THE INTELLECTUAL STRUCTURE OF THE STRATEGIC MANAGEMENT FIELD: AN AUTHOR CO-CITATION ANALYSIS

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This paper complements a recent study by Ramos-Rodriguez and Ruiz-Navarro (2004) that investigated the intellectual structure of the strategic management field through co-citation analysis. By using authors as the units of analysis and incorporating all the citations that are included in the Science Citation Index and the Social Science Citation Index, we trace the evolution of the intellectual structure of the strategic management field during the period 1980–2000. Using a variety of data analytic techniques such as multidimensional scaling, factor analysis, and Pathfinder analysis, we (1) delineate the subfields that constitute the intellectual structure of strategic management; (2) determine the relationships between the subfields; (3) identify authors who play a pivotal role in bridging two or more conceptual domains of research; and (4) graphically map the intellectual structure in two-dimensional space in order to visualize spatial distances between intellectual themes. The analysis provides insights about the influence of individual authors as well as changes in their influence over time. Copyright © 2007 John Wiley & Sons, Ltd.

INTRODUCTION

Strategic management as an academic discipline is relatively young. Its emergence as a rigorous, research-based field of inquiry dates to the early 1960s, especially the publication of classic works such as Chandler (1962), Andrews (1971), and Ansoff (1965). Right from the beginning it was recognized to be an interdisciplinary field of inquiry, and strategy researchers have not only acknowledged but also have been proud of the discipline's multidisciplinary intellectual heritage (e.g., Jemison, 1981b; Porter, 1981). Three watershed events in the early history of the field were the Schendel and Hofer (1979) publication, Porter's (1980) book, and the launching of the *Strategic Management Journal* (*SMJ*) in 1980. Schendel and Hofer (1979) brought together the leading scholars in the field to review and summarize the state of the field and draw a research agenda for the next two decades. Porter's *Competitive Strategy*

became the foundation for much of the strategy curriculum and marked a transition from the reliance on toolkits developed by consulting firms (such as the BCG matrix) to a systematic, theoretical analysis of firm-level strategy. *SMJ* provided scholars in the area a forum to publish their research.

The subsequent two decades witnessed the rapid growth of the strategic management field. The Business Policy and Strategy division of the Academy of Management became one of the two biggest divisions in the Academy. Strategy scholars such as Porter and Prahalad became sought after business gurus around the world. *SMJ* doubled the number of issues per year and other leading journals began to devote more space to strategy research. Practitioner journals dedicated to strategy research such as *Strategy & Business* also appeared in the 1990s. Thus, strategic management became a mature field of inquiry in a relatively short period of time.

During this period of growth, strategic management scholars also began a phase of critical introspection. Mintzberg's *The Rise and Fall of Strategic Planning* (Mintzberg, 1994) and Gilbert's *The Twilight of Corporate Strategy* (Gilbert, 1992) raised important questions about the contribution of the field and its future direction. Leading strategy scholars such as Bettis (1991) and Meyer (1991) also offered constructive critiques of the field. If introspection, self-analysis, and occasional self-doubt are signs of maturity, one can definitely say that strategic management today can be viewed as a mature discipline.

In recent years, there have been many attempts to systematically analyze the domain of the strategic management field, trace its historical evolution, map its intellectual structure, and assess its strengths and weaknesses. Hoskisson *et al.* (1999) provided a historical analysis of the intellectual currents underlying the evolution of the field. Nag, Hambrick, and Chen (2007) used a lexicographic analysis of strategy articles to extract a consensual definition of the field. Boyd, Gove, and Hitt (2005) used content analysis of published articles in strategic management to identify its methodological shortcomings. Using structural equation modeling, Boyd, Finkelstein, and Gove (2005) measured the maturity of the field by assessing research productivity of strategy faculty and compared it to other disciplines. Phelan, Ferreira, and Salvador (2002) investigated changes in the diversity and content of

articles published in *SMJ* during its first 20 years. This surge in the attempts to undertake systematic analyses of the field suggests two things. First, more than a quarter century after the formal birth of the field, scholars within the field believe that sufficient research has accumulated to warrant such analyses. Second, strategy scholars are in a mood of self-analysis to define the boundaries of their field and map its intellectual domain.

Ramos-Rodriguez and Ruiz-Navarro (2004)[1] recently published an analysis of the intellectual structure of the strategic management field using the bibliometric technique of document co-citation analysis. Their analysis provided several interesting conclusions. These include the greater influence of books rather than journal articles in the early part of the history of the field (especially those of Chandler, Andrews, and Ansoff), Porter's preeminent influence in the 1980s and 1990s, and the late blooming of the resource-based view in the late 1990s and beyond, although Porter's work and the early work in the resource-based view were separated by only 4 years.

Bibliometric methods, such as those employed by RR, can both complement and validate expert judgments by experienced scholars in the field. First, bibliometric methods have the advantages of quantifiability and objectivity. Thus, bibliometric analysis can avoid some of the potential subjective biases and perhaps serve to provide validation to what the best experts in the field may have intuitively inferred. Second, because strategic management is a multidisciplinary field that has liberally borrowed and assimilated works from a variety of other related academic disciplines, a bibliometric analysis covering an extended period of time can help us to pinpoint the most influential ideas/schools of thought (as proxied by associated authors) and the interrelationships among them.

Research objective

Through a bibliometric analysis, Ramos-Rodriguez and Ruiz-Navarro (2004) recently identified the most influential works in the field and traced the intellectual evolution of the field by tracking changes in citation patterns over time. The premises for their study were that (a) the field of strategic management has become mature enough to treat the literature generated by the field as a

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[1] We refer to this study as RR throughout the rest of this paper.

research topic in its own right, and (b) bibliometric techniques provide an appropriate tool for studying the intellectual structure of the field.

