MIS Quarterly

ISSUES AND OPINIONS

UNCOVERING THE INTELLECTUAL CORE OF THE INFORMATION SYSTEMS DISCIPLINE[1]

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Abstract

What is the intellectual core of the information systems discipline? This study uses latent semantic analysis to examine a large body of published IS research in order to address this question. Specifically, the abstracts of all research papers over the time period from 1985 through 2006 published in three top IS research journals—MIS Quarterly, Information Systems Research, and Journal of Management Information Systems—were analyzed. This analysis identified five core research areas: (1) information technology and organizations; (2) IS development; (3) IT and individuals; (4) IT and markets; and (5) IT and groups. Over the time frame of our analysis, these core topics have remained quite stable. However, the specific research themes within each core area have evolved significantly, reflecting research that has focused less on technology development and more on the social context in which information technologies are designed and used. As such, this analysis demonstrates that the information systems academic discipline has maintained a relatively stable research identity that focuses on how IT systems are developed and how individuals, groups, organizations, and markets interact with IT.

Keywords: IS identity, IS research issues, IS research agenda, organizational identity, latent semantic analysis

Introduction

> *If influential stakeholders are unable to comprehend the nature, importance, and distinctiveness of the role being served by the IS discipline, these stakeholders are unlikely to acknowledge its legitimacy within the organizational field.*
>
> *(Benbasat and Zmud 2003, p. 185)*

[1]Detmar W. Straub was the accepting senior editor for this paper.

Over the past quarter of a century, the Information Systems academic discipline has made significant progress toward widespread acceptance within the academy. While the field is significantly younger than counterparts such as Management or Accounting, it is now considered to be a maturing discipline (George et al. 2005; Grover et al. 2006; Power 2003). Nevertheless, many IS researchers agree that continued development and success of the discipline depends on its ability to establish a strong identity (Benbasat and Zmud 2003; Robey 2003).

Identity concerns are not new. Some of the early efforts to shape the IS discipline's identity can be traced to Mason and Mitroff's (1973) article, "A Program for Research on Management Information Systems." Various scholars contributed to the refinement of the discipline's identity through the 1980s and 1990s by providing overarching frameworks to guide IS research (Ives et al. 1980; Nolan and Wetherbe 1980), by examining the relationships between IS and other disciplines (Keen 1980), by directing attempts at "disciplining" the field (Banville and Landry 1989), by providing editorial guidance (e.g., DeSanctis 1993), and so on.

Among the most visible efforts to shape the identity of the IS discipline is the diversity debate that took place in the mid-1990s (Benbasat and Weber 1996; Robey 1996). In particular, Benbasat and Weber (1996) examined the high level of diversity within the IS field, especially in terms of reference disciplines and theoretical foundations, suggesting that such diversity may have deleterious effects on the field's legitimacy. Robey (1996), while agreeing with Benbasat and Weber on some threats of diversity, argued that the advantages of diversity are much greater than its threats. Specifically, he argued that diversity promotes creativity and helps attract top researchers from different disciplines; likewise, denouncing diversity in IS research is equivalent to curbing the much-valued academic freedom. Along the lines of Landry and Banville (1992), Robey (1996) recommended the use of *disciplined diversity*, where the choices of theories and methodologies are driven by the research question rather than a dominant paradigm. Discourse on benefits and dangers of diversity continued into the 2000s. For example, Mingers (2001), another advocate of diversity, suggested a multi-method, multi-paradigm approach for IS research that would provide richer and more reliable results.

More recently, the identity debate resumed when Benbasat and Zmud (2003) expressed concerns about the lack of a distinctive intellectual core in IS research. Drawing on the work by Orlikowski and Iacono (2001), they point out that while the focus on information technology differentiates the IS field from others, many scholarly papers published in top-level IS journals did not investigate phenomena directly related to IT. It was argued that this lack of an "IT artifact" within many of these publications sent an ambiguous signal regarding the identity of the IS discipline. To remedy the situation, they proposed that IS scholars should focus on issues that are directly related to the development, use and effect of IT, and leave other phenomena to scholars from other disciplines (Benbasat and Zmud 2003). These provocative recommendations spurred a number of responses from IS academics (e.g., Agarwal and Lucas 2005; Iivari 2003; Lyytinen and King 2004; Myers 2003; Power 2003; Robey 2003; Westland 2004; Wu and Saunders 2003), some of which were featured and further elaborated in the book *Information Systems: The State of the Field* (King and Lyytinen 2006). For instance, Agarwal and Lucas (2005) partially agreed with Benbasat and Zmud on the need for a new, stronger identity of the IS discipline. They also cautioned, however, that a narrow focus on IT, with little attention to broader business issues, may lead to severance from other disciplines. Such a narrow view may, therefore, result in lower perceived relevance of IS research by both academics and practitioners. Adding to the debate, Robey (2003) also argued for a more flexible identity for the IS discipline, which would ensure higher adaptability of the discipline, making diversity a major strength of the field. A comprehensive comparative analysis of recent contributions to the identity debate is featured in Agarwal and Lucas (2005).[2]

While there are differences of opinions as to the nature of the IS discipline's identity (i.e., breadth and inclusiveness), most participants of the identity-related debates agree on the need to maintain a strong identity. In this paper, guided by the organizational identity construction literature, ***we seek to facilitate identity construction within the IS discipline by distilling the intellectual core from the multitude of individual research papers*** using latent semantic analysis (LSA). Using this methodology, we then trace the evolution of the IS discipline over the past two decades through the lens of research articles published in top IS journals.

The rest of the paper is organized as follows. First, we discuss how identity of a discipline is constructed and propose that a major difficulty in identity construction is related to distilling a common core from the extensive body of prior research. Then, we describe how latent semantic analysis can be used to address this issue, and go on to apply LSA to a col-

[2]This analysis includes Alter (2003), Benbasat and Zmud (2003), Deans (2003), DeSanctis (2003), Dufner (2003), El Sawy (2003), Galliers (2003), Guthrie (2003), Hirschheim and Klein (2003), Holland (2003), Iivari (2003), Ives et al. (2004), McCubbrey (2003), Myers (2003), Power (2003), Robey (2003), Weber (2003), Westland (2004), and Wu and Saunders (2003).

lection of IS publications. The results of this analysis are then examined, focusing on the implications for discovering the identity of the IS discipline. We conclude with a summary of findings, limitations, and directions for future research.

IS Discipline Identity Construction

Organizational Identity in the Management Literature

Organizational identity has been defined as "what is central, distinctive and enduring about an organization" (Albert and Whetten 1985). As such, it has been extensively examined in the management literature. Prior work has focused on understanding the relationship between organizational identity and the individual identities of organizational members or stakeholders (Ashforth and Mael 1989; Brown et al. 2006), the identity construction process itself (Brown 1997; Dutton and Dukerich 1991; Scott and Lane 2000), the evolution of organizational identity over time (Meyer et al. 2002), the effects of identity on organizational outcomes (Brickson 2000), and so on. Organizational identity was found to influence behavior of organizational members in various situations; therefore, understanding organizational identity is considered central to any organizational change efforts (Gioia et al. 2000).

Organizational identity is also closely related to the construct of organizational image, which is how leading organizational members, or "organizational elites," would like the organization to be perceived by external stakeholders (Gioia et al. 2000; Whetten et al. 1992). Specifically, as an organizational image is developed, it leads key internal and external stakeholders to reexamine their perception of the organization, acting as a catalyst for change in organizational identity (Gioia et al. 2000). The stakeholder approach to organizational identity construction (OIC) (Scott and Lane 2000) appears to be particularly relevant to addressing the alleged identity crisis in the IS discipline, given a variety of stakeholders that influence the identity of the discipline. Next, we discuss the stakeholder approach and how it applies to identity construction within the IS discipline.

Stakeholder Approach to IS Discipline Identity Construction

As suggested by the stakeholder approach (Scott and Lane 2000), a discipline's identity is constructed through a process of negotiation among its various stakeholders.[3] These include scholars, both within and from reference disciplines, administrators, public and private funding institutions, practitioners, and the society at large (see also Benbasat and Zmud 1999). Similar to managers in traditional organizations, the most influential of these stakeholders, often editors and editorial board members of key research journals, construct the desired image based on strategic considerations, the need for self-definition, and the perceived believability of such image. In the context of the IS discipline, such image construction is likely to be reflected by the composition and editorial policies of the top IS journals. For example, the article by Benbasat and Zmud (2003) calling for stronger focus on IT artifact in IS research can be considered a communication of a desired image of the IS discipline to its stakeholders. Such a communication has a direct effect on the discipline's identity (i.e., on how various stakeholders view the discipline). Figure 1 shows the stakeholder approach for identity construction within the IS discipline.

