SOCIAL DETERMINANTS OF INFORMATION SYSTEMS USE: A NETWORK-ANAYLTIC APPROACH

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Abstract

The social group of which an individual is a part will affect how that individual uses information systems (IS). The social group will affect how an information system is interpreted and used. The social group will also place pressures and demands on IS usage. A field study of this idea was conducted. The concept of structural equivalence, operationalized by blockmodeling, was used to measure the effect of the social group on individual information systems usage. The results of the field study show that structural equivalence is related to IS usage, but this relationship is different for different information systems. These results are believed to have implications for many important areas of IS research such as the strategic use of IS, user involvement in the IS design process, and research on the impacts of IS.

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I. Introduction

The use of an information system will be determined by many factors, such as the usability and usefulness of the system, the tasks facing the user, the training and background of the user, and the social group of which the user is a part. Too often, many of these factors have been ignored, and the resulting research suffers. Only by understanding all these factors can we understand how and when information systems (IS) are used. The factors affecting IS use are important to consider when designing IS, applying IS for competitive advantage, or predicting the impacts of IS. Impacts research especially has suffered from ignoring these factors.

The goal of this paper is to explore one specific determinant of an individual's decision to use a system: the social group surrounding the individual. It is argued that the social group can exert strong influences on the way in which an individual uses a system. The social group will idiosyncratically affect how and when the individual uses an IS. Thus, similar organizations (and even similar groups in the same organization) could use the same information system very differently.

Thus it is understandable that much research on the impact of information systems on organizations has had mixed and even contradictory results (25, 27). Poor research methods, different operationalizations of the same variables, different levels of analysis, and inadequate theory are all partly responsible for the variance in results (24,36,38). It is argued that the lack of convergence in the results is also due to the fundamental assumptions behind some impacts research: that IS can cause any impact to occur. Rather, it is believed that the social system, along with the features of an IS, affect how and where that IS will be used. This idea is tested using the concept of structural equivalence, and the results of a field study are reported. First, a short review of the IS impacts literature is presented.

II. A Review of Selected Impacts Research

In this section, the research on three different types of IS impacts will be reviewed: quality of working life (QWL), centralization/decentralization, and height of the hierarchy. The purpose of this section is not to survey the research on the impacts of information systems on the individuals and organizations that use them; there have been many good reviews in this area (3, 17, 25). Rather, three representative types of impacts are selected to show the mixed results that are common in impacts research.

The research in the quality of working life category focuses on the impacts of IS on job content and job satisfaction. Some research has found that IS can cause a decrease in the QWL of clerical jobs by increasing job stress, lowering job content, or deskilling jobs (22, 31, 39, 41). Yet many case studies show that IS can enlarge jobs, increase influence, and generally improve QWL (16, 21, 28). Some studies show both an increase and decrease in QWL (3, 7).

A similar pattern of results occurred in research on the impacts of IS on the relative centralization or decentralization of decision making and authority. While early research postulated that information systems would increase the ability of management to monitor subordinates, thus centralizing authority (31, 42), subsequent research has found no such simple relationship (15, 32, 33).

The final area of research to be reviewed is research on the impacts of IS on the height of the organizational hierarchy. The height of the hierarchy is the number of levels of reporting relationships. This area of research was started in 1958 by Leavitt and Whisler (26), who argued that IS would flatten organizations by automating many functions traditionally performed by middle management. While some subsequent research in this area has found that information systems do tend to flatten the hierarchy (14, 29, 42), other studies found that information systems actually increased the number of levels of management (8, 9, 32).

This lack of consistent results in these three as well as other areas of impacts research is due to many factors. Poor methods and measures cause much noise in results. Comparing different types of information technology also introduces error. Inadequately conceptualized concepts and theory can cause results to vary as well.

Yet the lack of results in impacts research is due to more than these problems; it is due in part to the assumption implicit in some impacts research: that computers <u>cause</u> an impact to occur. Kling (25), after reviewing the literature, states, "the first thing we learn is that computers by themselves 'do' nothing to anybody (pg. 100)." Impacts are mixed because organizational contexts are mixed, and it is the interaction of the organizations and the information system that ultimately determines the impact of that system. Attewell and Rule (4) state:

> we suspect that the transformations in organizational life through computing are so multifarious as to encompass the most disparate cause-effect relations in different contexts.... [O]ne might expect quite different effects to ensue from what appear to be the "same" causes in similar or even identical organizations (pg. 1190).

