

BEHAVIOR OF SCIENTIFIC PRODUCTION ON STRATEGIC ALLIANCES IN THE STRATEGIC MANAGEMENT JOURNAL BETWEEN 2010-2020

COMPORTAMIENTO DE LA PRODUCCIÓN CIENTÍFICA SOBRE LAS ALIANZAS ESTRATÉGICAS EN LA STRATEGIC MANAGEMENT JOURNAL EN EL PERIODO 2010-2020

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ABSTRACT

Objective. To characterize the scientific production on strategic alliances in the period 2010-2020 by updating the previous study covering the period 1998-2009 of the Strategic Management Journal.
Design/Methodology/Approach. The execution of this bibliometric study followed the methodology

proposed by Ronda Pupo, which consists of a four-step procedure: selection units of analysis; definition of the period of study; analysis of collected data and further description of results. **Results/Discussion.** The results show Ranjay Gulati as the most productive and referenced author, Strategic Management Journal as the most cited journal and the United States as the country with the most publications on the subject. The treatment of indicators and the selection of other databases were identified as gaps, which constitute lines for future research. **Conclusions.** Strategic alliances are one of the most powerful options for granting competitive advantages to firms that trust in their effectiveness, due to the approach based on cooperation for the attainment of common objectives they promote. **Originality/Value.** The bibliometric study is a useful tool for updating academics for future research. It provides reference information for tourism managers to consult reference bibliographies on successful experiences in terms of current trends. **KEYWORDS:** strategic alliances; Strategic Management Journal; bibliometrics

RESUMEN

Objetivo. Caracterizar la producción científica sobre alianzas estratégicas en el periodo 2010-2020 actualizando el estudio anterior que cubría el periodo 1998-2009 de la revista Strategic Management Journal. **Diseño/Metodología/Enfoque.** La realización de este estudio bibliométrico ha seguido la metodología propuesta por Ronda Pupo, que consiste en un procedimiento de cuatro pasos: selección de unidades de análisis; definición del periodo de estudio; análisis de los datos recogidos y posterior descripción de los resultados. **Resultados/discusión.** Los resultados muestran a Ranjay Gulati como el autor más productivo y referenciado, a Strategic Management Journal como la revista más citada y a Estados Unidos como el país con más publicaciones sobre el tema. Se identificaron como lagunas el tratamiento de los indicadores y la selección de otras bases de datos, que constituyen líneas para futuras investigaciones. **Conclusiones.** Las alianzas estratégicas son una de las opciones más potentes para otorgar ventajas competitivas a las empresas que confían en su eficacia, debido al enfoque basado en la cooperación para la consecución de los objetivos comunes que promueven. **Originalidad/Valor.** El estudio bibliométrico es una herramienta útil de actualización académica para futuras investigaciones. Proporciona información de referencia para que los gestores turísticos consulten bibliografías de referencia sobre experiencias exitosas en cuanto a tendencias actuales.

PALABRAS CLAVE: alianzas estratégicas; Strategic Management Journal; bibliometría

INTRODUCTION

Enterprises in general are facing difficulties to consolidate and establish their products in markets, successful management turns harder every day, since clients are more demanding and competitors, very numerous. In this context, strategic alliances between enterprises become vital in overcoming the difficulties deriving from this situation. Effective options to generate new opportunities and survive in a more and more competitive market may be favored by on strategic alliances.

The advantages offered by strategic alliances are multipurpose. Some alliances are created to fulfill a single goal, but others may involve multiple simultaneous objectives. In every case, the most important thing is to be very clear about what is expected and how to get to the desired result. In any economic branch, they have a positive effect on the enhancing of relationships and the creation of loyalty as well as on the expansion of the enterprise operations. (Suárez Moreno, 2019)

Authors such as (Todeva & Knoke, 2005), (Kazakova, Shemetkova, Chemarina, & Melnik, 2018) (Sánchez Llor, 2020), (Tomaylla Deza & Zumaeta Campos, 2018), (Bouncken, Fredrich, Ritala, & Kraus, 2018), (Genc, Alayoglu, & Oyku, 2018), (Ramírez Juárez & Delgado Fernández, 2008), (Penoel & Zaragoza, 2018), (IšoraItè, 2009), (Chathotha & Olsenb, 2003), (Hernández Leal, Quintero Soto, & Velázquez Rodríguez, 2019) (Mora Castellanos, Cano Olivos, Martínez Flores, & Partida, 2019), (Cobeña Ruiz-Lopera, 2018), in general, define strategic alliances and, at the same time, they extol, elements such as importance, feasibility and others.

