EMPIRICALLY TESTING SOME MAIN USER RELATED FACTORS FOR SYSTEMS DEVELOPMENT QUALITY

(Research Paper)

Tor Guimaraes
Tennessee Tech, Canada
tguimaraes@tntech.edu

D. Sandy Staples
Queen's University, Canada
sstaples@business.queensu.ca

James D. McKeen
Queen's University, Canada
jmckeen@business.queensu.ca

Abstract: The importance of user-related factors has long been recognized as important to system success by various researchers. This study attempts to test the importance of these variables as determinants of system quality. It has brought together some user-related variables (degree of user participation, user expertise, user/developer communication, user training, user influence, and user conflict) previously studied separately by different authors into a more cohesive model. Data from 228 systems has been used to test proposed relationships between the independent variables and system quality. The results confirm the importance of user participation, user training, and user expertise as significant variables for system quality. User/developer communication, user influence, and user conflict are found to possibly have only an indirect effect on system quality.

Key Words: Information Systems, system quality, quality measurement, user satisfaction

INTRODUCTION AND BACKGROUND

As business dependence on software systems increases, so does the need to ensure that it performs according to specifications and/or user needs and wants. Despite continuous efforts to improve the software development process, controlling software quality remains difficult in today's software development environment. Fok, Fok, and Hartman found that Total Quality Management (TQM) programs can be helpful in IS quality improvement. [13] However, a recent study by Pearson, McCahon & Hightower found that it normally takes three-to-five years for the quality program to yield significant benefits in areas of customer satisfaction and quality of product and services. [37] Meanwhile, a study by Jones found the costs of defect removal among the top expenses in software development projects.[29] Furthermore, inadequate and insufficient published empirical studies on software quality have made it difficult for project managers to effectively apply available software metrics and strategies in management and quality control. Much of the present difficulties come from the relatively complex be overestimated given the enormous amount of company resources spent on information systems and the degree of company dependence on the increasing collection of system applications. System quality should be construed as a primary surrogate of system success. Some important research questions are: Will system quality be affected by some of the same variables found important to system success? How important is user participation and other user characteristics for system quality?

The importance of user participation in systems development nature of software quality management. The complexity of assessing software system quality stems from its many dimensions. Humphrey classifies the measurement of software quality into five general areas: development, product, acceptance, usage, and repair. [21] These areas are to be measured in terms of objectivity, timeliness, availability, representativeness, and ability to control by developers.

The importance of system quality cannot as an important ingredient for system success has been studied widely. [24, 33, 40, 3, 4] There are many published reviews of this literature. [26, 38, 34, 7] Additionally, there have been a few studies of contextual factors such as the complexity of the business problem being supported by the system, the complexity of the system being developed, user training that affect these interrelationships. [32, 34]

One may expect that finding evidence to corroborate the essential role that users play during development should be a simple matter. Surprisingly, this is not the case. While the majority of research evidence finds user participation/involvement correlated with various measures of system success, the literature has often presented conflicting results. [33, 24] Some studies have shown user participation to be positively correlated with systems success, negatively correlated with system success, and sometimes non-significantly correlated with system success.[5] As mentioned above, other user characteristics beyond mere participation in the system development process have been found to be important factors by various authors. The main objective of this study is to focus on user related factors, which have been found to be significant factors in system success, and test their validity for system quality and to propose and test an expanded model in this important area.

In the next section, we define the primary constructs studied here (system quality, user participation, user expertise, user/developer communication, user training, user influence, and user conflict). We explain the nature of each variable and develop testable hypotheses. Following that, we explain the methodology used and present the results of our tests. Finally, we discuss the implications of the results for managers and researchers.

THE THEORETICAL BACKGROUND AND HYPOTHESES TESTED

Figure 1 graphically depicts our research model.

