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Abstract

While organizations, collectively, spend billions of dollars to achieve "integration," little is known about practitioners' perceptions of integration that influence these decisions and actions. This paper describes a qualitative research study to surface practitioner interpretations (assumptions, knowledge and expectations) of applications integration. Evidence from interviews of 51 practitioners representing three stakeholder groups – managers, IT professionals, and end users – revealed 15 major themes related to practitioner perspectives of the characteristics, benefits and downsides of applications integration. The findings indicate that there is no generally accepted definition of what applications integration is or ought to be, and that there are significant differences among the stakeholder groups regarding the potential benefits and downsides of applications integration.

Keywords: Applications integration, enterprise system, stakeholder perspectives

Introduction

Integration has been the dominant IT theme for organizations over the past ten years. The integration of separate and isolated "islands" of systems and data began with projects involving a few applications (Tapscott and Caston 1993). Today, the scope of the integration efforts has broadened to encompass enterprise-wide initiatives such as enterprise resource planning (ERP) systems and enterprise data warehouses (Davenport 2000), and interorganizational systems (IOSs) that transcend legal enterprise boundaries (Konsynski 1993; Kumar and van Dissel 1996). Organizations, collectively, spend billions of dollars to achieve "integration." However, little research has been conducted to understand practitioner perceptions of integration that influence these decisions and actions.

The purpose of the research presented in this paper is to surface practitioner interpretations (assumptions, knowledge and expectations) of applications integration. Similar to work on the social construction of technology (e.g., Barley 1986) and technological frames (e.g., Orlikowski and Gash 1994; Tan and Hunter 2002), we adopt the position that interpretations of applications integration by practitioners are socially constructed and subject to multiple interpretations (Berger and Luckmann 1966), and that these interpretations shape organizational outcomes. In this paper we describe the findings of an exploratory study to develop an initial understanding of sense-making and perceptions of applications integration by three stakeholder groups – managers, IT professionals and end users. As the findings of the study indicate, there is no generally accepted definition of what applications integration is or ought to be. While it is generally assumed that the value of integration is "obvious," the results of this study indicate multiple interpretations of the key characteristics, benefits and disadvantages of applications integration.

Data was collected on the three stakeholder groups described above. Analysis of stakeholder differences is not the primary purposes of this paper, but will be the topic of a future paper. However, some differences in groups are reported in the results.

This paper begins with a brief description of approaches to IT integration pursuits beginning in the 1950s. Then, the purpose of this research, its importance, and the need for continued research on this topic are discussed. Next, the research is described and includes the methodology, data collection, and data analysis procedure. This is followed with a description of the results and supporting evidence. The appendix contains a summary of the quantitative results. The paper concludes with a discussion of implications and future research directions.

Integration Approaches and Importance of IS Research on Integration

Integration is a widely applied concept in science, engineering, computer science, and economics as well as IT (Pelkmans 1980; Anderson 1991; Hill et al. 1993; Fulton 1995, Davenport 1998). A review of the topic of integration in the IS research literature shows that the pursuit of IT-enabled integration dates back to the dawn of the computer age – the idea for enterprise-wide integration was considered as early as the 1950s and 1960s (Alsene 1994). For over 50 years, experts have sought to integrate the various functions of the enterprise using computers (Diebold 1952). The initial concept was to create a single, totally integrated system for an enterprise (Gordon 1960; Blumenthal 1969). The next major school of thought that followed sought to achieve enterprise integration by having all programs "feed" off a single, centralized database for the entire organization (Diebold 1965). In practice, the focus of integration efforts has evolved over the past 5 decades from interfacing modules of a computer program to the electronic coupling of different organizations with one another (known as B2B). Successive generations of integration technologies have become increasingly complex as the scope of integration has continuously expanded.

Historically, the research emphasis in information systems and computer science domains mirrors a similar pattern, moving from 'small scope' to 'large scope' integration topics. The emergence of enterprise systems, in particular, has prompted calls for intensive IS research in this area. As Markus and Tanis (1999) comment, "Integrated enterprise systems deserve serious research because of their great potential for financial, technical, managerial, human, and strategic benefits, costs, and risks" (p. 173). Increasingly, IS researchers have begun to question assumptions about the benefits of integration and the degree of integration that is desirable or practical (Hecht, 1997; Sasovova et al. 2001), e.g.,

> "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).

> "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)

Others also echo Dearden's sentiment that the demands imposed by integration might be too great in some circumstances (e.g., Sasovova et al. 2001; Goodhue et al. 1992). Prompting these concerns are issues related to complexity, turbulent business environments, short applications lifecycle and rapid technological changes.

