

Supply chain management: A review of the literature applying the meta-analytical approach

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Abstract

The number of articles written on the theme "Supply Chain Management" (SCM) was increasing periodically, showing increasing interest for researchers. The methodology of the exploratory perspective is based on the systematic review of the literature, applying the model of the seven stages of the meta-analytical approach (Melo Mariano, García Cruz, and Arenas Gaitán, 2011) and supported by computer tools for scientific research such as VOSviewer and SSfM. Of the 1162 articles identified in the result we were shown the best magazines as a son "Cleaner Production Magazine" and "Supply of Chian Management" and the most relevant authors to Sarkis J., Govindan K. and Shu Q. The focus of the Research on SCM is related to the "management of the green supply chain" and the "development of sustainable practices in the social, environmental and economic field through the supply chain". The investigations were developed mainly in the Asian continent, the United States and the United Kingdom. For future research, it is suggested that these be empirical about SCM, using the valuable documents that are systematically selected in this research work, as a contribution to science.

Management of the supply chain, Sustainable, Environmental Management, Business performance, Meta-analytical Approach

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Introduction

Companies are organized to develop their production processes by forming supply chains. Mentzer et al., (2001) mentions that industries also depend on the flows of information, materials, economic resources, labor and capital goods.

Forrester, 1958, p. 37 cited by Mentzer et al., (2001) stated that the "way in which these five flow systems are interconnected to expand and cause changes, will constitute a basis for anticipating the effects of decisions, policies, ways of organizing and the investment options "(p.1).

In this way, a theory of distribution management of an integrated and organizationally related nature is introduced, starting the supply chain (CS) that over time its definition was expanded from a single process in the different areas of the organization as something that exists, going through Supply Chain Management (SCM) as a systemic coordination throughout the SC and currently the new trends speak of Green Supply Chain Management (GSCM) where a behavior of environmental care.

Several authors such as (Cooper & Ellram, 1993), La Londe and Masters, (1994) and Mentzer et al., (2001) proposed that the supply chain is a group of companies that participate in their different processes and activities to generate value. That is, the companies that interact with its five systems proposed by Forrester will generate value through a final product. From these propositions, Mentzer et al., (2001) states that individuals participate directly in the flows of products, services, finances and information, which flow from a supplier to a customer and vice versa through a direct, extended supply chain and final.

Therefore, a supply chain has operational activities that must necessarily be carried out in order to transfer a product from a source to a customer and to carry out each of these activities, a management process is necessary, and the management of the supply chain arises.

The literature has several definitions of Supply Chain Management (SCM). One strategic concept is La Londe and Masters, (1994) stating that companies make long-term understanding agreements and work intensively to achieve high levels of trust and commitment, to achieve an improvement in services and cost reduction for members. at all levels of the supply chain. Where the chain as a whole becomes more competitive compared to companies in the industry that work individually.

On the other hand, Cooper et al., (1997) considers that the management of the supply chain is an integrating philosophy to manage the total flow of materials from the supplier to the final customer. From the various definitions that were proposed for Supply Chain Management Mentzer et al., (2001) indicates that these can be classified into three categories: a management philosophy, the implementation of a management philosophy and a set of processes Management (p.5).

An SCM proposal that considers the various definitions, taking into account that the management of the supply chain involves several companies, many business activities and the coordination of these activities, was proposed by Mentzer et al., (2001) defining the Management of the supply chain as: the strategic coordination of business functions of a particular company and in the supply chain, to improve the long-term performance of companies and the supply chain.

As we can see, several efforts were made to achieve a clear definition of the supply chain management, however the advances in the processes during the last years demanded greater efficiency and better results in the business management, seeking greater integration between the companies and an advance in the management of the supply chain to achieve an integration in the supply chain (SCI).

In Flynn's document, Huo, & Zhao, (2010) presents the definition of the term integration proposed by Webster's, 1966 as "the unified control of a number of successive or similar economic or especially industrial processes that were previously carried independently "(p.59). In the context of the supply chain, the integration of the supply chain (SCI) is the "degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and interorganizational processes" (Flynn et al. al., 2010, P.59).

However, the new generations of consumers are looking for products that are processed in environmentally friendly conditions, the companies that satisfy these demands have a customer base with a high awareness of economic, ecological and social sustainability; emerging a new evolution of the supply chain called the sustainable management of the supply chain (SSCM)

The academic and corporate interest in the sustainable management of the supply chain has increased considerably in recent years, defined as the management of material flow, information, capital and cooperation between companies along the supply chain, with goals sustainable development, which are derived from the needs of customers and stakeholders (Seuring and Muller, 2008).

This definition highlights the cooperation of stakeholders in the three dimensions of sustainable development. On the other hand, Beske, Land and Seuring, (2014) highlights the categories in which SSCM practices can be structured as strategic orientation, continuity, collaboration, risk management, proactivity. All this process of evolution of the supply chain raises us that a management must be developed under a commitment with the sustainable development, that involves a strong attitude of collaboration of the executives of the companies.

On the other hand, Salamanca-Costs, (2015) indicates that cooperation agreements improve the competitive advantage of the industry when all members of the supply chain participate to avoid that the strongest are the ones that benefit the most. As can be seen, the knowledge widely generated in different studies on the management of the supply chain has been oriented towards a process management in search of competitive advantage in a collaborative and environmentally friendly way.

Thus, the exponential increase in research, especially empirical studies that are published in different topics of the social sciences, makes it impossible to review the scientific literature, if not with the help of objective and systematic tools. .

As an alternative arises meta-analysis, a type of scientific research that aims to integrate in an objective and systematic way the results of empirical studies on a specific research problem, in order to determine the state of the art in a given field of research. study (Sánchez-Meca, 2010).

The idea of many researchers to combine the results of independent studies to produce a more general knowledge of a phenomenon of interest is called meta-analysis work method.

However, Ramirez Correa and Garcia Cruz, (2005) consider it convenient to call "meta-analytical approach" to differentiate it from quantitative meta-analysis.