We are in general agreement with both the above premises. The objective of our paper is to extend RR's exploration of the intellectual structure of the strategic management field. More specifically, our goals are to (1) delineate the subfields that constitute the intellectual structure of strategic management; (2) determine the relationships, if any, between the subfields; (3) identify authors who play a pivotal role in bridging two or more conceptual domains of research; and (4) graphically map the intellectual structure in two-dimensional space in order to visualize spatial distances between intellectual themes. In order to accomplish these goals, first we identify influential authors whose scholarly works have been frequently cited in *SMJ*. The intellectual structure of the strategic management field and its evolution over time are then assessed in terms of the relationships between these authors. Finally, a network structure of these authors is analyzed to provide insights into the strength of the relationships between the authors. Further, the network structure helps us to identify boundary-spanning authors whose works pervade more than one intellectual theme, thereby bridging distinct research streams.

We see our paper as a companion piece, which in conjunction with the RR paper can provide readers with a comprehensive retrospective on the intellectual evolution of the strategic management discipline. While the two papers share a common philosophy for analyzing the intellectual structure of a field, there are also significant differences in terms of the unit of analysis, methodologies, and representation of intellectual structure. The basic unit of analysis in our paper is the *author*, whereas the RR paper used a *publication* as the unit of analysis. The basic premise behind this approach is that the scholarly contributions of authors who are frequently co-cited are likely to embody similar or related concepts. Methodologically, we augment the multidimensional scaling used in the RR paper with additional analyses such as factor analysis and Pathfinder analysis. Together, these analyses help us to identify the distinct subfields within strategic management, to graphically render author proximities, and to develop a network structure of the field that helps us identify boundary-spanning authors who provide a bridge between two or more conceptual domains.

Overview of research methodology

Our effort at delineating the intellectual structure of the strategic management discipline involves author co-citation analysis (ACA), a bibliometric technique that uses a matrix of co-citation frequencies between authors as its input (McCain, 1990a). This matrix is the basis for various types of analyses. First, we perform factor analysis to extract the key conceptual themes (i.e., specialties) in the strategic management field. The analysis also shows the protagonists of the subfields and the pervasiveness of their influence. This is followed by multidimensional scaling (MDS) to provide a graphical representation of author proximities. We conclude with a graph-theoretic approach called Pathfinder analysis to gain insights into network relationships among authors as well as to identify boundary spanners within each field. Each of these methodologies and the rationale for their use is described next.

Author co-citation analysis

ACA is a bibliometric technique that has found widespread applicability. Besides being employed to clarify subfields in a discipline and to explicate ideational relationships between them (McCain, 1983; Culnan, 1986, 1987; Culnan, O'Reilly, and Chatman, 1990; Bayer, Smart, and McLaughlin, 1990; McCain, 1990a; Eom and Farris, 1996; White and McCain, 1998; Sircar, Nerur, and Mahapatra, 2001; Ponzi, 2002), it has been used by researchers to investigate various phenomena. For example, Cottrill, Rogers, and Mills (1989) applied the methodology to analyze research traditions, and Sircar *et al.* (2001) examined the conceptual differences between seminal authors in software development to address the question of whether object orientation constitutes a revolutionary change. Given that there are no empirical or objective approaches to detecting and elucidating paradigms and paradigm shifts, some have suggested the use of citation patterns for such purposes (e.g., Kuhn, 1970; Crane, 1972; Weber, 1987). ACA's ability to reveal patterns of association between authors based on their co-citation frequencies makes it a prospective methodology for understanding the evolution of an academic discipline (White and McCain, 1998). The versatility of the technique and its acceptance by diverse disciplines make it appropriate for this study.

The formal and informal communications that authors engage in are systematically chronicled in journals that publish their works. Authors working in a stream of research often cite one another as well as draw on common sources of knowledge. Further, their works are likely to be frequently *co-cited* (i.e., cited together) by other authors working on intellectually similar themes. The upshot of this process is an intricate web of relationships between authors established through the creation and dissemination of knowledge. Thus, citations of seminal authors provide a basis for unraveling the complex patterns of associations that exist among them as well as to trace the changes in intellectual currents taking place over time.

Influence can be assessed using different units of analysis such as a paper or book (Ramos-Rodriguez and Ruiz-Navarro, 2004), an author (White and Griffith, 1981; McCain, 1990a, 1990b; White and McCain, 1998), or a journal (Podsakoff *et al.*, 2005). Our unit of analysis is an individual author rather than a specific paper or book as was the case in the RR paper. Often an author's work over a period of time tends to be characterized by thematic consistency, advocacy of a particular perspective, and cumulative contributions in answering a specific research question. Although seminal papers or books are very influential, treating an author as a unit of analysis can complement the insights gained from the RR study that focused on individual works.

ACA, which uses seminal authors in a discipline as the units of analysis, predicates that the conceptual similarity in the works of such authors would increase the likelihood of their being cited together regularly (McCain, 1990a). The frequency of co-citation is therefore a measure of the proximity between authors. It must be emphasized that the name of the author is merely a label for the central conceptual theme or idea that he or she represents (Culnan, 1986, 1987). The intellectual map is thus a representation of ideational interactions among authors established through their frequency of co-citations and the overall distribution of co-citations that they share with one another (McCain, 1990a; White and McCain 1998). This makes ACA eminently suitable for explicating the subfields that fall within the overall disciplinary domain of strategic management.

Figure 1, adapted from McCain (1990a), summarizes the steps that were used in this study.
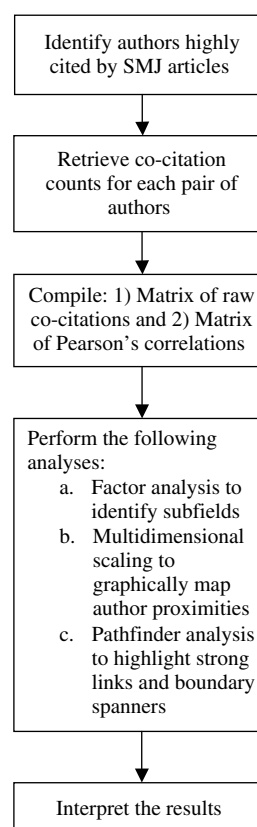

Figure 1.   Steps used in author co-citation analysis (adapted from McCain, 1990)

Factor analysis

ACA researchers usually perform multivariate techniques such as factor analysis, cluster analysis, and multidimensional scaling to analyze the data (McCain, 1990a). Factor analysis uses the matrix of raw co-citation frequencies as its input. Factor analysis permits us to derive subfields from the co-citation matrix. Subfields correspond to the extracted factors, and each subfield represents an intellectual theme defined by the works of authors who load highly on that subfield/factor. The amount of variance explained by a factor may be construed as its contribution to the conceptual foundation of the field. Subfields that exhibit a high cumulative tradition in research are likely to account for a larger percentage of the total variance. Oblique factor rotation, such as oblimin, also allows the researcher to examine interfactor relationships (i.e., relationships between subfields). Finally, factor analysis also reveals which authors have a pervasive influence on the

field. Such authors would appear in more than one subfield.

