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Information Systems Research: Reference Disciplines and Theoretical Contributions

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ABSTRACT

The role of theory and research methodology in information systems (IS) research is deemed essential to its progress and eventual acceptance as a legitimate discipline. Despite IS disposition for practitioner-related issues, researchers have proposed that in addition to drawing upon reference disciplines IS should develop its own theories. This paper reports preliminary results of an investigation of published research between 1995 and 2004 to examine how IS discipline has utilized theories from the reference disciplines and used research methodologies.

The findings indicate that IS has primarily focused upon studying the impact of IT upon organizational consequences. The adoption of IS has been a widely studied phenomenon. Further, the findings suggest the Technology Acceptance Model (TAM), Task-Technology Fit (TTF) and the Resource Based Theory (RBT) have been the most commonly utilized theory bases. The paper also discusses how IS has pursued a number of evolving phenomenon and in the process has expanded the theoretical frameworks of the reference disciplines.

Keywords: Reference Disciplines, Theoretical contributions, Information Systems Research

INTRODUCTION

A quarter of a century after Peter G.W. Keen called for information systems (IS) to draw upon theories from reference disciplines – economics, psychology and social sciences, the debate over the role of theory in information system research continues (Keen 1980). The search for a balance between rigor and relevance (Benbasat and Zmud 1999) has once again renewed the question of what role should theory play in developing frameworks that are relevant for practitioners -- after all, the IS discipline differentiates itself as practice-oriented compared to computer science discipline's more technical role. At the same time, researchers have challenged IS research to demonstrate the IT artifact in their research (Orlikowski and Iacono 2001).

We must take stock of what IS research has learned from the reference disciplines in explaining the phenomenon associated with human and organizational interaction with information systems, assess where it is wanting in theoretical grounding, and identify opportunities for use of theories both from within and from other disciplines. However, the use of theories from reference disciplines is not a one-way street. Theories drawn from reference disciplines are likely to have been enriched by their use in IS. Recent research has conducted histographical examination (Farhoomand and Drury 1999) and mapped ontology of IS research (Lee Lee and Gosain 2004) to understand methodological and thematic trends, and has created categories mapping theories to frameworks in IS research. These studies make valuable contributions of engaging in self reflection, recognizing diversity, and identifying gaps in theory development in the IS discipline.

In reporting preliminary results of an ongoing study, we review previous research to examine the use of theories, methodologies and context in published IS empirical research within organizations and the role of these theories in explaining the IT-Organizational interaction phenomenon. The objective of this research is to (i) explore the focus of IS research (ii) identify the theories most widely applied (iii) investigate the research methodologies utilized, and (iv) highlight the contributions of IS research to reference disciplines.

We utilize, and build upon, the Silver, Markus and Beath (1995) (SMB) Information Technology Interaction Model as a roadmap to examine the locus of such theoretical and methodological contributions. This analytical approach will provide an opportunity to identify theoretical gaps in our understanding of the role that IS plays in inter and intra-organizational relationships. Findings from this research will provide guidance for future researchers as to which theories to draw upon when researching an IT-related phenomenon, and where new theories are needed. In addition, our findings will demonstrate how IS research has contributed to existing theories while highlighting opportunities to expand the boundaries of other

theories. Given the evolving nature of IS and their critical role in expanding a firm’s capabilities, such examination is important for the development of IS as well the reference disciplines.

RESEARCH METHODOLOGY

The data for this research was gathered through the ISI Web of Science database. The search criteria consisted of key words ‘theory’, ‘theoretical’, ‘model’ or ‘framework’ for the period 10-year period between 1995 and 2004 (See Table 2). We collected the data in 2005 and to ensure completeness, our data collection concluded with 2004. Beginning with 1995 provided a 10-year window which coincided with data availability in several online databases. Consistent with journals used in previous information systems studies, we also included US and European journals in our study. Our selected journals are Decision Support Systems, Information Systems Research, Journal of Management Information Systems, Management Science, MIS Quarterly, European Journal of Information Systems, and Information Systems Journal. The selected articles were reviewed to ensure that they were indeed relevant and empirical in nature. Conceptual papers were excluded from the data (See Table 3). The final tally yielded 333 usable journal papers which applied at least one theory, model, or framework in an information system setting.