Thus, mixed impacts can in a sense be viewed as a replicated finding: the same type of system can have different impacts in different organizations. Individuals in different social groups will have different influences on their usage, and will thus use information systems differently.

III. Social Determinants of Information Systems Usage

If the usage of an IS is determined in part by the social group surrounding the individual using the IS, then we must define and measure how this social effect occurs. There are two ways the social group can have an effect: (1) by affecting how the individual interprets the system and (2) by the social pressures and demands from the group on the individual using the system. Initially, the social group will affect the manner in which an IS is used by affecting the way the individual *interprets* the system (i.e. how he or she decides when and how to use the system) (6). The social group, when faced with a new technology, will experiment with it and form ideas about which tasks it should or shouldn't be used to solve. Different people will have different (sometimes radically different) views of the technology and its capabilities. Over time, these interpretations of the technology will be tested and refined, and may converge within the social group. As this interpretation process occurs, the tasks performed by the group may change as well. It is believed that the usage of a new IS (and the ultimate impact of that system) is not determined solely by the features of the IS nor the opinions of those in the social group using the system. Rather these two factors interact to determine the proper role of the IS in the social group.

The general idea that social groups influence the perceptions of the individuals within is not a new finding. Social psychologists have known for years that the social system can change an individual's perception of unchanging physical objects (2). That computers can be perceived differently by different people is not a new conclusion either. Turkle (37) argued that computers are highly abstract objects that can be interpreted in many ways.

The other social determinant of computing usage comes from individual role pressures and demands. These can arise from requests to use a particular system from others working on interdependent tasks, or required IS usage by supervisors. Also, if an individual's rivals in the firm are using a new system, then the system may be used out of fear, envy, or curiosity.

In order to test the proposition that the usage of an IS is in part determined by the social group of which the IS user is a part, we must first quantify the influence of the social group on the individual. The concept of structural equivalence will be used in this paper to dimensionalize the social system so that its influence can be measured. Structural equivalence and its meaning will be discussed next. Following that, the concept will be linked to IS usage.

Structural Equivalence

Structural equivalence (1, 11, 34, 43) is a measure of similarity in interaction patterns. If two people work with the same others, go to the same others for technical and administrative help, and report to the same person, then the two are *structurally equivalent* (with respect to those relationships). Two or more structurally equivalent individuals can be said to occupy the same *structural position*.

Structural equivalence analysis aggregates "who to whom" data to distill overall interaction patterns. The interaction between any two structural positions A and B is thus a good estimate of the interaction between any individual in position A and any in position B. The social structure revealed reflects the informal structure of the organization-- the actual pattern of interactions between organizational members.

As such, structural equivalence captures a social network characteristic different than that captured by formal title. A formal title imperfectly defines the responsibilities, knowledge, and behaviors of the individuals holding that title. A structural position (with respect to task interactions) will separate those individuals who have similar interaction patterns, which may better reflect actual individual characteristics. For example, if persons A and B both have the title "Database Consultant," while person C has the title "Manager," but all requests for help on database issues go to persons B and C, then B and C will be structurally equivalent. Thus, structural positions will be expected to be different from titles. This leads to the first hypothesis:

H1: *Structural equivalence will capture an effect different from that captured by title.*

Structural equivalence has been linked to many important concepts in the literature (19, 30), two of which will be reviewed here. Following that, a third possible interpretation of structural equivalence will be discussed. Walker (40) examined the network of interactions across five types of task relations in an organization and found that structurally equivalent individuals perceived product goals in similar ways. Structural position was linked to cognition and was found to be "a stronger and more stable predictor of differences in cognition than either the type of function an individual had or the type of product worked on (pg. 103)."

A second concept that structural equivalence can be linked to is that of role. Boorman and White (11) argued that structural equivalence is a valid measure of social role. Individuals with similar interaction patterns will have similar social pressures and demands placed on them. Burt (13) supported this idea in his reanalysis of the data from the Coleman gammanym study. Burt found that a doctor's time to adoption was best predicted by the time to adoption of other structurally equivalent doctors. Burt argued that, while a doctor may have frequent interaction with those in other structural positions using a new drug, it is only when others in his structural position start using the drug that emotions such as fear, envy, and worries about loss of status begin to have an effect. Thus structurally equivalent individuals behave similarly because the social influences and demands on them are similar.

