Review of Supply Chain Integration between 2000 and 2019:Analysis of Current Status and Future Trends

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***Abstract*— Supply Chain Integration (SCI) integrates the activities between a firm and its channel members; therefore, it is a significant interdisciplinary subject for Supply Chain Management. The main aim of this paper is to review previous research on SCI in main academic sources to give some insights and practical information in the field of SCI, while indicating an overview of the main definitions, descriptive analysis and key themes of the selected studies. This paper refers from 115 research articles in 28 journals from main academic sources between 2000 and 2019. The main result of this study shows that in the last years, research interest in SCI has increased. Although there is a huge geographic dispersion on published studies, the USA holds a leading position on SCI publications. It has been identified that scholars mainly are looking for relationship between SCI and performance issues; in addition, new themes emerge such as the implementation of Information Technology (IT) in order to have better-integrated Supply Chains. By considering the complexities of Supply Chains, this research contributes to the literature on the ways of analyzing new trends and geographical dispersion as well as identifying the key themes in the context of SCI.**

***Keywords*—** *Supply Chain Integration, literature review, Supply Chain Management, Integrated Supply Chains, Supply Chain Partners*

1. Introduction

Since its introduction in the early 1980s [1], the concept of Supply Chain Management (SCM) has received increasing attention in management and operational research [2]. The literature provides the importance of SCM, most of which are related to Supply Chain Integration (SCI), supporting a better performance for companies and their supply network [3]. The integration of Supply Chains is the essence of achieving supply chain performance and competitive advantages for companies [4], [5].

SCI is commonly considered as a company's level of alignment of internal and external processes and strategic linkages with their value chain partners; however, this alignment could be taken at different levels at both supplier and customer levels. [5]. Integrating supply chain processes with suppliers and customers help companies to improve their product and material flows through the supply chain, reach various resources and capabilities within other supply chain partners; thus, stimulate companies' innovativeness [6]. According to [7], the extent of cooperation with key suppliers and customers helps companies to achieve their internal business processes.

In the recent years issues of SCI have been extensively examined by scholars [8], [9]. The purpose of this paper is to review previous research on SCI with a concise representation of the current status and future directions in the subject. Thus, the key objectives can be categorized as follows.

- To examine the definition and main concepts of Supply Chain Integration between 2000 and 2019.
- To examine the geographical spread in general.
- To identify the research themes between 2000 and 2019.
- To identify the future trends on the subject.

The remaining part of the paper is structured as follows. In section 2 the authors deal with the relevant literature to identify the definition and dimensions of SCI. In section 3 the methodology is explained through the identification and selection of

the studies, and also key steps used for the analysis of the selected studies. The main results are presented in Section 4, followed by the conclusions and future directions in Section 5.

2. Literature Review

SCI represents the degree at which a company can cooperate with its partners and manage processes to achieve flows of products, services, information by offering the maximum value to the final customer [8], [10]. According to [11] SCI integrates the relationships, value-adding activities, functions, processes such as controlling and planning of raw materials and finished goods ranges from manufacturers to suppliers and to final customers. In a supply chain context, [12] mentions that the term 'integration' describes a process of interaction and collaboration of working together with the partners. The study also claims that an integrated supply chain is different from a traditional supply chain. A poorly integrated supply chain will result in demand distortions because of the lack of flow of data across the supply chain [13]. Therefore, the research of [14] identifies that the operations of companies are extremely needed of coordination particularly on the activities of purchasing, production, advertising, transportation and accessing information.

The previous studies on SCI are represented by evolving definitions and dimensions [15], [16]. Many of the studies point out three sub-dimensions of SCI; supplier integration (SI), internal integration (II) and customer integration (CI) [17], [18] [19], [20]. The study of [21] categorizes the dimensions by internal and external integration which explains information sharing and collaborates to the inclusion of suppliers and customers. Supplier/Customer integration refers to the extent to which a company can collaborate with its main suppliers/customers [22]. [23] suggest that the companies first should integrate their activities internally and then extend the integration to their partners. However, many conceptualizations are still outstanding [16] and do not commonly agree on sub-dimensions of SCI [8].