We considered several IS models as a possible lens to categorize the surveyed articles e.g. (Soh and Markus 1995) and (Lucas 1993). However, we decided to base our classification upon the Information Technology Interaction Model presented by Silver Markus and Beath (1995), henceforth referred to as SMB model, and examine the loci of such theoretical contributions. The SMB model, although primarily proposed to facilitate teaching the MIS course in business schools, is well-suited for researching how technology impacts organizations. It highlights most of the factors that were explored by the surveyed articles.

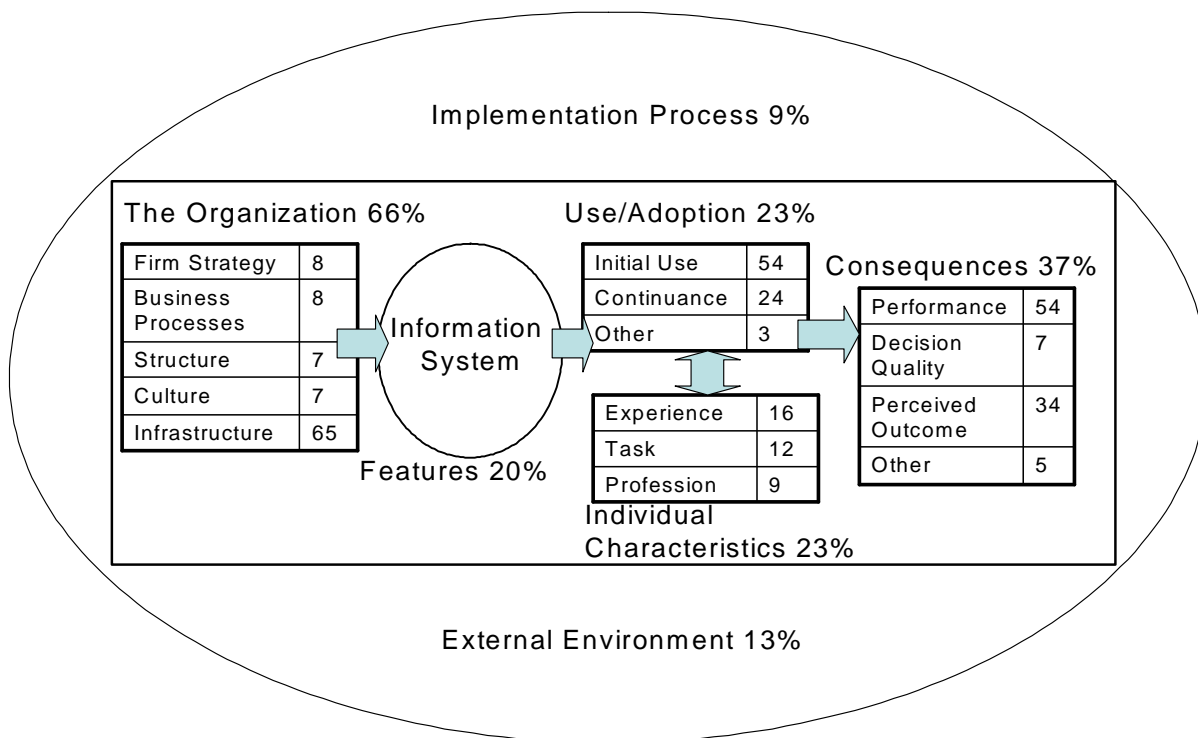


Figure 1: The percentage of 333 studies utilizing theories and models

FINDINGS

Our search yielded 114 theories, models, and frameworks from 333 publications. An examination of the studies suggested the need to extend the SMB framework. For instance, 23% of the surveyed studies researched ‘individual characteristics’ while 7 articles deployed theories to examine organizational ‘culture’, neither of which are explicitly discussed in the SMB model. Therefore, we extended the SMB model to include the above components in Figure 1 and Figure 2. Given that many studies utilize multi-theoretic models to examine variables pertaining to IT and organizations, the sum of the percentages allocated in the figure 1 and 2 can exceed 100. We discuss our preliminary findings below.

