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Review Article

The Emergence of a Sustainable and Reliable Supply Chain Paradigm in Supply Chain Network Design

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Shorter product life due to technology development and changing customer needs requires optimal supply chain management and structuring. Achieving this optimization brings productivity to the organization. A sustainable and reliable supply chain (S&RSC) as an emerging paradigm, with a comprehensive view, leads the supply chain network design (SCND) issue to the desired situation. This study, as part of an emerging theme, presents a systematic review and classification of 42 articles at the intersection of sustainability, reliability, and supply chain network design. In this regard, in a historical course, the four concepts of green supply chain, socially responsible supply chain, sustainable supply chain, and reliable supply chain in the form of four structures of history and definition, deriver and importance, substrate and practice, evaluation, and implementation are discussed. The result of the review shows that the articles that study the integration of sustainability and reliability in SCND are vibrant and rapidly growing in various industries. Developing countries and manufacturing companies with the largest number of articles have been the research fields of the studies. Most of the studies have considered the structure of the supply chain as a forward flow. The key contribution of this review is the development of a comprehensive framework of S&RSC from the conceptual point of view, elements, assessment tools, and its implementation context. The present review can serve as a guide for various stakeholders. In particular, practitioners and policymakers can effectively develop their own strategies and policies to advance the sustainable-reliable program.

1. Introduction

The highest operating costs of organizations, which are usually not noticeable, are related to wrong decisions in the design and installation of facilities. Profitability, customer service, flexibility, and reliability are various performance measures of the supply chain to be affected by supply chain network design decisions. Therefore, maybe 80% of total product cost is related to supply chain design decisions [1]. Statistics show that about 40 to 60 percent of small businesses never reopen after a disaster [2].

Today, the role of reference materials in reducing production costs and the impact of greenhouse gas (GHG) emissions on the environment is understood by green supply chain (GSC) design [3]. The social aspect of supply chains is related to social justice and the rights of stakeholders including employees, customers, and local communities [4]. Attention to social and environmental issues has led to the creation of a new concept in business called corporate social responsibility (CSR). Recently, governments have paid much attention to social participation and development as one of the main aspects of social responsibility, especially in developing countries [5]. For example, according to the "Fifth Development Plan of the Islamic Republic of Iran," issues related to job creation and balanced economic development have been significantly welcomed. Environmentally friendly innovation (in terms of process) has a positive effect on the economic, environmental, and social performance of supply chains [6]. Design is one of the main tools for companies to achieve innovation. In general, GSC as an innovative strategy can lead the company to gain a competitive advantage [7]. The effects of supply chain design and establishment remain for many years, during which time business environment parameters (such as customer demand) may change [8]. Supply chain risks severely affect the performance and growth of businesses and a decision that looks good in the current environment seems weak by changing position [9]. Therefore, SCND decisions must be durable enough to operate well in uncertain and complex business environments [10].

According to statistics published on the website of the World Health Organization, in 2020, 2292374 people worldwide died due to the Coronavirus. The prevalence of coronavirus in many value chains around the world, especially in the SSC, has caused huge disruptions [11]. Such disturbances have significant negative effects on sales revenue, return on investment, purchasing strategies, brand image, supply, materials, shareholder and customer health, logistics services, and overall supply chain performance [12–14]. These negative effects are the consequences of out-of-reach supply, production, and distribution processes in the supply chain [15]. In such situations, industry managers must adopt policies that make the supply chain sustainable, highly resilient, and reliable [16]. Multinational corporations place special importance on their business location decisions for the predictability and reliability of the supply chain and the selection of suppliers based on sustainability criteria [17]. In order to prevent supply chain collapse as well as reliable delivery of goods and services, supply chain resilience to failure needs to be reconsidered [18]. Following the outbreak of Coronavirus, delivery reliability, in addition to ensuring customer satisfaction, is a lever to facilitate supply chain sustainability [19].

Given today's challenging environment, suppliers and buyers tend to push supply chains toward lower distribution costs and greater responsiveness. Traditionally, economic optimization (higher profitability or lower cost) has been a competitive advantage in SCND. Recently, the ability of supply chain continuity as one of the new paradigms in SCND has become more important. Therefore, simultaneous attention to the aspects of sustainability and reliability in SCND, in addition to gaining a long-term competitive advantage, will also have the ability to maintain the supply chain.

