Should End-users Participate as Much as They Want in The Development of Collaborative Applications?

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Abstract
User participation seems especially important in the development of collaborative work systems where the technology is used by a work group to coordinate their joint activities. Using a sample of 163 collaborative and 239 non-collaborative applications, this research focuses on (1) Is user participation more effective in collaborative applications? (2) What specific decision issues enhance user satisfaction and productivity? and (3) Can permitting end-users to participate as much as they want on some issues be ineffective or even dysfunctional.

The results indicate that user participation is more effective in collaborative applications. Of the four decision issues tested, only participation in information needs analysis predicts end-user satisfaction and task productivity. Encouraging end-users to participate as much as they want on a broad range of systems analysis issues such as project initiation, information flow analysis, and format design appears to be, at best, a waste of time and, perhaps, even harmful. These findings should help managers and analysts make better decisions about how to focus participatory efforts and whether end-users should participate as much as they want in the design of collaborative systems.

1. Introduction
A new era of collaborative organizations characterized by lateral leadership and virtual teams is emerging (Pasternack & Viscio, 1998; Ghoshal & Bartlett, 1997). Firms that compete by developing and deploying intellectual assets are finding that their competitive advantage will depend on developing a superior collaborative capability (Hargrove, 1998). Collaborative work systems are defined as applications where information technology is used to help people share information or knowledge and, thus, coordinate their work with others.

Knowledge is a social activity. Complex problems can not be solved by specialists thinking and working in isolation, but in coming together through a process of dialogue, deeply informed by human values and focused on practical problems. Today people from all over the world have the capacity to communicate by e-mail and to participate in electronically distributed meetings. Technology has, in most cases, increased the quantity of interactions people are having. But, has it improved the quality of those interactions? To do this will require a shift in thinking and attitudes towards being more creative and collaborative in systems development (Hargrove, 1998).

Can analysts really design collaborative applications that enhance the quality of human interactions without engaging the application’s users in the design effort? In other words, should the design of collaborative applications itself be a collaborative activity? The literature on collaborative systems has focused on: (1) the nature and capabilities of the software, and (2) its application to specific problems requiring collaborative interaction. It has largely ignored the issue of user participation in the design of collaborative applications.

User participation is widely accepted as essential to developing successful information systems (Ives & Olson, 1984; Barki & Hartwick, 1994; McKeen et al., 1994). System analysis decisions have a huge effect on the downstream costs, timing, and on the likelihood of overall system success. Through interviews, surveys or joint application development sessions, the specification of user requirements is thought to improve the quality of design decisions and, thereby, improve the satisfaction and productivity of end-users.

Many analyst and user man-hours and considerable expense can be incurred in making sure that the user requirements are correctly specified. Despite the cost and importance of user participation, we have little knowledge of which decision issues are the most important. Research on user participation has focused more on the form (Barki & Hartwick, 1994) or degree of user participation (Franz & Robey, 1986)
rather than the efficacy of specific decision issues. More emphasis should be placed on identifying the key decision issues and how those issues might differentially relate to satisfaction and productivity.

Few doubt whether users should participate in systems analysis decisions. However, should they participate as much as they want? Studies have shown that most end-users want (desire) to participate more than they are actually permitted to participate in the development of applications that they use (Doll & Torkzadeh, 1989). Participatory arrangements, time constraints, and resources often constrain user participation and limit its potential (Doll & Torkzadeh, 1991).

User participation seems especially important in the development of collaborative work systems where the technology is used by a work group to coordinate their joint activities. Collaborative systems are especially difficult to design and require user input. Several interacting users are involved and their collaborative requirements emerge from a changing task context. User experience with the emergent nature of this collaborative activity is essential to effective systems design. In collaborative systems, users rather than systems analysts are often the best source of information on how they will use these applications to coordinate their work.

Managers and systems analysts would like to encourage further end-user participation. However, such efforts can be costly and time consuming, especially when they are not well focused on specific issues. We have little information on what decision areas are the most effective avenues for user participation. Despite the growing importance of collaborative systems, no research studies have specifically focused on: (1) which decision issues are the most effective for improving user satisfaction and task productivity, and (2) whether end-users should participate in the development of collaborative systems as much as they want.

