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The moderating influence of user characteristics on the relationship between user involvement and perceived usefulness of information systems

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ABSTRACT

This study examines the moderating effect of user characteristics on the relationship between user involvement and perceived usefulness of ISs. Thirty-two organizations with 127 users have participated in this study. Results indicate that among user characteristics, feelings about the existence of procedures to handle conflicts between users and the IS staff, years with the company, and years of IS experience produce moderating effects in the planning and design stage, or in the implementation stage of IS development.

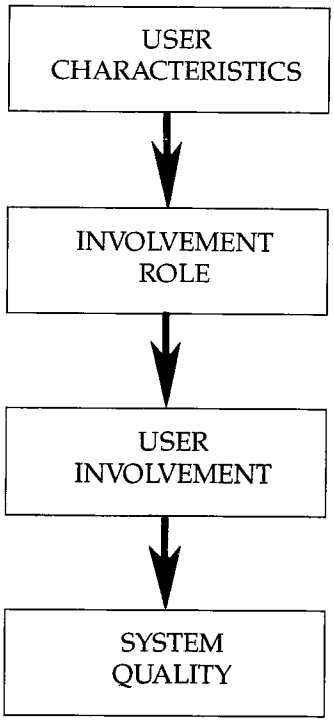
INTRODUCTION

During recent decades, information systems (ISs) have been widely utilized at all levels of administration in every type of organization. Regardless of the administrative level or organizational type, several factors affect the successful implementation of an IS. These include top management support, competence and experience of the IS staff, quality of goal setting, formal training programs for users, user characteristics, and user involvement. Many researchers and practitioners agree that user involvement is a necessary condition for a high quality system. The importance of user involvement is also reflected in Ives & Olson's descriptive model of user involvement in IS development (Ives and Olson, 1984), which was developed based on the theories of participative decision making (PDM) and planned organizational change, and previous work done on user involvement. Figure 1 shows part of their model.

As indicated in the model, user characteristics are included since they are important variables affecting involvement role, user involvement and system quality. Among user characteristics, cognitive style, personality, attitude, and demographic and situational variables are believed relevant to IS quality.

Involvement role refers to the type of user who should be involved in an IS's development. According to Zmud (1981), a leading researcher in IS implementation, a user's predisposition to becoming involved might be an important factor in the organization's choosing him or her as a participant. This predisposition should in turn depend on the user's characteristics, as supported by the study done by Lucas (1988).

Figure 1. A Descriptive Model of User Involvement



Reprinted from Ives, B. and Olson, M. H. (1984). User Involvement and MIS Success: A Review of Research. *Management Science, 30*(5), 588.

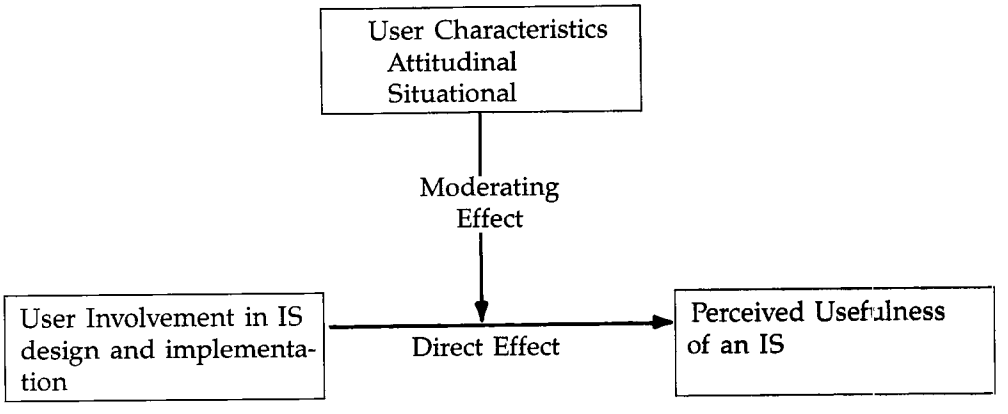
Involvement role can directly influence the type of user involvement. Summarized by Mumford (1979), there are three types of involvement: consultative, representative and consensus. Consultative means the IS staff makes the design decision although the objectives and form of the system are influenced by the needs of users. Representative refers to having the affected user group, from all levels and functions, represented in the system design team. Consensus means the involvement of all users, at least in communications and consultation roles, throughout the system design process. These three types of user involvement can affect the entire system's quality.