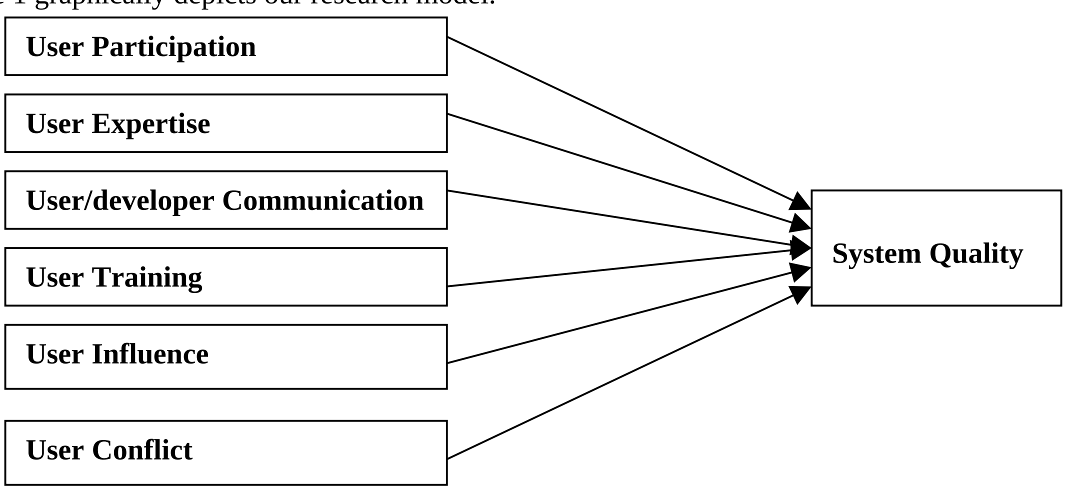

Figure 1: The Research Model

The Dependent Variable

System Quality: From an engineering perspective, the quality of a product or service is commonly measured in terms of its fitness for intended use, i.e., it must be adequate for the application the customer has in mind. [10] According to the American National Standards Institute, quality "is the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs." [1] Quality control activities are undertaken with the objective of designing, developing, and tailoring a product to satisfy user's requirements. [12] Enterprises that have attained high levels of quality state that the ultimate yardstick of quality is attaining maximal satisfaction of customer's needs and expectations. [8] Thus, the importance of assessing quality as something perceived by the end-user of the product or service is widely recognized in industry.

Similarly, measures of user satisfaction (UIS) with computerized systems have been widely used as measures for system quality. [17, 47] UIS is defined as the extent to which users believe the information system available to them meets their information requirements. The summary results obtained from the UIS instrument provide a subjective assessment of system quality. User satisfaction with a system deals with how users view their information system but not the technical quality of the system. In other words, it measures users' perception of the information services provided, rather than a direct assessment of the functional capabilities of the system. UIS is a widely used method to measure whether users believe their IS meets their information requirements. [10] This is a very reliable construct that has been rigorously tested and validated by many researchers. [2, 6, 15, 27, 28, 31] Using Likert scales, it collects user perceptions about the system such as accuracy of information produced, timeliness of reports, and attitude of support staff.

Gatian tested the validity of using user satisfaction as a surrogate measure of system effectiveness and confirmed its construct validity.[14] Following the rationale presented above, we chose user satisfaction with the output of the system as measure of system quality, the dependent variable in this study. The specific items included in the measures for this and the other constructs in this study are presented later in the variable measurement section.

The Independent Variables

User participation: It refers to the extent to which non-IS members of an organization are engaged in activities related to systems development.[42] According to Barki and Hartwick, participation can therefore be measured by "assessing the specific assignments, activities, and behaviors that users or their representatives perform during the systems development process." [3] Using meta-analytical techniques, Hwang and Thorn reviewed the IS literature and concluded that user participation has a positive correlation with system success as measured by system quality, use, and user satisfaction.[24] Thus, we propose **H1** : **User participation is directly related to system quality.**

User Expertise: User expertise is a user's acquired experience and skill level with regard to computer usage and development. [25] Not all users are equal in their ability to participate meaningfully within the system development process. It seems intuitive that their level of expertise in the development of systems would be important. User expertise is gained through both experience on previous development efforts and through training in preparation for the tasks that they are required to perform. Experienced users are expected to perform to higher standards given their facility with the "tools of the trade" (e.g., methodologies, notation, processes, language, tools, acronyms, documents, deliverables, and pro-forma analysis). We expect this facility (i.e., expertise) to have a positive effect on the nature of their participation, its impact on system quality, as well as the formation of beliefs. That is, user expertise will have an impact on the behavioral aspect as well as the psychological aspect of system development. Users with high expertise are able to participate more efficiently and effectively during the development process and, through this participation, are able to form more accurate expectations about the functioning of the resultant system (and its impact on their working lives) than users with less expertise. For these reasons, we hypothesize that the relationship between user participation and system quality will be stronger where user expertise is higher as will the relationship between user participation and user involvement.