Structural equivalence (with respect to task interactions) could also be thought of as reflecting individual competence. It can be argued that structurally equivalent individuals receive and send the same task-related interactions because they have the same competencies: they perform the same types of tasks or possess the same types of task-related knowledge.

Structural Equivalence and IS Use

Structural equivalence (with respect to task relationships) can be expected to be associated with the usage of new information systems for each of the three reasons stated above. First, just as structurally equivalent people perceive product goals similarly, structurally equivalent people would be expected to interpret an IS similarly. Structurally equivalent people (with respect to task relationships) receive the same types of task-related information. Since the application of information systems to tasks (and the definition of tasks in terms of information systems) can vary around an organization, different structural positions could receive different interpretations of new information systems. Thus:

H2: *Individuals in different structural positions will interpret and use information systems in different ways.*

A second reason why structural equivalence would predict usage of a new information system is that structurally equivalent people would receive the same pressures and demands on behavior. If people structurally equivalent to an individual begin to use a new system, then that individual may begin to use the system out of fear of loss of status, curiosity, or envy. Furthermore, structurally equivalent people may work with or report to the same people, thus increasing the likelihood that the individuals are requested or required to use a given IS.

H3: *Individuals in different structural positions will have different social pressures and demands, and thus will use information systems in different ways.*

It is important to distinguish between hypotheses H2 and H3, both conceptually and empirically. Conceptually, the difference is related to whether usage is internally or externally motivated. Hypothesis H2 argues that structurally equivalent individuals internalize similar interpretations and thus use information systems similarly. Hypothesis H3 argues that usage results from factors external to the user: requests or requirements for use, or use triggered by fear of loss of status, curiosity, or envy.

Empirically, hypotheses H2 and H3 can be separated by also considering training. If structural equivalence is related to usage only through its relationship to social demands and pressures, then the inclusion of the amount of training received would not change the size of that relationship. If, however, structural equivalence is related to IS usage through its relationship to the interpretation of the IS, then the amount of training received should affect this relationship. Training is the primary way that interpretations are communicated. There is little formal training in the organization, thus the training received will be informally conducted by those around the individual. Training will thus explain much of the variance in IS usage associated with structural equivalence's relationship to interpretation. When the variance in usage explained by training is removed, the residual variance will be more strongly related to social demands and pressures.

A third reason why structural position could predict IS usage relates to competence and task assignment. Structurally equivalent people (with respect to task relationships) may have similar competencies. People with similar competencies would tend to perform similar tasks and would thus use information technology in similar ways. A given information system can be used to solve many tasks, but is good at solving relatively fewer. For example, while a spreadsheet can be used as a word processor, few would decide that it should be used in that fashion. Thus two different individuals, when faced with two similar tasks and given the same limited set of information systems with which to solve those tasks, will tend to choose the same technology. The range of choices available will depend on the task at hand- some tasks may have many good information systems available, others may have few or none. Thus if structural equivalence through its relationship to competence predicts task assignment, then it could be expected that it will predict some types of usage as well. This leads to the final two hypotheses to be tested:

H4: *Different structurally equivalent groups will have different task assignments.*

H5: *People with similar task assignments will use IS in similar ways.*

IV. Methodology

The hypotheses were tested in one office of a management consulting firm. 93 people were surveyed in January of 1986. 70 usable replies were received for a response rate of 75.3%

Measuring Information Systems

Measuring the usage of the available information systems was done by first identifying (through interviews with five members of the organization in various positions in the organization) the important systems. The IS most widely used by the organizations were all personal computer-based software programs. The five programs, followed by an acronym, the uses of each, and the date the organization started using each program are presented in Table 1.

Table 1
The Information systems

Technology	Acronym	Uses Identified	Initiation Date
System Designer's Workbench	SDW	Computer-Assisted Software Engineering (CASE) tool	Summer 1985
Project Manager's Workbench	PMW	Forecasting project-related resource requirements and expenses; project tracking	Summer 1984
Mac Paint	MAC	Presentation graphics; data flow diagrams	Early 1984
Lotus 123	123	Project management (same as PMW); project-related financial analysis	Early 1983
Word Processing	WP	Word processing (no graphics)	Before 1981

For each type of technology, the respondents were asked to rate their frequency of usage on a six point scale with 0 corresponding to no usage or experience and 5 corresponding to a great deal (more than 16 hours per week). Training was rated from 0 (no training) to 4 (one to two weeks of training). The correlation matrix for all the usage variables is shown in Table 2.

