

## Supply Chain Integration: A Review and Bibliometric Analysis

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### Abstract

Supply chain integration has been widely identified as a key research topic by both practitioners and academicians. In such environment, it is essential to vividly illustrate the publications contribution during the period of time and recognize research area and interests as well as the direction of research trend for future studies. With the availability of bibliometric data and variety of analytical tools for evaluation purposes, disregarding bibliometric analysis would be a missed opportunity for this area. Therefore, the current research attempts to deliver a comprehensive comparison thorough using rigorous bibliometric tools that provides a better understanding not previously fully grasped or evaluated by prior studies in the area of supply chain integration. The objective of this research is to recognize the global scientific production; the most productive authors, journals, articles and countries as well as to extract the most influential articles. The analysis begins by identifying over 500 published studies during the period of 1980 to 24th February 2016, which are then purified to works of proven influence and those authored by influential investigators. Web of Science Core Collection (formerly known as ISI), category of management was utilized to identify the relevant articles. Gaps are also discussed in knowledge about literature and bibliometrics analysis. The findings provide wisdom and a vigorous roadmap for further investigation in this field.

**Keywords:** Supply chain integration; Citation tracking; Impact factor; Literature review; Bibliometrics

### Introduction

Over the last decade, the supply chain integration (SCI) has become a vigorous topic of research in the context of operations management (OM). SCI is widely considered by both practitioners and researchers on investigating collaborative relationships between a manufacturing firm and its supply chain partners [1]. As supply chains grew up, a variety of relevant issues have occurred. While customer expectation is continuously increasing, companies have forced to invest and focus their attention to coordination across and beyond the organizational boundaries. Customers expect wider choice, better service, fast delivery and higher quality as all these are critical factors which affect company's strategies and the bottom line of its operations [2]. Accordingly, the increasing global competition has driven firms to not only develop their own performance, but also concentrate on integrating their supply chain partners into the overall supply chain competitive advantage [3,4].

The initial debate about supply chain integration began with horizontal alignment of operations across processes which discussed in the 1990s [5]. Stevens divides SCI with two distinct flows of material and information. Most concepts in such relationships are supplier integration, customer integration and internal integration [6-10] and the intention was to cover the basic concepts usually used to measure SCI, in both operational and strategic purposes.

In developing viable organizational performance, Kim [11] conceptualized the linkages between firm's supply chain integration strategy and its competitive strategy. Effective SCI links a manufacturer firm with upstream suppliers and downstream customers, as well as other channel members by integrating their relationships, activities, functions, processes and locations [12]. Based on a review of prior studies, SCI was defined from three perspectives of material flow, information flow and financial flow [13].

Integrated supply chains provide operational visibility, coordination of plans, and streamlined flow of goods that compress the time interval between a customer's request for a product or service and its delivery as well as the ability of providing the necessary quantity of goods in the

right place at the right time. Likewise, there are still many unanswered questions regarding the mechanism of SCI implementation among researcher and managers and further research in this area is still in its infancy; thus, it is a fundamentally pertinent area for current research [14]. Moreover, in a centralized organization, individuals look to top management for guidance and provision of information, so there is less reliance on customer integration as a source of information [15,16].

Frohlich and Westbrook empirically and theoretically agree that the higher the level of integration with suppliers and customers, the greater the potential benefits. Despite the awareness that integration is important, companies are failing in their attempts at internal and external integration [17]. Many suppliers have invested in modern technologies, but cannot use their own technologies to build matchless supply chain capabilities [18]. The resource-based view (RBV) theory stresses how strategically it is important for a firm to have the resources and competencies that are invaluable, rare, and which are difficult to imitate or replace [19-21]. In addition, the RBV theory framework points out not all resources confer enduring and long-lasting value and it is important to be able to differentiate those that offer sustainable valuable resources. Hence, there must be tangible and intangible integration of both internal and external resources to develop organizational capabilities.

Whereas studies focusing on more narrow conceptualizations of information flow, material flow and financial flow integration, there is a dearth of research investigating of other aspect of integration like infrastructure technology integration and knowledge integration in

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which lead organization to a sustainable performance. Practice of how to exchange knowledge may support firms change from a traditional relationship with supply chain partners to dyadic integration; therefore, suppliers and customers become as a tactical partners and more integration appeared into their business [22].

The current research attempts to provide a comprehensive evaluation of SCI through using precise bibliometric tools; thus, we started with a pool of over 500 published articles and considered more related studies. The aim of this research is to provide a unique structure to better understanding of SCI related publications as well as to provide a systematic and objective mapping of different themes and concepts in the development of SCI field. In addition, this research attempts to recognize the contribution to the development of SCI by identifying research gap. Formerly, studies have provided insight into the field, but additional analysis of previous studies using rigorous bibliometric analysis which can provide further insights, not previously fully grasped or evaluated to demonstrate the value of scientific research. However, the results of bibliometric analysis can contribute to future studies and guide scholars towards producing effective and qualified research.

## Research Methodology and Initial Data Statistics

Rowley and Slack [23] discuss that scanning documents, creating the mind map to writing the literature review, purification and understanding of key concepts, conducting a research and structuring the bibliography study are the most important structural methodology to conduct a literature review study. We employ the newsworthy evaluation of bibliometric analysis to provide insights for current research interests and directions for future studies in the field for creating a better systematic understanding of the trend of research. This study uses bibliometrics analysis for better understanding of the research trends in SCI from 1980 to 24<sup>th</sup> February 2016. However, bliometrics analysis offers quantitative methods based on generic measures or on the quantification of expert opinions [24] and provides a list of what's available in a research area; thus, it has been receiving increased attention in supply chain management disciplines [25-27].

An excellent bibliometrics analysis describes information sciences for better investigation and identifying the research trend and most contributing research by using graphical techniques during a certain time [28,29]. For instance, Fahimnia et al. examined research trends in green supply chain by comparing all articles published in the Web of Science (WoS) during 1992-2013 to demonstrate how those trends had evolved and changed. Seebacher and Winkler briefly illustrated number of scientific contributions and citation frequencies to identify the most influential scientific works and journals in the field of supply chain flexibility. However, to the best of our knowledge, little has been done to date to investigate the presence of altmetrics across various aspects of supply chain and operations management fields [30] and more bibliometric research needs to investigate in OM field.

## The appropriate search terms

Data were retrieved from the online version of the "Web of Science Core Collection" which includes Science Citation Index Expanded (SCI-EXPANDED), Social Science Citation Index (SSCI), Arts and Humanities Citation Index (A&HCI), Conference Proceedings Citation Index-Science (CPCI-S), Conference Proceedings Citation Index-Social Science and Humanities (CPCI-SSH), and Emerging Sources Citation Index (ESCI). The main key terms of SCI explicitly recognize the existence of the physical flow, information flow and financial flow integration. SCI has emerged from dyadic and sustainable relationship;

thus, other related keywords were also used in our search attempts. For instance supply chain relationship; dyadic integration, reverse logistics and logistics integration are all covered by SCI. We ensured that these keywords are entirely enclosed all aspects of SCI.

The database was searched using the keywords including "Internal Integration" or "External Integration" or "Supply Chain Relationship" or "Supplier Integration" or "Customer Integration" or "Logistics Integration" or "Physical Integration" or "Material Flow Integration" or "Information Flow Integration" or "Financial Flow Integration" or "Dyadic Integration" or "Supply Chain Relationship" or "Supply Chain Integration" in terms of topic (title, abstract, author keywords, and Keywords Plus) within the publication year limitation from 1980 to 24<sup>th</sup> February 2016. We extracted 548 documents into spread sheet software.