All in all, Ives and Olson's descriptive model reflects the importance of a user's characteristics on the system's quality through the process of user involvement. Zmud (1979) agreed that individual differences do exert a major force in determining IS success. Unfortunately, most research has been concerned only with a direct relationship either between user involvement and system quality or between user characteristics and system quality. Both relationships can be oversimplified. The interrelationships among a user's characteristics, his/her involvement in the design process, and the system's quality are still neglected in current literature (Ives and Olson, 1984).

OBJECTIVE AND HYPOTHESES

The objective of this research was to examine the possible moderating influence of user characteristics on the relationship between user involvement and perceived system usefulness. It was believed that when the user characteristic variables systematically varied, the relationship between user involvement and perceived system usefulness would change. Figure 2 presents an overview of the conceptual relationships among variables under study.

Figure 2. Conceptual Relationship among Variables Under Study



Two sets of hypotheses were derived from the proposed model, with the first set related to user attitude and the second concerned with situational variables. The first set consisted of three hypotheses:

H1: Involved users will perceive their systems as more useful when they perceive the quality of the IS staff as higher.

Organizational members possess preconceived attitudes, i.e., beliefs, values and expectations, regarding the role of the IS within the organization. These attitudes can be observed as expressions of perceptions of the IS staff, and as a need for user interactions with this staff (Zmud, 1979). If the users perceive the IS staff as technically competent and good in dealing with people, they should not be skeptical of the capability of the IS staff and should maintain a harmonious relationship. As a result, they can be more involved in the process of development and perceive the quality of the systems as higher.

H2: Involved users will perceive their systems as more useful when they perceive the level of management support higher.

Management support should motivate greater understanding, more favorable attitudes, and greater cooperation between users and the IS staff and this should directly influence the system use.

H3: Involved users will perceive their systems as more useful when they feel more comfortable about the existence of policies and procedures to handle conflicts between users and the IS staff.

If users perceive that they do not have difficulties consulting the IS staff when problems and questions occur, they should feel more comfortable in participating, especially if designated problem solving staff members are present and there are formal procedures for the interactions between users and IS staff members. As a result, they should be able to improve the quality of the systems.

The second set consisted of four hypotheses:

H4: Involved users will perceive their systems as more useful when they have been in the company more years.

This is based on the assumption that users with longer tenure are more familiar with the organization and have longer standing relationships with the IS staff. If the relationship is positive, users should be more involved and this can improve the quality of the systems.

H5: Involved users will perceive their systems as more useful when they have more years of experience with IS development.

If users have experience with ISs, they should be able to identify some of the common problems in the development process. Therefore, their ideas are likely to be incorporated into the systems, and they should be more involved in the development process and perceive the systems as more useful.

H6: Involved users will perceive their systems as more useful when they have higher levels of education.

Highly educated users should have more confidence in their ability in the involvement process since their knowledge should make them more capable of contributing to the usefulness of the systems.

H7: Involved users will perceive their systems as more useful when they have higher organizational level.

Users at a higher organizational level should be more involved since their opinions should be more respected because of their positional authority. Furthermore, they are the people speaking for their subordinates, and they should therefore have greater responsibility and exhibit more enthusiasm for participation. Even though it is possible that managers may delegate their responsibilities to subordiantes throughout the process of involvement, they should still maintain a high degree of personal involvement due to the fact that they are the primary intended users of the IS and should achieve appreciable benefits from the system, especially for supporting decision making.