While IS researchers are questioning assumptions and raising concerns related to applications integration, no empirical research has been conducted to understand practitioner perspectives on applications integration. Because practitioner perceptions – including assumptions about the characteristics, benefits, and downsides of integration – influence decisions and actions, this represents a critical knowledge gap. As one viewer exclaimed, "Perception is reality." The purpose of this research is to begin to address this gap by surfacing the shared frames of reference (assumptions, knowledge, and expectations) (Porac et al. 1989) of three stakeholder groups - managers, IT professionals and users.

Method

Data Collection

The data collection method for the study was semi-structured interviews. Fifty-one participants were interviewed from four organizations ranging from the public sector of higher education to large and mid-size private sector petro-chemical firms. Each organization included members of three stakeholder groups – senior/mid-level managers, IT professionals and end users. Group

interviews of 3-5 individuals from the same stakeholder group were conducted. An interview guide was used, consisting of 12 semi-structured, open-ended questions designed to surface practitioner perspectives related to the topics shown in Table 1.

Recognizing that the articulation of what constitutes integration might be difficult for participants, multiple questions were designed to explore the same idea – e.g., What are the attributes of integration?, What is the difference between an integrated and non-integrated system? Interviews were approximately one hour in length and were tape-recorded. Each interview session was opened by reading a brief statement about the research and the purpose of the interviews. During the interviews, care was taken to avoid asking additional questions that might bias the responses. Additional unscripted questions were asked primarily to ensure that the interviewer understood a person's input or to help get the discussion started after a period of silence.

Table 1. Interview Topics

1. From an enterprise systems perspective, what constitutes integration of applications — what are the attributes?

2. What are the benefits of applications integration?

3. What are the downsides, or disadvantages, of applications integration?

4. What are the alternatives to applications integration?

5. How should applications integration be measured? How do you determine the extent of the integration?

Data Analysis

Content analysis was used to surface themes in the interview data that reflected practitioner understandings related to applications integration. The approach suggested by Weber (1990) was used to code the interview data. A set of codes used to classify the data was developed, based on concepts from the research literature and augmented with major additional concepts (emergent ideas) discovered by the researchers during the coding. Using a content analysis form developed for the study, each sentence from the interview transcripts was assigned one or more codes. Each data element (sentence) was coded by two different coders, the primary researcher and an IS doctoral student. The coders then met to assess the level of agreement in code assignments. Discussion resulted in refinement of the initial set of codes. The data was then recoded, again independently, by the two different coders. Average overall inter-coder agreement was 67%. However, the inter-coder agreement for the last two organizations coded was 74% reflecting much learning by the coders. Krippendorf (1980) recommends that inter-rater reliabilities be greater than 70%. Considering this is the first study that uses content analysis about perceptions of integration, 67% is considered acceptable.

Table 2 lists the most frequently cited attributes and benefits of integration. A more detailed summary showing category/dimension frequencies for each stakeholder group is shown in the Appendix. (Frequencies can provide an indicator of the relative importance of the ideas related to applications integration for each of the stakeholder groups.) The final step in the analysis was to review all transcripts, results of the coding and notes made by the researchers during the data collection/analysis process. Fifteen major themes, described in the next section, were identified.

Table 2. Most Frequently Mentioned Integration Attributes and Benefits

Attributes of Integration			Benefits of Integration		
Item	Count	% of Cat	Item	Count	% of Cat
Applications work together	53	16.8	Improved data accuracy/reliability	61	12.6
Data sharing	36	11.4	Lower Costs	49	10.1
Common database	29	9.2	Greater efficiency & productivity	47	9.7
Real-Time processing	25	7.9	New or increased functionality	38	7.8
Record once, use everywhere	24	7.6	Better management, decisions, analysis	33	6.8

Results

This section describes fifteen major themes that emerged from analysis of the interview data. The themes are organized into four groups. These themes paint an initial picture of the mental models of practitioners – how they "make sense of" applications integration.

Integration Attributes

1. *Articulation of integration*—a "benefits" view – Many of the practitioners interviewed, even those with extensive IT knowledge and experience, had difficulty articulating their interpretation of what integration "is" in terms of the characteristics of integration. Interviewees routinely described integration in terms of outcomes (benefits) rather than what constitutes integration.

2. *The "meaning" of integration—a simplified view* – Practitioners' comments reflected a relatively simplified view of what integration means. While most of those interviewed agreed that integration means "*working together*," their verbalized conceptualizations seldom elaborated beyond this basic idea.

3. *Dimensions of Integration Characteristics* – Three dimensions of integration characteristics—groups of related topics—were identified in the interview data: 1) Intrinsic core characteristics, 2) Functionality and behavior, and 3) Design concepts and standards.