Empirical research has established how user expertise raises expectations and performance levels within the systems development process. Saleem found that "users who perceive themselves as functional experts are unlikely to accept a system unless they exerted a substantive influence on its design."[44] This result was found to hold in both experimental and field research. It is based on the belief that the participation of expert users in system design should result in a better quality system through integration of employee expertise, better understanding of users' information requirements, superior evaluation of the system, and more accurate formation of expectations regarding the end product of the systems development and its impact on the organization. Thus, we propose **H2**: **User expertise is directly related to system quality.**

User-Developer Communication: User-developer communication indicates the quality of the communications that exists between the systems designers and the user participants. [35, 16] Communication plays a key facilitating role within the process of application system development. According to McKeen et al.,

> "what facilitates productive, collaborative effort in the conduct of systems development is effective communication … due to the necessity of users to convey their understanding and insight of business practice accurately and completely to developers who, in turn, must receive this information and translate it into a working computer system. Accordingly, effective communication works to the benefit of both parties."[34]

It is through articulation, conveyance, reception and feedback that user/system requirements gain currency and have effect. Communication, to be effective, must flow both ways – from sender to receiver and vice versa. With effective user-developer communication, participation will be more meaningful. Users' inputs will be heard and understood by developers and users will be able to understand technical tradeoffs as described by developers. As a result, effective communication will provide clarity. Beliefs will be based on a more comprehensive understanding of the system deliverables and the system itself will be implemented as articulated. In situations where effective communication is lacking, the benefit of user participation is lessened – users fail to convey their needs for (and understanding of) the system under development accurately and developers fail to seek, explain, and translate user needs into system requirements effectively. As a result, ineffective communication weakens the relationship between user participation and system quality. Conversely, we argue that the relationship between user participation and system quality is stronger where user-developer communication is of high quality. Empirical research bears this out. In a study of 151 application systems, McKeen et al., found that user-developer communication moderated the relationship between user participation and user satisfaction as well as having a direct impact on user satisfaction.[34] They found that, in situations where there was effective user-developer communication, the relationship between user participation and user satisfaction was stronger than in situations where communication was less effective.

The quality of communication has a psychological impact on systems development as well. With ineffective communication, users convey/form ideas, impressions and expectations of the end system based on incomplete (or inaccurate) information due to misunderstandings between themselves and the design team. Although we are not able to cite empirical evidence to support this assertion, we expect that the relationship between user participation and user involvement will be stronger where there is effective communication and weaker where there is not. In sum, we propose **H3: User-developer communication is directly related to system quality.**

User Training: The importance of user training for system success has been recognized widely. [36, 45, 25, 47] Training is important to provide a general background to familiarize users with the general use of computer technology, the process of systems development, and to help users to effectively use the specific system under development. Based on what we propose **H4: User training is directly related to system quality.**

User Influence: Robey et al. define user influence as the extent to which members of an organization affect decisions related to the final design of an information system.[42] Furthermore, they argue that it is through participation that users exercise this influence. McKeen et al. concur and claim, "without participation, there can be no influence."[34] Saleem outlines the role of user influence within system development by differentiating it from user participation as follows:

> "Participation varies in degree, that is, in the extent of user influence on the system design … this variation may be conceived as a continuum. On the low end of this continuum, user input is not solicited or is ignored; and, on the high end, user input forms the basis of system requirements … Thus, participation and influence are not synonymous; a participant user may or may not have any influence on the system development".[44]

With high levels of influence, users become active decision makers within the system development process. Through the exercise of their responsibilities, these instrumental players are able to shape the resultant system to function in ways that best advances their vision of automation. As compared to users with low levels of influence, these users participate (i.e., the behavioral dimension) much more effectively and form beliefs about the system (i.e., the psychological aspect) with greater acumen based solely on their ability to affect the end product of development. Thus, we expect the relationship between user participation and user satisfaction (the behavioral impact) to be stronger where user influence is high and weaker where it is not.

Empirical research has demonstrated the importance of user influence in systems development. Hunton and Beeler found that participation by mandatory users was significantly related to user performance leading them to conclude, "participation by mandatory users may be ineffective, particularly if the users do not gain a sense of overall responsibility (i.e., control)".[22] Barki and Hartwick identified three components of user participation – overall responsibility, user-IS relationship, and hands-on activity – but found that overall responsibility was the key dimension of user participation.[4] Interestingly, overall responsibility (which refers to user activities and assignments reflecting overall leadership or accountability for the system development project) is closely related to the concept of user influence.

Doll and Torkzadeh argued the importance of user influence due to the likelihood that "without adequate influence to change things and affect results, users are likely to see their participation as a waste of time or, worse still, as an act of social manipulation".[11] By differentiating user participation and user influence, it is possible to understand how user participation is most useful when balanced appropriately with user influence. Such a balance gives rise to "meaningful" participation.[4] Imbalanced situations (that is, high participation accompanied by low influence or low participation accompanied by high influence) would result in "hollow" participation (in the first instance) and "coercive" participation (in the second instance). According to Saleem, users caught in the "hollow" participation role may feel manipulated while those in the "coercive" participation role would exert undue influence over the system development without participating fully. [44]