Multidimensional scaling

Multidimensional scaling (MDS) is a data reduction procedure that allows us to generate a map using similarities (or dissimilarities) between objects (Wilkinson, 2002). The objects of interest in ACA are authors. The correlations between authors are used to render a two-dimensional graph of author proximities. Since authors are tokens of concepts, their spatial separation in two-dimensional space allows us to visualize the conceptual distance between various intellectual strands of research. The ideational similarity of authors may be discerned by examining the proximities of authors. This map is a reflection of the perception of the overall community of researchers who cite the works of these authors (White and McCain, 1998). The evolution of the field may be discerned by examining changes in the structure of such maps over time.

Pathfinder analysis

The references (i.e., citations) made to scholarly works of seminal authors in a discipline may be formally analyzed to: (1) delineate a network structure highlighting prominent relationships between authors; and (2) identify those 'boundary-spanning' authors who serve to bridge research specialties. Pathfinder analysis, a technique that has been widely used in cognitive psychology (e.g., Schvaneveldt, 1990) and more recently in citation analysis (Marion and McCain, 2001; White, 2003), is a viable approach for generating a network structure of authors.

Pathfinder analysis fundamentally draws on concepts from graph theory to generate a network structure called a PFNet in which strongest relationships between concepts of interest in the domain are emphasized (Schvaneveldt, 1990). The nodes in such a network represent concepts, which, in our study, manifest themselves as authors. As mentioned earlier, the co-citation frequency between authors is a measure of their conceptual similarity. The input to Pathfinder analysis is a matrix of similarities or dissimilarities, where the data may be symmetric or asymmetric. The dataset that this study employs is symmetric as the co-citation frequency between two authors is not dependent on direction. Such a dataset results in an undirected graph.

Pathfinder analysis attempts to find least-cost paths between nodes while ensuring that triangular inequalities are not violated (Dearholt and Schvaneveldt, 1990). A direct link between two nodes (i.e., concepts or, in our study, authors) is the shortest path between the two and there exists no indirect link that is more cost-effective (i.e., shorter) than the direct link. For example, if nodes A and B have a direct link, there cannot be a path from A to B through one or more nodes (e.g., A to C and C to B) that is shorter than the direct path. The distances that Pathfinder deals with are geodetic and not Euclidean. An excellent presentation of the details of the algorithms and the motivation behind Pathfinder analysis can be found in Schvaneveldt (1990).

ANALYSIS

In this section, we present details of each of the stages of our analysis and their results.

Selection of authors

The primary objective of this paper is to unravel the conceptual structure of the strategic management discipline as perceived by authors contributing to its intellectual advancement. Conceptual structure refers to the key specialties that define the field and the relationships between them. Since this article is intended as a complement to the RR study, to facilitate comparison we used the same time period, 1980–2000, as the RR study. 1980 marks the founding of *SMJ*, an important milestone in the history of the field. The 21-year period represents a significant slice of time that witnessed the growth and maturity phases of strategic management as an academic discipline.

In order to ensure that only influential authors who had a significant impact on the strategic management discipline were included in the study, we started by looking at the reference section of every article published in *SMJ* between 1980 and 2000. We then constructed a rank-ordered list of highly cited *lead* authors. The *ISI Web of Knowledge* database product called Web of Science, which includes the Science Citation Index-Expanded (SCI-Expanded), the Social Science Citation Index (SSCI), and the

Table 1.   Alphabetical list of authors selected for analysis

ALDRICH H	CHILD J	HARRIGAN K	MILLER D	SIMON H
ANDREWS K	COOL K	HAYES R	MINTZBERG H	TEECE D
ANSOFF H	CYERT R	HENNART J	MITCHELL W	THOMPSON J
BARNEY J	DESS G	HILL C	MONTGOMERY C	TUSHMAN M
BARTLETT C	DOZ Y	HITT M	NELSON R	VAN DE VEN A
BETTIS R	EISENHARDT K	HOFER C	PENROSE E	VENKATRAMAN N
BOURGEOIS L	FAMA E	HOSKISSON R	PFEFFER J	WALSH J
BOWER J	FREDRICKSON J	JENSEN M	PORTER M	WEICK K
BOWMAN E	GALBRAITH J	KOGUT B	PRAHALAD C	WERNERFELT B
BURGELMAN R	GRANT R	LAWRENCE P	QUINN J	WILLIAMSON O
CAVES R	HAMBRICK D	LUBATKIN M	RUMELT R	
CHANDLER A	HAMEL G	MARCH J	SCHENDEL D	
CHATTERJEE S	HANNAN M	MILES R	SCHERER F	

Arts and Humanities Citation Index (A&HCI), was used for this purpose. It must be reiterated that the list shown in Table 1 was compiled by considering only first authors of cited references. Only authors with 100 or more citations were considered, yielding a total of 62 authors. Table 1 provides an alphabetical listing of the authors thus identified.

Retrieval of co-citation data

To be consistent with the RR study, we split the total period of interest (1980–2000) into three durations of 7 years each. For each of the authors in Table 1, a file containing cited references was obtained from the ISI Web of Knowledge by using the *Cited References Search* for each of the time periods, 1980–86, 1987–93, and 1994–2000. The cited references were retrieved from SCI-Expanded and SSCI under the Web of Science database, which is available in ISI Web of Knowledge. This search allows us to retrieve not just articles published in *SMJ*, but all the articles indexed in SCI and SSCI in a given period that cite at least one work of the author. Thus, cited references for an author would include *any* scholarly publication appearing in *any journal* that cites at least one work of the author. Each cited reference has a unique identifier that forms the basis for getting the co-citations between a pair of authors. A co-citation occurs between two authors, say A and B, when a cited reference to A's work (which could have been published in *any journal*) also cites some work of B. That is, the number of cited references of A that match the cited references of B gives the frequency of co-citations between A and B.

