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RESEARCH ARTICLE

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A systematic literature review to integrate lean, agile, resilient, green and sustainable paradigms in the supply chain management

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Abstract

The main focus of this study is to conduct a systematic literature review to integrate lean, agile, resilient, green and sustainable (LARGS) paradigms in the supply chain (SC) domain. To achieve this aim, several research questions were designed: First, how to locate LARGS research in context of SC domain? For this, it is important to understand which types of research articles should be selected for the study? Further, where such studies were conducted (geographical location)? Second, what is the focus of research in LARGS paradigm in SCs? For this, it is important to study, which types of industries or sectors have been targeted in literature? In addition, which tools and techniques have been used mostly? Third, what are the current trends in the relationships of LARGS paradigms, among themselves, and with SC performance measures? Fourth, what are the emerging issues, unexplored areas in this field, based on these what could be future research avenues in this subject domain have been proposed? A total of 160 relevant articles published during 1999–2019 were used for analysis. Based on analysis, findings are summarised, and main research issues and possible future research directions in LARGS paradigms in SCs are highlighted.

KEYWORDS
agile, green, lean, resilient, supply chain management, sustainable development

1 | INTRODUCTION

Supply chain management (SCM) refers to within and in-between linkages of suppliers, focal firms, distributors and customers/consumers, to maintain the efficient and effective flow of materials, information and money to meet the stakeholders' requirements (Azevedo, Carvalho, & Cruz-Machado, 2011a; Carvalho, Azevedo, Duarte, & Cruz-Machado, 2011; Azevedo, Carvalho, Duarte, & Cruz-Machado, 2012). However, in the past few decades, supply chains (SCs) and their various stages have been facing various internal (operational) as well as external challenges. These external challenges may be associated with environment or nature and societies (Dahlmann & Roehrich, 2019; Dey, Malesios, De, Chowdhury, & Abdelaziz, 2019; Tasdemir & Gazo, 2018), technological disruptions with shorter product life cycle (Carvalho, Azevedo, & Cruz-Machado, 2010, 2012; Carvalho, Barroso, Machado, Azevedo, & Cruz-Machado, 2012), global sourcing (Parkouhi, Ghadikolaei, & Lajimi, 2019) and customers' demand uncertainty (Lotfi & Saghiri, 2018; Singh & Vinodh, 2017).

These all challenges or issues make SC and its various stages inefficient, volatile, vulnerable and turbulent (Azevedo, Govindan, Carvalho, & Cruz-Machado, 2013; Centobelli, Cerchione, and Ertz (2020); Lotfi & Saghiri, 2018).

In addition, SC is facing various pressures from all stakeholders for sustainable business development (Chang, Tsai, & Huang, 2019). Leon and Calvo-Amodio (2017); Rajeev, Pati, Padhi, and Govindan (2017) and Digalwar et al. (2020) suggested that SC should include the dimension of social and environmental performance measures into the conventional performance metrics. In addition to that, Luthra, Garg, and Haleem (2016); Orazalin (2020); Ciccullo, Pero, Caridi, Gosling, and Purvis (2018) and Zhan, Tan, Ji, and Tseng (2018) discussed the relevance of sustainability. Abdollahi, Arvan, and Razmi (2015) discussed the need for dynamism in SC and their various stages, to remain competitive and meet the stakeholders' expectations effectively and efficiently.

Thus, all these issues attract the scholar to investigate how the various existing and emerging management philosophies or paradigms help in avoiding the aforementioned challenges and achieve their objectives to remain competitive in a SC.

Many research studies authored by Mohammed, Harris, Soroka, and Nujoom (2019); Sen, Datta, and Mahapatra (2017); Govindan, Azevedo, Carvalho, and Cruz-Machado (2015); Sayyadi Tooranloo, Alavi, and Saghafi (2018); Chavez, Yu, Sadiq Jajja, Lecuna, and Fynes (2020) and Thanki and Thakkar (2016) highlighted the importance of various evolving practices and theories and suggested to restructuring the traditional management philosophies such as lean and agile to survive. Wong, Wong, and Boon-itt (2018); Luthra et al. (2016); Azevedo, Carvalho, and Cruz-Machado (2016) and Dey et al. (2019) discussed the role of various emerging paradigms or integration of paradigms such as lean, agile, resilient, and green (LARG), green with sustainability, and leanness, greenness with agility and resilience in this highly competitive environment for supply chains. In the past years, the research on the integration of various combinations of lean, agile, resilient, green and sustainable (LARGS) paradigms in SC domain got enough attention from academic researchers and practitioners. However, no such research study was conducted that discusses how many integrations of above-mentioned paradigms are possible. Also, how research based on these paradigms was evolved in the supply chain domain? The previous research studies discussed the synergies and differences among these paradigms and their attributes considering few at a time. Naylor, Naim, and Berry (1999), Christopher (2000), Mason-Jones, Naylor, and Towill (2000), Bruce, Daly, and Towers (2004), Vonderembse, Uppal, Huang, and Dismukes (2006) and Agarwal, Shankar, and Tiwari (2006) discussed linkage of lean and agile (LA) paradigms; Christopher and Peck (2004) discussed linkage of agile and resilient paradigms; and Dües, Tan, and Lim (2013) and Lartey et al. (2020) discussed linkage between lean and green paradigms. Carvalho, Duarte, and Cruz-Machado (2011) explain the linkage of LARG paradigms. However, no study considers sustainable standards in addition in their framework. Therefore, to fill this research gap, this study is a unique research study that seeks integration of LARGS paradigms in domain of SCs. In LARGS, L stands for lean/leanness, A stands for agile/agility, R stands for resilient/resilience, G stands for green/greenness and S stands for sustainable/sustainability.

Hence, this research aims to understand the development and integration of LARGS research fields over the years to identify the unexplored areas and propose future research directions. In this sense, this study addresses the four research questions:

RQ1. How to locate LARGS research in context of SC domain? For this, it is important to understand which types of research articles should be selected for the study? Further, where such studies were conducted (geographical location)?

RQ2. What is the focus of research in LARGS paradigm in SCs? For this, it is important to study which types of industries or sectors have been targeted in literature? In addition, which tools and techniques have been used mostly?

RQ3. What are the current trends in the relationships of LARGS paradigms, among themselves, and with supply chain performance measures?

RQ4. What are the emerging issues, unexplored areas in this field, based on these what could be future research avenues in this subject domain have been proposed?

To fulfil the purpose of this research, systematic literature review (SLR) methodology proposed by Webster and Watson (2002), Levy and Ellis (2006) and Garza-Reyes (2015) has been adopted with some modification in this study. The remaining paper is divided into six different sections, whose details are provided one by one in the paper.

2 | LARGS PARADIGMS

The term 'LARGS' stands for lean, agile, resilient, green and sustainability. These all paradigms have their respective objectives, focus and importance in the SC domain; however, they serve for a common purpose, that is, to make supply chain competitive, efficient and effective.

LA paradigms in supply chains work from the customer perspective; for example, lean focuses on the customer value creations through nonvalue-added (NVA) activities or waste elimination, and agile supply chains focus on the uncertain customer demand. While resilient practices work towards how SC operations respond to the unexpected event. Green SCs focus on minimisation of the ecological impact and sustainable supply chains. The SC sustainability concept urges for embracing the triple bottom line concepts, which has all three dimensions, that is, economic, social and environmental.

Table 1 discusses the LARGS paradigms SC features, mostly based on the definitions, purpose, key ingredients, strategic advice, advantages, limitations, market and products, production or focal firm, performance measurement or competitive priorities, practice tools and planning level.

TABLE 1 Differentiation and synergies between LARGS paradigms

	Lean	Agile	Resilient	Green	Sustainable
Definition	Lean paradigm eliminates or minimises waste or NVAs. Further, aims to value creation through contentious improvement effort in a predictable demand environment	The agile paradigm seeks to sense and respond rapidly and in timely manner to highly volatile and unpredictable demand or customer uncertainty	Capability and capacity in SC to absorb or react to the unexpected disruptions or return into desirable state (Christopher & Peck, 2004)	Integration of natural environmental thinking based on the various Rs (recycle, reduce, remanufacture, refurbish, reverse logistics etc.) concepts in supply chain management (Srivastava, 2007)	Sustainable paradigm seeks management of the material, information and money in the entire supply chain in such a way that it follows triple bottom line (TBL) concepts (Schaltegger & Burritt, 2014; Seuring & Müller, 2008)
Purpose	Waste elimination and value creation and apply concept of zero inventory (Christopher, 2000; Hines, Holweg, & Rich, 2004) or cost minimisation through NVA elimination (Abdulmalek & Rajgopal, 2007)	Satisfy the customer through order configuration and develop the ability to respond quickly	Recover the desired state with in permissible time and cost, after experiencing unexpected disruption	Minimisation of the ecological impact and environmental risks by SC activities (Dües et al., 2013)	Inclusion TBL or sustainability in the SC performance measures for higher competitive gains (Schaltegger & Burritt, 2014)
Key Ingredients	Collaboration	Visibility and velocity (Christopher & Peck, 2004)	SC engineering or reengineering, agility, collaboration and culture of risk management (Christopher & Peck, 2004)	Proactive innovation and reactive response, active integration and receptive learning (Chen, Shih, Shyur, & Wu, 2012)	Orientation towards sustainable SCM, proactivity continuity, and collaboration, interorganisational information sharing (Schaltegger & Burritt, 2014)
Strategic Advice	Make collaboration with upstream and downstream actors	Develop new competences and open up new products lines to cope with volatile demand	Develop new capabilities through flexibility (investment in resources and infrastructure before actually needed) and redundancy (maintain the enough capacity to respond to disruptions) or keeping strategic surplus capacity and inventory	Focus should be on development and deployment on the internal SC resources (Bowen, Iverson, Boness, & Oftedal, 2001)	Cooperation among the various entities in SC (Seuring & Müller, 2008)
Advantages	Reduction in set-up times provides internal manufacturing flexibility and enhances cost reduction possibility (Vonderembse et al., 2006)	Quickly respond and in cost-effective manner to markets uncertainties (Vonderembse et al., 2006)	Anticipate and act on the changes in the market and minimise the demand risk.	Provide opportunities for waste minimisation and efficient and effective resource consumption	By pursuing sustainability goal, SCs differentiate themselves from the market (Schaltegger & Burritt, 2014)
Limitations	Lack of external responsiveness to customers' demands (Vonderembse et al., 2006)	May not be cost-effective or lowest cost supply chain	Have to keep strategic capacity and inventory buffer that is responsible for extra investment and cost	Expensive practices and product cost	Expensive practices and product cost