2. Collaborative Applications and User Participation

The interest in and adoption of collaborative applications is being driven by the needs of organizations to address fundamental business problems, specifically those relating to becoming more flexible organizations, shortening time-to-market, and, above all, becoming more responsive to customers (Marshak, 1994). Historically, information technology was used to support individual users and their needs. Computer systems that were used by groups of people e.g., transaction processing applications, were usually geared toward aggregations of individuals. That is, each user is seen by the system as a discrete unit or a point of input in a sequential process; there is little or no direct interaction, collaboration, or shared work among the users (Johansen, 1988). In the 1980's, information technology was seen to be a way to support and empower ad hoc teams to meet these needs. Initial applications were aimed at providing a method for these teams to communicate; particular emphasis was placed on teams that could not meet in real time due to organizational or locational differences. Applications such as e-mail, conferencing and bulletin boards provided these teams with the ability to brainstorm, share their findings, and, in some cases, work collaboratively.

For some time now, organizations have turned their focus from supporting teams and groups to looking at their business processes and figuring out how to redesign, support, and manage them to achieve the same overriding goals that has brought attention to teams (Harrington, 1991; Davenport, 1993). Thus, the focus has shifted from the team to the process and, in particular, to the business goal of the process - a satisfied customer and a quality product with short time-to-market.

David Marshak (1994) argues that by the year 2000, collaborative systems will disappear entirely as separate application category. He argues that as applications are redesigned around this process focus and the technologies currently grouped under the umbrella of groupware or collaborative systems become ingrained in the way we work, collaborative systems will simultaneously become transparent and ubiquitous, thus disappearing forever as a separate category of application (Marshak, 1994).

If this is true, researchers have to re-define what they mean by a collaborative application. Collaborative applications can be defined in terms of a design or a system-use paradigm. The design paradigm is based on the software designer’s intentions. Here a collaborative system is viewed as a separate application category whose primary purpose is to support collaborative work, whether it is actually used for that purpose or not. In contrast, the system-use paradigm is behaviorally based. Here a collaborative system is defined as any software application that is actually being used by individuals to help them coordinate their work with others, whether it was specifically designed for that purpose or not.

This research adopts the system-use paradigm for several reasons. First, as Schrage (1990) argues in his book entitled Shared Minds, the real purpose is “not to build collaborative tools but to build collaboration”. Second, the real end goals are increased responsiveness to customers, shorter time to market, and increased flexibility. If these end goals are to be achieved, information technology must be used more effectively in the organizational context to help work groups coordinate their joint efforts (Doll & Torkzadeh, 1998). Designer intentions do not, by themselves, contribute to these end goals. Third, if David Marshak is right, many of the software features associated with collaborative systems are already incorporated in much of today’s software. Excluding these applications from research on collaborative systems may greatly underestimate the extent to which information technology has been successfully applied to enhance collaborative work.

This system-use paradigm should have positive effects on the way collaborative systems are designed. It places emphasis on user behavior, rather than designer intentions or technical
features. As such, it suggests the need for the analyst to understand not only the technology, but also the dynamic nature of the task context and the changing nature of the relationships between the individuals who use the software. This is information that the analyst can only get from users, suggesting the need for active user participation i.e., making the development a collaborative activity between users and analysts. This suggests the following hypotheses:

H1A: User participation is more closely associated with user satisfaction in collaborative than in non-collaborative applications.

H1B: User participation is more closely associated with task productivity in collaborative than in non-collaborative applications.

2.1 User Participation in Systems Development

Reviews of the participative decision making (PDM) literature have identified six broad dimensions of PDM i.e., rationale, structure, form, decision issues, processes, and degree of involvement (Cotton et al., 1988; Dachler & Wilpert, 1978; Miller & Monge, 1986; Locke & Schweiger, 1979; Wagner & Gooding, 1987). Although multiple dimensions have been identified, little systematic theory exists concerning the impact of these diverse dimensions on outcomes (Black & Gregersen, 1997). Locke and Schweiger (1979) suggest that the key dimension of participation is decision making. The literature on decision issues suggests that both participant satisfaction and decision quality is, in part, a function of the knowledge or expertise that individuals involved in the decision bring to a particular issue (e.g., Davis, 1963; Derber, 1963; Maier, 1965; Vroom, 1973).

