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EMPIRICAL STUDY OF STAKEHOLDERS' PERCEIVED BENEFITS OF INTEGRATION ATTRIBUTES FOR ENTERPRISE IT APPLICATIONS

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Introduction

According to leading researchers, integration is the most distinguishing characteristic of Enterprise Systems (ES) and often is a core objective for the organizations that acquire and implement these large-scale systems (Markus 2001; Parr & Shanks 2000; Markus & Tanis, 1999; Alsene 1994). Cadarette and Durward remind us that the goal of integration for information technology (IT) is not new and it has not been easy to achieve (2000, p. vp¹):

“...from the dawn of the computing age, integrated automation has been the Holy Grail of computing. And like the Holy Grail, achieving full integrated automation remains elusive, despite huge investments in a wide array of technologies that promise integration...”

Is integration fundamental to the success of information systems (IS) such as ERP (enterprise resource planning) and EAI (enterprise application integration)? If so, shouldn't we understand why important stakeholders desire integrated systems and which characteristics of integration are associated with those outcomes? If integration is a major goal of ES, do we understand how key stakeholders perceive integration or what benefits will be forthcoming for having more or less of it?

Markus and Tanis say that, “Integrated enterprise systems deserve serious research because of their great potential for financial, technical, managerial, human, and strategic benefits, costs, and risks” (1999, p. 173). All indications are that integration is central to ES and their success. If integration is an important IT success factor of enterprise systems then it deserves serious research. A better understanding of integration attributes and benefits along with understanding why people value integration should allow us to improve our planning, selection, management, and evaluation of enterprise systems.

This paper provides a research model which can begin to address the value of integration in information systems by looking at linkages between stakeholders, integration, and benefits. Because integration has been identified so strongly with enterprise-wide systems, those technologies have been selected as the lens to research integration. Since stakeholders participate in decisions which ultimately enact ES, we have chosen to look at how their perceptions of integration benefits are related to attributes associated with integrated systems.

Research Questions

“Too much attention has been devoted to ‘what’ as opposed to ‘why’ or ‘when’ relationships exist...” (Lee et al. 1997, p. 109). The goal of this research is to address the ‘why’. However, before we can answer the whys, we must first define the issues. This study will therefore address both the ‘whats’ and the ‘whys.’ In an effort to throw light on the unique issues of integration, my overall research question is: why do decision makers believe that IT integration provides benefits to organizations? Specific questions are:

1. What are the attributes or characteristics of IT integration people associate with large-scale enterprise systems?

¹vp (virtual page) denotes that the article exists only on the web or the article was found on the web but the printed version was not available at press time.

2. What are the perceived benefits of IT integration in an enterprise system?
3. Are certain integration attributes associated with a particular perceived benefit?
4. What might explain the linkage between benefits and integration attributes?

Relevant Literature

Integration is a widely applied concept in science, engineering, and economics as well as IT (Pelkmans 1980; Anderson 1991; Hunt 1993). To avoid continually expanding the scope of this research, we have limited the review of integration to what can be discovered in IS/IT literature. References to integration as an act or a state is found in discussions of applications, computer programs and modules, business processes, data, and technology. Enterprises systems is the lens selected to discuss and research integration. Within ES, we are only concerned with the integration among applications.

Defining Integration

A closer look at the concept of integration reveals not clarity but a tangled mess. Generally, the concept of integration is offered without definition; its value and the source of its value are generally unexamined. This situation becomes even more complex when placed in the context of enterprise systems due to their large scale and scope. Bhatt (1995) proposed that integration for ES is “the extent various information systems are formally linked for sharing of consistent information within an enterprise.”

Bhatt’s definition provides a starting place to measure ES integration in a post-implementation snapshot for a single system. It isn’t clear how this construct would help firms determine the extent to which integration would be valuable for their firm, or to compare alternative systems or evaluate the benefit of various design scenarios. While the merits and nature of integration is implicit in most ES articles, the attributes and specific benefits are not tied directly to integration. Integration is a huge subject and includes applications, computer programs, processes, and data to name but a few examples. My research focuses on the role of integration in the context of enterprise applications.