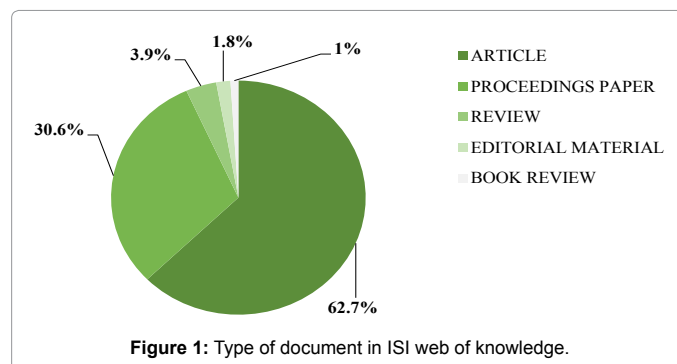
After scanning documents' information such as title, abstract, author keywords, Keywords Plus, subject categories, and journals; 162 unrelated articles were eliminated. Therefore, 386 unique papers have been left.

## Document type

Document type distribution of supply chain integration research literatures during the time span was illustrated in Figure 1. There were five document types in WoS, namely article, proceedings paper, review, editorial material, and book review. These document types were found among the total 386 publications in which English was the dominant language. From these documents, 242 publications belong to publication type of article, and it was the most frequently used document type, comprising 62.70% of the total document, followed by proceedings paper (118; 30.06%), review (15; 3.90%), editorial material (7; 1.80%), and book review (4; 1.00%) as illustrated in Figure 1. Journal articles produce the most useful information because of their timeline as well as the evaluation of the scholars.

## Characteristics of publication outputs

Figure 2 shows the trend in quantity of documents published annually from 1980 until 2016. The number of publications has been climbing up from 1980 to 2016 illustrate that SCI research revealed a great consideration, especially during last decade. Surprisingly the oldest papers in our search attempts date back to 1980 and 1984 which have not received citation yet. To be specific, the annual number of articles first exceeded 10 in 2004 and the number of publications rise dramatically between 2004 and 2010. The maximum annual publishing paper during this period is for 2010 by 54 published papers. The fluctuation of number of publication has met during 2011 and 2012. Moreover, the number of articles declined smoothly over 2014. While the research in supply chain integration is still in its early growth and



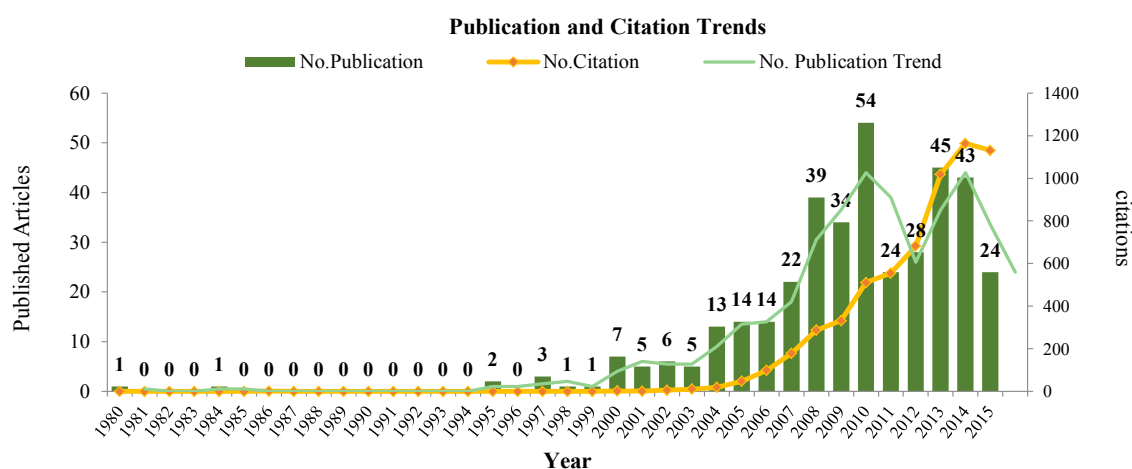


Figure 2: Number of articles published on supply chain integration and citations of articles between 1980 and 2016.

expansion period, these Figure 2 shows that a geometric growth in citations is occurring and research in this area have got much attention among operations/supply chain management researchers. On the other word, the trend of citation per year seems to be increasing but in the last years of the study between 2014 and 2015 a steep decline is observed in the number of citation.

## Bibliometric Analysis

Structural methodology and associated analytic types, which allow organization of the reviewed literature, can be obtained deductively or inductively. Methodology, in a deductive approach, is employed before the analyzing of material. Whereas inductive method methodology are developed from the material by means of generalization [31]. With a given model of a bibliometric analysis research, an inductive approach is employed for the purpose of data analysis. The bibliometric analysis and various visualization technologies instinctively presented the analysis results.

Bibliometric analysis using *SPSS*, *Excel* and *Kutools* provide additional data statistics including author, affiliation, and country distribution. *Kutools* can be used to analyze the frequency of occurrence of a text in different fields of the bibliographic data. In addition, *Tableau* was employed to demonstrate geographic distribution of publications and *VOSviewer* text mining and visualization functions was used to create a co-occurrence map of title field keyword.

## Country/territory and institution

We investigated the geographical distribution of SCI research by analyzing the production of articles on per country. The 386 articles originated from 41 different countries, where the top ten countries based on the number of publications are displayed in the Figure 3. Articles originating from England, Scotland, Northern Ireland, and Wales were reclassified as being from the United Kingdom (UK). The 41 countries were divided into four parts according to the number of publications. Particularly, 32 countries (78.05%) had publications less than 10 and within these countries, Tunisia, Jordan, Israel, Croatia, and Chile published only one article. Five countries (12.20%); Taiwan, Spain, Netherlands, Italy, and Australia had less than 20 publications. Two European countries (4.90%); United Kingdom and Germany were found to be the third part of countries with 38 and 31 publications

respectively. The most articles are belonged to the USA and China with 103 and 101 published articles respectively.

Globalisation has increased the scope of opportunities and the geographical spreading shows that SCI research and practice has involved institutes and research centers from throughout the World. The distribution by country/territory helps future studies for further research collaboration and expanding relevant issues. The USA as a developed country and China as a developing country held the majority of total world production. The issue of SCI and its solution is complex and varies in different categories, environment and culture [32]. As it has been shown in Figure 3, there is a lack of empirical research in African and South American countries. It seems quite clear that research on SCI should be expanded in different environment and culture. Therefore, future research should encompass research with extending to a broader population of firms, including other countries, for generalizability of the results and to detect potential country effects.

## The top 10 subject categories

The top 10 distribution of subject categories is shown in Table 1. It indicates that “management” (194; 50.26%), “operations research management science” (115; 29.79%), “business” (96; 24.87%), and “engineering industrial” (94; 24.35%) were the top 4 most popular subject categories. According to the top 10 subject categories, four research perspectives on supply chain integration were as follows: management science, business, and engineering.

