

EXPLORING THE KNOWLEDGE NETWORK OF STRATEGIC ALLIANCE RESEARCH: A CO-CITATION ANALYSIS

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ABSTRACT

This study is to describe the knowledge network of strategic alliance studies embedded in the leading articles and to explore the key research themes in this field between 1999 and 2008. A total of 521 articles with 21,493 cited references were extracted from the Social Science Citation Index and the Science Citation Index. By using bibliometric methods, the citation and co-citation counts obtained were analyzed and then mapped with multivariate analysis and social network analysis techniques. Three main research themes of the strategic alliance field between the period 1999 and 2008 were discovered. They are strategic alliance formation; learning and absorptive capability; and the relationship and characteristics of partnership success. In addition, the knowledge network of strategic alliance studies is graphically mapped in a two-dimensional space to visualize spatial distances between intellectual themes. The results can help researchers to gain a better understanding of the major themes, concepts, and relationships related to strategic alliance research. This study provides a useful channel to access the publications in this field and to identify the research direction of strategic alliance studies.

Keywords: Strategic Alliance, Bibliometrics, Co-Citation Analysis, Social Network Analysis

1. INTRODUCTION

Strategic alliances are organizational firms that allow independent firms to share various resources [2]. Koza [20] views alliances as a means for firms to attain market power and extract monopoly rents. The research on business strategic alliance has been very active since 2000, producing a large number of journal articles and other documents. Once a scientific discipline has reached a certain degree of maturity, the scholars in this specific area will pay attention to the literature generated by their community and conduct literature reviews to assess the general state of the art [32]. In general, these types of research are considered to adopt the impressionistic approach, and their findings tend to reflect the subjective views of their authors.

To avoid some of the potential subjective biases and to provide a systematic way to understand the

contemporary research in strategic alliance, this paper collects works in this area over the last decade and uses bibliometric methods to determine how this field has evolved by describing what emerges in the rear-view mirror [37,32].

The term “bibliometrics” relates to the application of mathematics and statistical methods to books and other media to quantify the process of written communication and the nature of the development of a discipline [31]. Bibliometric methods, which include citation and co-citation analysis, are most often used in the field of library and information science and, with advantages of quantifiability and objectivity, can complement and validate expert judgments by experienced scholars in the research field [26]. The use of bibliometrics as a research methodology is based on the assumption that bibliographic citations are an acceptable surrogate for the actual influence of various information sources on an area of research [6].

This study aims to conduct an overview of the

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knowledge network of studies in strategic alliance. The knowledge network refers to the communication process embodied in written and published works of a given field. By using citation and co-citation methods, this study draws upon the invisible knowledge network of the strategic alliance in terms of its intellectual architects (who), their respective contributions (what), and the times and places at which they published them (when and where), answering all the relevant questions regarding this field of study except for 'why' and 'how?' [11,22].

The goals are to (1) gain an impression of strategic alliance research; (2) identify publications that play a crucial role in this area; (3) portray the subfields that constitute the intellectual structure of strategic alliance research; and (4) map the knowledge network of strategic alliance research in a two-dimensional space to reveal spatial distances between intellectual themes.

2. LITERATURE REVIEW

Citation analysis is a major bibliometric approach based on the premise that authors cite documents that they consider important to the development of their research. Highly cited documents are likely to have a greater influence on the research field than those that are less highly cited [6].

Co-citation analysis is a form of document-coupling that records the number of papers that have cited any specific pair of publications [35, 12]. Co-citation analysis shows that literatures cohere and change in intelligible ways over time. It is explicated as a measure of the similarity of the content in the two documents [32]. Such articles that are heavily co-cited tend to cluster together when mapped, while articles that are rarely cited together do not. As such, bibliometric analysis can be used as indicators of the present and past activities of scientific work [35,12].