Following the procedure outlined above, a frequency of co-citations was obtained for each pair of authors. While some ACA researchers choose to treat the diagonals as missing values (McCain, 1990a; White and McCain, 1998), others like Sircar *et al.* (2001), Culnan (1986, 1987), and White and Griffith (1981) use an artificial value obtained by dividing the sum of the three highest values for that row (or column) by two. Since neither approach affects the results in an appreciable way (McCain, 1990a), we followed the procedure employed by the latter authors.

For each period of analysis, only authors who had a threshold of mean co-citations were retained for analysis. Following previously employed rules of thumb (e.g., McCain 1990a, 1990b; Marion and McCain, 2001), we used a mean co-citation threshold in order to obtain more interpretable and robust results. Only authors with average co-citation rates equal to the number of years included in the period of analysis were considered. The mean/average co-citation rate was computed by summing the row or column values, except the diagonal value, and dividing by one less than the number of authors. Using this approach, only 33 of the 62 authors met the cutoff for the 1980–86 period, while the remaining time periods included 61 of the authors. However, it must be noted that while not all 62 authors appear in *all* the time periods analyzed, the contribution of every one of them is evident in at least one time period.

Factor analysis

Multivariate approaches such as factor analysis, cluster analysis, and multidimensional scaling help us to gain insights regarding the relationships

among the authors. The results of cluster analysis are not included in this paper due to considerations of space. The remaining analyses were performed using Systat (version 10.2), a statistical software package.

Factor analysis is a data reduction technique that yields factors and the *factor loadings* of the authors for each of those factors. Authors who work in specialized areas tend to build on each others' ideas, and are likely to be co-cited by other researchers in the field (McCain, 1990a). Such authors tend to load on the same factor. The factor loading is an indication of the degree to which an author belongs to or loads on a factor. A factor is thus deemed to be a subfield whose theoretical underpinnings may be gleaned by examining the writings of the authors who load highly on it.

Principal components with oblimin rotation was employed to extract the key generalizations/factors and their correlations. Only factors with a minimum eigenvalue (or latent root) of 1 were extracted. Eigenvalue is an indication of the amount of variance explained by a factor (Hair, Anderson, and Tatham, 1998). Five factors were extracted for the period 1980–86 and eight for the years 1987–93. Although nine factors were extracted for 1994–2000 as well as for the period 1980–2000, in both cases one of the factors was not interpretable. Hence, an eight-factor solution

was forced for these two periods. To be consistent with other ACA studies, only authors with loadings above ±0.4 were included in a factor. Tables 2–5 summarize the factors and their relationships. Authors whose sphere of influence extends beyond one specialty tend to load on more than one factor. Such authors (e.g., Porter) whose influence is spread over many areas generally have lower factor loadings.

Multidimensional scaling

The Kruskal loss function available in Systat was used to produce a spatial solution displaying authors in two-dimensional space. The maps for each of the time periods are shown in Figures 2–5. In order to reduce clutter and to make the maps easier to understand and interpret, only authors with loadings greater than or equal to ±0.7 are shown. It must be emphasized that factor loadings are a function of the relationships that authors have with others in the network as well as on their wide-ranging influence. That is, the loadings for authors are not directly proportional to the raw citations they receive. For example, Porter, who was the most cited author in *SMJ* between 1980 and 2000, has relatively low factor loadings. But, the fact that he loads on more than one factor suggests that he has a far-reaching influence on the discipline as a

Table 2. Factors extracted for the period 1980–86

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
	Pfeffer	*Hambrick*	*Scherer*	*Bower*	*Jensen*
	Lawrence	*Hofer*	*Caves*	*Quinn*	*Fama*
	Aldrich	*Schendel*	*Porter*	*Cyert*	Williamson
	Van de Ven	*Rumelt*	*Nelson*	Simon	
	Child	Harrigan	*Williamson*	Ansoff	
	Weick	Miles	Chandler	Mintzberg	
	Thompson	Bourgeois		Hayes	
	Galbraith	Andrews		Andrews	
	Tushman	Ansoff			
	Mintzberg	Miller			
	Miles	Porter			
	Chandler				
	Miller				
	Cyert				
	Simon				
Variance explained	8.60	6.11	4.45	4.58	2.57
Percent of variance explained	26.07	18.53	13.49	13.88	7.78

Total variance explained: 79.8%.
Authors with loadings ≥ ±0.7 are shown in italics.
Significant factor correlations: factors 1 and 4: 0.31; factors 2 and 5: 0.32.

Table 3.   Factors for the period 1987–93

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
	Aldrich	*Hoskisson*	March	*Doz*	*Penrose*	*Bower*	*Fama*	*Schendel*
	Hannan	*Lubatkin*	Simon	*Hamel*	*Nelson*	*Burgelman*	*Jensen*	*Cool*
	Thompson	*Montgomery*	Cyert	*Bartlett*	*Scherer*	*Quinn*	Eisenhardt	Hofer
	Van de Ven	*Bettis*		*Prahalad*	*Teece*	Ansoff	Walsh	Dess
	Pfeffer	*Chatterjee*		*Kogut*	*Caves*	Hayes		Venkatraman
	Child	*Grant*		Hennart	Williamson	Andrews		Harrigan
	Tushman	*Hill*			Chandler	Mintzberg		Hambrick
	Lawrence	*Hitt*			Hennart	Chandler		Porter
	Galbraith	*Wernerfelt*			Porter			Andrews
	Weick	Rumelt			Wernerfelt			Bowman
	Mintzberg	Barney						Bourgeois
	Miller							Miles
	March							Miller
	Miles							
	Bourgeois							
Variance explained	11.07	7.59	2.53	5.22	6.14	7.22	3.33	6.97
Percent of total variance explained	18.15	12.44	4.15	8.55	10.06	11.83	5.46	11.43

Total variance explained: 82.1%.
Authors with loadings $\geq \pm 0.7$ are shown in italics.
Significant factor correlations: factors 1 and 6: 0.5; factors 1 and 8: 0.3; factors 2 and 8: 0.3; factors 4 and 5: 0.31; factors 6 and 8: 0.44.

