Association for Information Systems
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ECIS 2009 Proceedings

European Conference on Information Systems (ECIS)

2009

Component-based process modelling in health care

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CONCEPTUAL CONVERGENCES: POSITIONING INFORMATION SYSTEMS AMONG THE BUSINESS DISCIPLINES

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Abstract

The structure and interrelationships of formal knowledge produced in the scientific disciplines have long been of interest to academics. One increasingly important domain of Information Systems (IS) research is the study of the creation and evolution of knowledge. Recent discourse about the intellectual structure of IS has revealed Latent Semantic Analysis (LSA) as an analytic technique that reduces problems associated with human categorization and citation analysis. This exploratory research positions IS within a 'science of business' using LSA to analyze semantic relationships in 24,841 abstracts from core business journals and begins to chart research concepts around which IS and other business disciplines converge. Results indicate that IS research has greater conceptual similarity to the disciplines of Management, Operations, Strategy, and Marketing than previously thought, and that these disciplines are converging on semantically similar research topics and concepts. This organizational-behavior-technical domain is distinct from an economics focused domain dominated by Finance and Accounting. The convergence suggests that IS is contributing to research and knowledge creation useful to other business disciplines and that strategic and functional dependence among the disciplines is increasing. This potentially leads to more integrated systems-oriented knowledge and greater practical relevance for both IS and other business disciplines.

Keywords: Business science, Latent Semantic Analysis, reputational networks, knowledge production, functional dependence, strategic dependence.

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1 INTRODUCTION

The discipline of Information Systems (IS) has a long history of research into the design and management of socio-technical systems for the capture, storage, dissemination, retrieval, and management of information and knowledge. One increasingly important domain of IS that has received less attention is the study of the creation and evolution of knowledge. Recent discourse regarding the intellectual structure and core concepts of IS (Larsen et al. 2008; Sidorova et al. 2008) has illuminated Latent Semantic Analysis (LSA) (Deerwester et al. 1990) as an analytic technique that reduces some of the problems associated with human categorization and citation analysis that has been observed in prior studies. Furthermore, studies of the status of IS as a reference discipline (Grover et al. 2006, Wade et al. 2006) examine the positioning of IS among related business and computer disciplines. But as Straub (2006 p. 242) notes: "scholarly endeavor should not draw artificial boundaries within the domain of information systems, and without any persuasive logic or reasoning, cut itself off from topics that are clearly intimately related to the practice of the IS profession." In response, this paper uses LSA to analyze semantic relationships among 24,810 abstracts from a selection of core business journals, thereby broadening our perspective to encompass the context of the IS discipline among the business disciplines. We are not seeking to identify IS's own structure or asking whether IS has become a reference for other disciplines, but instead we are beginning to chart the creation and evolution of concepts around which IS and other business disciplines orbit.

The structure and interrelationships of formal knowledge produced in the scientific disciplines have long been of interest to academicians. Formal knowledge derived from business school research has been seen increasingly as an economic resource (Machlup 1962; Whitley 2000). Questions regarding the basis of knowledge production, academic rewards, rigor, and relevance of research results have been raised by the business community, government, and business schools themselves. Business research is rarely considered holistically due to institutional structures that preclude integration (Campbell 1969; Whitley 2000). The production of knowledge has been dominated by natural categories "in terms of discipline (business economics, industrial sociology, occupational and organizational psychology) or functional orientation (operations, marketing, finance, HR)" (Tranfield 2002 p. 409). External professional associations and job markets are organized by discipline, and internally, most business schools are organized by discipline – with each discipline its own cost center. Often, each business discipline is presented pedagogically as 'the most important' to students.

An alternative view holds that because industry requires functional areas to be highly applied, functional, and integrated, business school research may emulate this model (Starkey and Madan 2001). Businesses are striving to create integrated value (arguably the basis for much of the reengineering revolution of the 1990s). To some extent this is the model followed by most business schools when designing undergraduate and MBA educations. If business school research is less fundamental in nature and more applied, then there should be a parallel between academic research and business in practice. However, in practice, whereas businesses serve customers who are not concerned about the academic reputation of a finance or marketing department, business school departments develop independent reputations and consider other departments in the same discipline as the primary consumers of their published research.

This exploratory research addresses the position of IS within a 'science of business' which is seeking to created integrated knowledge about business problems, practices, and opportunities. LSA was used to analyze the semantic content of 24,8141abstracts from top journals in the core areas of business as identified by Trieschmann et al. (2000), including Accounting, Finance, Information Systems, Management, Marketing, Operations, Insurance/Risk and Real Estate. Following Whitley's (2000) framework of science as "the product of the social transformation of intellectually constructed objects" in a reputational system (p. 35), the functional and strategic dependence of disciplines was used as lens to examine the conceptual convergence of business disciplines over a thirty year timespan. An increasing degree of consensus on core themes and topics in the academic community would indicate the emergence of a paradigmatic 'business science' that would position the discipline of IS as moving toward integration. Divergence would indicate that academic business research is best represented as moving towards an adhocracy of stove-piped silos of knowledge, in which IS as a discipline is marginalized.