Integration Limits and the Downside

“The value of [an ERP system] is that it is totally integrated; and the downside of [an ERP system] is that it is totally integrated” (Strong et al. citing Filipczak 1997, p. 1049). Contrary to popular belief, integration may not always be desirable or deemed practical for a variety of reasons including complexity, turbulent business environment, and rapid technological changes. Some of these references argue against seeking a high degree of integration citing a variety of reasons (Hecht, 1997; Sasovova et al. 2001). Some seem to think that full integration may not be possible.

“The notion that a company can and ought to have an expert (or group of experts) create for it a single, completely integrated supersystem—an “MIS”—to help it govern every aspect of its activity is absurd.”
Dearden 1972 cited in Markus & Tanis 1999, p. 173

History of IT Integration

The idea for enterprise-wide integration was considered as far back as the 1950s and 1960s (Alsene 1994). Integration has evolved from interfacing modules of a computer program to coupling of entire organizations with one another (known as B2B)—see figure 1. As might be expected, successive generations of integration technologies have become increasingly complex as the scope continuously expands.

ERP and EAI Literature

Several authors have lamented the lack of empirical research for enterprise systems. The literature that we have does not explicitly address integration and associated benefits. Yet, from the literature, we are able to glean a number of integration attributes and ascribed benefits of enterprise systems. Integration appears to be intimately related to the success of enterprise systems. Most of the available literature about EAI and ERP is found in books and practitioner articles. Few refereed academic articles are available. Boudreau and Robey (1999) have proposed theoretical choices for process research for ERP. Brown and Vessey (1999) have proposed a contingency framework for ERP implementations.

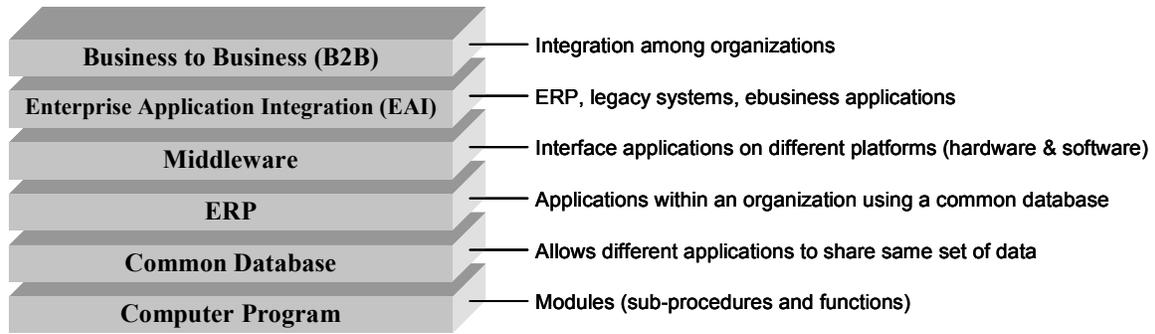


Figure 1. Integration Developments and Hierarchy

Case studies are a popular research methodology which describes successes and failures of ERP projects (Clemons 1998; Puschmann, et al. 2001; Themistocleous & Irani 2002). Popular books about enterprise systems have been written by David Linthicum (1999); Ruh, et al. (2000); and Thomas Davenport (2000). Many are descriptive or prescriptive in nature. None appear to be directly related to this research effort. However, all have implicit knowledge about perceived benefits and integration attributes that does bear on this research. Specific references and associations are provided in the tables below.

Perceived Benefits of IS/IT

None of the literature has attempted to measure integration or perceived benefits although both are frequently discussed. User perceptions have been important in several streams of research. Use of perceptions is a frequent means to gain the cognition of participants regarding the subject matter under investigation. Perceived usefulness and perceived ease of use from TAM (Davis 1986, 1989) and TAM2 (Venkatesh & Davis 2000) are probably the best known uses of perception in MIS. Perceived benefits (table 1) is employed in several disciplines to establish relationships between attributes and beliefs. Table 2 lists several examples of perceived benefits found in the IS/IT literature.