Table 4. Factors for the period 1994–2000

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
	Lawrence	*Scherer*	*Chatterjee*	*Jensen*	*Doz*	*Dess*	*Ansoff*	March
	Thompson	Mitchell	Lubatkin	Fama	Hamel	Hambrick	Andrews	Cyert
	Galbraith	Caves	Hoskisson	Williamson	Bartlett	Fredrickson	Quinn	Walsh
	Child	Penrose	Montgomery		Prahalad	Hofer	Hayes	Burgelman
	Pfeffer	Nelson	Hitt		Kogut	Bourgeois	Chandler	Weick
	Aldrich	Teece	Bettis		Harrigan	Miller		Bower
	Van de Ven	Cool	Hill		Hennart	Venkatraman		Simon
	March	Wernerfelt	Bowman		Porter	Schendel		Tushman
	Hannan	Rumelt	Rumelt		Teece	Miles		Eisenhardt
	Mintzberg	Barney	Wernerfelt					
	Miles	Schendel	Barney					
	Weick	Williamson						
	Tushman	Montgomery						
	Chandler	Hannan						
	Simon							
Variance explained	9.10	7.44	6.52	3.32	7.16	6.61	4.15	5.37
Percent of total variance explained	14.91	12.20	10.69	5.45	11.75	10.83	6.81	8.80

Total variance explained: 81.4%.
Authors with loadings ≥ ±0.7 are shown in italics.
Significant factor correlations: factors 1 and 6: 0.40; factors 1 and 8: 0.45; factors 2 and 5: 0.40.

Table 5.   Factors for the period 1980–2000

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
	Lawrence	*Nelson*	*Lubatkin*	*Jensen*	*Doz*	Walsh	*Ansoff*	*Dess*
	Thompson	*Mitchell*	*Chatterjee*	*Fama*	*Bartlett*	Eisenhardt	*Bower*	*Hambrick*
	Child	*Penrose*	*Montgomery*	Williamson	*Hamel*	March	Andrews	*Venkatraman*
	Aldrich	Teece	*Hoskisson*		*Prahalad*		Quinn	Schendel
	Galbraith	Scherer	*Bettis*		Kogut		Hofer	Hofer
	Pfeffer	Cool	Hitt		Hennart		Burgelman	Miller
	Van de Ven	Caves	Hill		Harrigan		Hayes	Bourgeois
	Weick	Wernerfelt	Rumelt				Mintzberg	Harrigan
	Hannan	Barney	Wernerfelt				Schendel	Miles
	Tushman	Rumelt	Bowman				Chandler	Fredrickson
	Mintzberg	Williamson	Barney					
	March	Hannan						
	Cyert	Porter						
	Simon							
	Chandler							
	Miles							
Variance explained	10.77	6.88	6.63	3.33	6.12	3.23	6.02	6.72
Percent of total variance explained	17.65	11.28	10.87	5.45	10.04	5.3	9.87	11.02

Total variance explained: 81.5%.
Authors with loadings ≥ ±0.7 are shown in italics.
Significant factor correlations: factors 1 and 6: 0.32; factors 1 and 7: 0.36; factors 1 and 8: 0.32; factors 2 and 5: 0.37; factors 2 and 8: 0.
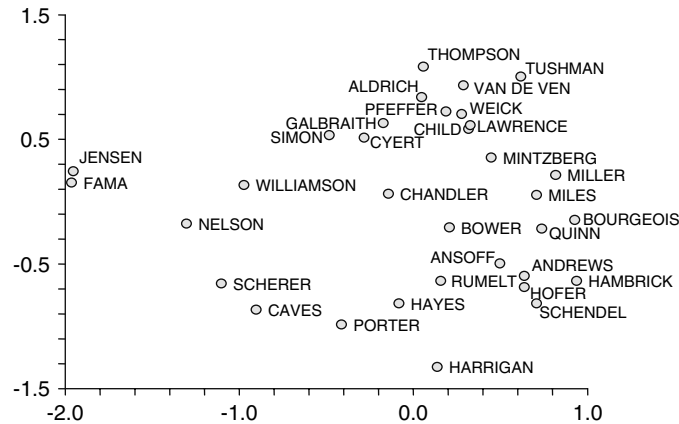
Figure 2. Conceptual structure of strategic management (1980–86). Stress of final configuration is 0.11988. Proportion of variance (RSQ) is 0.93115
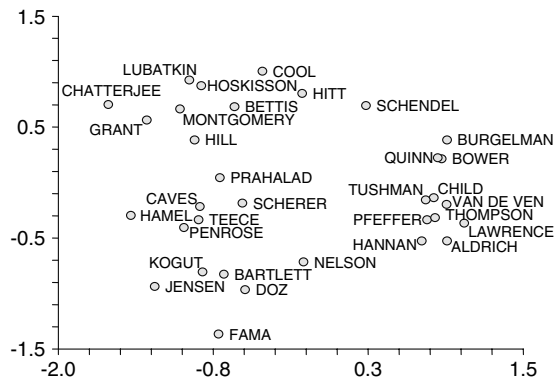

Figure 3. Conceptual structure of strategic management (1987–93). Stress of final configuration is 0.18671. Proportion of variance (RSQ) is 0.83024

whole. The stress and r^2 values are an indication of how good the fit is. The stress values for all the periods are below 0.2, which suggests an acceptable fit for co-citation data (McCain, 1990a). The fit would be considerably enhanced by considering higher dimensions. While a two-dimensional solution may not have the explanatory power of a solution involving higher dimensions, it has the advantages of being easy to map and interpret. Despite the fit being at best fair, a two-dimensional solution is a reasonably good approximation of what one might get from higher dimensions.