In this way, before undertaking a particular investigation, the researcher must ask himself what is known about the phenomenon, since without a clear vision about the state of the art, a new study will not be very useful. SÁNCHEZ-MECA (1999) according to the document by Ramirez Correa and Garcia Cruz, (2005) indicates that "reviews of research constitute an essential link between the scientific task of the past and the future, establishing the starting point of new research". Research on the management of supply chains in the industrial sector seeks to identify the main and current studies conducted in this context. For the sector to improve its performance it is important to understand its dynamics in the supply chain.

Therefore, we pose the problem with the following questions: Is the management of the supply chain aligned with the evolution of the research carried out in recent years? Do the studies carried out in recent years propose or identify other ways of managing the Supply chain? Which are the main countries that investigate this topic?

Once the problem has been defined, this study aims to review the evolution of articles on supply chain management published since 2010 using the analytical goal approach.

The methodology to be applied in the present investigation will have an exploratory perspective of qualitative type through the meta-analytical approach. In section 2 the methodology is presented, section 3 describes the results obtained through meta-analytical approach and section 4 presents the conclusions of the research and suggests future work.

Methodology

The methodology to be applied in the present investigation will have an exploratory perspective through the meta-analytical approach.

The meta-analytical approach applies selection criteria for journals and articles based on the impact factor to choose the best journals and the number of citations to select the best articles that will be the source of information.

According to Melo Mariano et al., (2011) and Ramirez Correa and Garcia Cruz, (2005) the meta-analytical approach makes it possible to select the best authors, articles, journals and also perform an analysis of statistical techniques, sample techniques, the most researched lines, the approaches used and other information.

Stages of the meta-analytical approach

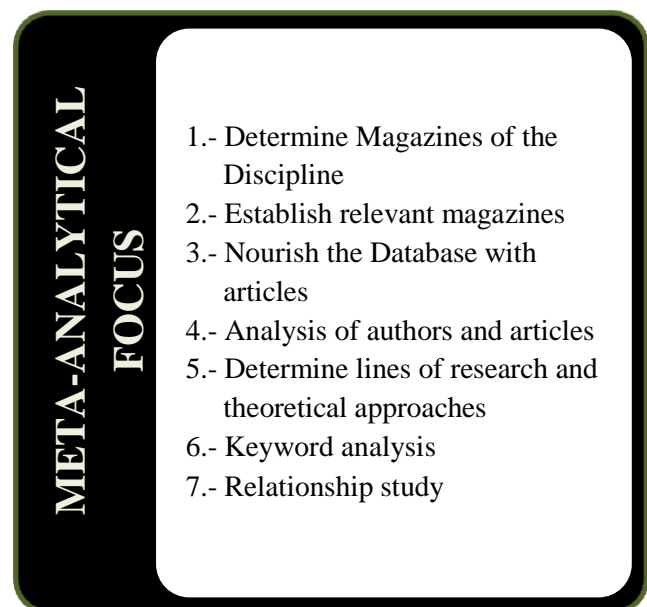


Figure 1: Stages of the meta-analytical approach
Source: Adapted from (Melo Mariano et al., 2011)

According to Ramirez Correa and Garcia Cruz, (2005) The analytical goal approach can be implemented in 4 stages and Melo Mariano et al., (2011) mentions 7 stages for the implementation of the analytical goal approach, which are shown in figure 1.

1. The first step to explore the state of the art is to know which scientific journals are most used in the subject studied. In the case of databases, some relevant journals can be established. Congresses, conferences and scientific associations are also important sources of references for specialized journals.
 2. After determining the scientific journals of the study area, it is necessary to select the most relevant ones. These will be the basis for searching our research. To make this selection it is recommended to use some relevant criteria such as: a) impact factor ISI, (Institute for Scientific Information), Institute of Scientific Information; b) the times that the journal is cited by the publication with the greatest ISI impact factor; c) Magazines selected from large conferences in the areas of interest. It is convenient to establish the origin of the publications in order to guarantee the presence of studies of American, European, Asian and regional journals.
 3. Scopus is also available, which is a bibliographic database covering approximately 20,000 scientific, technical, medical and social journals (Ramírez-correa, Alfaro-pérez, Rondan-cataluña, and Arenas-gaitán, 2015) and through the website scimagojr.org you can access the titles of the journals. In this article we use the Scopus database and with the help of the software Sweet Spots for Manuscripts 1.01 (SSFm),
- Which can be found on the following website <http://www.sweetspotsweb.com>, we will select the best journals based on three indicators: two indicators related to citations, the SCImago Journal Rank (SJR) (González-pereira, Guerrero-bote, and Moya-anegón, 2010) and the h-index (Hirsch, 2005) and one related to volume, Annual number of published articles (Ramírez-correa et al., 2015).
4. Once the relevant journals have been selected, an investigation is carried out on the subject using the key words of the study and the previously selected publications as a filter. For this task it is suggested the use of databases that are currently available to researchers. These databases have an alternative to export a set of variable data related to each article to a text file for programs such as Ms Excel or Ms Access.
 5. The first analysis to be performed is to calculate the annual average of articles on the subject researched, as well as their citations, together with the number of citations of the selected publications. The objective of this first analysis is to examine the relative importance of the issue over the years, to show whether the research has a progressive scientific interest. This analysis will indicate the importance of the selected journals in relation to the research in the study period. In a second analysis, the most published authors will be identified by the selected journals and by the studies contained in the bibliographies of the articles found. The purpose of this second analysis is to know the authors who lead in quantitative terms the journals that register the highest quality studies.