In response to the communicated image, various organizational stakeholders express how they view the organization through *reflected stakeholder appraisals*. In the context of the IS discipline, internal stakeholders (IS academics) are likely to closely identify with the IS discipline, and their view of the discipline identity is likely to reflect their need for self-definition, their research interests, and the institutional pressures they experience (see Figure 1). IS academics express their reflected appraisals by selecting research topics and methodologies, as well as by submitting their manuscripts to particular IS research journals. These appraisals are also shaped by obtaining favorable or unfavorable peer-reviews for certain types of research. External stakeholders influence identity creation by providing research and funding opportunities as well as by applying institutional pressures on IS scholars. ***Therefore, the body of published IS research can be considered to be the stakeholders' reflection on the IS field identity.*** This is consistent with the view of Benbasat and Zmud that "the primary way in which a scholarly discipline signals...its intellectual core is through the topics that populate discipline-specific research activities" (2003, p. 184), as well as with the notion of identity construction through creation of narratives (Boland and Lyytinen 2004).

The final step in the identity construction process is the reconciliation of the reflected stakeholder appraisals with the image projected by the key stakeholders (Scott and Lane 2000). In

[3]While Scott and Lane focus on two key groups of participants of the OIC process, internal stakeholders (managers) and external stakeholders, in our application of this framework we do not formally distinguish between different types of stakeholders.

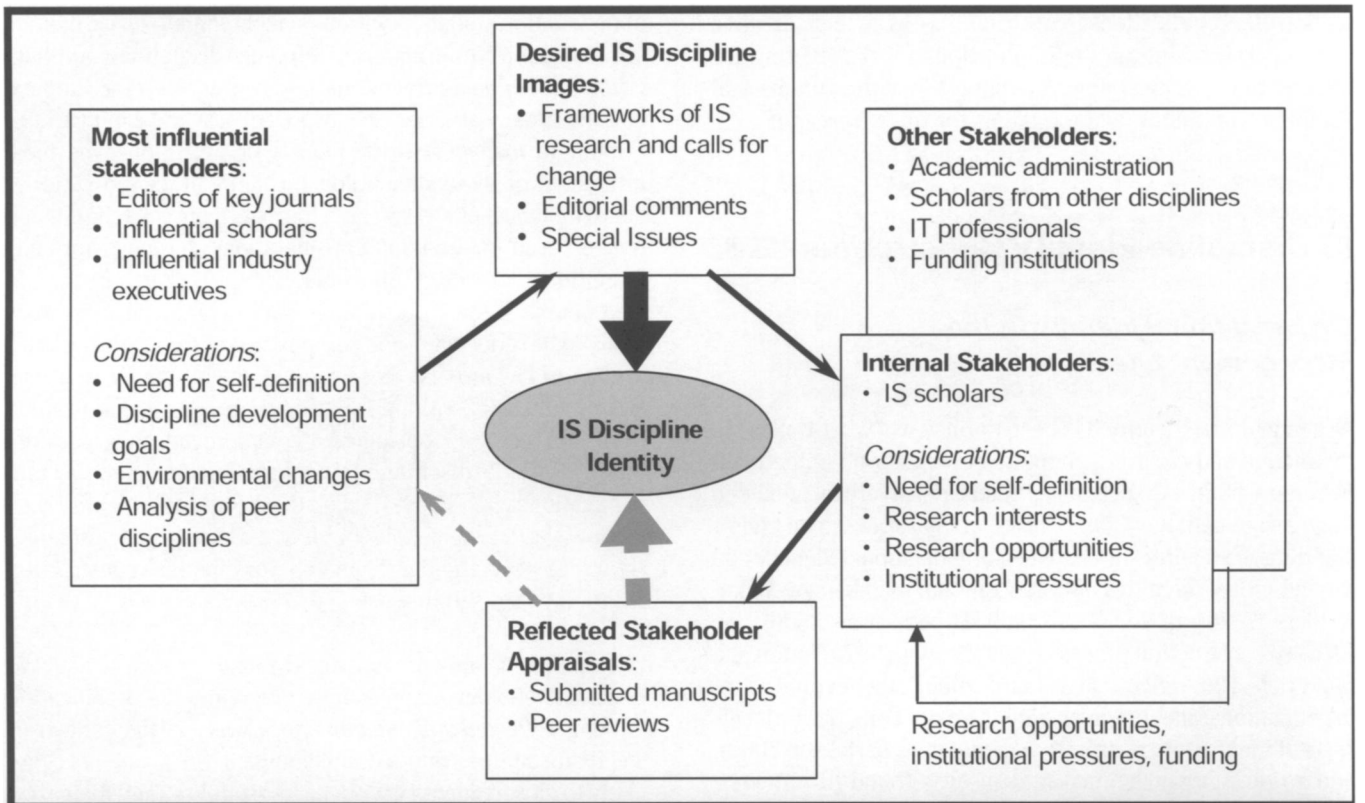

Figure 1. Stakeholder Approach to Identity Construction of the IS Discipline (adapted from Scott and Lane 2000, p. 45)

the case of the IS discipline, the key problem appears to lie in the interpretation of the reflected stakeholder appraisals (i.e., in distilling the core from the large volume of IS research). This is indicated by broken arrows in Figure 1. We believe that the difficulty in understanding the core of the IS research is largely related to the level at which such research is being examined (i.e., the level of individual research papers). Because scientific knowledge is often developed through incremental advances (Cohen 1985; Van Gigch and Le Moigne 1989), many individual research efforts are narrowly focused. Thus individual research may appear to be insignificant, or only marginally related, to the core problems addressed by a scientific field. A higher focus on rigor often requires scholars to conduct research at a finer level of granularity, resulting in lower perceived relevance of such work (Benbasat and Zmud 1999; Davenport and Markus 1999) and possibly higher perceived diversity of the discipline. Thus, although individual publications comprise the basis of the discipline, when viewed separately, they are unlikely to reveal a shared identity. Therefore, in order to facilitate the identity construction process, *it is necessary to provide a clear view of the IS intellectual core by aggregating individual research papers at a higher semantic level.*

In the next section we propose how latent semantic analysis, a technique that allows uncovering hidden concepts from textual data, can help to distill the core research areas from a large pool of individual papers. The results of such an analysis can be used to shape and clarify the identity of the IS discipline.

Method

In order to provide a robust examination of IS research, we analyzed abstracts from all research articles published in *MIS Quarterly* (*MISQ*), *Information Systems Research* (*ISR*), and *Journal of Management Information Systems* (*JMIS*) in a chosen period of time. These journals are consistently considered to be top "pure MIS" journals (Rainer and Miller 2005). In order to obtain a longitudinal and evolutionary

view of the discipline, a 22-year period, 1985 through 2006 (inclusive), was utilized. This period allows enough time for a particular research topic to go through a large part of its life cycle[4]. We collected the data using the electronic library databases ProQuest via ABI/INFORM Global and EBSCOhost. The collected data amounted to 1,615 research article abstracts from the years 1985 through 2006 for *MISQ* and *JMIS*, and from the years 1990 through 2006 for *ISR* given that it was not established until 1990.

Identification of Research Themes Using Latent Semantic Analysis

Latent semantic analysis (LSA) was introduced to aid in information retrieval and search (query) optimization (Deerwester et al. 1990; Dumais 2004). The main idea behind LSA is to collect all of the contexts within which words appear, and to establish common factors that represent underlying concepts. Extensive research in psychology suggests that LSA simulates the way the human brain distills meaning from text. LSA was shown to mathematically model synonyms (Landauer 2002; Landauer et al. 1998), metaphors (Kintsch and Bowles 2002), and explain various psychological phenomena (Wolfe and Goldman 2003).

LSA is generally similar to traditional factor analysis, as its main purpose is the reduction of dimensionality of original data through singular value decomposition (SVD). In a fashion similar to principal component analysis, SVD produces simultaneous principal components for two sets of variables, the terms and the documents. As such, SVD results include two sets of factor loadings, one for the terms and one for the documents. Each latent semantic factor is associated with a set of high-loading terms and a set of high-loading documents, therefore each factor represents a word usage pattern (a theme). Similar to traditional factor analysis, LSA allows the researchers to impose the number of factors and thus regulate the level of aggregation at which common themes are identified. At a lower level of aggregation, factors will reveal common research themes and, at a higher level of aggregation, key research areas. Appendix A provides some technical details related to our LSA implementation using the sample of IS research abstracts.[5] In the next section we discuss the interpretation of the latent semantic factors. For the interested reader, we provide a brief mathematical introduction to LSA together with a small illustration example in Appendix C.

Factor Interpretation

Similar to what is commonly done in classical factor analysis, we related each factor to its high-loading terms and documents in order to assist factor interpretations. For each solution we prepared a table listing all high-loading terms and documents sorted by absolute loading value by factor. We further used terms and documents that load sufficiently high on a particular factor to interpret and label the factor. Table A1 (see Appendix A) presents the 30 highest-loading terms for each factor in the five-factor solution; Table A2 (see Appendix A) presents 10 highest-loading research papers for each factor in the five-factor solution.[6]

The task of labeling the factors was carried out independently by two IS researchers. The process consisted of examining the terms and abstracts related to a particular factor, interpreting the underlying area or theme, and determining an appropriate label. After independently labeling all factors for each solution (using 2 through 13 and 100 as the number of factors), the researchers compared their resulting factor labels. Apart from trivial semantic differences (e.g., "Issues in IS" versus "Critical Issues in IS Management"), 90 percent or more of the factors were given practically identical labels; the researchers were able to reconcile their differences regarding the other 10 percent or less without controversy.

