An Invisible Knowledge Network of Strategic Management Studies: Scientometrics and Tag Cloud Analysis

Chen-Tsung Kuo, Yuan-Duen Lee, Yender Lee, and Cheng-Hua Wang

Abstract—The purpose of this study is to identify the evolution of the intellectual structure of strategic management studies and to propose a theory of an invisible network of knowledge. By analyzing 303,402 citations of 4,616 articles published in SCI and SSCI journals in the strategic management field from year 2003 to year 2012, this study maps the intellectual structure of strategic management studies. This article dwells upon the wide spreading social tags of website applications. By so called "crowd wisdom", the tag cloud analysis reveals the preliminary investigation from a social network viewpoint, provides researchers with profiles of strategic management related subjects and theories, and sheds light on future directions of studies. The contribution of this study is to provide important insights and implications of current and future research paradigms for both management scholars and practitioners.

Index Terms—Co-citation, intellectual structure, network of knowledge, strategic management, tag cloud analysis.

I. INTRODUCTION

If I have seen further, it is by standing on the shoulders of giants (Sir Issac Newton, 1645-1736). It's said "stand on the shoulders of giants (the under-box slogan of Google Scholar®)" in which giants means the highly cited authors, papers and books [1]. We have realized via INK modelcould help a novice like a brand new doctoral student in nurture process to escape from vicious cycle of chick-egg with clear scientific map at hand first to navigate the blue ocean of knowledge domain in which novice does know nothing [2]:
1) I don't know in which field I am.
2) I don't know where to get readings of the field.
3) I don't know why are they important?
4) Now, what was it you wanted to tell me?

Looking back over the past decade, we cannot imagine a more opportune time for the field of strategic management studies. We must ask is, what do we know and what should we know about strategic management? The strategic management perspective on strategic management development, as a function of corporate organization, we show that research on strategic management development's impact remains puzzled.

While research findings in Strategic management can be disseminated to scientists and practitioners in the form of journal articles, papers, books, and other documents, people are easily confused with the subjects and their contributions to the development of strategic management when faced with hundreds of such publications. Great efforts have been made to explore these issues, yet all the issues are usually discussed solely based on the subjective assessment of different experts, which often leads to many controversies in the strategic management area.This article attempts on the sociality marks one of website widespread application characteristics: The tag cloud carries on the preliminary inquisition, pondered from the social network angle, uses the populace wisdom, a little at a time mounts up, or may be " strategic management " the theory and the real diagnosis, provides a new ponder direction.

The aim of this study is to provide strategic management researchers with a unique map to better understand strategic management related publications and to provide a systematic and objective mapping of different themes and concepts in the development of Strategic management field. This study also attempts to help identify the linkage among different publications and confirm their status and positions in their contribution to the development of strategic management field.

II. METHODOLOGY

The citation data used in this study included journal articles, authors, publication outlets, publication dates, and cited references. Based on the objective of this study, the authors explored the intellectual structure of Strategic management between 2003 and 2012. This time period was chosen because contemporary Strategic management studies of the past decade represent the most update and probably also the most important research on Strategic management. Citation and co-citation analysis is the main method for this study. First, the databases were identified as the sources of Strategic management publications. Then data collection and analysis techniques were designed to collect information about topics, authors, and journals on Strategic management research. In the second stage, the collected data were analyzed and systematized by sorting, screening, summing, subtotaling, and ranking. After a series of operations, key nodes in the invisible network of knowledge in Strategic management were identified and the structures developed. In the final stage, the co-citation analysis was used and the knowledge network of Strategic management was mapped to describe the knowledge distribution process in Strategic management area. In this study, the Science Citation Index (SCI) and Social Sciences Citation Index (SSCI) were usedfor analysis. The SCI and SSCI are widely used

databases, which include citations published in over 8000 world's leading scholarly journals [3]. While there are arguments that other online databases might also be used for such analysis, using SCI and SSCI provided the most comprehensive and the most accepted databases of Strategic management publications.

