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Prof. Ronald E. Rice *Rutgers University*

MULTIPLE THEORIES, ISSUES, DATA AND METHODS

FOR UNDERSTANDING THE IMPLEMENTATION OF AN INFORMATION SYSTEM

This article briefly describes several aspects of an ongoing, longitudinal study of the implementation of two related information systems within an organization which is active in the field of systems design and customer service. First, the range of conceptual issues involved in such a study will be identified, and then the diverse sources of data collected will be considered. Several specific sub-studies are then summarized, including the ways in which measures are used to support or constrain organizational learning, how people develop informal help networks as the new systems are implemented, and how users' desktops apply different mixes of material-based versus computer-based information over time.

1. Introduction

The argument that it is useful to apply multiple methods and have multiple sources of data when undertaking research is by now familiar. Actual practice of this argument, however, is not yet as common as it might be. Researchers have identified a wide range of new ways to combine sources of data and methods of analysis. For example, by integrating unobtrusive measures (Anderson 1989), and by integrating information system usage data with survey data (Williams, Rice & Rogers 1988). Jick (1979) showed how this triangulation increases the validity of overall insights into organizational change from both qualitative and quantitative methods. Kuhlthau (1993) used multiple data sources to better understand how people seek information and how they use information systems.

Not only do researchers reason the use of multiple data sources or methods of analysis, but recent discussions have also raised the possibility of comparing, if not integrating, different theoretical para-

digms. While there are many ways to characterize and describe social science research paradigms, we refer here to the four quadrants of the Burrell and Morgan (1979) taxonomy. This taxonomy is based on the extent to which a research focus emphasizes: (1) objectivism versus subjectivism; and (2) social regulation versus social change. Thus, for instance, traditional positivism is a paradigm assuming objectivism and social regulation, while radical humanism is a paradigm assuming subjectivism and social change. We feel that it is important to consider multiple paradigms when studying a complex social phenomenon such as the implementation of information systems in organizations, as each paradigm emphasizes and highlights different, though often overlapping, aspects of the phenomenon. Furthermore, each paradigm emphasizes different sources of data and different analytical approaches.

There are some insightful examples of the application of multiple paradigms: to provide multiple perspectives or readings of a single research setting (Hirschheim & Klein 1989) or of comparative settings (Hassard 1991). Gioia and Pitre (1990) push the concept of theoretical and methodological pluralism further, by showing that, in spite of some incommensurability across paradigms, there are opportunities for joint applications, and that each paradigm can offer both complementary as well as unique insights into a research problem. Lee (1991) goes even further. He has developed an iterative, multi-levelled approach that identifies how different paradigmatic perspectives and their methods provide specific kinds of understandings and validity tests. Thus, with the right combination, disparate perspectives such as ethnographic description and positivist hypothesis-testing can both enable and provide checks on each other.

2. Project

The project described here is especially suitable for exploring multiple theories, data sources, analysis methods and even paradigms. A longitudinal study was carried out of a multiple-site organization, that was implementing two comprehensive information systems – a customer service database and a document imaging retrieval and display programme. The two systems were run side-by-side on a PC workstation. The study was guided by a variety of research foci, complex and consequential customer service and management issues, and involved a team of researchers.

The project focuses on a variety of basic conceptual/theoretical components, in particular:

Attitudes. We measured learning styles, locus of control, socialization, computer experience, computer attitudes, innovativeness and employee satisfaction.

Social Influence. We measured the communication network and supervisory attitudes, participation in implementation, assessed open-ended comments and customer comments, and considered influences associated with the organizational chart and office layout.

Influence of Source and Information on Implementation Evaluation. We measured seven characteristics of communication across four sources (from senior management to those who report directly).

Job Characteristics. We used the standard 'job characteristics' measures, as well as task analyses, critical success factors, understanding others' work and procedures, and perceptions of responsibility.

System Usage. We used implementation dates, self-report measures of usage, and system-monitored measures of usage, at individual, group, process and centre levels of analysis.