Integration Benefits

4. *Dimensions of Integration Benefits* – Analysis of the interview data revealed six dimensions for perceived integration benefits: 1) Fundamental integration benefits, 2) Expected direct benefits, 3) People-centered benefits, 4) Functionality benefits, 5) Enabled benefits, and 6) Strategic benefits.

5. *Degree of Integration Practical/Desirable* – There was a high level of agreement among the practitioners interviewed that 100% integration is neither practical nor desirable. When asked to provide a rough estimate of the degree of integration that was practical, the average of the responses was 85% (Range: 65%-100%). Comments such as "Is there any purpose for integrating plant maintenance with student admissions?" were typical.

Packaged Enterprise Systems

To some, packaged enterprise systems have become almost synonymous with integration. Consequently, their view of integration may be biased somewhat by ERP vendors and their past experience with ERP software. ERPs were created to provide integrated solutions and therefore represent one valid view of integration. The comments in this section were made by those who use packaged enterprise software.

6. *Issues* – Interviewees cited problems and issues arising from the use of commercial enterprise system solutions provided by vendors such as SAP, Oracle, and PeopleSoft. One problem cited was lack of flexibility – "With an integrated system, you have to adjust the way you do business to the system – not the other way around." While recognizing that the software could be modified or interfaced with other applications in order to address this problem, it was noted that this option was rarely chosen due to the complexity and scope of the software and because custom alterations may become obsolete or no longer work with new releases. A complaint voiced by practitioners was constant upgrades which can be costly, time consuming and disruptive for organizations even though they realized that upgrades are necessary to solve problems and provide desired additional functionality.

7. *Unforeseen Benefits of Integration* – While most integration benefits described by the participants were not surprising, other benefits were unanticipated by the researchers – e.g., reputation and prestige attainment or enhancement; support for legal matters; to become independent organizationally and geographically; can leverage size to influence better deals and support; paperless or reduced paper operations; and empowered employees.

8. *Emergent vs. Sought Benefits* – Emergent benefits are typically not immediately evident and appear to surface or become recognized only after a period of time. Practitioners described several benefits that appeared to have emerged rather than being explicitly sought. The specific view depended upon the stakeholder group. A generally held view for explicitly sought benefits of applications integration include lower cost, increased efficiency, new functionality, and data sharing among applications, departments, and people. Example of emergent benefits are:

    ➢ Users gain a much better understanding of the overall organization and process – "In an integrated environment, users have a wider view of the organization because of the integration with other departments. They have a better understanding of how what they do affects other people and how what other people do affects them."

    ➢ People become less dependent on other people and departments for information – "I start to think back about the evolution of integration. To look back at the days when you had to fax stuff. They had to look at it and fax it back. Then, you store it or mail it. Now everyone just goes into the system and looks at the information for themselves."

9. *Enabler of Standardization* – A major advantage related to applications integration cited by several of the participants was establishing standardized processes and business practices firm-wide.

10. *Differences in Attitudes Related to Integration Based on Level of Enterprise System Knowledge and Experience* – While not a formal part of the data analysis, the researcher conducting the interviews observed differences in attitudes and perceptions related to integration based on the extent of knowledge and experience with enterprise systems. First, practitioners who appeared to know the least about integration were more likely to feel that 100% integration was a practical goal. The opposite opinion was expressed by knowledgeable and experienced individuals who felt that integration was not always practical. The second difference between these groups observed by the interviewer was that individuals with the most enterprise experience also appeared to understand and acknowledge the potential downsides and limits of integration.

11. *Integration Desirable in Spite of Problems* – For the most part, people with commercial enterprise systems experience felt that integration was still desirable even though they fully understood and acknowledged the numerous problems and downside to integration.

12. *Alternatives to Integration* – None of the participants could think of any practical or desirable approaches to achieve integration other than a commercial enterprise system package or "build your own" custom solution. In all fairness, the question was poorly worded. Instead of asking about alternatives to integration, the question should have been, "What alternatives are there to achieving integration other than with packaged enterprise systems or building your own enterprise systems?"

Philosophical and Stakeholder Differences

13. *Differing Views - Stakeholder Groups* – One of the key findings revealed in the data is that different groups of practitioners have different views of integration. The following comments are representative of the perspectives heard from members of the three stakeholder groups interviewed:

    ➢ End User: "I think of integration as you having this one system that everybody does everything in. Real-time [and] creates synergy."
    ➢ Manager: "Seamless, tightly coupled, shared databases, [and] single transactions [that] spawn multiple updates."
    ➢ IT Professional: "Seamless, combined, single point of entry, fewer number of systems, real-time, and non-duplicated data."

14. *"Parochial" Views of Integration Downsides* – While many of the downsides of integration voiced by participants are enterprise concerns, many concerns voiced could be described as narrow, or parochial views. For instance, one end-user remarked that, "If you mess up, everybody knows about it immediately."