Reviews of the literature on participative decision making (PDM) generally recommend that managers encourage broad-based participation in a variety of decision making issues (Locke & Schweiger, 1979). Individuals typically have different interests and differing areas of knowledge/expertise. Encouraging broad-based participation enables individuals to participate on issues important to them (i.e., where they desire to participate) and/or where they have the knowledge/expertise necessary to improve the quality of decision making. Locke and Schweiger contend that PDM may be a waste of time or even harmful to decision quality or productivity if the focal individual has significantly less knowledge/expertise than others. PDM research typically focuses on participation's impact on the quality of decisions and, through better decision making, its resultant impact on employee satisfaction and productivity.

End-user participation in systems analysis activities represents a different context than that normally assumed in the PDM literature. First, the range of possible participatory activities focuses on decisions related to the development of a particular application and is, thus, more constrained. Second, the dependent variables of interest are application specific measures of end-user satisfaction or productivity. Third, within the constrained set of systems analysis activities, end-users are not always the best source or only source of knowledge/expertise. In this context, it may be wise to focus participatory efforts on decision issues where end-users have superior knowledge/expertise.

In the literature on user participation in systems development, there are two validated instruments: (1) the Barki and Hartwick (1994) instrument which focuses on identifying the structure and form of user participation, and (2) the Doll and Torkzadeh (1990) instrument which focuses on decision issues. Doll and Torkzadeh’s instrument is used in this research because it identifies thirty-three decision issues in systems development that are grouped into three factors -- system analysis, system implementation, and administration. Predictive validity analysis suggested that only one factor – user participation in systems analysis issues - was effective for improving user satisfaction. System implementation and administration factors had spurious correlations with user satisfaction. Doll and Torkzadeh’s research suggests that user participation’s effectiveness may be limited to a specific and somewhat narrow set of decision issues in systems analysis.

2.2 Decision Issues in Systems Analysis

Kendall and Kendall (1995) describe the system development life cycle (SDLC) as consisting of seven phases. The first four phases, often referred to as system analysis activities, include: (1) identifying problems, opportunities, and objectives; (2) determining information requirements; (3) analyzing system needs (e.g., information flow analysis), and (4) logical design of the information system. Several researchers (Edstrom, 1977; Doll & Torkzadeh, 1989; 1990) have suggested that user participation may be most effective in these system analysis stages where decisions are made on system objectives, user information needs, information flows, and initial input/output screens/formats.

Shelly et al. (1995) describe the first stage where the problems and opportunities are identified and objectives for the system are set as project initiation. In the logical design stage, users participate in prototyping to validate the user interface i.e., decisions concerning input/output formats or screens.

This research identifies four key decision issues for user participation that roughly correspond to Kendall and Kendall’s states in systems analysis. These key decision issues are referred to as project initiation, information needs analysis, information flow analysis, and format design. Table 1 describes how the items used by Doll and Torkzadeh can be grouped by Kendall and Kendall’s four stages in system analysis.
These decision issues arise at different times during systems analysis and require different expertise/knowledge. Users may participate in some of these decisions, yet not be available or otherwise occupied when other decisions are made. Also, user participation in each of these decision issues may not be equally effective. Where managers or systems analysts rather than end-users have the knowledge/expertise necessary to improve the quality of decision making, encouraging end-users to participate as much as they want may be ineffective or dysfunctional i.e., result in lower quality decisions.

Managers or systems analysts may have a broader view of the organization’s business activities/needs and be in a better position to make decisions concerning the initiation of new projects and the determination of project objectives. Determining system needs can require technical skills or knowledge of related systems beyond the scope of the job responsibilities of a particular end-user. A skilled professional may be necessary to trace information flow from source to end-user and be sure the “right” information is being used for decision making. End-users should be able to judge whether they find a particular format design useful or easy to understand, but they would not normally be as knowledgeable as a systems analyst about the range of possible alternative design formats.