(Continues)

TABLE 1 (Continued)

	Lean	Agile	Resilient	Green	Sustainable
Markets and products					
Product design strategy	Maximise performance and minimise cost (Dües et al., 2013; Vonderembse et al., 2006)	Product designing based on the customers' requirements (Vonderembse et al., 2006)	Postponement strategy or delayed differentiation	Integration of material life cycle and eco-design (Dües et al., 2013) and postponement strategy or delayed differentiation	Based on the TBL philosophy and postponement strategy or delayed differentiation
Product type	Functional or standard products (Vonderembse et al., 2006) Commodities (Mason-Jones et al., 2000)	Innovative product (Vonderembse et al., 2006) Fashion goods (Mason-Jones et al., 2000)	Hybrid (innovative and functional) sustainable product (Seuring & Müller, 2008)	Hybrid (innovative and functional) sustainable product (Seuring & Müller, 2008)	Hybrid (innovative and functional) sustainable product (Seuring & Müller, 2008)
Product volume	High (Christopher, 2000)	Low (Christopher, 2000)	Low	All types of products that is based on the eco-design concepts	All types of products that is based on the TBL philosophy
Product variety	Low (Christopher, 2000; Mason-Jones et al., 2000)	High (Christopher, 2000; Mason-Jones et al., 2000)	High	High	High
Product life cycle	Long (Christopher, 2000; Mason-Jones et al., 2000; Vonderembse et al., 2006)	Short (Christopher, 2000; Mason-Jones et al., 2000; Vonderembse et al., 2006)	Short (Hou, Mao, Zhao, Du, & Zuo, 2015)	Long	Long
Customers' demand	Predictable (Mason-Jones et al., 2000, Christopher, 2000, Vonderembse et al. (2006))	Unpredictable & Volatile (Mason-Jones et al., 2000, Christopher, 2000, Vonderembse et al., 2006)	Unpredictable and uncertain (Hou et al., 2015)	Mixed (predictable and unpredictable)	Mixed (predictable and unpredictable)
Customers' drivers	Cost (Dües et al., 2013; Mason-Jones et al., 2000)	Lead time and availability (Mason-Jones et al., 2000)	Lead time and availability (Mason-Jones et al., 2000)	Environmentally friendly products and process	Sustainable products
Market	Current market segment with predictable demand	Highly unpredictable, volatile and fragmented market (Vonderembse et al., 2006)	Turbulent and uncertain market (Christopher & Peck, 2004)	Current as well as highly unpredictable and volatile market	Current as well as highly unpredictable and volatile market
Production/focal firm					
Production planning and control	Confined orders with reliable demand forecasts (Vonderembse et al., 2006)	Based on mass customisation to quickly respond to varying customers' demand Vonderembse et al. (2006)	Based on mass customisation to quickly respond to varying customers' demand and disruptive event	High capability with respect to customer's needs	High sustainable practices based on TBL practices
Organisation/ supply chain structure	Static structure (Dües et al., 2013; Hines et al., 2004; Vonderembse et al., 2006)	Virtual organisations that change frequently to offer different products 'mass customisation' or dynamic structure (Christopher, 2000; Vonderembse et al., 2006,)	SC risk management culture and ability to cope with unexpected disturbance	Environmental criteria for risk sharing and Internal environment management system	Stable (Schaltegger & Burritt, 2014; Seuring & Müller, 2008) Have internal sustainable management system and sustainable measuring criteria

(Continues)

TABLE 1 (Continued)

	Lean	Agile	Resilient	Green	Sustainable
Inventory strategy	Minimise the inventory throughout the chain or concept of 'zero inventory' (Christopher, 2000; Dües et al., 2013; Vonderembse et al., 2006)	Make decisions to manage customer demand or follow principle of postponement (Christopher, 2000; Vonderembse et al., 2006)	Keep strategic surplus capacity and stock (Christopher & Peck, 2004)	Make available reusable and remanufactured products	Keep strategic surplus capacity and stock (Christopher & Peck, 2004)
Stock reduction	Essential	Desirable or keep strategic stock against the demand variability	Keep stock strategically	Essential	Essential
Performance measurements/competitive priorities					
Market/order winning	Cost (Agarwal et al., 2006; Mason-Jones et al., 2000) and service level (Dües et al., 2013)	Flexibility and service level (Mason-Jones et al., 2000) or service level (Agarwal et al., 2006)	Cost and time (Carvalho & Cruz-Machado, 2011) and flexibility and innovativeness	CO_2 and service level (Dües et al., 2013) green innovation (Lin & Tseng, 2016)	Innovation (Lin & Tseng, 2016)
Market/order qualifier	Quality, lead time and service level (Agarwal et al., 2006; Mason-Jones et al., 2000)	Cost, quality and lead time (Agarwal et al., 2006, Mason-Jones et al., 2000)	Quality, delivery and service level	Cost, quality, lead time and delivery	Cost, quality, lead time, delivery and service level
Profit margin	Low (Agarwal et al., 2006; Mason-Jones et al., 2000)	High (Agarwal et al., 2006; Mason-Jones et al., 2000)	High	Moderate	Moderate
Lead time	Minimised lead time as long as it does not increase the cost (Dües et al., 2013)	Invest aggressively in ways to minimised lead times	Minimum lead time is desirable	Minimum transport lead time as long it does not increase carbon dioxide emissions (Dües et al., 2013)	Minimum lead time is desirable
Practices/tools/ principles	Value stream mapping, JIT, Kanban, respect for employees, automated mistake proofing, 5S SMED and cellular manufacturing (Dües et al., 2013)	Collaborative relationships, process and information integration, customer/market sensitivity analysis (Lin et al., 2006; Yusuf, Gunasekaran, Adeleye, & Sivayoganathan, 2004) and wait and see approach to customer demand (Qrunfleh & Tarafdar, 2013)	Supply chain engineering and reengineering, collaboration, agility and risk management culture (Christopher & Peck, 2004)	Sustainable value stream mapping and life cycle assessment tools (Dües et al., 2013)	Dedicated to concepts of triple bottom line, partner selection and development, long-term relationships, enhanced communication, logistics and technological integration, development operation standardisation and selective monitoring, stakeholder management and lifecycle assessment (Schaltegger & Burritt, 2014)
Planning level	Strategic and operational	Strategic and operational	Strategic, tactical, operational (Christopher & Peck, 2004) and strategic and tactical (Christopher, 2000)	Strategic and operational (Sayyadi Tooranloo et al., 2018; Seuring & Müller, 2008)	Strategic and operational (Sayyadi Tooranloo et al., 2018; Seuring & Müller, 2008)

Abbreviations: NVA, nonvalue-added; SC, supply chain; LARGS, lean, agile, resilient, green and sustainable.

3 | METHODOLOGY

SLR helps in understanding the existing body of knowledge, research gaps and position the direction for future research (Thome, Scavarda, & Scavarda, 2016). Rafi-Ul-Shan, Grant, Perry, and Ahmed (2018) defined the SLR method as an evidence-based method with four fundamental principles, namely, heuristic nature, transparency, explanatory and inclusivity that make it more robust. According to Garza-Reyes (2015), the SLR method brings transparency and appropriate rigour in the literature review process. Rafi-Ul-Shan et al. (2018) and Carter and Liane Easton (2011) further added that it minimises the researcher biases, thereby enhancing the reliability of research.

In Table 2, an outline of SLR methodology is shown, and it has been discussed in the upcoming section.

4 | INPUT PHASE

Based on SLR methodology, initially Google Scholar was used to explore the publications in this field. Then, Scopus search engine with two electronics databases, Science Direct and Emerald Insight, were used. However, other databases such as Springer, Inderscience and Taylor & Francis have also been used during snowballing technique. An inclusion and exclusion criteria were also established, to enhance the reliability of the SLR process as shown in Table 3.

The keyword search string or syntaxes '(TITLE-ABS-KEY (lean) AND TITLE-ABS-KEY (agile) AND TITLE-ABS-KEY (resilient) AND TITLE-ABS KEY (green) AND TITLE-ABS KEY (supply AND chain AND performance)) AND (LIMIT TO (DOCTYPE, "ar"))' was used in the Scopus search engine. As a result, total five documents appeared, out of which the article titled 'A decision-making model for Lean, Agile, Resilient and Green supply chain management' appeared as the most relevant one. In the Emerald Insights database, the keyword search string 'lean + agile+ resilient+ green+ sustainable+ supply chain performance' with the filter 'supply chain management' was used; as a result, 15 documents appeared. Out of these, two articles titled 'Lean, agile, resilient, and green: Divergences and synergies' and 'LARG index: A benchmarking tool for improving the leanness, agility, resilience and greenness of the automotive supply chain' appeared as the most relevant.