Table 2

	SDW Tng.	SDW Use	MAC Tng.	MAC Use	PMW Tng.	PMW Use	123 Tng.	123 Use	WP Tng.
SDW Use	.646**								
MAC Tng.	.069	.091							
MAC Use	.441**	.510**	.566**						
PMW Tng.	.161	.102	.202*	.068					
PMW Use	.133	.159	.080	.143	.264*				
123 Tng.	.003	-.183	.096	.078	.134	-.029			
123 Use	-.084	-.047	-.022	-.031	-.173	-.099	.376**		
WP Tng.	-.084	-.098	.262*	.059	.248*	-.092	.279**	.164	
WP Use	-.133	-.030	.024	-.008	-.032	.321**	.149	.274*	.350**

* significant at the $p<.05$ level
** significant at the $p<.01$ level

Measuring Structural Equivalence

Blockmodeling (11, 43) was used to define the structurally equivalent groups in the organization. Blockmodeling consists of two specific routines, implemented in APL (available from the author). Both routines used the matrix of organizational members' task-related interactions (described below). The first routine, CONCOR (12), is a hierarchical splitting algorithm which takes as input the stacked array of network interactions. (For this study, data was obtained from 70 people about 12 interactions. The input to CONCOR was thus an 840x70 matrix.) CONCOR correlates the columns of the matrix, then iteratively correlates the columns of the resulting correlation matrix until all entries are approximately ± 1. The data set is then split and the analysis performed on either or both of the two groups. CONCOR is applied until the size of all groups is seven members or less.

The second algorithm, CALCOPT, refines the CONCOR partition by successively moving members from one group to another until no improvement in blockmodel fit can be obtained. The version of CALCOPT used in this study was originally developed by Boorman, and enhanced by Walker (see [40]) The function used to evaluate the goodness of fit of the blockmodel partition is described in (10).

The interactions used in the blockmodel were obtained through a series of structured interviews in which respondents were asked to name the types of interactions which were crucial in completing their jobs. In addition, the total amount of communication across all types of interactions was measured. In the final questionnaire, the most important interactions were measured by two questions (one each concerning the sending and receiving of these types of communication). The major task-related interactions (in the order in which they appeared on the questionnaire) are:

- Receive feedback on job performance
- Receive help on problems related to a specific technology (i.e. database systems, telecommunications, etc.)
- Receive help on problems related to a specific industry (for example, problems that are unique to the oil or the banking industry).
- Receive information about the coordination of projects.
- Trade information information about the how projects are progressing (with respect to deadlines, specifications or budget).
- Trade information about the political situation at the client site.
- Give feedback on job performance.
- Provide help on problems related to a specific technology.
- Provide help on problems related to a specific industry.

- Give information about the coordination of projects.
- Total communication.

In addition, the respondents were asked to identify those individuals who controlled resources critical to the success of their project(s).

All the individuals in the office were listed in the questionnaire. Holland and Leinhardt (23) recommend this to reduce the measurement error inherent in the questionnaire. The responses were coded as binary data, with a "1" indicating the presence of a tie. The total communication question was coded so that a "1" indicated that the individuals communicated once per week or more.

The result of the blockmodel analysis of the survey data was a blockmodel with fourteen structural positions. These positions were used as the categories for the ANOVA tests of Hypotheses H2 and H3.

Measuring Task

Task assignment was collected using measures defined and used by the consulting firm. The firm categorizes the projects it undertakes so that individuals with different competencies can be assigned to the projects that require their skills. Thus the different project types will reflect different types of tasks. The project types are listed in Appendix A. Individuals were asked to rate the percentage of time they spent on each project type.

V. Results and Discussion

The results of the Hypothesis tests are shown in Tables 3 through 6. Hypothesis H1 was tested using a crosstabulation of titles versus structural positions. The results shown in Table 3 show that respondent titles have little relation to structural positions.

The tests of hypotheses H2 and H3 are shown in Table 4. There are two possible ways in which structural position could be related to IS usage; either through

Table 3

Crosstabulation for Hypothesis H1

Structural Position Numbers	Titles					
	Sec'y	Staff Cons.	Snr. Staff Cons.	Manager	Principal	Partner
1	3	3	4	3		
2	3		4	4	1	
3		1		2		
4					1	2
5	3	3		3		
6		2	2	1		
7						2
8						1
9				3		
10	2		3	3		
11				2		
12						2
13		1		2		1
14		1	2			

interpretations of the system (H2) or social demands and pressures to use the system (H3). These two effects can be separated by the inclusion of the amount of training received.