## The top 10 productive journals

The top 10 most active journals with more than 127 (32.89%) published articles on SCI research from 1980 to 2016 are listed in Table 2. The majority of these articles (91) were published in first-quartile journals and the rest articles including 36 were published in second-quartile journals. *International journal of production economics* (24; 6.22%) was the top journal by number of publications, comprising 6.22% of 386 publications which belong to publication type of Journal, followed by *Supply Chain Management-An International Journal* (20; 5.18%) and *International Journal of Operations & Production Management* (17; 4.40%). Impact factor (IF), as an inimitable measure for the evaluation of scientific journals [33], has become perhaps the most popular bibliometric product used in bibliometrics itself but also outside the scientific community [34]. In addition, the value of

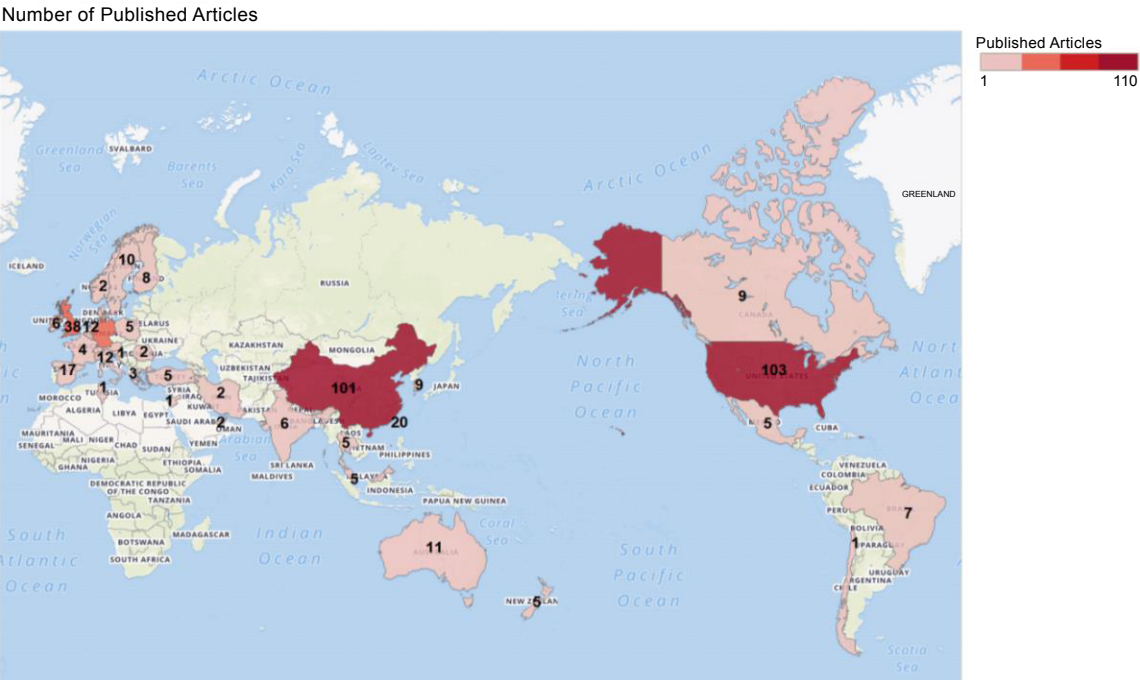


Figure 3: Global geographical distribution of published articles.

Web of Science Categories	TP	TR R (%)
Management	194	1 (50.26)
Operations Research Management Science	115	2 (29.79)
Business	96	3 (24.87)
Engineering Industrial	94	4 (24.35)
Engineering Manufacturing	58	5 (15.03)
Computer Science Information Systems	43	6 (11.14)
Computer Science Interdisciplinary Applications	33	7 (8.55)
Computer Science Artificial Intelligence	20	8 (5.181)
Engineering Electrical Electronic	18	9 (4.663)
Computer Science Theory Methods	14	10 (3.63)

**Note:** TP: The Total Publications; TP R: The Rank; TP (%): The Share in Publications.

Table 1: Top 10 subject categories distribution.

the impact factor is affected by different factors such as subject area, type of documents or length of the citation measurement window [35]. The journal impact factor, originally developed as a tool to select journals for indexing in the Science Citation Index published by the Institute for Scientific Information (ISI), has nowadays become the bibliometric construct most widely used for evaluation in the scholarly and publishing community [36]. The Impact Factor introduced by Eugene Garfield and regularly published in the annual updates of the Journal Citation Reports (JCR) is the general bibliometric indicator for assessing the citation pattern and article quality.

The journal impact factor once employed to show the quality of an article will upgrade the bad ones and downgrade the good ones [37]. In other words, impact factor may have improperly used to evaluate the quality and value of articles. Impact factor depends on the research field, since citation habits and citation dynamics can be altered in every research fields [38]. The journal impact factor (IF) of each publication was obtained from the latest Journal Citation Reports (2015 JCR). *Journal of Supply Chain Management* with 10 publications has the highest IF (4.571), which is followed by *Journal of Operations*

Journals	TP	TP R (%)	Q	IF
International Journal of Production Economics	24	1 (6.22)	Q1	2.782
Supply Chain Management-An International Journal	20	2 (5.18)	Q1	2.731
International Journal of Operations and Production Management	17	3 (4.40)	Q1	2.252
Journal of Operations Management	14	4 (3.63)	Q1	4
Production Planning and Control	11	5 (2.85)	Q2	1.532
International Journal of Production Research	11	6 (2.85)	Q2	1.693
Journal of Supply Chain Management	10	7 (2.59)	Q1	4.571
International Journal of Physical Distribution and Logistics Management	8	8 (2.07)	Q2	2.101
Industrial Marketing Management	6	9 (1.55)	Q2	1.93
Decision Support Systems	6	10 (1.55)	Q1	2.604

**Note:** TP: The Total Publications; TP R: The Rank; TP (%): The Share in Publications; Q: Quartile Scores; IF: Impact Factor.

Table 2: The top 10 productive journals in SCI researches based on number of publications.

*Management* with 14 publication and IF of 4.0 among top these10 journals. *Production Planning & Control* with 11 publications and IF of 1.532 and *International Journal of Production Research* with the same number of publications and IF of 1.693 are the lowest IF in this category.

### The top 10 contributing authors

Table 3 outlines the top ten contributing authors and the quantity of papers they authored or co-authored and ranked by the total number of publications. As can be seen in this data, Baofeng Huo and Xiande Zhao seem to dominate the list with eighteen articles. It should be noted that Huo and Zhao have coauthored with each other a large number of these papers. They followed by Ram Narasimhan and Martin Lockstroem which contributed in 6 articles. Min Zhang, Shawnee Vickery, Van Donk, Van Der Vaart, Jayanth Jayaram, and



Authors	TP	TP R (%)	TC	ACR	HC (Year)	FA (First Year)
Baofeng Huo	18	1 (4.66)	432	24	253 (2010)	8 (2006)
Xiande Zhao	18	2 (4.66)	353	19.6	253 (2010)	3 (2008)
Ram Narasimhan	6	3 (1.55)	359	59.8	161 (2002)	2 (2002)
Martin Lockstroem	6	4 (1.55)	45	7.5	34 (2010)	6 (2008)
Min Zhang	5	5 (1.30)	84	16.8	59 (2009)	2 (2009)
Shawnee K Vickery	5	6 (1.30)	200	40	165 (2004)	1 (2013)
DP Van Donk	5	7 (1.30)	210	42	124 (2008)	2 (2005)
Taco Van Der Vaart	5	8 (1.30)	86	21.5	124 (2008)	2 (2004)
Jayanth Jayaram	5	9 (1.30)	397	79.4	185 (2005)	3 (2010)
Cornelia Droge	5	10 (1.30)	200	40	165 (2004)	2 (2004)

**Note:** TP: The Total Publications; TP R: The Rank; TP (%): The Share in Publications; TC: The Total Citation (times cited); ACR: The Average Citation Rate; HC: The Highly Cited Paper; FA: The First Author.

**Table 3:** The top 10 contributing authors and number of published articles.

Cornelia Droge equally published 5 articles in the area of supply chain integration. Baofeng Huo published 8 articles as a first author which ranked him top one in first author articles.

### The most influential articles

Follow-up future studies are needed to analyses citation patterns in details and identify core articles in the research domain. While most studies, in OM discipline, picked up the highly cited/total citation (TC) articles as the most important articles [39] a few researcher in other discipline used average citation rate (ACR) as an extra indicator to evaluate the most influential articles [40]. Previous studies, traditionally, extracted and ranked articles based on the number of times citation or ranked them based on journal's impact factor. Although total citation may allow us to distinguish productive articles, it is not enough to enjoy a substantial evaluation. However, there is not a clear cut-off criterion to recognize influential articles among a set of objects. Therefore, we are going to conduct a systematic way to achieve the goal of identifying the most influential research.