In [4], reviewing 87 articles in the field of SSC design published between 1990 and 2014 found that more than 70% of the articles were published after 2009. Environmental requirements were considered in 96% of the articles, while social aspects were considered in only 15% of the articles. Analyzing 85 articles from 2000 to 2016 showed the growing trend of literature on sustainable supply chain management (SSCM) practices in developing countries since 2008 and concluded that there is a strong need for research on trends and ways to achieve sustainability in emerging markets [20]. In general, in the last two decades, the issue of SCND has received more attention from industry managers and academic researchers [21].

The purpose of this study is to investigate the sustainability and reliability of studies related to the field of SCND. Thus, the concepts of the GSC, SRSC, SSC, and RSC in the form of four structures: (1) history and definition, (2) driver and importance, (3) substrate and practice, and (4) evaluation and implementation, are discussed. Examining these structures and the relationships between them can have new insights for management and users. The remainder of the study is structured as follows. Section 2, as the starting point, describes the review methodology. In Section 3, the way of evolution, the motivation to create, the effective factors, and the evaluation methods related to the four concepts of the supply chain are argued. The results are reported in Section 4. Research gaps are in Section 5, and conclusions appear in Section 6.

2. Methodology

Articulating clear and practical research questions is a determining factor in conducting a successful literature review. Questions inform the audience about the purpose of the study and its expected result. It shapes the collection and selection of texts and determines the method of its analysis. It is also a valuable indicator for reviewers by ensuring that the focus of the study is not lost. This last aspect is particularly meaningful when the research area is wide and there are a large number of relevant sources.

Therefore, Table 1 introduces the research questions that motivate this study. The purpose of this study is to identify the existing literature on sustainability and reliability in supply chain network design (research questions 1-1), categorize previous studies based on the pillars of sustainability, i.e., green supply chain, responsible supply chain, sustainable supply chain, and the reliable supply chain (research question 1-2), to outline the gaps of the sustainable and reliable supply chain paradigm, and clarify the direction of future research (research question 1-3). For this purpose, a search protocol has been implemented as described in Table 1. The search protocol includes the steps of collecting documents (steps 1 to 4) and providing input and output criteria for selecting and analyzing articles related to answering the research questions (steps 5 and 6). Finally, the results of the search protocol are reported (step 7).

2.1. Collecting Documents. The search was done on August 1, 2022. The search included all "research" articles published in English without restriction on journal type or date of publication. The search was done within the title, abstract, and keyword sections. Two search strings were defined. Each string is a combination of the keyword "reliability" and two other keywords (see step 4). A systematic literature review should include broad enough keywords to ensure that relevant contributions are not excluded [22]. For this reason, to consider keywords derived from the same root, an asterisk (*) was used at the end of some keywords (e.g., "sustainability*" and "reliability*") [23]. In this study, in order to obtain a comprehensive set of sources according to the claim of Martins and Pato [24], keyword selection has been made based on related records.

Two databases, Web of Science and Scopus, have been used to access most of the essential publications in the research field, such as Elsevier, Emerald, Inderscience, and Springer. This search yielded 286 unique articles, with Web of Science providing the largest number of documents (217).

Table 1: Research protocol.

1	Research questions	1-1	Which documents in the literature have examined sustainability and reliability in SCND?							
		1-2	In the evolution of the S&RSC paradigm, what concepts have existed in the field of SCND?							
		1-3	What research opportunities have the identified gaps in designing an S&RSC network created for researchers?							
2	Information resources		Web of Science and Scopus scientific databases							
3	Search criteria	3-1	Language					English		
		3-2	Document types					Article		
		3-3	Search field					Title, abstract, and keywords		
		3-4	Search time					August 1, 2022		
4	Search string				Keywords			Web of science	Scopus	Total[a]
		4-1	"Sustainability*"	and	"Reliability*"	and	"Supply chain"	139	118	207
		4-2	"TBL"	and	"Reliability*"	and	"Network design"	126	97	188
					Total[a]			217	178	286
5	Inclusion criteria		After removing duplicate records							
		5-1	Do not review			and				
		5-2	Follow a sustainable approach							
6	Exclusion criteria	6-1	Articles in nonrelated fields such as medicine			or				
		6-2	Consider only economic sustainability			or				
		6-3	Not having a mathematical model							
7	Search results	7-1	Based on keyword searches			286				
		7-2	After analyzing the title of the article			165				
		7-3	After reading the abstract of the article			72				
		7-4	After reading the text of the article			34				

The highest number of articles (207 items) was generated by with search for the keywords "sustainability," "reliability*," and "supply chain." In return, the search for the keywords "triple line," "reliability*," and "network design" created fewer results (188 items). For each search string, 15% and 20% of the total articles retrieved from the two databases overlapped. This shows that the databases for the present study are largely complementary.