2 FROM CITATIONS TO CONCEPTS

Banville and Landrey (1989) suggest that the "preoccupation about the actual state and future evolution of MIS as a scientific field" (p 48) is a warranted and essential epistemological endeavor. Numerous studies that examine the structure, core issues, reference disciplines, and position of IS as a legitimate, mature discipline have been published (see Larsen et al. 2008 for a review). These studies have been widely influential in the discipline and most rely on citation analysis or human derived content analysis in attempts to capture the conceptual relationships in a large set of wide-ranging literature.

There have also been numerous bibliographic studies in the business disciplines that examine the emergence, growth and spread of ideas, which also trace changes in the intellectual structure of disciplines. Disciplines analyzed include Strategic Management (Ramos-Rodríguez and Ruíz-Navarro 2004), Operations (Pilkington and Liston-Heyes 1999), Management (Podsakoff et al. 2008), and Information Systems (Cheon et al. 1991; Culnan 1986), but generally these empirical studies do not involve a comparison among different disciplines. However, recent citation studies have examined IS as a reference discipline to other business disciplines (Grover et al. 2006; Wade et al. 2006) and determined inter-disciplinary citation patterns.(Biehl et al. 2005). Although citation studies can show patterns of knowledge movement, they generally do not address the specific content of the knowledge itself – the semantic relationships of research terms, concepts, and problems addressed by the disciplines in question.

How intellectual disciplines are organized, how they become mature, how they are controlled, and how they coordinate and orient research have been the focus of research on knowledge production. Scientific knowledge is increasingly seen as the product of social transformation of intellectually constructed objects, and scientific change is increasingly viewed as the outcome of social processes of negotiation, conflict, and competition (Whitley 2000) or "as a complex knowledge market, the constitution of which is, and has been, subject to shaping by institutional forces" (Ramiller et al. 2008, p. 5). These views are in contrast to Kuhn's (1962) internalist view of mature sciences as being characterized by "uniformity and inevitability in knowledge development" (Whitley 2000 p. 3) rather than subject to external economic and political controls. In this latter perspective of formal knowledge production, disciplines are organized and controlled in different ways to produce different knowledge.

One basic type of knowledge production system is produced by political and organizational structures that compartmentalize university departments. Well-bounded and distinct departments support local reputational networks, determine employment criteria, and institutionalize training programs, which together lead to fragmented and internally-referential silos of knowledge (Shove 2000). A contrasting type of knowledge production is based in the social unit of the intellectual discipline in which moderately-bounded and distinct organizations "control and direct the conduct of research on particular topics...through the ability of their leaders to allocate rewards according to the merits of the intellectual contribution" (Whitley 2000 p. 7). Disciplines gain reputation through the production of novel research regarding concepts which have utility in other disciplines. The social systems (e.g. conferences, working groups, journals) provide coordination of task outcomes through access to rewards. Historically, the intellectual disciplines "have been very dominant in the organization of the science system, in the reward system, and in the career system…" (van den Besselaar and Heimeriks 2001, p. 1). Formal public communication and distribution channels (e.g. journals, conferences) provide the arena for conflicts over reputations as well as interpretations of the relative importance of research concepts and ideas. Selection of representative sample sets becomes a critical factor in determining the structure and relationships among and within disciplines. The different views of the IS discipline presented in Larsen et al. (2008) and Sidorova et al. (2008) show this quite clearly, with the former relying on a expansive set of journals (65 total) to examine the IS discipline, and the latter making the assumption that three high profile journals are representative of the core concepts in the IS discipline. The reputation of the high profile journals will influence researchers to pursue questions that align with the concepts that appear in those journals. Therefore an important characteristic of reputation in intellectual disciplines is the degree of control the researcher has over work processes and research goals. Where research concepts, terms, and priorities are similar to commonsense ones, or are borrowed from other disciplines, it is more difficult to maintain unified control of research than in disciplines where vocabularies and work methods are distinct and arcane. In addition, highly selective distribution channels, result in greater dependence of researchers on

the gate-keepers of such channels, and thereby an increased disciplinary control of reputation and research direction. Finally, with increased diversity of legitimate audiences come increasingly differentiated research goals, leading to limitations on coordination and integration of intellectual priorities.

Rather than examining which disciplines cite other disciplines as reference sources, we examine the conceptual linkages among the disciplines to determine the position of IS in relation to other business disciplines. At one extreme, business science is comprised of isolated disciplinary silos, each with its own distribution channels, in which researchers do not utilize concepts from other disciplines and distribution channels limit the range of research topics, concepts, and problems they will accept. In this conception, reputations are forged within disciplines, and researchers depend less on other disciplines for coordinating integrated knowledge and building valid knowledge claims. At the other extreme, there is a "paradigm," loosely defined as an understanding of shared topics, concepts, and models for the science of business that is recognized and accepted by its sub-disciplines. Researchers who often focus in one area are also observed in working in other areas as attempts are made to coordinate and expand research to increase the value of intellectual contributions.