In the early 2000s, [24] explains the curves of integration in Supply Chains with a global sample of 322 manufacturers. This study has improved scales for measuring SCI and had identified different strategies. [25] to identify a comprehensive model of SCI and its impact on operational and financial effectiveness in SCs. [26] identifies that adoption of e-business in SCs is slow, the research particularly focuses on small and medium-sized companies (SMEs). Besides of it, some researchers [27], [28] analyze the effects of advanced technologies on SCI and operational performance. [29] examines the importance of cloud-enabled supplier integration on companies' sustainability and competitive advantages. Another study of [30] identifies the role of environmental uncertainty on SCI. The study of [31] mentions that less SCI could result in a snowball effect (disruptions on SCs). [5] examines the effects of partner trust on SCI and their effects on business performance.

The efficient and effective integration of trading partners brings many improvements in Supply Chain activities [32]. Although previous research attempts to identify the concept of SCI in many different areas; in conclusion, the concept of SCI has a limited understanding and comprehensive framework for it [23].

3. Methodology

In this paper content analysis technique was used by following four-step process model suggested by [33]. This model has also later been used by [34] in order to review the studies in the field of Supply Chain Management. The structure of the model comprises four criteria introduced below.

3.1 Material Collection

Our research sample covers peer-reviewed literature studies in English language on the subject of Supply Chain Integration. The study covers the last two decades (from 2000 to 2019) since the maturity of supply chain processes has reached a high level in this time period [35]. The literature search was conducted based on sets of keywords; 'Integration' and 'Supply Chain'; which were found in common in the title and keywords. In the present study the term 'Supply Chain' was selected as a whole since it is a well-known term [2]. In order to collect the sample papers, three main sources were selected in this study; ScienceDirect (SD), EmeraldInsight (Emerald), and Taylor and Francis Online (TF). The keywords were searched based on 'relevance by the subject' in the search engine of each source. After this initial process of selection we identify a total of 616 papers (SD (205), Emerald (228) and TF (183).

However, the selection of papers could be narrowed in order to follow a clear and purposeful

process structure. Therefore, the next step was carefully reading the abstract of selected studies. In this sense, the following criteria were used at the selection of the studies.

- In this study there were only applied those papers where the terms of 'Integration' and 'Supply Chain' were used in the title in common.
- The research excluded the terms such as 'collaboration,' 'alliances', 'joint ventures' that can be replaced by the term of 'Integration' as well as the studies which only focus on individual sub-dimensions of SCI (such as a supplier or customer integration, external, process, information integration only.)
- Conference papers, books chapters were excluded from this study.
- We only concentrate on management, operations, and supply chain journals which are indexed in scientific quality indicators (JCR, SSCI, SCI OR SJR).

By following these criteria, we extracted a total of 115 papers for the final analysis (SD (45), TF (21), EmeraldInsight (49)). Table 1 shows the final list of studies selected by the publisher.

Table 1. Research articles indicated by publishers

Publisher	Number of Selected Studies
Emerald	49
SD	45
TF	21
Total	**115**

Source: Authors' own calculation

3.2 Descriptive Analysis

This step is addressing the information about the distribution of the studies through different journals. Besides, this process attempts to add some analytic findings. In our study selected journals, the year-wise distribution of the articles, the country classification of the selected papers is presented in Section 4.

3.3. Category Selection

The process of 'Category Selection' mainly aims to examine 'aim of research/research themes, method of data gathering and data analysis.' This process also can be an extended number of sample sizes gathered and time period covered. In this study, the selected papers analyzed the period between 2000 and 2019.

3.4. Material Evaluation

In the final step, the categories selected must be enhanced by coding in order to increase the reliability and validity of the research. Abstract and text-based evaluations must be conducted through codes to generalize the findings [36]. The sample of review papers on SCI has been analyzed according to selected themes. Later, the extracted codes are applied in each text to see the frequencies of the selected keywords. This enables ensuring the results of the study.

4. Results

4.1 Selected Journals

Table 2 indicates the journals in which papers published are related to 'Supply Chain Integration'. The top four journals which cover the selected articles account for almost a half percent of the total of the articles. When we consider these articles; International Journal of Production Economics (20 papers), Supply Chain Management: An International Journal (19 papers), International Journal of Production Research (10 papers), and International Journal of Logistics Management (8 papers) reflect the subjects mainly in Supply Chain, Production, Logistics and Operations; we see that these journals highly emphasize the relevance of the analyzed topic. The research consists of 28 different journals on supply chain, operations and production management, logistics, planning, information management and manufacturing disciplines.

