

EFFECTS OF PARTICIPATIVE MANAGEMENT

ON THE PERFORMANACE OF SOFTWARE DEVELOPMENT TEAMS

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ABSTRACT

Researchers and practitioners advocate a participative management style for improving employee productivity and job satisfaction. Field studies have shown that participation has a modest, yet positive influence on productivity and job satisfaction. For software development teams, however, management approaches such as the notion of the chief programmer suggest that participation might not be productive. Systematic research has not been conducted to investigate the importance of a participative management style when managing software development teams. In this study we examine the relationship between software development team members' participative style and team performance.

We collected survey data from 573 respondents of 91 software development teams. 112 business and IS managers provided the performance ratings for the study. Findings suggest that two contextual factors, team size and the professional experience of team members moderate the relationship between participation and performance. In small teams that consist of experienced members, participation is strongly associated with team performance. Also, in large teams that consist of relatively inexperienced members, participation is significantly related to team performance. Other findings and implications are discussed in the paper.

INTRODUCTION

Companies today face a highly turbulent environment. Competitive globalized markets and rapidly advancing technologies demand companies to improve their productivity, while adopting to their environment. IS organizations are no exception. Often, the products and services that companies offer need to be supported by IS applications and as such, IS organizations need to produce high quality software with a decreased time-to-market.

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SIGCPR 94-3/94 Alexandria, Virginia, USA © 1994 ACM 0-89791-652-2/94/0003..\$3.50 Various forms of employee participation such as Quality Circles and labor-management teams are proliferating in many companies as solutions for improving quality and productivity problems (Cotton, Vollrath, Froggatt, Lengnick-Hall & Jennings, 1988). Likewise, a recent case study of Corning's Information Services Division suggests that participative management may be effective in IS organizations (Shrednick, Shutt & Weiss, 1992). Although many studies have examined the effects of participative management on productivity and job satisfaction (Cotton, et al., 1988; Locke & Schweiger, 1979; Miller & Monge, 1986), little systematic research has been conducted to investigate the importance of participative management when designing information systems. The purpose of this research is to examine the relationship between participation and software development team performance.

CONCEPTUAL BASIS FOR STUDY

Researchers, practitioners, and educators point to the importance of participative management (Cotton, et al., 1988; Locke & Schweiger, 1979; Miller & Monge, 1986). In fact, some argue that a participative management style should be used for moral and ideological reasons, regardless of its practical consequences (Locke & Schweiger, 1979; Miller & Monge, 1986). Whether or not participative management offers more than moral satisfaction for practitioners has been the focus of many studies (Abdel-Halim, 1983; Cotton, et al., 1988; Locke & Schweiger, 1979; Miller & Monge, 1986; Neider, 1980; Yukl & Kanuk, 1979). For example, Miller and Monge (1986) proposed two types of models to delineate mechanisms through which participation affects performance: cognitive and affective models. First, cognitive models suggest that participation may improve performance by bringing out more relevant information. On the other hand, affective models propose that the effects of participation on performance are not due to the information. rather they are due to satisfaction from participation. In this model, participation satisfies higher-order needs of employees and consequently they are willing to work harder. Although these two types of models differ in explaining how participation may cause performance changes, both models suggest that participative management will improve performance. Meta-analyses of field studies on participative management style have shown that. although the effects are modest, participative management is positively associated with overall performance as well as job

satisfaction (Cotton, et al., 1988; Miller & Monge, 1986; Wagner & Gooding, 1987).

Although participative management studies have been conducted in various settings such as management of retail drug company (Abdel-Halim, 1983), beauty salons (Yukl & Kanuk, 1979), and retail stores (Neider, 1980), little systematic research has examined the importance of participative management in software development teams. Some evidence suggests that participative management may yield different results in software development settings. For example, software development teams are often managed using the chief programmer team management method. This method suggests that only one or a few members of team should be involved in critical decision making while others perform peripheral supporting tasks (Baker, 1972; Brooks, 1975). Although the use of this method does not prohibit participation entirely, most of the participation is limited to discussing the specific tasks assigned to team members. To determine the relationship between participative management and software development team performance, the following hypothesis is formulated:

> H1: Software development teams that are managed in a more participative style perform better than those managed with a less participative style.