Whitley's (2000) framework for reputation proposes that the major objective of scientific endeavor is couched within a reputational system. Progress in reputation is determined by the degree to which the contribution offers novelty, and the extent to which it is useful to others in the discipline (Figure 1). Conflicts between the two demands create particular tensions between scientists, and variations in their mutual balance affect the organization of knowledge. Structural characteristics of a discipline can influence the ways in which these objectives are sought and knowledge is produced. These foundation characteristics are: Strategic Dependence, Functional Dependence, and Strategic Task Uncertainty.

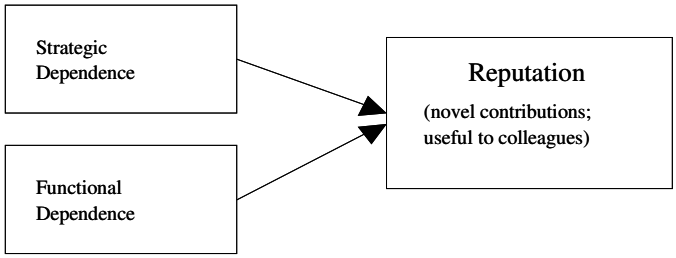


Figure 1. Reputational system (after Whitley 2000)

Our research focuses on two of these factors:

1. Strategic Dependence can be defined as the "extent to which researchers have to persuade colleagues of the significance and importance of their problem and approach in order to attain high reputation from them" (Whitley 2000 p. 88). Although this is a complex construct, for this study it was operationalized by determining the association of distribution channels. The correlations among the representative journals of each business discipline was based on the shared topics that were published (e.g. the amount of concept sharing between academic disciplines).

2. Functional Dependence can be defined as the "extent to which researchers have to use the specific results, ideas, and procedures of fellow researchers in order to construct knowledge claims that are regarded as competent and useful contributions" (Whitley 2000 p. 88). In this study, functional dependence was measured by the convergence/divergence of different business disciplines around specific research topics and ideas.

The science of business can be represented as a continuum between an integrated bureaucracy at one end, and a fragmented adhocracy at the other. An integrated bureaucracy would have high strategic dependence and high functional dependence between sub-disciplines. Positive indicators would include consensus around important concepts and topics for business research, and the valuation of opinions of researchers in other disciplines. If the science of business is a fragmented adhocracy, there would be low strategic dependence and low functional dependence among sub-disciplines. All sub-disciplines work in their own domain using different methods, focusing on different topics, and seeking internal reputations.

If the science of business is becoming a conceptually integrated bureaucracy, it is creating knowledge that is contextualized and shared among the disciplines. This would be recognized in the convergence of

disciplines around fundamental topics (functional dependence) and strong associations among the distribution channels (strategic dependence). If, on the other hand, the science of business is a fragmented adhocracy, then it is creating important and perhaps more fundamental knowledge within sub-disciplines but is losing out on the contextualization and integration of knowledge between disciplines that is necessary to create value. Prior citation analyses of business sub-disciplines (Cheon et al. 1991; Grover et al. 2006; Wade et al. 2006) have shown a limited boundary-crossing of intellectual research topics among sub-disciplines. The degree of fragmentation/integration also stimulates questions of research relevance. The practice of business benefits from knowledge of integrated strategies and business functions that are not separated by the artificial stovepipes that characterize academe (Campbell 1969). In a strongly applied science such as business, research relevance can be increased by production of integrated knowledge that views business activities from a systems perspective (Alter 2004).

3 METHOD

In contrast to prior scientometric studies based upon citation analysis, this study analyzed the co-occurrence and proximity of words as a measure of semantic similarity or meaning. We argue that this is a semantic analysis, as it determines the similarity in meaning of "a word, phrase, sentence or text."[*] In contrast to citation patterns as indicators of diffusion of ideas among disciplines, semantic analysis emphasizes identifying the similarities and differences among disciplines regarding topics and concepts presented in the research and envisioning a semantic network that clarifies the conceptual focus of research in different business disciplines. Abstracts are a distilled and valid representation of the conceptual meaning of research papers, and have been used in analysis of intellectual communities in the IS discipline (Larsen et al. 2008). LSA is a computational technique that decomposes the semantic content of a textual corpus (abstracts, in this study) into a numerical representation of the 'meaning' of each text unit. The underlying theory of LSA is that the aggregate of all the word contexts in which a specific word does (and does not) appear is a measure of the similarity of the meaning of words or of texts, to other words or texts (Landauer 2007). This technique assumes that written/verbal meaning comes from the relationships that are represented and activated by collections of words. Furthermore, it is these abstract relationships that "make thinking, reasoning, and interpersonal communication possible" (Landauer 2007 p. 8) and the relationships among the words in an abstract are precisely what the human, and the LSA technique, uses to determine meaning. LSA is a method, although new to Information Systems, that is part of a long history of computational research on semantic relationships, theory of meaning, and cognition (Jurafsky and Martin 2000; Manning and Hinrich 1999) which assumes that human interpretation is not the only path for representing human knowledge. LSA allows for rapid analysis of very large text-based data sets, while minimizing many of the problems associated with human categorization. LSA offers: 1) the means to handle very large data sets (24,000+ abstracts in this study) and 2) a consistent and replicable technique that allows for comparison between researchers, data sets, and time horizons. This consistency provides the ability to state that the differences (or similarities) in "meaning" we ascribe to the data are not due to methodological or interpretative differences. If you reanalyze data with the same parameters, you will get the same result. The converse is also true: if you use LSA with the same parameters on a *different* data set, then any differences in meaning arise from the data, and not from the method or human interpretation.