Information needs analysis is a decision issue that is dominated by the end-users rather than the analyst. Here the end-users have on-the-job experience/expertise and best understand how the application will actually be used to get their work done and to coordinate their activities with others. In a changing job context, these patterns of collaborative work must remain flexible. Collaborative applications must be designed to support this on-going refinement of how they are used.

Organizational or staffing changes can also affect the relationships between users and how they coordinate their activities. Users of the same application often have different information needs due to differences in their job responsibilities, decision context, or the scope of their personal influence. Even when standard software packages are being installed, differences in the way firms do business may require “work-arounds” or modifications to meet the needs of users in a particular firm. Systems analysts typically recognize user expertise in this area by conducting user interviews to determine “what decisions they make” and “what information they need to make those decisions”.

User participation is more likely to be effective for those decision issues where the end-user has superior expertise or knowledge (Locke & Schweiger, 1979). In both collaborative and non-collaborative applications, end-user expertise is unquestioned in making decisions about information needs. In the other decision issues, line management or information systems professional may have more expertise or knowledge. Thus, the researchers suggest the following hypotheses:

H2A: Participation in information needs analysis is more effective in improving user satisfaction than participation in other decision issues (i.e., project initiation, information flows analysis, and format design).

H2B: Participation in information needs analysis is more effective in improving task productivity than participation in other decision issues (i.e., project initiation, information flows analysis, and format design).

3. Research Methods

Mindful of Marshak’s (1994) argument that, as applications are redesigned around a process focus, technologies currently grouped under the umbrella of collaborative systems will become ingrained in the way we work, the researchers employed the system-use paradigm rather than a design paradigm to define a collaborative application. This methodology also enabled the researchers to

Table 1: Decision Issues in Systems Analysis

<table>
<thead>
<tr>
<th>Label for Decision Issues</th>
<th>Kendall and Kendalls Decision Stages</th>
<th>Doll and Torkzadehs Measurement Instrument (Items X1 thru X8)</th>
</tr>
</thead>
</table>
| Project Initiation        | Identifying problems, opportunities, and objectives | X1. Project initiation  
X2. Determining system objectives |
| Information Needs Analysis| Determining information requirements | X3. Determining the user’s information needs  
X4. Assessing alternative ways of meeting the user’s information needs |
| Information Flows Analysis| Analyzing system needs (e.g., information flow analysis) | X5. Identifying sources of information  
X6. Outlining information flows |
| Format Design             | Logical design*, especially the validation of user interface requirements (e.g., prototyping) | X7. Developing input forms/screens  
X8. Developing output format |

* Logical design includes the design of data entry procedures, user interface, files or databases, and controls and backup procedures. Of these, the validation of user interface requirements via prototyping is, perhaps, the best opportunity to involve users.
assess to what extent information technology is currently being used for collaborative purposes. The system-use paradigm influenced both the sampling methods and the means for classifying collaborative versus non-collaborative applications.

3.1 The Sample

The researchers gathered a sample of 402 end-users from 18 organizations including 8 manufacturing firms, 1 retail firm, 2 government agencies, 2 utilities, 2 hospitals, 2 educational institutions, and one "other". This was half of the firms contacted. In each firm, the MIS directors were asked to identify their major applications and the major end-users for each application. They also consulted with the heads of user departments to identify important end-user applications and their users. A list of respondents was compiled and surveys were distributed via inter-office mail. Responses were obtained from 63 percent of those surveyed.

Respondents were asked to identify their position within the organization; they responded as follows: 20 top level managers, 80 middle managers, 75 first level supervisors, 140 professional employees without supervisory responsibility, and 87 operating personnel. The sample consisted of 139 different applications including profit planning, engineering analysis, process control, budgeting, CAD, CAD-CAM, customer service, service dispatching, manpower planning, financial planning, inventory control, production planning, purchasing, quality analysis, sales analysis, accounts payable and receivable analysis, work order control, general ledger, order entry, payroll, and personnel.

To identify collaborative versus non-collaborative applications, the researchers used a four-item summed scale recently published by Doll and Torkzadeh (1998) to measure horizontal integration i.e., the extent that information technology is used to coordinate work activities with others in one’s work group. The items were:

- My work group and I use this application to coordinate our activities.
- I use this application to exchange information with people in my work group.
- I use this application to communicate with other people in my work group.
- I use this application to coordinate activities with others in my work group.