III. DATASET AND SCIENTOMETRICS

To identify the key publications and scholars that have laid down the ground work of Strategic management research, citation data were tabulated for each of the 4,616 source documents and 303,402 references using the Excel package. A citation is taken to be a valid and reliable indicator of scientific communication and a basis for the identification of "invisible college", i.e. research networks that refer to each other in their documents without being linked by formal organizational ties [4]. As Small and Sweeney [5] have shown in their comparison of methods, it can be an advantage to define citations not in absolute terms but in their relation to the length of the citing document's bibliography. This is particularly relevant for the study of the relation between different disciplines employing different citation practices.

In this stage, the citation analysis produced interesting background statistics, data mapping was conducted and an intellectual structure of current Strategic management studies was revealed. Co-citation analysis is a bibliometric technique that information scientists use to map the intellectual structure of an academic field. It involves counting documents from a chosen field - paired or co-cited documents. Co -citation analysis compiles co-citation counts in matrix form and statistically scales them to capture a snapshot at a distinct point in time of what is actually a changing and evolving structure of knowledge [6]. Based on the total number of citations in the selected journals, the top scholars were identified, and then a co-citation matrix was built before a pictorial map was drawn to describe the correlations among different scholars. In doing so, we were following the procedures recommended by White and Griffith [07].

The top 30 highly cited author teams (denoted by first author only) with their representative works are shown in Table I and Table II. In the total Strategic management citation sample, the top 5 authors are BARNEY J(316→567), Teece DJ (259→455), WERNERFELT B (178→274), Eisenhardt KM.(127→263), COHEN WM (169→250). Table I and Table II shows the "Historical Timeline of Strategic management" that the top 5 authors of books and articles. No matter fair or no, aiding process is kind of a voting system. Accordingly to the metaphor of citation as effortful voting [08], an effortful analysis by hands and computer-aid of 303402 citations voted by thousands of authors traces the visible historical timeline along Strategic management development path and paradigms could be as a shorter reading list. This list in sense of read less but know more for Ph.D. students could help cost-effectively in the epistemology stage as well as ontology stage in terms of comprehensive exam and research proposal. In nature and in nurture, INK--Strategic management is obviously fitting with Pareto's Law (1846-1923); Few Vital Many Trivia.

IV. TAG CLOUD ANALYSIS

A. The Meaning of the Tag Cloud

The tag cloud is the common display mode for the search results in folksonomy-based websites, presenting tag sizes according to the frequency and the popularity of the key words. It is called the weighting detailed list in the visual design domain, one of user interface main design elements, uses for the achievement to describe the website content vision tool [09]. According to Rivadeneira [10], the tag cloud presents for the writing collection vision, usually for the tag collection which chooses based on some kind of reason, using the size, the weight, the color attributes and so on, to take the correlation character word the characteristic. While some people regard as the tag cloud as thing semantics field the vision symbol [11]. In other words, the tag cloud is one kind the sole glossary, demonstrated by the different color size font, encircles the shape with the succinct sole vision to present the subject index the network application way, may let human one see the popular tag, each tag all is a directional same subject group linking, simultaneously also is one kind of survey tool.

A tag cloud is a visual representation for summarizing text data, used to depict keyword metadata (tags) on websites. Typically, the tag size in a collection (cloud) signifies its frequency of use. It offers a spatial view of the frequency of keywords and draws our attention to high frequency ones in a specific area [12]-[14]. Early application is Web 2.0 sites such as Flickr, del.icio.us and Technorati. E-Commerce websites such as Amazon or O'Reilly Media successfully provide tag clouds service to help users navigate through aggregated data [15]. However, tag clouds are not only used to display tag sets but are also increasingly applied in other contexts and for various data sets, for instance, in the areas of information visualization or text summarization [16], [17]. Clouds are an effective way to make the most of limited page space by showing tags alphabetically as well as ranked by popularity. In addition, they are a graphically interesting way to display a long list of tags [18].