Measuring the Strength of Research Themes

In order to compare different IS research themes within each solution, as well as track rise and decline patterns within the themes, we measured the strength of a research theme as the number of documents that load highly on the corresponding factor. These document counts were calculated for each theme for the total study period of 22 years, as well as for four different 5-year segments within this period. In order to calculate theme strength in a specific 5-year segment, only those documents that were published during the corresponding time period were taken into account. To establish the relationship between factors in different solutions, we also calculated document cross-loading counts across selected

[4]The start of our analysis also coincides with the end year in the study of IS discipline intellectual structure by Culnan (1987).

[5]The appendices for this paper are located at http://www.misq.org/archivist/vol/no32/issue3/SidorovaAppendices.pdf.

[6]Note that full citations for these 50 papers are not provided; however, the papers are easily identifiable by the provided author name, journal, month, and year.

factor solutions. Results of the analysis are discussed in the next section.

Results

An Overview of Different Factor Solutions

Factor interpretation proved meaningful for all factor solutions considered. Examination of different factor solutions suggests that the body of IS research can be aggregated at different levels, thus revealing different aspects of the IS discipline. A two-factor solution offers the highest level of aggregation and illuminates the two broad directions of IS research: *macro* (research dealing with organizational and societal issues) and *micro* (research examining interactions with the IT artifact at the individual and group levels). As the number of factors increases, these broad directions become separated into high-level *research areas*, such as IS development, IT and organizations, IT and individuals, and so on. Factor labels for selected solutions containing 2, 3, 4, 5, 8, 12, and 13 factors are presented in Table A3 (see Appendix A). For the rest of the paper we number the factors using F*k.x*, to refer to the x^{th} factor of the *k*-factor solution. For example, F5.1 refers to the first factor of the 5-factor solution. We find the 5-factor solution to offer a particularly interesting insight into the key research areas of IS discipline, and will examine it in more detail in the discussion section.

Further increase in the number of retained factors results in the emergence of specific prominent research themes, such as decision support systems, human resources issues in IS, and so on. In addition, as the number of factors increases, higher level research areas get divided into subareas. For example, comparing the 5-factor solution to the 13-factor solution, *IT and organizations* (F5.1 from Table A3) gets divided into *IT management* (F13.2) and *strategic and economic value of IT* (F13.3). It also appears that F13.3 picks up some content related to the value of IT from F5.4 (*IT and markets*). It is important to note that while we used identical labels to describe factors in different solutions, their content differs. For example, F5.2 (*IS development*) contains most of F8.2 (*IS development*), along with a significant portion of content in F8.4 (*HR and project management in IS*) and F8.8 (*decision support systems*).

Examination of the 100-factor solution reveals a large variety of research topics addressed by the IS discipline (see Table A4 in Appendix A). Of the 100 extracted factors, 99 factors could be interpreted as representing identifiable *research themes*. Factor F100.100 appears to combine several unrelated themes (Internet and social integration of IT), and no document loads highly on it. Examination of the 100 labeled factors suggests that most identified themes are related to a specific stream of IS research, for example, ERP and IS implementation (F100.64), decision support systems (F100.1), trust in IT-enabled relationships (F100.29), and so on. Yet some factors represent methodological issues, for example, measurement instruments (F100.2) and research methodology (qualitative versus quantitative) (F100.57), general academic debates (such as journal focus, diversity, etc.) (F100.18), and even terminology artifacts, such as MIS itself (F100.63).

Dynamics of IS Research

We examined the dynamics of IS research based on (1) the total number of publications corresponding to each of the research areas and themes during different time periods and (2) the number of cross-loading documents between areas and themes. This analysis shows the relative strength and popularity of the corresponding research areas and themes during different time periods and provides insight into how the nature of IS research has changed over time. Tables A3 and A4 show paper counts for four 5-year periods, 1987–1991, 1992–1996, 1997–2001, and 2002–2006, for different factor solutions. Examination of cross-loading documents between research areas (5-factor solution) and research themes (100-factor solution) indicates which research themes were most strongly represented within each research area during different time periods. Table 1 shows top cross-loading research themes (100-factor solution) for each of the five research areas (5-factor solution) during each of the four time periods.

Examination of paper counts for the five different research areas suggests that the interests in some research areas, such as IT and organizations (F5.1) and IT and individuals (F5.3) remained relatively constant over time (see Figure 2). In the case of IT and groups (F5.5), the strength of the area increased significantly from the 1987–1991 period to the 1992–1996 period and remained relatively constant between 1992 and 2006 (see Figure 2). The two other research areas exhibited significant changes in popularity over time. Most notably, IS development (F5.2) experienced significant and constant decline in popularity among IS researchers from the 1987–1991 period (112 highly loading papers, see Table A3) to the 2002–2006 period (62 highly loading papers). At the same time, the number of publications related to IT and markets (F5.4) grew from 18 in late 1980s to 115 in mid-2000s (see Figure 2).

Examination of cross-loadings of research areas (5-factor solution) and research themes (100-factor solution) suggests

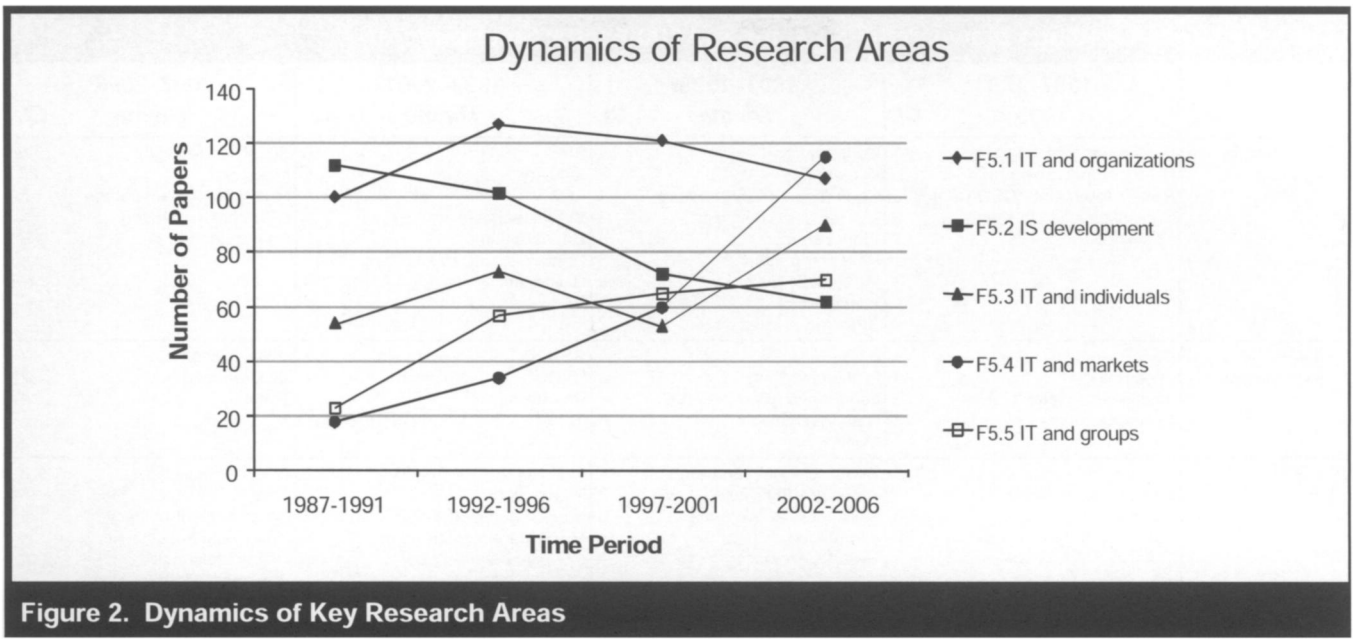

Figure 2. Dynamics of Key Research Areas

that the top research themes corresponding to each of the research areas changed significantly over time (see Table 1). For example, research on IT and organizations (F5.1) in late 1980s (1987–1991) focused largely on IS planning (F100.9), IT for competitive advantage (F100.6), and the role of top management – CEO/CIO (F100.22), whereas in the mid-2000s (2002–2006) it focused on supply chain management (F100.54), industry-specific issues (F100.56), and IT for competitive advantage (F100.6). Similarly, research on IS development (F5.2) in late 1980s focused largely on IS planning (F100.9) and specific types of systems such as DSS (F100.1), expert systems (F100.62), and intelligent systems (F100.53), whereas in the mid-2000s it focused on collaboration (F100.84), risk management (F100.34), and training (F100.46). Implications of changes in the focus of IS research are examined next.

Discussion

Multilevel Model of IS Research

Exploring the body of IS research at different levels of aggregation offers interesting insights into the relationship between diversity of the IS discipline and its identity. At the lowest level, individual papers constitute fundamental units of IS research (see Figure 3). They discuss a variety of topics and use a multitude of theoretical and methodological approaches. The authors of such papers, in an effort to highlight their contribution, emphasize unique elements of their studies. A direct reading of these papers makes it difficult to see what is common in IS research. When viewed at a higher level of semantic aggregation, the IS field can be represented through a large number of research themes. Because of the variety of the covered topics, many research themes appear to be unrelated to each other. Examples from our 100-factor solution include object-oriented methodologies (F100.69), auctions and other dynamic pricing mechanisms (F100.73), power and politics (F100.31), group support systems (F100.10), and computer self-efficacy (F100.13) (see Table A4). Focus on such research themes draws attention to the diversity of the IS field and makes it difficult to see its intellectual core. We refer to the research theme level as the *Diversity Level* (see Figure 3).