In short, strategic alliances are based on collaboration and cooperation between two or more enterprises, which share common goals related to the improvement of their positioning in the market and the achievement of competitive advantages. The number of authors mentioning strategic alliances in relation to strategic direction is on the rise and scientific publications contain plenty of articles on the subject.

Strategic Management Journal, due to its high specialization in the domain of strategic management, was chosen as the main source of information. Since its coming into existence in 1980, this magazine has given impetus to the discipline and it has also contributed to its consolidation through the rapid increase of the scientific production in the field. This publication focuses on scientific research and it wages a strict policy for the selection of the papers to be published; so, the information coming from this source may be considered “certified knowledge”, that is to say, knowledge that has been assessed by experts. Furthermore, it is the worldwide leading bulletin on strategy and its articles often deal with strategic alliance (Urguellés Terrero, 2012), the subject of the present paper. According to the research platform Dimensions the papers published by this magazine are the most cited ones.

On the other hand, this magazine is an indexed journal with a high ranking position in databases analyzing the impact of magazines, which proves the reputation it has earned before the scholars in this domain of research. It is included in ISI Web of Knowledge database and it appeared for the first time in the Journal Citation Reports (JCR) Social Sciences Citation Index in the 2010 edition. (Cruz Aguilera, Cruz Aguilera, Aguilera Mustelier, Lao León, & Moreno Pino, 2018).

One of the ways to determine the evolution in the field of knowledge in relation to strategic alliances is by means of bibliometrics, a branch of scientometrics, which applies mathematical and statistical method to measure and analyze scholarly literature and the authors who produce it in order to establish the dynamics of scientific activity. (Urguellés Terrero, 2012)

Consequently, this paper aims at analyzing the behavior of scientific production about strategic alliances in the Strategic Management Journal between 2010 and 2020 and it is intended to be a continuation of the previously mentioned paper.

For the above-mentioned purpose the following research questions are answered:

What bibliometric indicators allow to determine the evolution of knowledge about strategic alliances?

How does the scientific production related to strategic alliances behave?

Who are the most cited and prolific authors?

Which are the most quoted articles?

What is the relationship among authors?

Answering these questions involved quantitative analysis (bibliometric analysis) and qualitative analysis (social media analysis)

MATERIAL AND METHODS

Logic setting

The execution of this bibliometric study followed the methodology proposed by Ronda Pupo, which consists of a four-step procedure: selection units of analysis; definition of the period of study; analysis of collected data and further description of results. This method was successfully employed in Analysis of scientific production quotations about strategic alliances in Strategic Management Journal between 1988-2009 (Urguellés Terrero, 2012).

Selection of unit of analysis

In determining the unit of analysis, the number of references found in the 43 articles related to strategic alliances from Strategic Management Journal between 2010 and 2020 was taken. The journal was chosen, because it ranks fifth in terms of the amount of articles related to strategic alliances and first, as to the number of references within the period under study. In addition, it is a leading magazine worldwide in terms of strategic management issues, whose articles require strict scientific approval.

Definition of the study period

A study period of 10 years was defined, from 2010 to 2020, because bibliometric studies had been previously carried out by (Urguellés Terrero, 2012) and (Cruz Aguilera et al., 2018) in relation to the productivity of this journal on Strategic Alliances.

Data collection

To obtain the necessary data, the scientific articles provided by “Dimensions”, a site, which operates under the database Web of Science, were used. In terms of period of study, the search was limited to ten years (2010-2020) and, as to the source name, it was narrowed to Strategic Management Journal. Only articles related to the term strategic alliances, which included in the abstracts the words "strategic alliances" were selected

Processing and analysis of data

For the data analysis, a count involving the number of references in the 43 articles previously extracted from the database was made. The authors and their memberships in these extracted articles were used to determine production indicators such as productivity of the authors and institutions.

On the other hand, with the more than 2,000 authors of the references, the analysis of two groups of authors was carried out: the most referenced ones, regardless of whether they have publications within the study period and the most referenced ones with papers published in the period covered by the present

investigation. For the analysis of these groups a relationship matrix was made between the most cited ones and the most referenced ones. The first group of authors was established to make comparisons with other bibliometric studies developed for the journal on the subject of strategic alliances and the second group was established to carry out a study of social networks aiming at providing qualitative support to this bibliometric study of quantitative nature.

For the analysis of social networks, the UCINET 6 software was used and the Net Draw software was applied to the creation of the resulting graph. Microsoft Excel 2013 software from the Microsoft Office 2013 package was used for the grouping, processing and analysis of general data, such as those contributing to the bibliometric indicators studied in this research.

Descriptive analysis of results.

