Garcia-Buendia, N., Moyano-Fuentes, J. and Maqueira, J.M. (2022), "Mapping the lean supply chain management research through citation classics", *International Journal of Lean Six Sigma*, Vol. 13 No. 2, pp. 428–456, doi: https://doi.org/10.1108/IJLSS-01-2021-0006. Accepted 6 May 2021.

Mapping the Lean Supply Chain Management research through Citation Classics

Abstract

Purpose. The purpose of this paper is to systematically identify the key intellectual developments of the Lean Supply Chain Management (LSCM) field from its very first beginning by analyzing the publications that have been highly cited.

Design/methodology/approach. The Citation Classics method has been used to examine the origins and evolution of the research field. Seventy-four articles have been identified as having the highest impact on LSCM research published from its beginnings to the present day. Key aspects and links among the scientific contributions are studied by descriptive, bibliometric, network, and content analyses.

Findings. Publication and citation trends, methodologies used, top journals, most influential authors, institutions, and countries, collaboration patterns, and evolution of the most used keywords are some of the aspects studied. Three main research areas are identified: (1) LSCM foundations and implementation, (2) Lean-agile supply chain and performance assessment, and (3) The role of sustainability, which offer a holistic view of the field and enable the identification of potential avenues for future research susceptible to contribute to advancing the knowledge on LSCM.

Originality. This study provides a useful insight into the development of the LSCM field and can help researchers as it explores the state-of-the-art of LSCM by identifying the most relevant contributions in the area, the main research lines addressed by the scientific community in this topic, and opportunities for further research on LSCM for years to come.

Keywords: Lean Supply Chain Management, Bibliometrics, Citation classics, H-index, Network analysis

1. Introduction

The Lean Supply Chain Management (LSCM) concept has attracted increasing attention since Lamming (1996) first coined the term, as can be observed by the large number of papers recently published in the field. After some years of productive research in the LSCM field, it is now a good time to look backward and review the developed research.

Bibliometric studies are used mainly to evaluate research performance and they contribute to assessing the progress made, the academic output, the most reliable sources of scientific publications, the major scientific actors, and the scientific evolution of the field, among other things (Martínez *et al.*, 2014). Bibliometrics has been used successfully in the past, both in the supply chain management field (Ardito *et al.*, 2019; Fahimnia *et al.*, 2015; Mishra *et al.*, 2018) and the Lean Management area (Ciano *et al.*, 2019; Filser *et al.*, 2017), and also in LSCM (Garcia-Buendia *et al.*, 2020; de Sousa *et al.*, 2018). According to Garfield (1979), the more often a paper is cited, the greater its influence in the field. So, highly cited papers can be considered relevant in the development of a research field as they have attracted the interest of the scientific community (Moral-Munoz *et al.*, 2016). Garfield (1977) designated the highly cited papers of a scientific discipline with the bibliometric concept of "*citation classic*", also called "*classic article*" or "*literary classic*".

Citation classics enable the identification of potentially important information for developing a

discipline and understanding its past, present, and future scientific structure (Cabrerizo *et al.*, 2017; Moral-Munoz *et al.*, 2016). An analysis of the citation classics in a research field provides a historical view of the scientific progress of a discipline, identifies the main intellectual actors in a research field – which can be journals, researchers, countries, or research groups or institutions– and enables to recognize the major advances in a specialty by identifying emerging or hot topics in order to inspire other works in the area (Baltussen and Kindler, 2004; Garfield, 1977; Smith, 2007; Stack, 2012; Tam *et al.*, 2013). Citation classics method for analyzing the scientific literature on a particular field has been widely used in many different research areas recently (Arshad *et al.*, 2020; Hassan and Mathiassen, 2018; Maingard *et al.*, 2018), and also in business and management (Eggert *et al.*, 2019; Flyvbjerg and Turner, 2018).

In the past few years, previous research has reviewed the LSCM literature by using bibliometric methods with different objectives. De Sousa et al. (2018) used a bibliometric study to review the LSCM field through 57 papers published in SCOPUS and Web of Science databases. The relatively small number of publications analyzed and their lack of contrasted influence in the research field may raise questions about the significance of the findings. More recently, Garcia-Buendia et al. (2020) have studied the evolution of LSCM through bibliometric performance analysis and science mapping analysis of 522 papers. In this case, the high number of documents analyzed complicates the content analysis of the research literature, and insights may be more broad and generic, losing the particular perspective of the most influential contributions in the field. Examining and analyzing the most influential articles is needed since the insights provided by these documents have already been recognized and highlighted by the scientific community. Providing an overview of which are these papers and an analysis of their content to academics and practitioners involves mapping and disseminating the most significant knowledge on LSCM. Although the LSCM literature has been widely analyzed since 1996, there has been no study that identifies the most influential contributions with a view to understanding the most relevant research in LSCM.

The aim of this study is, therefore, to systematically identify the most significant intellectual developments in the LSCM field and analyze how these have evolved over time in order to address the following research questions: RQ1 – What are the most significant intellectual contributions of the field in terms of productivity and influence?, and RQ2 – What are the main research areas that have drafted the field? To address these issues, we first need to carry out a systematic overview of the field. This overview may be useful for novel researchers since it explores the LSCM state-of-the-art, by helping them to identify the main contributions and actors in this sphere. It may also offer LSCM senior researchers a more comprehensive map of the field as a whole, especially of areas conceived as less directly linked, by identifying the links between the main research areas. More specifically, it might enable researchers to identify gaps in the field or potential synergies between a priori rather distinct research areas, and hence offer guidance as to where they might most fruitfully concentrate their efforts. Managers may also benefit from the most relevant knowledge in the LSCM field, which enables them to have this knowledge available for applying it in their organizations.

In order to accomplish these objectives, citation classics provide an overview of papers that have attracted significant interest in the scientific community and are considered the basis of a research field. H-Classics method is considered a robust bibliometric measure to identify citation classics in a field

(Martínez *et al.*, 2014). In addition, a network study can enable the bibliometric relationships between the citation classics to be mapped and examined through the use of co-occurrence and bibliographic coupling analyses. Therefore, this study uses H-Classics to identify and analyze the highly cited papers in the LSCM research field and offer additional information to understand the field's scientific structure. As a novelty, compared to previous citation classic studies based on the H-Classics method, this study combines descriptive, bibliometric, network, and content analyses to provide a deeper overview of the research field. In particular, we present the publication and citation trends of the citation classics, the research methodologies used by the scientific community in the field, the most contributing journals, the most productive authors, institutions, and countries, the characteristics of the co-authorship collaboration patterns, the evolution of the most used keywords based on co-occurrence, and the identification of the main research areas covered by these highly cited papers through bibliographic coupling.

The remainder of this work is organized as follows. Section 2 describes the methodology used in the paper, both procedure and sample, and the software employed. Then, the main results of our analysis are presented and discussed in Section 3, including a descriptive analysis, a bibliometric analysis, a network analysis, and a content analysis of the most cited papers in the field with a discussion of the main insights. Finally, conclusions are drawn in Section 4.

2. Methodology

This section presents the methodology used in this study. First, the procedure applied for the identification of the citation classics in LSCM is described. Then, a detailed explanation is given of the sample used in this work. Last, software used for analyzing particular aspects of the bibliometric and network analyses is presented.

2.1. Procedure

Traditionally, two main approaches have been used to identify citation classics: (i) setting the threshold values of the citations received (Ibrahim *et al.*, 2012; Ponce and Lozano, 2011; Rosenberg *et al.*, 2010), and (ii) setting the threshold values of the number of highly cited papers to be retrieved (Cassar Gheiti *et al.*, 2012; Feijoo *et al.*, 2014; Tam *et al.*, 2013). However, the disadvantage of both of these methods is the way to determine the specific threshold, which will vary depending on the studied field. Thus, the identification procedure lacks any scientific support in either case and the thresholds are set ad hoc, which can bias the choice of the classics. To overcome this problem, Martínez et al. (2014) proposed a new method based on the popular H-index (Hirsch, 2005) to identify citation classics, called H-Classics, which is considered a robust bibliometric measure (Martínez *et al.*, 2014). The properties of the H-index mean that this method is sensitive to a research discipline's particular features and its evolution, thus overcoming the drawbacks associated with traditional approaches. By identifying the highly cited papers in a research field, this method helps researchers to understand the field's scientific structure and evolution, and also to discover the knowledge useful for its future progress.

The following steps are used in H-Classics to identify highly cited papers in a research area (Martínez *et al.*, 2014):

1) *Selection of the bibliographic database to retrieve scientific production and citations*. Web of Science (WoS) Core Collection was chosen as it contains the most reliable research information and

offers a great number of analytical tools to process this information (Martínez *et al.*, 2014).

2) *Establishment of the research area under study*. The main research publications related to the area of study have to be identified, so an appropriate query has to be run to retrieve the sample of relevant documents.

3) *Computation of the research area's H-index*. A research area's H-index is calculated by ranking papers by their citations. WoS provides filtering tools to easily compute the H-index of a given set of research documents.

4) *Retrieval of the research area's H-core*. The next step is to determine the research area's H-core with the inclusion of the first H highly cited papers from the previous ranking. The H-core of a research area includes its H-Classics.

Figure 1 shows a flow diagram of the procedure used.

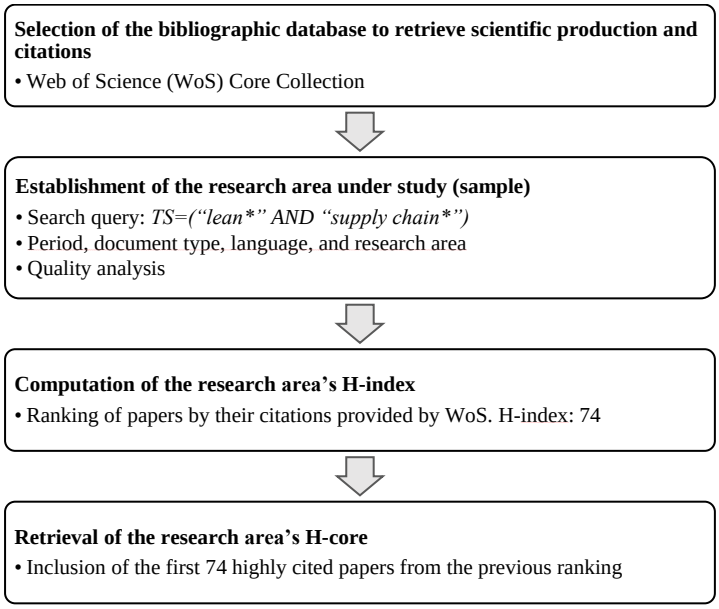

Figure 1 – H-Classics method procedure

2.2. Sample

The study sample consists of papers indexed in WoS during the period 1996-2019. The WoS database was used for this study because it is a comprehensive search engine that can provide full results for an accurate analysis of this field as it contains a wide range of detailed information about each document. The data period set for the analysis of this research was 1996-2019, as the concept of LSCM was first used by Lamming (1996) in 1996. The search was restricted to full-length articles and reviews to ensure that important literature was not excluded, and only documents published in English were considered as this is the language used by the majority of the relevant scientific research. The search focused on three main operations management-related research areas, i.e., Business Economics, Engineering, and Operations Research Management Science. LSCM research documents likely to be suitable for our study were then retrieved using the following WoS advanced search query: TS=("lean*" AND "supply chain*"). These words were considered suitable for the identification of scientific papers related to the LSCM field as they represent the core elements of the research area.

The advanced query yielded a total of 975 documents in a search performed on January 29, 2020. A preliminary content analysis of the results was conducted before continuing the process and making a

final selection of the research papers to be examined. The 100 most cited papers were thoroughly scrutinized to verify that the documents selected for the study were focused on aspects closely related to LSCM. After this quality control stage, 15 papers were discarded for not specifically addressing lean or supply chain management issues. The final sample was, therefore, 960 papers on LSCM.

The H-index of the LSCM field was found to be 74. So, a total of 74 LSCM H-Classics were retrieved for the identification of the authors, institutions/universities, countries, journals, and main topics covered. Figure 2 shows the details of the sample selection process with indication of the remaining documents in each step.