3.1 DATA COLLECTION

As an exploration and proof of concept, this study used Trieschmann et al.'s (2000) determination of a warranted set of A-journals from each business discipline, based on the proportion of academicians in each discipline. They concluded that eight disciplines and 20 journals best represented the business disciplines:

> *Our goals were to develop a research "bread basket" of business school journals that was representative of research in the 13 business school disciplines defined by AACSB (1998). Within each discipline, there are many "good" journals. For example, Glick, et al. (1997) and Johnson & Podsakoff (1994) identify more than 30 "good" journals in the management group, which accounts for about one fifth of business school faculty (3,457 out of 15,474). While this number*

[*] http://wordnetweb.princeton.edu/perl/webwn?s=semantics

> *of journals is useful for evaluating one discipline, it becomes challenging to find and analyze the 150 or so "good" journals this number would imply for the business school as a whole… Instead, we decided to focus on a smaller set of the "best" journals in each discipline. Thus our measure of business school research productivity is deliberately biased to only one form of business research: publications in leading research journals. We exclude other forms of research such as articles in "good" but lower ranked journals, conference papers, books, book chapters, and articles in practitioner journals (Dennis 2000).*

Our research utilized 24,841 abstracts from Trieschmann et al.'s (2000) list of 20 journals over a period of 30 years. Twelve of the journals provided full datasets beginning in 1973, and eight journals initiated publication between 1974 and 1990. Only two disciplines (Management Information Systems (1977), Production/Operations Management (1980)) began publication after 1973, but were included beginning with the first year of their publication. Abstracts were obtained from ProQuest's database of journal abstracts. Exhibit A lists the business disciplines and journals published by Trieschmann et al. (2000).

3.2 LATENT SEMANTIC ANALYSIS

This research represents the first application of Latent Semantic Analysis (LSA) to a longitudinal inter-field dataset, and the first empirical analysis of research topics within all the major business disciplines. LSA can be used to determine the conceptual similarity among text units (artifacts), is capable of handling large datasets, and aims to:

> *develop a reproducible representation of artifacts (e.g., documents, interview data, survey data, etc.) and an approach to labeling that representation in a way that would (a) reduce… problems of human interpretation of the data; and (b) allow the application of quantitative techniques based on cardinal, rather than ordinal or nominal, data. Such an advance would offer an alternative as well as a complement to some existing methods for categorizing and labeling qualitative data* (Larsen and Monarchi 2004, p. 351).

LSA begins by treating each abstract as a set of words without structure. "Stop words," or words that have little or no meaning when taken out of context, but that provide structure to the sentence, are removed. Stop words typically include articles, prepositions, pronouns, and conjunctions, as well as common adjectives and adverbs.

The remaining words are stemmed to avoid having multiple forms of a word (its morphological variants) represented in the analysis. Stemming converts a word to a related form, i.e. it "conflates" the word. For example, removing an "s" or "es" will convert some plurals to singulars, and stemming the words "walks," "walking," and "walked" reduces all three to "walk." Stemming reduces processing time as well as increases identification of similar words.

After stemming, words reflecting research methods or techniques, such as "regression," "correlation," "ethnographic," etc. are removed to allow the focus to be completely on the topics of interest rather than the specifics of research approaches. Although the meaning of objects is constituted by the epistemological perspective, we assumed that the contextual similarity of concepts would still be present. A sparse matrix of unique stems as rows and abstracts as columns with the number of occurrences of a specific stem in a specific abstract as the cell value is created next. This matrix is submitted to a singular value decomposition (SVD), which creates a high-dimensional space in which each abstract and each stem in those abstracts occupies a specific location. Furthermore, by aggregating the SVDs of the abstracts, a centroid for those abstracts may be located in the high-dimensional space representing that collection of abstracts (for example, all abstracts published in a specific journal over 30 years). This representation allows measurement of distance (or cosine or angle) between individual abstracts in all disciplines to the centroid representing a specific discipline.

