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Expanding our View of Information Systems Success

Barbara Ann Sherman
State University of New York at Buffalo, Computer Science Department,Buffalo, NY 14260
Voice: 716-878-4912; Fax: 716-878-6677, Email: shermaba@buffalostate.edu

G. Lawrence Sanders
State University of New York at Buffalo, 310A Jacobs Management Center,Buffalo, NY 14260
Voice: 716-645-2373; Fax: 716-645-6117, Email: mgtsand@acsu.buffalo.edu

Edward J. Garrity[†]
Richard J. Wehle School of Business, Canisius College, 2001 Main Street, Buffalo, NY 14208
Voice: 716-888-2267; Fax: 716-888-2525, Email: garrity@canisius.edu

INTRODUCTION

The deployment of technology has had a profound impact on the quality of work life of individuals in organizations. Consider for example, that computer-based applications are expected to empower workers in both a functional and democratic sense. In other words, systems are intended to aid workers in the completion of tasks, as support devices to complete organizational transactions (functional empowerment) and as devices which both support and give rise to new forms of organizational communication, interaction and subsequently, new forms of organizational structure (democratic empowerment). The specific technical and social contexts in which computer systems are deployed significantly influence the characteristics of the systems and their implications for the workers. In particular, the tradition of socio-technical research in information systems considers these issues important.

A central question in systems development is, "When does theoretical knowledge become practical knowledge" (Klein & Hirschheim, 1996). The principal objective of the socio-technical design ideal is to optimize the interrelationships between the social and human aspects of the organization and technology used to achieve organizational goals. Quality of work life represents the satisfaction of human needs at work. A high degree of fit between job (task) characteristics and a limited set of human needs (including both social and health profiles) can improve both the quality of work life as well as the profitability and system efficiency. Klein (1981) and Klein & Hirshheim (1996) identify a list of ten criteria for social and ethical acceptability of new information system technology. Two of these design ideals for information systems (numbers 6 and 9 from the original table) are directly relevant to the justification of this research:

· "Its production and use should present no undue health hazards or risk."

· "It should permit those elements of work which are recognized as being related to high job satisfaction to be improved (for example development of new skills, task variety, challenging tasks, and the like)."

A substantial body of research has identified a range of potentially deleterious effects from computerization, including, but not limited to stress, health and safety, social isolation and alienation, occupational immobility and pay inequity. What happens to office workers who experience computerization is of considerable importance, not only to themselves, but also to their organizations, the clientele they serve and society as a whole. This implies a complex set of responsibilities and challenges for systems analysts and integrators who implement and deploy information systems (Clement, 1994).

Another extensive body of research has looked at the measurement of information systems success. In 1992, DeLone & McLean proposed a model of Information Systems Success (ISS) based on a review of the existing IS success and satisfaction literature. They consolidated the various success variables previously used into six success factors: System Quality, Information Quality, Use, User Satisfaction, Individual Impact and Organizational Impact. User satisfaction (also referred to as user information satisfaction) is probably the most widely used measure of IS success because: (1) it has a high degree of face validity; (2) a stream of research starting with Bailey & Pearson (1983) has provided a tradition of studies using reliable and comparable tools for measurement; and (3) most of the other measures are so poor by comparison (DeLone & McLean, 1992). This very important contribution to the success literature has stimulated research (c.f. Seddon & Kiew 1994; Hwang & Windsor 1994; Seddon 1997).

It is interesting, and relevant to this discussion, to note that the traditional IS success research stream has had little intersection with the socio-technical research stream. Existing IS satisfaction models and corresponding measurement instruments largely ignore the quality of work life dimension. A theoretical framework and a potential set of dimensions that addressed this gap between the two traditions was proposed by Garrity & Sanders (1998a). That model (see Figure 1) includes the following four dimensions to retrospectively structure prior empirical research: task support satisfaction, decision-making satisfaction, interface satisfaction and quality of work life satisfaction. A distinctive part of their model is the inclusion of the socio-technical aspect of systems success in the form of the quality of work life construct.