These items used a five point scale (1=not at all, 2=at little, 3=moderately, 4=much, and 5=a great deal). In this sample, the scale has a reliability of .90. The sample of 402 respondents was divided into two groups based upon this four-item scale: 239 non-collaborative applications i.e., respondents with a score of less than 12; and 163 collaborative applications i.e., a score of 12 or higher.

The collaborative respondents were substantially more likely to be using a decision support application. The breakdown of the sample by type of application is depicted in Table 2. Sixty three percent of the collaborative systems were decision support; only thirty eight percent of the non-collaborative applications were classified as decision support. Forty eight percent of the non-collaborative applications were transaction processing while only twenty five percent of the collaborative systems were used to process transactions. Many of the collaborative transaction process applications represented tasks such as service dispatching or customer service that, while transaction processing in nature, required extensive use of the computer to coordinate the activities of the work group.

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Non-collaborative Applications</th>
<th>Collaborative Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample Size</td>
<td>Percentage</td>
</tr>
<tr>
<td>Decision Support</td>
<td>90</td>
<td>38%</td>
</tr>
<tr>
<td>Database</td>
<td>35</td>
<td>14%</td>
</tr>
<tr>
<td>Transaction Processing</td>
<td>114</td>
<td>48%</td>
</tr>
<tr>
<td>Total</td>
<td>239</td>
<td>100%</td>
</tr>
</tbody>
</table>

The 139 names of the applications were sorted alphabetically for both collaborative and non-collaborative applications. A comparison between the two lists revealed that, in almost all cases, the same application names appeared on both lists. This indicated that the key issue was not the nature of the application, but rather how the technology was used by the individuals. This observation further supported the system-use paradigm for defining collaborative applications.

3.2 Instrument for Measuring User Satisfaction, Task Productivity, and User Participation

Participation is considered effective if it improves user satisfaction with the resultant application or the user’s task productivity. To explore the efficacy of the eight-item participation instrument as well as the initiation, information needs analysis, information flow analysis, and format design sub-scales, the researchers used the 12-item end-user computing satisfaction scale (Doll & Torkzadeh, 1988) and a
3-item task productivity scale. In this sample, the end-user satisfaction instrument has a reliability (alpha) of .93.

The task productivity scale measures a user’s perception of a specific application’s impact on his/her work. The task productivity items are: “This application increases my productivity”, “This application allows me to accomplish more work than would otherwise be possible”, and “This application saves me time.” A five-point scales is used (1=not at all, 2=a little, 3=moderate, 4=much, 5=a great deal). In this sample, the task productivity scale has a reliability (alpha) of .93.

To measure whether users participate as much as they want, the researchers used a participation congruence instrument developed by Doll and Torkzadeh (1991). To scale participation congruence, respondents are asked how much they desired (wanted) to participate in specific systems analysis decisions and how much they actually did participate using the items X1 to X8 illustrated in Table 1. For each item, the difference between desired and actual participation provides a direct measure of whether the end-user participate as much as they want. These differences are summed over the eight items to provide a single measure of participation congruence. The scale is reversed; thus, high participation congruence exists when an individual’s desire to participate in a specific decision activity equals to their actual (i.e. perceived) level of participation.

The eight-item congruence instrument is reliable (Torkzadeh & Doll, 1994), distinguishable from its components (i.e., actual and desired participation), and a better predictor of end-user computing satisfaction than perceived participation (Doll & Torkzadeh, 1991). While the participation congruence instrument has items that correspond to Kendall and Kendall’s four stages in systems analysis (see Table 1), the reliability and dimensionality of these four subscales has not been previously assessed.

The eight-item participation congruence scale had a reliability (alpha) of .95 in this sample. The project initiation, information needs, information flows, and format design subscales had reliabilities (alpha) of .92, .89, .88, and .89, respectively. These results suggest that the eight-item scale and each of the subscales have adequate reliability.

3.3 Methods for Testing Hypotheses

H1A and H1B are tested by examining the correlations between the eight-item congruence instrument and the dependent variables - end-user computing satisfaction and task productivity - for both collaborative and non-collaborative respondents. A test of the difference in correlation coefficients between independent samples (Ferguson, 1966) was used to determine whether differences between collaborative and non-collaborative applications were statistically significant.