B. The Finding from Tag Clouds Analysis

Tag clouds are an excellent way to display long lists of tags. It was surprising to observe that tag clouds are not used more. The combination of tag clouds offers a spatial view of the frequency of words and draws our attention to high frequency words in a specific geographical area.

In Stage 1, based on the results of tag cloud analysis shown in Fig. 1 and Fig. 2, there is clearly an immediate visual impact of these tag clouds that identifies dominant words, making what was tacit within the document more implicit. This study looks at changes in the use of words over time, describes the tag clouds for the individual documents, and identifies the prominent messages. (see Table III)The largest tag in the Stage1 analysis (indicating the most frequently used term) is "management" (608→1235). The words "strategic" (332→652), "performance" (160→381), "strategy" (171→346) and "knowledge " (139→330) are also dominant.

TABLE I: HISTORICAL TIMELINE OF STRATEGIC MANAGEMENT: 2003-2007

5-star	Timeline	Fq	Type	Top Citation Index For Books And Articles
☆	1910	87	B	Wicksteed P. H., 1910, MARKETS HIERARCHIES
☆☆	1959	135	B	Penrose E., 1959, THEORY GROWTH FIRM
☆	1963	103	B	Cyert R.M., 1963, BEHAV THEORY FIRM
☆	1967	76	B	Thompson J., 1967, ORG ACTION
☆	1978	75	B	Nunnally J. C., 1978, PSYCHOMETRIC THEORY
☆	1978	78	B	Miles R.E., 1978, ORG STRATEGY STRUCTU
☆	1978	110	B	Pfeffer J., 1978, EXTERNAL CONTROL ORG
☆☆☆	1980	202	B	Porter M. E., 1980, COMPETITIVE STRATEGY
☆☆	1982	159	B	Nelson R., 1982, EVOLUTIONARY THEORY
☆	1983	91	J	DIMAGGIO PJ, 1983, AM SOCIOL REV, V48, P147
☆	1984	90	J	HAMBRICK DC, 1984, ACAD MANAGE REV, V9, P193
☆☆☆	1984	178	J	WERNERFELT B, 1984, STRATEGIC MANAGE J, V5, P171
☆	1985	96	B	Porter M. E., 1985, COMPETITIVE ADVANTAG
☆	1986	74	J	TEECE DJ, 1986, RES POLICY, V15, P285
☆	1989	108	J	EISENHARDT KM, 1989, ACAD MANAGE REV, V14, P532
☆☆	1989	128	J	DIERICKX I, 1989, MANAGE SCI, V35, P1504
☆☆☆	1990	169	J	COHEN WM, 1990, ADMIN SCI QUART, V35, P128
☆☆	1990	126	J	PRAHALAD CK, 1990, HARVARD BUS REV, V68, P79
☆	1991	106	J	March JG, 1991, ORGAN SCI, V2, P71
☆☆☆☆☆	1991	316	J	BARNEY J, 1991, J MANAGE, V17, P99
☆	1992	96	J	KOGUT B, 1992, ORGAN SCI, V3, P383
☆	1992	80	J	LEONARDBARTON D, 1992, STRATEGIC MANAGE J, V13, P111
☆	1993	99	J	AMIT R, 1993, STRATEGIC MANAGE J, V14, P33
☆	1993	118	J	PETERAF MA, 1993, STRATEGIC MANAGE J, V14, P179
☆	1995	106	B	Nonaka I., 1995, KNOWLEDGE CREATING C
☆	1995	82	J	HUSELID MA, 1995, ACAD MANAGE J, V38, P635
☆	1996	94	J	Grant RM, 1996, STRATEGIC MANAGE J, V17, P109
☆☆☆☆	1997	259	J	Teece DJ, 1997, STRATEGIC MANAGE J, V18, P509
☆	1998	92	J	Dyer JH, 1998, ACAD MANAGE REV, V23, P660
☆☆	2000	127	J	Eisenhardt KM, 2000, STRATEGIC MANAGE J, V21, P1105