The descriptive analysis of the results from data processing in the previous step made possible the answers to the questions generated by the indicators chosen for the analysis of this bibliometric study. It also allowed the right interpretation of the relationship matrix between authors, as well as of those derived from the Ucinet Software and Net Draw program, as part of the network analysis.

RESULTS AND DISCUSSIONS

In 2018, (Cruz Aguilera et al., 2018), carried out a bibliometric study on the behavior of the scientific production of the Strategic Management Journal, which was published by the RECUS Magazine (Electronic Magazine for the Cooperation of University and Society), where the results of the bibliometric indicators chosen by the authors are shown, which show as well the evolution of knowledge of the strategic alliances of the journal between 1988 and 2009 and constitutes the state of the art of this article.
Development of indicators for bibliometric analysis

The 2858 references present in the 43 articles about strategic alliances in the Strategic Management Journal are analyzed. For this research, the following bibliometric indicators are selected:

- ❖ Average number of references per document (Scientific argumentation)
- ❖ Typology of bibliographic references
- ❖ Language of bibliographic references
- ❖ Country of publication of the bibliographic references
- ❖ Degree of updating of citations
- ❖ Middle age of literature
- ❖ Half-life of items
- ❖ Most cited articles (Price Index)
- ❖ Sources with highest contributions to the development of the branch
- ❖ Most referenced authors.

Average of references per document

This indicator intends to determine the use given by the authors of the 43 articles analyzed to the bibliography they use. It consists of the quotient of the amount of references and the number of articles.

The higher the resulting coefficient, the larger the number of citations per document and therefore the use of the information. During the execution of this analysis, the articles are related to their respective years of publication together with the number of references used in each of them.

As it can be seen in table 1, the largest number of publications within study period took place in 2016 with a total of 10 publications that represent 23 % of the elements studied, followed by the 7 publications in the years 2013 and 2018, representing in each case 16 %. The accumulated percentage of these three years is 55 %, which means that the highest concentration of publications took place in these years. On the other hand, the lowest number of publications during this period of time for the Strategic Management Journal on strategic alliances took part in 2010, 2012, 2017, 2019 and 2020, with an accumulated percentage of 20 %.

Regarding the references used by the articles, the most cited ones correspond to 2013, 2015, 2016 and 2018, with an accumulated frequency of 64.97 %. Taking into account the description above, the years 2013 and 2018 stand out as periods of high scientific productivity in articles on strategic alliances; they are also remarkable for the large number of references received by their authors.

Finally, with regard to the average of reference per articles, it may be affirmed that, in general, in its annual distribution, it is in an interval whose lower limit is 43 references per article, reached in 2016 and whose upper limit is reached in the 2012, with an average of 84 references per article.

Table 1: Average of references per document

Year	Published article/ percentage	Reference per year/ percentage	Average of references per article
2020	1 (2.33%)	51 (1.78%)	51
2019	3 (7.0%)	242 (8.47%)	81
2018	7 (16.28%)	500 (17.49%)	71
2017	3 (7.00%)	222 (7.77%)	74
2016	10 (23.26%)	430 (15.05%)	43
2015	5 (11.63%)	418 (14.63%)	83
2014	1 (2.33%)	71 (2.48%)	71
2013	7 (16.28%)	509 (17.81%)	72
2012	1 (2.33%)	84 (2.94%)	84
2011	4 (2.3%)	266 (9.31%)	66
2010	1 (2.33%)	65 (2.27%)	65
Total	43 (100%)	2858 (100%)	

Typology of cited documents

This indicator allows determining what types of bibliographies are most cited by authors.

Table 2: Document typology

Typology	References	Percentages
Article	2768	96.851
Chapter	39	1.365
Monograph	40	1.400
Edited Book	10	0.350
Preprint	1	0.035
Total	2858	100.000

It is easy to realize that most of the documents used as reference are articles previously published by scientific journals (table 2), 2768 of 2858 are articles, which represents 96.85 % of the total references. The articles are followed by the chapters, but with a much lower percentage, only 1.37 %, then the monographs with 1.4 % and next the physical books and prints with only 0.35 % and 0.035 % respectively.

Cited sources with significant contribution to the discipline

On account of the importance of the typology “Article”, it is worth analyzing and highlighting the journals in which most of the cited articles were published. Of the total of the references, 2,77 references from scientific journals are counted.