3.3 DATA ANALYSIS

Data analysis consisted of two steps. First, the 30 years of abstracts in Trieschmann et al.'s list of journals was subjected to LSA analysis. Once each abstract was represented as a vector, the midpoint for all abstracts in each journal was calculated, and the "distance" from each of the 24,841 abstracts to every one

of the 20 journal midpoints was measured. The results were compiled in a table of 20 columns and ~24K rows which was used in a factor analysis using principal component analysis with varimax rotation. As a test of the association of distribution channels (strategic dependence), a correlation table between the semantic content of all journals was calculated and the resultant variance used to map a semantic network.

Second, functional dependence was examined by calculating the relative distance in semantic space of research topics which characterize the journals from each discipline over time. A sliding window of a 3 year period, centered on the target year, was used to select the abstracts for each discipline within that window. The centroid of each discipline's abstracts for a given period was plotted against the centroid for each of the other disciplines for the same time period. This pair wise comparison reveals relative convergence/divergence of concepts in the journals from each discipline over time.

4 FINDINGS

The analyses revealed two surprising results: 1) The distribution channels for the business disciplines are semantically more closely related than prior studies indicate, and 2) within the business disciplines, there exists a significant degree of conceptual convergence on two distinct domains of topics and concepts.

4.1 ASSOCIATION OF DISTRIBUTION CHANNELS

As a test of the association of distribution channels (journals) in this sample, semantic analysis of the total aggregate set of abstracts for each journal was performed to find the centroid for each journal. These results were then submitted to two subsequent analyses. First, multi-dimensional scaling (MDS) of the distances was calculated to determine the relative proximity of the journals centroids (the S-stress score was small, indicating that the resulting two-dimensional map is quite accurate). The relative positions of the journal centroids were construed to represent the relationships among the disciplines they represent (Figure 2). This mapping suggests the formation of two distinct domains of business interest based on conceptual csimilarity: a organizational-behavioral-technical domain composed of Management, Strategy, IS, Marketing and Operations, and an economics domain composed of Finance, Accounting, Real Estate and Risk & Insurance. This result is in remarkable agreement with the structural equivalence map based on citation analysis of the Financial Times basket of business journals (Biehl, 2001).

Second, using the same dataset as for the factor analysis, correlation coefficients between journals were calculated. Using the significant correlations (after Bonferroni correction) between journals in the different disciplines, a diagram of the network of interdisciplinary relationships between journals, and again by extension between disciplines, was developed and overlaid onto the MDS perceptual map (Figure 2). In this semantic network the network nodes are the centroids of each journal and the weight of the network links is determined by the correlations between journal abstracts. As the journals themselves are representative of the disciplines, the resultant relationships articulate "the groups…who share common understanding, those who have idiosyncratic meanings…and those who serve as liaisons and boundary spanners (Monge and Contractor 2003, p. 187).

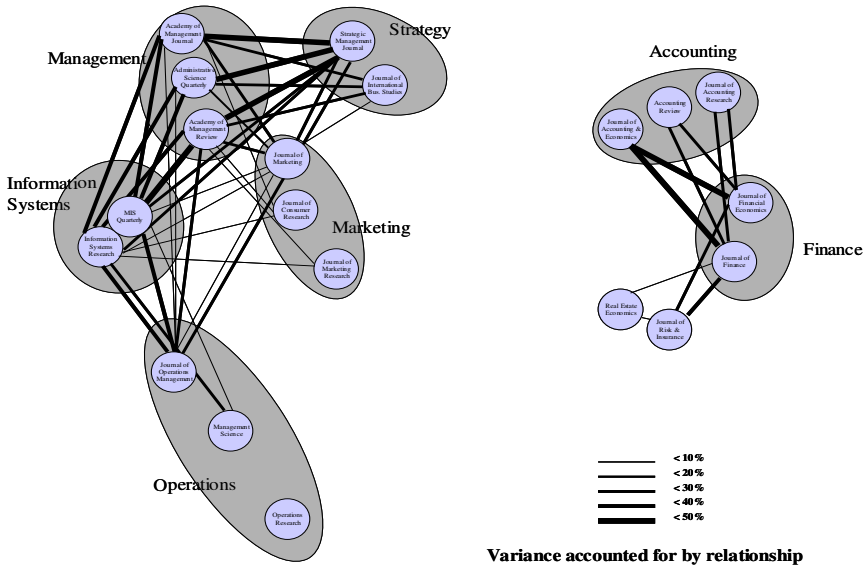


Figure 2. Semantic Network Among Journals Representing Disciplines

The semantic network suggests that over the 30-year span of journals included in this study, the business disciplines as represented by these journals are more tightly linked regarding the research topics and concepts they publish than previously thought. The network map shows two distinct domains that exhibit a significant degree of shared interest and consensus about important research concepts, topics, and problems as evidenced by the proximity of research articles in semantic space. By showing the semantic associations between journals, we can visualize the strategic dependence between the disciplines the journals represent. The line weighting of the ties indicates the percent variance for which each tie accounts (from 10-50%). The line weighting is therefore an indicator of the relative strength of the semantic association between journals. Overall, this network map indicates that there is a significant degree of strategic dependence within these two discrete business domains. The strongest associations are between Strategy and Management, IS and Management, and between Finance and Accounting. At lower degrees of association there are significant semantic relationships between Management and Information Systems, IS and Operations, and Marketing and Operations. Interestingly, Real Estate and Risk & Insurance are relative isolates with weaker associations with Finance.