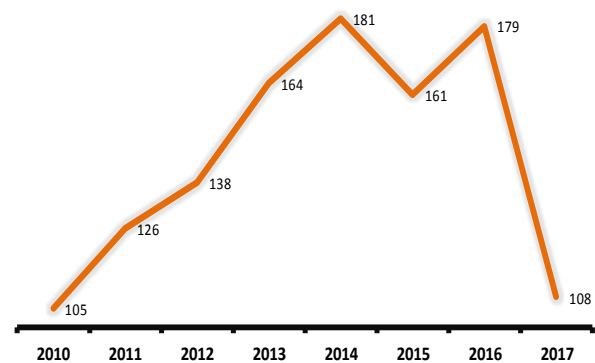
6. In this step, it is important to identify the main lines of research and the theoretical approaches on the subject of research. This phase is achieved by studying the lines and approach of the selected articles in the database. A search for lines and approaches is important so that the review of the state of the art is complete.
7. An analysis of the keywords of the articles will provide important elements regarding the evolution of the subject of study as well as the important lines of research within the topic.
8. The last phase is the broadest and has as a prerequisite the choice of the subject and the model of the research to be tested. It deals with the study of the relationships of the articles previously selected in the previous phases. In order to discover the sample sizes of the studies, statistical techniques used, places of study and significance of the relationships, approach addressed and other relevant information of the documents.

Results of the investigation

On the topic "Management of the supply chain" we carry out the research applying the analytical goal approach to be applied in seven stages according to the proposal of (Melo Mariano et al., 2011) and using the computer tools like SWEET SPOTS (SSFm) presented by (Ramírez-correa et al., 2015) and the VOSviewer Software that allows us to display bibliometric maps (Van Eck and Waltman, 2010), which will allow us to analyze authors, keywords and others that support research.

Determine the journals of the Research Area

The search for "Supply Chain Management" was carried out in Elsevier's Scopus database (<http://www.scopus.com>), from 2010 to 07/19/2017. Journals and congresses related to the study subject were reviewed, noting that 442 journals published 1162 articles, the temporal distribution of these studies is shown in Graphic 1, noting that the year 2017 has records only until the month of July and the graphic trend indicates that the subject is gaining interest every year due to its progressive growth, which validates the scientific importance of the present study.



Graphic 1. Evolution of written articles on supply chain management

On the other hand, 327 congresses were held whose documents incorporated 572 publications.

In the countries of Latin America, 14 congresses were held in Brazil and Mexico; and 60 articles on the subject of study were published in journals in Brazil, Chile, Argentina and Colombia.

With the help of the SSfM, the map of the magazines shown in figure 2 was drawn up. (Ramírez-correa et al., 2015)

They indicate that in the graphic each circle represents a scientific journal, for our case on the topic Management of the supply chain; the color depends on the percentile of the magazine with respect to its index H, the circle is red if it is less than or equal to 33%, it is yellow if it is between 33 and 66% and it is green if it is greater than 66%.

The position on the X axis of the circle is associated with the percentile of the SJR index of the journal and the position on the Y axis of the circle is associated with the percentile of the annual number of articles published in the journal.

The size of each circle indicates the number of articles published in the journal.

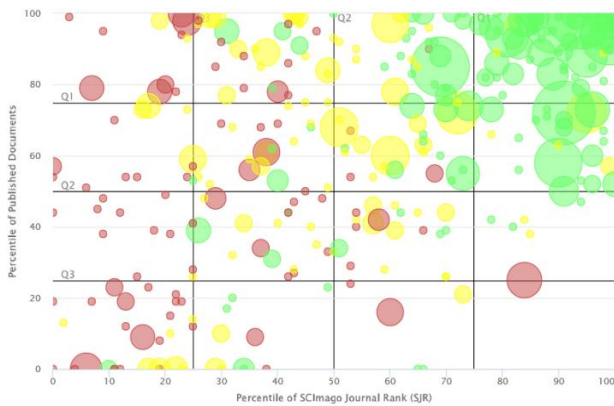


Figure 2: Analysis in ssfm of the topic supply chain management
 Source: Own preparation with support from the SSfM (<http://www.sweetspotsweb.com>).

Establish relevant journals

To establish the relevant journals, the SCOPUS database was used on the subject of study with data from 2010 to 19 / JUL / 2017, filtering the journals and articles published.

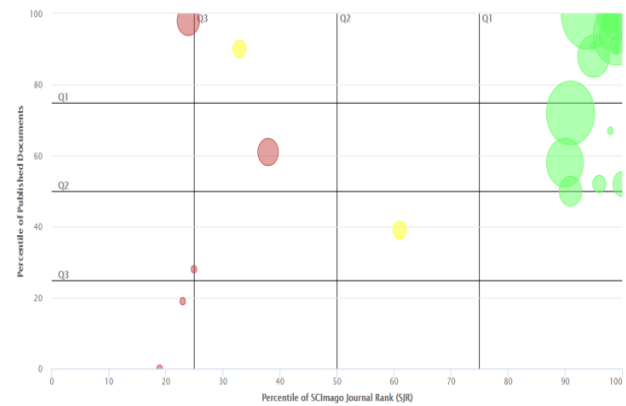


Figure 3. Most relevant and Latin American magazines analyzed in ssfm of the topic supply chain management
 Source: Own preparation with support from the SSfM (<http://www.sweetspotsweb.com>).

With the help of the SSfM software, the most relevant journals shown in figure 3 were selected, evaluated by the SJR index, H index and the annual number of published articles (Ramírez-correa et al., 2015).

The most relevant are located in quartile 1 (Q1) of SJR and in quartile 1 and 2 of publications.

Latin American journals are also incorporated, although they have low evaluation rates but we believe they will provide us with important regional information. Table 1 and 2 show the selected journals.

TITLE OF JOURNAL	SJR	H index	COUNTRY
Journal of Operations Management	4,599	149	Netherlands
Journal of Management Information Systems	3,036	119	United States
Operations Research	2,94	109	United States
European Journal of Operational Research	2,505	200	Netherlands
Energy Economics	2,387	101	Netherlands
Computers and Operations Research	2,326	118	United Kingdom
International Journal of Production Economics	2,216	131	Netherlands
Energy Policy	2,197	146	United Kingdom
Journal of Purchasing and Supply Management	1,925	67	United Kingdom
Information Sciences	1,91	131	Netherlands
Supply Chain Management	1,864	84	United Kingdom
Decision Support Systems	1,806	109	Netherlands
Journal of Cleaner Production	1,615	116	Netherlands
Journal of Transport Geography	1,558	68	United Kingdom
Computers and Industrial Engineering	1,542	98	United Kingdom
International Journal of Physical Distribution and Logistics Management	1,521	76	United Kingdom
Expert Systems with Applications	1,433	131	United Kingdom
International Journal of Project Management	1,396	103	United Kingdom

Table 1. Most relevant magazines

Source: Own elaboration with data from Sweet Spots for Manuscripts 1.01 and SCImago

For the selection of congresses, the SCIMAGO database (scimagojr.com) was used, filtering all the conferences of the Business Management and accounting area in all its sub areas for the year 2016.