Journal	Frequency	Percentage
Strategic Management Journal	700	25.29
Academy of Management Journal	269	9.72
Organization Science	253	9.14
Administrative Science Quarterly	223	8.06
Academy of Management Review	149	5.39
Management Science	92	3.32
Journal of Management	79	2.85
Research Policy	62	2.24
American Journal of Sociology	46	1.66
Journal of Business Venturing	39	1.41
Journal of International Business Studies	37	1.34
Journal of Management Studies	36	1.30
The Journal of Finance	30	1.08
American Sociological Review	27	0.98
Journal of Economic Behavior & Organization	26	0.94

The Strategic Management Journal, see (table 3), despite being a relatively young journal with its first article published in 1980, stands out as leader in referenced articles in the period studied. This journal

contains 707 of the total number of referenced articles, which represents 25.29 % of the total, which makes a great difference with the percentage shown by the second journal on the list: 9.72 %.

Age of references used

The age of the referenced literature for the elaboration of the 43 articles about strategic alliances in the Strategic Management Journal is 85 years, since the date of the first referenced article is 1937 and the last one dates from 2020. The year 2020 was set as the date from which the determination of the age of the references took place.

Table 4: Age of references

Age	Period 1937-2020	References	Percentage
81-84	1937-1940	2	0.07
77-80	1941-1944	0	0.000
73-76	1945-1948	1	0.035
69-72	1949-1952	2	0.07
65-68	1953-1956	3	0.105
61-64	1957-1960	3	0.105
57-60	1961-1964	11	0.385
53-56	1965-1968	5	0.175
49-52	1969-1972	13	0.455
45-48	1973-1976	21	0.735
41-44	1977-1980	51	1.784
37-40	1981-1984	54	1.889
33-36	1985-1988	106	3.709
29-32	1989-1992	221	7.733
25-28	1993-1996	339	11.861
21 -24	1997-2000	476	16.655
17-20	2001-2004	489	17.110
13-16	2005-2008	501	17.530
9 -12	2009-2012	370	12.946
5-8	2013-2016	161	5.633
1-4	2017-2020	29	1.015
	Total amount	2858	100.000

As it can be seen in table 4, the most referenced bibliography in the 43 articles is concentrated mostly in the last 35 years representing 94.20 % of the bibliographies referenced in them. In addition, there is a trend to decrease in referenced bibliographies over time. The highest number of references are between the ages of 25-28, 21-24, 17-20, 13-16, 9-12; each one, showing a percentage superior to 10 %, with an accumulated frequency, from 9 to 28 years, of 72.77 %, so it is inferred that more than 73 % of the citations are less than 30 years old. It should also be noted that: 41.63 % of the articles are 16 years old or

even younger than that; 23.86 % of the articles published are 12 years old or even younger than that, and finally, 14.83 % of the articles were published within the last 10 years.

Obsolescence of literature

To establish the obsolescence of the literature, it is necessary to determine two indicators, the half-life of the articles and the Price Index. (Urguellés Terrero, 2012). Half-life of the articles: the half-life of the articles (h), is defined as the period of time in which a bibliography loses half of its usefulness.

Table 5: Usefulness of the articles from the first ten years

Year	Age	References	Accumulated frequency	Usefulness
2020	1	1	2858	1.000
2019	2	4	2857	0.996
2018	3	12	2853	0.998
2017	4	12	2841	0.994
2016	5	25	2829	0.989
2015	6	27	2804	0.981
2014	7	41	2777	0.971
2013	8	68	2736	0.957
2012	9	66	2668	0.933
2011	10	79	2602	0.910
2010	11	89	2523	0.882
2009	12	136	2434	0.851
2008	13	122	2298	0.804
2007	14	177	2176	0.761
2006	15	111	1999	0.699
2005	16	91	1888	0.660
2004	17	129	1797	0.628
2003	18	99	1668	0.583
2002	19	145	1569	0.548
2001	20	116	1424	0.498
2000	21	143	1308	0.457

In table 5 the referenced articles per year with their respective ages until the year 2000 are shown and the necessary margin for the analysis of their usefulness is provided. The table also shows a decreasing accumulated frequency that ranges from the total sum of all frequencies (equivalent to 2858 bibliographies, the number of referenced citations), to 1308, which is the accumulated frequency corresponding to 2000. To determine the usefulness of the articles, the number of the accumulated frequency was divided by the total number of articles.

Taking into account that the maximum usefulness of an article is 1, which is the one obtained in the reference of the year 2020, and that the half-life generates a reduction of 50 %, that is to say 0.5, the

utility values are selected according to their closeness to 0.5, in this case 0.498, the utility value corresponding to 2001, therefore it is inferred that the referenced articles reach their half-life at 19 years old.