4.2 POSITIONING IS AMONG BUSINESS DISCIPLINES

The final analysis reveals the changes in semantic content of each business discipline over time in comparison to each other discipline (Figure 4 A-F). An increase in the semantic distance (the angle) between the target discipline (listed first) and any other specific discipline indicates that the topics, and concepts in the journals are diverging. A decrease in distance indicates greater convergence on semantically related concepts. As words pertaining to research methods, epistemologies, and ontologies were removed from the analysis, any convergence/divergence of the centriods representing the discipline reflects changes in the meanings of the abstracts.

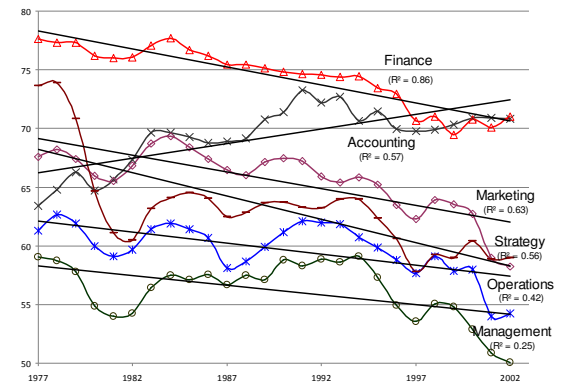
Given the limitations of representing discipline centroids in a two-dimensional semantic space, for the purpose of displaying the data one discipline must be used as a baseline to be compared to each other discipline. In Figure 3 A-F, the baseline discipline is noted in the figure heading and does not appear in the figure. We found that Real Estate and Risk/Insurance were very insular and did not converge or diverge with any other discipline. Therefore, for clarity, they were not included in these figures. Lastly, only significant relationships have been displayed in each figure.

Figure 3A shows that the semantic content contained in IS abstracts is converging with the semantic content in the abstracts of the other six disciplines, with the exception of Accounting, which is diverging in

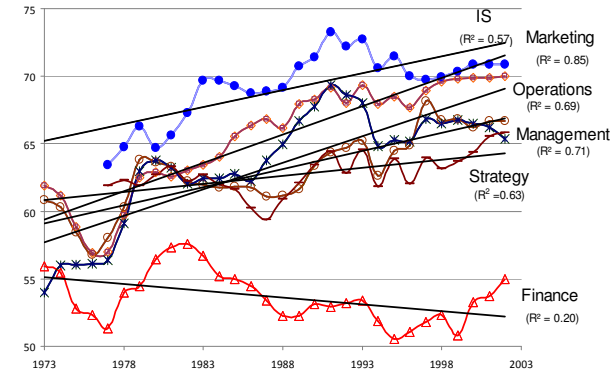
semantic content (i.e.. the "distance" in semantic space is becoming greater). An analogous pattern is observed when Accounting is held as the baseline (Figure 3B). In this figure, we observe that all business disciplines are diverging in semantic content from Accounting with the exception of Finance, which is converging.

Surprisingly, this pattern holds when each of the other business disciplines is held as the baseline - as a group, Operations, IS, Management, Strategy, and Marketing are converging with each other. Accounting and Finance are also converging with each other but are simultaneously becoming more distant from the organizational-behavioral-technical domain. Although there are annual oscillatory variations, in each case the trend lines are converging at significant values.

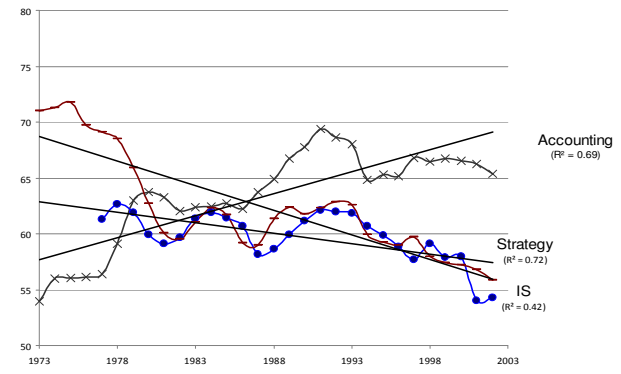
A: Information Systems vs. all other disciplines