Learning. We looked at perceived learning, work processes, system and work understandings, process workarounds, understanding methods and procedures, and 'reinventions' or adaptations of the systems after adoption.

Internal and Informal Help Networks. We measured formal position, task interdependencies, socialization, gender, location, etc., the extent to which each person sought out help concerning four problem areas, and which people and what positions were named as sources of help.

'Quality'. We identified both formal 'quality measures' as well as critical success factors, and assessed how people interpreted them, and what role they played in any improvement.

Performance. We measured quality, error rates, problem tracking, efficiency, unit effectiveness, employee satisfaction, and other relevant outcomes.

Behavioural artefacts. We looked at how users' desktops changed over time as they adjusted to the document imaging system. From this we developed initial typologies of artefacts and of the roles of desktop information.

Our data triangulation included:

1. Questionnaire surveys;
2. Communication network rosters;
3. Personal interviews;
4. Archival sources, reports, past analyses, and Customer Satisfaction Surveys;

5. Observation of system use and task accomplishment;
6. System-monitored and reported quality and performance data;
7. Observation, photography, and description of five 'desktops' over the period of the study;
8. Tracking tasks to see how those same five people identify and use measures to learn about, and redesign their job.

In the following sections three specific components of the overall project will be summarized briefly: the use of measures in organizational learning; the role of help networks; and changes in electronic and physical desktop landscapes. Other components are still in process.

3. Organizational Measurement and Learning

Measurement is an activity that has concerned organizations for a long time. Many would argue that intense internal measurement has been carried out since the advent of scientific management and Taylorism, and has resulted in the routine quantification of such areas as sales, profit, inventory, stock prices, and others. Given the increasingly competitive marketplace within which organizations are active, the measures they use take on even greater importance; an organization's very survival might depend on its ability to measure and evaluate the right things.

The advent of total quality management (TQM) and influx of other total quality (TQ) approaches has realized a shift in the measurement imperative. According to a survey conducted in 1994 by the Gallup organization and the American Society for Quality Control (ASQC), more than half (58%) of the U.S. business sector has a formal quality programme in place. Organizations seek to measure such concepts as customer satisfaction, employee satisfaction, the cost of losing a customer, and others. Other types of organizations, including educational institutions and health care providers, are also jumping on the quality bandwagon.

Consequently, given the fact that total quality and its emphasis on measurement in the organization appears to be more than just a passing fad, it becomes important to develop and test a theoretical framework with which the roles and meaning of measurement in the TQ organization can be examined.

In the spring of 1995, agreement was reached with an American company to undertake research to look at several dimensions of organizational adaptation to new technology, in particular a

document imaging system. The company in question was reported to be a practising 'quality' organization, and it provided, therefore, an opportunity to begin exploring some aspects of measurement within a TQ organization. The study that is presented in this article is limited to two nearby sites in two states (location A and location B). Location A consists primarily of customer service representatives and support staff who interact directly with companies that wish to maintain or change their corporate calling cards. Location B consists primarily of technical and systems staff, who develop, integrate, and maintain the company's own computer/information systems. The two locations therefore have very different task foci and professional cultures.

An extensive survey was administered to collect some baseline data against which later responses could be compared. The five subjects who participated in the study were chosen because of the likelihood that they would be interacting with a new document imaging system.

Using the categories of the Malcomb Baldrige National Quality Award, we first asked people how frequently they thought seven quality areas are measured in their organization. These categories are leadership, information and analysis, strategic planning, human resource development and management, process quality, customer satisfaction, and business results. The baseline results revealed that few of these areas are, in fact, measured specifically. When asked to select from the seven categories the two areas which they perceived to be measured most often in the organization, respondents in the two locations differed in their responses. Employees at location A rated process quality and customer satisfaction as the two general areas that are measured most often; while employees at location B felt that process quality and human resource development and management are most frequently measured.

We also asked people which two measures – of those that were actually available – were, in their opinion, the best for assessing quality. At both locations personnel regarded customer satisfaction as the best measure. At location A, the next two best measures related to call monitoring (a process for recording the number, duration, and quality of calls) and DMOQS (the company's acronym for direct measures of quality). At location B, the next three best measures were employee satisfaction, system testing, and the annual quality review.