From a total of 130 titles the titles were selected of congress that made publications (Ramírez-correa et al., 2015) shown in Table 3, being the IEEE International Conference on Industrial Engineering and Engineering Management the most important one with 20 publications made.

TITLE OF JOURNAL	SJR	H index	COUNTRY
Journal of Theoretical and Applied Electronic Commerce Research	0,353	19	Chile
Revista de Administracao Publica	0,236	11	Brazil
Revista de la Facultad de Ciencias Agrarias	0,201	6	Argentina
Producao	0,197	10	Brazil
BAR - Brazilian Administration Review	0,182	9	Brazil
Espacios	0,17	3	Venezuela
Cuadernos de Administracion	0,133	5	Colombia

Table 2. Latin America Magazines

Source: Own elaboration with data from Sweet Spots for Manuscripts 1.01 and SCImago

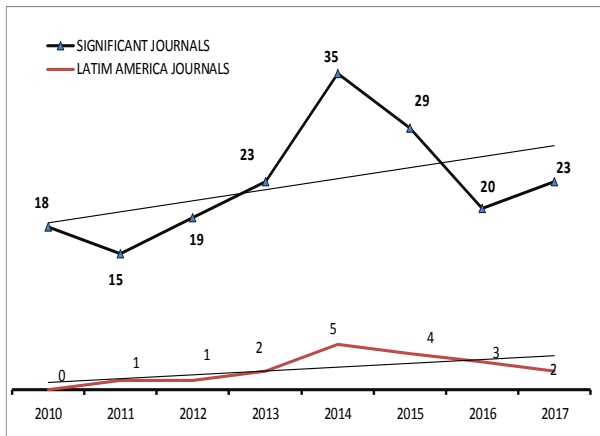
CONFERENCE	SJR	H index	COUNTRY	PUBLISHING
International Conference on Information and Knowledge Management, Proceedings	0,353	86	United States	1
IEEE International Conference on Industrial Engineering and Engineering Management	0,132	9	United States	20
WIT Transactions on Information and Communication Technologies	0,102	10	United Kingdom	3
TOTAL				24

Table 3. Most relevant congresses

Source: Own elaboration with data from Scimago

Nourish the database with articles

After the selection process of journals based on the SJR, Index H and annual number of publications, 19 journals considered the most relevant and 7 Latin American journals considered as journals in the region in which articles were published with regional approach Graphic 2 shows the annual behavior of publications of articles on the theme of supply chain management, identifying a total of 200 articles published.



Graphic 2. Most relevant magazines

Of the 19 titles of most relevant magazines, 6 contain 80% of the articles, being the magazine JOURNAL OF CLEANER PRODUCTION the one that more publications realized with the term "Supply Chain Management" equivalent to 23%, as shown in the Table 4.

TITLE OF JOURNAL	PUBLISHING
Journal of Cleaner Production	23%
Supply Chain Management	18%
International Journal of Production Economics	16%
International Journal of Physical Distribution and Logistics Management	10%
Computers and Industrial Engineering	7%
European Journal of Operational Research	5%
Expert Systems with Applications	5%
Journal of Purchasing and Supply Management	3%
Decision Support Systems	3%
Journal of Operations Management	3%
others	8%

Table 4. Percentage of articles published in journals

Table 5 shows the magazines of Latin America, the most published on the subject of study are the magazines Espacios de Venezuela and Producao de Brazil.

TITLE OF JOURNAL	2011	2012	2013	2014	2015	2016	2017	2017
Espacios	0	1	1	1	0	2	1	6
Producao	0	0	1	3	1	0	0	5
Journal of Theoretical and Applied Electronic Commerce Research	0	0	0	0	1	0	1	2
Revista de Administracao Publica	1	0	0	0	1	0	0	2
Revista de la Facultad de Ciencias Agrarias	0	0	0	0	1	0	0	1
BAR - Brazilian Administration Review	0	0	0	1	0	0	0	1
Cuadernos de Administracion	0	0	0	0	0	1	0	1
TOTAL MAGAZINES LATIN AMERICA	1	1	2	5	4	3	2	18

Table 5. Journals with more publications in Latin America

Analysis of authors and articles

In Graphic 2 we can see that the progressive trend of publications of articles, shows that research on the topic "management of the supply chain" has a growing scientific interest that supports our research on this topic.

In this sense, the most cited authors with the most publications in the study period are shown in Table 6, observing Sarkis J. as the most cited author and Govindan K. as the author with the most publications made.

Author	Citations	Documents
Sarkis J.	1082	10
Govindan K.	1030	16
Zhu Q.	845	12
Lai K.-H.	823	6
Seuring S.	645	9
Beske P.	415	5
Geng Y.	334	7
Diabat A.	325	5
Pagell M.	313	5
Mathiyazhagan K.	295	7
Gold S.	274	6
Kannan D.	265	6

Table 6. Authors with more citations and publications

In the analysis carried out with the Vosviewer Software, a free access computer program developed to build and visualize bibliometric maps (Van Eck and Waltman, 2010), indicates that in a literature review process on the topic of chain management of supplies, can not miss the documents of the authors Govindan K. and Sarkis J., as can be seen in figure 4, are the most cited with the largest number of recently written articles.