The intellectual core of the IS field emerges when the entire body of IS research is forced to be described through a smaller number of research areas, as we did with a 5-factor solution. We believe that this rather concise view of IS research reveals its identity, thus we refer to the research area level as the *Identity Level* (Figure 3). Here, research areas span multiple research themes, and individual research themes may be related to more than one research area. Table 1 and Table A5 (Appendix A) show the correspondence between research areas and most prominent research themes based on the analysis of cross-loading papers. Examination of research themes that are mostly related to a particular research area allows us to better understand the area itself.

Table 1. Cross-Loadings between the 5-Factor and 100-Factor Solutions

	1987–1991		1991–1996		1997–2001		2002–2006	
	Theme	*Ct.*	*Theme*	*Ct.*	*Theme*	*Ct.*	*Theme*	*Ct.*
F5.1 IT and Organizations	IS planning	1	Coordination	7	BPR	6	Supply chain mgmt.	5
	IT for compet. advantage	6	IS planning	6	Industry	5	Industry	3
	Role of top mgmt. (CEO/CIO)	3	Centr./decentr. IS structure	4	EDI	4	IT for compet. advantage	3
	Critical issues in IS mgmt.	3	EDI and interorg. syst.	3	Virtual teams	4	ERP implementation	3
	Networks	3	Virtual teams	3	Coordination	3	Knowledge mgmt.	3
			Role of top mgmt.	3	Centr./decentr. IS structure	3		
			Value of IT invest.	3	IT adoption	3		
			Executive IS	3				
			BPR	3				
F5.2 IS Development	DSS	11	DSS	5	DSS	3	Collaboration	2
	IS planning	4	Problem solving	4	BPR	2	Risk management	2
	Intelligent systems (AI)	3	Languages (progr./query)	4	Prototyping	2	Training	2
	Expert systems	3	Database design	4				
	Problem solving	3	Multimedia	3				
F5.3 IT and Individuals	Measurement instruments	4	Measurement instruments	11	Indiv. tech. acceptance	7	Web site design	6
	End-user computing	3	HR issues in IS field	8	IT adoption	6	Trust	5
	Training	3	Indiv. tech. acceptance	6	Service quality (SERVQUAL)	3	Computer self-efficacy	4
	Satisfaction (user & job)	2	Information centers	4	Measurement instruments	3	Indiv. tech. acceptance	4
			Expert systems	4	Computer self-efficacy	3	Online consumer	4
							Personalization & privacy	4
F5.4 IT and Markets	Networks	2	EDI	3	Trading systems	37	E-marketplaces	12
			Coordination	3	EDI	26	Online consumer	11
			Customer service	3	Real options	43	Economics of IT	10
			Value of IT invest.	2	E-marketplaces	19	Trust	8
			E-marketplaces	2	IT adoption	8	Customer service	6
					Economics of IT	4	Web site design	4
							Personalization & privacy	3
							Auctions	3
F5.5 IT and Groups	GDSS	5	EMS	7	GSS	13	Virtual teams	11
	EMS	4	GDSS	4	Virtual teams	5	Trust	10
			Learning and education	3	EMS	3	Collaboration	8
			Computer self-efficacy	3	Electronic brainstorming	3	GSS	4
			Virtual teams	3			Computer self-efficacy	4

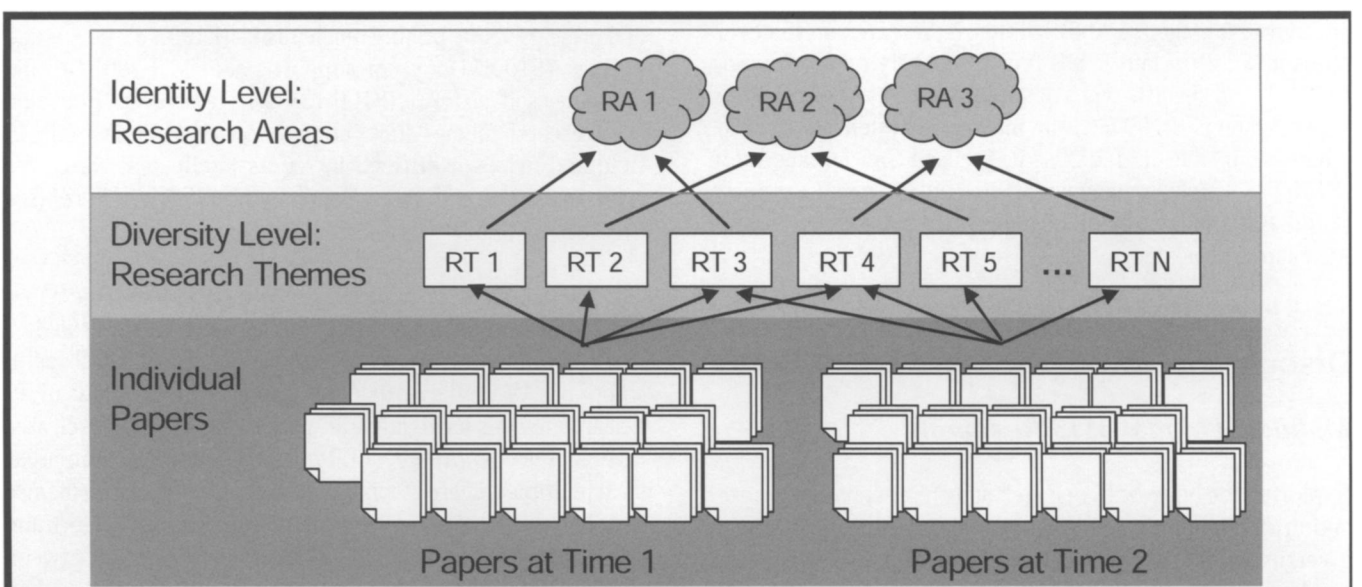

Figure 3. Multilevel Model of IS Research

Interpreting the Identity of IS Research

The research areas revealed through the 5-factor solution provide a meaningful yet parsimonious view of the intellectual core of the IS discipline (see Appendix A, Table A3). Four of the five factors comprising the solution can be interpreted as research examining the interaction of humans and their collectivities with the IT artifact; they include IT and organizations (F5.1), IT and individuals[7] (F5.3), IT and markets (F5.4), and IT and groups (F5.5). Interestingly, each of these factors corresponds to a different level of a typical business organization (see Figure 4). *F5.3: IT and individuals* examines primarily psychological aspects of human-computer interactions; from its corresponding research themes (see Table A5), this research focuses primarily on individual technology acceptance, HR issues in IS, computer self-efficacy, end-user computing, and so on.

At the next level, *F5.5: IT and groups* examines the interaction of groups with IT. Here, research focuses on various types of systems used to support group work, including group decision support systems, as well as how such systems influence group dynamics or trust in IT-enabled relationships (see Table A5). Next, *F5.1: IT and Organizations* focuses on the implications of IT use for organizations, such as the strategic role of IT, the impact of IT investments on organizational performance, and the effect of IT on business processes. Research at this level has also focused on business practices related to the management of IT, such as IS planning and outsourcing, as well as the organization of the IS function. As IT is used in the interactions between organizations, *F5.4: IT and markets* examines how such use is affecting interorganizational relationships and markets in general. Here, the research focuses on specific types of information systems such as electronic data interchange (EDI) or on the impacts of such systems on consumers, sellers, prices, and markets.

While these four research areas examine how, and to what effect, humans use and manage IT, the fifth distinct research area, *F5.2: IS development*, examines the information technology itself, and how it is developed. Here, the research tends to be more technical in nature, largely focusing on system functionality and/or the design of different types of systems such as decision support systems, expert systems, or databases. Also, development methodologies and approaches for performing IS development are examined, including prototyping, object-oriented methodologies as well as the use of programming and query languages.

Combining the interpretations of the five research areas, the intellectual core of the IS discipline can be summarized as follows:

> *The Information Systems academic discipline focuses on how IT systems are developed and how individuals, groups, organizations, and markets interact with IT.*

In the next section we will discuss how the identity of IS research has changed over time.

Dynamics of IS Research

As implied by its definition, organizational identity is expected to remain relatively stable over time (Albert and Whetten 1985). Yet, some management researchers argue that changes in organizational identity are important to ensure the organization's adaptability to its changing environment (Gioia et al. 2000). Similarly, Robey (2003, p. 353) argues that "a mutable and adaptive identity for IS might permit the flexibility needed to change." Here, we will discuss the changes in IS research identity over the last two decades, based on the results of our analysis.