TABLE 2 SLR methodology with an outline of the paper (modified from Garza-Reyes, 2015; Levy & Ellis, 2006; Webster & Watson, 2002)

Input phase	Step 1	Formulation of research objectives and research questions	
	Step 2	Locating, selecting and evaluating relevant literature	1. Selection of search engines and electronic databases. 2. Defining the inclusion and exclusion criteria. 3. Identification of the search string, that is, keywords search. 4. Identification of the reference or base papers on which the study will be based. 5. Forward and backward search.
Processing phase	Step 1	Analysing the finally selected articles.	
	Step 2	Synthesising the finally selected articles.	
Output phase	Reporting of the findings/result and discussion.		

TABLE 3 Inclusion and exclusion criteria

Sr. No.	Inclusion and exclusion criteria		Reason
1.	Unit of analysis	Peer-review journal articles	
2.	Type of language used in the article	English	Most of the excellent quality (world-class) journals are only in English.
3.	Articles mainly discuss	Concepts of LARGS in supply chain domain	To remain in the scope of the study.
4.	Search engine	Google Scholar	Freely available, only used for the initial search, that is, for exploration purpose only because it has some limitations.
5.	Database	Scopus with Science Direct and Emerald insight	Includes perfect (world-class) peer-reviewed journals.
6.	Limitations	The conclusion of this study is reflection of the selected peer-reviewed research articles.	
8.	Exclusion criteria	Conference paper, working paper, technical paper, practical handbooks and books' chapters.	To ensure the quality of the literature review, only peer-reviewed journal articles included.
7.	Finally selected articles	160	

Based on these papers, forward and backward approach, also known as snowballing technique, was used to trace the most relevant literature, as suggested by Webster and Watson (2002) and Levy and Ellis (2006), and articles are retrieved from the Google Scholar, Science Direct, Emerald insight, Taylor & Francis, Inderscience, Springer, Elsevier, MDPI and so on. Further, Levy and Ellis (2006) have highlighted the importance of these approaches and suggested that the researcher should continue the search till the main themes or concepts of the study are begin to repeat. In this process, we stopped searching for research articles on 20 June 2019; a total of 171 papers appeared as the most relevant. However, after analysing them individually, 20 research articles had to be dropped, as they were either repetitive or irrelevant to this study. Hence, finally, 160 articles were selected for this review. We are fully aware that thousands of research articles published with the related theme and unable to review all the already published articles. We sincerely apologise for any unintentional omission. This study is descriptive in nature.

5 | PROCESSING PHASE

In this section, we discussed the detailed procedure—how the 160 selected articles, ranging from 1999 to 2019, were analysed and synthesised. To present the existing body of knowledge, research gap and the future research avenues, a structured categorisation scheme was adopted with some modification that enables a useful classification of all selected peer-reviewed journal research articles. Henao, Sarache, and Gomez (2018) categorised the articles into six different types: research type, method, industry/sector, geographical application, the focus and measure impact. Similarly, to address RQ1, RQ2, RQ3 and RQ4, the research articles are classified based on the

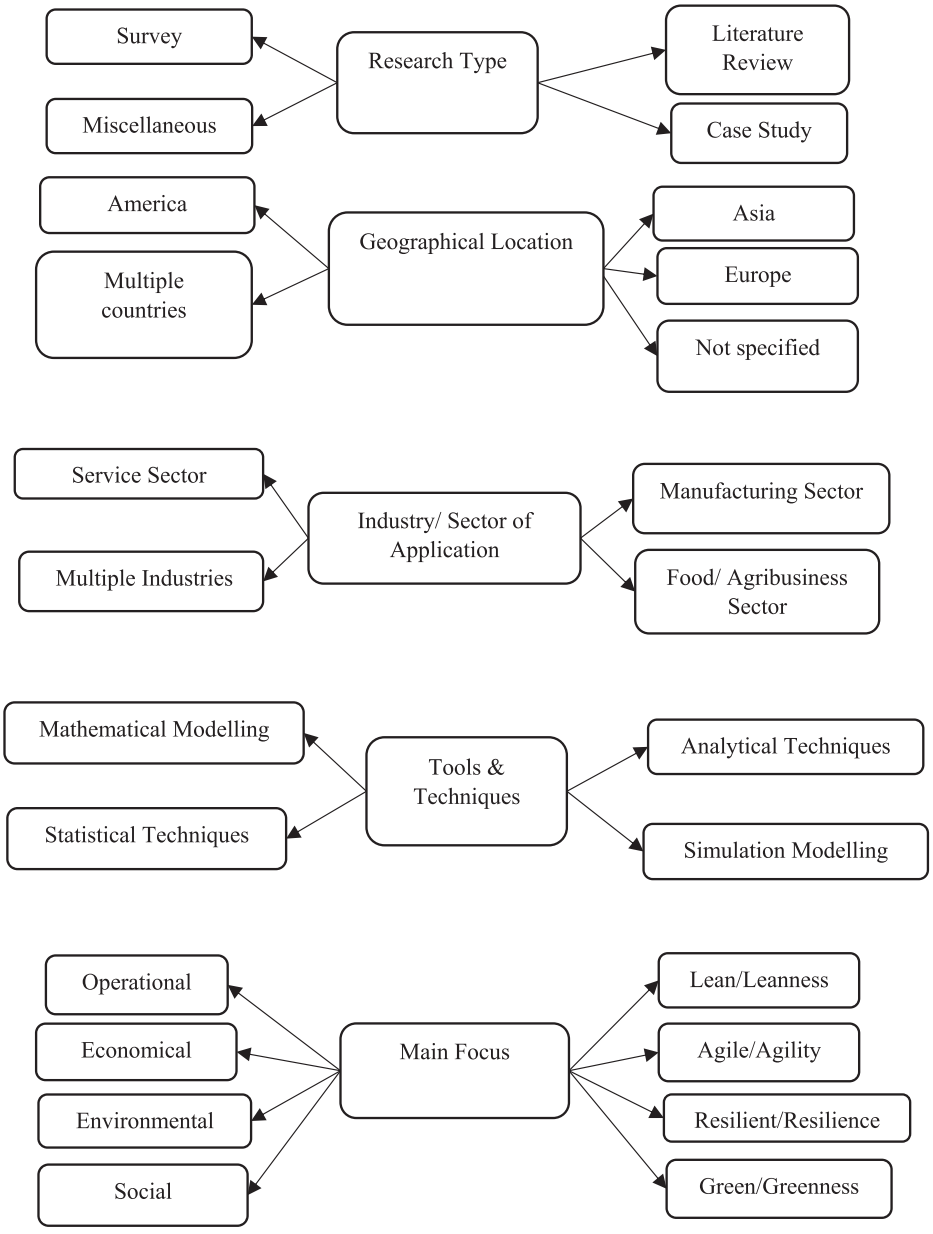

FIGURE 1 Classification scheme (modified from Henao et al., 2018)

research type, geographical location, tools/techniques used, industry/sector of application and focus; see Figure 1.

In *research type*-based classification, all selected articles were categorised into four groups: (1) Literature review includes the articles based on the previous studies/research articles and proposes either theoretical frameworks or propositions for the future research work; (2) survey includes articles presented in the output of online surveys, includes the opinion of a large number of experts and applies statistical tools and techniques; (3) case study includes articles addressed a particular issue or case, focusing on a specific company or multiple companies, and uses analytical tools and techniques and (4) miscellaneous: all other remaining articles were classified under this. The second classification is based on geographical location: based on the countries where the study was conducted. It includes individual countries, multiple countries and not specified (including case study-based articles where the country of research was omitted).

The next classification scheme is based on the area of application/industry: Initially, the articles were classified into four broad categories: (1) manufacturing, (2) food/agribusiness, (3) service and (4) multiple industries. The next classification is done based on the tools and techniques used: Statistical methods, analytical techniques, mathematical modelling and simulation were mainly used. Another classification is based on the concepts or paradigms: linkages among LARGS paradigms in the SC domain and categorised as the main focus. These five categories are further divided into several subcategories. The detailed discussion on all these is discussed in the output phase.

6 | OUTCOME PHASE

The outcome phase analyses, synthesises all articles individually and depicts the results based on the various categorisation schemes as discussed in Section 4. This section answers all the above-mentioned questions, that is, RQ1, RQ2, RQ3 and RQ4. The detailed discussion is as follows:

In research type-based classification, Figure 2 presents the classification of the research articles in terms of research type.

They are classified into four different groups: literature review, case studies, survey based, and miscellaneous. From Figure 2, it is evident that this study contains 24% literature review-based articles, 27% publications based on case studies, 27% studies based on surveys and 22% articles falling under the miscellaneous category. The geographical locations-based classification is shown in Figure 3.

This categorisation mainly includes survey-based and case-based studies. A total of 82 studies belong to this category, 17 studies were done in multiple countries, and 10 studies did not disclose or did not specify (NS) the country's name. Apart from these, in individual countries, Portugal led with eight studies, followed by India and United States with seven research articles each. More details are provided in Table 4.

This section addressed RQ2.

Thus, a categorisation scheme is applied based on the industry targeted in the research articles and tools and techniques used. In industry-based classification, 80 out of 82 research articles were either survey based or case study based, focusing on a particular company/sectors or multiple companies/sectors. Out of 80, 59 covered the manufacturing sector (few researchers directly stated that they did it in manufacturing whereas some specified the industry: automotive, aerospace, wood and paper, electronic and garment). Five were carried out in the food and agribusiness (catering, wine), two were in the service sector and 14 were in the multiple sectors, as shown in Figure 4.