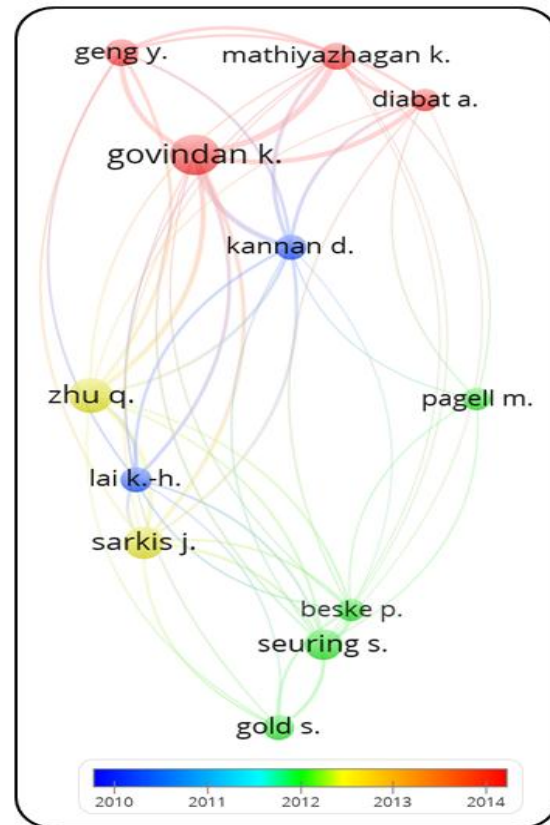


Figure 4. Autores más Citados

On the other hand, the analysis conducted with Vosviewer and the Scopus database on the subject of study, in figure 5 we can see the most cited articles, where Sarkis J. (2011) is the most relevant article.

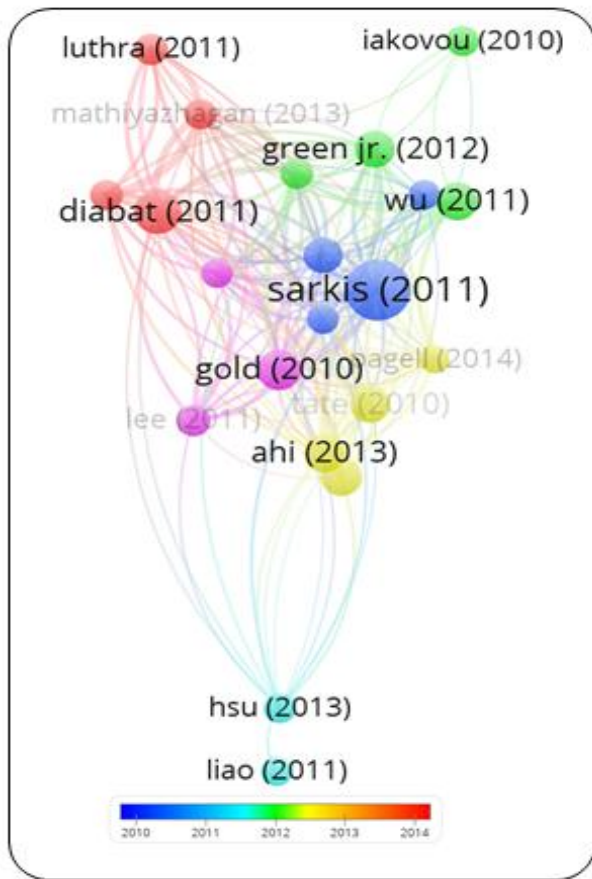


Figure 5. Most cited articles.

Complementing figure 5, from the Scopus database we can extract the articles with more than 100 citations shown in Table 7 that reaches 21 articles.

In the case of Latin American journals, articles with more than one citation are shown in table 8.

The published articles of conferences of the last five years are shown in Table 9.

Main Author	Article	Journal	Year	Citation
Sarkis J.	An organizational theoretic review of green supply chain management literature	International Journal of Production Economics	2011	455
Diabat A.	An analysis of the drivers affecting the implementation of green supply chain management	Resources, Conservation and Recycling	2011	240
Gold S.	Sustainable supply chain management and inter-organizational resources: A literature review	Corporate Social Responsibility and Environmental Management	2010	200
Ahi P.	A comparative literature analysis of definitions for green and sustainable supply chain management	Journal of Cleaner Production	2013	182
Wu Z.	Balancing priorities: Decision-making in sustainable supply chain management	Journal of Operations Management	2011	180
Brandenburg M.	Quantitative models for sustainable supply chain management: Developments and directions	European Journal of Operational Research	2014	178
Green Jr. K.W.	Green supply chain management practices: Impact on performance	Supply Chain Management	2012	175
Tate W.L.	Corporate social responsibility reports: A thematic analysis related to supply chain management	Journal of Supply Chain Management	2010	167
Testa F.	Shadows and lights of GSCM (green supply chain management): Determinants and effects of these practices based on a multi-national study	Journal of Cleaner Production	2010	160
Luthra S.	Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique-an Indian perspective	Journal of Industrial Engineering and Management	2011	125
Lee K.-H.	Integrating carbon footprint into supply chain management: The case of Hyundai Motor Company (HMC) in the automobile industry	Journal of Cleaner Production	2011	121
Iakovou E.	Waste biomass-to-energy supply chain management: A critical synthesis	Waste Management	2010	118
Lin R.-J.	Using fuzzy DEMATEL to evaluate the green supply chain management practices	Journal of Cleaner Production	2013	117
Hsu C.-W.	Using DEMATEL to develop a carbon management model of supplier selection in green supply chain management	Journal of Cleaner Production	2013	114
Govindan K.	Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process	International Journal of Production Economics	2014	113
Mathiyazhagan K.	An ISM approach for the barrier analysis in implementing green supply chain management	Journal of Cleaner Production	2013	113
Liao C.-N.	An integrated fuzzy TOPSIS and MCGP approach to supplier selection in supply chain management	Expert Systems with Applications	2011	111
Shang K.-C.	A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan	Journal of Environmental Management	2010	110
Zhu Q.	Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices	Journal of Purchasing and Supply Management	2013	108
Liu H.	The role of institutional pressures and organizational culture in the firm's intention to adopt internet-enabled supply chain management systems	Journal of Operations Management	2010	106
Pagell M.	Why research in sustainable supply chain management should have no future	Journal of Supply Chain Management	2014	102