H2A and H2B are tested in a similar manner using the four subscales for project initiation, information needs analysis, information flow analysis, and format design. However, the four subscales are highly correlated with each other, suggesting the need to test for spurious correlations. For example, the correlations between project initiation and information needs, information flows and format design are .7542, .7303, .7088, respectively. Information needs correlation with information flows and format design are .7966 and .7702, respectively. Information flows also has a .7427 correlation with format design. Thus, correlations between project initiation, information flows, and format design on one hand and satisfaction or productivity on the other might be an artifact of these variables’ high correlation with information needs analysis. Thus, even where the correlations were not significantly different, the researchers checked for spurious correlations.

Previous research has shown that the effective range of participation decisions did not include factors such as participation in implementation and project administration. These factors had spurious correlations with user satisfaction i.e., correlations that were an artifact of their correlation with participation in systems analysis decisions (Doll & Torkzadeh, 1990). Due to this prior evidence of spurious correlation, the researchers felt that they should also examine the subscales measuring project initiation, information needs, information flow, and format design for spurious correlations with satisfaction and task productivity. Partial correlation analysis was used to provide a simple and effective test for spurious correlations. Structural equation modeling was not used to test for spurious correlation because partial correlation was considered simpler, more effective, and easier to present and interpret (Bollen, 1989).

4. Results

The collaborative and non-collaborative subgroups are compared in Table 3. The mean scores of overall participation congruence as well as the project initiation, information needs, information flows and format design were not significantly different between collaborative and non-collaborative applications. This indicates that the gap between actual and desired participation is not effected by whether the application is used for collaborative purposes. A reasonable inference is that systems analysts are not making special efforts to encourage user to participate as much as they want in the development of collaborative applications.

The mean scores for end-user computing satisfaction and task productivity are significantly higher for collaborative applications. This suggests that the collaborative features built into these applications, when used, enhance both user satisfaction and user productivity. The biggest change is in task productivity which changed from 9.7 to 12.1, almost a 25 percent increase. As described earlier in the sample description, the same applications had respondents in both the collaborative and the non-collaborative groups. To a large extent, the difference was not in the applications, but rather, in how they were used. When applications are used to enhance collaborative work, information technology’s potential for
improving productivity is enhanced.

4.1 Results for Hypotheses H1A and H1B

The results for H1A and H1B are depicted in Table 4. Overall participation congruence has significant (p < .01) correlations with end-user computing satisfaction among non-collaborative and collaborative applications, .3622 and .3679, respectively. This difference is non-significant. Thus, H1A, the hypothesis that participation is more effective at improving user satisfaction in collaborative applications, is rejected. Overall participation congruence has a non-significant correlation with task productivity (r=.0511) among non-collaborative applications. However, it has a significant (p < .01) correlation with task productivity (r=.2533) among collaborative applications. This difference is significant at p < .0212. Thus, H1B, the hypothesis that participation is more effective at improving task productivity in collaborative applications, is not rejected.

Table 3: Analysis of Collaborative and Non-collaborative Subgroups

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Non-collaborative Applications</th>
<th>Collaborative Applications</th>
<th>p-value of the difference between means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall participation (X1 thru X8)</td>
<td>29.560 (8.922)</td>
<td>29.683 (9.398)</td>
<td>.4509</td>
</tr>
<tr>
<td>Project Initiation (X1 &amp; X2)</td>
<td>7.425 (2.477)</td>
<td>7.608 (2.628)</td>
<td>.2492</td>
</tr>
<tr>
<td>Information Needs Analysis (X3 &amp; X4)</td>
<td>7.050 (2.518)</td>
<td>7.316 (2.541)</td>
<td>.1601</td>
</tr>
<tr>
<td>Information Flows Analysis (X5 &amp; X6)</td>
<td>7.792 (2.316)</td>
<td>7.533 (2.446)</td>
<td>.1529</td>
</tr>
<tr>
<td>Format Design (X7 &amp; X8)</td>
<td>7.136 (2.630)</td>
<td>7.213 (2.626)</td>
<td>.3902</td>
</tr>
<tr>
<td>End-user Computing Satisfaction</td>
<td>46.778 (8.566)</td>
<td>49.247 (7.905)</td>
<td>.0022</td>
</tr>
<tr>
<td>Task Productivity</td>
<td>9.703 (3.861)</td>
<td>12.104 (2.799)</td>
<td>.0000</td>
</tr>
</tbody>
</table>

This means that, from the perspective of improving user satisfaction, permitting end-users to participate as much as they want in systems analysis decision is equally effective in both collaborative and non-collaborative applications. If the goal is satisfied users, user participation works regardless of the nature of the application.