Whether a study is authoritative, it can be judged from two aspects; the first aspect is the number of times citation (TC) and the next one is the average of citation rate (ACR). The former aspect refers to the studies that appeared most frequently in the references of SCI. Building upon these factors, a multidimensional scaling analysis was employed to provide a visual depiction based on importance-performance analysis (IPA) matrix to identify most influential articles and overcome the weaknesses of previous studies. TC is essential to distinguish articles with the high performance in citation. In addition to TC, ACR allows us to recognize the most important articles. On the other word, this technique enables us to figure out the most effective articles which published so far and helps to examine the origin and direction of future research trends (Table 4).

Martilla and James [41] introduce the IPA matrix into the marketing domain to help target audiences identify and rate certain product or service attributes, based on their importance to the rater and their impact on the organisation's overall performance. This analysis has become popular among researchers to enlarge the priority of finding analyses for managerial usage and academic purpose [42,43]. More specifically, in this study, the result leads the identification of two determinants with a relatively high importance (ACR) and relatively more performance (TC), where performance is depicted along the x-axis and importance along the y-axes. IPA extends the outcome by taking the importance and performance of each study into account. In this two-dimensional matrix, sources of data fall into one of four

quadrants; *Quadrant I* (high TC, high ACR), *Quadrant II* (low TC, high ACR), *Quadrant III* (high TC, low ACR) and *Quadrant IV* (low TC, low ACR). *Quadrant I*, reflecting high level of both total citation and average citation rate and represent areas which contribute to recognize the most influential articles.

To construct the importance-performance matrix, the mean of ACR and TC were calculated. To calculate the accurate cut-off criterion, we removed documents with no citation and they do not accounted for calculating the cut-off rate. The number of 159 documents was ignored due to zero citation. We calculate the value cut-off criterion of ACR and TC by considering 229 documents from 386. The total of times citation is 6061 and the total of average citation rate is 799.88. We propose cut-off values of 3.52 (799.88 divided by 229) for ACR and 26.7 (6061 divided by 229) for TC. Therefore, any cases greater than these cut-off criterions is located in *Quadrant I* and considered as influential articles.

Figure 4 shows the scatter plot of data to visualize highly cited articles with highest citation rate. This figure represents the total citations (performance) in vertical axis and average citation rate (importance) in horizontal axis corresponding yearly average. Spots are displayed by case numbers. By a close examination of the two rankings, we found out 46 articles out of the total number of 386, which have the highest total citation and average citation rate and representing roughly 11.92% of total publications. The sequence of most importance with the highest performance articles is provided in Table 4 with a general coverage of the topic, without losing specificity. The novel results of IPA offer numerous implications to the SCI research. This technique enables us to identify the broader group of published articles and helps to uncover groups of themes or research for future studies.

Based on the above discussion, the most authoritative studies would contribute to a better understanding of the SCI research area and its development trajectory. We believe this technique makes sense conceptually in some instances. Attribute in *Quadrant I*, represent opportunities for developing an effective literature review, identifying the derivation of research gaps, helping future researchers and practitioners to detect the broad range of business activities. Attribute in *Quadrant II* enabling researchers to prioritise the relative importance of various studies, based on their contribution, identifying research gaps, understanding recent research and industrial problems, developing conceptual model, expanding research topic, and following up research trends.

*Quadrant II* is characterised by low levels of citation in attributes considered to be high levels in average citation rate and is thus termed as an area for improvement, demanding immediate researches attention. Low levels of citation and high levels in ACR represent recent studies with the meaningful of attention fall into this category. The Figure 5 illustrates that all studies in this quadrant which have been published between 2010 and 2015. Table 4 depicts 17 articles in this quadrant with a general coverage of the topic and important details.

### Authorship pattern

Collaboration is found as an essential effort to publish in the area of SCI. Individual efforts account to only 15.8% of the total, whereas 84.2% of publications are produced in collaboration. Figure 6 shows that collaboration pattern of co-authorship has categorized into 5 groups. However, maximum output is observed in the team strength of two authors (34.46%), followed by group of three (28.24%), four (17.10%), single author (15.80%) and five authors (4.40%) respectively. Inzelt

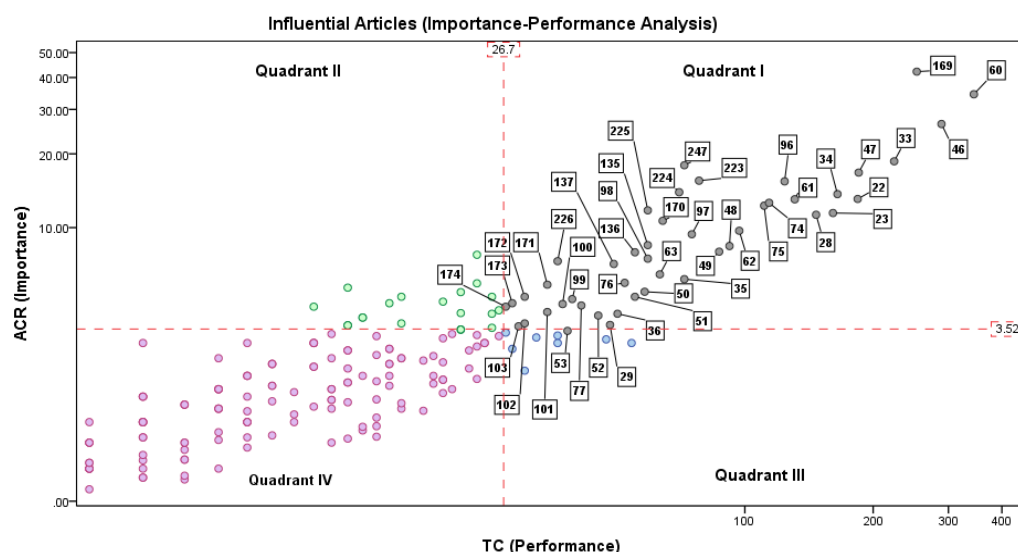
Rank	N	TC	ACR	Title	Author	Year	Journal
1	169	253	42.17	"The impact of supply chain integration on performance: A contingency and configuration approach"	Flynn, et al. [6]	2010	Journal of Operations Management
2	60	344	34.4	"Firm performance impacts of digitally enabled supply chain integration capabilities"	Rai, et al. [13]	2006	MIS Quarterly
3	46	289	26.27	"Supplier integration into new product development: coordinating product, process and supply chain design"	Petersen, et al. [48]	2005	Journal of Operations Management
4	33	224	18.67	"Information systems in supply chain integration and management"	Gunasekaran, et al.	2004	European Journal of Operational Research
5	247	72	18	"Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration"	Prajogo, et al. [1]	2012	International Journal of Production Economics
6	47	185	16.82	"Internal and external integration for product development: The contingency effect of uncertainty, equivocality, and platform strategy"	Koufteros, et al.	2005	Decision Sciences
7	223	78	15.6	"The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance"	Wong, et al. [16]	2011	Journal of Operations Management
8	96	124	15.5	"A critical review of survey-based research in supply chain integration"	Van der Vaart, et al.	2008	International Journal of Production Economics
9	224	70	14	"The impact of internal integration and relationship commitment on external integration"	Zhao, et al.	2011	Journal of Operations Management
10	34	165	13.75	"The effects of internal versus external integration practices on time-based performance and overall firm performance"	Droge, et al.	2004	Journal of Operations Management
11	22	184	13.14	"Benefits associated with supplier integration into new product development under conditions of technology uncertainty"	Ragatz, et al.	2002	Journal of Business Research
12	61	131	13.1	"Supplier integration - Finding an optimal configuration"	Das, et al. [8]	2006	Journal of Operations Management
13	74	114	12.67	"Black-box and gray-box supplier integration in product development: Antecedents, consequences and the moderating role of firm size"	Koufteros, et al. [7]	2007	Journal of Operations Management
14	75	111	12.33	Supply chain integration in vendor-managed inventory	Yao, et al.	2007	Decision Support Systems
15	225	59	11.8	"From Virtual to Physical: Integration of Chemical Logic Gates"	Guliyev, et al.	2011	Angewandte Chemie-International Edition
16	23	161	11.5	"Effect of supply chain integration on the relationship between diversification and performance: evidence from Japanese and Korean firms"	Narasimhan, et al.	2002	Journal of Operations Management
17	28	147	11.31	"A model of supplier integration into new product development"	Petersen, et al. [48]	2003	Journal of Product Innovation Management
18	170	64	10.67	"Effects of Supplier and Customer Integration on Product Innovation and Performance: Empirical Evidence in Hong Kong Manufacturers"	Lau, et al.	2010	Journal of Product Innovation Management
19	62	97	9.7	"Relational antecedents of information flow integration for supply chain coordination"	Patnayakuni, et al.	2006	Journal of Management Information Systems
20	97	75	9.38	"Customer Integration and Value Creation Paradigmatic Traps and Perspectives"	Vargo, et al.	2008	Journal of Service Research
21	135	59	8.43	"The effects of trust and coercive power on supplier integration"	Yeung, et al.	2009	International Journal of Production Economics
22	48	92	8.36	"Logistics-production, logistics-marketing and external integration - Their impact on performance"	Gimenez, et al.	2005	International Journal of Operations and Production Management
23	49	87	7.91	"The impact of supply chain relationship quality on quality performance"	Fynes, et al.	2005	International Journal of Production Economics
24	136	55	7.86	"An investigation on the direct and indirect effect of supply chain integration on firm performance"	Kim, et al.	2009	International Journal of Production Economics
25	98	59	7.38	"Supply chain integration and performance: a review of the evidence"	Fabbe-Costes, et al.	2008	International Journal of Logistics Management