Table 1. Selected Literature Employing Perceived Benefits

Accounting	McGowan, Annie S 1998; Gramling, Audrey A. 1997; Lipe, Marlys Gascho 1993
Decision Science	Guimaraes, et, al. 1992
Management	Holt, Diane 1998; Kaufmann, et al. 1995
Marketing	Higgins, Kevin T. 1998
MIS	Iacovou, Charalambos L. 1995
Operations Management	Murphy, Paul R. 1996; Ghobadian, A. 1994; Armistead, Colin G 1993; Freeland, James R 1991
Other	Blumenfeld, Tracy Harmon 1998; Staniforth, David 1995; Cox, Clifford T. 1991

Perceptions are grounded in Ajzen's (1991) research that produced the Theory of Planned Behavior (TPB). He established relationships between beliefs, attitudes, intentions, and behaviors. "According to the theory, human behavior is guided by three kinds of...beliefs..." (Ajzen 2001). Perceptions are based on beliefs and attitudes. Decisions (our learned predispositions to respond in a given manner) are outcomes of perceptions. Perceptions are the foundation for decisions. This idea has been heavily researched in marketing (Muthitacharoen & Palvia 2001). The foundation of preferential choice is attributes and attitudes. It is unclear how people make integration decisions but it seems reasonable to believe that people make choices based on perceptions. We posit that attitudes towards integration coupled with the attributes of integrations will explain why individuals make integration decisions.

Table 2. Example Perceived Benefits of Integrated Enterprise Systems

Perceived Benefits	Source
Lower Cost	Herr 1996; Markus & Tanis 1999
Customer service	Markus & Tanis 1999
Facilitate organizational change	Boudreau & Robey 1999
Replace Legacy Systems	Markus & Tanis 1999; Boudreau & Robey 1999
Acquire multi-language and multi-currency IT support	Markus & Tanis 1999
Operational improvements	Herr 1996

Integration Attributes

Implicit attributes of integration are discussed in the literature. Table 3 contains several integration attributes identified thus far. Example integration attributes include data sharing, connections, and real-time. These attributes explain specifically how applications are integrated. Data sharing is an implicit part of nearly every discussion of integration. Application integration is defined as “unrestricted sharing of information between two or more enterprise applications” (Linthicum 1999). A connection involves establishing a link between applications. There are different types of connections but each have a common objective which is to permit sharing of information among applications. EWS [enterprise wide systems] package developers pride themselves on the dense set of interconnections that these packages claim to manage (Sor 1999). Real-time interaction implies non-delayed interactions (such as data sharing) among application components. This is in direct contrast to batch processing. Real-time processing is an attribute that apparently has desired benefits. “The ideal setup [for chemical process industries] would integrate business and manufacturing in real time...” (Shanley et al. 1999).

Table 3. Example Integration Attributes

Integration Attribute	Source
Data sharing	Linthicum 1999; Kalakota & Whinston 1993; Bhatt 1995
Connections	Sor 1999; Bhatt 1995; Alsene 1994
Real-time processing	Margulius 2002; Shanley et al. 1999
Common database	Cadarette & Durward 2002; Veth 1998; Bhatt 1995
Seamless operation	McGuire 1999; Clemons 1998; Davenport 1998
Interface	Zimmerman 1969; Alsene 1994

Model

Figure 2 is the research model proposed for this study. Certain integration attributes are thought to be associated with perceived benefits. Stakeholder characteristics appear to moderate the benefits for a given set of attributes.

Integration attributes (IA) are the properties that characterize how IT components interact. Distinct IAs (such as data sharing and real-time) are discussed in the literature. Example IAs are application data sharing, real-time processing, and application connections. See table 3 for examples of other attributes. Perceived benefits (PB) are the outcomes valued by organizations. Example PB are improved customer service, replacement of aging legacy systems, and increased functionality. Table 2 lists additional perceived benefits. Stakeholders are thought to change the perception of benefits. Intuitively, it seems that individuals that are members of one group will differ from those of another group in terms of how they perceive integration benefits. In comparing end-users to IT professionals, it is likely that each will ascribe different benefits to the same attributes.