More interestingly, these results suggest that permitting end-users to participate as much as they want in systems analysis decisions is ineffective at improving productivity among non-collaborative applications. A significant participation-productivity relationship is only present among collaborative applications. If the goal is more productive users, user participation appears to work in collaborative applications. The evidence suggests that user participation’s power to enhance productivity is more limited among non-collaborative applications.

Socio-technical (Passmore & Sherwood, 1978; Pasmore, 1995) systems theory provides a possible explanation of these results. This theory says that, to optimize productivity, both the social system and the technical system must be considered in the design of work. Systems that are optimized for technology, but do not consider the social environment of work, will be less productive. Collaborative applications are complex social and technical systems. The team or work group can achieve its goals in many ways. User participation enables the analyst to understand how the work group wants to use information technology to get their job done. Thus, user participation can result in a design that integrates both social system issues and technology issues to optimize productivity.

Socio-technical systems theory may also be applicable to non-collaborative applications. However, the low use of these systems to coordinate work with others suggests that these jobs have not, as yet, been redesigned from a process perspective that emphasizes lateral relationships. Here user participation may enhance design, but the improved design may focus narrowly on the requirements of one user or category of user. Other stakeholders may not be consulted. Thus, participation’s potential for productivity improvement is more limited. Improved design can enhance productivity, but collaboration itself is the major driver.

4.2 Results for Hypothesis H2A and H2B

Table 4 indicates that project initiation, information needs analysis, information flow analysis, and format design have significant correlations with end-user satisfaction, .2682, .3551, .2916, and .3202, respectively. While information needs has the highest correlation with satisfaction, it is not significantly higher than the others. Information needs analysis has a significant (p < .01) correlation (r = .1625) with task productivity while the others have non-significant correlations. Again, information need’s correlation with task productivity is not significantly higher than project initiation’s (r=.0927), information flows (.0743) or format design (.0839). Thus, without examining partial correlations, H2A and H2B would
be rejected.

Because the participation subscales are highly correlated with each other, the researchers conducted a partial correlation analysis using the overall sample of 402 respondents. In Table 5a, the participation congruence dimensions are correlated with user satisfaction and task productivity while controlling for the impact of information needs analysis. With the effect of information needs partialed out, overall participation scale as well as the participation scales for project initiation, information flows, and format design have non-significant correlations with user satisfaction. With the effect of information needs partialed out, overall participation scale as well as the participation scales for project initiation, information flows, and format design have negative partial correlations with task productivity. Two of these negative partial correlations are statistically significant, -.0963 for overall participation (p < .05) and -.1391 for information flows (p < .01).

Table 4. Correlations Between Participation Congruence Dimensions and Dependent Variables

<table>
<thead>
<tr>
<th>Participation Congruence Dimension</th>
<th>End-User Satisfaction</th>
<th>Task Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Participation Congruence (X1 to X8)</td>
<td>.3629***</td>
<td>.3622***</td>
</tr>
<tr>
<td>Project Initiation Congruence (X1,X2)</td>
<td>.2682***</td>
<td>.2544***</td>
</tr>
<tr>
<td>Information Needs Congruence (X3,X4)</td>
<td>.3551***</td>
<td>.3238***</td>
</tr>
<tr>
<td>Information Flows Congruence (X5,X6)</td>
<td>.2916***</td>
<td>.2691***</td>
</tr>
<tr>
<td>Format Design Congruence (X7,X8)</td>
<td>.3202***</td>
<td>.3329***</td>
</tr>
</tbody>
</table>

Notes: * indicates significant level at .10; ** indicates significant level at .05; and *** indicates significant level at .01.