Closely related to influence/control and the preceding argument is the concept of "voice". Hunton and Price differentiate participation by voice (the probabilistic control over the decision-making process) from participation by choice (the deterministic control because the degree to which choice impacts the decision outcome is known in advance). [23] In another work, Hunton and Beeler articulate instrumental voice as the opportunity for users to express their opinions, preferences, and concerns to decision makers thus providing users with a sense of control during the development process since the expression of instrumental voice is expected to become manifest in the decision outcome. [22] The exercise of voice engenders feelings of ownership, relevance and importance on the part of users. For all these reasons, we propose **H5**: **User influence is directly related to system quality.**

User Conflict: As pointed out by Hartwick and Barki, multiple definitions of conflict exist and the various definitions reveal three key facets: conflict occurs among interacting parties; there is divergence of interests, opinions, or goals among these parties; and these differences appear incompatible to the parties. [19, 39, 20] Such conditions occur frequently during systems development. [9, 30, 46] In every case, conflict between users and system developers is expected to produce negative results during the system development process. Ultimately, such conflict may impair communication during the development process, discourage user participation, and lead to dysfunctional behavior. For these reasons we propose **H6:** **User conflict is inversely related to system quality.**

A quantitative research design was chosen to examine the proposed relationships among the various constructs in the research model. The next section describes the sample, measures, and analysis methods employed to test the research model.

METHODOLOGY

The Sample

Given the variables being studied, our sample is focused on application systems developed by IS professionals for a definable set of business users within an organization. A letter describing the research project was sent to 30 CIO's from companies in a single geographic area to seek their potential interest in collaborating. Of the 23 who responded favorably[1], each was asked to provide "political" support for the project by distributing a one-page document that described the project (its goal, timelines, and deliverables) and introduced the researchers. At each company, ten application systems were selected according to the following criteria: (1) each had been implemented; (2) each had been fully operational for at least 6 months; (3) each had been developed by the internal IS department.

The primary contact for each application system was the project manager (and/or project leader) responsible for its development. These individuals were asked to complete the first part of the questionnaire pertaining to the identification of the system, operational platform, development cost/time, system complexity and business processes supported. The research team worked with the project managers to identify a primary user of the system (i.e., an individual who was part of the project development team and a current user of the system). This individual provided all additional information for each system (see description under Construct Measurement below). The researchers met with the primary user to explain the project briefly, identify the system under scrutiny, and distribute the questionnaire. Completed questionnaires were collected internally and returned to the researchers. Researchers conducted necessary follow-up telephone calls. Of the 230 completed questionnaires, only two sets were deemed unusable due to the inability to locate either the project manager or the project leader. The final sample size was 228 and a summary of the characteristics of the systems is presented in Table 1.

	Frequency	*Percent*
System Development Cost (US$)		
Less than 50,000	*1*	*0.4*
50,000 to 100,000	*11*	*4.8*
101,000 to 300,000	*41*	*18.0*
401,000 to 600,000	*30*	*13.2*
601,000 to 1 million	*36*	*15.8*
1 to 3 million	*35*	*15.4*

[1] *Of those that declined to participate in this research project, reasons given were due to company policy regarding divulging company information (n=1), not interested in the topic (n=2), and too busy at the time (n=4).*

3 to 5 million	*27*	*11.8*
5 to 10 million	*26*	*11.4*
Over 10 million	*21*	*9.2*
SYSTEM DEVELOPMENT TIME		
1 to 3 months	*16*	*7.0*
3 to 6 months	*24*	*10.5*
6 to 12 months	*62*	*27.2*
13 to 24 months	*72*	*31.6*
Over 24 months	*54*	*23.7*
SYSTEM PLATFORM		
Mainframe	*177*	*61.2*
Local Area Network	*28*	*9.7*
Client-Server	*48*	*16.6*
Mini-microcomputer	*36*	*12.5*
BUSINESS PROCESS(S) SUPPORTED BY THE SYSTEM		
Customer service	*32*	*4.8*
Sales & order entry	*92*	*13.8*
Invoicing & billing	*65*	*9.7*
Purchasing	*9*	*1.3*
Advertising & promotions	*37*	*5.5*
Pricing	*47*	*7.0*
Marketing research	*38*	*5.7*
Product design & development	*38*	*5.7*
Distribution & logistics	*45*	*6.7*
Business planning	*101*	*15.1*
Inventory management	*45*	*6.7*
Quality management	*52*	*7.8*
Production scheduling and planning	*43*	*6.4*
Personnel management	*23*	*3.4*

Table 1: Characteristics of the Systems

Construct Measurement

System quality: Quality was measured by a 10-item scale adapted from Yoon et al. and previously used by Guimaraes, Yoon, and Clevenson. [47, 18] The scale is a measure of end-user satisfaction with various aspects of the system, including items regarding output information content, accuracy, usefulness, and timeliness; system response/turnaround time, system friendliness (ease of learning and ease of use), and documentation usefulness. Each item was measured on a 5-point Likert scale indicating the extent of user satisfaction along each item. The scale ranged from “1” (no extent) to “5” (great extent). These questions were answered by end users.