Bibliography Update Index or Price Index

After calculating the age and usefulness of bibliographies, the Price index, which provides the number of references, less than 5 years old, used in the articles studied, was determined. When this index reveals values close to 1, it can be concluded that the referenced bibliographies have a high update rate within period under study.

Table 6: Price index

Year	Total of references	References aged under 5	Price index
2010	65	12	0.19
2011	266	41	0.15
2012	84	7	0.08
2013	509	79	0.16
2014	71	11	0.15
2015	418	78	0.19
2016	430	62	0.14
2017	222	24	0.11
2018	500	38	0.07
2019	242	42	0.17
2020	51	5	0.09

As it can be seen in table 6, all the values of the bibliographies update indexes are well below 0.5, so the level of bibliographies update is considered to be low, reaching the minimum value in 2018, only 0.08, and a maximum in 2015, with only 0.19. In order to provide a better illustration of these data, the average of these indices was calculated, which resulted in 0.14, a value that is below 0.20.

Language of bibliographic references

In the period studied (2010-2020), despite the different origins of the 43 articles on strategic alliances, 100 % of them are in English, as well as their respective references.

Publication sources. Country and institution

When the affiliation of the authors of the 43 articles studied (table 7) was established, it revealed that 59.80 % of the total belong to universities based in the United States and when units from Hawaii are added, it goes up to 61.76 % of authors , almost three-quarters of the total, which clearly shows the dominance of the United States in productivity, followed by the Universities of Canada (6.86 %), the

Netherlands (5.88 %) and China (3.92 %), as the countries with higher percentage of article productivity on strategic alliances between 2010 and 2020.

Table 7: List of countries of origin of the authors

Country	Number of authors	Percentage
EU	61	59.80
Canadá	7	6.86
Países Bajos	6	5.88
China	4	3.92
Francia	4	3.92
España	4	3.92
Alemania	3	2.94
Singapur	3	2.94
Hawaii (EU)	2	1.96
Suiza	2	1.96
Italia	1	0.98
Inglaterra	1	0.98
India	1	0.98
Israel	1	0.98
Brasil	1	0.98
Nigeria	1	0.98
Total	102	100.00

Table 8: Affiliation of the authors

Institution	Frequency
Tilburg University	4
Texas A&M University	5
Georgia Institute of Technology	3
West Virginia University	3
National University of Singapore	3
Northwestern University	3
University of Groningen	3
University of Navarra	3
University of North Carolina at Chapel Hill	3
University of Toronto	3

Table 8 shows a selection of 10 campuses - out of the total of 72 institutions - with issues between 3 and 5 authors. According to the bibliography reviewing, summarized in table 8, Texas A&M University turns out to be the university with the highest number of participations in the preparation of articles on strategic alliances in the period of time under study.

Relationship between the most productive and most referenced authors

The analysis of the 102 authors of the 43 articles in the Strategic Management Journal, with a number of researchers much greater than the number of publications, reflects a large number of contributions in their preparation. In order to determine the productivity index of these authors, the Lotka index is calculated, which is determined by the logarithm base 10 of n, where n is the number of publications corresponding to each author.

Table 9: Productivity index

Number of authors	Number of articles	Productivity index
2	3	0,47712
9	2	0,30102
91	1	0

By calculating the productivity index, it is determined that 91 of the authors analyzed show zero productivity, that is to say, the number of published articles is 1; 9 of the analyzed articles have low productivity ($0 < \log n < 1$) and none of the authors analyzed have high productivity ($\log n \geq 1$).+

Since authors with high productivity were not determined, authors whose index is between two and three articles in the period under study were analyzed. Subsequently, the authors who received the most citations were studied. During the period under study, more than 2000 authors with articles and other forms of scientific expression on strategic alliances were referenced by the authors of the 43 articles analyzed. In order to carry out the tabulation of these authors, Microsoft Excel software is used, with statistical functions for selective counting.

Table 10: Most referenced authors

Authors	References	Percentage
Ranjay Gulati	118	4.13
Singh Harbir	104	3.64
Frank T. Rothaermel	63	2.20
Jeffrey J. Reuer	58	2.03
Lavie Dovev	54	1.89
Jeffrey H. Dyer	43	1.50
Will Mitchell	40	1.40
Gautam Ahuja	37	1.29
Lori Rosenkopf	36	1.26
Toby E. Stuart	36	1.26
Kathleen M. Eisenhardt	35	1.22
Joanne E. Oxley	34	1.19
Kale Prashant	33	1.15
Bruce Kogut	32	1.12
Brian S. Silverman	31	1.08

When analyzing the 16 most cited authors, following the number of references (table 10), Ranjay Gulati, stands out as the most referenced author with 4.13 %, of the total of the references; Harbir Singh comes

next with 3.64 % of the references he is followed by Frank T. Rothaermel, Jeffrey J Reuer. and Lavie Dovev, with 63 references (2.20 %); 58 (2.03 %) and 54 (1.89 %) respectively.

