

# **INFORMATION TECHNOLOGY IMPLEMENTATION: A LONGITUDINAL MULTIMETHOD RESEARCH DESIGN**

*John M. Borton, Colorado State University - Pueblo, Pueblo, Colorado, (719) 549-2095,  
borton@uscolo.edu*

*James C. Brancheau, GartnerG2, Media Industry Research, Boulder, Colorado, (303)-442-3354,  
james.brancheau@gartner.com*

## **ABSTRACT**

This paper describes a longitudinal multimethod case research design used to study the information technology (IT) implementation process. The design provides a more comprehensive and possibly disparate view of the IT implementation processes and outcomes than do single-survey, retrospective studies. The researchers suggest that failure to consider temporal effects or narrowly measuring implementation outcomes can lead to erroneous conclusions regarding the effectiveness of the IT implementation process.

## **INTRODUCTION**

Successfully managing information technology (IT) implementation demands consideration of many factors related to the adoption, diffusion, and routinization of technology [2]. The interaction of these factors further increase the complexity of the process. Implementation research is often performed retrospectively using "simple impact models" [5]. These studies provide researchers and practitioners with interesting and useful insights into the factors which impact the IT implementation process. However, a comparison of studies often reveals contradictory results [7]. Three aspects of previous research which contribute to this problem include: The use of research designs which do not account for, or are unable to measure the interaction of factors within and among the various stages of the implementation process [8]; a lack of theory guiding the research process [3], and the use of invalid or unreliable measures [6].

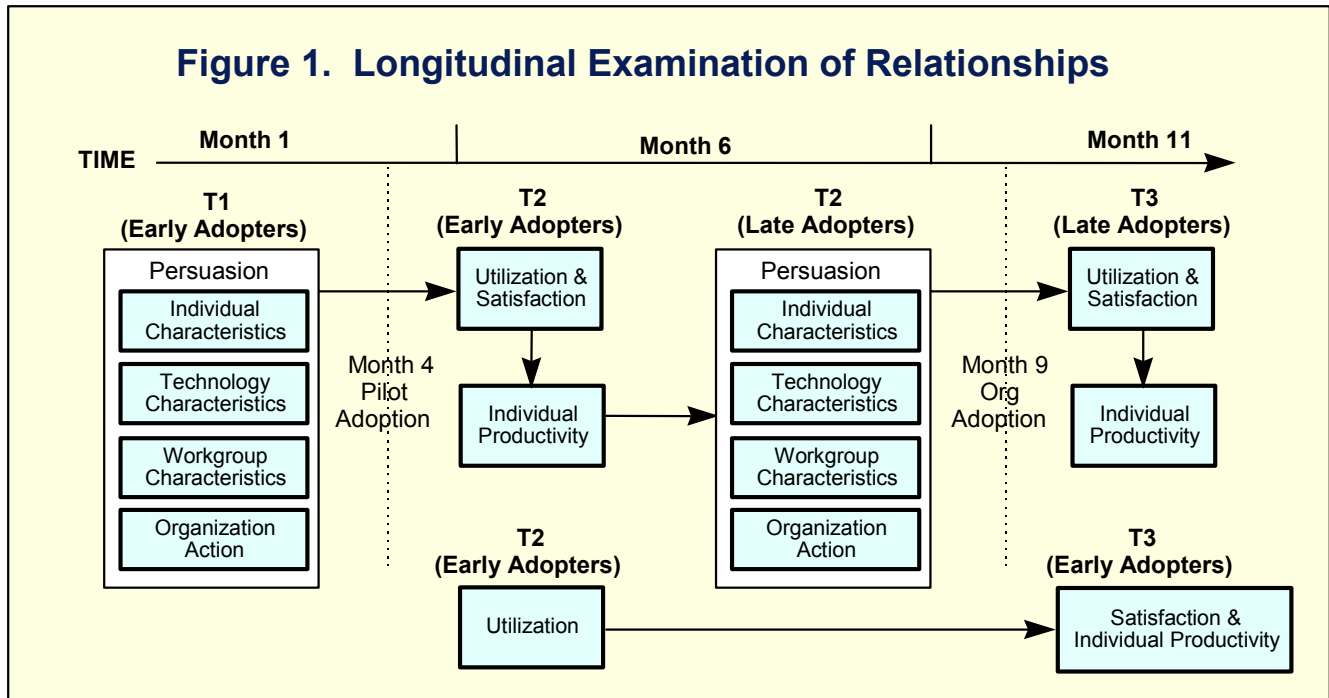
To address these problems, many researchers encourage theory-based research designs, using data collected before, during, and after the adoption of a technology, [4]. The goal of this paper is to describe a multimethod research design, triangulating qualitative and quantitative measures to increase validity and reliability of IT implementation research.