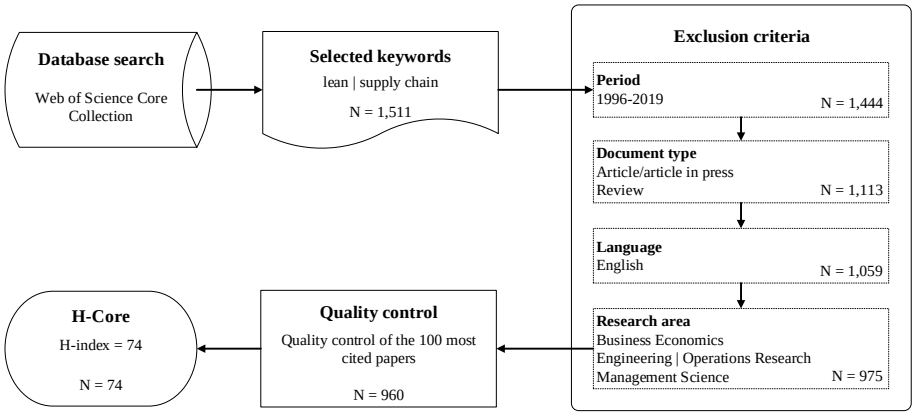

Figure 2 – Sample selection process

2.3. Software

This work uses SciMAT (Cobo *et al.*, 2012) and VOSviewer (van Eck and Waltman, 2010) software to address some aspects of the highly cited papers in the LSCM research field. The SciMAT software tool is used to identify topics in a longitudinal science mapping analysis based on co-word bibliographic networks. In this study, SciMAT has been used in the bibliometric analysis to standardize keywords in order to identify the topics covered by the 74 citation classics in the LSCM research field. On the other hand, VOSviewer collects data and generates maps and different types of bibliographic data-based analyses, such as citation, co-citation, co-authorship, co-occurrence, and bibliographic coupling. This software has been used in the network analysis to carry out keywords co-occurrence and bibliographic coupling of the highly cited articles in LSCM.

3. Results and discussion

According to the retrieved scientific production, the LSCM field's H-index is 74. LSCM's H-Core is therefore composed of the 74 highly cited papers shown in Table I.

Table I – H-Core of the LSCM research field

Paper	TC	C/Y
1. Zhu, Q. and Sarkis, J. (2004), "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises", *Journal of Operations Management*, Vol. 22 No. 3, pp. 265–289.	1,029	60.5
2. Kleindorfer, P.R., Singhal, K. and Wassenhove, L.N. (2009), "Sustainable Operations Management", *Production and Operations Management*, Vol. 14 No. 4, pp. 482–492.	751	46.9
3. Christopher, M. (2000), "The agile supply chain - Competing in volatile markets", *Industrial Marketing Management*, Vol. 29 No. 1, pp. 37–44.	736	35.1
4. Ben Naylor, J., Naim, M. and Berry, D. (1999), "Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain", *International Journal of Production Economics*, Vol. 62 No. 1–2,	629	28.6

pp. 107–118.		
5. Hines, P., Holweg, M. and Rich, N. (2004), "Learning to evolve", *International Journal of Operations & Production Management*, Vol. 24 No. 10, pp. 994–1011.	623	36.7
6. Li, S., Rao, S.S., Ragu-Nathan, T.S. and Ragu-Nathan, B. (2005), "Development and validation of a measurement instrument for studying supply chain management practices", *Journal of Operations Management*, Vol. 23 No. 6, pp. 618–641.	381	23.8
7. Yang, M.G., Hong, P. and Modi, S.B. (2011), "Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms", *International Journal of Production Economics*, Vol. 129 No. 2, pp. 251–261.	372	37.2
8. Agarwal, A., Shankar, R. and Tiwari, M.K. (2006), "Modeling the metrics of lean, agile and leagile supply chain: An ANP-based approach", *European Journal of Operational Research*, Vol. 173 No. 1, pp. 211–225.	295	19.7
9. Bozarth, C.C., Warsing, D.P., Flynn, B.B. and Flynn, E.J. (2009), "The impact of supply chain complexity on manufacturing plant performance", *Journal of Operations Management*, Vol. 27 No. 1, pp. 78–93.	282	23.5
10. Bruce, M., Daly, L. and Towers, N. (2004), "Lean or agile - A solution for supply chain management in the textiles and clothing industry?", *International Journal of Operations & Production Management*, Vol. 24 No. 1–2, pp. 151–170.	272	16.0
11. Mollenkopf, D., Stolze, H., Tate, W.L. and Ueltschy, M. (2010), "Green, lean, and global supply chains", *International Journal of Physical Distribution & Logistics Management*, Vol. 40 No. 1–2, pp. 14–41.	254	23.1
12. Corbett, C.J. and Klassen, R.D. (2006), "Extending the horizons: Environmental excellence as key to improving operations", *Manufacturing & Service Operations Management*, Vol. 8 No. 1, pp. 5–22.	248	16.5
13. Dues, C.M., Tan, K.H. and Lim, M. (2013), "Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain", *Journal of Cleaner Production*, Vol. 40, pp. 93–100.	218	27.3
14. Mason-Jones, R., Naylor, B. and Towill, D. (2000), "Lean, agile or leagile? Matching your supply chain to the marketplace", *International Journal of Production Research*, Vol. 38 No. 17, pp. 4061–4070.	197	9.4
15. Kainuma, Y. and Tawara, N. (2006), "A multiple attribute utility theory approach to Lean and Green Supply Chain management", *International Journal of Production Economics*, Vol. 101 No. 1, pp. 99–108.	196	13.1
16. Zsidisin, G., Melnyk, S. and Ragatz, G. (2005), "An institutional theory perspective of business continuity planning for purchasing and supply management", *International Journal of Production Research*, Vol. 43 No. 16, pp. 3401–3420.	195	12.2
17. Lamming, R. (1996), "Squaring lean supply with supply chain management", *International Journal of Operations & Production Management*, Vol. 16 No. 2, pp. 183–196.	192	7.7
18. Vonderembse, M., Uppal, M., Huang, S. and Dismukes, J. (2006), "Designing supply chains: Towards theory development", *International Journal of Production Economics*, Vol. 100 No. 2, pp. 223–238.	186	12.4
19. Bhamu, J. and Sangwan, K.S. (2014), "Lean manufacturing: literature review and research issues", *International Journal of Operations & Production Management*, Vol. 34 No. 7, pp. 876–940.	181	25.9
20. Birdi, K., Clegg, C., Patterson, M., Robinson, A., Stride, C.B., Wall, T.D. and Wood, S.J. (2008), "The impact of human resource and operational management practices on company productivity: A longitudinal study", *Personnel Psychology*, Vol. 61 No. 3, pp. 467–501.	176	13.5
21. Koh, S.L., Demirbag, M., Bayraktar, E., Tatoglu, E. and Zaim, S. (2007), "The impact of supply chain management practices on performance of SMEs", *Industrial Management & Data Systems*, Vol. 107 No. 1–2, pp. 103–124.	176	12.6
22. Hallgren, M. and Olhager, J. (2009), "Lean and agile manufacturing: external and internal drivers and performance outcomes", *International Journal of Operations & Production Management*, Vol. 29 No. 10, pp. 976–999.	166	13.8
23. Martinez-Jurado, P.J. and Moyano-Fuentes, J. (2014), "Lean Management, Supply Chain Management and Sustainability: A Literature Review", *Journal of Cleaner Production*, Vol. 85, pp. 134–150.	164	23.4
24. Inman, R.A., Sale, R.S., Green, K.W. and Whitten, D. (2011), "Agile manufacturing: Relation to JIT, operational performance and firm performance", *Journal of Operations Management*, Vol. 29 No. 4, pp. 343–355.	164	16.4
25. Melton, T. (2005), "The benefits of lean manufacturing - What lean thinking has to offer the process industries", *Chemical Engineering Research & Design*, Vol. 86 No. 6, pp. 662–673.	155	9.7
26. Cagliano, R., Caniato, F. and Spina, G. (2006), "The linkage between supply chain integration and manufacturing improvement programmes", *International Journal of Operations & Production Management*, Vol. 26 No. 3, pp. 282–299.	146	9.7
27. Scherrer-Rathje, M., Boyle, T.A. and Deflorin, P. (2009), "Lean, take two! Reflections from the second attempt at lean implementation", *Business Horizons*, Vol. 52 No. 1, pp. 79–88.	145	12.1
28. Tseng, M.-L., Chiu, (Anthony) Shun Fung, Tan, R.R. and Siriban-Manalang, A.B. (2013), "Sustainable consumption and production for Asia: sustainability through green design and practice", *Journal of Cleaner Production*, Vol. 40, pp. 1–5.	143	17.9
29. Browning, T.R. and Heath, R.D. (2009), "Reconceptualizing the effects of lean on production costs with evidence from the F-22 program", *Journal of Operations Management*, Vol. 27 No. 1, pp. 23–44.	141	11.8
30. Garza-Reyes, J.A. (2015), "Lean and green – a systematic review of the state of the art literature", *Journal of Cleaner Production*, Vol. 102, pp. 18–29.	140	23.3
31. MacDuffie, J.P. and Helper, S. (1997), "Creating Lean Suppliers: Diffusing Lean Production through the Supply Chain", *California Management Review*, Vol. 39 No. 4, pp. 118–151.	136	5.7