These results indicate that most of the research was done in the manufacturing sectors, whereas others remain either less explored or untouched. The studies categorised are as follows:

In *manufacturing*: in the wood and paper industry (Agus & Shukri Hajinoor, 2012; Azadeh et al., 2017; El Mokadem, 2017; Fercoq et al., 2016; Fullerton & Wempe, 2009; Galeazzo et al., 2014; Gandhi et al., 2018; Garza-Reyes et al., 2018; Gavronski et al., 2011; Green et al., 2012; Hallgren & Olhager, 2009; Hajmohammad et al., 2013; Inman & Green, 2018; Kumar & Rodrigues, 2018; Laosirihongthong et al., 2013; Lin et al., 2006; Manuj & Mentzer, 2008; Martin & Patterson, 2009; Parkouhi et al., 2019; Prajogo et al., 2016; Sajan et al., 2017; Zhan, Tan, Ji, Chung, & Chiu, 2018);

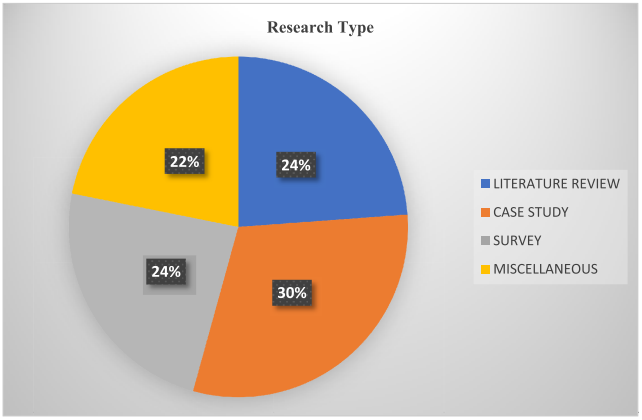

FIGURE 2 Research type-based categorisation [Colour figure can be viewed at wileyonlinelibrary.com]

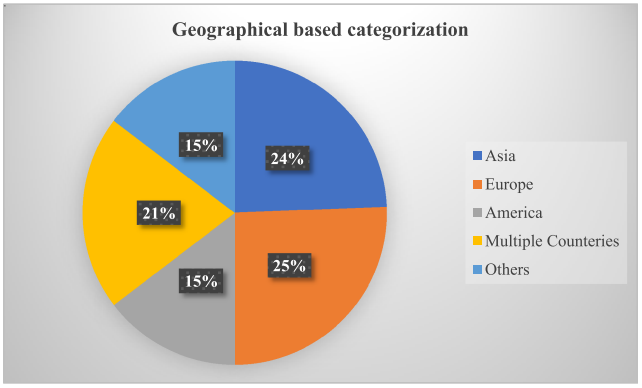

FIGURE 3 Geographical-based classification [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 4 Geographical-based classification

Geographical location	Author's name and year
Multiple countries	Saenz, Revilla, and Acero (2018); Azevedo, Carvalho, and Cruz-Machado (2013); Fahimnia, Jabbarzadeh, and Sarkis (2018); Norrman and Jansson (2004); Fahimnia and Jabbarzadeh (2016); Mohammaddust, Rezapour, Farahani, Mofidfar, and Hill (2017); Govindan, Azevedo, Carvalho, and Cruz-Machado (2014); Manuj and Mentzer (2008); Aramyan, Oude Lansink, Van Der Vorst, and Van Kooten (2007); Brandenburg (2015); Bruce et al. (2004); Hallgren and Olhager (2009); Rao and Holt (2005); Cosimato and Troisi (2015); Chan, Ngai, and Moon (2017); Ortas et al. (2014); Garza-Reyes, Kumar, Chaikittisilp, and Tan (2018); Lartey et al. (2020); Dey et al., 2019.
Did not specify	Carvalho, Govindan, Azevedo, and Cruz-Machado (2017); Fercoq, Lamouri, and Carbone (2016); Govindan, Khodaverdi, and Jafarian (2013); Arif-Uz-Zaman and Nazmul Ahsan (2014); Diaz-Elsayed, Jondral, Greinacher, Dornfeld, and Lanza (2013); Ng, Low, and Song (2015); Azevedo, Govindan, et al. (2013); Duarte and Cruz-Machado (2017)
Portugal	Azevedo, Carvalho, & Cruz-Machado, 2011b; Azevedo et al. (2012); Cabral, Grilo, and Cruz-Machado (2012); Carvalho, Barroso, et al. (2012); Carvalho, Cruz-Machado, and Tavares (2012); Govindan et al. (2014); Azevedo et al. (2016); Carvalho, Azevedo, et al. (2011)
India	Luthra et al. (2016); Chaudhuri, Srivastava, Srivastava, and Parveen (2016); Sen et al. (2017); Gandhi, Thanki, and Thakkar (2018); Thanki and Thakkar (2018a); Sajan, Shalij, Ramesh, and Augustine (2017); Digalwar et al. (2020)
United States	Lockamy (2014); Gligor, Holcomb, and Feizabadi (2016); Green et al. (2012); Gligor, Esmark, and Holcomb (2015); Inman and Green (2018); Fullerton and Wempe (2009); Qrunfleh and Tarafdar (2013)
United Kingdom	Mohammed et al. (2019); Thomas, Byard, Francis, Fisher, and White (2016); Brindley and Oxborrow (2014); Kumar and Rodrigues (2018); Purvis, Gosling, and Naim (2014)
Iran	Parkouhi et al. (2019); Azadeh, Yazdanparast, Zadeh, and Zadeh (2017); Govindan, Khodaverdi, and Vafadarnikjoo (2015); Sayyadi Tooranloo et al. (2018); Lotfi and Saghiri (2018)
Ireland	Chen et al. (2012); Lin et al. (2006); Tseng, Lim, and Wong (2015); Chiou, Chan, Lettice, and Chung (2011) in Taiwan, Marshall, McCarthy, Heavey, and McGrath (2015)
Egypt	Tachizawa, Gimenez, and Sierra (2015) in Spain; Drohomeretski, Gouvea da Costa, and Pinheiro de Lima (2014); Tortorella, Miorando, and Marodin (2017); Campos and Vazquez-Brust (2016) in Brazil; El Mokadem (2017)
China	Hajmohammad, Vachon, Klassen, and Gavronski (2013); Gavronski, Klassen, Vachon, and do Nascimento (2011) in Canada, Zhan, Tan, Ji, Chung, and Chiu (2018); Zhan, Tan, Ji, and Tseng (2018); Wu et al. (2018)
European Union	Ruiz-Benitez, López, and Real (2017); Ruiz-Benitez et al. (2018); Chiarini (2014)
Malaysia	Agus and Shukri Hajinoor (2012)
Italy	Formentini and Taticchi (2016); Galeazzo, Furlan, and Vinelli (2014)
Australia	Prajogo, Oke, and Olhager (2016)
Thailand	Laosirihongthong, Adebanjo, and Choon Tan (2013); Wong et al. (2018)
France	Verrier, Rose, Caillaud, and Remita (2014).

in automotive (Azevedo et al., 2012; Azevedo et al., 2016; Azevedo et al., 2011a, 2011b; Azevedo, Carvalho, et al., 2013; Azevedo, Govindan, et al., 2013; Cabral et al., 2012; Carvalho et al., 2017; Carvalho, Azevedo, et al., 2011; Carvalho, Barroso, et al., 2012; Chiarini, 2014; Dey et al., 2019; Diaz-Elsayed et al., 2013; Drohomeretski et al., 2014; Duarte & Cruz-Machado, 2017; Govindan et al., 2014; Govindan, Khodaverdi, & Vafadarnikjoo, 2015; Lockamy, 2014; Lotfi & Saghiri, 2018; Luthra et al., 2016; Mohammaddust et al., 2017; Sen et al., 2017; Thomas et al., 2016; Wong et al., 2018; Wu et al., 2018); in aerospace (Ruiz-Benitez et al., 2017; Ruiz-Benitez, López, & Real, 2018); in garment industry (Arif-Uz-Zaman & Nazmul Ahsan, 2014; Bruce et al., 2004; Chan et al., 2017; Distelhorst, Hainmueller, & Locke, 2016; Fahimnia et al., 2018; Fahimnia & Jabbarzadeh, 2016; Purvis et al., 2014; Thanki & Thakkar, 2018b); in electronic (Chen et al., 2012; Norrman & Jansson, 2004; Tseng et al., 2015); and in metal stamped (Ng et al., 2015).

In *food/agribusiness*: in tomato SC (Aramyan et al., 2007; Chaudhuri et al., 2016); in wine SC (Carvalho, Cruz-Machado, et al., 2012); in meat SC (Mohammed et al., 2019); in catering (Brindley & Oxborrow, 2014); and in appliance sector (Campos & Vazquez-Brust, 2016).

In *service industry*: in fast moving consumer goods (Brandenburg, 2015; Cosimato & Troisi, 2015). In *multiple industries*: (Chiou et al., 2011; Formentini & Taticchi, 2016; Gligor et al., 2015; Gligor et al., 2016; Govindan et al., 2013; Marshall et al., 2015; Ortas et al., 2014; Rao & Holt, 2005; Saenz et al., 2018; Sayyadi Tooranloo et al., 2018; Tachizawa et al., 2015; Tortorella et al., 2017; Verrier et al., 2014; Zhan, Tan, Ji, & Tseng, 2018).

In this subsection, the research articles are elaborated and categorised on the basis of tools and techniques used: statistical, analytical (MCDM), mathematical modelling and simulation. A total of 79 research articles used statistical, analytical and mathematical or simulation techniques. Fifty-four per cent of the studies used statistical techniques, 40% employed analytical techniques and 3% took to mathematical modelling, whereas 3% of the studies reported using simulation as shown in Figure 5.