If including training in the analysis reduces the amount of variance in usage explained by structural position, then we can conclude that structurally equivalent individuals interpret systems similarly, and accept H2. If the amount of variance in usage explained by structural position remains unchanged or increases, then structural position is related to social demands and pressures, thus confirming H3.

Hypothesis H2 is supported for the system newest to the organization, the SDW. Examining the data for the usage of the SDW (Table 4), we find that , when training is included in the analysis, then usage is not significantly different between structural positions. Thus we can conclude that the SDW is interpreted differently by individuals in different structural positions.

Hypothesis H3 is supported for three systems, the PMW, MAC and WP. The variance in the usage of the three explained by structural position is not

Table 4
Anova Tests of Hypotheses H2 and H3
(Categories are Structural Positions)

Information System	Sum of Squares	DF	Mean Square	F value
Use of SDW:				
Main Effects:	30.00	13	2.31	2.51**
Residual:	51.50	56	0.92	
Total:	81.50	69	1.18	
Controlling for Training:				
Covariate: Training SDW	34.06	1	34.06	49.41**
Main Effects:	9.53	13	0.73	1.06
Residual:	37.91	55	0.69	
Total:	81.50	69	1.18	
Use of PMW:				
Main Effects:	27.08	13	2.08	5.37**
Residual:	21.72	56	0.39	
Total:	48.80	69	0.71	
Controlling for Training:				
Covariate: Training PMW	3.41	1	3.41	8.86**
Main Effects:	24.26	13	1.87	4.86**
Residual:	21.13	55	0.38	
Total:	48.80	69	0.71	
Use of MAC:				
Main Effects:	28.35	13	2.18	2.49**
Residual:	49.09	56	0.88	
Total:	77.44	69	1.12	
Controlling for Training:				
Covariate: Training MAC	24.84	1	24.84	46.03**
Main Effects:	22.92	13	1.76	3.27**
Residual:	29.68	55	0.54	
Total:	77.44	69	1.12	
Use of 123:				
Main Effects:	26.42	13	2.03	0.99
Residual:	114.38	56	2.04	
Total:	140.80	69	2.04	
Controlling for Training:				
Covariate: Training 123	19.95	1	19.95	12.21**
Main Effects:	31.01	13	2.39	1.46
Residual:	89.83	55	1.63	
Total:	140.80	69	2.04	
Use of WP:				
Main Effects:	56.33	13	4.33	1.47
Residual:	165.16	56	2.95	
Total:	221.49	69	3.21	
Controlling for Training:				
Covariate: Training WP	27.20	1	27.20	11.61**
Main Effects:	65.40	13	5.03	2.15*
Residual:	128.89	55	2.34	
Total:	221.49	69	3.21	

* Significant at the $p<0.05$ level
** Significant at the $p<0.01$ level

significantly reduced by including training in the analysis. In fact, for the oldest system, WP, the inclusion of training causes the relationship to become statistically significant. Thus we can conclude that individuals in the same structural position receive similar demands and pressures to use these three systems

The test of the other possible way that structural equivalence could be related to IS usage, through its relationship to task assignment, showed little support for the hypotheses. Hypothesis H4 was tested using multiple ANOVA tests, with the structural positions as categories (Table 5). Hypothesis H5 was tested using stepwise regression. The variables included in the final model are shown in Table 6. Of the five types of usage measured, only two were predicted by task assignment. The System Designer's Workbench (SDW) was associated with assignment to Data Modeling (DM) projects. This is as expected, as those projects were the only formal application of this relatively new system. Thus this project has few choices for IS tools. The usage of the MAC was associated with assignment to Strategic Information Systems Planning (SISP) projects. It is possible that most of the "boilerplate" documents for this project were stored in this format.

VI. Conclusion

The hypothesis that the structural position of an individual is related to how he or she uses information systems received limited support from the data. This relationship is believed to occur in two ways: directly, through the individual's attention to the social influences and demands of those around him or her, and indirectly, through the social system's influence on how the individual interprets the information systems available.