## **RESEARCH APPROACH**

The longitudinal multimethod case study design described in the paper provides a detailed, temporal account of events which occur during the implementation process. Data quality is improved since events are described at the time they occur rather than retrospectively. It facilitates in-depth examination of relationships and permits qualitative exploration of time-varying effects. The design also uses methodological and data source triangulation to enhance validity and reliability. Survey data provide consistent, quantifiable measures. Interview data provide a detailed view of the implementation process from the user's perspective. Observation data provide information which is not biased by the user's interpretation of events. In addition, multiple sources of data tap the varying perspectives of the many stakeholders involved. This paper focuses on a description of the case study site, research instrumentation, and data collection procedures. Appendix A briefly describes each variable in the research model, the method of data collection, the source of any applicable scales, and their related reliability's. Figure 1 illustrates the primary temporal relationships examined in the research model. A detailed description of the research model may be found in a previous paper [1].

## Case Study Site

The case study site (Beta Inc.) is “an international training and consulting firm specializing in skills training for quality, team, productivity, and management effectiveness initiatives.” Beta Inc. is implementing a computerized information system which provides client information to approximately 100 field-based personnel in four United States regions. The computer system being implemented is a distributed database application with information stored on both the user's personal computer and the corporate host computer. Data is transferred on a weekly basis from the user's computer to the corporate host computer.



User computers are equipped with a custom-designed database application suite including an integrated client database, appointment calendar, project management system, sales forecasting system, and word processor. Besides improving the quality of client information available in the field, the system is intended to improve communication among users in the field and the corporate office. The improved information sharing and quality is expected to enhance client management and increase sales.

## Surveys

Survey development was a multi-step process including scanning for existing scales, developing additional measures, pilot testing, and testing for reliability and validity. Surveys were administered three times over a period of ten months at five month intervals. The users selected for the pilot installation participated in all three survey administrations. All other field associates participated in the last two survey administrations. This group included both a second wave of users and non-users. The pre-installation survey requests information on users' individual characteristics, technology characteristics, workgroup characteristics, organization action, and organization context. The post-installation survey requests identical information excluding background data. It also requests information regarding infrastructure support and selected outcome variables.

The survey was mailed to users, follow-up procedures with non-respondents included leaving a voice-mail reminder, mailing a second survey, and following this with a second voice-mail reminder. A total of 92 individuals responded to one or more of the surveys. Response rates ranged from 83% to 100%

(see figure 2). System users represent 70% of the total number of survey respondents. Five regional vice-presidents provide a senior management perspective, while seven client service managers and regional office support managers provide a middle management perspective.

<b>Figure 2. Survey Response Rates</b>									
<b>Survey Response Rates</b>									
	<b>---- Month 1 ----</b>			<b>--- Month 6 ---</b>			<b>---- Month 11 ----</b>		
	<b>Sent</b>	<b>Returned</b>	<b>Rate</b>	<b>Sent</b>	<b>Returned</b>	<b>Rate</b>	<b>Sent</b>	<b>Returned</b>	<b>Rate</b>
Pilot Users	17	17	100%	14	14	100%	14	12	86%
New Users	--	--	--	--	--	--	39	36	93%
Non-Users	--	--	--	81	67	83%	39	38	97%

## **Interviews**

Two types of semi-structured interview guides were employed. They were administered to system users, senior management, and the IS implementation team. The first interview guide gathers background information on the implementation project, an overview of project status, an overview of organization climate, and perceptions regarding the future consequences of implementing the new system. The second interview guide focuses on the impact of the implementation process and the effect of organization actions on project outcomes.