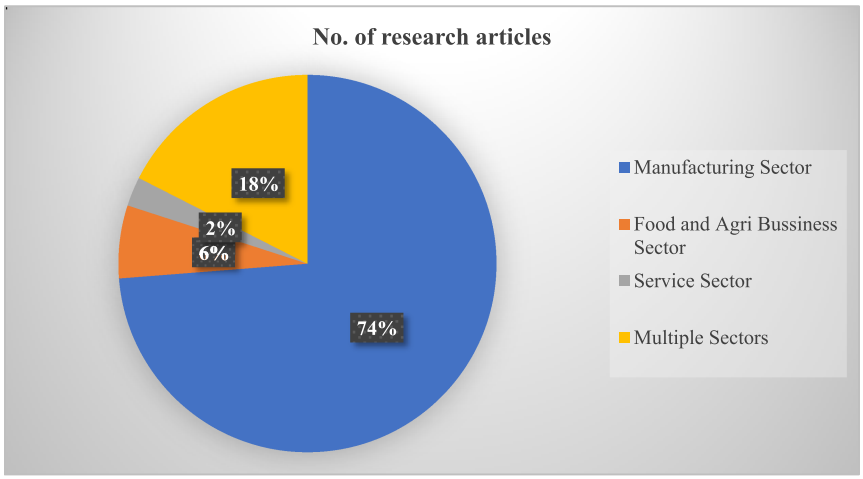

FIGURE 4 Industry-based distribution of research articles [Colour figure can be viewed at wileyonlinelibrary.com]

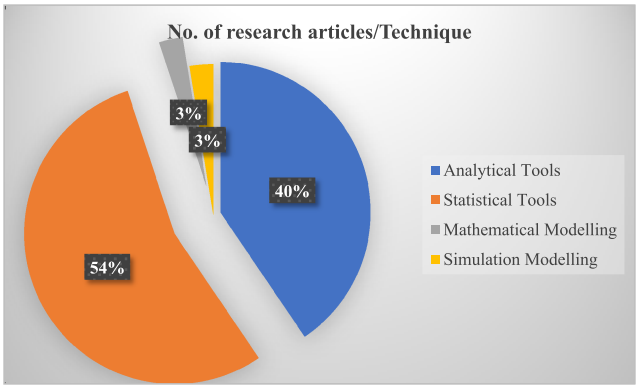

FIGURE 5 Tools and techniques-based classification [Colour figure can be viewed at wileyonlinelibrary.com]

The more detailed classification is given as follows: The authors used various *analytical (MCDM) techniques*: Mohammed et al. (2019) used fuzzy-AHP and TOPSIS, Ruiz-Benitez et al. (2017) applied importance-performance analysis (IPA) technique and interpretive structural modelling (ISM), and Fahimnia and Jabbarzadeh (2016) applied a multi-objective model with a stochastic fuzzy goal programming approach. Chen et al. (2012) and Cabral et al. (2012) used analytical network programming (ANP), whereas Sen et al. (2017) applied fuzzy set theory with ISM. Govindan, Azevedo, et al. (2015) used the intuitionistic fuzzy DEMATEL (fuzzy set theory), and Arif-Uz-Zaman and Nazmul Ahsan (2014) used the fuzzy-based evaluation method. Lin et al. (2006) used the fuzzy agility evaluation method (FAEM). Brandenburg (2015) employed goal programming, whereas Tseng et al. (2015) used fuzzy Delphi method and ANP. Thanki and Thakkar (2018a, 2018b) used the fuzzy set theory and the DEMATEL method with ANP, whereas Parkouhi et al. (2019) used the Gray DEMATEL and additive weighting technique. Ruiz-Benitez et al. (2018) and Govindan, Khodaverdi, and Vafadarnikjoo (2015) used the ISM method. Chaudhuri et al. (2016) used the fuzzy-ISM, whereas Govindan et al. (2013) used fuzzy set theory with fuzzy TOPSIS. Gandhi et al. (2018) used the MCDM TOPSIS method with simple additive weighting (SAW). Thanki and Thakkar (2018a) used ISM, interpretive ranking process (IRP) and MICMAC analysis. Azevedo et al. (2013) used the Delphi technique with SAW method. In their subsequent study, Azevedo et al. (2016) again used the Delphi technique but with linear aggregated. Azadeh et al., 2017 used intelligent algorithm, whereas Aramyan et al. (2007) perceived importance score. Kumar and Rodrigues (2018) used resource-based view approach. Azevedo et al. (2011a) and Duarte and Cruz-Machado (2017) used score method. Azevedo et al. (2011b) used balanced scorecard model, Lockamy (2014) used Bayesian networks, and Norrman and Jansson (2004) used tree analysis, that is, fault and evolution. Carvalho, Cruz-Machado, and Tavares (2012), Ng et al. (2015) and Chiarini (2014) used VSM; Digalwar et al. (2020) used ISM with ANP.

Statistical techniques: Luthra et al. (2016) used the factor analysis with multiple regression analysis, whereas Agus and Shukri Hajinoor (2012); Prajogo et al. (2016); Gligor et al. (2016); Sayyadi Tooranloo et al. (2018); Garza-Reyes et al. (2018); Green et al. (2012); Lotfi and Saghiri (2018); Hallgren and Olhager (2009); Rao and Holt (2005); Fullerton and Wempe (2009); Sajan et al. (2017); Qrunfleh and Tarafdar (2013); Azevedo, Govindan, et al. (2013); Chan et al. (2017); Chiou et al. (2011); Wong et al. (2018); Wu et al. (2018); Dey et al. (2019); Chavez et al. (2020) and Zhan, Tan, Ji, Chung, and Chiu (2018) applied structural equation modelling (SEM). Marshall et al. (2015) employed the confirmatory factor analysis (CFA), whereas Tachizawa et al. (2015) used the partial least square method. Gavronski et al. (2011); El Mokadem (2017); Tortorella et al. (2017) and Distelhorst et al. (2016) used the regression method. Gligor et al. (2015) used the SEM with maximum likelihood estimation (MLE). Inman and Green (2018) used SEM and partial least square (PLS), whereas Hajmohammad et al. (2013) used PLS. Zhan, Tan, Ji, and Tseng (2018) used the exploratory factor analysis (EFA), whereas Laosirihongthong et al. (2013) used the multivariate linear regression. Martin and Patterson (2009) used multiple regression analysis. Mohammaddust et al. (2017) used linear regression approximation. Fercoq et al. (2016) used the ANOVA technique, whereas Formentini and Taticchi (2016) used the contingency theory. Drohomeretski et al. (2014) used the content analysis, whereas Ortas et al. (2014)

used the Granger causality test. Manuj and Mentzer (2008) used the grounded theory, whereas Govindan et al. (2014) and Galeazzo et al. (2014) used cross case study. Campos and Vazquez-Brust (2016) did document analysis, whereas Bruce et al. (2004) and Azevedo et al. (2012) used exploratory analysis. Thomas et al. (2016); Brindley and Oxborrow (2014) and Verrier et al. (2014) did statistical analysis.

Mathematical modelling: Fahimnia et al. (2018) used mathematical modelling (GAMS) method with sensitivity analysis, and Carvalho et al. (2017) also used mathematical modelling.

Simulation modelling: Carvalho, Barroso, et al. (2012) and Diaz-Elsayed et al. (2013) used simulation modelling.

To make this literature review-based study more robust and comprehensive and answer RQ3, all the articles were individually analysed to identify the underlying concepts, that is, the linkages of various paradigms and their combination among themselves and with the SC performance, as discussed in Section 4 and Figure 1.

After analysing all the articles individually, it was observed that they followed a kind of pattern: mostly, authors used one or two paradigms and analysed their impact on SC performance. Based on this, all the research articles were categorised into 22 different combinations, as shown in Figure 6, and discussed in detail in the subsequent paragraphs; these paragraphs initially discussed the total number of research articles belonging to that category and then went on to explain in the gist of a particular research article.

The highest number of research articles appeared from lean with green paradigms' combination, followed by resilient with SC performance, sustainable SC performance with green SC performance, as seen in Figure 6 and Table 5.

After this, to understand what exactly authors did in a particular study is argued as below.

Lean paradigm: A total six studies: Agus and Shukri Hajinoor (2012) revealed that lean production has more influence on product quality performance as compared with business performance and product quality performance has a direct influence on business performance. Prajogo et al. (2016) empirically tested a research model and identified that while logistic integration had no impact on operational outcomes, lean practices do impact inbound supply performance. Distelhorst et al. (2016) analysed the Nike apparel SC and presented that lean paradigms positively affect social performance and have no effect on the health and safety standard. Garza-Reyes et al. (2018) empirically investigated the relationships among five lean practices with environmental performance. Arif-Uz-Zaman and Nazmul Ahsan (2014) discussed a fuzzy model based on the lean supply chain performance. Tortorella et al. (2017) empirically analysed how lean practices affect SC performance.