User Participation: The measure of end-user participation in the system development process was adapted from Doll and Torkzadeh and Santhanam et al.[11, 45] Respondents were asked to what extent they were primary players in each of nine specific activities, such as initiating the project, establishing the objectives for the project, determining the system availability/access, and outlining information flows.

The 5-point scale ranged from "1" (not at all) to "5" (great extent). These questions were answered by the end users.

User Experience: This measure was adapted from Igbaria et al. [25] It assessed user computer experience by asking respondents to rate the extent of their experience relative to their peers along five dimensions: experience using systems of the type, using the specific system, using computers in general, being a member of a system development team, and as a member of the development team for the specific system being studied. The rating scale ranged from "1" (not at all) to "5" (to a great extent).

User/Developer Communication: The measure was originally developed by Monge, et al. and modified by Guinan to assess communication quality. [35, 16] Subsequently it was used by McKeen et al. [34] Using a scale ranging from "7" (very strong agreement), "4" (neutral feelings or don't know), to "1" (very strong disagreement with), users were asked to rate the communication process between themselves and the systems developers along 12 statements regarding whether developers had "a good command of the language," were "good listeners," and "expressed their ideas clearly."

User Training: This measure was proposed by Nelson & Cheney and has been used extensively. [36, 45, 25, 47] Respondents were asked to report the extent of training which in any way affects their use of the specific system. Five sources: college courses, vendor training, in-house training, self-study using tutorials, and self-study using manuals and printed documents. For each source, this was measured with a five-item scale ranging from "1" (not at all) to "5" (to a great extent).

User Influence: Based on the work of Robey and Farrow and Robey et al., Hartwick and Barki used a measure for user influence composed of three items: How much influence did you have in decisions made about this system during its development? To what extent were your opinions about this system actually considered by others? Overall, how much personal influence did you have on this system? [41, 42, 43, 19] For this study, end users were asked to rate the degree of conflict along each item with a scale ranging from "1" (not at all) to "5" (very much).

User Conflict: Based on the work of Robey and Farrow and Robey et al., this study adopted the measure for user/developer conflict used by Hartwick and Barki. [41, 42, 43, 19] It is composed of three items which asked: Was there much conflict concerning this system between yourself and others? To what extent were you directly involved in disagreements about this system? Was there much debate about the issues concerning this system between yourself and others? For this study, end users were asked to rate the degree of conflict along each of these items using a scale ranging from "1" (not at all) to "5" (very much).

The measures used in this study were chosen that had demonstrated reliability and validity in previous studies. The number of items used to measure each construct along with indicators of reliability and correlations among the constructs, are summarized in Table 2. As discussed in the results section, psychometric properties of all constructs were acceptable.

					Correlations					
Construct/Scale	*Number of Items*	*Cronbach's Alpha*	*Mean*	*Std. Dev.*	*1*	*2*	*3*	*4*	*5*	*6*
1. Success – System quality	*10*	*0.94*	*2.93*	*0.86*						

2.User Participation	*9*	*0.92*	*2.87*	*0.80*	*0.74***					
3.User Experience	*5*	*0.84*	*3.12*	*0.79*	*0.33***	*0.34***				
4.User-Developer Communication	*12*	*0.98*	*3.68*	*1.40*	*N.S.*	*N.S.*	*0.24***			
5. User Training	*5*	*0.83*	*2.85*	*0.80*	*0.54***	*0.48***	*N.S.*	*0.14**		
6. User Influence	*3*	*0.79*	*2.96*	*0.95*	*N.S.*	*N.S.*	*N.S.*	*0.39***	*N.S.*	
7. User Conflict	*3*	*0.72*	*2.84*	*0.79*	*N.S.*	*N.S.*	*N.S.*	*-0.38***	*-0.30***	*N.S.*

** = p<.05 ** = p<.01 or lower N.S.= Not Significant*

Table 2: Measurement Characteristics of the Constructs

Data Analysis

To test the proposed hypotheses, the relationships between the independent variables and the dependent variable have been separately assessed through the calculation of Pearson's correlation coefficients. To address the possibility that the independent variables are also interrelated, multivariate regression analysis has been undertaken to produce a model capable of explaining the largest possible variance in the dependent variable.

RESULTS

Table 2 reports Cronbach's alpha for each of the constructs in the research model. Cronbach's alpha should exceed 0.7, which it does for all scales in Table 2 indicating adequate reliability. Discriminant validity was assessed by conducting factor analysis with all the items from all the constructs. Appendix A contains the pattern matrix from this analysis. A clear pattern of factors emerged, demonstrating discriminant validity among the constructs. The results from the regression analysis of the research model is summarized in Table 3.