32. Alford, D., Sackett, P. and Nelder, G. (2000), "Mass customisation — an automotive perspective", *International Journal of Production Economics*, Vol. 65 No. 1, pp. 99–110.	134	6.4
33. Gosling, J. and Naim, M. (2009), "Engineer-to-order supply chain management: A literature review and research agenda", *International Journal of Production Economics*, Vol. 122 No. 2, pp. 741–754.	130	10.8
34. Stratton, R. and Warburton, R. (2003), "The strategic integration of agile and lean supply", *International Journal of Production Economics*, Vol. 85 No. 2, pp. 183–198.	125	6.9
35. Towill, D.R. (1997), "The seamless supply chain - the predator's strategic advantage", *International Journal of Technology Management*, Vol. 13 No. 1, p. 37.	124	5.2
36. Hajmohammad, S., Vachon, S., Klassen, R.D. and Gavronski, I. (2013), "Lean management and supply management: their role in green practices and performance", *Journal of Cleaner Production*, Vol. 39, pp. 312–320.	123	15.4
37. Jasti, N.V.K. and Kodali, R. (2015), "Lean production: literature review and trends", *International Journal of Production Research*, Vol. 53 No. 3, pp. 867–885.	122	20.3
38. Gligor, D.M. and Holcomb, M.C. (2012), "Understanding the role of logistics capabilities in achieving supply chain agility: a systematic literature review", *Supply Chain Management: An International Journal*, Vol. 17 No. 4, pp. 438–453.	115	12.8
39. Tommelein, I.D. (1998), "Pull-Driven Scheduling for Pipe-Spool Installation: Simulation of Lean Construction Technique", *Journal of Construction Engineering and Management*, Vol. 124 No. 4, pp. 279–288.	115	5.0
40. Carvalho, H., Duarte, S. and Cruz Machado, V. (2011), "Lean, agile, resilient and green: divergencies and synergies", *International Journal of Lean Six Sigma*, Vol. 2 No. 2, pp. 151–179.	110	11.0
41. Aboelmaged, M. (2010), "Six Sigma quality: a structured review and implications for future research", *International Journal of Quality and Reliability Management*, Vol. 27 No. 3, pp. 268–317.	106	9.6
42. Reichhart, A. and Holweg, M. (2007), "Creating the customer-responsive supply chain: a reconciliation of concepts", *International Journal of Operations & Production Management*, Vol. 27 No. 11, pp. 1144–1172.	105	7.5
43. Holweg, M. and Bicheno, J. (2002), "Supply chain simulation – a tool for education, enhancement and endeavour", *International Journal of Production Economics*, Vol. 78 No. 2, pp. 163–175.	103	5.4
44. Holweg, M. (2005), "The three dimensions of responsiveness", *International Journal of Operations & Production Management*, Vol. 25 No. 7, pp. 603–622.	100	6.3
45. Liker, J.K. and Wu, Y.C. (2001), "Japanese automakers, U.S. suppliers and supply-chain superiority", *MIT Sloan Management Review*, Vol. 42 No. 1, pp. 81–93.	99	4.7
46. Cabral, I., Grilo, A. and Cruz-Machado, V. (2012), "A decision-making model for Lean, Agile, Resilient and Green supply chain management", *International Journal of Production Research*, Vol. 50 No. 17, pp. 4830–4845.	98	10.9
47. Gligor, D.M., Esmark, C.L. and Holcomb, M.C. (2015), "Performance outcomes of supply chain agility: When should you be agile?", *Journal of Operations Management*, Elsevier B.V., Vol. 33–34 No. 1, pp. 71–82.	97	16.2
48. Piercy, N. and Rich, N. (2015), "The relationship between lean operations and sustainable operations", *International Journal of Operations & Production Management*, Emerald Group Publishing Ltd., Vol. 35 No. 2, pp. 282–315.	97	16.2
49. Hofer, C., Eroglu, C. and Rossiter Hofer, A. (2012), "The effect of lean production on financial performance: The mediating role of inventory leanness", *International Journal of Production Economics*, Vol. 138 No. 2, pp. 242–253.	94	10.4
50. Karim, A. and Arif-Uz-Zaman, K. (2013), "A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations", *Business Process Management Journal*, Vol. 19 No. 1, pp. 169–196.	93	11.6
51. Moyano-Fuentes, J. and Sacristán-Díaz, M. (2012), "Learning on lean: a review of thinking and research", *International Journal of Operations & Production Management*, Vol. 32 No. 5, pp. 551–582.	93	10.3
52. Qrunfleh, S. and Tarafdar, M. (2013), "Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement", *Supply Chain Management: An International Journal*, Vol. 18 No. 6, pp. 571–582.	88	12.6
53. Govindan, K., Azevedo, S.G., Carvalho, H. and Cruz-Machado, V. (2014), "Impact of supply chain management practices on sustainability", *Journal of Cleaner Production*, Vol. 85, pp. 212–225.	87	12.4
54. Qi, Y., Zhao, X. and Sheu, C. (2011), "The Impact of Competitive Strategy and Supply Chain Strategy on Business Performance: The Role of Environmental Uncertainty*", *Decision Sciences*, Vol. 42 No. 2, pp. 371–389.	87	8.7
55. Prasad, S. and Babbar, S. (2000), "International operations management research", *Journal of Operations Management*, Elsevier Science Publishers B.V., Vol. 18 No. 2, pp. 209–247.	87	4.1
56. Azadegan, A., Patel, P.C., Zangoueinezhad, A. and Linderman, K. (2013), "The effect of environmental complexity and environmental dynamism on lean practices", *Journal of Operations Management*, Elsevier B.V., Vol. 31 No. 4, pp. 193–212.	86	10.8
57. Levy, D.L. (1997), "Lean Production in an International Supply Chain", *Sloan Management Review*, Vol. 38 No. 2, pp. 94–102.	86	3.6
58. Cherrafi, A., Elfezazi, S., Chiarini, A., Mokhlis, A. and Benhida, K. (2016), "The integration of lean manufacturing, Six Sigma and sustainability: A literature review and future research directions for developing a specific model", *Journal of Cleaner Production*, Vol. 139, pp. 828–846.	85	17.0
59. Nishat Faisal, M., Banwet, D.K. and Shankar, R. (2006), "Mapping supply chains on risk and customer sensitivity dimensions", *Industrial Management & Data Systems*, Vol. 106 No. 6, pp. 878–895.	85	5.7

60. Azevedo, S.G., Carvalho, H., Duarte, S. and Cruz-Machado, V. (2012), "Influence of Green and Lean Upstream Supply Chain Management Practices on Business Sustainability", *IEEE Transactions on Engineering Management*, Vol. 59 No. 4, pp. 753–765.	84	9.3
61. Wee, H.M. and Wu, S. (2009), "Lean supply chain and its effect on product cost and quality: a case study on Ford Motor Company", *Supply Chain Management: An International Journal*, Vol. 14 No. 5, pp. 335–341.	81	6.8
62. Verrier, B., Rose, B., Caillaud, E. and Remita, H. (2014), "Combining organizational performance with sustainable development issues: the Lean and Green project benchmarking repository", *Journal of Cleaner Production*, Vol. 85, pp. 83–93.	80	11.4
63. Taj, S. and Morosan, C. (2011), "The impact of lean operations on the Chinese manufacturing performance", *Journal of Manufacturing Technology Management*, Vol. 22 No. 2, pp. 223–240.	80	8.0
64. Morash, E.A. (2001), "Supply Chain Strategies, Capabilities, and Performance", *Transportation Journal*, Penn State University Press, Vol. 41 No. 1, pp. 37–54.	79	4.0
65. Galeazzo, A., Furlan, A. and Vinelli, A. (2014), "Lean and green in action: interdependencies and performance of pollution prevention projects", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 85, pp. 191–200.	78	11.1
66. Qrunfleh, S. and Tarafdar, M. (2014), "Supply chain information systems strategy: Impacts on supply chain performance and firm performance", *International Journal of Production Economics*, Vol. 147 No. PART B, pp. 340–350.	78	9.8
67. Qi, Y., Boyer, K.K. and Zhao, X. (2009), "Supply Chain Strategy, Product Characteristics, and Performance Impact: Evidence from Chinese Manufacturers", *Decision Sciences*, Vol. 40 No. 4, pp. 667–695.	77	6.4
68. Kaipia, R., Holmström, J. and Tanskanen, K. (2002), "VMI: What are you losing if you let your customer place orders?", *Production Planning & Control*, Vol. 13 No. 1, pp. 17–25.	77	4.1
69. Bowersox, D. (1999), "Lean launch: managing product introduction risk through response-based logistics", *Journal of Product Innovation Management*, Elsevier Science Publ Co Inc, Vol. 16 No. 6, pp. 557–568.	77	3.5
70. Timans, W., Antony, J., Ahaus, K. and van Solingen, R. (2012), "Implementation of Lean Six Sigma in small- and medium-sized manufacturing enterprises in the Netherlands", *Journal of the Operational Research Society*, Vol. 63 No. 3, pp. 339–353.	75	8.3
71. Rubio, S. and Corominas, A. (2008), "Optimal manufacturing–remanufacturing policies in a lean production environment", *Computers & Industrial Engineering*, Vol. 55 No. 1, pp. 234–242.	75	5.8
72. Papadopoulou, T.C. and Özbayrak, M. (2005), "Leanness: experiences from the journey to date", *Journal of Manufacturing Technology Management*, Vol. 16 No. 7, pp. 784–807.	75	4.7
73. Naim, M., Childerhouse, P., Disney, S.M. and Towill, D.R. (2002), "A supply chain diagnostic methodology: determining the vector of change", *Computers & Industrial Engineering*, Vol. 43 No. 1–2, pp. 135–157.	75	4.0
74. Jayaram, J., Vickery, S. and Droge, C. (2008), "Relationship building, lean strategy and firm performance: an exploratory study in the automotive supplier industry", *International Journal of Production Research*, Vol. 46 No. 20, pp. 5633–5649.	74	5.7
TC – Total citations; **C/Y** – Citations per year		

A brief observation of Table I identifies some of the trends in LSCM research based on its H-Core. Almost 30% of the highly cited papers on LSCM addressed green or sustainable issues in conjunction with lean in the supply chain (21 documents). The number of studies on lean and agile, and leagile supply chain strategies, is also relevant (13 documents). The study and implementation of LSCM usually seem to be linked to other supply chain strategies, either for joint adoption or for a comparative analysis. A large number of citation classics also address performance and measurement issues (22 documents), due to the importance of assessing the impact of these strategies.

The present section analyzes the H-Core in LSCM research in depth. In particular, the next subsection includes a descriptive analysis of the LSCM research field, focusing on the publishing trend, the type of methodologies used, and the most contributing journals. Following this, a bibliometric analysis analyzes author production, affiliation statistics, and the most popular keywords. After, a network study handles keywords co-occurrence and bibliographic coupling analyses, and finally, a content analysis of the LSCM literature by research areas and the discussion of key findings are provided.

3.1. Descriptive analysis

Initial data analysis can be useful for capturing basic information in the LSCM H-Classic literature and

presenting a preview of the topic. This section includes a descriptive analysis of the citation classics, focusing on the publishing and citation trends, the type of study and methodology used, and the most contributing journals.

3.1.1. Distribution of LSCM H-Classic papers and their citations by year

Figure 3 shows the distribution of H-Classic publications by year and their accumulated citations. As can be seen, highly cited papers in LSCM research have been published between 1996 and 2016, with 2009 being the year with the highest number of citation classics (7 papers, 9.5%). The first highly cited paper, with 192 citations, was published by Lamming (1996) in the *International Journal of Operations & Production Management*, and the most recent highly cited paper, with 85 citations, was published in the *Journal of Cleaner Production* by Cherrafi et al. (2016). During the considered period, the number of accumulated citations has increased, a trend that can be expected to continue in the future.

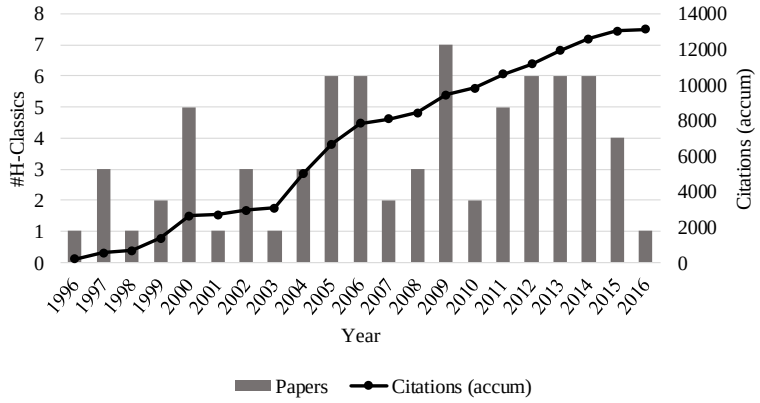

Figure 3 – Distribution of LSCM H-Classic papers and accumulated citations by year

Figure 4 shows the distribution of H-Classic papers by year, dividing the considered period by decades, i.e., the 90s, 2000s, and 2010s, and grouping the publications in quartiles according to their positions in the H-Core. Q1 (red) represents the 25% most cited papers. Q2 (blue), the next 25% in the list, Q3 (green) the following 25%, and finally, Q4 (yellow) shows the 25% least cited classics. As can be observed, the most ancient publications addressing the LSCM, i.e., those documents published in the 90s, are distributed all along with the H-Classic ranking occupying all the quartiles. Q1 positions are mostly occupied by citation classics published in the 2000s, which may show that the LSCM research field seems to have acquired certain maturity and acceptance by the scientific community since the most significant contributions have been published in this period. Logically, most of the citation classics published in the 2010s are grouped in Q3 and Q4, with fewer citations than previous studies.