Studies have shown that participation is more effective in some situations than others (Abdel-Halim, 1983; Gibbons, 1992; Griffin, 1979; Miller & Monge, 1986; Wagner & Gooding, 1987). Therefore, in this study we examine how two contextual factors, team size and team members' professional experience, affect team performance and moderate the effects of participation.

First, it may be reasonable to assume that smaller software development teams perform better than larger ones. Communication and coordination breakdowns are one of the most salient problems that software development teams face (Curtis, Krasner & Iscoe, 1988). As software development teams increase in size, the complexity of communication and coordination increase drastically, which may mean severe problems for the team (Brooks, 1975; Curtis, et al., 1988). The following hypothesis is formulated:

H2: Smaller software development teams perform better than their larger counterparts.

Further, a participative management style may be more effective in small teams than in larger ones (Gardner, 1977; Wagner & Gooding, 1987). When the software development team is sufficiently large, participation of all team members in most decisions regarding the overall design may not be possible nor appropriate. Thus,

H2a: Participative management is more strongly associated with increased performance in smaller teams than in larger ones.

Another contextual factor of this study is the professional experience of team members. Behavioral research examining

management processes within teams emphasizes the importance of the teams' previous experience with a given task (Gladstein, 1984). Also, studies of software development found that the capability of developers is one of the most influential determinants of performance (Boehm, 1987; Curtis, et al., 1988; Rasch & Tosi, 1992), suggesting that teams with experienced members may perform better than teams with less experienced members. Hence, the following hypothesis:

H3: Teams with more experienced members perform better than those with less experienced members.

Further, the experience of team members may moderate the effects of participative management. Although there is no previous research examining the role that experience plays when implementing participative management processes, it is reasonable to postulate that experienced software developers are more likely to contribute useful information through participation, than their inexperienced counterparts. Hence, the following hypothesis is formulated:

H3a: A participative management style is more strongly related to increased performance in experienced teams than in inexperienced teams.

METHODS

Eighteen companies participated in the study. These companies represented a range of industries, including financial services, high technology, and transportation (see Table 1). MIS managers in these companies selected 4 to 5 software development teams in the requirement analysis phase of the Software Development Life Cycle. Selected software development teams were working on projects expected to take six to twelve months to complete and business data processing was their development domain. We ensured respondents confidentiality and in most instances the questionnaires were collected in person at the site by members of the research team or mailed directly to the researchers.

SUBJECTS

We administered questionnaires to all members of each software development team. 573 usable responses were collected from 91 software development teams. The average age of respondents is 35, 38 percent of which are female. On average, they have been with their current organizations for 4.4 years. 65 percent of the respondents have bachelors' degrees and another 20 percent have masters degrees. A remaining 15 percent have a high school diploma or have taken some college courses.

Many studies on participative management used a percept-percept research procedure in which the same respondents rate the extent of participation and performance (Wagner & Gooding, 1987). To avoid percept-percept bias, we collected performance ratings from IS managers and business managers who are not involved in the daily operations of the teams, but who can affect design activities

Table 1: Participant Companies by Industry

Industry	Companies	Teams	
Insurance	6	23	
Transportation	2	20	
High Technology	1	19	
Financial Services	4	16	
Petroleum	2	4	
Steel	1	4	
Education	1	4	
Pharmaceutical	1	1	
Total	18	91	

and who can be affected by the resulting IS. In this study we will refer to them as stakeholders. These stakeholders assess performance based on their knowledge of the organization's needs, experience with previous and ongoing system design projects, as well as their expectations for quality work. Venkatraman and Ramanujam (1987) suggest that perceptual assessments of performance provided by knowledgeable managers (i.e., stakeholders) have a high level of convergence with other objective measures of performance.

Whenever possible, to ensure the reliability of stakeholder ratings, we obtained ratings from more than one stakeholder. Out of 91 teams, we were able to obtain 65 team ratings from 112 stakeholders. 19 teams were rated by one stakeholder, 45 teams were rated by two stakeholders, and one team was rated by three stakeholders. To ensure that there are no significant difference between teams for which we have stakeholder ratings and those for which we do not, T-tests of key demographic variables and all variables used in this study were conducted. None of the T-test results were significant, suggesting that there is no bias due to non-responses of stakeholders.