Several articles have filed the use of bibliometric techniques to study other areas of management research. Ramos-Rodriguez and Ruiz-Navarro [32] map the intellectual structure of strategic management research by conducting a co-citation analysis of publications from the Strategic Management Journal between 1980 and 2000. Nerur, Rasheed and Natatajan [26], using authors as units of analysis and incorporating all the citations included in the Social Science Citation Index and Science Citation Index to trace the evolution of the intellectual structure of the field of strategic management. Culnan applies the co-citation technique to information systems management research and organizational behavior research to explore their intellectual structures [6,5]. Henderson, Shurville, and Fernstrom [15] draw on a wide

literature base as well as their experience as academics, conference organizers, and researchers to describe the changes in the culture of research assessment and research management for small and specialist interdisciplinary conferences.

In the past decade, research on strategic alliances has blossomed greatly, reflecting the importance of strategic alliances in business practice [20]. However, to the best of our knowledge, no such study has dealt with the area of strategic alliance research. This study aims to fill this gap in the strategic alliance literature and complement the findings of other studies that have approached the topic from the qualitative perspective.

3. METHODOLOGY

This study adopts citation and co-citation analysis, determining the most influential publications in the strategic alliance literature and the correlations among these identified publications which represent a solid foundation of the knowledge network in the topic of strategic alliance. Applying a citation and co-citation analysis begins with the selection of a list of authors, publications or journals, which depends on what the unit of analysis is. Subsequently, we have to retrieve the co-citation frequencies and convert those frequencies to a correlation matrix for further multivariate analysis and data mapping. This study proposes a four-phase analysis adapted from McCain [23] to conduct citation and co-citation analysis. The details of each phase are discussed as follows.

Phase 1: Identify database and data preparation

The unit of analysis in this study is the article. Every article is unique; analyzing the article itself instead of its author can prevent the limitation of only accounting for the first author, ignoring the involvement of other authors that appear in the cited references of the SCI and SSCI databases. This study uses two stages to gather the necessary data. First, "strategic alliance" are the keywords used to search the SCI and SSCI within the ISI database, and the publication dates searched range from 1999 to 2008 to gain an impression of contemporary research in strategic alliance. To refine the search results, only articles belonging to business, economics, and operation management fields are included. The second step is to manually screen these results to ensure that every result is related to strategic business alliances. After a two-stage investigation, there are 521 articles and 21,493 cited references that are highly related. Among these 521 articles, 65 come from the Strategic Management Journal, which account for 10.75% of the total number of related articles.

Table 1 presents the number of articles published between 1999 and 2008. The total number of articles between 2004 and 2008 is 344, almost twice the total number of articles, which is 177, during the period 1999-2003. Strategic alliance studies are drawing more attention than they have in the past. Table 2 shows the article distribution analysis. The Strategic Management Journal, the Journal of Business Research, and the Journal of Management Studies are the top three journals in terms of the number of articles published in this research area.

Phase 2: Data collection and citation analysis

All highly related articles and their cited references identified in the last phase are collected and analyzed in this phase. The citation analysis involves sorting, summing, sub-totaling, ranking, and screening collected cited references. After a series of systematic analyzing processes, key nodes, which are represented by highly cited articles in the knowledge network of strategic alliance research, are identified. The most influential articles are then determined by their total citation counts within the selected cited references.

Table 3 presents a list of the 33 publications related to strategic alliance research with a citation frequency that is equal to or greater than 40 for the period 1999-2008.

Phase 3: Co-citation analysis and data mapping

Co-citation analysis is a widely accepted bibliometric technique. Based on the top 33 most-cited articles listed in table 3, a co-citation matrix is created by counting the frequency of a certain pair of articles that have been cited by the same article within those 21,493 referred references. Those counts are converted into a (33x33) Pearson correlation matrix to remove differences in scale and to understand the similarity of co-cited articles. Further multivariate analysis is applied to the Pearson correlation matrix to gain insights into the relationships among articles.