Examination of the evolution of the five research areas over the past 20 years (see Table 1) suggests that while many aspects of the IS research core remained stable over time, there are some notable changes. IS researchers consistently devoted significant attention to issues of IT use at individual, group, and organizational levels. However, within each of these three research areas, *the specific issues under investigation changed over time* (see Table 1), reflecting changes in the business environment and the evolution of technologies. Examples of technology-driven changes include the emergence of such issues as enterprise resource planning implementation (F100.64) at the organizational level, and online consumer behavior (F100.41) at the individual level. New business practices and issues are also reflected in the change of focus within each research area. Examples include IT outsourcing (F100.23) and supply chain management (F100.54) at the organizational level, virtual teams (F100.7) at the group level, and personalization and privacy (F100.76) at the individual level. At the same time, some research themes such as end-user computing (F100.50), group decision support.

[7] As evident from the list of high-loading terms, a significant amount of research within the IT and individuals (F5.3) research area is related to the development of measurement instruments. In fact, from Table A5 it is clear that measurement instruments (F100.2) is the most prominent research theme within the F5.3 research area. This can be explained by the fact that individual-level research in IT relies heavily on the measurement of psychological constructs, and therefore is concerned with the development of reliable measurement instruments.

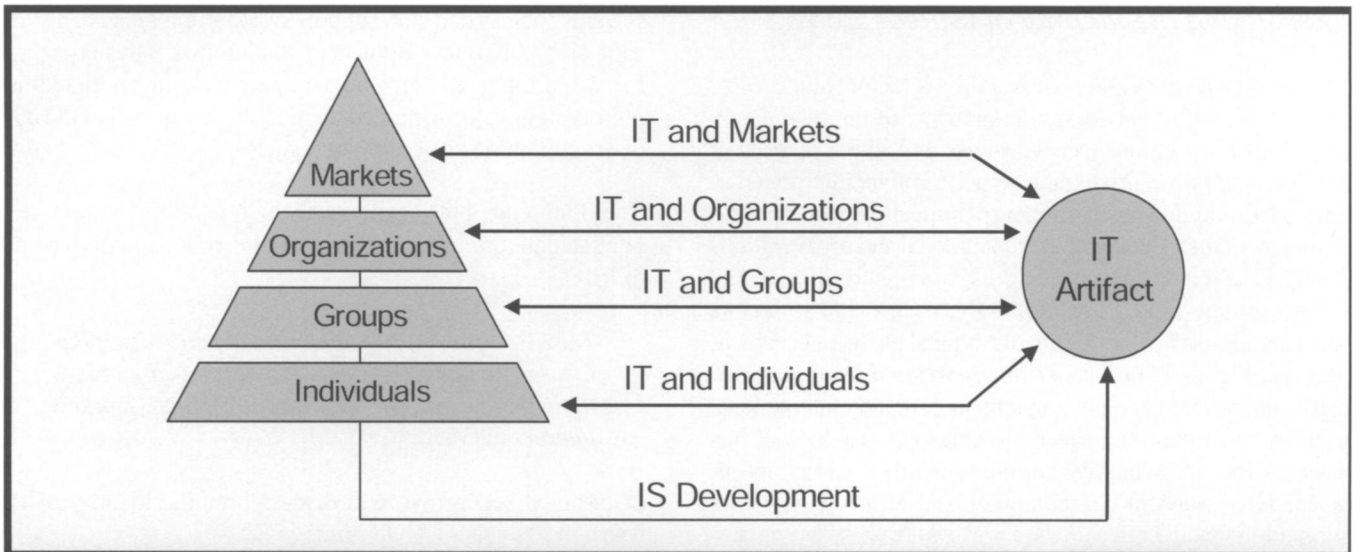

Figure 4. Model of IS Research Identity

systems (F100.15), and IS planning (F100.9) have become less prominent. Such decline may reflect the decreasing relevance of such topics, the fact that these topics have already been extensively researched, or that more finely grained investigations (using more precise terminology) are occurring later in a topic's life cycle.

A notable change in the IS research identity is the emergence of IT and markets (F5.4), where research focuses on market-level issues, completing the picture of how humans and their collectivities interact with IT at various levels of an organization (see Figure 4). The emergence of this research area is likely related to the reliance on information and communication technology for the interorganizational transactions. Concerned with issues of EDI (F100.26), interorganizational coordination (F100.38), and characteristics of electronic marketplaces (F100.19) at the time of its emergence in the mid-1990s, research in this area expanded to include such themes as economics of IT (F100.4), trust in IT-enabled relationships (100.29), as well as auctions and other dynamic pricing mechanisms (F100.73).

The second and, perhaps, most notable change in the IS research identity is the decreasing attention to the development of the IT artifact (IS development, F5.2). Overall, the number of papers related to this area has decreased, with an observable shift in focus away from the IT artifact and a movement toward process-related and managerial issues in IS development. For example, in the late 1980s and early 1990s, the key research themes within the IS development area were related to specific types of information technologies, such as decision support systems (F100.1), intelligent systems (F100.53), expert systems (F100.62), databases (F100.14), and so on. In contrast, in the late 1990s and early-to-mid-2000s, the key research themes within this area were related to managerial practices in IS development, such as business process reengineering (F100.58), prototyping (F100.20), risk management (F100.34), and training (F100.46). Both of these trends suggest that the IS discipline became ***less technology focused and more business-process- focused*** over time, which is consistent with the observation by Robey, that "IS has shifted its identity from a narrow preoccupation on computer programming and application development methodologies to an identity that encompasses the social context of IS development and use" (2003, p. 353). This is also consistent with the concern about the insufficient focus on the IT artifact expressed by Orlikowski and Iacono (2001). This shift in identity may be related to factors such as the institutional affiliation of IS researchers (business versus engineering schools). It may also reflect various business trends, such as higher reliance on packaged IT solutions, making the lower-level technical aspects of IS development less relevant to the broader IS community.

One may argue that such refocusing from the IT artifact itself to more general business issues may lead to the lower distinctiveness of IS research from other business disciplines (Benbasat and Zmud 2003), thus endangering the IS discipline's identity. On the other hand, convergence with other business disciplines may contribute to the establishment of the IS discipline as a reference discipline (Wade et al. 2006). Despite the aforementioned concerns, our results suggest the

existence of a stable core of IS research at the *boundary of IT and organizations*. To successfully conduct such research one should have a good understanding of *both technical and organizational issues,* as opposed to *only* technical issues addressed in computer science and *only* organizational issues studied by other business disciplines. We believe that such positioning highlights the distinctiveness of IS research and may help carve a stable existential niche for the IS discipline.

Overall, our results support the view of mutable identity of IS research as proposed by Robey (2003). We found that the IS research core as reflected in the five research areas discussed here, while slowly evolving, shows significant temporal stability. Adaptation of the IS field to its changing environment occurs mainly at the diversity level, as reflected in our research themes. Our multilevel view of the body of IS research (see Figure 3) showed that a high degree of diversity and a high degree of mutability at the research theme level can coexist with a stable intellectual core (key research areas); such diversity at the research theme level does not, therefore, undermine the ability of the IS field to establish a strong and *stable* identity.

Our results may also have implications with respect to the classification by Banville and Landry (1989) of the IS discipline as a "fragmented adhocracy." Banville and Landry examined the position of the IS discipline on three dimensions: *strategic dependence*, *strategic task uncertainty,* and *functional dependence*.[8] While an in-depth reexamination of the position of the IS discipline on these three dimensions is beyond the scope of this paper, our findings hint to a possible shift on at least one of these dimensions. Specifically, the presence of a stable intellectual core may be an indication of reduced strategic task uncertainty. At the same time, other studies provide evidence of a shift on other dimensions. For example, the difficulty of publishing in elite IS journals as well as the importance of such publications in tenure and promotion decisions (Dennis et al. 2006) point to a growing strategic dependence within the IS field. Finally, the persistent attention to research methods in IS discipline during the past two decades (e.g., Lee 1989; Mingers 2001; Petter et al. 2007) suggests a higher functional dependence within the field. Together, such shifts suggest that the IS discipline is moving away from a fragmented adhocracy toward a "conceptually integrated bureaucracy" (Banville and Landry 1989).

[8]Following Whitley (1984), Banville and Landry define *strategic dependence* as "a measure of the political dependence of the members within a field," *strategic task uncertainty* as "a measure of the conceptual coherence within a field," and *functional dependence* as "a measure of the technical and procedural coherence within a field" (1989, p. 54).

Comparing Research Themes and Research Areas to Existing Models of IS Research

Revisiting the stakeholder approach to IS field identity construction (Figure 1), a strong identity is created as the stakeholder appraisals, reflected in the body of published research, are reconciled with the desired IS field image projected by the organizational elite. Our results provide a comprehensive view of the IS discipline's stakeholder appraisals in the form of research areas and research themes. In this section, we attempt to reconcile the results of our IS discipline identity construction analysis with the views put forth by Benbasat and Zmud (2003) and the human–computer interaction (HCI) research model by Zhang and Li (2005).

Benbasat and Zmud (2003) argue that the core of IS research should focus on the IT artifact, the capabilities and practices involved in the development and use of such an IT artifact, and the impacts of IT artifact use. Our results generally agree with this view of IS research. The research area of IS development (F5.2) corresponds to the study of the IT artifact, and the other four research areas reflect different aspects of human interaction with IT at different organizational levels, including "the managerial, methodological, and operational practices for directing and facilitating IT artifact usage and evolution,...the impacts...of these artifacts on the humans... and associated collectives (groups, work units, organizations)" (Benbasat and Zmud 2003, p. 186). Our results, however, suggest that the IT artifact may not be at the center of IS research, but instead that it is an equal partner, interacting with humans and their collectivities in an organizational context. It is the interaction itself that assumes the central place in IS research. This positioning highlights the distinctive nature of the IS field, separating it from other business disciplines that focus exclusively on the business organization itself or from pure technology-focused disciplines, which focus on different aspects of the IT artifact.