METHODOLOGY

A mail survey was used as the medium for data collection. The questionnaire used was composed of three parts: user involvement, perceived system usefulness, and user characteristics. The instrument developed by Franz and Robey (1986) was employed in this study to measure user involvement in the *planning and design stage* and the *implementation stage*, and perceived usefulness of ISs. The instrument used to measure the user's feeling about the quality of IS staff, the user's feeling about management support, the user's feeling about the existence of procedures to handle conflicts between users and the IS staff, and the situational variables was developed based on exhaustive literature review. Except for the situational variables, all items were measured by the 6-point Likert scaled questions (1=Not at All, 2=Very Little, 3=Little, 4=Moderately, 5=Much, 6=Very Much). An index of each of the above variables was computed by averaging the users' responses to the questions. For the situational variables, years in the company and years of IS experience were measured in terms of number of years; level of education was determined by a user's highest degree obtained; and the organizational level was indicated by whether or not a user was in a managerial position.

In order to examine both the reliability and validity of the questionnaire, a pre-test was administered. Twenty-one IS managers and user-managers were asked for (1) a completed questionnaire and (2) comments and opinions on the content and wording of the instrument. Construct validation was done based on the method suggested by Kerlinger (1973) while reliability was examined by using the Cronbach Alpha technique. Both the validity and the reliability of the questionnaire were proven to be very high.

Thirty-two organizations agreed to participate in this survey. Questionnaires were sent to the IS managers, who were then to hand deliver them to the users of the IS. Each user had a return envelope in order to ensure anonymity throughout the entire process, and to prevent any fear that the IS manager would know of unfavorable responses by users. After the users had completed the questionnaires, they returned them directly to the researcher.

RESULTS

There were 127 usable questionnaires returned. The distribution of surveyed companies and users by industry type is shown in Table 1. Table 2 shows a distribution of companies in terms of their annual sales. A distribution of the companies in terms of their total number of employees is shown in Table 3. Table 4 presents the descriptive statistics of the study variables.

Table 1. Distribution of Surveyed Companies and Users by Industry Type

Industry Type	No. of Companies	%	No. of Users	%
Agriculture, Forestry, and Fisheries	1	3.13	9	7.09
Mining	4	12.50	8	6.30
Manufacturing	2	6.25	12	9.45
Transportation, Communications, and Public Utilities	4	12.50	17	13.39
Wholesale Trade	10	31.25	39	30.70
Retail Trade	5	15.62	12	9.45
Finance, Insurance, and Real Estate	5	15.62	26	20.47
Services	1	3.13	4	3.15
TOTAL	32	100.0	127	100.00

Table 2. Distribution of Companies by Annual Sales

Annual Sales	No. of Companies	%
Less than 1 million	5	15.62
1 million to 4.99 million	8	25.00
5 million or more	18	56.25
Not Reported	1	3.13
Total	32	100.00

Table 3. Distribution of Companies by Number of Employees

No. of Employees	No. of Companies	%
Less than 100	16	50.00
100 to 499	10	31.25
500 to 999	4	12.50
1,000 or more	2	6.25
Total	32	100.00

Table 4. Descriptive Statistics of Study Variables

Variable	Mean	S.D.
User Involvement in the Planning and Design Stage	4.13	1.27
User Involvement in the Implementation Stage	4.12	1.23
Perceived Usefulness	4.25	0.79
Feelings about the Quality of the IS Staff	4.28	1.28
Feelings about Management Support	4.91	1.01
Feelings about the Existence of Procedure to Handle Conflicts between User and the IS Staff	4.50	1.12
Years with the Company	11.08	8.08
Years of IS Experience	8.26	5.87

Variable	No. of Users	%
Highest Level Achieved in School		
High School Graduate	33	26.0
Undergraduate Degree	56	44.1
Graduate Degree	35	27.6
Not Reported	3	2.3
Job Position		
Managerial Level	64	50.4
Non-managerial Level	56	44.1
Not Reported	7	5.5

The possible moderating effect of user characteristics on the relationship between user involvement and the perceived usefulness of an IS was explored by the moderated regression analysis (MRA) technique recommended by Sharma et al. (1981). This technique examines three regression equations for equality of the regression coefficients:

(1) $Y = a + b(1) * X$
(2) $Y = a + b(1) * X + b(2) * Z$
(3) $Y = a + b(1) * X + b(2) * Z + b(3) * X * Z$

where: Y = perceived usefulness,
b = regression coefficients,
X = involvement variables (planning and design stage or implementation stage),
Z = user characteristic variables, and
X * Z = interaction of X and Z