Agile paradigm: A total of nine studies: Agarwal et al. (2007) identified 15 different variables that affect SC agility. Baramichai et al. (2007) developed a matrix and highlighted its importance in supplier–buyer supply chain configuration through a case study. Verrier et al. (2014) proposed an approach that links competitive bases, agile attributes and agile enablers. Christopher and Towill (2001) differentiated leanness from agility and highlighted the importance of the agility or agile supply chain in the highly volatile and turbulent environment. Campos and Vazquez-Brust (2016) empirically tested the fuzzy agility index (FAI) to highlight the importance of agility in achieving the competitive advantages of the supply chains. Martin and Patterson (2009) highlighted the need and importance of the agile supply chain. Beske and Seuring (2014) revealed that supply chain agility positively affects the TBL and outlined the differences

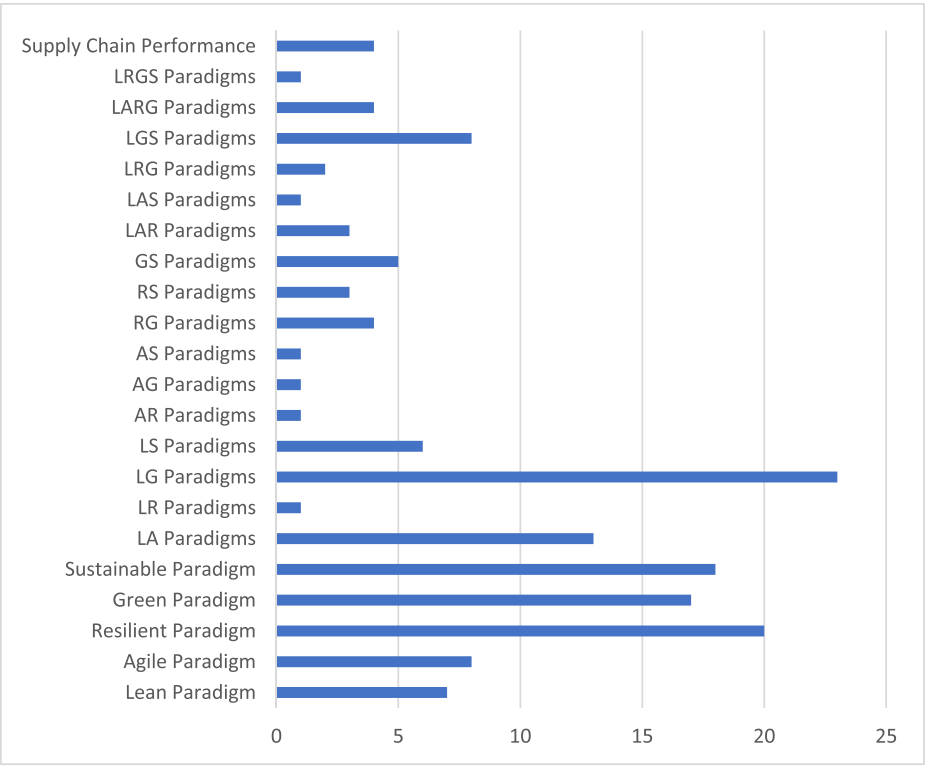

FIGURE 6 Number of articles based on integration [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 5 Combinations of the practices with supply chain (SC) performance with authors' details

Sr. No.	Combination of the practices with SC performance	Authors
1.	Lean paradigm	Garza-Reyes et al. (2018); Tortorella et al. (2017); (Azadeh et al. (2017); Prajogo et al. (2016); Distelhorst et al. (2016); Arif-Uz-Zaman and Nazmul Ahsan (2014) and Agus and Shukri Hajinoor (2012)
2.	Agile paradigm	Campos and Vazquez-Brust (2016); Beske and Seuring (2014); Verrier et al. (2014); Chiou et al. (2011); Martin and Patterson (2009); Agarwal, Shankar, and Tiwari (2007); Baramichai, Zimmers, and Marangos (2007) and Christopher and Towill (2001)
3.	Resilient paradigm	Parkouhi et al. (2019); Behzadi, O'Sullivan, Olsen, and Zhang (2018); Thanki and Thakkar (2018a); Garza-Reyes et al. (2018); Saenz et al. (2018); Ali, Mahfouz, and Arisha (2017); Azadeh et al. (2017); Singh and Vinodh (2017); Kamalahmadi and Parast (2016); Chaudhuri et al. (2016); Torabi, Baghersad, and Mansouri (2015); Lockamy (2014); Brindley and Oxborrow (2014); Ghadge, Dani, and Kalawsky (2012); Carvalho, Barroso, et al. (2012); Carvalho, Cruz-Machado, et al. (2012); Gavronski et al. (2011); Hallgren and Olhager (2009); Markley and Davis (2007) and Christopher and Towill (2000)
4.	Green paradigm	Garza-Reyes et al. (2018); De Oliveira et al. (2018); Subramanian and Gunasekaran (2015); Tachizawa et al. (2015); Drohomeretski et al. (2014); Govindan, Khodaverdi, and Vafadarnikjoo (2015); Brandenburg (2015); Luthra, Garg, and Haleem (2014); Laosirihongthong et al. (2013). Chen et al. (2012); Green et al. (2012); Azevedo et al. (2011b), Chiou et al. (2011); Gavronski et al. (2011); Hervani, Helms, and Sarkis (2005); Rao and Holt (2005) and Sarkis (2003)
5.	Sustainable paradigm	Rajeev et al. (2017); Formentini and Taticchi (2016); Touboulic and Walker (2015); Marshall et al. (2015); Tseng et al. (2015); Beske-Janssen, Johnson, and Schaltegger (2015); Schaltegger and Burritt (2014) Beske and Seuring (2014); Varsei, Soosay, Fahimnia, and Sarkis (2014); Bai and Sarkis (2014); Ortas et al. (2014); Govindan et al. (2013); Taticchi, Tonelli, and Pasqualino (2013); Gimenez and Tachizawa (2012); Carter and Liane Easton (2011); Carter and Rogers (2008); Markley and Davis (2007) and Dahlmann and Roehrich (2019)

(Continues)

TABLE 5 (Continued)

Sr. No.	Combination of the practices with SC performance	Authors
6.	LA paradigms	El Mokadem (2017); Abdollahi et al. (2015); Purvis et al. (2014); Qrunfleh and Tarafdar (2013), Hallgren and Olhager (2009); Morgan (2007); Bruce et al. (2004); Christopher and Towill (2000, 2001); Mason-Jones et al. (2000) and Naylor et al. (1999)
7.	LR paradigms	Ruiz-Benitez et al. (2018)
8.	LG paradigms	Thanki and Thakkar (2016, 2018a, 2018b); Kumar and Rodrigues (2018); Zhan, Tan, Ji, Chung, and Chiu (2018); Zhan, Tan, Ji, and Tseng (2018); Inman and Green (2018); Duarte and Cruz-Machado (2017); Carvalho et al. (2017); Hallam and Contreras (2016); Fercoq et al. (2016); Verrier, Rose, and Caillaud (2016); Campos and Vazquez-Brust (2016); Garza-Reyes (2015); Ng et al. (2015); Galeazzo et al. (2014); Chiarini (2014); Duarte and Cruz-Machado (2013); Dües et al. (2013); Diaz-Elsayed et al. (2013); Carvalho et al. (2010); Fullerton and Wempe (2009) and Simpson and Power (2005)
9.	LS paradigms	Das (2018); Tasdemir and Gazo (2018); Henao et al. (2018); Sajan et al. (2017); Leon and Calvo-Amodio (2017); Dey et al., 2019; Chavez et al. (2020) and Martínez-Jurado & Moyano-Fuentes, 2014
10.	AR paradigms	Carvalho, Azevedo, et al. (2012)
11.	AG paradigms	Sayyadi Tooranloo et al. (2018)
12.	AS paradigms	Singh and Vinodh (2017)
13.	RG paradigms	Mohammed et al. (2019); Fahimnia et al. (2018); Sen et al. (2017) and Azevedo, Carvalho, et al. (2013).
14.	RS paradigms	Rafi-Ul-Shan et al. (2018); Thomas et al. (2016) and Fahimnia and Jabbarzadeh (2016)
15.	GS paradigms	Luthra et al. (2016); Singh and Vinodh (2017); Cosimato and Troisi (2015); Brindley and Oxborrow (2014) and Ahi and Searcy (2013)
16.	LAR paradigms	Lotfi and Saghiri (2018); Mohammaddust et al. (2017) and Purvis, Spall, Naim, and Spiegler (2016)
17.	LAS paradigms	Ciccullo et al. (2018) and Digalwar et al. (2020)
18.	LRG paradigms	Ruiz-Benitez et al. (2017) and Govindan, Azevedo, et al. (2015)

(Continues)

TABLE 5 (Continued)

Sr. No.	Combination of the practices with SC performance	Authors
19.	LGS paradigms	Gandhi et al. (2018); Caldera, Desha, and Dawes (2017); Verrier et al. (2014); Dhingra, Kress, and Upreti (2014); Hajmohammad et al. (2013); Azevedo et al. (2012); Carvalho, Duarte, et al. (2011); Wong et al. (2018); Wu et al. (2018); Lartey et al. (2020) and Mollenkopf, Stolze, Tate, and Ueltschy (2010).
20.	LARG paradigms	Azevedo et al. (2016); Cabral et al. (2012); Carvalho, Duarte, et al. (2011) and Azevedo et al. (2011a)
21.	LRGS paradigms	Govindan et al. (2014).
22.	Supply chain performance	Azevedo, Govindan, et al. (2013); Martin and Patterson (2009); Aramyan et al. (2007) and Beamon (1999)

between lean and agility paradigms. Chiou et al. (2011) empirically validated a conceptual framework that linked agility antecedents and discussed how strategic flexibility and manufacturing flexibility positively affect the SC agility. Gligor et al. (2016) analysed how market orientation affects SC agility.

Resilient paradigm: A total of 20 studies: Saenz et al. (2018) highlighted the role of SC resilient management. Torabi et al. (2015) developed a stochastic model for building a supplier base resilience under operational and disruption risk. Parkouhi et al. (2019) identified customisation as the most important resilience enhancer and supplier's capacity as the resilience reducer criteria. Based on a SLR, Ghadge et al. (2012) identified seven critical factors, whereas Kamalahmadi and Parast (2016) proposed a conceptual framework. Behzadi et al. (2018) identified resilience or resilient as a critical technique, whereas Ali et al. (2017) proposed that three primary constructs are required to define supply chain resilience. Garza-Reyes et al. (2018) proposed an SC resilience definition and highlighted the need of quantitative models in SCR. Hallgren and Olhager (2009) proposed SC resilience definition, principles, strategies and a conceptual framework.