Pathfinder analysis

As mentioned earlier, Pathfinder analysis generates a network structure in which the path between two
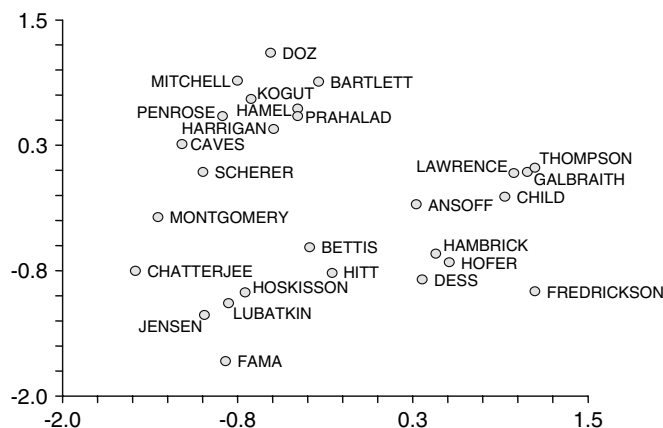

Figure 4. Conceptual structure of strategic management (1994–2000). Stress of final configuration is 0.19022. Proportion of variance (RSQ) is 0.81649
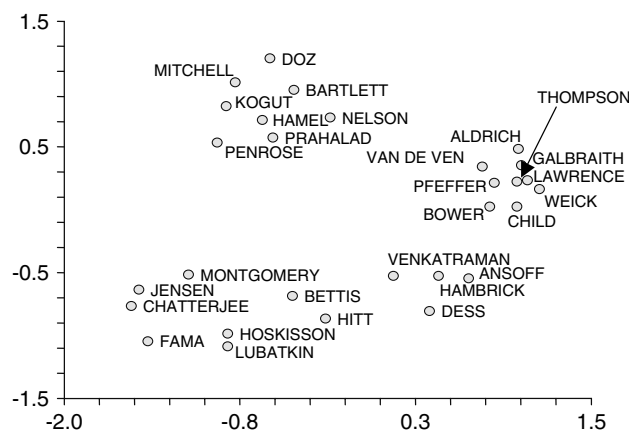
Figure 5.   Conceptual structure of strategic management (1980–2000). Stress of final configuration is 0.18523. Proportion of variance (RSQ) is 0.8289
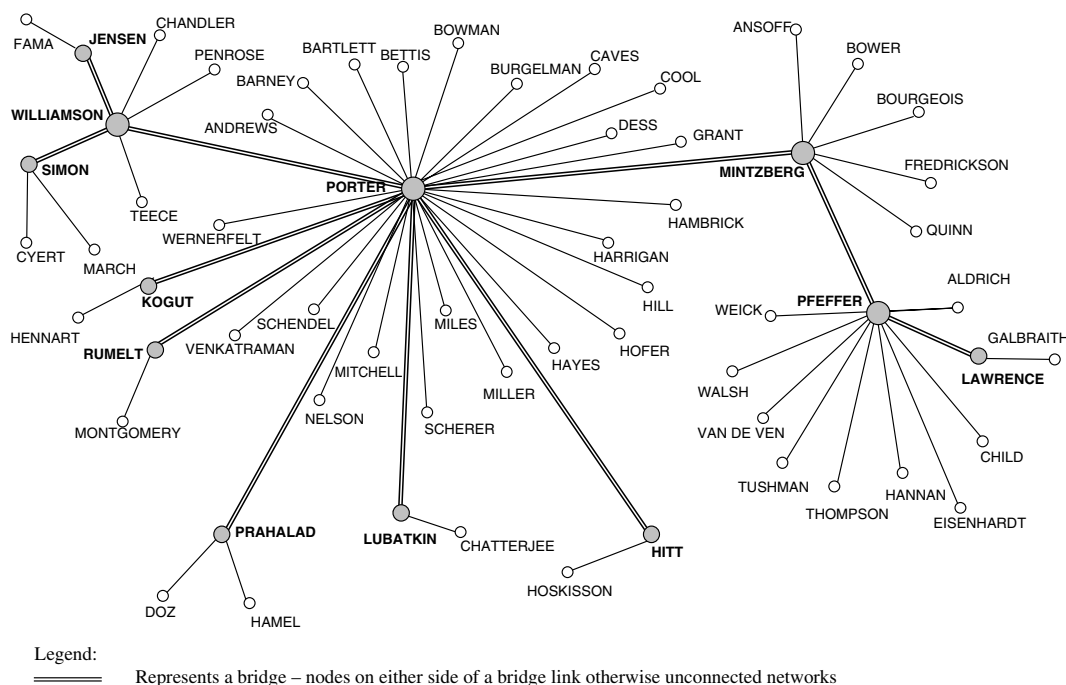

Figure 6.   Network diagram from Pathfinder analysis

nodes (i.e., authors) is a geodesic that does not violate the condition of triangular inequality (Schvaneveldt, 1990). The analysis was performed using a tool called PCKNOT. Figure 6 shows the network diagram (called PFNet) for the set of authors used in this study. In addition to emphasizing the most critical paths between authors, the figure also helps us to discern authors who play a pivotal role in bridging otherwise separate clusters. For example, Porter, Pfeffer, Mintzberg, and Williamson are

critical to the stability of this network of authors because they are central nodes that connect distinct clusters.

RESULTS AND DISCUSSION

The results of the factor analyses and multidimensional scaling together yield many insights on the evolution of the intellectual structure of the

strategic management field. Analysis of the first 7-year period (1980–86) resulted in five factors. Factor 1, dominated by authors such as Pfeffer, Lawrence, Aldrich, and Van de Ven, shows the strong influence of the organization theory field on strategy. Factor 2 shows the emergence of a distinct strategy school dominated by Hambrick, Hofer, Schendel, and Rumelt. Factor 3 is dominated by industrial organization and organizational economics. Factor 4, which includes authors such as Bower, Quinn, Cyert, and Simon, is the process school whose emphasis is on decision making. Finally, in Factor 5, we see the beginnings of the influence of agency theory. Factor correlations are significant between Factors 1 and 4 and Factors 2 and 5. Thus the analysis for this early part of the intellectual structure of the field reveals the multidisciplinary origins of strategy, the heavy debt to organization theory, the emergence of the field as a distinct discipline of inquiry, and cross-pollination across subfields.