TABLE II: HISTORICAL TIMELINE OF STRATEGIC MANAGEMENT: 2008-2012

5-star	Timeline	Fq	Type	Top Citation Index For Books And Articles
☆☆	1959	218	B	Penrose E., 1959, THEORY GROWTH FIRM
☆	1963	167	B	Cyert R.M., 1963, BEHAV THEORY FIRM
☆	1977	128	J	ARMSTRONG JS, 1977, J MARKETING RES, V14, P396
☆	1978	143	B	Nunnally J. C., 1978, PSYCHOMETRIC THEORY
☆	1978	133	B	Pfeffer J., 1978, EXTERNAL CONTROL ORG
☆☆	1980	229	B	Porter M. E., 1980, COMPETITIVE STRATEGY
☆	1981	172	J	FORNELL C, 1981, J MARKETING RES, V18, P39
☆	1982	211	B	Nelson R., 1982, EVOLUTIONARY THEORY
☆	1983	157	J	DIMAGGIO PJ, 1983, AM SOCIOL REV, V48, P147
☆	1984	148	J	HAMBRICK DC, 1984, ACAD MANAGE REV, V9, P193
☆☆	1984	274	J	WERNERFELT B, 1984, STRATEGIC MANAGE J, V5, P171
☆	1985	153	B	Porter M. E., 1985, COMPETITIVE ADVANTAG
☆	1986	139	J	PODSAKOFF PM, 1986, J MANAGE, V12, P531
☆☆	1989	216	J	EISENHARDT KM, 1989, ACAD MANAGE REV, V14,P532
☆	1989	158	J	DIERICKX I, 1989, MANAGE SCI, V35, P1504
☆	1990	144	J	PRAHALAD CK, 1990, HARVARD BUS REV, V68, P79
☆☆	1990	250	J	COHEN WM, 1990, ADMIN SCI QUART, V35, P128
☆☆☆☆	1991	567	J	BARNEY J, 1991, J MANAGE, V17, P99
☆	1991	200	J	March JG, 1991, ORGAN SCI, V2, P71
☆	1992	177	J	KOGUT B, 1992, ORGAN SCI, V3, P383
☆	1993	141	J	AMIT R, 1993, STRATEGIC MANAGE J, V14, P33
☆	1993	174	J	PETERAF MA, 1993, STRATEGIC MANAGE J, V14, P179
☆	1995	130	B	Nonaka I., 1995, KNOWLEDGE CREATING C
☆	1996	171	J	Grant RM, 1996, STRATEGIC MANAGE J, V17, P109
☆☆☆☆	1997	455	J	Teece DJ, 1997, STRATEGIC MANAGE J, V18, P509
☆	1998	152	J	Dyer JH, 1998, ACAD MANAGE REV, V23, P660
☆☆	2000	263	J	Eisenhardt KM, 2000, STRATEGIC MANAGE J, V21, P1105
☆	2001	143	J	Priem RL, 2001, ACAD MANAGE REV, V26, P22
☆	2002	125	J	Zollo M, 2002, ORGAN SCI, V13, P339
☆	2003	175	J	Podsakoff PM, 2003, J APPL PSYCHOL, V88, P879

TABLE III: COMPARISON OF KEYWORD ANALYSIS FROM 2003 TO 2012: SHOWING TOP 30 POSSIBLE KEYWORDS

Ranking	Key word	Times (2003-2007)	Times (2008-2012)	Change
1.	management	608	1235	+627
2.	**Strategic**	332	652	+320
3.	**Strategy**	171	346	+175
4.	**performance**	160	381	+221
5.	**Knowledge**	139	330	+191
6.	**Organizational**	128	283	+155
7.	**Technology**	119	176	+57
8.	**supply**	114	217	+103
9.	**resource**	113	210	+97
10.	**chain**	106	197	+91
11.	**Human**	105	214	+109
12.	**systems**	97	112	+15
13.	**Strategic management**	95	287	+192
14.	**information**	87	105	+18
15.	**theory**	82	234	+152
16.	**change**	74	129	+55
17.	**planning**	72	Na	
18.	business	62	174	+112
19.	development	62	143	+81
20.	learning	61	107	+36
21.	industry	59	104	+45
22.	manufacturing	58	Na	
23.	competitive	58	138	+80
24.	corporate	56	190	+134
25.	operations	56	Na	
26.	decision	53	104	+51
27.	research	53	105	+52
28.	product	48	Na	
29.	international	47	Na	
30.	analysis	46	163	+117