2.2. Selection of Documents. After collecting the documents, their selection is based on the inclusion and exclusion criteria presented in steps 5 and 6 in Table 1. These criteria, through setting boundaries, help to determine the scope of the study. Most of the collected articles did not meet all the inclusion criteria, such as Negri et al.'s review article, although they were classified as "research articles" in the databases reviewed [25]. In addition, an article to be selected must address at least two dimensions of sustainability in supply chain design (see steps 5-2 and 6-2 in Table 1). Although environmental sustainability and social sustainability are related to concepts such as reverse logistics or closed-loop supply chains, articles with an economic sustainability perspective dominate. Therefore, in accordance with the concept of sustainability assumed in this study, 23 articles, including Rohaninejad et al. [26], were excluded from the selection process despite the design of a cheap and reliable supply chain network.

The selection of articles was done in three stages. The first selection was based on the titles of the articles. In the second act, the abstracts of the articles were studied. In the third step, articles were screened by reading the full text. In order to ensure the correct and consistent implementation of the inclusion and exclusion criteria, a sample of 15 articles (equivalent to 5% of all collected articles) was randomly selected and reviewed by two of the authors. Due to the fact that two evaluators were involved, the statistical criterion chosen to evaluate the reliability level was Cohen's kappa coefficient [27]. The size of agreement between two evaluators was $\widehat{K} = 0.81$, which is in the upper range of the interval of agreement suggested by Landis and Koch [28]. Any disagreements were discussed a until consensus was reached. At the end of the first stage, 165 articles were identified. 93 and 38 articles were removed due to the analysis of the abstract and the complete text, respectively. 72 papers were of type review, 23 articles did not follow a sustainable approach or considered only economic sustainability, 19 papers are non-related, and 17 papers do not have a mathematical model. The final number of articles identified through the search protocol was 34 (see step 7 in Table 1).

In addition to the sources identified by the search strategy, other methods were also used to collect relevant materials. Review and follow-up of previously identified sources ensured the identification of three new articles that were meaningful to the study. Tracing references in previous sources (snowball backward) added five valid sources to the list. As a result, the total number of articles suitable for content analysis and coding increased to 42 (see Table 2).

3. Literature Review

3.1. History and Definition

3.1.1. GSC. The concept of GSC was first introduced by Kelle and silver in 1989. They created an optimal forecasting system for forecasting products that could be potentially reusable. Consideration of environmental factors along with supply chain management was first proposed by Beamon in

Table 2: Number of selected articles.

A	Through search manual	34
B	Through informal approaches	3
C	Through snowball method	5
	Total	42

1999 [29]. In the evolution of green supply chain management (GSCM), the complexity and scale of GSCM technology also increase [30]. GSC over time dedicated various names such as "Sustainable supply chain management," "Corporate social responsibility networks," "Environmental supply chain management," "Green procurement," "Environmental procurement," "Green logistics and environmental logistics" [31] and is an important component of supply chain environmental strategies [32]. GSC is a multidisciplinary concept that is created by creating environmental management practices in the field of supply chain [33]. The definitions provided of GSCM have been influenced by a wide range of factors such as author focus and green practice goals [34]. Among definitions of the GSCM, Suring and Müller's definition due to the highest number of citations to the main article (5913 citations as of November 11, 2021) can be considered the most effective definition, which is defined as follows: "Management of materials, information and capital flows, as well as cooperation between companies throughout the supply chain, taking into account the goals of all three dimensions of sustainable development, namely, economic, environmental, and social, which arise from the requirements of the customer and stakeholders."

In accordance with this definition, GSCM not only reduces the environmental impacts created during the product life cycle but also seeks a reduction of the environmental impacts of the activities of stakeholders involved in the supply chain. When comparing GSCM with a traditional supply chain, three distinct features are observed [35]:

(1) Green: GSCM emphasizes the environmental aspects of the supply chain. This means reducing all the negative environmental effects of the supply chain by reducing resources and energy production in addition to the main function of the supply chain system.

(2) Closed-loop: the GSC converts material flow into a closed cycle by adding recycling to the traditional supply chain. This recycling process not only increases the resource utilization ratio but also reduces the costs and negative environmental impacts of products that have completed their life cycle.

(3) Integration: environmental protection in the GSC is a long-term and strategic goal for the entire system. Therefore, integration in GSCM rather than the traditional supply chain is more needed.