Following Sharma et al., a stepwise hierarchical regression procedure was performed by stepping in the terms X, Z, and X * Z, respectively. It meant that there would be three regression equations: (1) regression of Y on X (step one in the stepwise heirarchical regression procedure), (2) regression of Y on X and Z (step two in the stepwise hierarchical regression),

and (3) regression of Y on X, Z and X * Z (step three in the stepwise hierarchical regression). The significance of the respective beta coefficient for the variable just entered was determined by examining the F ratio and p-value. If equations (2) and (3) are not significantly different (i.e., $b[2] \neq 0$; $b[3] = 0$), Z is not a moderator variable. For Z to be a pure moderator variable, equations (1) and (2) should not be different but should be different from equation (3) (i.e., $b[2] = 0$; $b[3] \neq 0$). For Z to be classified as a quasi moderator, equations (1), (2), and (3) should be different from each other (i.e., $b[2] \neq 0$; $b[3] \neq 0$).

The results of the moderated regression analysis are shown in Table 5. The findings indicated that feelings about the existence of policies and procedures to handle conflicts between users and the IS staff had a significant moderating effect on the relationship between user involvement and perceived usefulness in both planning and design stage (p-value = 0.011), and implementation stage (p-value = 0.011). However, its moderating effect was not clear since it was a quasi moderator having significant correlation (p-value = 0.000) with the criterion variable (perceived usefulness). This type of moderator can be clarified only by referring to theoretical grounds (Sharma et al., 1981). In this case, it is justifiable to consider the existence of policies and procedures to handle the conflicts between users and the IS staff as a moderator variable since it clearly existed as a condition prior to user involvement in IS development.

Two other pure moderator variables identified in this study were years with the company and years of IS experience. Years with the company produced significant moderating effect in both planning and design stage (p-value = 0.043), and implementation stage (p-value = 0.021) while years of IS experience had a significant moderating effect only during the implementation stage (p-value = 0.005). Other user characteristics did not produce any significant moderating effect in either stage.

Table 5. Moderated Regression Results for Perceived Usefulness Regressed on User Involvement and User Characteristics

INDEPENDENT VARIABLES	F	p-value
1. Planning and Design Stage	45.249	.000
Feelings about the quality of the IS staff	3.619	.060
Planning and design * Feelings about the quality of the IS staff	.108	.743
Feelings about management support	3.531	.063
Planning and design * Feelings about management support	.024	.878
Feelings about the existence of procedures to handle conflicts between users and the IS staff	15.287	.000
Planning and design * Feelings about the existence of procedures to handle conflicts between users and the IS staff	6.638	.011
Years with the company	1.331	.251
Planning and design * Years with the company	4.204	.043
Years of IS experience	.540	.464
Planning and design * Years of IS experience	3.358	.070
Education	.641	.425
Planning and design * Education	.012	.914
Organizational level	.720	.398
Planning and design * Organizational level	.499	.481
2. Implementation Stage	116.703	.000
Feelings about the quality of the IS staff	1.301	.257
Implementation * Feelings about the quality of the IS staff	.016	.899
Feelings about management support	3.381	.069
Implementation * Feelings about management support	.010	.929
Feelings about the existence of procedures to handle conflicts between users and the IS staff	5.259	.024
Implementation * Feelings about the existence of procedures to handle conflicts between users and the IS staff	6.733	.011
Years with the company	0.247	.620
Implementation * Years with the company	5.507	.021
Years of IS experience	.052	.820
Implementation * Years of IS experience	8.109	.005
Education	.399	.529
Implementation * Education	1.330	.251
Organizational level	.981	.324
Implementation * Organizational level	.056	.813

In order to gain more insight into the effects of the moderating user characteristics, further analysis was performed to examine the direction of such effects. Table 6 shows five equations, with each equation representing the possible effect of a moderating item identified by the moderated regression analysis technique. Each equation is in the form of equation (3) in the moderated regression analysis technique. Each b value represents the amount of change in perceived usefulness when the related independent variable (user involvement or user characteristic) changed by one unit with other variables held constant. The terms of the equation in each case were then rearranged so that the moderating variable became part of the intercept and the slope in the equation, making user involvement the only independent variable in the equation. After that, three values (one standard deviation below the mean, mean, and one standard deviation above the mean of the moderating item) were substituted into the equation. This produced three regression lines in each equation.