Table 7. Most cited articles

Main Author	Article	Journal	Year	Citations
Valverde R.	The effect of E-supply chain management systems in the North American electronic manufacturing services industry	Journal of Theoretical and Applied Electronic Commerce Research	2015	4
de Mattos C.A.	Electronic collaboration in supply chain management: A study of manufacturing companies in Brazil	Espacios	2016	2
Tridapalli J.P.	Supply chain management for the public sector: An alternative for the expenditures control in Brazil	Revista de Administracao Publica	2011	2
de Souza A.L.P.	The Brazilian Network for Public Production of drugs in the perspective of supply chain management: The role of ICTs	Revista de Administracao Publica	2015	1
Siklero C.	Supply chain management: A view from the theory of Constraints	Espacios	2014	1
Valdes R.	The Brazilian beef meat sector into a domestic and international context: A supply chain management (SCM) approach	Revista de la Facultad de Ciencias Agrarias	2015	1

Table 8. Most cited articles in Latin American magazines

Main Author	Article	Journal	Year	Citations
Jain N.	Integrated methodology for supplier selection in supply chain management	IEEE International Conference on Industrial Engineering and Engineering Management	2016	1
Leveling J.	Big data analytics for supply chain management		2014	3
Chaowarat W.	A review of Data Development Analysis (DEA) applications in supply chain management research		2014	1
Barroso A.P.	Demand information sharing impact on supply chain management under demand uncertainty. A simulation model		2014	1
Malviya R.K.	Identifying critical success factors for green supply chain management implementation using fuzzy DEMATEL method		2014	1
Tritos L.	Prioritizing lean supply chain management initiatives in healthcare service operations: A Fuzzy-AHP approach		2014	1

Table 9. Articles presented at conferences

Determine lines of research and theoretical approaches

To determine the main lines of research and theoretical approaches to the topic of study, "Supply chain management"; We review the selected articles in table 7, from which it is concluded that the research lines that were most discussed were: "Management of the green supply chain (GSCM) related to environmental, social and economic sustainability" with 1500 citations and " Management of the supply chain related to the criteria of decision making and selection of suppliers "with 289 citations.

A content analysis carried out with the internet computer tool "TagCrowd", using the titles of the articles obtained from the database is shown in figure 6, where it is observed that the words with the greatest size have the highest number of words occurrences, thus determining the lines of research.



Figure 6. Content analysis by title of the selected articles

On the other hand, the most studied theoretical approaches are related to "organizational theory" and "regulatory approaches", directed towards sustainable management and operational performance. This phase shows us the importance of the research approaches and lines that are of scientific interest and allow us to define the trends of the research in the topic of supply chain management.

Analysis of key words

In this phase we organize the articles by keywords, in order to detect the most important topics that are being studied in the field of research.

As Uddin and Khan (2016) indicate, keywords are very important to ensure that readers are aware of scientific articles and their content. In the same way, Khan and Wood (2015) state that the keywords provided by the author are the most representative of the research topic discussed in the documents.

In the analysis of keywords made with VOSviewer software to the database of the most cited articles shown in figure 7, we can see that the most repeated keywords are "Supply Chain Management", "Green supply chain management" and "Environmental management"

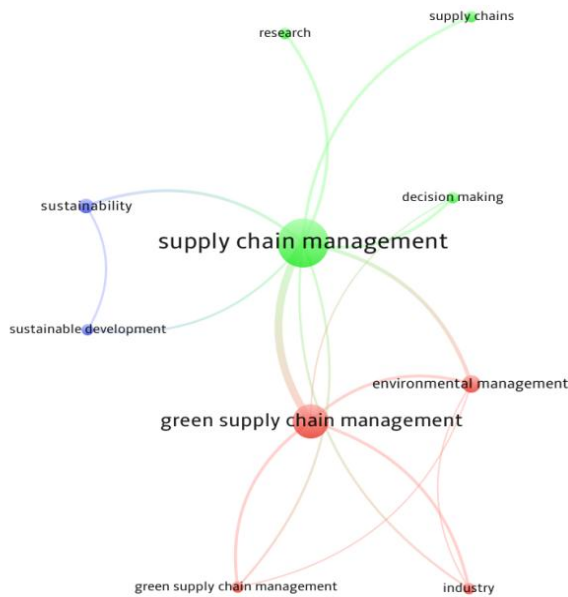
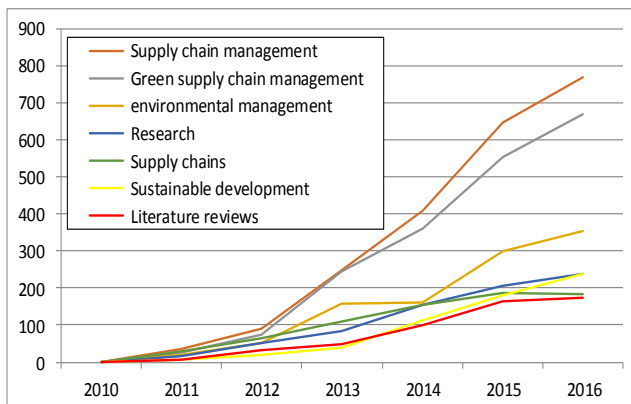


Figure 7. Keywords according to VOS viewer

Through the classification presented in table 10 we can see that the most cited words are "Supply Chain Management", "Green supply chain management" and "Environmental management" that were already mentioned in figure 7.