Azadeh et al. (2017) developed the SC risk-based simulation model. Analysed the Ericson case from the SC risk management perspective. Lockamy (2014) assessed the supplier disaster risk in a US-based automotive casting supplier. Chaudhuri et al. (2016) revealed that collaboration with supplier and logistics mitigates the risk and positively affects the revenue. Carvalho, Cruz-Machado, et al. (2012) proposed an SC mapping framework, revealing a linkage between the resilience attributes with the state variables and empirically testing it in a Portuguese wine supply chain. Carvalho, Azevedo, et al. (2012) used a simulation approach to identify how disruptions affect SC performance. Christopher and Towill (2000) highlighted the need and importance of resilient psychology in SCM.

Brindley and Oxborrow (2014) conducted a review of 238 papers and used the context-intervention-mechanisms-outcomes approach. Gavronski et al. (2011) used literature review and focused group interview approach to identify the risk management strategies for global manufacturing SC. Markley and Davis (2007) used the graph theory to propose a model and ISM for finding out the interrelationships. Thanki and Thakkar (2018a) carried out SC resilience-based study.

Green paradigm: A total of 17 studies: Hervani et al. (2005) discussed a framework that measures green SC performance. De Oliveira, Espindola, da Silva, da Silva, and Rocha (2018) presented the green SCM practices, and Garza-Reyes et al. (2018) discussed the adoption, diffusion and outcomes of the green supply chain (GSC) practices. Sarkis (2003) proposed a framework that helps in improving the green SC performance. Luthra et al. (2014) identified the various issues related to GSCs. *Based on the survey*: Tachizawa et al. (2015) identified the relationships between GSC approaches, performance and environmental drivers. Gavronski et al. (2011) developed guidelines that managers should remember while applying the GSC philosophy. Green et al. (2012) empirically identified how green practices positively affect economic, environmental and operational performance. Brandenburg (2015) revealed that decentralisation of the SC configurations helps in reducing the carbon emission without affecting economic performance. Rao and Holt (2005) reported that SC phases greening leads to SC integration that further indicate how it makes SC competitive and economically viable. Chiou et al. (2011) empirically established the relationships among SC greening, green innovation, competitiveness and environmental performance. Laosirihongthong et al. (2013) discussed how green practices affect SC economic, environmental and intangible performance and revealed that reverse logistics have no significant effect on the GSCM performance.

Azevedo et al. (2011a) revealed the positive and adverse relationship with the various operational, environmental and economic performance measures. Drohomeretski et al. (2014) described the drivers, barriers and practices for GSC. Govindan, Azevedo, et al. (2015) revealed that green practices help in improving

environmental as well as economic performance and in attaining competitive advantages. Chen et al. (2012) used the ANP technique in Taiwanese electronics firm for the selection of best green strategies. Subramanian and Gunasekaran (2015) proposed the framework that links cleaner SCM practices and performance.

Sustainable paradigm: A total of 18 studies: *Based on the literature*: Rajeev et al. (2017) discussed how sustainable paradigm evolves and proposed a conceptual framework. Bai and Sarkis (2014) identified the SSC key performance indicators (KPIs). Carter and Rogers (2008) described the relationships among TBL performance measures. Carter and Liane Easton (2011); Taticchi et al. (2013); Beske-Janssen et al. (2015); Touboulic and Walker (2015) and Schaltegger and Burritt (2014) discussed the evolution of the sustainability paradigms. Gimenez and Tachizawa (2012) discussed that supplier's assessment and collaboration positively affect SC performance. Beske and Seuring (2014) revealed five essential categories on which sustainable SC depends.

Formentini and Taticchi (2016) discussed the integration of corporate sustainability with the governance mechanism. Marshall et al. (2015) measured social and environmental sustainability practices. Ortas et al. (2014) established a relationship of sustainable SC with financial performance. Govindan et al. (2013) discussed the use of the concept of sustainability for supplier selection. Markley and Davis (2007) discussed the impact of sustainable SC on TBL and competitive advantages. Tseng et al. (2015) evaluated the sustainability prospects of the four aspects: sustainability, internal operation, learning and growth and stakeholder. Varsei et al. (2014) assessed the supply chain sustainability by using a multidimensional framework.

LA paradigms: A total of 13 studies were encountered under this category. Morgan (2007) highlighted the need of the LA, whereas Christopher and Towill (2001) explored how LA used to make cost-effective SCs and discussed when to use these paradigms. Christopher and Towill (2000) proposed the concept of agile based on the marketplace requirement with the cyclic migratory model. Hallgren and Olhager (2009) empirically identified various driving factors and their impact on LA capabilities as well as on the operational performance. El Mokadem (2017) empirically examined how manufacturing strategies, lean or agile, affect the SC performance. Qrunfleh and Tarafdar (2013) analysed the role of LA strategies on supplier selection, firm responsiveness and performance. Based on a case study approach, Bruce et al. (2004) discussed the lean, agile or leagile prospective in the apparel or textile industry. Purvis et al. (2014) used two UK-based fashion retailer supply networks to ascertain LA capabilities in the field of vendor and sourcing flexibility. Abdollahi et al. (2015) discussed the role of LA in supplier portfolio selection. Naylor et al. (1999), a pioneering study, along with Christopher and Towill (2000); Bruce et al. (2004) and Mason-Jones et al. (2000), discussed the importance of LA paradigm.

LR paradigms: Only one study, conducted by Ruiz-Benitez et al. (2018) discussed the relationships among various practices of LR paradigms and how these affect the SC performance.

LG paradigms: A total of 23 studies: Dües et al. (2013) suggested that LG paradigms compliment or benefit each other, whereas Garza-Reyes (2015) discussed the relationship various practices belongs to LG paradigms and their effect on organisational performance. Carvalho et al. (2010) discussed linkage of LG paradigms with various SC performance. Hallam and Contreras (2016) analysed the linkage of LG paradigms and suggested that they have fragile relation. Simpson and Power (2005) proposed framework that discusses the relationships of customer and supplier based on factors such as supplier relation, lean, green or environmental performance. Duarte and Cruz-Machado (2013) explored the relationships between LG paradigms. Inman and Green (2018) revealed that lean positively affects operational and environmental performance measures while green practices impact only on environmental performance. Fullerton and Wempe (2009) and Zhan, Tan, Ji, Chung, and Chiu (2018) confirmed the impact of the LG paradigms on SC performance.

Carvalho et al. (2017) empirically validated mathematical model based on decision making to choose the best LG practices to improve eco-efficiency. Galeazzo et al. (2014) examined the relationship between LG paradigms and their impact on various SC performance measures through case studies from the two manufacturing plants. Campos and Vazquez-Brust (2016) identified that out of 31, 26 practices are synergistic between LG paradigms. Kumar and Rodrigues (2018) analysed the synergetic impact of LG paradigms on innovation, whereas Diaz-Elsayed et al. (2013) empirically identified that both strategies helped in reducing production cost. Ng et al. (2015) integrated LG paradigms and validated them, just as Duarte and Cruz-Machado (2017) developed and validated conceptual framework. Thanki and Thakkar (2018b) used balanced scorecard and assessment criteria to evaluate LG performance and also discussed the causal relation between them. Fercoq et al. (2016) identified how LG paradigms affect solid waste management performance. Verrier et al. (2016) discussed the synergies among LG paradigms and developed a maturity model. Thanki and Thakkar (2018a) identified the 25 critical success factors for lean and green paradigms, whereas Thanki and Thakkar (2018b) discussed a tool that assesses LG performance. Chiarini (2014) analysed how lean paradigm affects environmental performance, and Zhan, Tan, Ji, and Tseng (2018) discussed the relation of lean and green with organisational performance.

LS paradigms: A total of six studies: Henao et al. (2018) ascertained how lean paradigms affect sustainable performance. Leon and Calvo-Amodio (2017) explored the relationships of lean paradigms with sustainability. Martínez-Jurado and Moyano-Fuentes (2014) and Tasdemir and Gazo (2018) identified the linkage LS paradigms for SCs. Das (2018) defined antecedents, enablers, ingredients and practices that linked lean with sustainability. Sajan et al. (2017) defined the relationships of lean paradigms with sustainability and among the sustainability dimensions.

AR paradigms: Only one study by Carvalho, Azevedo, et al. (2012) analysed the interrelationships between AR paradigms and their effect on SC competitiveness and performance.

AG paradigms: Only one study by Sayyadi Tooranloo et al. (2018) used seven criteria and 37 subcriteria to evaluate the agility paradigm in the green SC.

AS Paradigms: Only one study by Singh and Vinodh (2017) empirically tested a model with five enablers and included 25 criteria and 75 attributes to establish the relationships between agility and sustainability.

RG paradigms: A total of four studies: Based on a case study approach, Mohammed et al. (2019) highlighted the RG paradigms' importance in the present context. Azevedo, Carvalho, et al. (2013) empirically investigated an Ecosilient index, whereas Fahimnia et al. (2018) empirically identified the similarity and differences between RG paradigms, and Sen et al. (2017) analysed the RG paradigms' integration and developed a resilient index.

RS Paradigms: A total of three studies: Thomas et al. (2016) identified the various practices, tools and models to analyse resilience and sustainability empirically. Fahimnia and Jabbarzadeh (2016) studied resilience and sustainability relationships. Rafi-Ul-Shan et al. (2018) synthesised the risk management and sustainability concept.