As shown in the first and third cases in Table 6, the slope of the equation increased when feelings about the existence of procedures to handle conflicts between users and the IS increased. This suggests that for a given level of user involvement in the planning and design stage and in the implementation stage, improved feelings about the existence of procedures to handle conflicts between users and the IS staff should increase the user's perceived usefulness. On the other hand, the slope decreased when the moderating item increased for the second, fourth and fifth cases. The implication is that the more the years with the company, the less was the perceived usefulness for a given amount of planning and design involvement. Also, for a given amount of implementation involvement, the more the years with the company and the years of IS experience, the less was the user's perceived usefulness of an IS.

DISCUSSION

There are many reasons for conflicts between users and the IS staff. Some of the more important ones relate to communication problems, differences in interests and goals, different perceptions and attitudes, and lack of clarity about responsibility. Such conflicts can be avoided if the top management gets involved in setting up formal policies and procedures for the IS project to make sure that both users and the IS staff:

(a) Understand and accept the objective of the IS
(b) Express constructive criticism, carefully evaluate each other's ideas, and attempt to understand each other's point of view
(c) Make the decision by consensus, if possible, rather than by majority vote
(d) Have clear assignments of tasks and accept the assigned jobs
(e) Stay involved throughout the entire process of IS development.

To further improve the relationship between users and the IS staff, greater integration or collaboration among them must occur. The IS manager should set up the policies and procedures, as well as use various strategies to increase integration and minimize conflicts. These strategies include:

(a) Exercising the subordinate-centered leadership approach since both users and the IS staff are resources and sources of expertise in the IS development project

Table 6. Moderating Effect of User Characteristics on the Relationship between User Involvement and Perceived Usefulness

1. Planning and Design (PD) and Feelings about the Existence of Procedures to Handle Conflicts between Users and the IS Staff (PC)

$Y = 4.013 - .280\ (PD) - .211\ (PC) + .121\ (PD)(PC)$
$= (4.013 - .211\ [PC]) + (-.280 + .121\ [PC])\ (PD)$

Let PC = 3.377	Y = 3.300 + .129 (PD)
Let PC = 4.496	Y = 3.064 + .264 (PD)
Let PC = 5.615	Y = 2.828 + .399 (PD)

2. Planning and Design (PD) and Years with the Company (YC)

$Y = 2.313 + .495\ (PD) + .034\ (YC) - .011\ (PD)\ (YC)$
$= (2.313 + .034\ [YC]) + (.495 - .011\ [YC])\ (PD)$

Let YC = 3.002	Y = 2.415 + .462 (PD)
Let YC = 11.080	Y = 2.690 + .373 (PD)
Let YC = 19.158	Y = 2.964 + .284 (PD)

3. Implementation (IM) and Feelings about the Existence of Procedures to Handle Conflicts between Users and the IS Staff (PC)

$Y = 3.706 - .076\ (IM) - .269\ (PC) + .107\ (IM)(PC)$
$= (3.706 - .269\ [PC]) - (.076 - .107\ [PC])\ (IM)$

Let PC = 3.377	Y = 2.798 + .285 (IM)
Let PC = 4.496	Y = 2.497 + .405 (IM)
Let PC = 5.615	Y = 2.196 + .525 (IM)

4. Implementation (IM) and Years with the Company (YC)

$Y = 1.771 + .606\ (IM) + .041\ (YC) - .011\ (IM)\ (YC)$
$= (1.771 + .041\ [YC]) + (.606 - .011\ [YC])\ (IM)$

Let YC = 3.002	Y = 1.894 + .573 (IM)
Let YC = 11.080	Y = 2.225 + .484 (IM)
Let YC = 19.158	Y = 2.556 + .395 (IM)

5. Implementation (IM) and Years of IS Experience (YE)

$Y = 1.710 + .633\ (IM) + .059\ (YE) - .017\ (IM)\ (YE)$
$= (1.710 + .059\ [YE]) + (.633 - .017\ [YE])\ (IM)$

Let YE = 2.384	Y = 1.851 + .592 (IM)
Let YE = 8.256	Y = 2.197 + .493 (IM)
Let YE = 14.128	Y = 2.544 + .393 (IM)