Four interviews were conducted with the IS implementation team over a 15 month period. Two sets of interviews were held with senior management. Monthly telephone interviews were conducted with the project leader (a total of 16 were completed). These interviews were open-ended allowing the project leader to discuss the topics she believed were important. Since discussions often focused on unexpected problems which had recently occurred, interesting insights into the implementation process were provided. Two sets of telephone interviews were conducted with the pilot user group. Five additional interviews were conducted with an informant from the pilot user group. These additional interviews were open-ended and focused on organization events which indirectly affected the implementation process.

## **Observation**

Two types of observation were conducted: observing project meetings and observing user training. Project meetings (via conference call) were held monthly and typically included 15-20 individuals from the pilot user group, the IS implementation team, and a researcher (who took informal notes). Fourteen of these monthly project meetings were included in the study. Two days of hands-on system training were provided to pilot team members at Beta Inc.'s corporate headquarters. A researcher observed these meetings and took informal notes.

## **Additional Data Collection**

Two other sources of data include written documents and voice-mail messages. During an on-site visit, documents were obtained relating to project objectives and goals, implementation planning, and Beta, Inc.'s organization structure. In addition, all written correspondence and voice-mail sent to members of the pilot user group were provided to the researchers. Items included messages from senior management concerning organization events and communications from the implementation team concerning the project.

## CONCLUSIONS

The longitudinal multimethod case design provided an extremely rich set of data for analysis. Both qualitative and quantitative data were viewed as equally viable modalities of evidence. The qualitative data provided an overview of the implementation process. A combined quantitative/qualitative analysis was used to examine relationships and explore the strengths and weaknesses of the research model.

The complexity of the IT adoption and implementation process is clearly demonstrated in our case organization. The implementation process made several major changes in direction throughout the longitudinal timeline. Despite this, the theory-based research model and the longitudinal, multimethod research design provided the necessary framework to interpret these changes and analyze their influence on implementation outcomes. The combination of quantitative and qualitative data strengthened the findings by extending them beyond a description of "what" occurred during the process to "how" and "why" the process evolved.

Findings about factors in several stages of the implementation process varied depending on whether longitudinal or cross-sectional data were employed. Cross-sectional data consistently yielded positive results while longitudinal data yielded mixed results. Previous research tested many of the relationships proposed in the research model using retrospective analyses based on cross-sectional data. Our findings mirror those of previous research when using measures taken retrospectively. Researchers have assumed that these variables were also useful as predictors in time-varying models. Our results show that when these "predictor" variables are measured longitudinally, the proposed relationships are not always supported. A key finding is that potential users must become sufficiently familiar with the technology before they can answer surveys used to gather predictive data. In our case, pilot users were quite familiar with the technology due to their role in its design and development. New users were only vaguely familiar with the technology and the expected consequences of use and therefore were not able to respond appropriately. Although our results cannot disconfirm previous research, they raise questions about the impact of non-longitudinal data collection on IT implementation research.

In summation, longitudinal, multimethod research designs provide a more comprehensive and possibly disparate view of the IT implementation processes and outcomes than do single-survey, retrospective studies. Failure to consider temporal effects may lead to invalid conclusions regarding the effectiveness of the IT implementation processes.

## REFERENCES

- [1] Borton, J. "Information Technology Adoption and Implementation: A Proposed Model For Research," Proceedings of the Western Decision Sciences Institute, Vancouver, Canada, April, 2001.
- [2] Brancheau, J.C. and Wetherbe, J.C. "The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-User Computing," *Information Systems Research*, Vol. 1, No. 2, June 1990.
- [3] Kappelman, L. "Measuring User Involvement: A Diffusion of Innovation Perspective," *Data Base*, Vol. 26, May/August 1995.
- [4] Markus, M.L. and Robey, D. "Information Technology and Organization Change: Causal Structure in Theory and Research," *Management Science*, Vol. 34, May 1988.
- [5] Nelson, D.L. "Individual Adjustment to Information-Driven Technologies: A Critical Review," *MIS Quarterly*, March 1990.
- [6] Orlikowski, W.J. and Robey, D. "Information Technology and the Structuring of Organizations," *Information Systems Research*, Vol. 2, No. 2, June 1991.
- [7] Prescott, M.B. and Conger, S.A. "Information Technology Innovations: A Classification by IT Locus of Impact and Research Approach," *Data Base*, Vol. 26, May/August 1995.
- [8] Tyre, M.J. and Orlikowski, W.J. "Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations," *Organization Science*, Vol. 5, No. 1, 1994.