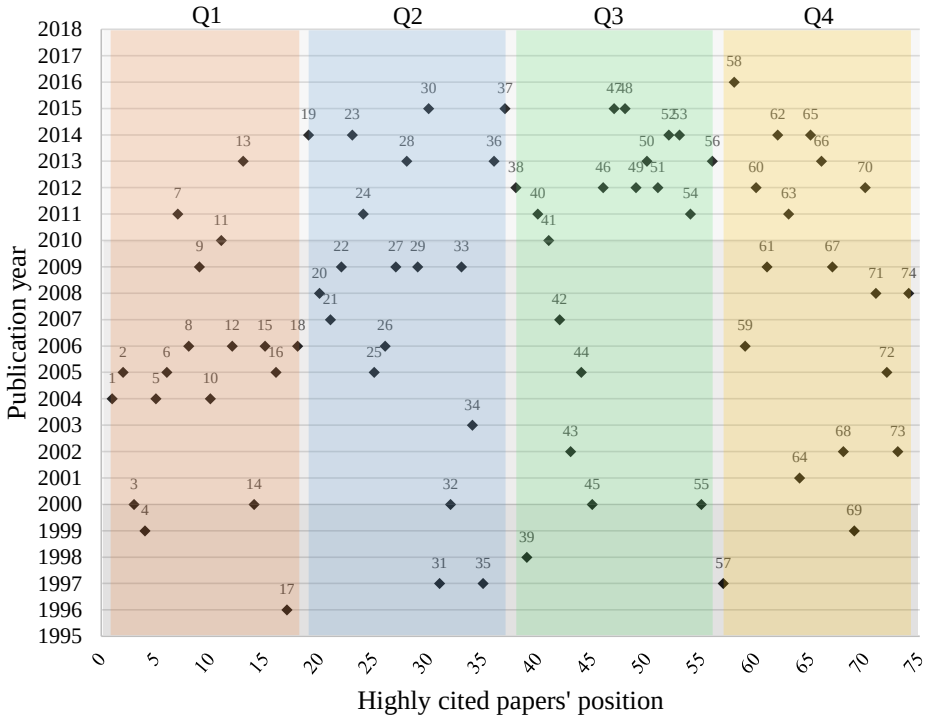

Figure 4 – Distribution of LSCM H-Classic papers by decades and by quartiles

3.1.2. Type of study and methodology used by LSCM H-Classic papers

Figure 5 shows the three types of studies that form the H-Core in LSCM, i.e., conceptual, qualitative, and quantitative papers. As can be seen, there is a similar number of the different types of study: quantitative and qualitative citation classics each represent 35% of all the studies and 30% of all the papers deal with LSCM from a conceptual perspective. This shows that conceptual, qualitative, and quantitative approaches are considered equally valuable in the study of the research field, with none standing out when it comes to being highly cited.

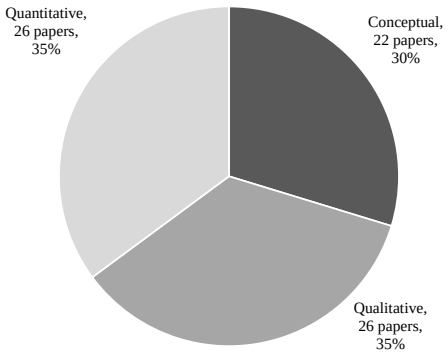

Figure 5 – Types of paper in the LSCM H-Core

Most conceptual highly cited studies in LSCM address the field using the literature review approach (15 out of 22 papers). All the citation classics that are qualitative in nature are based on the case study methodology (26 out of 26 papers). Regarding quantitative studies, a great number analyze the field using structural equation modeling (11 out of 26 papers), while others focus on regression models (5 out

of 26 papers) and simulation (3 out of 26 papers).

Focusing on the different nature of the highly cited papers on LSCM, Figure 6 shows the number of H-Classic papers published by year, while Figure 7 shows the highly cited papers' citations. The circles represent the citation classics, and their size expresses the number of articles. The influence of the conceptual studies published in the 2010s is increasing, while qualitative studies have received attention independent of their publication year. Finally, quantitative studies mostly published from 2006 are generating interest in the research community.

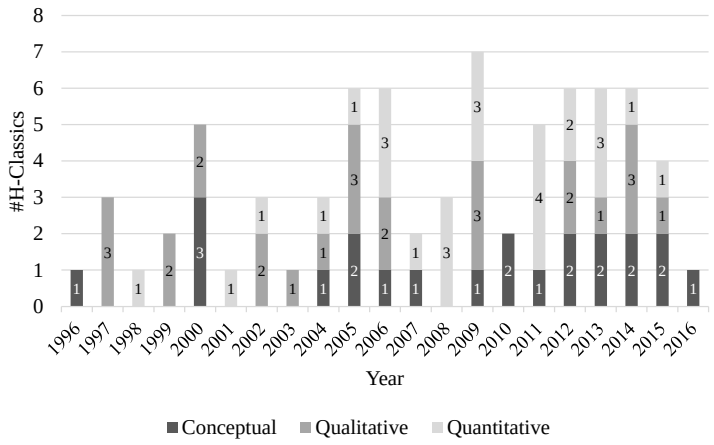

Figure 6 – Distribution of LSCM H-Classic papers by type

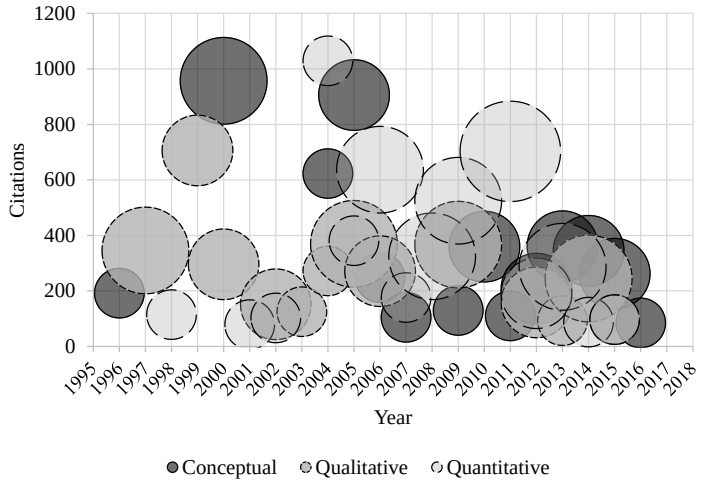

Figure 7 – Distribution of LSCM H-Classic papers' citations by type

3.1.3. Top journals publishing highly cited papers on LSCM

Table II shows journals with two or more citation classics. This table includes the number of highly cited papers for each journal, the cumulative percentage that the papers represent of the total, and the Journal Impact Factor (JIF) of the journals based on JCR (Journal Citation Reports) 2019. *International Journal of Production Economics* and *International Journal of Operations & Production Management* are the most important journals in LSCM H-Classics research, with 20 citation classics between them (10 each). *Journal of Cleaner Production* and *Journal of Operations Management*, with 9 and 8 highly cited papers, respectively, have also made significant contributions to the development of the research field. Together, these four journals account for 50% (37 documents) of the H-Classic literature. The sources in this list are

mainly in the operation research science, management, and industrial engineering categories.

Table II – Most productive journals of highly cited papers in LSCM

Journal	#H-Classics	Cumulative %	Journal IF (JCR 2019)
International Journal of Production Economics	10	13.5%	5.134
International Journal of Operations & Production Management	10	27.0%	4.619
Journal of Cleaner Production	9	39.2%	7.246
Journal of Operations Management	8	50.0%	4.673
International Journal of Production Research	5	56.8%	4.577
Supply Chain Management: An International Journal	3	60.9%	4.725
Industrial Management & Data Systems	2	63.6%	3.329
MIT Sloan Management Review	2	66.3%	2.706
Decision Sciences	2	69.0%	2.014
Journal of Manufacturing Technology Management	2	71.7%	3.385
Computers & Industrial Engineering	2	74.4%	4.135

3.2. Bibliometric analysis

This section describes the production and influence of LSCM H-Classic papers with the analysis of the following bibliometric indicators: published papers, citations received, data on the geographic distribution of publications, and most commonly used keywords. It is interesting to observe the most productive highly cited actors in the LSCM field (authors, institutions, and countries). In addition, it is also relevant to investigate the geographic distribution of these citation classics, and the collaboration patterns between the co-authors, as this may be of help when evaluating and determining where to focus studies on LSCM. The most used keywords can provide an overview of the different topics covered by the LSCM H-Classic literature.

3.2.1. Authors' productivity and influence in LSCM H-Classic papers

Table III lists the authors with two or more H-Classics or highly cited papers in the LSCM field, i.e., the most productive highly cited authors. This table includes the number of highly cited papers by each listed author, the percentage of the 74 citation classics that their papers represent, the year of publication of these documents, and the number of citations received. Holweg, M. (UK) and Cruz-Machado, V. (Portugal) are identified as the authors who have most influenced this research field, with 4 citation classics each. The most cited authors in this list are Holweg, M., Naim, M., and Naylor, J. B., with 931, 834, and 826 citations, respectively.

Table III – Most productive highly cited authors in LSCM

Author	#H-Classics	% of total	Year of publication	Citations
Holweg, M.	4	5.4%	2002, 2004, 2005, 2007	931
Cruz-Machado, V.	4	5.4%	2011, 2012, 2012, 2014	379
Naim, M.	3	4.1%	1999, 2002, 2009	834
Towill, D. R.	3	4.1%	1997, 2000, 2002	396
Carvalho, H.	3	4.1%	2011, 2012, 2014	281
Naylor, J. B.	2	2.7%	1999, 2000	826
Rich, N.	2	2.7%	2004, 2015	720
Shankar, R.	2	2.7%	2006, 2006	380

Klassen, R. D.	2	2.7%	2006, 2013	371
Moyano-Fuentes, J.	2	2.7%	2012, 2014	257
Gligor, D. M.	2	2.7%	2012, 2015	212
Holcomb, M. C.	2	2.7%	2012, 2015	212
Duarte, S.	2	2.7%	2011, 2012	194
Azevedo, S. G.	2	2.7%	2012, 2014	171
Qrunfleh, S.	2	2.7%	2013, 2014	166
Tarafdar, M.	2	2.7%	2013, 2014	166
Qi, Y. N.	2	2.7%	2009, 2011	164
Zhao, X. D.	2	2.7%	2009, 2011	164

3.2.2. Affiliation statistics and analysis

Based on information on authors' addresses in the highly cited paper details, contributions from institutions and countries are identified by having at least one author in the publications. Therefore, if a paper has been co-authored by two authors from two different countries, a publication will be recorded for each of the countries irrespective of the order of the authors in the document. The same principle applies to the citations.

Table IV shows the most productive institutions or universities of H-Classics in LSCM, i.e., with two or more highly cited papers. This table includes the country where the institution is based, the number of highly cited papers, and the percentage of the total H-Core that they represent, and the citations received by these documents. Cardiff University (UK) stands out with 7 papers, almost twice as many citation classics as the next-ranked universities, Michigan State University (USA) and Universidade Nova de Lisboa (Portugal), with 4 each. Regarding citations received by the H-Classic papers, Cardiff University (UK), the University of Toledo (USA), and the University of Pennsylvania (USA) are the institutions in the list that have received most citations, with 1,881, 917, and 887 citations, respectively.

Table IV – Most productive institutions of highly cited papers in LSCM

Institution	**Country**	**#H-Classics**	**% of total**	**Citations**
Cardiff University	UK	7	9.5%	1,881
Michigan State University	USA	4	5.4%	416
Universidade Nova de Lisboa	Portugal	4	5.4%	375
University of Toledo	USA	3	4.1%	917
University of Tennessee	USA	3	4.1%	462
University of Pennsylvania	USA	2	2.7%	887
Cranfield University	UK	2	2.7%	833
Indian Institute of Technology	India	2	2.7%	373
University of Western Ontario	Canada	2	2.7%	358
University of Sheffield	UK	2	2.7%	339
Birla Institute of Technology and Science	India	2	2.7%	298
Universidad de Jaen	Spain	2	2.7%	252
University of Cambridge	UK	2	2.7%	202
Universidade da Beira Interior	Portugal	2	2.7%	168
Eastern Michigan University	USA	2	2.7%	163
Lancaster University	UK	2	2.7%	163

Chinese University of Hong Kong	PRC*	2	2.7%	162
University of International Business Economics	PRC*	2	2.7%	162
***PRC**: People's Republic of China				

Table V shows the countries that have produced the most influential papers in the LSCM field. This table includes the number of citation classics, the percentage of the highly cited papers that they represent, their citations, and also the citations received per paper (C/P). Note that papers with authors from institutions and organizations in different countries have been assigned to multiple regions, so the total number of documents by country is greater than the total number of highly cited papers on LSCM, i.e., 74 papers. The leading country in the production of highly cited papers is the USA with 29 H-Classic publications (almost 40%) out of the total of 74, closely followed by the UK with 24 highly cited papers. The next most productive countries are the People's Republic of China (PRC), India, and Portugal, although they lag far behind the leaders in the list. The predominance of the USA and the UK in producing LSCM H-Classic papers is therefore evident.