MEASURES

For this study, we developed a questionnaire for team members that measures one independent variable, participative management style, and two dependent variables of performance. The items for these constructs are drawn from Gladstein (1984). The specific items used for each construct in the study are shown in Appendix 1. To assess the extent to which teams are managed in a participative way, we used 4 items (see Appendix 1). Reliability of this construct, measured by Cronbach's alpha is .68 which is somewhat low, yet within an acceptable range (Nunnally, 1967).

Further, we measured team members' evaluation of their team process. People working in a group perform two types of process behaviors: task behaviors and maintenance behaviors (Bales, 1958; Gladstein, 1984). Task behaviors refer to the activities that team members perform to carry out the task given to the group (in our study, software development). Maintenance behaviors are activities that build and strengthen the interpersonal relationship within a group. We measured team members' perception of the effectiveness of these two process behaviors (see Appendix 1). The reliabilities of these two constructs are .90 and .87, respectively.

To test the discriminant validity of participative management and team members' perceptions of performance, an exploratory factor analysis was conducted using the principal component extraction method and varimax rotation (Appendix 2). As expected, three factors were extracted, explaining 64.0% of the variance. Rotations converged in 5 iterations and factor loadings ranged from .838 to .663. Since teams are the unit of analysis in our study, individual responses are aggregated to a team level. Before aggregating these three variables to a team level, the homogeneity of individual response within teams was tested using one-way ANOVA. The F-ratios for three ANOVA tests were significant at the .0001 level or better, suggesting that the effects of teams were highly significant.

In the stakeholder questionnaire, we measured stakeholder ratings of team performance using items drawn from Henderson and Lee (1992). The reliability of stakeholder ratings is .85. One-way ANOVA was conducted to test homogeneity of these ratings within teams. The F-ratio was significant at .001 level.

DATA ANALYSIS

Table 2 provides means and standard deviations for all variables used in the analysis, as well as intercorrelations among the variables. To test the hypotheses presented earlier, multiple regression analyses are performed. Participative management style, team size and professional experience are entered into equations as independent variables. Also, to test the moderating effects, two-way interaction terms of participative management style with team size and professional experience are included in the equations. Finally, to make the equations more complete, a three-way interaction term among participative management, team size and professional experience is added.

Results of the regressions are shown in Table 3. Beta coefficients for participative management style are significant for equations that use team members' evaluations of task and maintenance behaviors as dependent variables. In the equation for stakeholder ratings, participative management style is not significant. The three-way interaction term among participative management, team size and professional experience is significant in the equation for stakeholder ratings.

To investigate further this three-way interaction term, the sample of software development teams are divided into small/large teams and low/high experience teams based on median values of team size and experience. Correlations between participative management style and the dependent variables within each split sample are shown in Table 4. Results indicate that in small teams with high experience or in large teams with low experience,

			Correlations				
	Mean	Std. Dev.	2	3	4	5	6
1. Stakeholder Rating	5.32	.93	.42***	.20	.33**	31*	.25*
2. Task Behaviors	5.16	.61		.50***	.41***	31**	.12
3. Maintenance Behaviors	5.46	.80			.47***	09	.18
4. Participative Management	4.88	.58				06	.26*
5. Team Size ^b	6.30	3.86					27**
6. Professional Experience°	8.51	3.29					

Table 2: Descriptive Statistics and Correlations Among Variables in This Study^a

Note.

* N=91 for all statistics except for those related to the Stakeholder Rating. N=65 for the stakeholder ratings.

^b Number of team members.

^c Number of years.

* p<.05, ** p<.01, *** p<.001

participative management style is strongly related to performance. In particular, the correlations with stakeholder ratings were .53 (p < .05) and .67 (p < .01), respectively. In large teams with high experience or in small teams with low experience, all correlations are not significant with one exception. The correlation between participation and team members' evaluations of task behaviors in large, high experience teams is statistically significant.