3.1.2. SRSC. Abrams extended the focus of responsibility from the managerial level to employees, customers, and the public [31]. According to this view, the interests of stakeholders are very important in the decision-making process. CSR in the second half of the Industrial Revolution was introduced by Bowen with the theme that organizations should pay attention to the values of society when making decisions and implementing strategies [32]. Friedman defended the representation theory to argue for CSR. In other words, organizations are responsible for their activities as well as their supply chain partners [33]. In an attempt to link the two concepts of CSR and corporate social responsiveness, Carroll introduced another concept called Corporate Financial Performance (meaning a voluntary role, like the outer ring in the CED definition of CSR) [34]. The relationship between financial performance and corporate social responsibility is more apparent in the 1980s than in the 1970s [35]. Therefore, the next step in the evolution of the CSR concept examined the social effects of social responsibility on the financial performance of companies. One of the first studies on social responsibility and the cornerstone of its introduction in the supply chain is the survey research of Carter and Jennings [36–38]. Of course, social responsibility in their research was evaluated only at the purchase stage and with the participation of sellers. In general, the process of formation and evolution of the concept of CSR can be expressed in five periods [39]:

(1) The period of greed: the social responsibility of organizations in this period is defensive so that the responsibility and permanence of organizations are limited.

(2) The period of altruism and philanthropy: organizations work benevolently and through their financial and nonfinancial support to empower social groups.

(3) Misdirection period: in this age, organizations saw social responsibility in the form of Promotional or propaganda as an opportunity to promote their brand, image, and reputation.

(4) Management period: a strategic approach to the issue of social responsibility to adhere to the principles of environmental and social management in the business cycle was viewed.

(5) Period of responsibility: by targeting change and transformation, social responsibility focuses on identifying and addressing the causes of instability through innovation in business models and the transformation of processes, products, and services nationally and internationally.

In the last decade, social responsibility has become the dominant paradigm in the field of management of organizations. Carroll defined CSR as an organization's sensitivity to stakeholders' expectations of managing social, environmental, economic, ethical, and legal issues [34]. CSR in ISO 26000 is defined as the responsibility of an organization for the impact of its decisions and activities on society and the environment, through ethical and transparent behavior [40]. CSR defines as "the responsibility of companies for their impact on society" by European Commission [41]. According to the ethical framework of social responsibility, the activities of organizations should be such that, as a result, society is not harmed and in case of harm, the relevant organizations are obliged to compensate it [42]. Companies have social responsibility by accepting responsibilities beyond their profitability and Legal Liability [43, 44]. Social responsibility is seen as a subset of organizational tasks related to voluntary activities toward society [45].

3.1.3. SSC. The International Union for Conservation of Nature first used the term sustainable development in 1980 to describe a situation in which development is not only harmful to nature but also helpful. A strategic plan for sustainable living was presented in 1991 by the International Union for Conservation of Nature in collaboration with the United Nations Environment Program, the World-Wide Fund for Nature, UNESCO, and the Food and Agriculture Organization of the United Nations. In this strategy, sustainable development means that the quality of human life is sustainable as the capacity of supported ecosystems increases. SSCs were first introduced by Elkington in 1998 with the aim of encouraging business owners to evaluate their performance based on environmental and social impacts alongside the conventional goal of "increasing profitability" [46].

SSC rather than the traditional supply chain requires a wider view and more cooperation between participating companies [47]. To transform a supply chain (SC) into a sustainable supply chain (SSC), cooperation and integration at all stages from the purchase of raw materials to the end of consumption by customers are essential. SSCs are not limited to green and responsible supply chains [48]. The quality of what is produced depends on the operational processes that must be performed in the social, environmental, and economic dimensions [49]. SSCM refers to the transparent integration and achievement of organizations' social, environmental, and economic goals through the effective coordination of internal organizational processes [50]. In 2013, the Supply Chain Management Professional Council updated the concept of sustainability as a business effort to conform to the elements of sustainable development, taking into account the requirements of stakeholders and CSR [51]. To achieve sustainability, organizations need to redesign their current supply chains to incorporate sustainability goals into their operations from acquisition to distribution [52]. According to [33], a true SSC does not harm the environment and society (noneconomic dimensions) in addition to completing the economic dimension. Organizational collaboration, improving overall chain performance, and paying attention to stakeholder interests are some of the common factors in the definitions provided for SSCM in the literature.