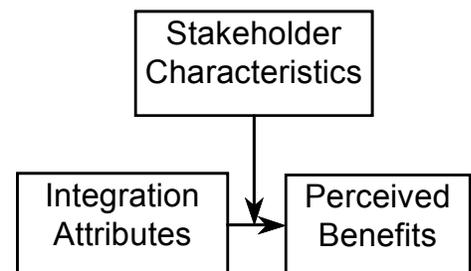


Figure 2. Perceived Benefits of Integration (PBI)

It is thought that a given subset of IAs are associated with a specific PB. PBs are thought to be the basis for enterprise IT integration decisions. Integrations decisions are believed to be one of the ERP success factors. The proposed study seeks to discover a parsimonious set of integration attributes and perceived benefits. In doing so, we will attempt to discover why given attributes are thought to have associated benefits. Further, the study will attempt to determine why people choose particular integration strategies.

Three stakeholder groups are being considered: end-users, IT professionals, and management. The groups differ in many respects—these differences are called characteristics. Although this part of the study has not been fully developed yet, we can speculate as to the differences. Likely characteristics are: education/training, type of responsibility, technical knowledge, objectives, and role in the organization. For instance, end-users may be interested in those things that make doing their job (specific tasks) easier. Management may also care about the tasks performed, but may also be interested in how all the people within their division work together to achieve objectives. IT professional may only care that software is functioning as designed.

Study Design

Instrument Development

A new instrument will be developed. Questions to be included will be based on the literature and the qualitative field research. The information obtained from the field research will be used to create a survey instrument. The field study results will also be used to make sense of the issues, problems, and possible solutions for those involved with enterprise application integration. A question and answer format will be used to solicit input from interview and focus group participants. Most questions will be open-ended and participants will be encouraged to add anything deemed important or relevant that was not covered by the questions. At the end, participants will be asked to respond to a list of simple phrases in order to get feedback for concepts (like real-time) found in the literature. Cognitive mapping will be used to analyze the qualitative data collected.

The draft of the initial questionnaire will be circulated to several experts for their evaluation and input. Two types of experts will be used: Enterprise systems domain experts and questionnaire creation experts. The questionnaire will be modified based on the feedback from these experts. The next step will pilot test the instrument to obtain preliminary analysis regarding validity and reliability. The data from the pilot test will be analyzed and the instrument revised as needed.

Survey Administration

A paper questionnaire will likely be used to conduct a single survey of individuals deemed representative of stakeholder groups. Several steps will be taken to maximize participation. Two-three firms will be selected where the university has key contacts. Efforts will be made to secure a high-level sponsoring executive at the firm. Pre-survey announcements will be sent out explaining the nature and purpose of the survey. We anticipate two types of follow-up. Reminder postcards will be mailed as the first follow-up. The second follow-up will be personal phone calls. Use of a web survey is under consideration, but that decision is premature at this point.

Sample

Participants will be selected from organizations that have experience implementing integrated enterprise systems. The survey will be sent to an equal number of people in each of the three stakeholder groups (end-user, information technology professionals, and operational managers). A survey will be sent to approximately 1,200 individuals (400 per stakeholder group) in 2-3 different organizations of the same type. A 25-30% return rate is typical which will provide a data set of about 300-360 which is adequate to meet the statistical assumptions for most multivariate data analysis techniques.

Unresolved Issues

A number of issues have yet to be addressed and it likely that some cannot be dealt with in this study. Below is a brief summary of several key issues.

- Integration may not always be desirable. This poses the problem of knowing when and why integration may present a credible threat or problem. For instance, disintegration is equally as important as integration. “If integration is hard enough, disintegration is unlikely to be any easier and it carries more risks” (Sasovova et al. 2001). Disintegration occurs when it becomes necessary to remove an IT component such as when a division is sold.
- The sampling technique is not random. Instead, the sample will be taken from organizations where there is reason to believe that the survey return rate will be high.
- The nature of survey means that self-selection in the sample occurs because a subject decides if he/she will participate.
- This is the first study of this type and it uses a newly developed instrument
- Future replication is needed to validate this research effort.
- This study is limited to those who have experience with enterprise systems. Other firms may have evaluated and chosen alternative solutions. Hence, this study would not reflect the insights of those who rejected typical ES solutions.
- The experiences of firms with ES range from total failures to highly satisfactory with most having only achieved partial success. It is unclear how a firm’s ES experience will affect their judgment and hence their response.

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