Table 1: Article counts

Year	No. of Articles	Year	No. of Articles
2008	90	2003	41
2007	87	2002	31
2006	61	2001	29
2005	47	2000	48
2004	59	1999	28

Table 2: Article distribution analysis

Journal Title	Counts	%
Strategic Management Journal	56	10.75
Journal of Business Research	21	3.84
Journal of Management Studies	20	3.65
International Journal of Technology Management	19	3.65
Organization Science	19	3.26
Research Policy	17	3.26
Technovation	17	2.88
Academy of Management Journal	15	2.69
Long Range Planning	14	2.50
Journal of Management	13	2.11
Others	310	61.42
Total	521	100

Netdraw, a social network analysis tool, is used to map the relationships in the co-citation matrix and identify the strongest links of the core areas of interest in strategic alliance [28]. In this study, only articles that share over 30 co-citations with other individual articles are shown in the network.

Figure 1, a two-dimensional mapping of nodes, representing articles, is generated by the UCINET 6.22 for Windows. It reveals the core areas of strategy alliance research via co-citation analysis. Nodes are linked together by different size linkages, representing the co-citation frequency between two articles. The size of linkages is proportional to co-citation frequencies. The linkage strength of articles on such a map is algorithmically related to their similarity as perceived by citers [37].

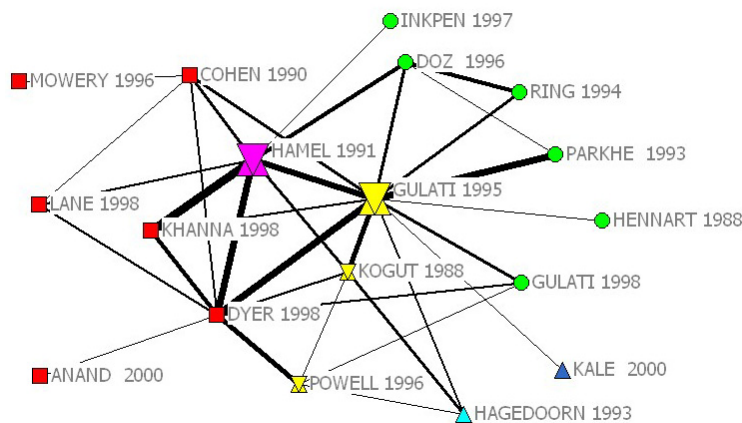


Figure 1: Article co-citation mapping with frequency > 30

Table 3: Top 33 highly cited publications during 1999-2008

Article	Cited Frequency
GULATI R, 1995, ACAD MANAGE J, V38, P85	111
DYER JH, 1998, ACAD MANAGE REV, V23, P660	97
HAMEL G, 1991, STRATEGIC MANAGE J, V12, P83	89
KOGUT B, 1988, STRATEGIC MANAGEMENT, V9, P319	88
POWELL WW, 1996, ADMIN SCI QUART, V41, P116	80
PARKHE A, 1993, ACAD MANAGE J, V36, P794	79
GULATI R, 1998, STRATEGIC MANAGE J, V19, P293	78
HAGEDOORN J, 1993, STRATEGIC MANAGE J, V14, P371	73
COHEN WM, 1990, ADMIN SCI QUART, V35, P128	70
KHANNA T, 1998, STRATEGIC MANAGE J, V19, P193	68
DOZ YL, 1996, STRATEGIC MANAGE J, V17, P55	68
MOWERY DC, 1996, STRATEGIC MANAGE J, V17, P77	63
RING PS, 1994, ACAD MANAGE REV, V19, P90	62
ANAND BN, 2000, STRATEGIC MANAGE J, V21, P295	61
EISENHARDT KM, 1996, ORGAN SCI, V7, P136	60
WILLIAMSON OE, 1985, EC I CAPITALISM	58
LANE PJ, 1998, STRATEGIC MANAGE J, V19, P461	56
KALE P, 2000, STRATEGIC MANAGE J, V21, P217	56
DOZ YL, 1998, ALLIANCE ADVANTAGE A	55
HENNART JF, 1988, STRATEGIC MANAGEMENT, V9, P361	52
GULATI R, 1995, ADMIN SCI QUART, V40, P619	50
GULATI R, 1998, ADMIN SCI QUART, V43, P781	47
BARNEY JB, 1991, J MANAGE, V17, P97	47
WILLIAMSON OE, 1991, ADM SCI Q, V36, P269	47
CONTRACTOR FJ, 1988, COOPERATIVE STRATEGI, P3	46
INKPEN AC, 1997, ACAD MANAGE REV, V22, P177	45
NELSON RR, 1982, EVOLUTIONARY THEORY	45
MOHR J, 1994, STRATEGIC MANAGE J, V15, P135	44
GULATI R, 1999, STRATEGIC MANAGE J, V20, P397	44
KOZA MP, 1998, ORGAN SCI, V9, P255	43
BURT RS, 1992, STRUCTURAL HOLES SOC	43
DAS TK, 1998, ACAD MANAGE REV, V23, P491	42
SAXTON T, 1997, ACAD MANAGE J, V40, P443	41