26	226	36	7.2	"Review of logistics and supply chain relationship literature and suggested research agenda"	Daugherty, et al.	2011	International Journal of Physical Distribution and Logistics Management
27	137	49	7	"The impact of IT implementation on supply chain integration and performance"	Li, et al.	2009	International Journal of Production Economics
28	63	63	6.3	"The linkage between supply chain integration and manufacturing improvement programmes"	Cagliano, et al.	2006	International Journal of Operations and Production Management
29	35	72	6	"Does mass customization pay? An economic approach to evaluate customer integration"	Piller, et al.	2004	Production Planning and Control
30	76	52	5.78	"Process approach to supply chain integration"	Trkman, et al.	2007	Supply Chain Management- An International Journal
31	171	34	5.67	"Antecedents to supplier integration in the automotive industry: A multiple-case study of foreign subsidiaries in China"	Lockstrom, et al.	2010	Journal of Operations Management
32	50	58	5.27	"The impact of supply chain relationship dynamics on manufacturing performance"	Fynes, et al.	2005	International Journal of Operations and Production Management
33	51	55	5	"Supply chain integration and performance: US versus East Asian companies"	Zailani, et al.	2005	Supply Chain Management- An International Journal
34	172	30	5	"Supply chain integration with third-party logistics providers"	Jayaram, et al. [17]	2010	International Journal of Production Economics
35	99	39	4.88	"On-demand e-supply chain integration: A multi-agent constraint-based approach"	Wang, et al.	2008	Expert Systems with Applications
36	173	41	4.67	"Supply chain integration and product modularity An empirical study of product performance for selected Hong Kong manufacturing industries"	Lau, et al.	2010	International Journal of Operations and Production Management
37	100	27	4.63	"Timing and extent of supplier integration in new product development: a contingency approach"	Parker, et al.	2008	Journal of Supply Chain Management
38	77	34	4.56	"Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer"	Lee, et al.	2007	Supply Chain Management- An International Journal
39	174	50	4.5	"On Decisions for Integration Implementation: An Examination of Complementarities Between Product-Process Technology Integration and Supply Chain Integration"	Narasimhan, et al.	2010	Decision Sciences
40	101	45	4.25	"Customer Integration-A Key to an Implementation Perspective of Service Provision"	Moeller	2008	Journal of Service Research
41	36	30	4.17	"Supply-chain integration: implications for mass customization, modularization and postponement strategies"	Mikkola, et al.	2004	Production Planning and Control
42	52	48	4.09	"Supply chain relationship quality, the competitive environment and performance"	Fynes, , et al.	2005	International Journal of Production Research
43	102	29	3.75	"Buyer dependency and relational capital formation: the mediating effects of socialization processes and supplier integration"	Petersen, et al.	2008	Journal of Supply Chain Management
44	29	48	3.69	"Simplified material flow holds the key to supply chain integration"	Childerhouse, et al.	2003	Omega-International Journal of Management Science
45	103	29	3.63	"The influence of institutional norms and environmental uncertainty on supply chain integration in the Thai automotive industry"	Wong, et al.	2008	International Journal of Production Economics
46	53	38	3.45	A case of shared resources, uncertainty and supply chain integration in the process industry	Van Donk, et al.	2005	International Journal of Production Economics
<b>QUADRANT II</b>							
47	275	23	7.67	"A Meta-Analysis of Supply Chain Integration and Firm Performance"	Leuschner, et al.	2013	Journal of Supply Chain Management
48	248	23	5.75	"Does supply chain integration mediate the relationships between product/process strategy and service performance? An empirical study"	Droge, et al.	2012	International Journal of Production Economics
49	320	11	5.5	"The impact of supplier integration on customer "integration and new product performance: The mediating role of manufacturing flexibility under trust theory"	He, et al.	2014	International Journal of Production Economics

50	249	21	5.25	"Customer integration within service development-A review of methods and an analysis of insitu and exsitu contributions"	Edvardsson, et al.	2012	Technovation
51	227	25	5	"Supply chain integration and efficiency performance: a study on the interactions between customer and supplier integration"	Danese, et al.	2011	Supply Chain Management- An International Journal
52	276	15	5	"On the relationship between supplier integration and time-to-market"	Perols, et al.	2013	Journal of Operations Management
53	250	19	4.75	"The impact of supply chain integration on company performance: an organizational capability perspective"	Huo, et al.	2012	Supply Chain Management- An International Journal
54	277	14	4.67	"The impact of supply chain integration on responsiveness: The moderating effect of using an international supplier network"	Danese, et al.	2013	Transportation Research Part E-Logistics and Transportation Review
55	321	9	4.5	"Do a country's logistical capabilities moderate the external integration performance relationship?"	Wiengarten, et al.	2014	Journal of Operations Management
56	175	26	4.33	"Angles of integration: an empirical analysis of the alignment of internet-based information technology and global supply chain integration"	Thun, et al.	2010	Journal of Supply Chain Management
57	176	25	4.17	"A service oriented framework for construction supply chain integration"	Cheng, et al.	2010	Automation in Construction
58	228	21	4.2	"Interorganizational System Characteristics and Supply Chain Integration: An Empirical Assessment"	Saeed, et al.	2011	Decision Sciences
59	279	12	4	"The impact of supply chain risk on supply chain integration and company performance: a global investigation"	Zhao, et al.	2013	Supply Chain Management- An International Journal
60	251	15	3.75	"Impact of customer integration on project portfolio management and its success-Developing a conceptual framework"	Martin	2012	International Journal of Project Management
61	281	11	3.67	"Effects of supply chain integration and market orientation on firm performance Evidence from China"	Liu, et al.	2013	International Journal of Operations and Production Management
62	138	25	3.57	"The moderating role of barriers on the relationship between drivers to supply chain integration and firm performance"	Richey, et al.	2009	International Journal of Physical Distribution and Logistics Management
63	178	21	3.5	"Information Sharing in a Long-Term Supply Chain Relationship: The Role of Customer Review Strategy"	Ren, et al.	2010	Operations Research