TABLE IV: COMPARISON OF COMPANY TITLE ANALYSIS FROM 2003 TO 2012: SHOWING TOP 30 POSSIBLE COMPANIES

Ranking	Company Title	Times (2003-2012)	Times (2008-2012)	Change
1	management	841	1599	+758
2	performance	686	1512	+826
3	strategic	460	956	+496
4	firm	347	666	+319
5	advantage	345	575	+230
6	competitive	331	553	+222
7	Strategic management	216	392	+176
8	capabilities	210	439	+229
9	organizational	191	458	+267
10	perspective	182	373	+191
11	industry	180	280	+100
12	knowledge	177	421	+244
13	view	162	369	+207
14	strategy	162	229	+67
15	firms	159	329	+170
16	model	147	299	+152
17	business	129	314	+185
18	Resource-based	128	288	+160
19	product	128	301	+173
20	alliances	127	231	+104
21	dynamic	117	247	+130
22	organizations	116	216	+100
23	technology	111	Na	Na
24	development	107	240	+133
25	systems	104	221	+117
26	research	93	222	+129
27	impact	93	211	+118
28	making	89	Na	Na
29	organization	85	191	+106
30	human-resource	81	Na	Na

TABLE V: COMPARISON OF TITLE ANALYSIS FROM 2003 TO 2012: SHOWING TOP 30 POSSIBLE TITLES

Ranking	Title	Times (2003-2007)	Times (2008-2012)	Change
1	strategic	444	560	116
2	management	421	577	156
3	performance	212	388	176
4	knowledge	109	189	80
5	organizational	107	189	82
6	study	106	156	50
7	strategy	100	167	67
8	technology	95	120	25
9	supply	94	159	65
10	firms	90	164	74
11	firm	89	163	74
12	development	87	124	37
13	case	86	145	59
14	resource	86	143	57
15	business	82	112	30
16	Strategic management	81	235	154
17	research	79	142	63
18	industry	79	104	25
19	human	79	148	69
20	role	77	168	91
21	empirical	71	103	32
22	analysis	71	120	49
23	change	68	Na	Na
24	model	67	121	54
25	product	65	Na	Na
26	corporate	64	121	57
27	chain	57	117	60
28	learning	55	Na	Na
29	approach	55	Na	Na
30	practices	52	Na	Na

Fig. 1. Keyword analysis of tag clouds from 2003 to 2007: Showing top 30 possible words

Fig. 2. Keyword analysis of tag clouds from 2008 to 2012: Showing top 30 possible words

Fig. 3. The company title analysis of tag clouds from 2003 to 2007: Showing top 30 possible words

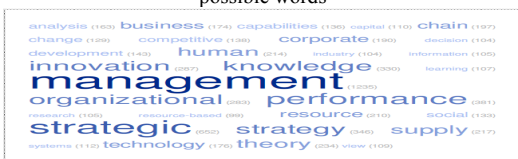Fig. 4 The company title analysis of tag clouds from 2008 to 2012: Showing top 30 possible words

In Stage 3, there is a tag cloud of the 30 most popular title analysis in the selected number possible words (see Fig. 5 and Fig. 6). The largest tag in the Stage 3 analysis is "Strategic" (444→560), followed by "management" (421→577), "performance" (212→388), "knowledge" (109→189), "organizational" (107→189). (see Table V)

Fig. 5. Title analysis of tag clouds from 2003 to 2007: Showing top 30 possible words

Fig. 6. Title analysis of tag clouds from 2008 to 2012: Showing top 30 possible words