For the period 1987–93, the number of significant factors increases from five to eight, mirroring the growth of the field as well as the development of a larger number of subfields. The major changes that occur during this period are the emergence of Factor 4, essentially reflecting the writings of Doz, Hamel, Bartlett, Prahalad, and Kogut, and greater influence of institutional economics mirrored in the higher number of citations of Penrose and Nelson. Factor 2 represents mainstream corporate strategy research with its focus on diversification whereas Factor 8, which is more difficult to interpret, seems to represent the research on the relationships between firm attributes and organizational environments. Organization theory's influence on strategy continues to be strong during this period. The large number of significant intercorrelations between factors suggests that despite its growing diversity of areas of inquiry, the field did not become fragmented or compartmentalized, reflecting a level of disciplinary cohesion as well as the field's eclectic orientation.

As we move into the period 1994–2000, we find relative stability in terms of factors. That is, the trends of the previous period are continued, by and large. The influence of organization theory is now balanced by influences from organizational economics and the resource-based view. In other words, theories of the firm have become central to strategy research, which suggests a greater theoretical orientation for a discipline that started with a high practitioner orientation. Even within theoretical influences from economics, the attention paid to theories of the firm seem to be higher than to industrial organization economics, which had greater influence in the earlier part of the field.

Comparisons across the three time periods also reveal some interesting patterns. While the first 7 years reveal the dominant influence of organization theory and industrial organization economics, subsequent periods show greater fragmentation arising from exogenous theoretical influences and endogenous theoretical developments. Agency theory and transaction cost economics, for example, represent outside influences whereas the resource-based view is, by and large, an endogenous development. The persistence of a large number of clusters and the low inter-factor correlations also underscore the need for integration across them. The need for an integrative approach to strategy research and the contributions of other disciplines such as administrative behavior (Jemison, 1981a), industrial organization economics (Porter, 1981), and marketing (Biggadike, 1981) have been well recognized right from the early days of the history of the field. (Surprisingly, the inflow of ideas from marketing to strategic management seems to have tapered off over the last two decades).

Figures 2–5 present the conceptual structure of the field as two-dimensional maps. The proximity of two authors in the map also indicates that these two authors are usually cited together, suggesting that there is considerable commonality or interconnection between their works. For example, Fama and Jensen appear proximately in all three maps. This is indicative of the fact that both are pioneers in the development of agency theory and that agency theory has exerted considerable influence on the field through all the time periods. On the other hand, the fact that Jensen and Bower appear at considerable distance from each other indicates that there is very little in common between these authors. Those who cite Bower are unlikely to be citing Jensen.

An analysis of the four multidimensional maps yields some interesting observations. First, the right-hand sides of the maps bear the strong imprint of organization theory. As we go from the first time period to subsequent periods, the left-hand side begins to become more populated, reflecting the growing influence of economic theories ranging from industrial organization economics to theories of the firm. The 1987–93 period

shows the emergence of a strong corporate strategy group, represented by authors such as Lubatkin and Hoskisson.

The Pathfinder analysis results, as presented in Figure 6, provide many interesting insights about the network structure of the intellectual community in strategic management. First, it identifies the influence of Porter, Williamson, Mintzberg, and Pfeffer on the field. The results suggest that financial and institutional economics (Williamson), industrial organization economics (Porter), process school (Mintzberg), and the power/resource dependence school (Pfeffer) as the four dominant perspectives that delineate the field. The above four authors also play an important 'boundary-spanning' role as indicated by the Pathfinder analysis. The Pathfinder analysis also confirms the enormous influence of Michael Porter on the field. Boundary-spanning roles of a smaller magnitude can also be attributed to Simon, Prahalad, Kogut, Lubatkin, Hitt, Rumelt, Jensen, and Lawrence. In interpreting the Pathfinder diagram (Figure 6) it is important to bear in mind that the proximity between authors is highlighted by links and not by their spatial nearness to one another, unlike in the multidimensional scaling maps that we presented earlier.

In interpreting the network diagram, Burt's (2005) concepts of closure, brokerage, and structural holes are particularly useful. Most network diagrams, whether networks of social connections among individuals, linkages among corporations through interlocking directors, or ideational links as represented in our co-citation network diagram, are characterized by clusters of dense connections linked by occasional bridge relations between clusters. Gaps between clusters are referred to as structural holes. Structural holes act as buffers between clusters. Different clusters have different degrees of closure. A high level of closure means there is decreasing variation and a high level of information flow within a cluster. Individuals within a cluster develop a common vocabulary and a shared language. Brokers are those individuals who act as links between different clusters. As Burt (2005) points out, both closure and brokerage have distinct advantages. In the context of research communities, closure results in faster communication within the group and a focused research agenda based on a unifying paradigm. Brokerage, on the other hand, brings different research communities together,

spurring cross-fertilization of ideas and theoretical innovation. There are opportunities for brokerage among subdisciplines within a field as well as across disciplines. Well-known examples of scholars who have played a brokerage role between strategic management and other disciplines include Eisenhardt (1989), who introduced agency theory to the strategic management field, and Kogut (1991), who played a big role in popularizing the real options approach to strategic management research. What our map clearly reveals is that the field of strategic management has distinct research communities held together by disciplinary origins and common research questions and separated by structural holes. However, there are also authors who are cited by members in different clusters, highlighting their brokerage role in connecting distinct clusters and their intellectual influence that pervades the entire discipline rather than a specific cluster.

CONCLUSIONS AND LIMITATIONS

The objective of this paper was to trace the evolution of the intellectual structure of the strategic management field. We attempted to accomplish this objective by performing a co-citation analysis and a Pathfinder analysis of the leading authors in the field. This paper was presented as a companion piece to RR, which did a comprehensive analysis of the citation patterns of scholarly works that were frequently cited in *SMJ* over a 21-year period. Our analysis, however, differs from the RR paper in several significant ways. First, the unit of analysis of this study was the author, not a specific paper or a book. One reason for using an author as the unit of analysis was that the contributions of an author are often spread over several papers and books rather than a single work. A limitation of this approach is that if an author is remarkably proficient and makes contributions in seemingly unrelated areas, our results may present some challenges in interpretation. However, it is our belief that when the RR paper and this study are read together, it would provide a comprehensive picture, each paper addressing some of the limitations of the other. Further, co-citation patterns capture, at least to some extent, the social construction of a discipline. To the extent that social construction takes place at the individual level, the use

of authors as the unit of analysis provides a better representation of the social construction of a field.