**Note:** N, the case number; TC: Total Citation; ACR: The Average Citation Rate.

**Table 4:** The top contributed articles in "SCI".



**Figure 4:** The most influential articles in "SCI" by taking *Quadrant I* into account.



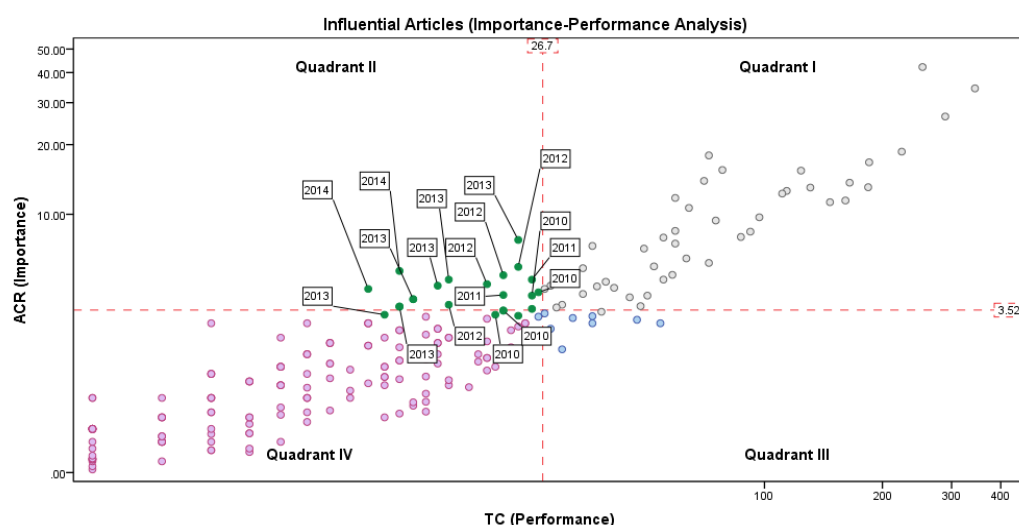


Figure 5: The most influential articles in "SCI" by taking quadrant II into account.

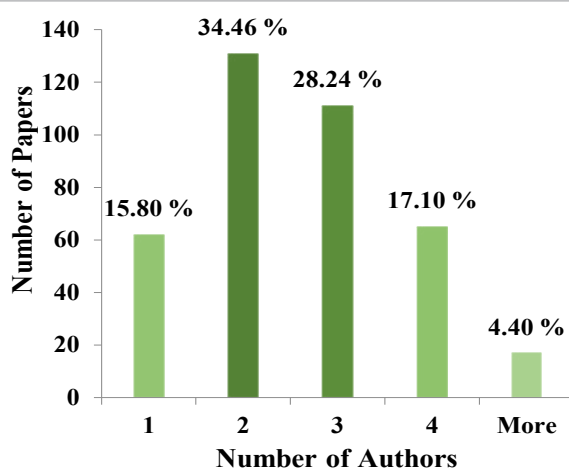


Figure 6: Authorship patterns.

et al. [44] believe that scientific collaboration and co-authorship has significant influence on citation rate of publications. The most evident form of scientific collaboration is co-authorship, which is a frequent and reliable target of scientometric studies on collaboration [45-50]. According to Raan [51], international collaboration among researchers would increase the citation rate through spurious causes, such as self-citations. However, it is essential to use necessary references in scientific publications which are made for professional reasons principally [52].

The Figure 7 was compared collaboration and no collaboration in order to highlight the growth of the co-authored papers, which is the determinant/indicator of collaboration. The number of collaboration has been climbing up from 2000 to 2010 illustrate that SCI research revealed a great consideration.

Collaboration increased dramatically in 2010, whereas after 2010, the Figure 7 reveals a significant disparity in the number of co-authored paper due to the fluctuation of number of publication which has met during 2011 and 2012. On the other side, single author articles

increased from 2006 to 2008 in linear growth; however, it didn't increase as fast as papers published by few co-authors. In the last years of the research a steep decline is observed in the number no collaboration research. Therefore, the analysis reveals that collaboration is possible and necessary for the SCI research.

### Cooperation network

The cooperation network of authors is shown in Figure 8, the size of the rectangles and labels represent the authorship weight. The cooperation network of authors was analyzed by VOSviewer, authors that have published  $\geq 2$  papers were extracted from the database. The co-authorship relations are relations representing whether an author have written a paper with another author. Typically, a paper is written by two or more authors. Investigating co-authorship information on a larger database of scientific publications will support in recognizing a set of researchers who work closely together [53]. In the co-authorship network, each author corresponds to a rectangle and each link between two rectangles of different authors indicates that there is a co-authorship. The authors, Xiande Zhao and Baofeng Huo, have most collaboration with each other and other authors. This means, not only Xiande Zhao and Baofeng Huo produced the greatest number of papers, but also has the most collaboration with other researchers. Thus, these authors can be considered as the most influential author in the area of SCI.

### Co-authorship countries

Authorship collaboration is the main pattern in scientific collaboration, one thing worth noting is that visualizing the scientific collaboration at the country level exposes that country collaboration is significant in order to provide detailed information in international collaboration levels. The indicators of collaboration are based on authors' address. Figure 9 represents the network of international co-authorship among countries according to the information about research competency and co-authorship relations.

Bibliometric map of co-authorship of countries was analyzed by VOSviewer, countries that have published  $\geq 2$  papers were extracted

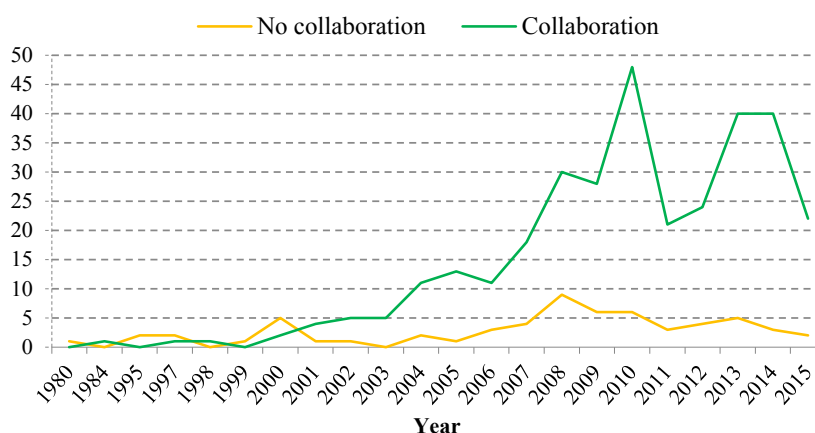


Figure 7: Co-authorship trends.



Figure 8: Cooperation network of authors.