Differences across the two sites might be a direct reflection of the type of personnel at each location. Employees at location A are front-line employees whose primary responsibilities are in

the realm of customer service. Employees at location B, on the other hand, are technical designers of the systems used by the employees at A.

During the autumn of 1995, three focus groups were formed at location A to further explore some of the areas surrounding the implementation of the new networking system. These focus groups revealed that there is currently no common understanding of what a measure is (quality or otherwise). Furthermore, what individual employees consider to be an accurate measure of the quality of his or her work differs, even when they are fulfilling the same function. This lack of mutual understanding and shared meanings among employees at both locations and within a given location was the focus of subsequent data gathering efforts.

A second survey was administered to employees of both locations in the autumn of 1995. Once again employees were asked about preferred measures. This time the questions were formulated differently in an attempt to address the individuals' understanding of measures more directly. In this case, employees were asked to indicate which measure they felt was best for improving performance both from their own as well as from the leadership's standpoint. Furthermore, they were asked to say which measures they felt were being used to monitor and control their work. The results showed that differences of opinion exist in all areas: between what individuals consider their own best measure of performance versus their perception of the organization's best measure of performance; whether their own or the organization's measures exert more control over their work; and there are also differences across the two locations. Generally speaking, individuals' most frequently chosen best measures to help improve performance included: on-the-job performance, reviews, customer surveys, productivity, leader reviews, adaptability to ECAM, and call monitoring. On the other hand, the organization's best measures, in their opinion, were on-the-job performance, call monitoring, reviews, productivity, leader reviews, improved climate, ranking-rating, and number of defects. Thus, a wide range of words and terminology was still being used to describe the measures.

4. Information Technology 'Helping Relationships'

It is vital for both the organization and the individual employee that the latter can get the help he needs to understand how to use and interpret new information systems. Indeed, both informal and formal help are expensive and necessary, but largely unidentified,

unmanaged, and underresearched.

Information technologies (IT) have become an essential means with which employees can perform a wide variety of tasks in an increasing number of organizations. Yet, formal training and professional assistance in the use of IT continues to lag far behind user demands. For example, a study of six public sector organizations revealed that the average information systems professional struggled to provide individual assistance to over 100 personal computer users, while still ensuring system-wide services for the organization as a whole (Wallace 1996). The limited ability of information systems professionals to provide a comprehensive service means that employees must turn to informal networks for help with their everyday needs for IT information and assistance (Bannon 1986). With our research we aimed to analyse what influences whether an individual is approached as a source of help, and the types of help sought.

Previous research suggests that the formation of IT helping relationships depends upon two factors: social-structural and individual. Social-structural factors include the proximity of employees giving and receiving help, or their relative positions within the networks of structured organizational relations. Individual factors include the comparative individual characteristics or experiences of those assisting and those being assisted. The analysis is carried out by: (1) delineating an informal network of IT helping relationships in an organization where information technology use is critical for most job tasks, including tasks in cooperative workgroups; (2) comparing the degree to which social-structural factors (such as organizational and relational proximity) or individual factors (such as individual experience with an IT system) influence employees' involvement in relationships where they seek or provide IT help.

Analyses were complicated by the fact that hypotheses could test the impact of (a) individual or (b) structural influences on helping relationships analysed at the (c) individual or (d) dyadic levels of analysis. Hypotheses analysed at the individual level could test the impact of (mostly individual) influences on: (1) being sought as an individual source of IT help, and (2) the extent of seeking help from a positional source through a positional source. Hypotheses analysed at the dyadic level could test the impact of (mostly structural) influences on the involvement of a pair of employees in a dyadic helping relationship.