(b) Selecting those users who not only are willing to, but also are interested in participating in the development of the IS
(c) Clearly explaining the system requirements to both users and the IS staff
(d) Estimating reasonable time required for each development stage, since users need time to adjust to new procedures and technology
(e) Clearly indicating that users, as well as the IS staff, should fully satisfy the outcome of the current stage before beginning the next stage in the IS development process
(f) Making sure that the system is documented for review and control purposes as it is developed rather than after it is implemented
(g) Informing the users by providing progress reports and intermediate documentation
(h) Requiring user control of logical design and implementation decisions
(i) Insisting on a detailed design report on a proposed system to specify exactly how the users operate the system
(j) Explaining to users the benefits of their review of the detailed design report.

It is important to realize that the high quality of a system does not guarantee its acceptance by the users. The user's resistance to and nonacceptance of the IS still continue after the completion of the IS project. Enough training for the potential users should be provided so that they do not have any difficulty in using the system. Also, the IS manager should carefully evaluate the overall quality of the system by considering it from the users' points of view, such as users' perceived system usefulness and system usage. Users should have the chance to express their perceptions of and feelings about the system so that the users' resistance to the system will be revealed right after it is implemented.

Another finding of this study suggests that involved users who had been with the company longer perceived their systems as less useful. Long-tenured users might resist changes in the organization and might not be willing to be involved in the IS development. Even if they are forced to participate in the IS development, their degree of involvement could be low and their contribution to the IS development might not be prominent. As a result, they might not perceive the system to be useful.

Also, assuming that users who have been with the company longer are older people, they probably cannot accept the technology of computers as easily as younger employees. Even though these older people might be involved in the IS development, they still might perceive the system as not useful, since their ideas and opinions might not be accepted or respected by the IS staff due to their limited knowledge of the technology.

It is surprising to find that involved users who had more years of IS experience perceived the systems as less useful during the implementation stage. However, there was no moderating effect on the relationship between user involvement and perceived usefulness during the planning and design stage. The result is disturbing since it seems that users with more years of IS experience should be more knowledgeable, should feel more comfortable being involved in the system development, and therefore should have higher perceived quality of the system. Possibly involved users with many years of IS experience expect greater capability from the IS. This could be especially pertinent during the implementation stage when they actually work on the system. Also, some experienced users' ideas or opinions may not be accepted or respected by the IS staff members. Communication problems may exist between experienced

users and the IS staff. As a result, even though experienced users are involved in the IS development, they do not perceive the system to be useful. To overcome all these problems, the IS managers should:

(a) Follow carefully all the policies and procedures set for the IS development project
(b) Select willing and educable users to involve in the IS development
(c) Ask the users to define the capability of an acceptable system
(d) Solve the communication problems between experienced users and the IS staff
(e) Understand the reasons the users resist the new system, such as the possibility that they could lose their jobs or lose power
(f) Tailor the training to the old users and those users who have been with the company for a long time.

CONCLUSION

Previous research concerned only with a direct relationship either between user involvement and system quality or between user characteristics and system quality is oversimplified. The moderating influence of some user characteristics on the realtionship between user involvement and system quality is evidenced in this research. The findings of this study should benefit those organizations which plan to implement a new IS. IS managers should seriously consider involving users in the system development, and more important, they should consider the type of users to be involved in the system development. Users who have favorable feelings toward the existence of policies and procedures to handle conflicts between users and the IS staff should be given priority since this characteriistic can produce positive moderating effects on the relationship between user involvement and perceived usefulness. On the other hand, when involving users who either have been with the company many years or have many years of IS experience, IS managers should be very careful about the negative moderating influence that could result in resistance to the system.

The insignificant results of some hypotheses in this research imply that the moderating effect of those user characteristics is not clear. Further research should be done on these. In this study, only attitudinal and situational variables were examined. Research on other user characteristics, such as cognitive style, motivational factors, personality, and demographic variables, is encouraged in the future.

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