Graphic 3. Most cited keywords

The evolution of the most cited keywords throughout the years 2010 to 2016 can be seen in Graphic 3 showing us a progressive trend, revealing the importance of these issues in scientific research

KEYWORDS	2010	2010	2010	2010	2010	2010	2010	TOTAL
Supply chain management	1	36	90	247	408	646	768	2196
Green supply chain management	0	25	75	243	361	553	668	1925
environmental management	0	21	50	158	162	299	354	1044
Research	0	16	50	84	154	205	237	746
Supply chains	1	29	66	111	153	187	185	732
Sustainable development	1	8	20	38	112	181	237	597
Literature reviews	0	7	33	48	101	165	174	528
Sustainable supply chains	0	2	2	19	71	151	178	423
Decision making	0	14	23	61	97	111	137	443
environmental protection	0	9	18	79	82	111	145	444
Interpretive structural modeling	0	2	6	67	71	113	142	401
Sustainable supply chain management	3	17	32	41	83	83	135	394
Industry	0	5	10	36	53	121	141	366
New directions	0	7	33	48	89	107	109	393
Organizational theory	0	7	33	48	89	107	109	393
Research opportunities	0	7	33	48	89	107	109	393
Research questions	0	7	33	48	89	107	109	393
Future directions	0	7	33	48	89	107	109	393
Environmental performance	0	7	18	44	74	96	127	366
Sustainability	2	13	16	39	78	89	129	366
Management	1	13	28	65	75	80	81	343
product recovery	0	2	6	52	54	83	96	293
Supply chain managements (SCM)	0	0	0	2	35	115	125	277
article	0	7	16	62	46	75	92	298
manufacturing	0	7	16	62	46	75	92	298
recycling	0	7	16	62	46	75	92	298
marketing	0	15	30	60	33	66	84	288
Taiwan	0	15	30	60	33	66	84	288
Climate change	0	0	6	19	44	78	99	246
Societies and institutions	1	8	6	40	52	62	70	239
Model structures	0	0	0	29	40	59	71	199
Structural models	0	0	0	29	40	59	71	199
Automotive industry	0	0	6	38	53	49	73	219
certification	0	2	6	42	35	53	64	202
conceptual framework	0	2	6	42	35	53	64	202
environmental monitoring	0	2	6	42	35	53	64	202
environmental planning	0	2	6	42	35	53	64	202
Environmental risks	0	2	6	42	35	53	64	202
government regulation	0	2	6	42	35	53	64	202
green chemistry	0	2	6	42	35	53	64	202
implementation process	0	2	6	42	35	53	64	202
India	0	2	6	42	35	53	64	202
industrial production	0	2	6	42	35	53	64	202
Manufacturing firms	0	2	6	42	35	53	64	202
model validation	0	2	6	42	35	53	64	202
modeling	0	2	6	42	35	53	64	202
organizational development	0	2	6	42	35	53	64	202
Organizational philosophy	0	2	6	42	35	53	64	202
organizational structure	0	2	6	42	35	53	64	202
risk assessment	0	2	6	42	35	53	64	202
social marketing	0	2	6	42	35	53	64	202
waste disposal	0	2	6	42	35	53	64	202
Drivers	0	2	6	42	35	53	64	202
DEMATEL	0	0	0	13	33	61	75	182
Biomass	0	18	22	34	42	40	58	214
Environmental impact	0	0	6	25	47	51	73	202

Table 10. Temporal evolution of keyword citations

Relations Studies

According to Melo Mariano et al., (2011) once the first six phases of the meta-analytical approach have been completed, the study must possess the necessary material to elaborate a structural model, together with all the phases of a bibliographic investigation.

In stage seven it is important to investigate which are the most approached approaches, the lines of research, the contribution made among other information obtained from the selected articles.

The analysis was carried out of the 21 most cited articles, where it was possible to observe that the investigations were carried out in industries of different types, in 67%, mainly in countries of the Asian continent, the United States and the United Kingdom. Table 11 presents part of the analysis carried out.

Authors/Year	Research Line	Theoretical Approach	Contribution
Sarkis J., Zhu Q., Lai K.-H. (2011)	Organizational theory regarding adoption and diffusion of GSCM practices	Organizational theory to interorganizational level	The theory of the organization provides a very valuable source of theoretical foundations to promote research in GSCM. There are additional and emerging organizational theories that can help solve unforeseen and emerging problems of GSCM
Diabat A., Govindan K. (2001)	Reduction of environmental risks in GSCM	Organizational philosophy	Develops a model of factors that affect the implementation of GSCM using an Interpretive Structural Modeling Framework (ISM) and highlights 11 types of controllers.
Gold S., Seuring S., Beske P. (2010)	Sustainable management of the supply chain	Competitive advantage inter-industry. Collaboration	Supply management capabilities focused on partners evolves towards core competencies of the company as the competition changes from an inter-industry level to an interprofessional one. The "collaborative paradigm" at SCM considers strategic collaboration as a crucial source of competitive advantage.
Ahi P., Searcy C. (2013)	Sustainable management of the supply chain	Business sustainability	Although some definitions of SSCM show considerable overlap with the GSCM definitions, it is argued that SSCM is essentially an extension of GSCM
Wu Z., Pagell M. (2011)	Profitability and environmental sustainability of the SC under uncertainty	Business models decision-making processes under uncertainty	It provides an important vision of decision making in the sustainable management of the supply chain.
Brandenburg M., Govindan K., Sarkis J., Seuring S. (2014)	Quantitative models for sustainable management of the SC	SCM. Reverse logistics	It presents a general meta-investigation model. Poporciona important findings that include the integration of social issues in the modification, expansion of the scope and dissemination of modeling from one industry to another
Green Jr. K.W., Zelbst P.J., Meacham J., Bhaduria V.S. (2012)	GSCM on performance	Operational performance Organizational performance	Provides a model that incorporates GSCM linking manufacturers with supply chain partners (suppliers, customers) to support environmental sustainability throughout the supply chain
Tate W.L., Ellram L.M., Kirchhoff J.F. (2010)	SCM and social, environmental and economic responsibility	Corporate communication	It concludes that companies emphasize different facets of social, environmental and economic responsibility in supply chains, based on industry, size and geographical location.
Testa F., Iraldo F. (2010)	GSCM and environmental performance improvement	Commercial performance	We find that GSCM is strongly complementary to other advanced management practices, and that it contributes to improving environmental performance
Luthra S., Kumar V., Kumar S., Haleem A. (2011)	GSCM	Interpretive structural modeling	The structured model developed indicates that it will help to understand the interdependence of the barriers
Lee K.-H. (2011)	Carbon footprint and automobile SCM	Climate change	Provides a new way to integrate carbon emissions into supply chain management
Iakovou E., Karagiannidis A., Vlachos D., Toka A., Malamakis A. (2010)	Design and management of waste biomass supply chains	Global energy system. Energy conversion technologies	It shows that the production of biomass to energy is a field of research in rapid evolution that focuses mainly on the technologies of production of biomass to energy
Lin R.-J. (2013)	GSCM and environmental performance improvement	Theory of fuzzy sets. Trial decision making.	Presents a structural model to discover cause and effect relationships for GSCM aspects
Hsu C.-W., Kuo T.-C., Chen S.-H., Hu A.H. (2013)	Carbon management in the GSCM	DEMA TEL Approach	Criteria of information management systems and carbon training are the two main influences in the selection of suppliers with carbon management competencies.
Govindan K., Kaliyan M., Kannan D., Haq A.N. (2014)	Supply chain management	Environmental focus	47 barriers were identified for the implementation of GSCM
Mathiyazhagan K., Govindan K., NoorulHaq A., Geng Y. (2013)	Implementation of the GSCM in industries	Cleaner production	It uses three phases of research: identification of literature barriers, interviews with department managers and surveys of automotive parts manufacturing industries. Of the 26 barriers identified, it determines that the supplier barrier is the dominant one, especially to maintain environmental awareness.
Liao C.-N., Kao H.-P. (2011)	Selection of suppliers in the management of the supply chain	Multiple decision making (MCDM)	The method allows decision makers to establish multiple aspiration levels for vendor selection problems.
Shang K.-C., Lu C.-S., Li S. (2010)	GSCM and competitive advantage	Resource-based vision (RBV).	Six dimensions of GSCM were identified: ecological manufacturing and packaging, environmental participation, green marketing, green suppliers, green stock and ecological design.
Zhu Q., Sarkis J., Lai K.-H. (2013)	GSCM	Corporate environmental practices	The research findings provide useful insights for administrators and other stakeholders seeking to adopt GSCM practices.
Liu H., Ke W., Wei K.K., Gu J., Chen H. (2010)	SCM systems	Organizational culture. Institutional theory	The results show that companies with greater control orientation are more prone to submit to regulatory pressures. He also found that firms with low orientation of flexibility or high control orientation are less affected by mimetic pressures
Pagell M., Shevchenko A. (2014)	Management of the supply chain and sustainability	GSCM. Radical innovation	We argue that the increased understanding of sustainability, current knowledge is not enough to create truly sustainable supply chains