To pilot test the validity of the model presented in Figure 1 and to see how extant information systems success metrics mapped into it, a content analysis study was conducted using a modified Delphi technique (Garrity & Sanders, 1998a). Six instruments that are considered well developed and frequently used in existing in-

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formation systems success research were selected for in-depth analysis to ascertain the coverage of existing measurement items for the four proposed dimensions. A panel of experts from the information systems success research stream participated in the study. Each expert was asked to categorize questions from the six information system success instruments into four categories from the Garrity and Sanders model. The results of the study showed that a variety of items from research exist to measure task support satisfaction, decision-making satisfaction and interface satisfaction, but only one item from all six instruments was identified as relevant to the measurement of quality of work life satisfaction.

The contribution of this paper is to bridge the socio-technical and information systems success research streams. In particular, we consider the theoretical underpinnings and relationship of technology's impact on quality of work life (TQWL) issues to the task support satisfaction experienced by users. The quality of work life dimension is an attempt to assess how well an information system supports the basic social and maintenance needs of workers. We look at two facets of quality of work life: task control and empowerment, and health concerns.

The next section discusses quality of work life and systems development approaches. That section will be followed by the development of the research model used in this paper. We then present the research results and model test using structural equation modeling. Finally, we present our summary and conclusions.

QUALITY OF WORK LIFE AND IS DEVELOPMENT APPROACHES

The human-centric school of systems development is closely aligned with approaches such as participative design. In participative design, a much greater amount of participation is achieved by workers who actively engage in designing the computer systems that they will use (Carmel, Whitaker, and George 1993). Using Mumford's (1981) classification of user involvement, participative design projects are focused on consensus design whereby all of the effected users form a consensus or compromise through being actively and continually engaged throughout the design process. This is important from a participative design perspective because proponents of the approach believe that workers are the ones best qualified to determine how to improve their work and their work life (Czyzewski, et al. 1990). Proponents of participative design believe that it is through democratic empowerment that workers have the freedom to influence their work environment and their lives and that systems developers have the obligation and professional responsibility to deliver systems that improve the quality of work life (Greenbaum 1993). In essence, participative design is a philosophy of development that establishes quality of work life as a foundational issue in delivering successful systems. In part, the genesis of this view of information systems success can be traced to Scandinavia and Europe and was the result of research and development projects that attempted to give workers control over their workworlds and lifeworlds through workplace democracy (c.f. the work on UTOPIA reported in Bjerknes, Ehn, and Kyng (1991)).

RESEARCH MODEL

Figure 2 presents the model that will be examined in this study. The foundational underpinnings for the model are derived from the Leavitt diamond. The Leavitt diamond is a particularly robust and enduring schema for representing the critical interdependencies between task, structure, technology, and people. The research model also draws on the descriptive model of information systems success developed by DeLone and McLean (1992) and the dimensions of information systems success identified by Garrity and Sanders (1998b). The model is also influenced by the theoretical research on the topic (c.f. Hwang and Windsor 1996; Hwang Windsor and Pryor 2000, Seddon and Kiew 1994, Seddon 1997) and the numerous empirical scales for measuring the various components of systems success (c.f. Davis 1989; Goodhue and Thompson 1995; Seddon and Kiew 1994; among others). The model also draws on the empirical work on total quality of work life (c.f. Bowditch and Buono 1982; Rice, McFarlin, Hunt & Near 1985; Clement 1994) and the socio-technical and related schools of systems development (c.f. Hedberg and Mumford 1975; Bostrum and Heinen 1977; Hirschheim 1986; Hirschheim, Klein, and Lyytinen 1995; Kling 1999).