Table V – Most productive countries of highly cited papers in LSCM

Country/Region	**#H-Classics**	**% of total**	**Citations**	**C/P**
USA	29	39.2%	5,467	188.5
UK	24	32.4%	4,992	208.0
PRC*	4	5.4%	1,297	324.3
India	4	5.4%	671	167.8
Portugal	4	5.4%	375	93.8
Canada	3	4.1%	498	166.0
Spain	3	4.1%	323	107.7
Taiwan	3	4.1%	322	107.3
Italy	3	4.1%	304	101.3
France	2	2.7%	815	407.5
C/P – Citations per paper ***PRC:** People's Republic of China				

Figure 8 shows the distribution of the highly cited papers and their total citations by country. The red background indicates that a country has produced one or more papers on this topic, while the green circle represents the citations received by the papers produced in a country. The higher the number of papers, the more intense the background color; similarly, the more citations, the larger the size of the circle.

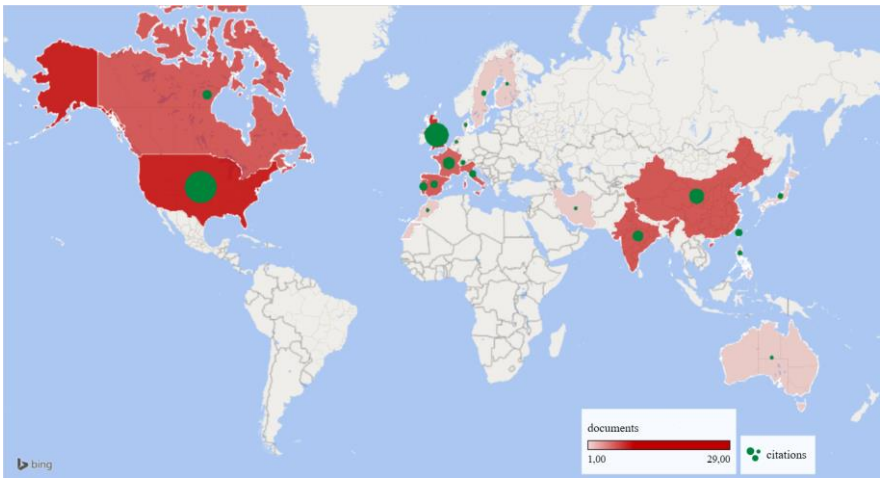

Figure 8 – Distribution of the LSCM H-Classic papers by country

Figure 9 presents the collaboration patterns detected in the H-Classic papers. Research collaboration has increased across many different disciplines (Gazni *et al.*, 2012). International collaboration was made more feasible by the widespread use of the Internet and is becoming increasingly more relevant in multidisciplinary scientific research. Collaboration between authors enables the sharing of ideas, resources, and different sets of skills. This study has analyzed the collaboration patterns in the highly cited papers according to information on author affiliation.

Of the 74 papers that form the H-Core of LSCM, 64 have been authored by more than one person, so research collaboration has taken place. As can be seen in Figure 8, 75% of the 64 co-authored highly cited papers on LSCM have been written by authors from the same country, while 25% are the result of international collaboration. Regarding the 48 H-Classic papers written by different authors from the same country, 25 have used collaboration within the same institution, while 23 are the result of collaboration between different institutions in the same country. In summary, national collaboration is more usual than international collaboration in the citation classics in LSCM and co-authorship has also occurred within the same institution and with other institutions in the same country.

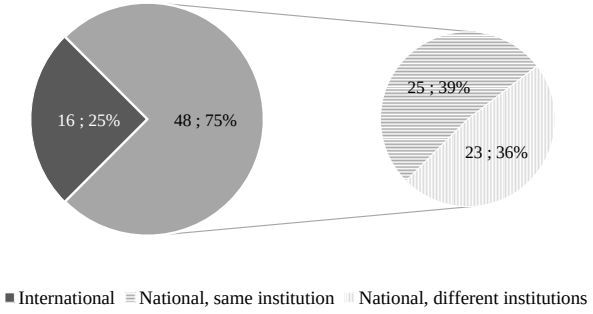

Figure 9 – Collaboration patterns in LSCM H-Classic papers

3.2.3. Main topics covered by LSCM H-Classic papers

A tag cloud was constructed to identify the topics covered by the 74 citation classics in the LSCM research field. For this, the keywords given by the researchers were processed using SciMAT (Cobo *et al.*, 2012). This software enables a filtering analysis to be performed by standardizing keywords with the same meaning and counting them as one. Figure 9 gives a tag cloud of the keywords that appeared in two

or more LSCM H-Classic papers to identify the main topics addressed. In this figure, the size of the terms is proportional to their frequency in the highly cited LSCM literature.

It can be observed in Figure 10 that "lean-manufacturing" and "supply-chain-management" are, logically, the most used keywords. However, there are other connected terms that are also seen to be very relevant in the field. Some of these are mainly related to different supply chain strategies, such as agility ("agile-manufacturing", "agility", "supply-chain-agility"), while others are linked to environmental issues ("green", "sustainability", "environmental-management", "environmental-performance", "green-supply-chain-management"), and some relatively relevant keywords are focused on methodologies and methods used in the LSCM field ("literature-review", "case-study", "empirical-study", "structural-equation-modeling"). The presence of "automotive-industry" is also interesting. This is a reflection of the relevance of this industry for the study of LSCM. Attention has also been paid to performance ("organizational-performance", "environmental-performance"), particular contextual circumstances ("environmental-uncertainty", "risk-management"), and to some strategies considered complementary to the study of LSCM, such as Six Sigma ("six-sigma") and Resilience ("resilient").

Figure 10 – Main topics covered by the H-Classic papers in LSCM

3.3. Network analysis

A network analysis was subsequently performed based on co-occurrence and bibliographic coupling analyses. VOSviewer was chosen for this study because of its viewing capabilities and flexible visualization, and easy-to-interpret graphical representations of bibliometric networks (van Eck and Waltman, 2010).

3.3.1. Keyword co-occurrence analysis

The number of co-occurrences of two keywords is the number of publications in which both keywords occur together (van Eck and Waltman, 2014). Figure 11 shows the co-occurrence of the citation classics' author keywords over time. In this case, the software was set to consider papers in which the keywords occur at least twice. The VOSviewer overlay visualization was used to graphically present the evolution of the keywords used in the highly cited papers. The color bar in the bottom right corner of the visualization indicates how scores are mapped to colors, i.e., the keywords colored blue were published in the 2000s, while yellow indicates the most recently used keywords in the LSCM H-Classic literature. The nodes are occurrences of keywords, while the links are co-occurrences, i.e., the number of publications in which two keywords occur together.

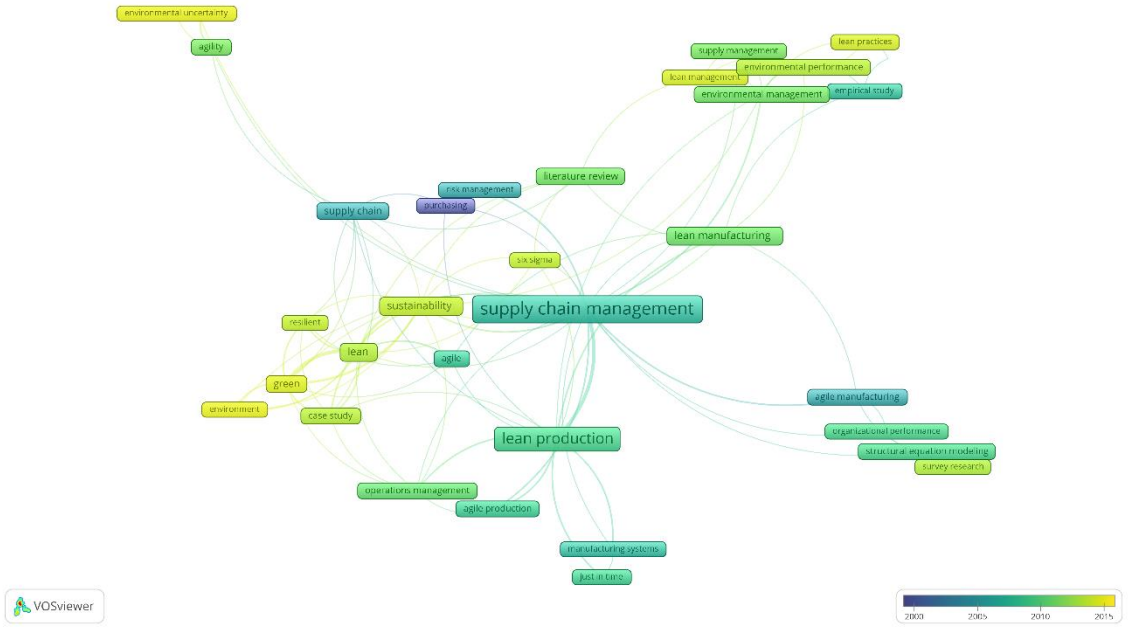

Figure 11 – Co-occurrence of LSCM H-Classic paper keywords

As can be observed in Figure 11 and also, previously, in Figure 10, the most used keywords are "supply chain management" and "lean production". The most interconnected keywords in the highly cited papers in LSCM are "supply chain management" (19 links), "lean production" (12 links), and "sustainability" (12 links), which reflects the importance of sustainability issues in the study of lean along the supply chain. According to Figure 11, different keywords have recently emerged, which may indicate new areas of interest in the LSCM research literature. Thus, "environmental uncertainty", "resilient", "green" and "sustainability", and "six sigma" are terms addressed in the citation classic papers in recent years. It is, therefore, possible that increasing attention is being paid to environmental complexity and sustainability in the field, as well as to quality issues.

3.3.2. Bibliographic coupling and clustering

Bibliographic coupling occurs when two documents have at least one reference in common (Kessler, 1963). In contrast, co-citation has been defined as the frequency with which two documents are cited together in other publications in the literature (Small, 1973). Therefore, co-citation is a similarity relationship between two cited publications, while bibliographic coupling is a measure of association between two citing publications. Bibliographic coupling is considered to be a suitable tool for detecting current trends and emerging research topics as it captures more recent contributions (Vogel and Güttel, 2012).

Bibliographic coupling has been used in this paper to identify current research issues in the LSCM H-Classic literature and to provide further valuable information through clustering and content analysis. Figure 12 presents the LSCM citation classics bibliographic network. The nodes are citations of papers, while the links are bibliographic couplings, i.e., the number of references that any two nodes share. In VOSviewer, the size of an item's label is determined by the weight of the item, while the color is determined by the cluster to which the item belongs. The distance between two items in the visualization

indicates the items' approximate relatedness (van Eck and Waltman, 2010).