Results shown in Table 4 suggest that participative management is associated with performance within two types of team composition: small teams with highly experienced team members or large teams with lower levels of experience. Therefore, we divided all teams in our sample into two groups. The first group consists of smaller teams with highly experienced team members and larger teams with lower levels of experience. The second group consists of small teams with inexperienced members and large teams with highly experienced members. Correlations between participative management style and performance are computed for each group of teams and the results are shown in Table 5. Among teams in the first group (small teams with high experience or large teams with low experience), correlations between participative management style and the performance are highly significant. In particular, the correlation with stakeholder ratings is .60 (p < .001), suggesting that although team size and experience do not show significant moderating effects as a separate variable, the combination of team size and experience moderate the effectiveness of participative management.

DISCUSSION

Findings suggest that the moderating effects of team size and experience are extremely important. Some of the previous studies of participative management examined each contextual factor independently, or did not account for the moderating effects of contextual factors in their research model at all (Miller & Monge, 1986; Wagner & Gooding, 1987). We found that the combination of two contextual factors (team size and experience) simultaneously moderate the effects of participation.

For example, in small teams, a participative management style is strongly associated with performance only when team members are relatively experienced. Whereas, in small teams that consist of less experienced members, participation is not significantly related to performance. One interpretation of this result is that in small teams with inexperienced members, due to lack of domain knowledge and limited skills, participation did not make a difference. However, when the team is small but members are experienced, participation brings out useful information to be shared among team members. Thus, participation becomes increasingly important for small teams with experienced members.

In contrast, among larger teams, participation is more often related to performance when team members are relatively inexperienced. In large teams with experienced members, participation is not significantly related to stakeholder ratings. The reason for this may be that, in large teams with inexperienced

	Dependent Variables			
Independent Variables	Stakeholder Ratings	Task Behaviors	Maintenance Behaviors	
Participative Management	.19	.43***	.43***	
Team Size	20	26*	.01	
Professional Experience	.20	06	.07	
Participative Management x Team Size	13	02	.00	
Participative Management x Professional Experience	35	.14	05	
Participative Management x Team Size x Professional Experience	45*	06	16	
F-Ratio	3.68**	5.55****	3.68***	
Adjusted R-Square	.18	.24	.18	
Degrees of Freedom	58	85	85	

Table 3: Regression Analysis of Effects of Parcipation on Team Performance^a

Note.

* Numbers are beta-coefficients.

** p<.01, *** p<.001, **** p<.0001

members, individual team members cannot perform specialized tasks very well due to lack of domain knowledge and skills. Hence, a participative management style that pools the knowledge of team members can be very effective. However, in large teams with experienced members, specialization is possible and increased participation may cause unnecessary communication and coordination activities. Therefore, although not significant, the correlation between participative management style and stakeholder rating shows a negative coefficient.

The hypotheses of this study stated that participative management style, team size, and professional experience will be related to performance. Further, it was postulated that two contextual factors, team size and professional experience, moderate the effects of participation. However, the findings did not support these hypotheses, because the combination of two contextual factors, team size and professional experience *simultaneously* moderate the effects of participation.

LIMITATIONS

This study focused on software development teams in the requirement analysis phase of the Software Development Life Cycle (SDLC). Although the findings of this study suggest that participative management style is associated with software development team performance in some situations, one needs to be cautious in generalizing this conclusion to other phases of the SDLC. Kydd (1989) suggests that the information processing needs of software development teams are different in each phase of the SDLC. Participation might be important in one phase, while it might not be as important in other phases. Other studies need to be conducted to examine the importance of participative management in other phases of the SDLC.

CONCLUSIONS

This study examined the relationship between a participative management style and software development team performance. Findings suggest that participation is positively associated with

	Small Teams ^b			Large Teams ^b		
	Stake- holder rating	Task behaviors	Main- tenance behaviors	Stake- holder ratings	Task behaviors	Main- tenance behaviors
High Experience	.53*	.45*	.36	27	.54*	.38
Teams ^e	(19)	(28)	(28)	(15)	(17)	(17)
Low Experience	.25	.09	.34	.67**	.50*	.64**
Teams ^c	(17)	(23)	(23)	(14)	(23)	(23)

Note.

^a Numbers in parenthesis are the sample size of correlations.

^b Median value of the team size is 6. Teams with less than 6 members are classified as small teams.

^c Median value of the professional experience is 8.3 years. Team with average professional tenure less than 8.3 years are classified as low experience teams.