Within each research area focusing on the interaction between IT and humans or their collectivities (i.e., F5.1, F5.3, F5.4, and F5.5), individual research themes can be mapped into the nomological net of IS research as proposed by Benbasat and Zmud (2003) (see Figures 5 through 8). The boxes in these figures correspond to the elements of the nomological net, including capabilities, practices, use, and impacts, and represent the relationships between the business organization at a particular level (the pyramid) and the IT artifact (the circle). For example, at the individual level (see Figure 5), *capabilities* include computer self-efficacy (F100.13); *practices* include training (F100.46) and HR practices (F100.5); *use* is reflected in individual technology acceptance (F100.3); and *impact* is reflected in satisfaction (F100.39). Similarly, at the

organizational level (see Figure 7), ***capabilities*** include the structure of the IS function (F100.27 and F100.22); ***practices*** include IS planning (F100.9) and IT outsourcing (F100.23); ***use*** is reflected in IT adoption (F100.8); and ***impact*** is reflected in the value of IT investments (F100.24). Proposed mapping for group and market levels are shown in Figures 6 and 8.

The HCI research framework by Zhang and Li offers another comprehensive reference model for mapping IS research. In general, their framework shows how HCI studies can be classified along various factors, including technology, human factors, task, context, interaction method, and so on. Notably, the interaction between humans and the information technology occupies the central place in both the HCI framework by Zhang and Li our model of IS research (Figure 4). The HCI framework is tailored to studies of human–IT interactions at individual and group levels and was not designed to accommodate organizational and market level interactions; therefore, it can be best related to the IT and individuals (F5.3) and IT and groups (F5.5) research areas. Within these research areas, many of the research themes (see Tables 1 and A5) could be mapped into one or more components of the HCI framework. For example, the individual technology acceptance theme (F100.3) represents the coexamination pattern of such components as IT use and impact, human cognition (attitudes and perceptions) and social context (norms). Trust in IT-enabled relationships (F100.29) corresponds to the social context characteristic, and so on. Therefore, Zhang and Li's framework could be regarded as a reification of our view of IS research for the subarea of HCI.

Comparing Our Results with Earlier Empirical Studies

To provide a well-rounded context for viewing our results, it is important to relate them to existing empirical studies on the intellectual structure of the IS discipline. Most notably, our study offers a natural extension to co-citation studies by Culnan (1986, 1987).

Our results are consistent with the intellectual structure identified in the IS research in the years 1980–1985 (Culnan 1987). Comparison of the five factors identified by Culnan (1987) and the research areas discussed here suggests the persistence of such research areas as IS development, as well as IT at organizational and individual levels. Some differences in actual factor mappings can be explained by differences between LSA and co-citation analysis. The comparison of the results also suggests that the evolution of the IS discipline led to the establishment of such important research areas as IT and groups and IT and markets during the last two decades. Comparison of our results to a more recent analysis of IS literature (Vessey et al. 2002) indicates a general agreement with regard to the core of IS research. Specifically, both studies suggest that the IS research is primarily focused on how individuals, groups, and organizations interact with IT; this corresponds to the ***organizational concepts*** category in Vessey et al. (pp. 140-141). Both studies also identify IS development as an important area of IS research, with IS development (F5.2) generally corresponding to their ***problem domain-specific*** and ***systems/software management*** concepts categories. Discrepancies in quantitative assessments are likely to be related to methodological differences between the studies. Our results also relate well to the IS research streams used by Banker and Kauffman (2004) to examine the evolution of IS research published in *Management Science* during the 50-year period 1954 through 2003.

Conclusions, Limitations, and Directions for Future Research

In this paper, we attempted to facilitate identity construction in the IS discipline by examining the vast body of IS research and empirically identifying key research areas and themes. The key contribution of the paper is that it distills and interprets the intellectual core of the IS research in the form of five key research areas. It also documents the broad diversity of the field through the identification of the 100 most important research themes. The results of the analysis provide an empirical basis for future debates about the identity and diversity in the IS field; however, it is important to remember that identity issues are broader than just summarizing the research core, and include the processes and values underlining IS research (Boland and Lyytinen 2004). Our view of the IS intellectual core can be used to better communicate the nature of IS research within the IS community and to its external stakeholders. The results of the study can be practically used to help IS scholars position their research topics into a broader context. Our results can also enable new scholars to efficiently gain an understanding of the breadth of the IS field and identify potential areas of interest based on corresponding research dynamics.

It is important to highlight several limitations of our study. First, we only examined IS publications; therefore, while our results allowed us to draw conclusions regarding what is central and enduring in IS research, they do not demonstrate its distinctiveness from other disciplines. The examination of common and distinct areas in IS research and in other disciplines constitutes an important direction for future research. Such investigation, if conducted longitudinally, could also

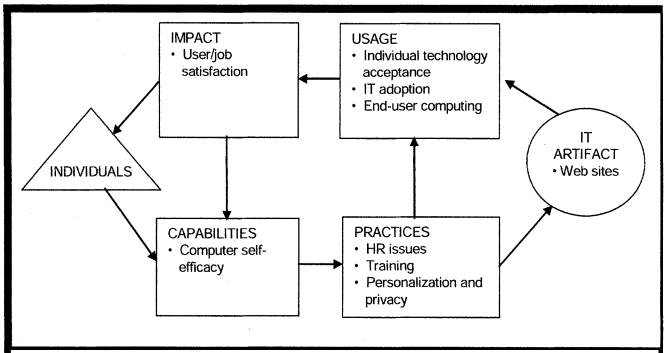

Figure 5. Mapping of Research Themes: IT and Individuals

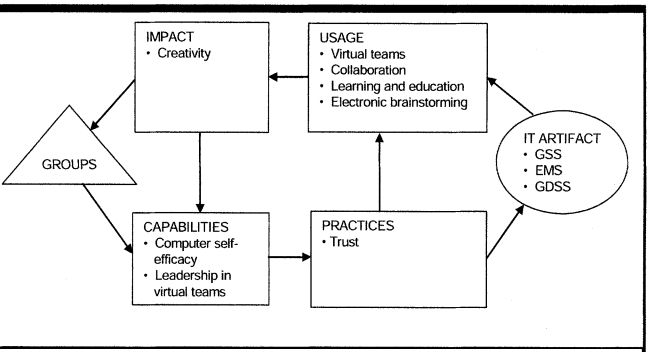

Figure 6. Mapping of Research Themes: IT and Groups

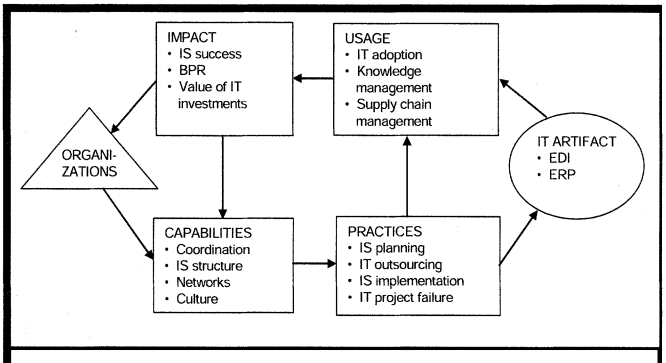

Figure 7. Mapping of Research Themes: IT and Organizations

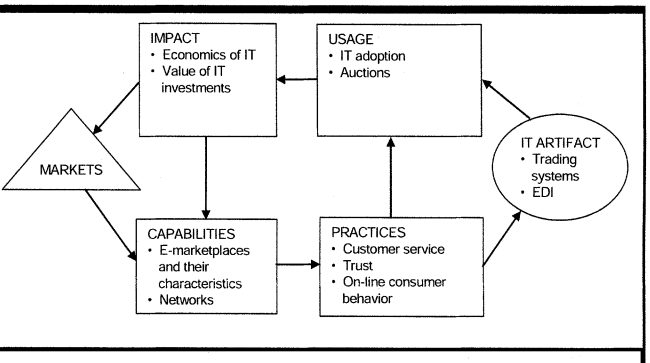

Figure 8 Mapping of Research Themes: IT and Markets

contribute to the debate about IS as a reference discipline (Grover et al. 2006; Wade et al. 2006). Other limitations are related to the methodology used in this study. First, the LSA methodology relies on the identification of repeating word usage patterns. If a particular research area is not well established, and the scholars have not developed consistent terminology, the research area is not likely to be well-captured as a strong factor. In addition, factor labeling is done by researchers and is inherently vulnerable to subjectivity biases. While we took care to minimize subjectivity in labeling by carefully examining highly loading terms and documents for each factor, as well as by having the factors labeled by two researchers independently, this remains a methodological limitation.