Independent Variables:	***Incremental R Squared***
User Participation	*.54***
User training	*.04***
User expertise	*.03***
User/developer Communication	*N.S.*
User Influence	*N.S*
User Conflict	*N.S*
Total R-Squared	***.61****

** = p<.05 ** = p<.01 or lower N.S. = Not Significant*

Table 3: Results From Multivariate Regression
Dependent Variable: System quality (n=228)

Results From Hypothesis Testing

Based on the results presented in Table 2, the following hypotheses are accepted at the .05 significance level or better**: H1: User participation is directly related to system quality, H2: User expertise is directly related to system quality,** and **H3: User-developer communication is directly related to system quality.** Hypotheses **H4: User training is directly related to system quality, H5: User influence is directly related to system quality,** and **H6: User conflict is inversely related to system**

quality cannot be accepted. Table 3 shows that user participation, user training, and user experience combined can explain 61 percent of the variance in the system quality measure.

Other Interesting Results

As one would expect, Table 2 also indicates that more experienced and/or more trained users tend to participate more in system development activities and tend to communicate better with systems developers. Further, users reporting to have more influence over the system development process tend to have better communication with system developers. Users with more training and/or reporting better communication with system developers tend to have less conflict during the system development process.

DISCUSSION AND MANAGERIAL IMPLICATIONS

The main objective of this study was to test a set of hypotheses regarding user characteristics proposed by various authors as important determinants of system success in this case defined as system quality. The importance of user participation in the system development process, user training, and user experience has been strongly corroborated. The other variables (user/developer communication, user influence, and user conflict) seem to have no significant direct relationships with system quality.

User previous experience with computer technology and with the system development process is directly related to system quality, user participation, and user/developer communication. Managers have to strike a balance between using experienced users too often and providing inexperienced users with the opportunity to participate in system development projects and to develop their computer technology knowledge and skills useful for future projects. Obviously, for the more critical projects, managers must ensure that experienced users are available to participate.

The importance of user training comes across not only as a determinant of system quality but also as a significant factor for user participation in the system development process, for improving user/developer communication, and to reduce user conflict during the system development process. Needless to say, managers must take more seriously the importance of user training to improve system quality, improve relations with the user community, and more effectively use company IT resources in the long run.

While user/developer communication seems to have no direct relationship to system quality, it is a significant factor to reduce user conflict during the system development process and to give users a feeling that they actually can influence the process of system development. On the other hand, users also will be more likely to strive for better communication with system developers if they believe they can influence the development process and get the system they want.

REFERENCES

[1] ANSI/ASQC, "Quality Systems Terminology," *Milwaukee: American Society for Quality Control*, 1978.

[2] Bailey, J.E. and Pearson, S.W., Development of a Tool For Measuring and Analyzing Computer User Satisfaction," *Management Science, 29* (5), 1983, pp. 530-545.

[3] Barki, H. and Hartwick, J., Measuring User Participation, User Involvement And User Attitude, *MIS Quarterly*, 1994a, pp. 59-79.

[4] Barki, H. and Hartwick, J., User Participation, Conflict, And Conflict Resolution: The Mediating Roles Of Influence, *Information Systems Research, 5*(4), 1994b, pp. 422-438.

[5] Brodbeck, Felix C., Communication And Performance In Software Development Projects, *European Journal of Work & Organizational Psychology, 10*(1), 2001, pp.73-94.

[6] Baroudi, J.J. and Orlikowski, W.J., A Short-Form Measure of User Information Satisfaction," *Journal of Management Information Systems, 4*(4), 1988, pp.44-59.

[7] Cavaye, A.L.M., User Participation In System Development Revisited, *Information & Management, 28,* 1995, pp. 311-323.

[8] Chief Information Officer: The Magazine for Information Executives, Special Issue on Companies Where Quality Counts, August 1991, pp.1-32.

[9] DeBrabander, D. and Thiers, G., Successful Information Systems Development In Relation To Situational Factors Which Affect Effective Communication Between MIS Users And EDP-Specialists, *Management Science*, 30(2), 1984, pp. 137-155.

[10] Dilworth, J.B., *Production and Operations Management*, 3rd Edition, Random House, New York, 1988.

[11] Doll, W.J. and Torkzadeh, G., A Discrepancy Model Of End-User Computing Involvement, *Management Science, 35*(10), 1989, pp. 1151-1171.

[12] Evans, J.R., and Lindsay, W.M., *The Management and Control of Quality*, West Publishing, St. Paul, MN, 1980.