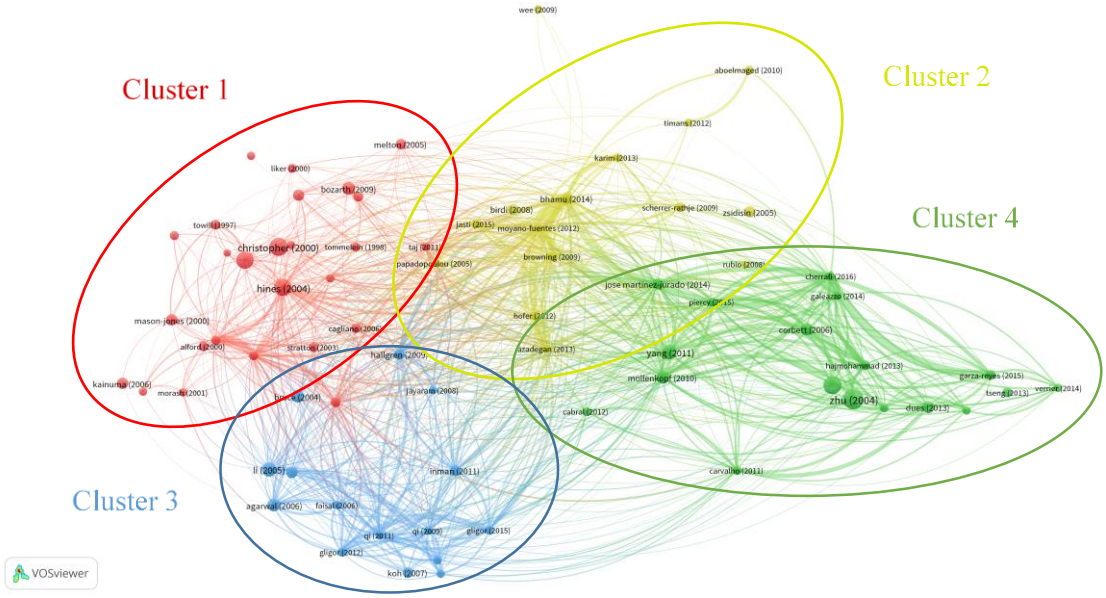

Figure 12 – Bibliographic coupling of LSCM H-Classic papers

The bibliographic coupling performed with VOSviewer software has enabled to identify different clusters in the H-Classics literature (see Figure 11). *Cluster 1* (26 papers/red) contains literature reviews focused on lean's foundations: the implementation of lean production or lean manufacturing, the role of supply chain integration, the benefits of the adoption of lean along the supply chain, and the appearance of the automotive industry as the key context for LSCM research. *Cluster 2* (15 papers/yellow) includes papers on the state-of-the-art of LSCM and focuses on the adoption of lean at the internal level and the effects of LSCM on performance. In *Cluster 3* (15 papers/blue), most of the studies are related to an examination of the relationships and trade-offs between lean and agile. *Cluster 4* (18 papers/green) includes the highly cited literature on LSCM and sustainability, mainly through the study of the green strategy.

3.4. Content analysis and key findings

The clustering process allows us to outline the different research areas addressed by the H-Classics papers in the LSCM field. Following the research clusters identified in the bibliographic coupling analysis, the LSCM highly cited literature has been classified into four main research areas:

Research area 1: LSCM foundations and implementation (Clusters 1 and 2). This research area is mainly formed of highly cited papers published in the early 2000s, meaning that they can be considered the most influential initial studies of LSCM. This literature has focused on the principles and foundations of lean implementation and the adoption and benefits of lean practices, with the manufacturing industry taking center stage. Some H-Classic papers in this research area have reviewed the literature on lean from a broad point of view (Hines *et al.*, 2004; Moyano-Fuentes and Sacristán-Díaz, 2012; Papadopoulou and Özbayrak, 2005) while others have focused specifically on lean in manufacturing at the internal level (Bhamu and Singh Sangwan, 2014; Jasti and Kodali, 2015a). Some highly cited papers have focused on lean implementation (Karim and Arif-Uz-Zaman, 2013; Scherrer-Rathje *et al.*, 2009; Timans *et al.*, 2012), while others have studied the benefits and effects of lean on performance (Browning and Heath, 2009;

Hofer *et al.*, 2012; Taj and Morosan, 2011; Wee and Wu, 2009). The extension of lean along the supply chain and the relevance of this integration have been also addressed (Cagliano *et al.*, 2006; MacDuffie and Helper, 1997). Regarding contextual factors, some authors in this field have paid attention to environmental complexity (Azadegan *et al.*, 2013; Bozarth *et al.*, 2009; Tommelein, 1998) while other citation classic papers in this research area deal with the automotive industry (Alford *et al.*, 2000; Liker and Wu, 2000; Wee and Wu, 2009).

Research area 2: Lean-agile supply chain and performance assessment (Cluster 3). Citation classics in this research area are distributed throughout the whole period. The joint study of LSCM and agile can be considered a constant in the research literature, as shown by the H-Classic papers in the field. Most of the highly cited papers in this research area have focused on the study of lean and agile and their impact on different performance dimensions, such as operational performance (Bruce *et al.*, 2004; Hallgren and Olhager, 2009), operational and financial performance (Qi *et al.*, 2009), and operational, financial, and market performance (Inman *et al.*, 2011; Qrunfleh and Tarafdar, 2013, 2014). Other authors have studied the relevance of supply chain design (Vonderembse *et al.*, 2006) and the role of distribution and logistics (Gligor and Holcomb, 2012). Finally, some authors have focused on the role in performance of a particular context's characteristics, e.g., environmental uncertainty (Agarwal *et al.*, 2006; Gligor *et al.*, 2015; Nishat Faisal *et al.*, 2006; Qi *et al.*, 2011).

Research area 3: The role of sustainability (Cluster 4). Most of the highly cited papers in this research area have been published in the 2010s, so interest in sustainability issues can be considered to be relatively recent in the LSCM field. Despite the later publication of these studies, they can be observed to have great influence in the research community as they are citation classic papers in the field. Some citation classics in this area have reviewed the research literature with a connection between LSCM and sustainability (Kleindorfer *et al.*, 2009; Martínez-Jurado and Moyano-Fuentes, 2014), and with a focus on lean and green practices in particular (Dües *et al.*, 2013; Garza-Reyes, 2015; Mollenkopf *et al.*, 2010). Some authors analyze relationships between LSCM and sustainability with the inclusion of Six Sigma (Cherrafi *et al.*, 2016), supply chain strategies such as agile, green, and resilient (Cabral *et al.*, 2012; Carvalho *et al.*, 2011) and resilient and green (Govindan *et al.*, 2014). In addition, most of the highly cited papers in this research area have focused on the impact of lean and green practices on performance. In this sense, some authors have focused on environmental performance (Corbett and Klassen, 2006; Galeazzo *et al.*, 2014; Hajmohammad *et al.*, 2013), market and financial performance (Yang *et al.*, 2011), environmental and economic performance (Zhu and Sarkis, 2004), and economic, environmental, and social performance (Azevedo *et al.*, 2012; Verrier *et al.*, 2014).

Figure 13 presents a conceptual diagram of the LSCM citation classics by research area from where some research streams emerge. In this case, all the articles fall within a minimum of one category, while some of them occur within two or more groups and overlap with various research streams. The research streams –organizational functions, impact on performance, sector, context, compatibility with other strategies, and proposal of models– are the result of a profound content analysis of the highly cited papers carried out. The three categories represented by RA1 (orange), RA2 (blue), and RA3 (green) classify the highly cited articles according to their research area, i.e., RA1: *LSCM foundations and implementation*, RA2: *Lean-agile supply chain and performance assessment*, and RA3: *The role of*

sustainability, respectively. Regarding organizational functions, supply chain and manufacturing and production processes have received almost undivided attention from the research community, mainly through citation classics dealing with the LSCM foundations and implementation. Operational and financial aspects have been the most influential elements concerning the LSCM performance dimensions, mostly in those articles that study the LSCM implementation and the lean-agile dyad. The manufacturing and automotive industry have attracted special attention through those documents centered on the LSCM foundations. Finally, the study of the similarities, divergences, and synergies between lean-agile and lean-green has also generated interest.

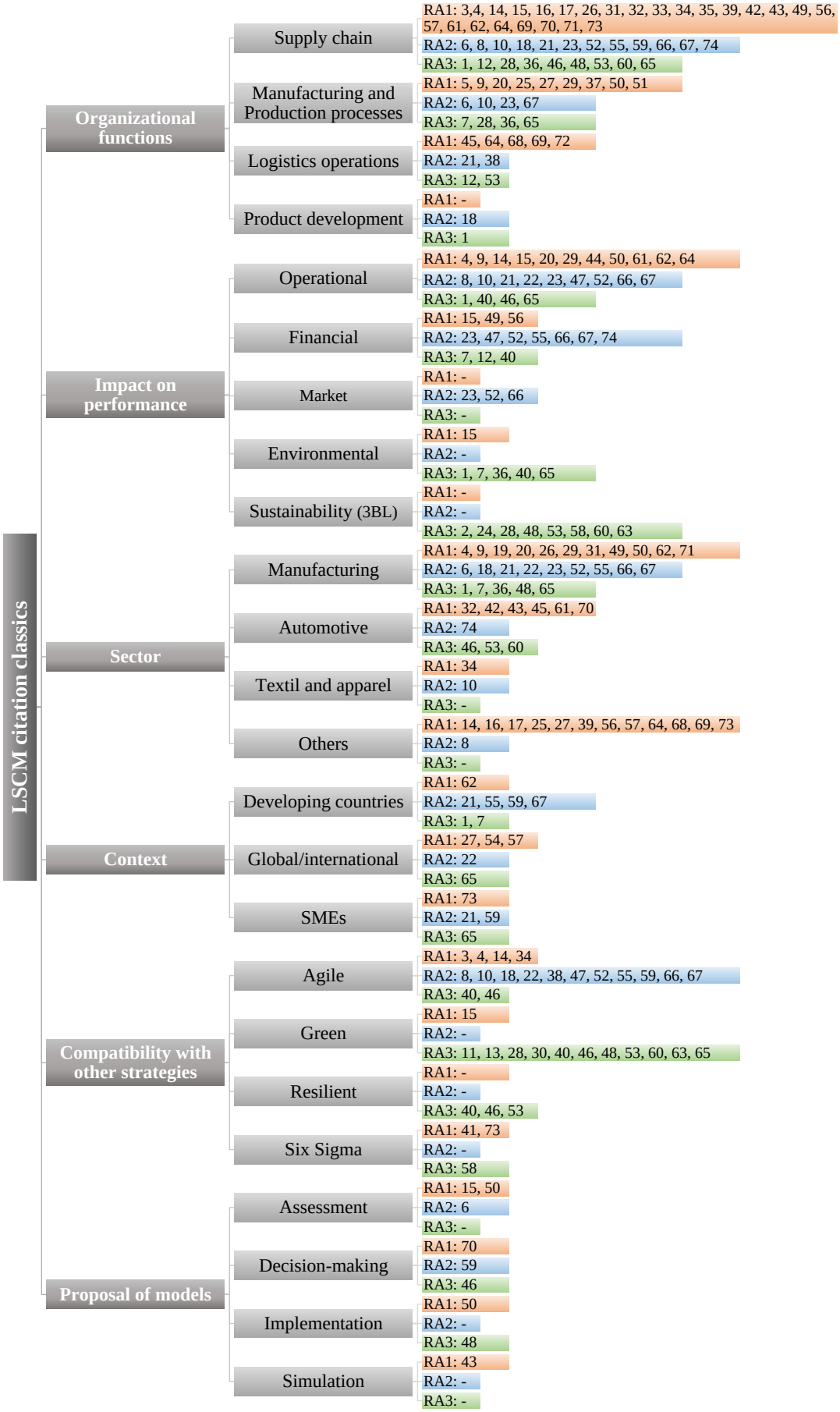

Figure 13 – Conceptual diagram of LSCM H-Classic papers

4. Conclusions

The research on LSCM has grown in recent years, as the diverse literature reviews on the topic demonstrate (Bhamu and Singh Sangwan, 2014; Jasti and Kodali, 2015a, 2015b; Martínez-Jurado and Moyano-Fuentes, 2014; Moyano-Fuentes and Sacristán-Díaz, 2012). Also, bibliometrics has been used to review the LSCM field (Garcia-Buendia *et al.*, 2020; de Sousa *et al.*, 2018). Our work maps the LSCM research focusing on the most relevant contributions published in the field.

Citation classics offer an overview of the papers that have attracted remarkable interest in the scientific community and are considered the basis of a research field. These highly cited papers enable to discover potentially valuable information for the development of a field and to understand the past, present, and future of its scientific structure. Therefore, a bibliometric study has been performed to identify the citation classics in the LSCM research field. For this, the concept of H-Classics (Martínez *et al.*, 2014) was used to characterize the highly cited papers. In the present study, 74 citation classics have been identified and several aspects of the H-core of the LSCM research field have been analyzed. As a novelty, compared to previous citation classic studies based on the H-Classics method, in order to give a deeper overview of the research field this study combines a descriptive analysis, which provides a preliminary overview of the research field, a bibliometric analysis, based on the production and influence of the most relevant actors in the H-Classics literature, and a network analysis, focused on the bibliometric relationships between these highly cited papers. To the authors' best knowledge, this is the first study to analyze the highly cited papers in the LSCM literature that can be considered important reference points in the research field. In addition, this work includes a network analysis of the citation classics using co-occurrence and bibliographic coupling, which gives additional value to the H-Classics method.