Also, we used abstracts instead of full texts; while this may be considered a limitation because of the loss of information, using full text would introduce a significant amount of noise, especially when including a paper's literature review and methodology sections. Nevertheless, this is a potential concern. It is also important to note that given our choice to only use *MISQ*, *ISR*, and *JMIS* as our sample, one may argue that this overly limited the scope of our analysis. We believe, however, that the inclusion of more narrowly focused journals, which often specialize on certain topics, would lead to biases and obscure the core of the IS research. Again, this limitation must also be considered when interpreting our results.

Related to our choice of journals, one may also argue that our results are biased toward research favored by North American scholars (Lyytinen et al. 2007). We recognize this as a limitation of our study, especially considering commonly acknowledged differences between North American and European research (Avgerou et al. 1999; Chua et al. 2002; Lyytinen et al. 2007; Paul 2007). Inclusion of journals with a higher share of European publications, such as the *European Journal of Information Systems* (Lyytinen et al. 2007), could lead to the emergence of new research themes, related, for example, to the socio-technical view of IT and interpretive research methodologies. However, we believe that it would have only a marginal effect on the key research areas and the identity of

IS research as a whole. Still, a comparative study of North American versus European IS research identities could be an interesting direction for future research.

In conclusion, just as all organizations struggle to identify and evolve their identity, so too has the IS discipline. As such, we believe that the ongoing negotiation among all interested stakeholders over the identity of the IS discipline should continue. We hope that our analysis of published IS research adds valuable insights to this discourse, resulting in a stronger and clearer identity for the discipline.

Acknowledgments

We would like to thank Izak Benbasat and Kalle Lyytinen for their insightful comments on earlier drafts of this paper. We would also like to thank the anonymous reviewers and especially the senior editor for their valuable comments and suggestions.

References

Agarwal, R., and Lucas Jr., H. C. 2005. "The Information Systems Identity Crisis: Focusing on High-Visibility and High-Impact Research," *MIS Quarterly* (29:3), September, pp. 381-398.

Albert, S., and Whetten, D. A. 1985. "Organizational Identity," *Research in Organizational Behavior* (7), pp. 263-295.

Alter, S. 2003. "The IS Core XI: Sorting Out Issues About the Core, Scope and Identity of the IS Field," *Communications of the AIS* (12), November, pp. 607-628.

Ashforth, B. E., and Mael, F. 1989. "Social Identity Theory and the Organization," *Academy of Management Review* (14:1), January, pp. 20-39.

Avgerou, C., Siemer, J., and Bjørn-Andersen, N. 1999. "The Academic Field of Information Systems in Europe," *European Journal of Information Systems* (8), pp. 136-153.

Banker R. D., and Kauffman R. J. 2004. "The Evolution of Research on Information Systems: A Fiftieth-Year Survey of the Literature in Management Science," *Management Science*, (50:3), March, pp.281-298.

Banville, C., and Landry, M. 1989. "Can the Field of MIS be Disciplined?," *Communications of the ACM* (32:1), January, pp. 48-60.

Benbasat, I., and Weber, R. 1996. "Research Commentary: Rethinking 'Diversity' in Information Systems Research," *Information Systems Research* (7:4), December, pp. 389-399.

Benbasat, I., and Zmud, R. W. 1999. "Empirical Research in Information Systems: The Practice of Relevance," *MIS Quarterly* (23:1), March, pp. 3-16.

Benbasat, I., and Zmud, R. W. 2003. "The Identity Crisis Within the IS Discipline: Defining and Communicating the Discipline's Core Properties," *MIS Quarterly* (27:2), June, pp. 183-194.

Berry, M. W., Dumais, S. T., and O'Brien, G. W. 1995. "Using Linear Algebra for Intelligent Information Retrieval," *SIAM Review* (37), pp. 573-595.

Boland Jr., R. J., and Lyytinen, K. 2004. "Information Systems Research as Design: Identity, Process and Narrative," in *Information Systems Research: Relevant Theory and Informed Practice*, B. Kaplan, D. P. Truex III, D. Wastell, A. T. Wood-Harper, and J. I. DeGross (eds.), Boston: Kluwer Academic Publishers, pp. 1-19.

Brickson, S. 2000. "The Impact of Identity Orientation on Individual and Organizational Outcomes in Demographically Diverse Settings," *Academy of Management Review* (25:1), pp. 82-101.

Brown, A. D. 1997. "Narcissism, Identity, and Legitimacy," *Academy of Management Review* (22:3), July, pp. 643-686.

Brown, T. J., Dacin, P. A., Pratt, M. G., and Whetten, D. A. 2006. "Identity, Intended Image, Construed Image, and Reputation: An Interdisciplinary Framework and Suggested Terminology," *Journal of the Academy of Marketing Science* (34:2), Spring, pp. 99-106.

Cheng, X., and Dunkerton, T. 1995. "Orthogonal Rotation of Spatial Patterns Derived from Singular Value Decomposition Analysis," *Journal of Climate* (5), pp. 2631-2643.

Chew, P., Bader, B., Kolda, T., and Abdelali, A. 2007. "Cross-Language Information Retrieval Using PARAFAC2," in *Proceedings of the 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, New York: ACM Press, pp. 143-152.

Chua, C., Cao, L., Cousins, K., and Straub, D. W. 2002. "Measuring Researcher-Production in Information Systems," *Journal of the AIS* (3), pp. 145-215.

Cohen, I. B. 1985. *Revolution in Science*, Boston: Harvard University Press.

Crawford, C., and Ferguson, G. 1970. "A General Rotation Criterion and its Use in Orthogonal Rotation," *Psychometrika* (35), pp. 32-332.

Culnan, M. J. 1986. "The Intellectual Development of Management Information Systems, 1972-1982: A Co-Citation Analysis," *Management Science* (32:2), February, pp. 156-172.

Culnan, M. J. 1987. "Mapping the Intellectual Structure of MIS, 1980-1985: A Co-Citation Analysis," *MIS Quarterly* (11:3), September, pp. 340-353.

Davenport, T. H., and Markus, M. L. 1999. "Rigor vs. Relevance Revisited: Response to Benbasat and Zmud," *MIS Quarterly* (23:1), March, pp. 19-23.

Deans, P. C. 2003. "The IS Core III: The Core Domain Debate and the International Business Discipline: A Comparison," *Communications of the AIS* (12), November, pp. 546-552.

Deerwester, S., Dumais, S., Furnas, G., Landauer, T., and Harshman, R. 1990. "Indexing by Latent Semantic Analysis," *Journal of the American Society for Information Science* (41:6), pp. 391-407.

Dennis, A. R., Valacich, J. S., Fuller M. A., and Schneider, C. 2006. "Research Standards for Promotion and Tenure in Information Systems," *MIS Quarterly* (30:1), March, pp. 1-12.

DeSanctis, G. 1993. "Theory and Research: Goals, Priorities, and Approaches," *MIS Quarterly* (17:1), March, pp. vi-viii.

DeSanctis, G. 2003. "The Social Life of Information Systems Research: A Response to Benbasat and Zmud's Call for Returning to the IT Artifact," *Journal of the AIS* (4:7), December, pp. 360-376.

Dufner, D. 2003. "The IS Core I: Economic and Systems Engineering Approaches to IS Identity," *Communications of the AIS* (12), November, pp. 527-538.

Dumais, S. T. 1991. "Improving the Retrieval Information from External Sources," *Behavior Research Methods, Instruments, and Computers* (23:2), pp. 229-236.

Dumais, S. 2004. "Latent Semantic Analysis," *Annual Review of Information Science and Technology* (38), pp. 189-230.

Dutton, J. E., and Dukerich, J. M. 1991. "Keeping an Eye on the Mirror: Image and Identity in Organizational Adaption," *Academy of Management Journal* (34:3), September, pp. 517-554.

El Sawy, O. A. 2003. "The IS Core IX: The 3 Faces of IS Identity: Connection, Immersion, and Fusion," *Communications of the AIS* (12), November, pp. 588-598.

Fox, C. 1992. "Lexical Analysis and Stoplists," in *Information Retrieval: Data Structures and Algorithms*, W. B. Frakes and R. Baeza-Yates (eds.), Upper Saddle River, NJ: Prentice-Hall, pp. 102-130.

Frakes, W. B. 1992. "Stemming Algorithms," in *Information Retrieval: Data Structures and Algorithms*, W. B. Frakes and R. Baeza-Yates (eds.), Upper Saddle River, NJ: Prentice-Hall, pp. 131-160.

Galliers, R. D. 2003. "Change as Crisis or Growth? Toward a Trans-disciplinary View of Information Systems as a Field of Study: A Response to Benbasat and Zmud's Call for Returning to the IT Artifact," *Journal of the AIS* (4:6), November, pp. 337-351.

George, J. F., Valacich, J. S., and Valor, J. 2005. "Does Information Systems Still Matter? Lessons for a Maturing Discipline," *Communications of the AIS* (16), pp. 219-232.

Gioia, D. A., Schultz, M., and Corley, K. G. 2000. "Organizational Identity, Image, and Adaptive Instability," *Academy of Management Review* (25:1), January, pp. 63-81.

Grover, V., Ayyagari, R., Gokhale, R., Lim, J., and Coffey, J. 2006. "A Citation Analysis of the Evolution and State of Information Systems Within a Constellation of Reference Disciplines," *Journal of the AIS* (7:5), May, pp. 270-325.