The organization studied is small and highly connected, and the individuals within are very experienced with information technology. The results of a similar study in a different firm would be expected to be different. If the firm is larger or

Table 5
ANOVA Tests of Hypothesis H4
(Categories are Structural Positions)

Type of Task		Sum of Squares	DF	Mean Square	F value
SISP					
	Main Effects:	9221	13	709.3	5.26**
	Residual:	7547	56	134.8	
CSDI					
	Main Effects:	13690	13	1053	1.09
	Residual:	54007	56	964.4	
MRDP					
	Main Effects:	864.7	13	66.51	0.39
	Residual:	9562	56	151.1	
DM					
	Main Effects:	2826	13	217.4	3.34**
	Residual:	3647	56	65.13	
DSS					
	Main Effects:	1182	13	90.91	0.51
	Residual:	10029	56	162.5	
HRM					
	Main Effects:	2575	13	198.0	0.61
	Residual:	18235	56	325.6	
FA					
	Main Effects:	8928	13	686.7	0.61
	Residual:	29205	56	521.5	
AUDIT†					
IE					
	Main Effects:	784.3	13	60.33	0.39
	Residual:	7200	56	128.6	
MFG					
	Main Effects:	8566	13	659.0	1.87
	Residual:	19720	56	352.1	
GOVT					
	Main Effects:	982.0	13	75.54	0.38
	Residual:	11197	56	199.9	
BANK					
	Main Effects:	3321	13	255.4	0.75
	Residual:	19074	56	340.6	
MOA					
	Main Effects:	9510	13	731.5	1.46
	Residual:	27983	56	499.7	
AOS					
	Main Effects:	5565	13	428.1	1.50
	Residual:	16042	56	286.5	
SYSSEL					
	Main Effects:	523.2	13	40.24	0.91
	Residual:	2473	56	44.16	

* Significant at the $p < 0.05$ level.
** Significant at the $p < 0.01$ level.
† No respondents reported this task assignment.

Table 6

Stepwise Regression Test of Hypothesis H5
(Variables in final model)

Dependent Variable	Significant Variable(s)	R-Squared	F-value
SDW	DM	0.152	12.17**
MAC	SISP	0.071	6.32*
PMW	<None>		
123	<None>		
WP	<None>		

* Significant at the $p < 0.05$ level.
** Significant at the $p < 0.01$ level.

less connected then the variation in usage between different structurally equivalent groups could be higher. Firms with less technologically experienced employees would also be expected to have higher variation in local usage patterns. High experience with information systems would lead an individual to be less dependent on those around him or her for interpretation of a new system.

The findings of this study have implications for many of the debates in MIS. For example, the competitive advantage caused by a strategic information system (SIS) will be determined in part by the unique product features of the system (5). One implication of this study is that the perception and use of these features may be quite different between different users, and between the users and the providers of the system. Thus different users may perceive the competitive advantage of an information system quite differently.

The methods in this study may also be used to improve our understanding of SIS. A new SIS may create new patterns of interaction within and between organizations. Blockmodeling (and other network analytic methods) can help distill meaning from the complexity of the interaction data, and can thus help in the understanding of how SIS are changing the relationships between organizations.

Another implication of the work is concerned with the design process and the importance of user involvement. Many have argued that involvement in the design process of the future users of the system is critical to the success of that system. One of the benefits of involvement may be a fuller interpretation of the system by the target user group. If, however, social forces play a large role in when and how a system is used, then the usage of the system by some other user group may be quite different, even if the second group faces similar tasks. Thus the benefits of user involvement may be much larger for the user group involved than they are for future users. A vivid example of this phenomenon in a different setting is described in the book *Industrial Democracy at Sea* (35)*.

Future research in this area could focus on the features of IS that are likely to be associated with similar impacts in different organizations, and features whose impacts could vary. Future research should also expand and further test the task-related hypotheses. It could be that a different conceptualization of task assignments would result in positive results for the task-related hypotheses (H4 and H5). Finally, future research could try to understand what characteristics of organizations cause high or low variations in interpretation between different groups.

Trice and Treacy (36) note that usage of an information system is the intervening variable through which information systems impacts occur. If it is true that the usage of information systems is determined by the interplay of the features of the information system and the characteristics of the organization, then the focus of impacts research must shift to include both in any analysis. In fact, what must be

* This book focuses on a merchant marine ship which had been redesigned to encourage greater democracy and better quality of work life. The results of the redesign were found to be very successful for the crew and officers who participated in the design process. The book chronicles the behavior of the second group to use the ship. This second group in effect redefined the features of the ship to implement a more traditional social structure. Few of the gains of the previous group were evident.

considered is not either the IS or the organization, but the relationship between the two (20). The unit of analysis should no longer be the information system nor the organization, but the information system with respect to a particular organization. No longer would an IS be described as "easy to use," but rather "easy to use in context X." The determinants of the decision to use an information system will include the features of the system, the characteristics of the individual, and the social context in which the individual is embedded.