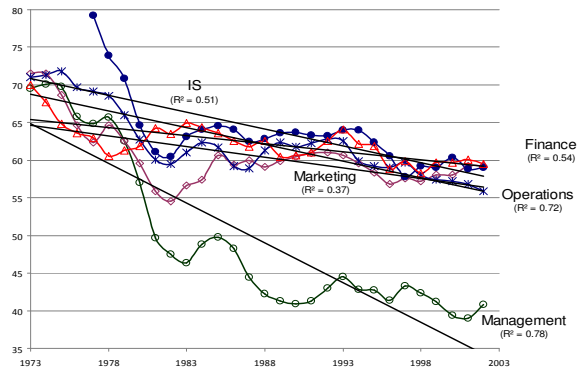
B. Accounting vs. all other disciplines



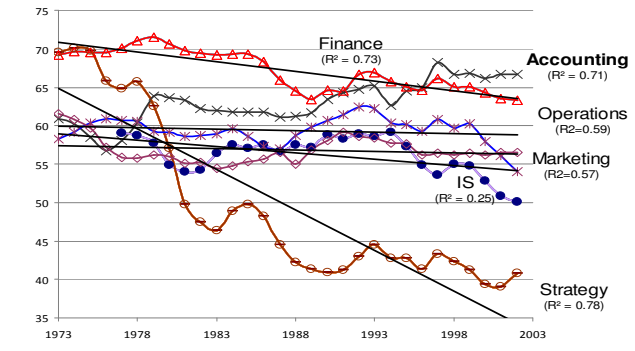
C. Operations vs. all other disciplines



D. Strategy vs. all other disciplines



E. Management vs. all other disciplines



F: Marketing vs. all other disciplines

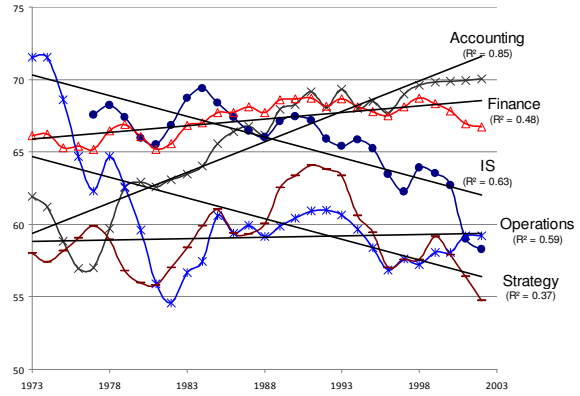


Figure 3 A-F Comparison of Conceptual Trends in Business Journals

Examination of these figures show that in the formative years of the disciplines much of the research published in these journals was semantically less similar regarding the research topics, concepts and problems than they were in recent publications. Although there is no baseline distance in semantic space

that serves as a demarcation between fragmentation and integration, these patterns show that the business disciplines were conceptually more fragmented 30 years ago than now and that in general, there is increasing agreement on conceptually related concerns and problems.

It is clear that the business disciplines are increasingly focusing on semantically similar research topics, concepts, and problems over time. There are two discrete but associated "domains" within business science: a convergence on financial concepts (Finance and Accounting, with weaker associations with Real Estate and Risk & Insurance); and a convergence around strategic, managerial, and technical concepts. These large-scale domains indicate a growing degree of functional dependence among sets of the previous more fragmented business disciplines. In addition, if research topics are held in common more frequently, there must be a greater association among distribution channels over time. This is a logical argument, rather than one with direct empirical support. But it suggests a greater degree of strategic dependence among the business disciplines within the separate domains.

Prior citation studies of business disciplines have shown that "the management field is becoming more integrated and interdisciplinary" (Biehl et al, 2006, p. 363) while other disciplines are becoming more insular. Our evidence suggests a broader pattern of conceptual integration and a long-term trend. It is important to note that semantic similarity is a continuum, not a point of demarcation. Our study indicates a greater degree of conceptual similarity among IS and other business disciplines than has been observed in prior citation studies. It should be noted that citation analysis may not always indicate consensus on the concepts under inquiry, but rather may reflect issues of method, history, or areas of distinction. Our semantic analysis of concepts shows that the research concepts published in top IS journals are similar to research in highly ranked journals in Management and Operations and to a lesser degree, Marketing and Strategy.

4.3 LIMITATIONS

This is an exploratory study and the set of business journals included do not necessarily capture the full extent of research topics and concepts in the business disciplines. For example, as shown in Larsen et al. (2008), the conceptual breadth of IS studies is not fully represented by MISQ and ISR. As noted in Straub (2006) the choice of journals will have a strong effect on any study of disciplinary structure and relationships. Additionally, the "basket of words" approach used in LSA flattens the semantic content of abstracts to a single point and may uniquely categorize studies that address multiple research terms. But these findings show long-lived trends of conceptual change in the research topics and concepts published in these highly ranked journals. Future research should include a broader data set which includes European and Asia-Pacific journals to determine whether these changes hold across the disciplines globally. In addition, the concepts or themes around which the journals publications are converging should be identified.