[13] Fok, L.Y., Fok, W.M., and Hartman, S.J. "Exploring the Relationship Between Total Quality Management and Information System Development," *Information and Management: Amsterdam, 38*(6), 2001, pp. 355-371.

[14] Gatian, A.W., Is User Satisfaction a Valid Measure of System Effectiveness? *Information and Management*, 26 (3), 1994, pp. 119-131.

[15] Gallagher, C.A., Perceptions of the Value of a Management Information System, *Academy of Management Journal, 17*(1), 1974, pp. 46-55.

[16] Guinan, P.J., *Patterns of Excellence for IS Professionals: An Analysis of Communication Behaviors*, ICIT Press, Washington, DC, 1988.

[17] Guimaraes, T., Igbaria, M. and Lu, M. The Determinants of DSS Success: An Integrated Model, *Decision Sciences 23* (2), 1992, pp. 409-430.

[18] Guimaraes, T., Yoon, Y., and Clevenson, A., Exploring Some Determinants of ES Quality, *Quality Management Journal 8* (1) 2001, pp. 23-33.

[19] Hartwick, J. and Barki, H., Explaining the Role of User Participation in Information System Use, *Management Science, (4),* 1994, pp. 440-465.

[20] Hocker, J.L. and Wilmot, W.W., *Interpersonal Conflict* (2nd ed.) William C. Brown, Dubuque, IA, 1985.

[21] Humphrey, W.S., *Managing the Software Process*, Addison-Wesley, Reading, MA, 1989.

[22] Hunton, J.E. and Beeler, J.D., Effects of User Participation in Systems Development: A Longitudinal Field Experiment, *MIS Quarterly, 21*(4), 1997, pp. 359-388.

[23] Hunton, J.E. and Price, K.H., Effects of the User Participation Process and Task Meaningfulness on Key Information System Outcomes, *Management Science, 43*(6), 1997, pp. 797-812.

[24] Hwang, M.I. and Thorn, R.G., The Effect of User Engagement on System Success: A Meta-Analytical Integration of Research Findings, *Information & Management, 35*(4), 1999, pp. 229-236.

[25] Igbaria, M., Guimaraes, T., & Davis, G., Testing the Determinants of Microcomputer Usage Via a Structural Equation Model, *Journal of Management Information Systems, 11* (4), 1995, pp. 87-114.

[26] Ives, B. and Olson, M., User Involvement and MIS Success: A Review of Research, *Management Science, 30*(5), 1984, pp. 586-603.

[27] Ives, B., Olson, M.H., and Baroudi, J.J., The Measurement of User Information Satisfaction, *Communications of the ACM, 26* (10), 1983, pp. 785-793.

[28] Jenkins, J.M. and Rickets, J.A., *"The Development of an MIS Satisfaction Questionnaire: An Instrument for Evaluating User Satisfaction with Turnkey Decision Support Systems,"* Working Paper #295, Indiana University, Bloomington, IN, 1986.

[29] Jones, C., *Programming Productivity*, McGraw-Hill, New York, 1986.

[30] Kaiser, K.M. and Bostrom, R.P., Personality Characteristics of MIS Project Teams: An Empirical Study and Action-Research Design, *MIS Quarterly, 6* (4), 1982, pp. 43-60.

[31] Larcker, D.F. and Lessig, V.P., Perceived Usefulness of Information: A Psychometric Examination, *Decision Sciences, 11*(1), 1980, pp. 121-134.

[32] Lin, W.T. and Shao, B.B.M., The Relationship Between User Participation and System Success: A Simultaneous Contingency Approach, *Information & Management, 37*(6), 2000, pp. 283-295.

[33] Mahmood, M.A, Burn, J.M., Gemoets, L.A., and Jacquez, C., Variables Affecting Information Technology End-User Satisfaction: A Meta-Analysis of The Empirical Literature, *International Journal of Human-Computer Studies, 52*(4), 2000, pp. 751-771.

[34] McKeen, J.D., Guimaraes, T. and Wetherbe, J.C., The Relationship Between User Participation and User Satisfaction: An Investigation of Four Contingency Factors, *MIS Quarterly, 18*(4), 1994, pp. 427-451.

[35] Monge, T. R., Buckman, S.G., Dillard, J.P., & Eisenberg, E.M., Communicator Competence in the Workplace: Model Testing and Scale Developments, *Communication Yearbook No. 5*, 1983, pp. 505-527.

[36] Nelson, R., and Cheney, P., Training End-Users: An Exploratory Study, *MIS Quarterly 11*(4), 1987, pp. 547-559.

[37] Pearson, J.M. McCahon, C.S., Hightower, R.T. Total Quality Management: Are Information Systems Managers Ready?, *Information and Management, 29* (5), 1995, pp. 251-263.