Employees whose jobs are more interdependent, who are less satisfied with the nature of that interdependence, or who have greater computer expertise (more with office automation in general and the new workstation support system in particular, but less with main-

frames), are somewhat more likely to act as a source of IT help. People with more experience with office automation, and who others communicate with more, are more likely to name a person instead of a position as a source of help.
Individuals were more likely to be involved in an IT helping relationship with those who interacted with them on a regular basis (relational proximity) and worked in the same functional work group (organizational unit proximity). Involvement in communication relationships, and being a member of the same work unit as the helper, were stronger predictors of IT helping relationships than spatial proximity.

5. Desktop and Electronic Landscapes

As individuals adjust to a new information system, they experience changes in attitudes, behaviour and information needs (Nelson 1990). The system introduces new procedures which the individual will have to learn. The system also brings changes to individuals' processes and environments. Change, especially from physical to more cognitive contexts such as a computer workspace, is often unsettling and requires effort on the part of the individual to cope and adjust (Weick 1985). One manifestation of changes associated with the implementation of information systems are the landscapes of users' physical and electronic desktops.
This study examines the role that physical artefacts on individuals' desktops play in this change and adjustment process. This important organizational site has only been considered by a few studies previously (Davis 1984; Lucas 1991; Malone 1983; Sommer 1969; Sundstrom & Sundstrom 1986; Zalesny & Farace 1987). The project under discussion describes these physical artefacts and their purposes as explained by the individuals. Research in this area is important because the desktop is a medium over which individuals have control and through which they can express themselves. Both the placement of these physical artefacts and the artefacts themselves can tell us what the individuals deem important. Knowledge of physical artefact trends would be a valuable tool for those persons responsible for taking individuals through the transition to a new information system. By understanding the preferred forms of physical and electronic artefacts, training and support personnel could provide individuals with information in the most useful manner. Here, participants placed physical artefacts on their desktops – especially their PCs – as reminders or indicators of gaps and errors.

The small sample was designed to consist of individuals with different job functions from five different parts of the process affected by NCS and Imaging. These five processes were identified as representing the areas most likely to experience changes as a result of the new system. The participants were volunteers. So the study consisted of five representative volunteers each stratified by different work processes.
The desktops of five individuals were studied over the course of nine months, to observe the role that physical artefacts played in the individuals' adjustments to a new information system. Physical artefacts on the desktop were important to the individuals as they experienced a change from a paper-based processing system to an information system. The artefacts helped the individuals associate the new system with the work processes they had been accustomed to under the old system. Artefacts in desktop and electronic landscapes seem to represent a potentially valuable resource for users, system designers, implementers, and researchers alike.
As the participants experienced the change to a new information system, their attitudes, behaviours and information needs changed, though rarely dramatically. While it was important for the organization that all of its employees conformed to a strict way of doing things in order to accomplish the change, the participants expressed themselves through their desktops. The items placed or posted there showed what was not working well, what information was missing, and what processes were causing the individuals difficulty, to name just a few functions. In particular, artefacts seemed to represent the following categories of information: reminders; temporary information; process-related information; indicators of frequency of use (roughly based on distance from the computer screen); and information unsupported by the system. The very nature of the information itself seemed to vary along the dimensions of paper/electronic information; amount, presence, complexity or level of uncertainty, forms (paper or on-screen); and meta-information, or information about other information activities or artefacts.
System implementation strategies should consider evaluating and tracking desktop artefacts, both as part of a needs assessment and systems analysis, as well as part of a system evaluation and on-going adaptation. One design implication is that reminders or important reference papers for employees should be made available in a small post-it form to facilitate convenient posting. Another suggestion is one made by Malone, who suggested that an electronic office system should be developed which allows for "electronic piles" and provides prioritizing, categorizing and visual cues for the user (1983). It is

clear that designers should be aware of the important role physical artefacts play for the individuals who are adjusting to a new information system.

7 Conclusion

In this paper we have discussed just three components of the longitudinal study of the implementation of two information systems. Three general implications arise from this summary; they concern paradigms, methods, and practices.