Phase 4: Perform factor analysis to identify subfields

Factor analysis is a valuable tool that can derive subfields from the co-citation matrix. The subfields correspond to the extracted factors, and each subfield represents an intellectual theme defined by the works that load highly on that factor [26]. Authors who work in specific areas tend to cite documents that are considered important in the development of their research and are likely to be co-cited by other documents in the field [23].

By conducting factor analysis, these articles in a certain field tend to load on the same factor. The factor loading indicates the degree to which an article belongs to a factor. A factor is thus considered a subfield whose theoretical underpinnings may be deduced by examining the publications that load highly on it. Publications that have a prevalent influence on the field should appear in more than one subfield [26]. Factor analysis, when applied to the co-citation data is a powerful tool to identify the

specialties that constitute an academic discipline and is helpful to us in gaining insights into the relationships among authors or publications.

This study only extracts factors whose eigenvalues are greater than 1. An article with factor loading greater than ± 0.7 is likely to have interpreting power; and those factors that have factor loading above ± 0.5 are included in this study as suggested by previous research [36,1]. Table 4 shows extracted factors and their relationships.

Three factors are extracted in this study, and combined they explain over 77% of the variance in the correlation matrix. Factor one has the greatest amount of variance explanation (54.3%). Subfields that show a high cumulative tradition in research are likely to account for a larger percentage of the total variance [26]. The next section will interpret each extracted factor and its corresponding theme for strategic alliance studies.

Table 4: Summary of factor analysis
Factor analysis (1999-2008)

Factor	Eigenvalues	Percent	Cum%
1	18.143	54.3	54.3
2	6.274	18.8	73.1
3	1.491	4.5	77.6

Rotated Factor Loadings

Factor 1: Learning and absorptive capability	Factor 2: The relationship and characteristics of partnership success	Factor 3: Strategic alliance formation
Lane 1998 (0.808)	Ring 1994 (-0.917)	Gulati 1995 ^a (0.89)
Cohen 1990 (0.805)	Parkhe 1993 (-0.914)	Eisenhardt 1996 (0.792)
Dyer,1998 (0.784)	Das 1998 (-0.883)	Hagedoorn 1993 (0.79)
Anand 2000 (0.783)	Saxton 1997 (-0.862)	Powell 1996 (0.756)
Nelson 1982 (0.778)	Williamson 1985 (-0.848)	Kogut 1988 (0.576)
Hamel 1991 (0.763)	Inkpen 1997 (-0.832)	Gulati 1999 (0.573)
Mowery 1996 (0.753)	Mohr 1994 (-0.813)	
Khanna 1998 (0.663)	Hennart 1988 (-0.808)	
Gulati 1999 (0.625)	Gulati 1995 ^b (-0.79)	
Barney 1991 (0.617)	Koza 1998 (-0.765)	
Powell 1996 (0.535)	Doz 1996 (-0.744)	
	Williamson 1991 (-0.638)	
	Gulati 1998 ^b (-0.622)	
	Hamel 1991 (-0.508)	
	Kogut 1988 (-0.501)	