5 DISCUSSION

This study analyzed the semantic content of abstracts in a warranted set of representative journals of the eight business disciplines identified by Trieschmann et al. (2000). By determining the proximity of the aggregated semantic content that contributes most to the position of a journal in semantic space, it is possible to show conceptual relationships among journals and the disciplines that they represent. By examining the actual terms and concepts underlying research, this research shows that two domains of business disciplines are more related, both conceptually and by distribution linkages, than previously thought. In one domain, Management holds a central position between IS and Strategy, and IS has centrality between Operations and Management. In the other large-scale business domain, Finance and Accounting research concepts are tightly intertwined with a lesser shared interest in some concepts within Real Estate and Risk & Insurance.

This study also highlights the importance of longitudinal analysis in scientometric research. A sliding window analysis clearly demonstrates conceptual convergence semantically related topics among journals in the organizational-behavioral-technical with a simultaneous divergence from an accounting/finance domain. The use of LSA was critical, in that it allows consistent semantic analysis of large data sets and enables comparison across time periods.

The focus on concepts and research problems shared with other business disciplines potentially leads to more integrated knowledge and greater practical relevance for IS. It is important to recognize the importance of this finding without overstating it. This does not indicate the direction or timing of boundary spanning knowledge, and no claims are made about IS as a reference discipline. But at the same time, it does suggest an increasing centrality of IS concepts as a contribution to knowledge regarding a broad set of problems that other business disciplines are concerned with.

As noted by Biehl et al. (2001), "PhD students are trained to focus on a single discipline...tenure is easier to obtain in a fairly focused research stream...and publishing in a variety of cross disciplinary journals is often seen in a negative light" (p. 369). But despite these institutional structures and the contrasting result from interdisciplinary citation studies (Biehl et al. 2005; Grover et al. 2006; Wade et al. 2006) these data suggest that IS and business disciplines are trending towards greater conceptual integration. Research, particularly in IS, is not as much transdiciplinary as neo-disciplinary, and is at risk of being marginalized by traditionally bounded business disciplines concerned with the same concepts. Although there is evidence that "business academics tend to publish in discrete and mostly non-overlapping disciplines" (Biehl et al. 2005, p 368), the disciplines themselves are converging on semantically, and arguably conceptually, similar research ideas, concepts, and problems.

Although the sources and direction of knowledge movement among disciplines is not apparent, this research suggests that IS is more conceptually related to other business disciplines in an organizational-behavioral-technical domain than prior studies would indicate. This implies that IS is becoming a central part of a maturing 'science of business' that has a network of functional and strategic dependencies that may lead to interdisciplinary perspectives on common research problems. These reputational networks can influence the institutional direction of research funding and programs. The allocation of subject domains to the sciences is not due to clear demarcations of content. Instead academic disciplines themselves exist due to a wide variety of internal, external, and historical forces, and reinforce ethnocentrism due to "the tribalism or nationalism or in group partisanship in the internal and external relations of university departments, national scientific organizations and academic disciplines" (Campbell 1969 p. 328). Recognition of the role played by IS in producing integrated knowledge has implications for collective coordination of task outcomes and for academic reward structures. Supporting, encouraging, and rewarding the trend toward interdisciplinary studies may have the effect of aligning research with the institutional and economic forces that drive research. This may increase both integrated systems-based knowledge and the relevance of academic knowledge to practice.

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Exhibit A

Table 1 Trieschmann et al (2000) Academic Business School Fields

Fields and Journals		Years	Abstracts
Field 1: Accounting			
Accounting Review [AR]		1973-2002	1,200
Journal of Accounting & Economics [JAE]		1979-2002 (v1-)	442
Journal of Accounting Research [JAR]		1973-2002	960
Field 2: Finance			
Journal of Finance [JF]		1973-2002	2,577
Journal of Financial Economics [JFE]		1974-2002 (v1-)	1,024
Field 3: Insurance, International Business & Real Estate			
Journal of Risk & Insurance [JRI]		1973-2002	1,052
Real Estate Economics [REE]		1973-2002	720

Journal of International Business Studies [JIBS]		1973-2002	893
Field 4: Management Science			
Management Science [MCI]		1973-2002	3,407
Operations Research [OPR]		1973-2002	2,436
Field 5: Management			
Academy of Management Journal [AMJ]		1973-2002	1,938
Academy of Management Review [AMR]		1976-2002 (v1-)	1,266
Administrative Science Quarterly [ASQ]		1973-2002	763
Strategic Management Journal [SMJ]		1980-2002 (v1-)	1,167
Field 6: Management Information Systems			
Information Systems Research [ISR]		1990-2002 (v1-)	258
MIS Quarterly [MISQ]		1977-2002 (v1-)	607
Field 7: Marketing			
Journal of Consumer Research [JCR]		1974-2002 (v1-)	1,140
Journal of Marketing [JMK]		1973-2002	1,056
Journal of Marketing Research [JMR]		1973-2002	1,373
Field 8: Production/Operations Mgmt			
Journal of Operations Management [JOM]		1980-2002 (v1-)	562
Total		**1973-2002**	**24,841**