4.2. The Year Wise Distribution

The second step of descriptive analysis is to chronologically identify the studies by year of publication. Figure 1 indicates the fluctuations in the number of research papers over the years. As it has been analyzed by us, research interest in SCI has reached its peak in the period of 2015 - 2016 (each of the years shares 14 papers); which is considered relatively new in the literature. The year '2001' has been identified the earliest time period in this study. The growing interest has been counted in the last

decade; in the period between 2001-2010 total 36 studies have been identified while that number jumps at 79 studies between 2010 and 2019.

Table 2. Journals in which the papers were published

S. No.	Journal	No. of Studies
1	International Journal of Production Economics	20
2	Supply Chain Management: An International Journal	19
3	International Journal of Production Research	10
4	International Journal of Logistics Management	8
5	Journal of Operations Management	7
6	International Journal of Physical Distribution & Logistics Management	7
7	Production Planning and Control	6
8	International Journal of Operations & Production Management	4
9	Journal of Purchasing and Supply Management	3
10	Benchmarking: An International Journal	3
11	International Journal of Logistics Research and Applications	3
12	Computers and Industrial Engineering	3
13	Journal of Cleaner Production	3
14	Industrial Marketing Management	2
15	Journal of Manufacturing Technology Management	2
16	European Journal of Operational Research	2
17	International Journal of Operations & Production Management	2
18	Asia Pacific Management Review	1
19	Transportation Research Part E: Logistics and Transportation Review	1
20	Competitiveness Review	1
21	Journal of Computer Information Systems	1
22	International Journal of Information Management	1
23	Journal of Enterprise Information Management	1
24	Journal of Systems and Information Technology	1
25	Journal of Management Information Systems	1
26	Journal of Business and Industrial Marketing	1
27	Energy Research and Social Science	1
28	European Management Journal	1
	Total	**115**

Source: Authors' own calculation

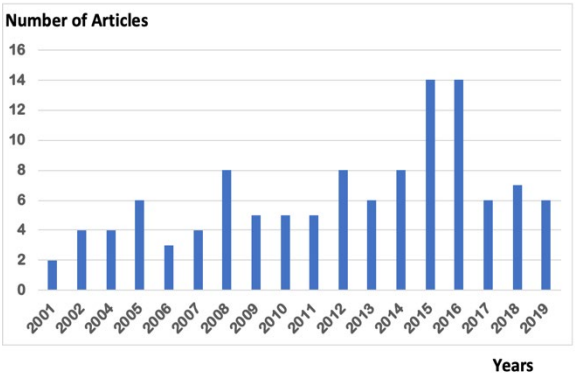


Figure 1. SCI publications over the years
Source: Authors' own calculation

4.3 Country Classification

According to the studies analyzed in this research, SCI papers show considerable geographic dispersion, as can be seen in Figure 2. The selected papers in this study cover 28 countries. Although some of the studies are written by multi-country authors, the countries were identified according to the first author's affiliation [37]. The huge number of contributions is counted from the United States (total 21 papers). UK and China are placed at the second highest position in the studies since they both have 19 papers in this research. These countries are followed by Spain since it has the third highest position in terms of the publications on SCI. The rest of the countries and the number of the studies are shown in Figure 2 (Australia (5), South Korea (5), Taiwan (4), Italy (4), Malaysia (3), Hong Kong (3), Netherlands (2), France (2), India (1), Cyprus (1), Croatia (1), Canada (1), Turkey (1), Greece (1), Belgium (1), Germany (1), Sweden (1), New Zealand (1), Thailand (1), Finland (1), Denmark (1), Poland (1), Slovenia (1), Pakistan (1)).

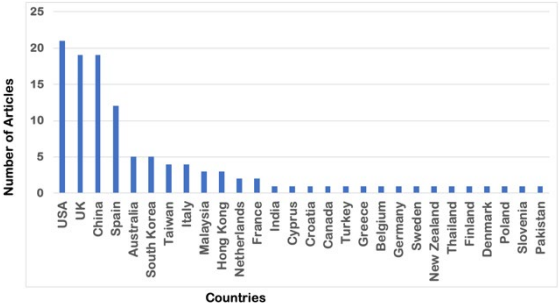


Figure 2. Countries with the highest number of studies in SCI
Source: Authors' own calculation

4.4. Research Themes

Many of the studies are conducted on the subject of SCI; however, the concept still suffers from a lack of convergence in terms of its dimensions, strategies, and challenges. Therefore, this research attempts to identify previous studies on the basis of their themes. Besides, it aims to introduce theory-building research to provide some insights for further research. The studies examined in this paper have been classified in seven broad areas; which has been indicated in Table 3.