Guthrie, R. A. 2003. "The IS Core V: Defining the IS Core," *Communications of the AIS* (12), November, pp. 557-561.

Han, J., and Kamber, M. 2006. *Data Mining: Concepts and Techniques* (2nd ed.), San Francisco: Morgan Kaufmann.

Harman, D. 1992. "Ranking Algorithms," in *Information Retrieval: Data Structures and Algorithms*, W. B. Frakes and R. Baeza-Yates (eds.), Upper Saddle River, NJ: Prentice-Hall, pp. 363-392.

Hirschheim, R., and Klein, H. K. 2003. "Crisis in the IS Field? A Critical Reflection on the State of the Discipline," *Journal of the AIS* (4), November, pp. 237-293.

Holland, C. P. 2003. "The IS Core X: Information Systems Research and Practice: IT Artifact or a Multidisciplinary Subject?," *Communications of the AIS* (12), November, pp. 599-606.

Husbands, P., Simon, H., and Ding, C. H. Q. 2001. "On the Use of the Singular Value Decomposition for Text Retrieval," in *Computational Information Retrieval*, M. Berry (ed.), Philadelphia: SIAM, pp. 145-156.

Iivari, J. 2003. "The IS Core VII: Towards Information Systems as a Science of Meta-Artifacts," *Communications of the AIS* (12), November, pp. 568-581.

Ives, B., Hamilton. S., and Davis, G. B. 1980. "A Framework for Research in Computer-Based Management Information Systems," *Management Science* (26:9), September, pp. 910-934.

Ives, B., Parks, M. S., Porra, J., and Silva, L. 2004. "Phylogeny and Power in the IS Domain: A Response to Benbasat and Zmud's Call for Returning to the IT Artifact," *Journal of the AIS* (5:3), March, pp.108-124.

Keen, P. G. W. 1980. "MIS Research: Reference Disciplines and a Cumulative Tradition," in *Proceedings of the First International Conference of Information Systems*, E. R. McLean (ed.), Philadelphia, December 8-10, pp. 9-18.

Kiers, H. 1997. "Techniques for Rotating Two or More Loading Matrices to Optimal Agreement and Simple Structure: A Comparison and Some Technical Details," *Psychometrica*, (62:4), pp. 545-568.

King, L. J., and Lyytinen, K. (eds.). 2006. *Information Systems: The State of the Field*, New York: Cambridge University Press.

Kintsch, W., and Bowles, A. 2002. "Metaphor Comprehension: What Makes a Metaphor Difficult to Understand?," *Metaphor and Symbol* (17), pp. 249-262.

Landauer, T. K. 2002. "On the Computational Basis of Learning and Cognition: Arguments from LSA," in *The Psychology of Learning and Motivation, 41*, B. H. Ross (ed.), Amsterdam: Elsevier Science & Technology, pp. 43-84.

Landauer, T., Foltz, P., and Laham, D. 1998. "Introduction to Latent Semantic Analysis," *Discourse Processes* (25), pp. 259-284.

Landry, M., and Banville, C. 1992. "A Disciplined Methodological Pluralism for MIS Research," *Accounting, Management and Information Technologies* (2:2), April-June, pp. 77-97.

Lee, A. S. 1989. "A Scientific Methodology for MIS Case Studies," *MIS Quarterly* (13:1), March, pp. 33-50.

Lyytinen, K., Baskerville, R., Iivari, J., and Te'eni, D. 2007. "Why the Old World Cannot Publish? Overcoming Challenges in Publishing High-Impact IS Research," *European Journal of Information Systems* (16), pp. 317-326.

Lyytinen K., and King J. L. 2004. "Nothing at the Center? Academic Legitimacy in the Information Systems Field," *Journal of the AIS* (5:6), June, pp. 220-246.

Mason, R. O., and Mitroff, I. I. 1973. "A Program for Research in Management Information Systems," *Management Science* (19:5), January, pp. 475-487.

McCubbrey, D. J. 2003. "The IS Core IV: IS Research: A Third Way," *Communications of the AIS* (12), November, pp. 553-556.

Meyer, J. P., Bartunek, J. M., and Lacey, C. A. 2002. "Identity Change and Stability in Organizational Groups: A Longitudinal Investigation," *The International Journal of Organizational Analysis* (10:1), pp. 4-29.

Mingers, J. 2001. "Combining IS Research Methods: Towards a Pluralist Methodology," *Information Systems Research* (12:3), September, pp. 240-259.

Myers, M. D. 2003. "The IS Core VIII: Defining the Core Properties of the IS Disciplines: Not Yet, Not Now," *Communications of the AIS* (12), November, pp. 582-587.

Nolan, R, and Wetherbe, J. 1980. "Toward a Comprehensive Framework for MIS Research," *MIS Quarterly*, June, pp. 1-19.

Orlikowski, W. J., and Iacono, C. S. 2001. "Research Commentary: Desperately Seeking the 'IT' in IT Research – A Call to Theorizing the IT Artifact," *Information Systems Research* (12:2), June, pp. 121-134.

Park, H., Jeon, M., and Rosen, J. B. 2001. "Lower Dimensional Representation of Text Data in Vector Space Based Information Retrieval," in *Computational Information Retrieval*, M. Berry (ed.), Philadelphia: SIAM, pp. 3-23.

Paul, R. J. 2007. "Changing the Challenge: To Challenge Makes You Larger and Being Challenged Makes You Small," *European Journal of Information Systems* (16), pp. 317-326.

Peay, E. R. 1988. "Multidimensional Rotation and Scaling of Configurations to Optimal Agreement," *Psychometrika* (53), pp. 199-208.

Petter, S., Straub, D., and Rai, A. 2007. "Specifying Formative Constructs in Information Systems Research," *MIS Quarterly* (31:4), December, pp. 623-656.

Porter, M. 1980. "An Algorithm for Suffix Stripping," *Program* (14:3), pp. 130-37. Republished in *Program: Electronic Library and Information Systems* (40:3), 2006, pp. 211-218.

Power, D. J. 2003. "The IS Core II: The Maturing IS Discipline: Institutionalizing our Domain of Inquiry," *Communications of the AIS* (12), November, pp. 539-545.

Rainer Jr., R. K., and Miller, M. D. 2005. "Examining References Across Journal Rankings," *Communications of the ACM* (48:2), February, pp. 91-94.

Robey, D. 1996. "Diversity in Information Systems Research: Threat, Promise, and Responsibility," *Information Systems Research* (7:4), December, pp. 400-408.

Robey, D. 2003. "Identity, Legitimacy and the Dominant Research Paradigm: An Alternative Prescription for the IS Discipline. A Response to Benbasat and Zmud's Call for Returning to the IT Artifact," *Journal of the AIS* (4:7), December, pp. 352-359.

Salton, G. 1975. "A Vector Space Model for Automatic Indexing," *Communications of the ACM* (18:11), pp. 613-620.

Salton, G., and Buckley, C. 1988. "Term-Weighting Approaches in Automatic Text Retrieval," *Information Processing and Management* (24:5), pp. 513-523.

Scott, S. G., and Lane, V. R. 2000. "A Stakeholder Approach to Organizational Identity," *Academy of Management Review* (25:1), January, pp. 43-62.

Van Gigch, J. P., and Le Moigne, J. L. 1989. "A Paradigmatic Approach to the Discipline of Information Systems," *Behavioral Science* (34:2), pp. 128-147.

Vessey, I., Ramesh, V., and Glass, R. L. 2002. "Research in Information Systems: An Empirical Study of Diversity in the Discipline and Its Journals," *Journal of Management Information Systems* (19:2), Fall, pp. 129-174.

Wade, M., Biehl, M., and Kim, H. 2006. "Information Systems is Not a Reference Discipline (And What We Can Do About It)," *Journal of the AIS* (7:5), May, pp. 247-269.

Weber, R. 2003. "Editor's Comments: Still Desperately Seeking the IT Artifact," *MIS Quarterly* (27:2), June, pp. iii-xi.

Westland, J. 2004. "The IS Core XII: Authority, Dogma, and Positive Science in Information Systems Research," *Communications of the AIS* (13), February, pp. 136-157.

Whetten D. A., Lewis, D., and Mischel, L. J. 1992. "Towards an Integrated Model of Organizational Identity and Member Commitment," paper presented at the annual meeting of the Academy of Management, Las Vegas.

Whitley, R. 1984. *The Intellectual and Social Organization of the Sciences*, Oxford, UK: Clarendon Press.

Wolfe, M., and Goldman, S. 2003. "Use of Latent Semantic Analysis for Predicting Psychological Phenomena: Two Issues and Proposed Solutions," *Behavior Research Methods* (35), pp. 22-31.

Wu, A. Y., and Saunders, C. 2003. "The IS Core – VI: Further Along the Road to the IT Artifact," *Communications of the AIS* (12), pp. 562-567.

Zhang, P., and Li, N. 2005. "The Intellectual Development of Human-Computer Interaction Research: A Critical Assessment of the MIS Literature (1990-2002)," *Journal of the AIS* (6:11), November, pp. 227-292.

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