According to the descriptive analysis carried out, seventy-four highly cited papers were published in the LSCM field during the 1996-2019 period. The year in which the most citation classics (7 documents) were published was 2009. Concerning the methodology used, quantitative, qualitative, and conceptual approaches have been equally valued in the LSCM citation classics. The most contributing journals to the field have been the *International Journal of Production Economics* and *International Journal of Operations & Production Management*.

Regarding the bibliometric analysis, professors Holweg, M. and Cruz-Machado, V. from the University of Cambridge (UK) and Universidade Nova de Lisboa (Portugal), respectively, were found to be the authors who have most contributed to the set of H-Classics in LSCM. Cardiff University (UK) was the main institutional contributor to this field. The USA was the leading country in the production of highly cited papers, closely followed by the UK. About the collaboration patterns between authors, 25% of the citation classics were the result of international collaboration. The most commonly used keywords in the LSCM H-Classic literature are related to lean and supply chain management, although environmental management, agility, and performance assessment also rank highly. The identification of the most cited papers in LSCM through the H-Classics method and the descriptive and bibliometric analyses enabled us to answer RQ1.

The network analysis has provided an overview of the evolution of the keywords in the highly

cited papers through keyword co-occurrence analysis. The recent appearance of keywords such as "environmental uncertainty", "green", and "resilient" demonstrate that increasing attention is being paid in the LSCM field to environmental complexity and sustainability. Bibliographic coupling of the citation classics has enabled to identify different clusters in the H-Classics literature, related to lean's foundations, the effects of LSCM on performance, the relationships and trade-offs between lean and agile, and sustainability, among others.

Finally, the content analysis with the key findings describe the three main research areas found in the LSCM research literature based on the clustering process: 1) *LSCM foundations and implementation*, focused on the principles and basis of lean implementation, the benefits of lean practices, and the manufacturing industry as the preferred context where attention has been directed; 2) *Lean-agile supply chain and performance assessment*, dealing with the joint study of lean and agile strategies, their impact on different performance dimensions, and the effects of specific contextual characteristics and 3) *The role of sustainability*, with papers that analyze the relationship between LSCM and sustainability, and the impact of lean and green practices on different kinds of performance. The network and content analyses enabled us to answer RQ2.

4.1. Academic and managerial implications

This study provides a useful insight into the development of the LSCM area of knowledge as it reveals the scientific actors who have made the most leading research contributions to its development. This study can, therefore, help researchers who are initiating their work in the LSCM knowledge area, as it identifies the most influential research areas and leading journals, authors, institutions, and countries in this research field. It is also useful for senior researchers in the field, as it explores the state-of-the-art of LSCM and identifies the most relevant works and the main research areas in the field. Besides, it identifies renowned authors and institutions for collaborations and suitable journals to which works on LSCM could be submitted. Lastly, this analysis can enrich other bibliometric studies of this topic developed with different techniques.

This work also attempts to encourage the transfer of research results from academia to industry. From a practical perspective, our analysis provides an easy access to the most relevant scientific knowledge on LSCM for managers and practitioners. This study identifies the main research topics and the most influential actors in the field, which makes it easier to find academic support and develop collaborative research, university-industry research projects, and academic consulting, for example. Managers aiming to implement LSCM may find useful studies that examine and discuss the main principles and foundations of this strategy. The main benefits and advantages derived from the adoption of LSCM, mainly affecting operational and financial performance but also sustainability, can be consulted in our study. In this sense, managers may feel encouraged to implement LSCM in their firms if they pursue the achievement of competitive advantage. Documents analyzing the role of the context are also included in our findings, so practitioners might find beneficial some scientific information likely to help in uncertain and complex environments. Interesting aspects of the potential synergies between LSCM and other supply chain strategies, i.e. agile, green, resilient, and Six Sigma, can stimulate and improve the supply chain design. Supply chain and focal firm performance can experience improvements derived from the joint implementation of LSCM and other supply chain strategies, so managers should be aware

of the tradeoffs of these relationships. Insights regarding sustainability issues and the impact of lean and green practices on performance can reduce practitioners' hesitation in focusing on sustainability to achieve better results.

4.2. Limitations and agenda for future research

This study presents some major limitations. On the one hand, the use of a single database and the inclusion and exclusion criteria determined the papers selected for the study. Therefore, the use of a larger number of databases and the choice of other inclusion and exclusion criteria could give different results. On the other hand, H-index presents some limitations (Alonso *et al.*, 2009): H-index is academic-field dependent, it takes into account self-citations, it rewards academic age or disadvantages newcomers. Nevertheless, previous literature has shown that it can be used to develop a good procedure to identify highly cited literature (Martínez *et al.*, 2014).

Our study enables us to find out the most influential research lines and topics in the LSCM field, and the observation of the latest thematic trends makes it possible to suggest some foreseeable research directions in the area of knowledge. The research about sustainability issues is likely to receive increasing attention from the scientific community in the form of citations. The concern about social and environmental aspects is foreseeable to be a hot topic in the next years given to the recent changes caused by the pandemic worldwide. Similarly, the study of lean and resilient in supply chain management may be a growing area in terms of citations because of the expected higher numbers of contributions to this topic concerning the current context that organizations are facing. It is also contemplated an increase in the number of citations for works focused on performance assessment: the current context in which the supply chain develops its activity requires urgent attention to the evaluation of the performance outcomes derived from LSCM and the adaptation of traditional ways of measuring them. Regarding the LSCM implementation, it is likely to witness an increase in the citations received by papers dealing with the role of information technologies in LSCM, given the foreseeable increase in the use of emerging technologies in the industry 4.0 context to manage the supply chain.

References

Agarwal, A., Shankar, R. and Tiwari, M.K. (2006), "Modeling the metrics of lean, agile and leagile supply chain: An ANP-based approach", *European Journal of Operational Research*, Vol. 173 No. 1, pp. 211–225.

Alford, D., Sackett, P. and Nelder, G. (2000), "Mass customisation — an automotive perspective", *International Journal of Production Economics*, Vol. 65 No. 1, pp. 99–110.

Alonso, S., Cabrerizo, F.J., Herrera-Viedma, E. and Herrera, F. (2009), "h-Index: A review focused in its variants, computation and standardization for different scientific fields", *Journal of Informetrics*, Vol. 3 No. 4, pp. 273–289.

Ardito, L., Scuotto, V., Del Giudice, M. and Petruzzelli, A.M. (2019), "A bibliometric analysis of research on Big Data analytics for business and management", *Management Decision*, Vol. 57 No. 8, pp. 1993–2009.

Arshad, A.I., Ahmad, P., Karobari, M.I., Asif, J.A., Alam, M.K., Mahmood, Z., Abd Rahman, N., *et al.* (2020), "Antibiotics: A Bibliometric Analysis of Top 100 Classics", *Antibiotics*, Vol. 9 No. 5, p. 219.

Azadegan, A., Patel, P.C., Zangoueinezhad, A. and Linderman, K. (2013), "The effect of environmental complexity and environmental dynamism on lean practices", *Journal of Operations Management*, Elsevier B.V., Vol. 31 No. 4, pp. 193–212.

Azevedo, S.G., Carvalho, H., Duarte, S. and Cruz-Machado, V. (2012), "Influence of Green and Lean Upstream Supply Chain Management Practices on Business Sustainability", *IEEE Transactions on Engineering Management*, Vol. 59 No. 4, pp. 753–765.

Baltussen, A. and Kindler, C.H. (2004), "Citation classics in critical care medicine", *Intensive Care Medicine*, Vol. 30 No. 5, pp. 902–910.

Bhamu, J. and Singh Sangwan, K. (2014), "Lean manufacturing: literature review and research issues", *International Journal of Operations & Production Management*, Vol. 34 No. 7, pp. 876–940.

Bozarth, C.C., Warsing, D.P., Flynn, B.B. and Flynn, E.J. (2009), "The impact of supply chain complexity on

manufacturing plant performance", *Journal of Operations Management*, Vol. 27 No. 1, pp. 78–93.
Browning, T.R. and Heath, R.D. (2009), "Reconceptualizing the effects of lean on production costs with evidence from the F-22 program", *Journal of Operations Management*, Vol. 27 No. 1, pp. 23–44.
Bruce, M., Daly, L. and Towers, N. (2004), "Lean or agile: A solution for supply chain management in the textiles and clothing industry?", *International Journal of Operations & Production Management*, Vol. 24 No. 2, pp. 151–170.
Cabral, I., Grilo, A. and Cruz-Machado, V. (2012), "A decision-making model for Lean, Agile, Resilient and Green supply chain management", *International Journal of Production Research*, Vol. 50 No. 17, pp. 4830–4845.
Cabrerizo, F.J., Martínez, M.A., Cobo, M.J., Lázaro-Rodríguez, P., López-Gijón, J. and Herrera-Viedma, E. (2017), "Aggregation operators in group decision making: Identifying citation classics via H-classics", *Procedia Computer Science*, Vol. 122, pp. 902–909.
Cagliano, R., Caniato, F. and Spina, G. (2006), "The linkage between supply chain integration and manufacturing improvement programmes", *International Journal of Operations & Production Management*, Vol. 26 No. 3, pp. 282–299.
Carvalho, H., Duarte, S. and Cruz Machado, V. (2011), "Lean, agile, resilient and green: divergencies and synergies", *International Journal of Lean Six Sigma*, Vol. 2 No. 2, pp. 151–179.
Cassar Gheiti, A.J., Downey, R.E., Byrne, D.P., Molony, D.C. and Mulhall, K.J. (2012), "The 25 Most Cited Articles in Arthroscopic Orthopaedic Surgery", *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, Vol. 28 No. 4, pp. 548–564.
Cherrafi, A., Elfezazi, S., Chiarini, A., Mokhlis, A. and Benhida, K. (2016), "The integration of lean manufacturing, Six Sigma and sustainability: A literature review and future research directions for developing a specific model", *Journal of Cleaner Production*, Vol. 139, pp. 828–846.
Ciano, M.P., Pozzi, R., Rossi, T. and Strozzi, F. (2019), "How IJPR has addressed 'lean': a literature review using bibliometric tools", *International Journal of Production Research*, Taylor & Francis, Vol. 57 No. 15–16, pp. 5284–5317.
Cobo, M.J., López-Herrera, A.G., Herrera-Viedma, E. and Herrera, F. (2012), "SciMAT: A new science mapping analysis software tool", *Journal of the American Society for Information Science and Technology*, Vol. 63 No. 8, pp. 1609–1630.
Corbett, C.J. and Klassen, R.D. (2006), "Extending the Horizons: Environmental Excellence as Key to Improving Operations", *Manufacturing & Service Operations Management*, Vol. 8 No. 1, pp. 5–22.
Dües, C.M., Tan, K.H. and Lim, M. (2013), "Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain", *Journal of Cleaner Production*, Vol. 40, pp. 93–100.
van Eck, N.J. and Waltman, L. (2010), "Software survey: VOSviewer, a computer program for bibliometric mapping", *Scientometrics*, Vol. 84 No. 2, pp. 523–538.
van Eck, N.J. and Waltman, L. (2014), "Visualizing Bibliometric Networks", *Measuring Scholarly Impact*, available at:https://doi.org/10.1007/978-3-319-10377-8_13.
Eggert, A., Kleinaltenkamp, M. and Kashyap, V. (2019), "Mapping value in business markets: An integrative framework", *Industrial Marketing Management*, Vol. 79, pp. 13–20.
Fahimnia, B., Sarkis, J. and Davarzani, H. (2015), "Green supply chain management: A review and bibliometric analysis", *International Journal of Production Economics*, Elsevier, Vol. 162, pp. 101–114.
Feijoo, J.F., Limeres, J., Fernández-Varela, M., Ramos, I. and Diz, P. (2014), "The 100 most cited articles in dentistry", *Clinical Oral Investigations*, Vol. 18 No. 3, pp. 699–706.
Filser, L.D., da Silva, F.F. and de Oliveira, O.J. (2017), "State of research and future research tendencies in lean healthcare: a bibliometric analysis", *Scientometrics*, Vol. 112 No. 2, pp. 799–816.
Flyvbjerg, B. and Turner, J.R. (2018), "Do classics exist in megaproject management?", *International Journal of Project Management*, Vol. 36 No. 2, pp. 334–341.
Galeazzo, A., Furlan, A. and Vinelli, A. (2014), "Lean and green in action: interdependencies and performance of pollution prevention projects", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 85, pp. 191–200.
Garcia-Buendia, N., Moyano-Fuentes, J., Maqueira-Marín, J.M. and Cobo, M.J. (2020), "22 Years of Lean Supply Chain Management: a science mapping-based bibliometric analysis", *International Journal of Production Research*, Taylor and Francis Ltd., pp. 1–21.
Garfield, E. (1977), "Introducing Citation Classics: The Human Side of Scientific Reports", *Current Contents*, Vol. 1, pp. 5–7.
Garfield, E. (1979), *Citation Indexing - Its Theory and Application in Science, Technology, and Humanities*, John Wiley & Sons, New York.
Garza-Reyes, J.A. (2015), "Lean and green – a systematic review of the state of the art literature", *Journal of Cleaner Production*, Vol. 102, pp. 18–29.
Gazni, A., Sugimoto, C.R. and Didegah, F. (2012), "Mapping world scientific collaboration: Authors, institutions, and countries", *Journal of the American Society for Information Science and Technology*, Vol. 63 No. 2, pp. 323–335.
Gligor, D.M., Esmark, C.L. and Holcomb, M.C. (2015), "Performance outcomes of supply chain agility: When should you be agile?", *Journal of Operations Management*, Elsevier B.V., Vol. 33–34 No. 1, pp. 71–82.
Gligor, D.M. and Holcomb, M.C. (2012), "Understanding the role of logistics capabilities in achieving supply chain agility: a systematic literature review", edited by Wilding, R.*Supply Chain Management: An International Journal*, Vol. 17 No. 4, pp. 438–453.
Govindan, K., Azevedo, S.G., Carvalho, H. and Cruz-Machado, V. (2014), "Impact of supply chain management practices on sustainability", *Journal of Cleaner Production*, Vol. 85, pp. 212–225.