The purpose of this research is to challenge some assumptions on the role of IS in organizations. The technologically deterministic assumptions of impacts research have lead to a great deal of mixed and contradictory results. This study has adopted and attempted to show the validity of an alternative view, an organizationally deterministic position. It is hoped that a debate on this issue will result in a clearer understanding of the role of information systems in organizations. A clearer understanding can add much to the debates on many other issues in MIS.

Appendix A

Task Assignments

Strategic information systems planning (SISP).

Computer systems design and implementation (CSDI).

Managerial review of data processing (MRDP).

Decision support system design and implementation (DSS).

Information systems selection (SYSSEL).

Advanced office systems design (AOS).

Manufacturing (MFG).

Data modeling (DM).

Human resource planning (HRM).

Industrial engineering (IE).

Managerial and organizational analyses (MOA).

Finance and accounting (FA).

Organizational audits (OA).

Banking (BANK).

Other.

Bibliography

1. Arabie, P., Boorman, S., and Levitt, P. Constructing Blockmodels: How and Why. *Journal of Mathematical Psychology*, 17, 1 (February 1978), 21-63.

2. Asch, S.E. Studies of Independence and Conformity: A Minority of One Against an Unanimous Majority,. *Psychological Monographs*, 70, 9 (1956).

3. Attewell, P. Microelectronics and Employment. Paper presented at the Conference on Microelectronics in Transition, University of California, Santa Cruz, 1983 (as reported in Attewell and Rule, 1984).

4. Attewell, P. and Rule, J. Computing and Organizations: What We Know and What We Don't Know. *Communications of the ACM*, 27, 12 (December 1984), 1184-1192.

5. Bakos, J.Y. and Treacy, M.E. Information Technology and Corporate Strategy: A Research Perspective. *MIS Quarterly* 10,2 (June 1986), 107-119.

6. Barley, S. The Professional, The Semi-Professional, and the Machines: The Social Ramifications of Computer Based Imaging in Radiology. PhD Dissertation, Sloan School of Management, Massachusetts Institute of Technology, 1984.

7. Bjorn-Andersen, N., Eason, K., and Robey, D. *Managing Computer Impact: An International Study of Management and Organization*. Norwood, NJ: Ablex, 1986.

8. Blau, P.M. and Schoenherr, R. *The Structure of Organizations*. New York: Basic Books, 1971.

9. Blau, P.M., Falber, C.M., McKinley, W., and Tracy, P.K. Technology and Organization in Manufacturing. *Administrative Science Quarterly*, 21, 1 (March 1976), 20-40.

10. Boorman, S.A. and Levitt, P.R. Blockmodelling Complex Statutes: Mapping Techniques Based on Combinational Optimization for Analyzing Economic Legislation and its Stress Point Over Time. *Economics Letters*, 13, 1 (1983), 1-9.

11. Boorman, S. and White, H., "Social Structure from Multiple Networks II. Role Structures," *American Journal of Sociology*, 81, 6 (May 1976), 1384-1446.

12. Breiger, R.L., Boorman, S.A., and Arabie, P. An Algorithm for Clustering Relational Data, With Applications To Social Network Analysis and Comparison with Multidimensional Scaling. *Journal of Mathematical Psychology*, 12, 3 (August 1975), 328-383.

13. Burt, Ronald. Social Contagion and Innovation: Cohesion versus Structural Equivalence. *American Journal of Sociology*, 92, 6 (May 1987), 1287-1335.

14. *Business Week*. Office Automation Restructures Business. October 8, 1984, 118-142.

15. Carter, N. Computerization as a Predominate Technology: Its influence on the Structure of Newspaper Organizations. *Academy of Management Journal*, 27, 2 (June 1984), 247-270.

16. Crawford, A. B. Jr. Corporate Electronic Mail - A Communication-Intensive Application of Information Technology. *MIS Quarterly* 6,3 (September 1982), 1-13.

17. Crowston, K. and Malone, T.W. Information Technology and Work Organization. MIT Center for Information Systems Research Working Paper No.165, December, 1987.