4. RESULTS AND DISCUSSION

Factor 1: Learning and absorptive capability

A total of seven articles have a factor loading of over 0.7 in factor 1. This factor is dominated by articles like Lane 1998, Cohen 1990, Dyer 1998, Anand 2000, Hamel 1991, and Mowery 1996 [21,3,9, 2,14,25]. These papers mainly discuss interfirm learning and absorptive capability. Alliances are complex organizational forms, typically involved the transfer of knowledge or know-how between firms. Findings from Mowery, Oxley, and Silverman [25] suggest that equity arrangements encourage greater knowledge transfer that and absorptive capability helps to interpret the span of technological capability transfer. Hamel [14] argues that international competition points up asymmetries in the skill endowments of firms. An alliance may provide an opportunity for partners to internalize the skill of others. However, not all partners master learning equally and are thus able to change the bargaining power of partners. Under the premise that learning capability is unequal between partners, Lane and Lubatkin [21] propose a relative absorptive capacity model. Their research findings suggest that the similarity of basic knowledge held by partners, lower management formalization, research centralization, compensation practices, and research communities were positively related to interorganizational learning. Alliances create value; however, what drives value creation in alliance? By investigating a dataset of over 2,000 joint ventures and licensing agreements,

Anand and Khanna [2] find evidence of large learning effects in managing joint ventures, especially in the research joint ventures.

Factor 2: The relationship and characteristics of partnership success

There are 11 articles that have a factor loading of over 0.7 in factor 2. The major themes in these papers are related to interfirm relationships, such as to explain how and why cooperative interorganizational relationships emerge, evolve, and dissolve, how to examine the interfirm cooperation, and what characteristics of partners make for successful alliances [20,24,33,34]. To understand the importance of the characteristics associated with partnership, Mohr and Spekman [24] report that partnership attributes, communication behavior, and conflict-resolution techniques are related to satisfaction and sales volume within the relationship.

Maintaining robust cooperation within a strategic alliance is very critical to a partnership's success. However, strategic alliances have been recognized as arenas with potential for opportunistic behavior by partners, and each partner may find it advantageous to maximize his own gains at the expense of the venture [7,16]. Game theory and agency theory are therefore applied to explain why some alliance structures are more likely than others to be associated with higher cheating opportunism [27, 33]. A firm needs to have an adequate level of confidence in its partner's cooperative behavior; Das and Teng [7] suggest that this confidence comes from

two sources: trust and control. These two sources are parallel concepts and have a supplementary relationship in terms of generating alliance confidence. Control mechanisms have an impact on the trust level, and this trust level moderates the effect of control mechanisms in determining the control level.

Factor 3: Strategic alliance formation

In 1980s, a number of environmental shifts, such as the globalization of markets, the convergence of and rapid shifts in technology, and regulatory changes in the United States, have led to dramatic growth in interfirm cooperation [13, 30]. There are various forms of interfirm alliance, such as R&D partnership, collaborative manufacturing, co-marketing arrangements, direct investment, licensing and equity joint ventures [30]. Every alliance encompasses a number of agreements where two or more firms agree to pool their resources to take advantage of particular market opportunities. Many studies have documented why firms enter into these partnerships, offering analyses such as transaction-cost explanations [16,29]. Gulati [13] argues that the transaction-cost approach treats each transaction as independent and ignores the importance of interfirm trust that emerges from repeated alliances between the same partners. Using multi-industry data on alliances between 1970 and 1989, the empirical study also finds that repeated alliances between two partners are less likely to be organized using equity-based alliances [13]. Transaction-cost explanations center on transaction characteristics and routine situations and thus do not catch the strategic and social factors that motivate firms to form alliances. Eisenhardt and Schoonhoven [10] report that alliances form when firms are in vulnerable strategic positions as well as in strong social positions. This suggests that not only the transaction cost but also strategic and social factors are relevant for predicting alliance formation.