When compared with the studies carried out by (Urguellés Terrero, 2012) and (Cruz Aguilera et al., 2018), Ranjay Gulati, holds the first place as the most cited author, since he appears in most of the articles analyzed in these investigations. For this reason, Ranjay Gulati, can be considered as a guru in subjects related to strategic alliances in the period covered by the three studies. (1989-2020).

Analysis of social Networks

In order to proceed with the analysis of social networks, the samples of authors to be analyzed are determined. An intentional non-probabilistic sample made up of 20 authors, out of a total population of 102 authors, is chosen. This selection is the result of the sum of the authors with productivity equal to or superior to two articles in the period (11), along with the nine most cited authors with publication on strategic alliances in the 2010-2020 period. For this reason, a square matrix of 20 * 20 showing the data of social relations between authors is elaborated and later entered into the UCINET 6 software.

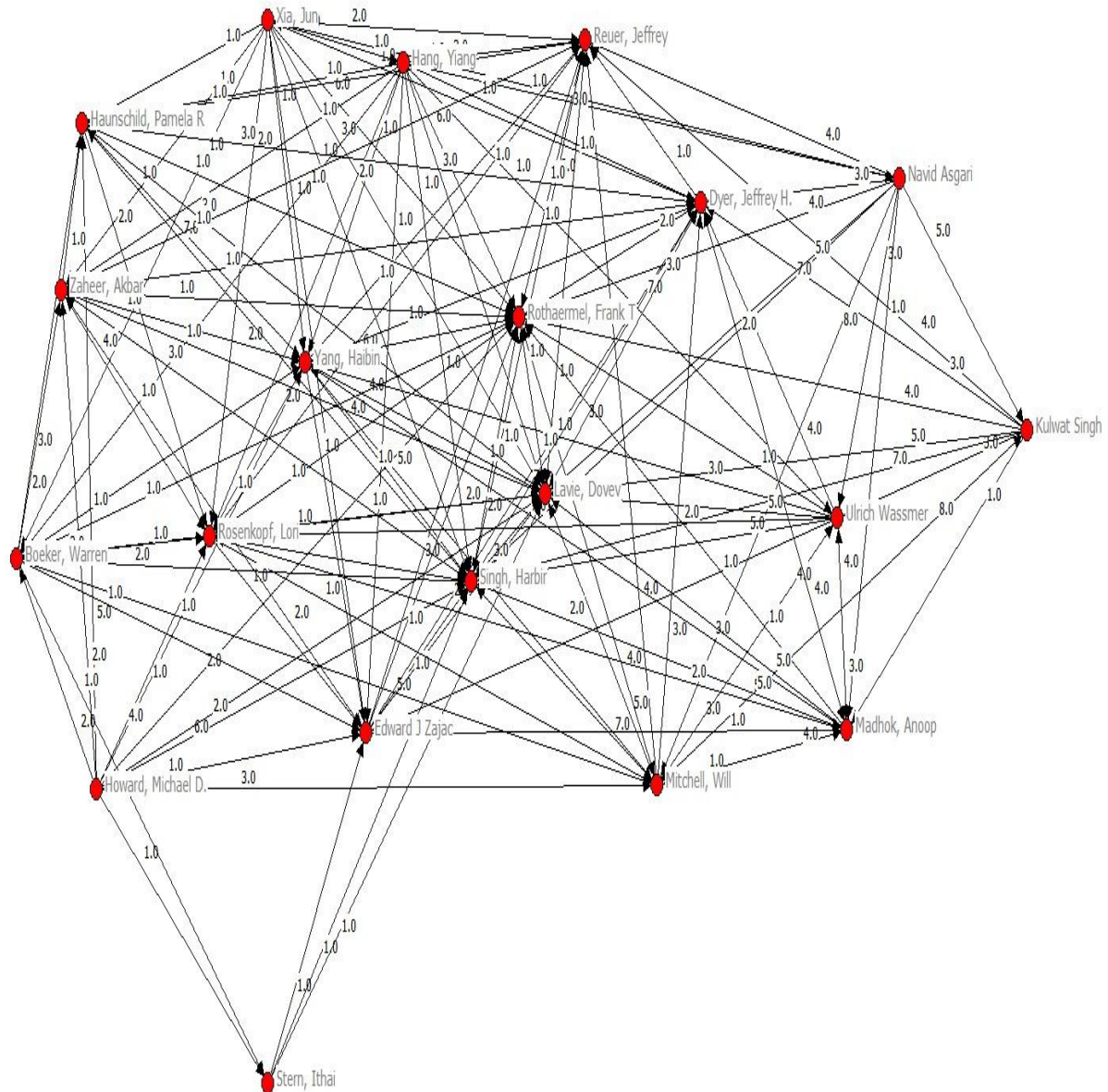
Table 11: Square Matrix

Authors (publications)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Howard, Michael D. (3)	3	0	0	1	1	3	0	1	0	0	0	6	2	2	0	4	5	0	2	2
2. Xia, Jun (3)	0	1	1	1	0	0	2	1	0	1	0	1	6	3	1	2	1	0	1	1
3. Hang, Yiang (2)	0	1	1	1	0	0	2	1	0	1	1	1	6	3	1	2	1	0	1	1
4. Yang, Haibin (2)	0	0	0	2	0	5	1	1	0	0	0	4	6	4	1	2	0	0	0	2
5. Stern, Ithai (2)	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0
6. Mitchell, Will (2)	0	0	0	0	0	8	4	0	5	0	3	7	4	5	3	0	0	1	0	0
7. Reuer, Jeffrey (2)	0	0	0	0	0	0	2	0	0	0	0	3	3	1	0	1	0	0	0	0
8. Edward J Zajac (2)	0	0	0	0	0	0	3	3	0	0	0	5	1	1	2	0	0	0	0	2
9. Kulwant Singh (2)	0	0	0	0	0	8	4	0	5	0	3	7	4	5	3	0	0	1	0	0
10. Navid Asgari (2)	0	0	0	0	0	8	4	0	5	0	3	7	4	5	3	0	0	1	0	0
11. Ulrich Wassmer (2)	0	0	0	3	0	4	0	1	0	0	3	5	1	5	4	2	0	4	0	0
12. Singh, Harbir (1)	0	0	0	0	0	0	1	0	0	0	0	7	2	3	7	0	1	2	0	1
13. Rothaermel, Frank T (1)	0	0	0	0	0	1	0	0	0	0	0	0	4	1	0	1	0	0	0	0
14. Lavie, Dovev (1)	0	0	0	1	0	0	1	0	0	0	0	7	1	3	3	2	0	0	0	0
15. Dyer, Jeffrey H. (1)	0	0	0	0	0	0	1	0	0	0	0	7	2	3	7	0	1	2	0	1
16. Rosenkopf, Lori (1)	0	0	0	1	0	1		1	0	0	0	1	1	1	0	4	0	0	0	0
17. Haunschild, Pamela R (1)	0	0	0	1	0	0	1	0	0	0	0	7	1	3	3	2	0	0	0	0
18. Madhok, Anoop (1)	0	0	0	3	0	4		1	0	0	3	5	1	5	4	2	0	4	0	0
19. Boeker, Warren (1)	0	0	0	1	1	1		1	0	0	0	2	1	1	0	3	3	0	0	2