The leading theme has been examined in the literature between 2000 and 2019 as 'the effects of SCI on performance-related issues. Most of the papers analyzed for the importance of SCI on Firm or Supply Chain Performance (SCP). There have been identified a total of 53 papers dealing with this topic. The most used second theme is the 'Information Technology' implementation in order to achieve better integrated supply chains (total of 21 papers). By having taken into account the evolution of Advanced Technologies of the last years through Industry 4.0, this result could not be considered as a surprising one. IT enabling SCs creates better communication with SC partners; thus, it increases SCI [38]. Another most investigated theme is to 'identify the framework, general principles, characteristics and dimensions of SCI' (total 20 papers). However, it has been observed that this theme is mostly searched in the first decade of our research paper (between 2000 and 2010) since SCI could be taken as a new concept for many scholars over this period of time. Except these three main themes, some of the researchers also have analyzed different themes related to SCI; 'the relationship between SCI and flexibility capabilities of SCs' (9 papers), 'the relationship between SCI and Green Management' (5 papers), 'the relationship between SCI and SC uncertainty' (5 papers) and finally 'the effects of SCI on lean management practices' (2 papers).

Table 3. Main research themes analyzed with SCI

Research Theme	Details	Example Articles
SCI and Performance Related Issues	Includes research papers impact of SCI on firm or Supply Chain Performance	[8], [16], [39], [30], [40], [41], [42], [43], [44], [45]
SCI and IT	Includes studies the relationship between SCI and Information Technology (IT) adoption	[25], [46], [26], [47], [48], [49],
SCI Framework	Includes papers that discuss the general framework of SCI such as principles, concepts, sub-dimensions and strategies on SCI	[9], [50], [51], [52]
SCI and Green Management	Includes research papers that discuss the relationship between SCI and Green Management issues	[12], [53], [54], [55]
SCI and Flexibility	Includes studies that explain the relationship between SCI and Flexibility in SCs	[56], [57], [58]
SCI and Uncertainty	Includes studies that explain the relationship between SCI and uncertainty in SCs	[21], [59]
SCI and Lean Management	Includes articles that discuss the relationship between SCI and Lean Management in general	[60], [61]

Source: Authors' own contributions

4.5. Method of Data Gathering and Analysis

According to the method of data gathering of selected studies, it has been identified that most of the scholars applied the primary source of data. In this sense, questionnaires, case studies, and interviews have been conducted among the representatives of the companies in the field of Supply Chain, Production, Planning, Operations Management and so on. The most used method of data gathering which has been observed are 'questionnaires'; observed in a total of 79 papers. The observations of the articles used reviews and case study as methods could be counted as intimate; total papers of 15 and 13 respectively. Besides, the interview method is applied only in 8 papers in the selected studies. Table 4 indicates the method of data gathering of the papers.

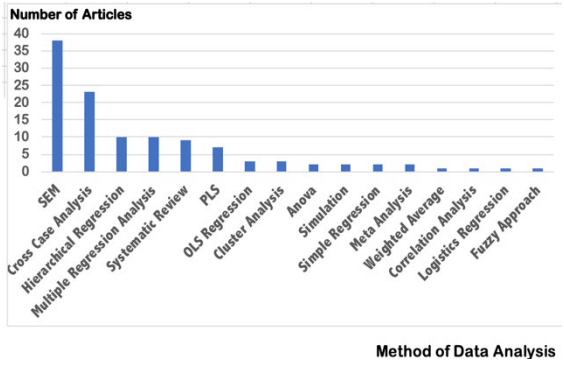
As for the method of data analysis, covariance based structural equation modeling (SEM) is the most used analysis method (total 38 papers) on the selected studies. SEM analysis could be seen also as popular especially in the last decade by researchers. This is followed by Cross Case Analysis, Hierarchical Regression, Multiple Regression Analysis, Systematic Review and Partial Least Squares Analysis (PLS-SEM) with the total papers of 23, 10, 10, 9, 7 respectively.