15. *Integration - Fundamental Concept or Context-Dependent Views* – Some participants felt that integration is a context-dependent concept and depends on the size and/or particular needs of a firm. Others expressed the view that integration (in the context of applications integration) is a fundamental concept that transcends specific applications and domains.

Discussion

The results of this study indicate that while practitioners have a general idea of applications integration as "working together," they have difficulty elaborating the characteristics of integration beyond this basic view. Rather, their understandings of integration are framed primarily in terms of perceived benefits. Moreover, the study discovered a typology, or dimensions, of the benefits of applications integration described by practitioners. One of the key findings of the study was significant difference in the interpretations of applications integration held by the three stakeholder groups.

This study has shown that applications integration is at best a "fuzzy notion" to many practitioners. The study indicates that, ironically, many practitioners may have pursued, and continue to pursue, applications integration without a precise or deep understanding of what it is they are seeking to achieve. Neither do they have means to judge when it is "achieved" or even agreement about potential benefits and downsides of applications integration. The major contribution of this study is that it has surfaced initial understandings of practitioner perceptions of applications integration. These understandings will be important to future IS research as those perceptions influence actions and decisions as organizations seek to leverage the investments they have made in enterprise systems and begin to envision "post-ERP" applications architectures.

Summary and Conclusions

This paper reports the findings from the analysis of in-depth interviews of 51 practitioners from four different organizations that represent three stakeholder groups. The data confirms that integration is a ubiquitous and fundamental concept important to all areas of information technology including applications integration which has been the focus of this paper. However, as noted above, integration is a fuzzy notion that varies from person to person and group to group. Virtually everyone believes that integration is desirable although not for all situations.

So, the question remains, "What is applications integration?" The simplistic idea that applications integration means, "working together," while accurate, is too vague to be of any practical value. Based on this research, we suggest the following definition of applications integration:

> "Applications integration is the seamless infrastructure represented by a set of applications within a specified domain that share data, without any appreciable delay, and work together in a coordinated manner to perform all functions required by an organization" (Singletary 2003).

The need for a precise definition of applications integration may be debatable although a good definition should serve several purposes. A common frame of reference appears essential to understanding applications integration, which in turn seems necessary to manage and evaluate applications integration and to discuss the topic. Establishing common ground for communications does not require ignoring the diverse views of applications integration.

Additional research is underway that will shed light on the phenomenon of applications integration in terms of defining characteristics, benefits, disadvantages, and metrics to assess applications integration. Numerous opportunities are available for additional research and include:

- Replicating this study
- Investigating and testing ways to measure or assess integration
- Investigating other aspects of information technology integration including enablers of integration, integration infrastructure, and process integration in relation to information technology

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Appendix. Coding Summary

Category/Dimension Frequencies by Stakeholder Group

Frequencies – Number of Sentences Coded by Category and Dimension										
	Management			IT Professionals			End Users			
		% of			% of			% of		
			Cat		Sub	Cat		Sub	Cat	Sub
Category & Dimension	Freq	Sub Tot	Tot	Freq	Tot	Tot	Freq	Tot	Tot	Total
Integration Attributes										
Intrinsic Core Characteristics	37	40.7	33.0	33	36.3	25.0	21	23.1	29.2	91
Functionality and Behavior	40	34.2	35.7	51	43.6	38.6	26	22.2	36.1	117
Integration Enablers	35	32.4	31.3	48	44.4	36.4	25	23.1	34.7	108
Category Total	112	35.4		132	41.8		72	22.8		316
Benefits of Integration										
Primitive Benefits	78	35.3	44.6	64	29.0	48.5	79	35.7	44.1	221
Expected Direct Benefits	33	40.2	18.9	22	26.8	16.7	27	32.9	15.1	82
People-Centered Benefits	29	27.1	16.6	33	30.8	25.0	45	42.1	25.1	107
Functional & Oper. Benefits	7	77.8	4.0	1	11.1	0.8	1	11.1	0.6	9
Enabled Benefits	21	37.5	12.0	9	16.1	6.8	26	46.4	14.5	56
Strategic Benefits	7	63.6	4.0	3	27.3	2.3	1	9.1	0.6	11
Category Total	175	36.0		132	27.2		179	36.8		486
Total: Attributes + Benefits	**287**	**35.8**		**264**	**32.9**		**251**	**31.3**		**802**
Other Categories										
Integration Downsides	66	37.7		57	32.6		52	29.7		175
How to Measure Integration	43	35.5		49	40.5		29	24.0		121
Miscellaneous	25			21			23			69
Sentences not coded	197	33.3		213	36.0		182	30.7		592
Grand Totals	**618**	**35.1**		**604**	**34.3**		**537**	**30.5**		**1,759**