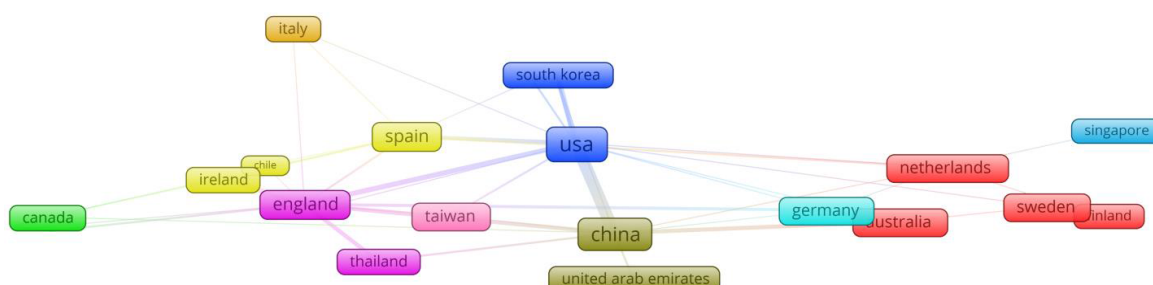


Figure 9: Global map based on the network of co-authorship relations among countries.

from the database; hence, 18 countries were taken into account. In this view, countries are indicated by a label and by a rectangle. The top productive countries have larger label and rectangle. This figure shows the major players in the network in terms of international co-authorship relations. The size of each rectangle shows the number of

papers written by authors from the country. Moreover, co-authorship relation among countries corresponds to a link and the width of links clarifies the number of co-authorships between countries. In the field of SCI, the US and China have most collaboration with each other as well as in the World. It can be concluded that the top productive

countries carried out most international collaboration with others in the SCI research.

## Conclusion

This article provided a quantitative perspective of bibliometric and citation analysis of journals citing and research trends of Supply chain integration (SCI) area in which brings contributions for both academics and practitioners. SCI is the main building block of every supply chain due to requiring coordinating and cooperation and managing of physical flow, information flow and financial flow between parties. Indeed, SCI is an interesting research topic, is of managerial relevance as well as academic importance, to achieve competitive drivers such as; “increased cost competitiveness, shorter product life cycles, faster product development cycles, globalisation and customisation of product offerings, and higher overall quality”. Likewise, SCI is a set of procedures that effectively integrates various business parties, including suppliers, manufacturers, warehouses, and stores, so that the company’s products enjoy proper distribution in the required quantities, to the right places at the right time and done at minimum cost and at satisfactory service levels.

We argue that the principal aim of the development of bibliometric method and indicators in the field under investigation on the nature of scholarly quality; number of publications and citation trends, the most productive articles, authors, journals and countries as well as identifying the most influential articles. However, a few review articles on supply chain management area and related fields have been published, thorough bibliometric analysis. Therefore, the current study shows an evolution of the influential articles and contributes to the SCI field by further mapping the relationships amongst the higher impact works.

The 386 papers in five document types published from 1980 to 24<sup>th</sup> February 2016 were analyzed, by summarizing characteristics of publication outputs, subject categories and major journals, international productivity and collaboration. This temporal analysis revealed that scientific productions of the SCI field experienced substantial growth in publications, as well as the total citations of documents during the period of 2010-2015. Prominently, the number of articles increased rapidly in the past 10 years. Most of the influential papers have been occurred in the middle of the last decade, whereas top highly cited papers were published at the beginning of last decades. Therefore, this may be a signal of new research trend with some modification on theory and conceptual model in the SCI context.

This study determined that the top 10 journals roughly contribute 32.89% to the total publication. In addition, “International Journal of Production Economics”, “Supply Chain Management-An International Journal”, “International Journal of Operations & Production Management”, and “Journal of Operations Management” were the most highly contributed journals. However, there is very few studies were carried out to validate relevant studies and analysed connected journals to this subject. The selected journals that are used in this study are relevant to Operations Management, Logistics as well as supply chain management with high-impact factors and they have been used in prior studies in SCI field. The spatial distribution of publications exhibits the USA and China have been taking a leadership position in SCI research area with the largest publication as well as a greater academic influence in this field.

Furthermore, the SCI in USA has attracted an increasing level of attention in recent years and was second to China in the number of

total publications. The findings also show that industrialized countries have had more publications contribution to the development of SCI. Likewise, little attention has been paid to the research in African and South American countries; thus, there is a lack of empirical research in these scopes of study in the area of SCI.

The current research will be very helpful to identify the latest research trends in the SCI field to offer guidance to future studies in this field. The novel aspect of this research is that the indicators have not been studied in this context before. While previous studies evaluated the quality of articles based on the number of citations, the current research utilized a complementary factor to identify the most influential articles in the research field. To the best of our knowledge, this is the first study to include total citation and average citation rate simultaneously and utilized importance-performance analysis (IPA) to prioritize the most influential articles. The 63 articles were categorized in two quadrants for developing an effective literature review, identifying the derivation of research gaps, helping future researchers and practitioners to detect the broad range of business activities. It is important to understand how the IPA contributes to the formulation of bibliometrics analysis, whereby researchers and practitioners are required to choose priorities from a number of studies.

The analysis which is conducted in this research is not without the limitation, and these pose challenges for the future development of this study. Firstly, the citation count is limited to the Web of Science Core Collection documents and citations from other documents are not included. However, one of the most popular data source for bibliometrics research is the ISI (Web of Science) Citation Databases (i.e., the Science Citation Index Expanded, the Social Science Citation Index and the Arts and Humanities Index). Nonetheless, future research may need to concentrate on both database; Web of Science and Scopus. Secondly, the concentration of this research was extremely on journals of an international scope which mainly published in English; thus, we ignored local journals and publications. Thirdly, we have dealt entirely with scientific articles, ignoring other channels of scholarly revelation, such as working documents. Nevertheless, in a given the nature of the tendencies identified in our analysis, we do not believe that these are seriously conditioned by the biases these limitations involve. Lastly, for future studies comparing judgements of experts and bibliometric indicators, datasets are necessary which cover a broad range of different disciplines.

Furthermore, supply chain members should recognize different types of relevant issues covered within the supply chain before employing the strategy of SCI. For instance, in a recent study, Flynn et al. show that different types of uncertainty require different levels of SCI. They discuss that without an appropriate consideration managers may invest in SCI that is not aligned with the type of uncertainty their firm faces. Despite the awareness that integration is important, companies are failing in their attempts at internal and external integration. Companies have bought advanced technologies, but not used them to build non-imitable supply chain competencies that deliver unique customer value. Managers should not assume that all investments are equally effective and the same level of investment will assure the same result. Therefore, a better understanding of the concept of integrating supply chain, its dimensions and its implications, is of managerial relevance as well as academic importance may enhance the overall supply chain competitive advantage. In order to do this, firms may need to develop a rating system or rank strategic areas by their perceived level of importance based on the management of the environmental supply chain.