It has been observed that the frequencies of other analysis methods (OLS Regression (3 papers), Cluster Analysis (3 papers), Anova (2 papers), Simulation (2 papers), Simple Regression (2 papers), Meta-Analysis (2 papers), Weighted Average (1 paper), Correlation Analysis (1 paper), Logistics Regression (1 paper), and Fuzzy Approach (1 paper) are rare. Figure 3 shows the details about the methods of data analysis in selected papers.

Table 4. Method of Data Gathering of The Articles

Method of Data Gathering	No. of Articles
questionnaire	79
review	15
case study	13
interviews	8
Total	**115**

Source: Authors' own calculation



Source: Authors' own calculation

Figure 3. Method of Data Analysis of The Articles

4.6. Reliability and Validity

In line with the principles of content analysis, each category should be determined by the codes extracted from the articles. In our study the first step is to carefully read the abstracts of the selected articles in order to determine the initial category theme and later to continue with the text-based reading to validate the results. Therefore, the frequencies were taken into account for identifying the category theme in the text of each article. Moreover, some of the concepts were held as a whole instead of dividing them into such as 'Supply Chain Performance', 'business performance', 'lean production', and so on. This helps us to ensure the results of category themes and provides with more insightful directions.

Some of the examples of codes extracted are shown in Table 5. For instance, we identify the papers related to SCI and Performance with the selected codes, like 'business performance', organizational performance' or 'firm performance'. These concepts are counted as the theme of 'performance relevance'. The sub-divisions of the themes are excluded from this paper.

Table 5. The Codes Extracted From Articles

Research Theme	Codes Extracted From Articles
SCI and Performance	'business performance', organizational performance', 'firm performance', 'Supply Chain Performance', 'delivery performance', 'logistics performance', 'financial performance'
SCI-IT	'information technology', 'technology', 'advanced manufacturing technologies', 'cloud', 'e-business'
SCI Framework	'SCI Framework', 'SCI Strategies', 'Dimensions of SCI', 'structure of SCI'
SCI-Green	'environmental impact', 'sustainability', 'green management', 'green SCI'
SCI-Flexibility	'flexibility', 'SC Agility', 'Responsiveness of SCs'
SCI-Uncertainty	'uncertainty', 'disruptions', 'snow-ball effect', 'risk management'
SCI-Lean	'lean', 'lean production', 'waste management'

Source: Authors' own contributions

5. Conclusions and Future Directions

The concept of Supply Chain Integration (SCI) has been quite popular in the last twenty years; the evidence could be the number of publications in literature in this time period. The term is in a center stage in Supply Chain activities [4]. This paper shows some implications about SCI by analyzing descriptive analysis through the related journals, years, countries, as well as category themes. In order to validate the results, the codes extraction was applied through the text of each article. Therefore, this study provides with numerous contributions to the field of supply chain integration literature. First of all, the research investigates some trends and advancements in SCI by updating previous literature studies. Secondly, the study explores SCI research in

different geographical regions; thus, it gives an insight on the pace of SCI development on a country basis. In this sense, the countries could revise their practices and underlying factors in order to improve their SCI. Finally, the research discussed in different themes related to SCI found in the literature. Therefore, further studies could trace the themes which are not well developed in the literature yet.

The main results could be concluded as that the most dominant theme is 'the impact of SCI on performance-related concepts'. The scholars still approach this theme skeptically; since it could be found even in contemporary research. 'The implementation of IT to get better integration in SCs' is also a significant theme by scholars especially in the last decade. In addition, researchers still attempt to define the characteristics, dimensions and framework of SCI.

In the last decade, there are numerous publications are observed about SCI (especially between 2015 and 2016). The USA, the UK and China are the leading countries in terms of selected publications. Besides, the questionnaire is the most dominant method of data gathering; while SEM is the most used method of analysis in the selected studies.

Furthermore, future studies could concentrate on sub-divisions of category themes in the last years; as well as more complex subjects; such as mediating effects of SCI among two or more concepts. As an empirical evidence, SCI could be seen mostly as a mediating concept among researchers; therefore, through the evolution of Advanced Technologies, the impacts of these technologies could be analyzed in integration and performance-related issues.

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