[38] Pettingell, K., Marshall, T, and Remington, W., A Review of The Influence of User Involvement on System Success, *ICIS Proceedings*, Boston MA, 227-236, 1989.

[39] Putnam, L.L. and Wilson, C., Communicative Strategies in Organizational Conflict: Reliability and Validity of a Measurement Scale, *Communication Yearbook 6,* 1982, Sage Publications, Newbury Park, CA, pp. 629-652.

[40] Robey, D. Modeling Interpersonal Processes During Systems Development: Further Thoughts and Suggestions, *Information Systems Research, 5* (4), 1994, pp. 439-445.

[41] Robey, D. and Farrow, D., User Involvement in Information System Development: A Conflict Model and Empirical Test, *Management Science, 26* (1), 1982, pp. 73-85.

[42] Robey, D., Farrow, D. and Franz, C.R., Group Process and Conflict in System Development, *Management Science, 35* (10), 1989, pp. 1172-1189.

[43] Robey, D., Franz, C. R., Smith, L. A., and Vijayasarathy, L.R., Perception of Conflict and Success in Information System Development Projects, *Journal of Management Information Systems,10* (1), 1993, pp. 123-139.

[44] Saleem, N., An Empirical Test Of The Contingency Approach To User Participation In Information Systems Development, *Journal of Management Information Systems, 13*(1), 1996, pp. 145-166.

[45] Santhanam, R., Guimaraes, T., & George, J., An Empirical Investigation of ODSS Impact on Individuals and Organizations, *Decision Support Systems, (30),* 2000, pp. 1-72.

[46] Smith, H.A. and McKeen, J.D., Computerization and Management: A Study of Conflict and Change, *Information & Management, (22),* 1992, pp. 53-64.

[47] Yoon, Y., Guimaraes, T., & O'Neal, Q., Exploring the Factors Associated with Expert Systems Success. *MIS Quarterly, 19* (1), 1995, pp. 83-106.

Appendix A

Pattern Matrix of the Items Used to Measure all the Constructs

	Factors							
	System Quality	*User-Developer Communication*	*User Experience*	*User Participation*	*User Influence*	*User Conflict*	*User Training*	*8*
V52 User-Dev comm1		***.900***						
V53 User-Dev comm2		***.859***						
V54 User-Dev comm3		***.894***					*-.104*	
V55 User-Dev comm4		***.882***					*.116*	
V56 User-Dev comm5		***.921***					*-.100*	
V57 User-Dev comm6		***.907***						
V58 User-Dev comm7		***.887***						
V59 User-Dev comm8		***.872***						
V60 User-Dev comm9		***.889***						
V61 User-Dev comm10		***.875***						
V62 User-Dev comm11		***.909***						*.114*
V63 User-Dev comm12		***.890***						
V105 User experience1			***.838***					
V106 User experience2	*.124*		***.766***		*.125*			
V107 User experience3			***.630***					*-.404*
V108 User experience4			***.673***	*.296*				*.270*
V109 User experience5	*.144*		***.752***					
V43 User Participation1	*.193*		*.141*	***.588***			*.128*	*-.175*
V44 User Participation2				***.794***				
V45 User Participation3	*.197*			***.561***				*-.151*
V46 User Participation4				***.780***				
V47 User Participation5	*.308*			***.521***				*.154*
V48 User Participation6				***.591***		*.134*		*-.396*
V49 User Participation7	*.111*			***.680***				*.147*
V50 User Participation8			*.166*	***.565***		*.151*	*.229*	*-.201*
V51 User Participation9				***.798***				
V70 User training1	*.324*		*-.113*			*.106*	***.688***	
V71 User training2				*.266*			***.679***	*.169*
V72 User training3	*.131*		*-.106*			*-.186*	***.531***	*-.275*
V73 User training4			*-.230*	*.398*		*-.184*	***.410***	*.235*
V74 User training5							***.754***	
V64 User influence1					***.850***			
V65 User influence2		*.102*			***.757***			
V66 User influence3					***.850***			

V67 Conflict1		.105		**.864**	.112	
V68 Conflict2		-.152	.280	**.337**	-.473	
V69 Conflict3				**.861**	-.118	
V95 User satisfaction1	**.832**					
V96 User satisfaction2	**.672**		.143	-.104		-.114
V97 User satisfaction3	**.688**					-.244
V98 User satisfaction4	**.491**		.311	-.161		-.180
V99 User satisfaction5	**.736**			.129	.140	
V100 User satisfaction6	**.766**					
V101 User satisfaction7	**.543**		.238			-.290
V102 User satisfaction8	**.791**	.126				.326
V103 User satisfaction9	**.598**		.195			-.327
V104 User satisfaction10	**.861**					.192

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.
a Rotation converged in 17 iterations.