The essence of the research question is related to the important role of quality of work life issues and how technology related impact on quality of work life (TQWL) relates to the way the system supports the user in the completion of his or her tasks. At the firm level, Brynjolfsson and Hitt (1998) found that organizational practices such as the use of self-directed work teams, greater levels of decision making authority, particularly over method and pace of work, etc., when coupled with technology investments resulted in higher firm performance than firms that did not use these practices. Based on their results, one may hypothesize that higher levels of TQWL (which includes items such as "greater control over my work" and "makes my tasks easier to schedule," etc.) would be associated with higher task satisfaction. Presumably, higher levels of task satisfaction and higher levels of information systems success will lead to better firm performance, as indicated in Delone and McLean's model of IS success and Garrity and Sander's model of IS success (Figure 1). The constructs used in examining this model are presented in the following sections.

TASK SUPPORT SATISFACTION

Task support satisfaction measures the user's satisfaction with the amount and type of support provided by the IS to help the user in the performance of work tasks. The construct is designed to measure a user's way of working and the ability of the user to easily and smoothly derive information from a system while problem solving. A number of factors, including: the information provided that is relevant to the task at hand, the design of the system to provide explicit support to the multitude of specific tasks involved in accomplishing work, and the overall fit between the technology and the user, are used to measure how well the IS provides task and job support. Goodhue (1986, 1990, 1995, 1998) and Goodhue & Thompson (1995) have evolved a model and theory around the Task-Technology Fit (TTF) and Task Performance Chain (TPC) paradigm. Davis (1989) and Davis, Bagozzi & Warshaw (1989) have evolved another relevant model and theory known as the Technology Acceptance Model.

TECHNOLOGY IMPACT ON QUALITY OF WORK LIFE SATISFACTION

This construct measures two aspects related to the perceived impact that technology has on the individual's quality of work life (TQWL). The first aspect is related to Task Control and Empowerment of the user in completing her job related tasks. The second aspect, Health Concerns, is related to the degree to which the system environment supports the health and safety concerns of the user. It is our contention that Health Concerns has the potential to impact individuals at all levels of the organization, not just the clerical and secretarial ranks.

The quality of work life construct is related to the socio-technical perspective. Systems designers who are aware of this perspective will ensure that their implementation efforts include a consideration of individuals and the actual work they perform, as well as managing the implementation process. Key themes that permeate quality of work life discussion related to computerization include work flexibility and efficiency, who controls, schedules, and organizes work, how work is divided by gender and by who reaps the benefits of technological and organizational change (Kling 1996).

A focus only on the task and information processing perspective may ignore the quality of work life of the individual, which can have important implications for the organization. There are very few examples of operational measures for technology impact on quality of work life satisfaction for information systems. In analyzing the various instruments for measuring information systems satisfaction, Garrity and Sanders found only one item related to quality of work life and it was in the Bailey & Pearson instrument that was published in 1983.

RESEARCH STUDY

The analysis was completed in two major phases consisting of construct development and structural equation modeling. The structural equation modeling first considered the measurement model for the constructs. We then tested the structural model using a holdout sample.

A pre-test of the instrument was performed to purify the questionnaire items by soliciting feedback from experts as well as individuals representative of the potential subject pools. In the pre-test, a relatively small sample was used to capture respondent feedback immediately regarding the clarity, understandability and appropriateness of the questions. A pilot test was conducted on the resultant items, using a sample size of 142, to test the items under circumstances similar to those anticipated for its ultimate use in data collection.

THE FIELD SETTING SAMPLE

Seven organizations agreed to participate in a larger study conducted by the authors. The organizations included: a government agency, a research institute, a manufacturing firm, an environmental firm, a health care provider, a bank, and a university development / alumni relations office.

STRUCTURAL EQUATION MODELING

The model in Figure 2 was tested in two phases. The 556 usable observations were randomly assigned to one of two groups, corresponding to the two phases of analysis. The measurement properties of the latent variables and the questionnaire items were examined using a sample of 265 observations. The structural properties of the model were examined using a holdout sample consisting of 291 observations.