18. Glenn, E.N. and Feldberg, R.L. Proletarianizing Clerical Work. In *Case Studies on the Labor Process*, A. Zimbalist (ed.). New York: Monthly Review, 1979.

19. DiMaggio, Paul. Structural Analysis of Organizational Fields: A Blockmodel Approach. *Research in Organizational Behavior*, Vol. 8 (1986), 335-370.

20. Downs, G.W. and Mohr, L.B. Conceptual Issues in the Study of Innovation. *Administrative Science Quarterly*, 21, 4 (December 1976), 700-714.

21. Foster, L. W. and Flynn, D. M. Management Information Technology: Its Effects on Organizational Form and Function. *MIS Quarterly* 8, 4 (December 1984), 229-235.

22. Gregory, J. and Nussbaum, K. Race Against Time: Automation in the Office. *Office, Technology, and People*, 1, 2-3 (September 1982), 197-236.

23. Holland, P. W. and Leinhardt, S. The Structural Implications of Measurement Error in Sociometry. *Journal of Mathematical Sociology*, 3, 1 (July 1973), 385-411.

24. Keen, P. G. W. MIS Research: Reference Disciplines and a Cumulative Tradition. *Proceedings of the First International Conference on Information Systems*, E. R. McLean (ed.). December 8-10, 1980, 174-186.

25. Kling, R. Social Analyses of Computing: Theoretical Perspectives in Recent Empirical Research. *Computing Surveys*, 12, 1 (March 1980), 61-110.

26. Leavitt, H. J. and Whisler, T. L. Management in the 1980's. *Harvard Business Review*, 36, 6 (November-December 1958), 41-48.

27. Markus, M.L. and Robey, D.F. Information Technology and Organizational Change: Conceptions of Causality in Theory and Research. *Management Science*, 34, 5 (May 1988), 583-598.

28. Matteis, P. The New Back Office Focuses on Customer Service. *Harvard Business Review*, 57, 2 (March/April, 1979), 146-159.

29. Mumford, E. and Banks, O. *The Computer and the Clerk*. London: Routledge and Kegan Paul, 1967.

30. Nelson, Reed Elliott. The Use of Blockmodeling in the Study of Organizational Structure: A Methodological Proposal. *Organization Studies*, 7, 1 (1986), 75-85.

31. Noble, D. Social Change in Machine Design: The Case of Automatically Controlled Machine Tools, and a Challenge for Labor. *Politics and Society*, 8, 3/4 (1978), 313-347.

32. Pfeffer, J. and Leblebici, H. Information Technology and Organizational Structure. *Pacific Sociological Review*, 20 (1977), 241-261.

33. Robey, D. F. Computer Information Systems and Organization Structure. *Communications of the ACM*, 24, 10 (October 1981), 679-687.

34. Sailer, L.D. Structural Equivalence: Meaning and Definition, Computation and Application. *Social Networks*, 1, 1 (August 1978), 73-90.

35. Schrank, Robert (ed.). *Industrial Democracy at Sea*. Cambridge, MA: The MIT Press, 1983.

36. Trice, A.W. and Treacy, M.E. Utilization as a Dependent Variable in MIS Research. (forthcoming in Database).

37. Turkle, S. Computer as Rorschach. *Society*, 17, 2 (January/February 1980), 15-24.

38. Turner, J.A. Improving the Quality of Information Systems Research. *Proceedings of the First International Conference on Information Systems*, E. R. McLean (ed.), December 8-10, 1980, 91-97.

39. Turner, J.A. Computer Mediated Work: The Interplay between Technology and Structured Jobs. *Communications of the ACM*, 24, 12 (December 1984), 1210-1217.

40. Walker, G. Network Position and Cognition in a Computer Software Firm. *Administrative Science Quarterly*, 30, 1 (March 1985), 103-130.

41. Wallace, M. and Kalleberg, A. Industrial Transformation and the Decline of Craft: The Decomposition of Skill in the Printing Industry, 1931-1978. *American Sociological Review*, 47, 3 (June 1982), 307-324.

42. Whisler, T.L. *The Impact of Computers on Organizations*. New York: Praeger, 1970.

43. White, H., Boorman, S. and Breiger, R. Social Structure from Multiple Networks I. Blockmodels of Roles and Positions. *American Journal of Sociology*, 81, 4 (January 1976), 730-780.

Date Due