20. Zaheer, Akbar (1)	0	0	0	1	0	0	1	1	0	0	0	3	1	1	1	4	1	0	0	1

The matrix represented in table 11 shows the authors numbered from 1 to 20 in "Column 0", which is labeled: "Authors." Each element of that column is matched with the elements of "Row 0", in order to determine the amount of citations received by those distributed in the column.

As it can be seen in table 10, self-citation is quite common among them, since nine authors collaborate at least once. On the other hand, 13; Frank T. Rothaermel, 14; Lavie Dovev, 15; Jeffrey H. Dyer, are the most “popular” authors in the system, being quoted by most of the others.

Illustration 1: Graph of relationships between authors



Network size

Size is critical to the structure of social relationships because of the limited resources and capacities available to each actor to build and maintain ties. As the group grows, the proportion of all potentially

present ties (density) will decrease and distinct groups and factions will most likely emerge. (Hanneman, 2002)

If in a network there are $(k * k-1)$ unique pairs of ordered actors (that is, AB is different from BA and reflexive loops are neglected), where k is the number of actors. (Hanneman, 2002).

Based on this statement, it can be affirmed that the size of the network that defines the number of possible relationships between the nodes is 380.

Density of networks

It is very useful for network analysis to determine to what extent the network under study reaches its potential, an element known as density of ties between actors. This is defined as the quotient between existing relationships and possible relationships. (Hanneman, 2002)

This can be defined by the following formula: $D=n / (k (k-1))$; where n is the number of existing relationships, k is the number of actors and D is the density. To determine n, the UCINET 6 software output is taken, resulting in a total of 158 existing loops. After replacing the values, a density of 0.42 is obtained, meaning that only 42 % of the possible relationships have been established. As it can be seen, the number of the density is close to half of the potential relationships because the number of actors analyzed is small. That is why, the density of the networks varies in inverse proportion with the number of actors analyzed, as it is affirmed (Hanneman, 2002).