A second area of difference between this paper and the RR paper is that 25 of the 62 authors used in our study were not covered by any of the articles analyzed in the RR paper. Thus, the important perspectives/insights that the works of these authors bring to the field of strategic management are missing in the RR analysis. While the works of some of the 25 omitted authors may be reflected to an extent in the 50 documents that the RR article identifies, it is very likely that the contributions of many important articles by these 25 authors were not explicitly considered in their articulation of the intellectual structure of strategic management.

Third, in addition to mapping the intellectual structure on two-dimensional space, we have also conducted a factor analysis to identify subfields. Fourth, the Pathfinder analysis used in this study enables us to understand the relationships among authors as well as to identify the authors who serve as 'boundary spanners' in the field. Each of these analyses augments multidimensional scaling that is common to both the RR study and our study. Factor analysis, when performed on the co-citation data, is a powerful tool to identify the 'invisible colleges' (Crane, 1972) or specialties that constitute an academic discipline. Pathfinder analysis helps us identify who the central authors are and how they act as bridges between what might otherwise seem to be unconnected subfields. For example, our Pathfinder diagram tells us that there are distinct intellectual communities built around Pfeffer and Williamson, and that these two communities have very little communication with each other. Similarly, despite repeated calls for the integration of content and process perspectives in strategy research (Mintzberg and Waters, 1985), our analysis shows that the content and process researchers are still separated by structural holes. While explaining the reasons for this as well as speculating on the possibilities of collaboration between these two communities are beyond the scope of the paper, we believe that the analysis undertaken in this paper can stimulate such discussions. Integrating and combining diverse theoretical strands can lead to more comprehensive answers to important research questions.

We believe our analysis contributes to our understanding of the field of strategic management in several ways. It is important for a young discipline such as strategic management, which is influenced by works of authors from several disciplines, to take stock of its evolutionary trajectory from time to time. While insightful reviews of the field such as Hoskisson *et al*. (1999) represent a 'ground-level' view of the field, it can be meaningfully complemented by the 'aerial' view afforded by the analysis of co-citation patterns such as the one undertaken in our study. Second, a co-citation analysis shows how citers, often numbering in the hundreds, jointly perceive the relationships (or lack thereof) among key writers in the field (White, 1990). A map based on co-citation data thus sheds light on the social construction of the field by its members. Third, a longitudinal comparison of such maps across a significant slice of the history of the field also informs us about the changes occurring in the social construction of the field and the evolving consensus (or lack thereof) about the domain of the field. Finally, we believe that the identification of structural holes within the intellectual network of the field suggests both opportunities for closure and brokerage that could contribute to the future development of the field.

All methodologies have their limitations and author co-citation analysis is no exception. Therefore, it is important to be aware of some of the limitations of ACA. Luckily, these limitations do not detract from the results of the study in any significant way. First, the issue of all citations being treated alike when in fact they are not has been a major source of criticism (e.g., Cronin, 1984). The rationale for citing a study could vary considerably, ranging from a reference that supports one's works to a scathing criticism of research that is poorly done (see Baumgartner and Pieters, 2003). Second, it is difficult to avoid some degree of subjectivity in deciding the number of authors to be included in an analysis. At the same time, the choice of authors is critical in determining the configuration of the field (McCain,1990a), and hence it is important to be as objective as possible. The researcher invariably has to make some judgment calls balancing these contrasting considerations. We believe that the 62 authors identified through objective criteria in our study are fairly representative of the field. In the event that an important author has been omitted, it would be fair to assume that his or her core concepts would be embodied in the publications of the authors included in this study.

Third, some level of 'noise' may be introduced in the data because of the way co-citation data are

retrieved, particularly in cases where authors have common last names (e.g., Simon). The first initial of the author was used for many of the authors, but there were some cases where both the first and middle initials had to be used to restrict the number of spurious records being extracted. The data collection procedure, for example, does not preclude the retrieval of citations for a Simon H. or Simon H. A. who publishes in medicine. However, there is very little likelihood that these false citations would be shared by authors from the strategic management discipline. Fourth, the identification of the 62 authors included in our study was based on the most cited lead authors. This may understate the contributions of co-authors who are influential scholars in the field, but who did not figure in our list because they were not lead authors. Finally, the time that it takes for a publication to appear and for it to build up a citation history would result in recent but influential authors being underrepresented. The large volume of data involved alleviates these problems to a great extent (White, 1990). Despite these limitations, ACA, as mentioned earlier, has found widespread applicability and is a useful methodology for studying the evolution of thought in a discipline.

This study, along with RR, demonstrates the usefulness of co-citation analysis as an effective tool in understanding the intellectual structure of a discipline. Co-citation analysis has the advantages of objective data, quantitatively rigorous methodology, and the ability to detect evolutionary patterns. It is clearly no substitute for experience and wisdom. But when used in conjunction with an understanding of the history of the field, it is a powerful tool to identify the waxing and waning of intellectual fashions, relative shifts in the influence of individual authors, the evolution of specific subfields within an area, and the linkages among subfields. It also provides a visual representation of the intellectual structure of the field.

The results of our analysis provide some degree of confirmatory evidence to a number of specific characteristics of the intellectual structure of the field. These include the semi-permeability of the strategy and organization theory areas, the growing influence of economic perspectives, and the increasing gravitational pull of theories of the firm along with a move away from practitioner orientation. Extending this research over future periods

will tell whether these trends are of an enduring nature or a reflection of the intellectual currents of the last decade. Similarly, additional data analytic procedures like entropy analysis, derived from Shannon and Weaver's (1963) theory of communications, can provide further insights on the extent to which each author contributes to the order or stability of the communications network (e.g., Shaw, 1981, 1983). The RR paper represents the beginning of the effort to use bibliometric methods to delineate the intellectual structure of a field. This paper builds on that beginning by using an author (more precisely, an author's *entire* body of writings or *oeuvre*—see White and Griffith, 1981) as the unit of analysis, broadening the range of methodological approaches to analyze co-citation data, and by addressing research questions left unexplored in their work.

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