As far as paradigms are concerned, we agree with Lee (1991) and Gioia and Pitre (1990) that paradigmatic approaches are not completely mutually exclusive, as some have argued. Indeed, different approaches do highlight, even narrow one's focus to, different aspects of an overall complex situation such as an organization. Furthermore, different approaches provide different ways of increasing our understanding of the 'same' phenomenon (here, the overall implementation process and use of these systems) as well as provide checks and balances on perspectives derived from any one particular approach. Here, for example, in-depth observation and photographic analysis of desktops not only provides detailed insight into how people construct and interpret their workspaces, but can also provide a basis for understanding how measures of activities 'show up' during one's processing of desktop work. The analysis of the informal network of IT helping relationships involved both a macro-quantitative approach of networks, as well as an understanding of the roles and interactions of different work groups in the particular organizational settings. And, our initial understanding of how 'measures' function (or do not!) as part of an overall organizational 'quality' initiative depended on both qualitative understanding of how people accomplished their work as well as survey responses measuring people's ratings of different measures. It should also be noted, that all approaches made use, at least to some extent, of Lee's notion of developing quantitative measures based on interpretative understandings of the participants' terms and roles (1991). For example, early focus groups identified measures of effectiveness and work-group norms that were used to design both questionnaire surveys as well as observation protocols.

With regard to methods, some have argued that particular methods bias one to look at the world in a specific way, excluding other perspectives, perhaps even 'creating' the results. To some extent this is true: how could it be any other way? On the other hand, by on-

going development of understanding different methodological and analytical approaches, one can design a study from its inception to involve multiple paradigms, methods and data. Not being familiar with network analysis ahead of time, would have made it impossible to even conceptualize the informal helping study, much less know how to collect useful information in a format that was easy to use by the participants. Further, network analyses can provide insights about overall structure that is simply not available to individual participants, no matter how 'in-depth' or 'ethnographic' the data collection might be. And, measures derived from the network data can be used easily in related studies, such as determining the source and strength of others' influence on one's own attitudes toward a new system (Rice & Aydin 1991). To use another example, understanding methods of content analysis, visual databases, stratified sampling and conceptualizations of electronic work enabled the project team to envision the 'desktop study' simultaneously with the questionnaire survey. And as we had an understanding of the existence and processing of system-monitored data, we were able to tap the especially rich archival resources of system and performance measures at this quality-oriented organization. We must conclude that while specific methods inherently embed some biases, being aware of multiple methods enables one to triangulate across different forms of biases, and even conceptualize different ways of understanding a phenomenon.

Finally, the multiple paradigms, methods and data here also serve to inform and guide practice. Indeed, as most organizational implementations involve multiple and changing actors (people leave, are promoted or transferred, are assigned to new customers, etc.), multiple system components, multiple customers, and multiple and changing organizational missions, it is quite important to be able to tell underlying research stories in multiple ways. In this sense, multiple rigorous theories and research methods actually enhance not only one's understanding of an organizational site, but also allow one to communicate with participants through multiple discourses. By basing the various data and methods on prior theory as well as in-depth discussions with organizational members before developing the research design, it is possible to provide insights not only grounded in the actual organizational context, but also in deeper understandings of the underlying theoretical issues than the participants themselves have about their experiences and systems.

As just one example, most personnel and management felt that the two greatest potential benefits of the document imaging system would

be the reduction of paper, and the elimination of errors associated with paper. Our prior understanding of computer-mediated work, technical systems specification, and desktop arrangements indicated to us that neither of these would be completely true. Indeed, we found that while new paper did diminish, older paper endured, way beyond its initial purposes, for some of the reasons identified in the desktop study. We also found that many new errors arose because the design and use of the new systems changed the basis for some traditional measures, and as people tried to learn how to integrate the new hardware, software, features and procedures into their familiar work routines.

In the end, then, rather than simplifying our use of paradigms in organizational settings to 'fit' narrow conceptualizations of the 'world of practice', we argue here that multiple paradigms, data and methods should be encouraged, to expand both the world of practice and participants' understanding of it.

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Ronald E. Rice is a professor at the School of Communication and Information Science at the State University of New Jersey.