent would “the technology” be useful to you for accomplishing your own tasks that are not related to the group (considering the adoption of “the technology”)?

***Maintainability*** (items capturing the *viscosity* and the *perceived continuity* of the technology)

1. To what extent do you perceive that “the technology” will have continued technical support from its vendors?
2. To what extent would your group be able to modify the features of “the technology” in order to meet your group’s needs from time to time?
3. To what extent does your group perceive that it would be easy to fix “the technology” in case it fails to perform according to expectations?

***Group Supportability*** (items capturing the *parallelism*, *transparency*, and *sociality* of the technology)

1. To what extent does “the technology” enable group members to work on different subtasks in parallel?
2. To what extent does “the technology” enable group members to view other members’ work whenever mutually desirable?
3. To what extent does “the technology” enable group members to modify other members’ work whenever mutually desirable?
4. To what extent does “the technology” enable the development of social relationship among group members?
5. To what extent does “the technology” enable the sharing of knowledge among group members?

**Adoption Decision**

1. To what extent has your group decided to use “the technology”?
2. To what extent is your group committed to the use of “the technology”?
3. To what extent does your group plan to regularly use “the technology”?

[7] “The technology” needs to be substituted with the names of each of the specific technologies being considered for adoption (i.e., the technology adopted by the group, and those that were considered but not adopted by the group).

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