GS paradigms: A total of five studies: Luthra et al. (2016) collected data from 123 Indian automobile companies to empirically test the proposed framework that established the relationship between the green practices with sustainability. Singh and Trivedi (2016) did a literature review on green sustainable SCM. Brindley and Oxborrow (2014) empirically investigated the synergies between the sustainable SCM with green marketing needs, for that used UK university catering department. Ahi and Searcy (2013) identified the 22 and 12 different green and sustainable SCM definitions, respectively, and Cosimato and Troisi (2015) investigated how green practices play an important role in keeping logistics organisation competitive through DHL case study.

LAR paradigms: A total of three studies: Mohammaddust et al. (2017) discussed a mixed integer non-linear model that includes LAR paradigms to meet different performance objectives. Purvis et al. (2016) proposed a framework for resilient SC strategies and highlighted the importance of leanness, robustness, agility and flexibility. Lotfi and Saghiri (2018) proposed a framework that highlights the relationships among LAG paradigms with SC performance and empirically test by collecting data from 151 automotive part suppliers.

LAS paradigms: Only one study conducted by Ciccullo et al. (2018) that analysed 73 papers to integrate social and environment dimensions of sustainability with LA paradigms.

LRG paradigms: A total of two studies: Ruiz-Benitez et al. (2017) analysed the impact of LRG paradigms in an aerospace sector and used ISM with IPA, and Govindan, Azevedo, et al. (2015) used the ISM technique to evaluate the critical LRG practices for the automotive SCs.

LGS paradigms: A total of eight studies: Caldera et al. (2017) proposed a lean and green matrix. Azevedo et al. (2012) developed a framework that link LRG upstream paradigms with sustainability and empirically test it through a Portuguese automaker case study. Verrier et al. (2014) discussed a framework that link LG practices with sustainable development. Mollenkopf et al. (2010) highlighted the relationships among LG and various SC strategies. Dhingra et al. (2014) discussed the integration of lean, green and sustainability. In Gandhi et al. (2018), based on the literature and experts' opinion, various drivers for implementing lean and green practices were identified, and MCDM, TOPSIS and SAW were also used to identify the criticality or importance of these drivers. Hajmohammad et al. (2013) proposed a framework that link lean with the environmental performance while mediating by environment practices and empirically test this relationship through a survey in which data were collected from the Canadian manufacturing plants, and Carvalho, Duarte, et al. (2011) validated a theoretical framework that link LG paradigm with sustainability or sustainable business development through a case study in Portuguese automotive supply chain.

LARG paradigms: A total of four studies: Azevedo et al. (2011a) discussed a framework that links LARG paradigms with operational, economic and social performance. Moreover, the study identified just in time (JIT) and supplier relation practices, with inventory level and time as the most important performance measures. Cabral et al. (2012) empirically studied a LARG integrated ANP model being used for choosing the most appropriated practices and KPIs to measure the SC performance. Azevedo et al. (2016) developed a LARG index. Carvalho, Azevedo, et al. (2011) discussed the synergies and differences among LARG practices.

LRGS paradigms: Only one study: Govindan et al. (2014) investigated linkage among various LRG practices with the SC sustainability and validated it by five case studies in Portuguese automotive SC.

Supply chain performance: A total of four studies: Beamon (1999) proposed a conceptual framework to evaluate the SC performance measures. Aramyan et al. (2007) empirically investigated a performance measurement framework to validate it in a Dutch-German tomato SC. Martin and Patterson (2009) discussed the linkage between the firm performances with the SC performance and revealed that inventory measurement, cycle time and financial performance as extraordinary performance measured. Azevedo, Govindan, et al. (2013) developed a framework and used the ISM technique to test the relationships empirically and rank performance measures.

Based on RQ1, RQ2 and RQ3 as discussed above, RQ4 will be answered in the upcoming section.

7 | CONTRIBUTION, CONCLUSION AND FUTURE AVENUES

This research seeks to analyse and discuss the present status, research outputs, current trends and future opportunities in the field of LARGS paradigms in SCM. As discussed, initially, key articles were selected from the various databases, relevant to the selected theme. Afterwards, we used the backwards and forwards approach, leading to a collation of total 160 research articles published from 1999 to June 2019.

A total of four research questions were raised—RQ1 revealed that a large number of studies were survey based, used statistical tools and still the researchers focused on single country-based SCs, only 21% studies included multiple countries in their studies, more multi-country supply chain-based studies revealed more interesting facts and is consider as an emerging research area. In RQ2, industry-based

classification, most of the researches were conducted in the manufacturing sector, especially in the automotive sector, whereas very less research was reported from the service sector but have great potential in the various field applied in public sectors management, healthcare, education, transport management and so on. It was observed that most research in this domain focused either on the focal company or supplier selection, and no study addressed the effect of these paradigms on the inbound and outbound logistics. In term of tools and techniques used as discussed earlier, large number of researchers applied either analytical techniques or statistical tools. Further, RQ3 presented the finding based on integration/relationships of various paradigms with SC performance. The literature revealed that no study was conducted on eight different combinations with supply chain performance, which includes (a) interrelationships among lean, agile, green paradigms and with the SC performance; (b) integration of lean, resilient and sustainable paradigms; (c) interrelationships among agile, resilient and green; (d) combination of agile, resilient and sustainable; (e) combination of resilient, green and sustainable; (f) integration of lean, agile resilient and sustainable; (g) combination of lean, agile green and sustainable; (h) combination of agile, resilient, green and sustainable and (i) LARGS practices with SC performance. In addition to that based on these studies, we also arrive at six different performance measures: overall performance, competitive advantages, operational performance, economic performance, social performance and environmental performance. These were further classified into a number of performance indicators: inventory level, quality, customer satisfaction, lead time, capacity utilisation, scrape rate, productivity/customer fill rate, service level, total cost, environmental cost, production cost, inventory cost, operational cost, transportation cost, cash to cash cycle, business waste, green image, CO_2 emission, flexibility, velocity, visibility, competence, collaboration, responsiveness and innovation. In this, it was observed that most of the researchers used these indicators randomly. No study elaborated on which indicator came under which performance measures and how they affect one another.

No study was also found in the literature (from 160 articles) that discussed how various types of the manufacturing strategies (make to order [MTO], make to stock, engineer to order [ETO], etc.) affects the selection of various LARGS practices. Further, various production systems (job-shop, Batch type, Mass production, continuous types of production systems) affect the selection of the LARG practices and the best/important practices for these production systems. Similarly, no study discussed the importance of the LARGS practices on the basis of organisational levels (strategies level, tactical level and operational level). In addition to this, still no study was conducted that depicted how implementation of these practices affects one another and end to end supply chain performance.

In addition, it was also observed that initially, green, resilient, agile and sustainable paradigm emerged as the performance measures and terms used were greenness or GSC, resilience or SC resilience, agility or agile supply chain, in the SC. Later, agile, green and resilient were established/used as the separate/have many practices known as resilient practices, green practices, agile practices and now known as individual paradigms which affects the SC performance. However, sustainable paradigm is still in the nascent phase and is considered the performance measures. Still it is not clear what type of practices are considered in the sustainable practices. While in case of the lean paradigm, this concept evolved just opposite to the above-mentioned paradigms. Initially, it was used as the lean practices and researchers used to find how these affect SC competitiveness. Later, it was also used as the performance measures like leanness. In the selected studies, mostly all researchers made a common argument, except lean (has extensively researched area/have extant literature), all the other agile, green and resilient paradigms are new or in nascent stage, and impact of the combination of all these on the SC chain is less explored. In addition to this, assessment of leanness, agility, greenness, resilient and sustainability is restricted to firm level and not yet explored fully to entire SC process in the literature.

Among limitations, this work is highly descriptive and theoretical, and only the reflection of the papers selected is studied for this study.

Based on the above discussions, the following future research directions are suggested:

- Which practices can be grouped under the Sustainable paradigm?
- What, if any, are the synergies and divergences among the LARGS paradigms, and how do they affect each another?
- How do the LARGS practices sequentially and simultaneously impact all the stages (supplier, focal firm, distribution and customer/consumers) of SC performance measures?
- How do the LARGS practices sequentially and simultaneously affect the various industrial sectors?
- How can the degree of compatibility among LARGS paradigms be measured?
- Is the integration of the LARGS paradigms enough for achieving the maximum potential of SC performance improvement?
- What is the impact of the combinations of these practices (LARGS) on the conventional performance matrix (includes only economic performance measures)? Moreover, what are the consequences of including environmental and social performance measures in the conventional performance matrix?
- How are the categorisations of the performance indicators based on operational, economic, social, environmental and competitive advantages, apart from the overall performance?
- What is the impact of combinations of LARGS paradigms on all kinds of MUDAS, and on the dynamic capabilities (structural and unstructured)?
- What is the implication/impact of the application of emerging technological interventions (Industry 4.0) on the trade-off among LARGS paradigms and SC performance measures as well?
- What are the most critical practices among LARGS paradigms, SC performance measures and impact of all these on one another and the SC performance?
- What are the most crucial performance indicators measures matrix for a sustainable SC and its entities?

- What is the role of LARGS paradigms and sustainability in supplier selection criteria, logistics (various stages of SC)?
- What is the role of the LARGS paradigms at the strategic, tactic and operational levels?
- What are the important performance measures that play an important role in the selection of LARGS paradigms? Moreover, how do these affect the selection of LARGS paradigms?
- How the production systems (job shop, batch production, mass production and contentious production) and various manufacturing strategies like make to stoke, make to assembly, ETO and MTO affect the selection of the various LARGS practices?
- What are the important LARGS practices at various organisation levels (strategical, tactical and operational levels)? Moreover, how these affect the selection of various LARGS practices?
- How the implementation of LARGS does practices impact with each other at the firm level and an end to end supply chain?

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