Table 11. Relations Studies

On the other hand, according to the analysis of the most cited references with the VOSviewer software, figure 8 shows the most related documents.

For the size of the bubbles that represents the number of citations, highlighting the following most important works: Srivastava S.K. (2007) and Walker H., Di Sisto L., McBain D. (2008) and by the color of the bubbles each of these documents determine a focus, meaningful for the theme "Supply Chain Management".

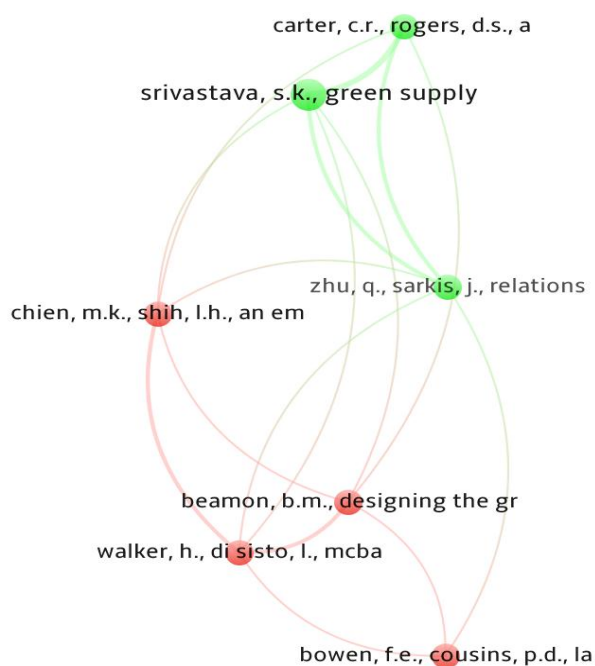


Figure 8. Related documents by most cited references

Conclusions

The application of the seven phases of the analytical goal approach allowed us to select from an abundant literature (1162 documents) obtained from the SCOPUS bibliographic database, the articles of the most cited authors in the journals with the highest impact factor, it was also possible to verify graph 2 that the topic "supply chain management" (SCM) is of interest to researchers because of its growing trend of research carried out over the period 2010-2017, 2014 being the year of greatest scientific production.

The most important journals are "Journal of Cleaner Production" and "Supply Chain Management" and the most relevant authors are Sarkis J., Govindan K. and Shu Q. for being the most cited. It was also possible to identify that the most referred articles for the study topic were from Srivastava S.K. (2007) Walker H., Di Sisto Ly McBain D. (2008), determining the focus of research on SCM that are related to new ways of managing the supply chain, such as "green supply chain management" and the "development of sustainable practices in the social, environmental and economic field through the supply chain", supported by the key words identified.

The use of computer tools to manage large databases such as VOSviewer, SSfM, TagCrowd, strengthens the systematic analysis of the meta-analytical approach for an effective bibliographic review, achieving a complete state of the art and at a level required by the best journals quality and very well conceptualized by the scientific community.

This document has selected the best articles, from the most cited authors in the best quality journals of a topic that finds a growing research interest, systematically carried out under the seven steps of the meta-analytic approach proposed by (Melo Mariano et al. al., 2011) and with the support of specialized computer tools for scientific research and incorporating the relationships of the valuable works selected, being an important base for the researcher in supply chain management that will allow you to carry out a future empirical investigation.

The research reviewed showed that empirical studies are being developed mainly in the Asian continent, identifying the need to address studies in other places such as Latin America, topics that we propose for future research.

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