V. CONCLUSION

The past decade years have seen extensive research on strategic management. This study investigates strategic management research using citation and co-citation data published in SCI and SSCI from 2003 to 2012. This study

constructs the INK of strategic management studies for the period 2003–2012. Moreover, the so-called research procedures provided in the INK model can be applied to other fields of research. This methodology can easily be applied to other disciplines and provides a powerful research tool for understanding the epistemology of a field as it evolves. By tracing the research path of a specific field in which they are interested, researchers would be able to navigate through time to discover how certain ideas may have evolved into respected scientific concepts, theories, or practices. Researchers can also use this methodology to explore the knowledge network of their own fields so as to gain a vantage position with respect to their field and conduct seminal research.

The contribution of this paper is thus to provide valuable research directions in the strategic management studies field, and to propose an objective and systematic means of determining the relative importance of different knowledge nodes in the development of the strategic management studies subfield of management. This study offers value added, not only because it is the first study to apply tag cloud analysis, but also because it complements and improves the findings of other studies that have approached the subject from the qualitative perspective.

This article attempts on the sociality marks one of website widespread application characteristics: The tag cloud carries on the preliminary inquisition, pondered from the social network angle, uses the populace wisdom, a little at a time mounts up, or may be "strategic management" theory and the real diagnosis, provides a new ponder direction.

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Chen-Tsung Kuo was born in Lukang, a small seashore town in Changhwa County, Taiwan. I was raised there and so completed my elementary and junior high school education there. While children in urban areas were coping with school pressure and rushing to a variety of extracurricular courses, He had been enjoying a childhood with lots of opportunities to stay close to nature. This is the time when he began to realize deeply that, for school children, life should be full of fun and beautiful memories, rather than heavy school bags. He pursued further studies in the evening school of National Taiwan Normal University from September 1980 to June 1984, and in the summer graduate program of National Taiwan Normal University from July 1987 to August 1990.In 2001, He was admitted to the School Administration Program of the Graduate Institute of Elementary and Secondary Education. He received an outstanding score of 90 for the thesis and, subsequently, his MA degree in March 2006. He continued with his studies in September 2007 in the Doctorate Program for the Professional Development of School Principals in the Graduate Institute of Educational Policy and Administration, National Taipei University of Education and completed the 32 credits for the program in 2009.

He is currently a Ph.D. Candidate of Business and Operations Management, Chang Jung Christian University, Tainan City, Taiwan. His research interests include Leadership Styles, Strategic Leadership, and Organizational Behavior. It is his hope that he could do further research in relevant areas in future. He published some articles on international journals.

Yuan-Duen Lee is former dean of the College of Management at the Chang Jung Christian University, Taiwan. He is currently Professor of SHRM/OBM/ Leadership. He is a management professor at doctoral program at the Chang Jung Christian University, Taiwan. His interests include (1) Leadership Behaviors, Attitudes, and Styles, (2) Strategic Leadership, (3) Organizational Behavior, and (4) Communication and Conflict Resolution Skills.

Yender Lee is a management professor at doctoral program at the Chang Jung Christian University, Taiwan. After having taught and consulted SMEs over 15 years, he decisively studied abroad and achieved his decent PhD degree (McGill, 2002) in beautiful Montreal near panoramic Mont Royal (3M School*). His interests include MIS-TIM, particularly meta-methodology and meta-theory via paradigm-mining. He published not bad international journal articles including recently Technology Forecasting and Social Change, International Journal of Conflict Management and Technovation. His special honors include ASAC1999/2009 Best Paper and 12 patents, besides his INK team hits a record-13/19 to top3 conferences (AoM, AIB and ASAC07/08/09).

Cheng-Hua Wang was born in Tainan, Taiwan, in 1965. He received the Master and Ph.D. degrees in industrial engineering from National Tsing Hua University, Hsinchu, Taiwan, in 1991 and 1998, respectively. He is currently Director of Graduate School of Business and Operations Management at the Chang Jung Christian University, Taiwan. He is a management professor at doctoral program. His research interests include Statistical Decision Analysis, Management Science, Operation Strategy, etc.