THE MEASUREMENT MODEL

The measurement properties of the latent variables and the survey items were analyzed using maximum likelihood estimation using 265 observations. The diagnostic and adaptive approach outlined by Hayduk and Glasser (2000) was used to select items for the measurement model. As illustrated in Figure 3, the factor loadings for the items comprising the latent variables are all above .75, except for the item related to "receiving sufficient breaks." This item had a factor loading of .4, which is still above the minimal acceptable value of .30 (Hair, Anderson, Tatham & Black,1995).

The chi-square statistic obtained for the measurement model was 35.11 with 24 degrees of freedom and a probability value of .07. The comparative fit index is 1.00 (recommended CFI ˜.95). The root mean square error of approximation = 0.04 (recommended RMSEA ˜0.06). We therefore accept the proposition that the research model in Figure 2 is a viable representation of the relationships.

THE STRUCTURAL MODEL

The structural model was examined using the 291 observations from the holdout sample. The chi-square statistic obtained for the structural model (see Figure 4) was 33.47 with 24 degrees of freedom and a probability value of .09. The chi-square value is used to test the null hypothesis that the model is plausible in the population. The null hypothesis should not be rejected in this case because of the probability level of the chi-square statistic is greater than .05. We should therefore accept the proposition that the research model presented in Figure 4 is a viable representation of the relationships.

The results for the goodness-of-fit indices for the structural model are similar to the results for the measurement model. The comparative fit index is 1.00 (recommended CFI ˜.95). The root mean square error of approximation = 0.04 (recommended RMSEA ˜0.06).

The squared multiple correlation coefficient, which is similar to the coefficient of determination value or R^2 in regression analysis, is quite good for Task Support Satisfaction (.83).

The path coefficients in Figure 4 are standardized partial regression coefficients. In Figure 4, the .90 path from Control and Empowerment to Task Support Satisfaction means that other things being equal, individuals from this particular population who are one standard deviation above the mean for Control and Empowerment will be .90 standard deviations above the mean for Task Support Satisfaction. Put another way, higher levels of system related Control and Empowerment are related to higher levels of Task Support Satisfaction.

Health Concerns have a very modest affect on Task Support Satisfaction, as a one-unit increase in the standard deviation of Health Concerns is associated with a .03 increase in Task Support Satisfaction.

An immediate implication of the model is that attending to Quality of Worklife related issues up-front can affect and improve downstream satisfaction. The system should be designed from the outset to support the user in controlling how a job is completed and providing a work setting that supports the health and physiological needs of the users.

The overall model fit indices, the squared multiple correlation coefficients for the constructs in the model and the path coefficients that are in the right direction lend support to the viability of the research model presented in Figure 2.

SUMMARY AND CONCLUSIONS

This study proposed a theoretical model of information systems success adapted from previous theoretical and empirical research studies. The two sub-dimensions of Quality of Worklife satisfaction—Control and Empowerment and Health Concerns—were hypothesized to be critical and central to supporting users in the performance of their tasks. This study did find support for this relationship, particularly from Control and Empowerment to Task Support Satisfaction. This is a significant finding since systems development approaches are often designed to produce results that align with one's view of information systems success. The European and Scandinavian approaches to development, often termed participative development, have been concerned with providing a development environment that promotes concerns for the workers' quality of work life through democratic empowerment and consensus design. Traditional approaches to information systems development could well be improved through techniques and processes that incorporate concern for the workers' quality of work life.

The implications of this research are that systems developers should begin the design process by focusing on how the new work system will facilitate task control by users. This is much different than the traditional approach to development that treats the individual as a system component much like another cybernetic machine. Although this study found that health and environmental concerns have little impact on task support satisfaction, common sense dictates that the workspace should be comfortable and ergonomically sound and breaks should be a part of the work routine. The development and inclusion of a Quality of Work life construct is an important addition to the collection of IS Success constructs which are so vital to the continued development of the field of MIS.

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