* p<.05, ** p<.01

	Performance Evaluations			
	Stakeholder Ratings	Task Behaviors	Mainte nance Behavio rs	
Small teams with high experience or large teams with low experience ^b	.60*** (33)	.52*** (51)	.51*** (51)	
Small teams with low experience or large teams with high experience ^b	.06 (32)	.19 (40)	.36* (40)	

Table 5: Moderating Effects of Team Size and Professional Tenure^a

Note.

* Numbers in parenthesis are the sample size of correlations.

^b Median value of the team size is 6. Teams with less than 6 members are classified as small teams. Median value of the professional experience is 8.3 years. Team with average professional tenure less than 8.3 years are classified as low experience teams.

* p<.05, *** p<.001

increased performance only in some situations. In small teams with highly experienced members or large teams with relatively inexperienced members, a participative management style is significantly related to team performance.

Findings of this study demonstrate that the combination of contextual factors, team size and experience, simultaneously moderate the effects of participative management, supporting the notion that the importance of participative management style is contingent on the specific situation in which it is operating. Research efforts should be made to identify other contingencies that affect the participation-performance relationship.

For IS practitioners, findings of this study suggest that team composition should be taken into account when a participative management style is used. Particularly, in large teams, managers need to consider specialization of tasks and reduced participation if team members have sufficient knowledge and experience to carry out specialized tasks by themselves. In such cases, a participative management style may increase communication and coordination activities unnecessarily. Further, findings suggest that, in large teams with less experienced members or small teams with relatively experienced members, encouraging

participation of team members is beneficial to team performance.

Acknowledgements. This research was funded by IBM and Boeing Co. The authors would like to acknowledge their support gratefully. Also, the authors wish to express their appreciation to the faculty members, in particular Lee Sproull, at the MIS department, Boston University, for their helpful comments on earlier drafts of this paper.

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APPENDIX 1: Items Used for Constructs in This Study

Participative Management^e:

- Participation 1 Managers here rarely consult with us about decisions that affect design teams and their work^b.
- Participation 2 The organization managers with whom we deal generally have a participative or democratic style.
- Participation 3 The project manager makes most of the decisions about our project on his or her own, leaving the rest of the team out of the loop^b.
- Participation 4 The project manager goes out of his or her way to consult with other team members, and to seek their ideas and advice.

Evaluations of Task Behaviors*:

- Task 1 Team members have developed effective plans and procedures to coordinate work.
- Task 2 This team is effective in translating broad goals into operational plans.
- Task 3 Team members do a good job of coordinating their activities.
- Task 4 This team is able to define its goals.
- Task 5 The team has done a good job of figuring out how work will flow among team members.
- Task 6 This team is effective in setting priorities and determines which aspects of the work are important.

Evaluations of Maintenance Behaviors^a:

- Maintenance 1 The people in this team get on my nerves.^b
- Maintenance 2 Dealing with the members of this team often leaves me feeling irritated and frustrated.^b
- Maintenance 3 After dealing with the members of this team all day, I feel quite emotionally drained.^b

Maintenance 4 There is a lot of unpleasantness among people in our team.^b

Stakeholder Ratings^c:

Rating 1 Extent to which the "right" users were consulted during the requirements determination process.

Rating 2 Ability of design team to listen to the users' descriptions of their needs.

- Rating 3 Ability to communicate with one another during requirements definition.
- Rating 4 Extent to which design team got important information from important users.
- Rating 5 Their reputation for work excellence during requirements definition.

Notes.

* Measured in 1-7 Likert-type scale (1=very strongly disagree; 4=no opinion; 7=very strongly agree).

^b Scales are reversed.

^c Measured in 1-7 Likert-type scale (1=extremely poor; 7=outstanding).

	Task Behavior (alpha=.90)	Maintenance Behavior (alpha = .87)	Participative Management (alpha = .68)
Task 1	.803		
Task 2	.788		
Task 3	.786		
Task 4	.781		
Task 5	.770		
Task 6	.764		
Maintenance 1		.838	
Maintenance 2		.818	
Maintenance 3		.801	
Maintenance 4		.777	
Participation 1			.706
Participation 2			.688
Participation 3			.682
Participation 4			.663

APPENDIX 2: Results of Factor Analysis^a

Note. * Factor loadings are the results of Varimax rotations, which is converged in 5 iterations. Factor loadings less than .3 are not shown on the table.