## References

- Prajogo, Daniel, Jan O (2012) Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics* 135: 514-522.
- Li, Yulong, Monideepa T, Subba R (2012) Collaborative knowledge management practices: Theoretical development and empirical analysis. *International Journal of Operations & Production Management* 32: 398-422.
- Alfalla-L, Rafaela, Carmen ML, Prasanta KD 2(013) Supply chain integration framework using literature review. *Production Planning & Control* 24: 800-817.
- Zhang, Xinyan, George QH, Paul KH, Valerie BG (2010) Simultaneous configuration of platform products and manufacturing supply chains: comparative investigation into impacts of different supply chain coordination schemes. *Production Planning & Control* 21: 609-627.
- Markham T, Roy W (2001) Arcs of integration: an international study of supply chain strategies. *Journal of operations management* 19: 185-200.
- Flynn BB, Huo B, Zhao X (2010) The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of operations management* 28: 58-71.
- Koufteros, Xenophon A, Edwin C, Kee-HL (2007) "Black-box" and "gray-box" supplier integration in product development: Antecedents, consequences and the moderating role of firm size. *Journal of Operations Management* 25: 847-870.
- Das, Ajay, Ram N, Srinivas T (2006) Supplier integration- finding an optimal configuration. *Journal of Operations Management* 24: 563-582.
- Pagell, Mark (2004) Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. *Journal of operations management* 22: 459-487.
- Huang, Samuel H, Mohit U, Jan S (2002) A product driven approach to manufacturing supply chain selection. *Supply Chain Management: An International Journal* 7: 189-199.
- Kim, Soo W (2006) Effects of supply chain management practices, integration and competition capability on performance. *Supply Chain Management: An International Journal* 11: 241-248.
- Kim, Soo W, Ram N (2002) Information system utilization in supply chain integration efforts. *International Journal of Production Research* 40: 4585-4609.
- Rai, Arun, Ravi P, Nainika S (2006) Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS quarterly* 30: 225-246.
- Childerhouse, Paul, Denis RT (2011) Arcs of supply chain integration. *International journal of production research* 49: 7441-7468.
- Boon, Sakun, Chee YW (2011) The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance. *International Journal of Physical Distribution & Logistics Management* 41: 253-276.
- Wong, Chee Y, Sakun B, Christina WYW (2011) The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations management* 29: 604-615.
- Jayaram, Jayanth, Keah CT (2010) Supply chain integration with third-party logistics providers. *International Journal of Production Economics* 125: 262-271.
- Fawcett, Stanley E, Cynthia W, Chad A, Amydee MF, et al. (2011) Information technology as an enabler of supply chain collaboration: a dynamic-capabilities perspective. *Journal of Supply Chain Management* 47: 38-59.
- Barney J (1991) Firm resources and sustained competitive advantage. *Journal of management* 17: 99-120.
- Carr, Amelia S, John NP (2002) The impact of purchasing and supplier involvement on strategic purchasing and its impact on firm's performance. *International Journal of Operations & Production Management* 22: 1032-1053.
- Feng, Taiwan, Linyan S, Ying Z (2010) The effects of customer and supplier involvement on competitive advantage: An empirical study in China. *Industrial Marketing Management* 39: 1384-1394.
- Asgari AA, Abu B, Abdul H, Sofian I, Rasoul A et al. (2015) The Contribution of Knowledge Exchange to Supplier's Operational Performance. *Advanced Science Letters* 21: 1807-1810.
- Rowley, Jennifer, Frances S (2004) Conducting a literature review. *Management Research News* 27: 31-39.
- Glänzel, Wolfgang, Henk FM (2013) Opinion paper: Thoughts and facts on bibliometric indicators. *Scientometrics* 96: 381-394.
- Asgari N, Ehsan N, Alex H, Reza ZF (2016) Supply chain management 1982–2015: a review. *IMA Journal of Management Mathematics* 27: 353-379.
- Fahimnia B, Sarkis J, Davarzani H (2015) Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics* 162: 101-114.
- Seebacher, Gottfried, Herwig W (2013) A citation analysis of the research on manufacturing and supply chain flexibility. *International Journal of Production Research* 51: 3415-3427.
- Park, Simon SH, Justin JS, James JHL, Wookey Lee et al. (2015) How to measure similarity for multiple categorical data sets? *Multimedia Tools and Applications* 74: 3489-3505.
- Wing, Louise, Tarik FM (2015) Trends in performance indicators of neuroimaging anatomy research publications: a bibliometric study of major neuroradiology journal output over four decades based on Web of Science database. *Clinical Anatomy* 28: 16-26.
- Thomé, Antônio MT, Luiz FS, Annibal JS (2016) Conducting systematic literature review in operations management. *Production Planning & Control* 27: 408-420.
- Seuring, Stefan, Martin M (2008) From a literature review to a conceptual framework for sustainable supply chain management. *Journal of cleaner production* 16: 1699-1710.
- Flynn, Barbara B, Xenophon K, Guanyi L (2016) On Theory in Supply Chain Uncertainty and its Implications for Supply Chain Integration. *Journal of Supply Chain Management* 52: 3-27.
- Garfield E (2006) The history and meaning of the journal impact factor. *Jama* 295: 90-93.
- Glänzel W (2002) Coauthorship patterns and trends in the sciences (1980-1998): A bibliometric study with implications for database indexing and search strategies. *Library Trends* 50: 461-475.
- Bordons, Maria, Santos B (1992) Bibliometric analysis of publications of Spanish pharmacologists in the SCI (1984–89). Part II: Contribution to subfields other than "pharmacology & pharmacy" (ISI)." *Scientometrics* 25: 425-446.
- Moed, Henk F, Lisa C, Jan R, Felix MA, et al. (2012) Citation-based metrics are appropriate tools in journal assessment provided that they are accurate and used in an informed way. *Scientometrics* 92: 367-376.
- Gisvold, Sven E (1999) Citation analysis and journal impact factors—is the tail wagging the dog?. *Acta anaesthesiologica scandinavica* 43: 971-973.
- Seglen, Per O (1997) Why the impact factor of journals should not be used for evaluating research. *BMJ: British Medical Journal* 314: 498-502.
- Cobo, Manolo J, Martínez MA, Gutiérrez SM, Hamido F, et al (2015) 25years at Knowledge-Based Systems: A bibliometric analysis. *Knowledge-Based Systems* 80: 3-13.
- Maghami, Mohammad R, Mohammad R, Nader AE, Chandima G (2015) Qualitative and quantitative analysis of solar hydrogen generation literature from 2001 to 2014. *Scientometrics* 105: 759-771.
- Martilla, John A, John CJ (1977) Importance-performance analysis. *The journal of marketing* 41: 77-79.
- Matzler, Kurt, Franz B, Hans HH, Birgit R, et al (2004) The asymmetric relationship between attribute-level performance and overall customer satisfaction: a reconsideration of the importance–performance analysis. *Industrial marketing management* 33: 271-277.
- Chen, Kuan-Y (2014) Improving importance-performance analysis: The role of the zone of tolerance and competitor performance. The case of Taiwan's hot spring hotels. *Tourism Management* 40: 260-272.
- Inzelt, Annamária, András S, Mihály S (2009) Incremental citation impact due to international co-authorship in Hungarian higher education institutions. *Scientometrics* 78: 37-43.
- Glänzel, Wolfgang, Bart T (2004) The influence of author self-citations on bibliometric macro indicators. *Scientometrics* 59: 281-310.



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46. Glänzel, Wolfgang, Henk FM (2002) Journal impact measures in bibliometric research. *Scientometrics* 53: 171-193.
  47. Hale, Trevor S, Jamison MD, Faizul H, Nikhil AP (2008) A framework for an integrated distribution system optimisation model. *International Journal of Logistics Systems and Management* 4: 506-522.
  48. Petersen, Kenneth J, Robert BH, Gary LR (2005) Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of operations management* 23: 371-388.
  49. Van Raan A (1998) The influence of international collaboration on the impact of research results: Some simple mathematical considerations concerning the role of self-citations. *Scientometrics* 42: 423-428.
  50. Vinkler P (2010) Indicators are the essence of scientometrics and bibliometrics: Comments to the book entitled *Bibliometrics and Citation Analysis*, From the Science Citation Index to Cybermetrics from Nicola De Bellis. *Scientometrics* 85: 861-866.
  51. Van E, Waltman L (2011) Text mining and visualization using VOSviewer. *arXiv preprint arXiv: 1109.2058*.
  52. Zhao, Yushan, Erin C, Tamer C (2014) An investigation of the black-box supplier integration in new product development. *Journal of Business Research* 67: 1058-1064.
  53. Bornmann, Lutz, Werner M (2015) Methods for the generation of normalized citation impact scores in bibliometrics: Which method best reflects the judgements of experts? *Journal of Informetrics* 9: 408-418.