What is the focus of IS/IT research?

We find that about two-thirds of the studies examine one or more components of the organization when studying an IS phenomena. This suggests a continuing, and perhaps growing, interest in studying organizations’ strategy, processes, and infrastructure. Within IT infrastructure, software development tools and IT compatibility are most widely studied. The implementation process of IS as well as the external environment are scantily studied. A further examination reveals that when examining the consequences, over half of the studies utilized performance based measures, while about one-third have studied users’ perception of consequences. We do not find studies that utilized performance measures and users’ perception of performance. In other words, past studies have not captured together the objective and perceived criteria and it appears to be a fertile area for future IS research. This call is justified by the findings of Straub et al. (Straub Limayem and Karahanna-Evaristo 1995) that these two types of measures do not usually converge. The preponderance of surveys, experiments, and case studies indicates an opportunity for future research to consider objective economic performance measures from archival data as another way to assess the value of IS.

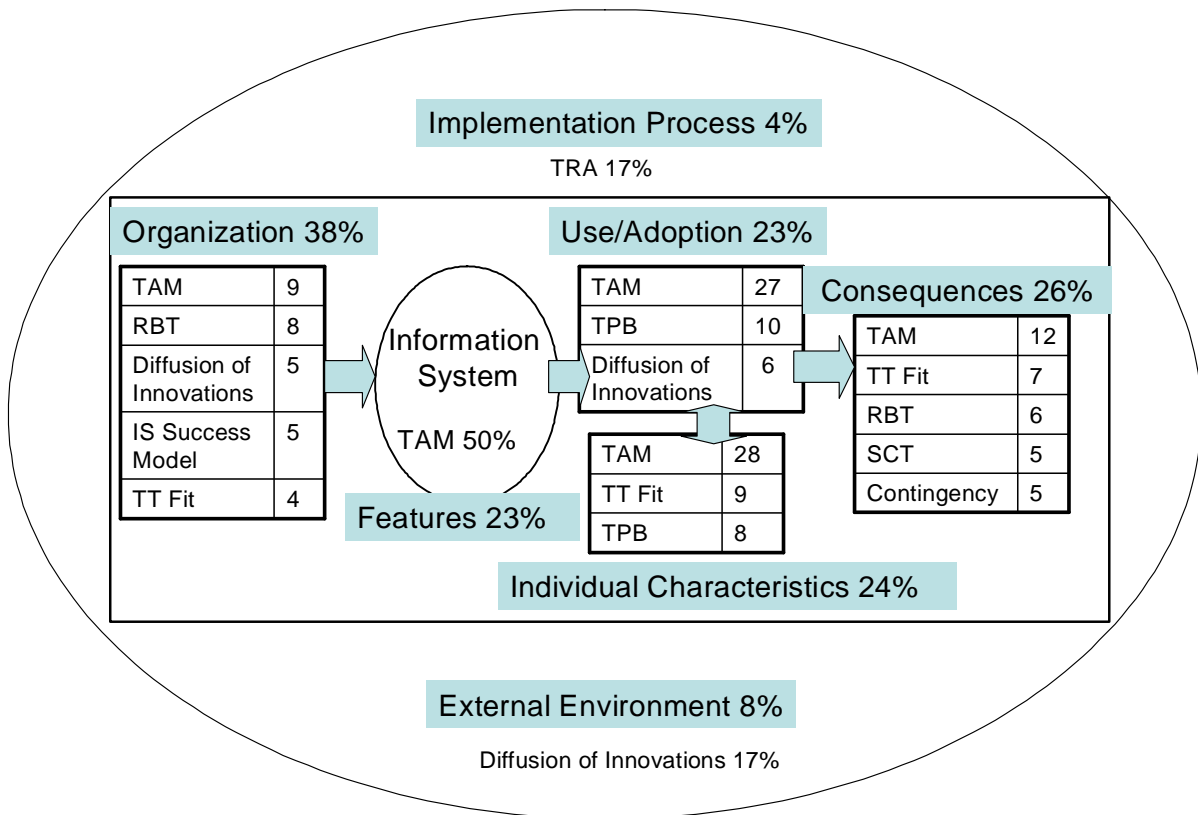


Figure 2: The prominent theories (%) utilized in the SMB Model

What theories are most widely used?

In order to understand the use of theory in IS/IT research, we superimposed the leading 3 to 5 theories in each segment of the SMB model. As shown in Figure 2, Technology Acceptance Model (TAM) is the leading theoretical basis for IS research in most segments. TAM was deployed in half the studies that examined IS functionality and features such as the user interface, and the capabilities of decisional guidance. Overall, TAM was utilized as a theoretical framework in about 30% of the IS research studies in our sample.

Given that TAM attempts to understand the usefulness and ease of use of an IS, the most common locus of TAM is in the study of use/ adoption and individual characteristics of those who use IS. Research in individual characteristics involves understanding such user characteristics as human cognition, task, or gender differences in the usefulness of IS. Task-Technology Fit (TTF) was the second most commonly deployed (7%) theoretical base in IS studies. Goodhue and Thompson (1995) proposed TTF to explain the linkage between IS and individual performance.