Degree of centrality

“Actors with stronger links to other actors may have advantageous positions; they may have alternative ways of satisfying needs and therefore they are less dependent on other individuals. In addition, they can access to the set of network resources and make better use of them; it often enables them to act as mediators and it also allows them exchanges with others, being able to take advantage of that position. A very simple, but often effective measure of an actor's centrality and potential power is the degree of it” (Cruz Aguilera et al., 2018)

The degree of centrality is the number of actors to which an actor is directly linked. The degree of centrality is divided into degree of input and degree of output, which, as shown in the output of the NetDraw software (Illustration 2), depend on the direction of the flow. (Velázquez Álvarez & Aguilar Gallegos, 2005). The degree of output is the sum of the relationships that the actors say they have with the others. On the other hand, the degree of entry is the sum of the relationships referred to an actor by others. (Velázquez Álvarez & Aguilar Gallegos, 2005)

Illustration 2 show the degree of input and output of all nodes and in the last two columns, the degree of normalized input and output, which are the percentage representation of the first two. Based on these results, it is concluded that the central actor in the reference network in relation to citations received is Singh Harbir, with an input grade of 79 and a normalized input grade of 51, 97. This can be validated by means of the output of the Net Draw software, in which the above-mentioned actor is in the center of the network being quoted by the rest of them.

Illustration 1: Graph of relationships between authors

		1	2	3	4
		OutDegree	InDegree	NrmOutDeg	NrmInDeg
10	Navid Asgari	40.000	2.000	26.316	1.316
9	Kulwat Singh	35.000	10.000	23.026	6.579
6	Mitchell, Will	32.000	35.000	21.053	23.026
1	Howard, Michael D.	29.000	0.000	19.079	0.000
11	Ulrich Wassmer	29.000	13.000	19.079	8.553
18	Madhok, Anoop	28.000	11.000	18.421	7.237
4	Yang, Haibin	26.000	14.000	17.105	9.211
3	Hang, Yiang	23.000	1.000	15.132	0.658
2	Xia, Jun	22.000	1.000	14.474	0.658
17	Haunschild, Pamela R	18.000	13.000	11.842	8.553
15	Dyer, Jeffrey H.	17.000	36.000	11.184	23.684
12	Singh, Harbir	17.000	79.000	11.184	51.974
19	Boeker, Warren	16.000	4.000	10.526	2.632
14	Lavie, Dovev	15.000	53.000	9.868	34.868
8	Edward J Zajac	14.000	10.000	9.211	6.579
20	Zaheer, Akbar	14.000	12.000	9.211	7.895
7	Reuer, Jeffrey	8.000	25.000	5.263	16.447
16	Rosenkopf, Lori	6.000	27.000	3.947	17.763
13	Rothaermel, Frank T	3.000	47.000	1.974	30.921
5	Stern, Ithai	3.000	2.000	1.974	1.316

The actors, whose centrality ranks right after Singh Harbir, are Lavie Dovev and Frank Rothaermel; with an estimated degree of input and output of 53; 34, 87 and 47; 30, 92 respectively. Illustration 2 shows that these two actors share the centrality in the network together with the main one, shaping the triad: Singh Harbir; Lavie Dovev and Frank Rothaermel.

CONCLUSIONS

As a result of the present investigation, the following conclusions have been reached:

- ❖ Strategic alliances are one of the most powerful options for granting competitive advantages to firms that trust in their effectiveness, due to the approach based on cooperation for the attainment of common objectives they promote.
- ❖ The scientific productivity of the Strategic Management Journal in the period under study is of forty-three articles related to strategic alliances, whose reduced number is due to the fact that it is a first-rate journal, specialized in the field of strategic management with high publishing standards. It is the journal that is most used as a source by the authors studied.
- ❖ The analyzed authors do not have a high productivity index, only Michael D. Howard, stand out with three publications.
- ❖ The most referenced authors are assessed in two ways: the most referenced authors regardless of whether they have published in the period under study, such as Ranjay Gulati, and the most referenced authors who have published in that period, such as Singh Harbir.
- ❖ By using the network analysis, the relationships between the most productive authors and the most referenced authors who have had publications in the period were defined. On the basis of this it is determined that the triad Singh, Harbir, Lavie Dovev and Frank Rothaermel represent the center of the network.

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