Table 4 reveals articles such as Hamel 1991, Kogut 1988, Gulati 1995, and Powell 1996 [14,19,13, 30] loading in more than one factor. Articles with this characteristic are shown to have a prevalent influence on the field appear in more than one subfield. Combing the results of data mapping (Figure 1) with factor analysis (Table 4), it is clear from the graph that articles loading in more than one factor represent bridges between clusters. The existence of these bridges, enables the combination of different ideas and theoretical innovations [26].

Figure 1 shows the most important linkages for those articles that have been co-cited over 30 times in strategic alliance research. Dyer 1998, Hamel 1991, and Gulati 1995 [9,14,13] are the top three influential publications in strategic alliance research in the past decade. Nodes in Figure 1 with the same shape

belong to the same group. On the left-hand side of the graph, Lane 1998, Cohen 1990, Dyer 1998, Anand 2000, Mowery 1996, and Khanna 1998 [21,3,9, 5,18] all load on factor 1. Inkpen 1997 [17], Doz 1996 [8] and other nodes with a circle shape on the right-hand side of the graph constitute group (factor) 2. Each group represents a different intellectual theme in strategic alliance research. There are three different groups identified in the diagram; the important nodes and linkages are consistent with the results from factor analysis.

5. CONCLUSIONS AND LIMITATIONS

The study of strategic alliance is one of the most important contemporary research topics in the strategic management field. Using articles dealing with the issues of strategic alliance between 1999 and 2008 collected in the SCI and SSCI databases, this study demonstrates the application of bibliometrics, an objective and systematic approach, of determining the relative importance of different knowledge nodes in the development of the strategic alliance field.

Factor analysis results and the two-dimensional spatial picture show that this field has focused on three different interests of research: strategic alliance formation, the relationship and characteristics of partnership success, and learning and absorptive capability issues faced in the last decade. The findings of this study can help researchers, especially newcomers who are interested in studying strategic alliance, to gain a better understanding of the major themes, concepts, and relationships related to strategic alliance research. This study provides a useful channel to access the publications in this field and to identify the research direction of strategic alliance studies.

This paper is accomplished by conducting a citation and co-citation analysis of the leading articles in strategic alliance research and has offered valuable insights into the knowledge network between strategic alliance studies. However, this approach has its own limitations. The perception that all citations are being treated equally, despite the fact that they are not, has generated much criticism [4]. Some degree of subjectivity in deciding the number of articles to be included in an analysis is inevitable. There could be noise accompanying the data from the way in which co-citation data are retrieved. Furthermore, publications need time to accumulate their influences within a specific research area. It is undeniable that works published towards the end of the research period have fewer opportunities to be exposed and cited as compared to those earlier publications. It is encouraged to integrate bibliometric methods, social network analysis techniques and qualitative analysis

methods, such as content analysis, into a future study to provide a more comprehensive overview of studies in the field of strategic alliance.

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策略聯盟研究之知識網絡探索：共引文分析模式

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摘要

本研究乃是探索近代有關於策略聯盟研究之論文的無形知識網絡。本文由 SSCI 與 SCI 資料庫中萃取出 1999 年至 2008 年間共 521 篇相關之論文及 21,493 篇引用文獻，並進一步藉由書目計量學之研究方法，如引文分析與共引文分析，以及多變量分析與社會網絡分析工具進行分析與智慧架構的映照。藉由因素分析本文辨識出包括策略聯盟的形成、學習與吸收能力，與聯盟關係成功的特質等近代策略聯盟研究的三大主要研究議題，並以二維的圖形來呈現智慧架構之間的關係。本研究之結果除可辨識出有關策略聯盟研究之重要文獻間的連結，歸納出主要的研究議題與理論之應用之外，並可由此展現策略聯盟研究其背後的智慧架構及推導出未來策略聯盟研究之方向。

關鍵詞：策略聯盟、書目計量學、共引文分析、社會網絡分析

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