Table 5b reports information need’s first-order partial correlations with user satisfaction and task productivity while controlling for each of the other participation subscales. While partialling out the effects of project initiation, information flows, and format design participation, information needs retains significant (p < .01) positive partial correlations with both end-user satisfaction and task productivity.

These results provide strong support that participation in information needs analysis is the only active causal agent that predicts end-user satisfaction and task productivity. The researchers conducted this analysis for both the collaborative and the non-collaborative subsamples with almost identical results to those reported in Tables 5a and 5b. In both subsamples, information needs was the only active causal agent predicting satisfaction and task productivity. The significant positive correlations reported in Table 4 between project initiation, information flow analysis, and format design on one hand and user satisfaction or task productivity on the other appear to be spurious.
### Table 5. Partial Correlations Between Participation Congruence Dimensions and Dependent Variables

<table>
<thead>
<tr>
<th>Participation Congruence Dimension</th>
<th>End-User Satisfaction</th>
<th>Task Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a. Partial Correlation Analysis Controlling for Information Needs (X3,X4)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Participation Congruence (X1 to X8)</td>
<td>.0237</td>
<td>-.0963**</td>
</tr>
<tr>
<td>Project Initiation Congruence (X1,X2)</td>
<td>-.0030</td>
<td>-.0520</td>
</tr>
<tr>
<td>Information Flows Congruence (X5,X6)</td>
<td>-.0219</td>
<td>-.1391***</td>
</tr>
<tr>
<td>Format Design Congruence (X7,X8)</td>
<td>.0546</td>
<td>-.0622</td>
</tr>
<tr>
<td><strong>b. Information Needs Partial Correlations With Dependent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlling for Project Initiation (X1,X2)</td>
<td>.2429***</td>
<td>.1373***</td>
</tr>
<tr>
<td>Controlling for Information Flows (X5,X6)</td>
<td>.2558***</td>
<td>.2183***</td>
</tr>
<tr>
<td>Controlling for Format Design (X7,X8)</td>
<td>.2075***</td>
<td>.1515***</td>
</tr>
</tbody>
</table>

Notes: * indicates significant level at .10; ** indicates significant level at .05; and *** indicates significant level at .01.

On the basis of this partial correlation analysis, the researchers failed to reject hypothesis H2A and H2B. The results suggest that, unlike participative decision making where a broad range of decision issues might be effective, the range of effective decision issues in the development of collaborative or non-collaborative applications appears to be limited to narrow set of decision issues surrounding the assessment of information needs where users have special expertise by virtual of their work experience and training. User participation in project initiation, information flows analysis, and format design appear to be “ancillary” in that they are additional decision activities that might clarify, supplement or embellish our understanding of user information needs. The significant negative partial correlation between information flow analysis and task productivity suggests that permitting end-users to participate as much as they want in technical issues where they may not possess unique skills or training may be dysfunctional.

### 5. Conclusions

In this new area of collaborative organizations, information technology offers substantial promise for improving productivity. This sample of major applications at 18 firms reveals that information technology already plays an important role in enhancing productivity by facilitating collaborative work. The key to achieving further productivity gains is to remember that the real goal is not to build collaborative systems, but to use information technology to enhance collaboration. The system-use paradigm is fundamental to this effort.

This study indicates that user participation is more effective in enhancing productivity in the context of collaborative work systems. This suggests that the design of collaborative work systems should itself be a collaborative activity between analysts and users. Moving the analyst-user relationship from participation to collaboration requires a common goal. By focusing both users and analysts on using information technology to enhance collaborative work rather than building collaborative systems, the system-use paradigm provides the common goal necessary to support this transition.

This study suggests that users should be encouraged to participate as much as they want in the development of collaborative applications. While the extent of participation should not be limited, the range of participatory issues should focus on supporting collaborative work by determining the information needs of a broad network of stakeholders who might improve how they work together. Encouraging too much user participation on technical issues such as information flow analysis where users do not have special expertise can be dysfunctional. The results suggest that the range of decision issues that are effective in improving user satisfaction or productivity are narrow and focused around information needs analysis.

### References

1994, pp. 59-82.