Our analysis of the data indicates that the resource based theory (RBT) as one of the prominently used perspective to understand IS impact on the organization infrastructure and hence the consequences of IS on organizations' performance. However, we find no evidence of RBT use in understanding organizational structure, culture or processes. This presents opportunities for future researchers to examine the extent to which these organizational characteristics, supported by IT, could serve as hard to imitate resources for firms. IS implementation process is another area where we do not find RBT being used. We believe that RBT, or similar theories such as the dynamic capability theory, offer the ability to explain how resources are created and deployed for IS implementation in achieving the firm's success.

What research methodologies are most commonly used?

. A significantly fewer studies conducted experiments or utilized objective data analysis to seek answers to their research questions. The most common methodology involved case studies of organizations to gather data and execute the research (Table 1). Over one-third of the studies utilized survey as a research methodology for gathering data for research.

How has IS research studied and expanded the phenomenon of interest?

Lee, Lee and Gosain (2004) define phenomenon studied by IS as behavior, cognition, strategy and outcomes. We refine their definition of phenomenon and include those topics that have demonstrated progress in the line of inquiry. For instance, we include technology adoption as a widely studied phenomenon in IS research. Given that the success of an IS is contingent upon the use by the end users, early studies focused upon the likelihood of the end users to adopt IS based upon the ease of use and the usefulness of the IS. Later works (Bhattacharjee 2001a, b) argued that although initial use is a critical first step of IS success, continuance is a measure of greater interest to organizations.

This line of research is particularly relevant to continued use in an electronic channel (Hsu and Chiu 2004). More recently, Kohli and Kettinger (2004) further the issue of IT adoption and continued use and argue that knowledge workers such as physicians must not only adopt and use IT but their continued use must be reflected in their practice behaviors. This line of inquiry has theoretical implications and the potential to expand control-related theories such as agency theory and concertive control theory as well as economic theories such as transaction cost theory.

Other Observations

Below is a brief description of our preliminary observations from the data. We anticipate a deeper set of observations and potential reasons to emerge from our research in the future. For instance, we find a less than 10% of studies in our database utilized longitudinal data for multiple periods. For the IS discipline to advance, the impact of a phenomenon must be viewed over time. Such longitudinal data allow researchers to view lag effects of technology interventions.