Hajmohammad, S., Vachon, S., Klassen, R.D. and Gavronski, I. (2013), "Lean management and supply management: their role in green practices and performance", *Journal of Cleaner Production*, Vol. 39, pp. 312–320.

Hallgren, M. and Olhager, J. (2009), "Lean and agile manufacturing: external and internal drivers and performance outcomes", *International Journal of Operations & Production Management*, Vol. 29 No. 10, pp. 976–999.

Hassan, N.R. and Mathiassen, L. (2018), "Distilling a body of knowledge for information systems development", *Information Systems Journal*, Vol. 28 No. 1, pp. 175–226.

Hines, P., Holweg, M. and Rich, N. (2004), "Learning to evolve", *International Journal of Operations & Production Management*, Vol. 24 No. 10, pp. 994–1011.

Hirsch, J.E. (2005), "An index to quantify an individual's scientific research output", *Proceedings of the National Academy of Sciences*, Vol. 102 No. 46, pp. 16569–16572.

Hofer, C., Eroglu, C. and Rossiter Hofer, A. (2012), "The effect of lean production on financial performance: The mediating role of inventory leanness", *International Journal of Production Economics*, Elsevier, Vol. 138 No. 2, pp. 242–253.

Ibrahim, G.M., Carter Snead, O., Rutka, J.T. and Lozano, A.M. (2012), "The most cited works in epilepsy: Trends in the 'Citation Classics'", *Epilepsia*, Vol. 53 No. 5, pp. 765–770.

Inman, R.A., Sale, R.S., Green, K.W. and Whitten, D. (2011), "Agile manufacturing: Relation to JIT, operational performance and firm performance", *Journal of Operations Management*, Vol. 29 No. 4, pp. 343–355.

Jasti, N.V.K. and Kodali, R. (2015a), "Lean production: literature review and trends", *International Journal of Production Research*, Vol. 53 No. 3, pp. 867–885.

Jasti, N.V.K. and Kodali, R. (2015b), "A critical review of lean supply chain management frameworks: proposed framework", *Production Planning & Control*, Vol. 26 No. 13, pp. 1051–1068.

Karim, A. and Arif-Uz-Zaman, K. (2013), "A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations", *Business Process Management Journal*, Vol. 19 No. 1, pp. 169–196.

Kessler, M.M. (1963), "Bibliographic coupling between scientific articles", *American Documentation*, Vol. 14 No. 1, pp. 10–25.

Kleindorfer, P.R., Singhal, K. and Wassenhove, L.N. (2009), "Sustainable Operations Management", *Production and Operations Management*, Vol. 14 No. 4, pp. 482–492.

Lamming, R. (1996), "Squaring lean supply with supply chain management", *International Journal of Operations & Production Management*, Vol. 16 No. 2, pp. 183–196.

Liker, J.K. and Wu, Y.C. (2000), "Japanese automakers, U.S. suppliers and supply-chain superiority", *MIT Sloan Management Review*, Vol. 42 No. 1, pp. 81–93.

MacDuffie, J.P. and Helper, S. (1997), "Creating Lean Suppliers: Diffusing Lean Production through the Supply Chain", *California Management Review*, Vol. 39 No. 4, pp. 118–151.

Maingard, J., Phan, K., Ren, Y., Kok, H.K., Thijs, V., Hirsch, J.A., Lee, M.J., *et al.* (2018), "The 100 most cited articles in the endovascular management of intracranial aneurysms", *Journal of NeuroInterventional Surgery*, Vol. 10 No. 9, pp. 859–868.

Martínez-Jurado, P.J. and Moyano-Fuentes, J. (2014), "Lean Management, Supply Chain Management and Sustainability: A Literature Review", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 85, pp. 134–150.

Martínez, M.A., Herrera, M., López-Gijón, J. and Herrera-Viedma, E. (2014), "H-Classics: characterizing the concept of citation classics through H-index", *Scientometrics*, Vol. 98 No. 3, pp. 1971–1983.

Mishra, D., Gunasekaran, A., Papadopoulos, T. and Childe, S.J. (2018), "Big Data and supply chain management: a review and bibliometric analysis", *Annals of Operations Research*, Springer US, Vol. 270 No. 1–2, pp. 313–336.

Mollenkopf, D., Stolze, H., Tate, W.L. and Ueltschy, M. (2010), "Green, lean, and global supply chains", edited by Halldórsson, Á.*International Journal of Physical Distribution & Logistics Management*, Vol. 40 No. 1/2, pp. 14–41.

Moral-Munoz, J.A., Cobo, M.J., Chiclana, F., Collop, A. and Herrera-Viedma, E. (2016), "Analyzing Highly Cited Papers in Intelligent Transportation Systems", *IEEE Transactions on Intelligent Transportation Systems*, Vol. 17 No. 4, pp. 993–1001.

Moyano-Fuentes, J. and Sacristán-Díaz, M. (2012), "Learning on lean: a review of thinking and research", *International Journal of Operations & Production Management*, Vol. 32 No. 5, pp. 551–582.

Nishat Faisal, M., Banwet, D.K. and Shankar, R. (2006), "Mapping supply chains on risk and customer sensitivity dimensions", *Industrial Management & Data Systems*, Vol. 106 No. 6, pp. 878–895.

Papadopoulou, T.C. and Özbayrak, M. (2005), "Leanness: experiences from the journey to date", *Journal of Manufacturing Technology Management*, Vol. 16 No. 7, pp. 784–807.

Ponce, F.A. and Lozano, A.M. (2011), "The most cited works in Parkinson's disease", *Movement Disorders*, Vol. 26 No. 3, pp. 380–390.

Qi, Y., Boyer, K.K. and Zhao, X. (2009), "Supply Chain Strategy, Product Characteristics, and Performance Impact: Evidence from Chinese Manufacturers", *Decision Sciences*, Vol. 40 No. 4, pp. 667–695.

Qi, Y., Zhao, X. and Sheu, C. (2011), "The Impact of Competitive Strategy and Supply Chain Strategy on Business Performance: The Role of Environmental Uncertainty*", *Decision Sciences*, Vol. 42 No. 2, pp. 371–389.

Qrunfleh, S. and Tarafdar, M. (2013), "Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement", *Supply Chain Management: An International Journal*, Vol. 18 No. 6, pp. 571–582.

Qrunfleh, S. and Tarafdar, M. (2014), "Supply chain information systems strategy: Impacts on supply chain performance and firm performance", *International Journal of Production Economics*, Elsevier, Vol. 147 No.

PART B, pp. 340–350.

Rosenberg, A.L., Tripathi, R.S. and Blum, J. (2010), "The most influential articles in critical care medicine", *Journal of Critical Care*, Vol. 25 No. 1, pp. 157–170.

Scherrer-Rathje, M., Boyle, T.A. and Deflorin, P. (2009), "Lean, take two! Reflections from the second attempt at lean implementation", *Business Horizons*, Vol. 52 No. 1, pp. 79–88.

Small, H. (1973), "Co-citation in the Scientific Literature : A New Measure of the Relationship Between Two Documents", *Journal of the American Society for Information Science*, Vol. 24 No. 4, pp. 265–269.

Smith, D.R. (2007), "Ten citation classics from the New Zealand Medical Journal.", *The New Zealand Medical Journal*, Vol. 120 No. 1267, p. U2871.

de Sousa, T.B., Furtado, F.R.C., Ferri, O.E. da S., Batista, A., Varella, W.A., Pinto, C.E., Yabarrena, J.M.S.C., *et al.* (2018), "Scientific Production on Lean Supply Chains Published in Journals Indexed by SCOPUS and Web of Science Databases: A Bibliometric Study", *World Academy of Science, Engineering and Technology International Journal of Industrial and Manufacturing Engineering*, Vol. 12 No. 6, pp. 799–806.

Stack, S. (2012), "Citation Classics in Suicide and Life Threatening Behavior: A Research Note", *Suicide and Life-Threatening Behavior*, Vol. 42 No. 6, pp. 628–639.

Taj, S. and Morosan, C. (2011), "The impact of lean operations on the Chinese manufacturing performance", *Journal of Manufacturing Technology Management*, Vol. 22 No. 2, pp. 223–240.

Tam, W.W.S., Wong, E.L.Y., Wong, F.C.Y. and Hui, D.S.C. (2013), "Citation classics: Top 50 cited articles in 'respiratory system'", *Respirology*, Vol. 18 No. 1, pp. 71–81.

Timans, W., Antony, J., Ahaus, K. and van Solingen, R. (2012), "Implementation of Lean Six Sigma in small- and medium-sized manufacturing enterprises in the Netherlands", *Journal of the Operational Research Society*, Vol. 63 No. 3, pp. 339–353.

Tommelein, I.D. (1998), "Pull-Driven Scheduling for Pipe-Spool Installation: Simulation of Lean Construction Technique", *Journal of Construction Engineering and Management*, Vol. 124 No. 4, pp. 279–288.

Verrier, B., Rose, B., Caillaud, E. and Remita, H. (2014), "Combining organizational performance with sustainable development issues: the Lean and Green project benchmarking repository", *Journal of Cleaner Production*, Vol. 85, pp. 83–93.

Vogel, R. and Güttel, W.H. (2012), "The Dynamic Capability View in Strategic Management: A Bibliometric Review", *International Journal of Management Reviews*, Vol. 15 No. 4, p. n/a-n/a.

Vonderembse, M.A., Uppal, M., Huang, S.H. and Dismukes, J.P. (2006), "Designing supply chains: Towards theory development", *International Journal of Production Economics*, Vol. 100 No. 2, pp. 223–238.

Wee, H.M. and Wu, S. (2009), "Lean supply chain and its effect on product cost and quality: a case study on Ford Motor Company", *Supply Chain Management: An International Journal*, Vol. 14 No. 5, pp. 335–341.

Yang, M.G., Hong, P. and Modi, S.B. (2011), "Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms", *International Journal of Production Economics*, Vol. 129 No. 2, pp. 251–261.

Zhu, Q. and Sarkis, J. (2004), "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises", *Journal of Operations Management*, Vol. 22 No. 3, pp. 265–289.