CONTRIBUTIONS

An objective of this research is to understand how the IS discipline has contributed to the reference disciplines. Below we briefly describe examples of how IS has contributed to the theories of its reference disciplines.

The TAM (Davis Bagozzi and Warshaw 1989) drew upon psychology as the reference discipline and built upon theory of reasoned action (TRA) and theory of planned behavior (TPB). A large number of studies utilizing TAM have shown that perceived IS ease of use and perceived usefulness are important predictors of technology acceptance. As technology deployment grows, the TAM will serve as an important tool to understand how likely the users to accept the system are. Acceptance is the first step in the adoption of technological systems, beyond those of IS.

Drawing upon the dynamic capability theory (DCT), Wheeler (Wheeler 2002) proposed the net enabled business innovation cycle (NEBIC) theory that asserts that for net-enabled firms choosing IT precedes rather than aligns with corporate strategy. The conventional wisdom thus far has suggested that IT should be align itself to the business strategy (Porter 2001). Given the unique characteristics of IT in firms, compared to other resources, NEBIC has the potential to expand managerial theories of competition.

Other examples of IS contribution to reference disciplines are Gefen and Straub’s (2000) inclusion of gender as a variable in the perceived social presence and information richness (SPIR) addendum to TAM, and information technology related control issues and the implications for agency theory (Kohli and Kettinger 2004).

The results of the analysis inform the IS researchers by:

- (i) identifying theoretical gaps in the study of IS within and outside organizations,
- (ii) providing guidance as to which theories to draw upon when researching an IT-related phenomenon,
- (iii) identifying research areas (using SMB model) where theory development is needed, and demonstrating how IS research has contributed to existing theories while highlighting opportunities to expand the boundaries of existing theories.

Research Methodology	Count	%
Survey	118	35%
Case Study	89	27%
Data Analysis	49	15%
Experiment	45	14%
Operationalization	11	3%
Action Research	8	2%
Meta-Analysis	3	1%

Table 1: Research methodologies utilized in IS research

	Search Term			Total	After removing redundant/incorrect	Potentially suitable ¹	Uncertain
	“Theor*”	“Model”	“Framework”				
<i>Web of Science:</i> DSS, ISR, JMIS, MS, MISQ, EJIS, ISJ	286	365	154	805	553	344	9

Table 2: Initial Search Results

¹ Include Computational Model, Data Analysis, Empirical, Experiment, Field Study, Longitudinal Study, Survey, and Scale Creation/Testing

Term	Meaning	Search Terms
Action Research	Use action research as the methodology	Action Research
Case Study	Use case study as the methodology	Case Study; Case; Interview
Computational Model	Develop and/or test mathematical model	Computation; Algorithm
Conceptual Model	Develop a theory/model/framework, with or without testing	-
Data Analysis	Analyze (secondary) data (do not specify methodology)	-
Design Modeling	Propose and/or test a system design/notation method	Prototype
Empirical	Empirical study (do not specify methodology)	Empirical; Finding
Ethnographic Study	Conduct Ethnographic Study	Ethnographic Study
Experiment	Do lab or field experiment	Experiment
Field Study	Conduct field study (do not specify methodology)	Field Study
Longitudinal Study	Use longitudinal data (do not specify methodology)	Longitudinal Study
Meta-Analysis	Conduct meta-analysis of past literature	Meta-Analysis
Qualitative	Use qualitative methodology (do not specify methodology)	Qualitative
Review	Review of literature or a phenomenon	Review
Scale Creation/Testing	Develop and/or validate a instrument	Operationalization; operationalize
Simulation	Computer simulation of a particular phenomenon	Simulation
Survey	Use survey to collect data	Survey; Questionnaire; Sample; Respondents
Taxonomy	Propose a taxonomy	Taxonomy; Categorize; Typology
Viewpoint	Authors' point of view, esp. on research methodology	-
Unknown	Cannot judge by simply reading the title, keywords and abstract	-

Table 3: Terminology and interpretation of "Theoretical and Empirical" Fields

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