Cetinkaya et al., in describing the SSC, state that transporting the product from the route with the highest value, in addition to economic justification, has major social and environmental consequences [53]. For example, road transport may lead to congestion and pollution. However, by compressing vehicle loads, congestion and pollution can be reduced and a step towards an SSC is achieved. Therefore, the steps taken to manage an SSC must be made in three key dimensions: economic, environmental, and social.

3.1.4. RSC. Reliability as a concept emerged in the late 1940s and early 1950s and was first used in communications and transportation [54]. In the 1940s, with the outbreak of World War II and the development of sophisticated military tools, the issue of reliability modeling was raised by Lusser and Murphy. In the 1950s, Agree and IEEE study groups were formed using electronic systems to develop standards for the production of highly reliable components. In the 1960s, with the development of the aerospace industry and the motivation of Apollo, the first book on the subject was written by Bazowski. Reliability practically was first developed in connection with aerospace and military applications, but were considered and used by other industries rapidly, such as the nuclear industry (which to ensure the safety and reliability of nuclear reactors in the supply of electricity is under intense pressure), and the continuous process industries such as steel and chemical industries (every hour stopping their activities can lead to financial loss, human damage, and environmental pollution in a huge amount) [55].

To date, no generally validated definition of an RSC has been provided. Thomas was the first to explicitly define the concept of supply chain reliability as "the likelihood that the key requirements of the chain will be met to meet the essential requirements for critical transmission points within the system" [56]. A company's ability to understand and manage economic, environmental, and social risks evokes the concept of RSC [50] which can be transformed into a flexible and agile supply chain by adopting suitable planning. In general, a supply chain is reliable if it performs well despite the failure of parts of the chain [57]. The reliability of supply chain members is defined as the natural performance of a facility over a period with a certain capacity [58]. Reliability is a popular indicator that is used to present the failure rate and evaluate the operations of companies. If reliability is effective in supply chain coordination, then it should be considered as one of the branches of supply chain literature [59]. A general classification of the concept of reliability in supply chains is based on the three criteria of frequency of operations, failure response, and the relationship between components provided [60] (see Table 3).

3.2. Motivation and Importance

3.2.1. GSC. Understanding SCM critical enablers and inhibitors, also known as critical success factors (CSFs), allows companies to successfully implement SCM [61]. In addition, consideration of GSCM-specific CSFs is highly effective in the successful implementation of GSCM [62, 63]. The old view of "greening as a responsibility" is changing to "greening as a potential competitive advantage" [64].

According to Kilbourne et al., the impact of coercive pressures on the promotion of environmental management

Table 3: Types of RSCs [60].

Criterion	Type	Example
Frequent operations	Once Reusable	Disposable Continuous operation
Dealing with failure	Recyclable Nonrecyclable	Business continuity with breakdowns Supply chain failure following disruption
Relationship between elements	Redundancy No redundancy	Parallel deployment of elements The secret connection between components and links

is significant [65]. Experimental findings show that government incentives are vital for the implementation of environmental management [66]. The customer is an important driver of company performance. Customers' decision, not to buy from companies that are not responsible for the environment, leads to serious problems in their financial performance. Cousins et al. and Björklund showed in their studies that the image of companies and their reputation play an important role in the desire of customers to buy corporate products [67, 68]. Pressure from government agencies and national/international regulators influences responsible environmental behavior [69, 70]. Public awareness of the company's environmental activities is the most effective motivating factor that is identified by the company when making green decisions [71]. If companies have a legal concern for the environment and there is social approval, environmental measures will be implemented more rapidly throughout the supply chain. It is important to note that the growth in the acceptance of environmental requirements is partly due to institutional pressures from market and regulatory demands [72–74]. Carbon pricing policies, carbon taxation, and fuel prices are examples of these pressures known as reactive drivers [75]. Active drivers are another type of GSCM driver that takes the lead in environmental responsibility. "Resource shortage theory" and "good management theory" are two examples of these drivers. Resource scarcity theory argues that financial performance can better use financial resources to invest in environmental performance and that financial performance predicts corporate environmental performance. The most successful companies have the financial resources and can spend the most money on environmental activities. Good management theory suggests a high correlation between good management practices and environmental performance because attention to environmental performance improves relationships with key stakeholders and thus corporate financial performance [76].

After extracting GSCM derivers during a thorough review of 39 key articles, a grouping for them is based on two dimensions (1) responsibility: self-awareness, or desired needs, and (2) source of motivation: internal or external [77] (see Figure 1). Environmental awareness (EA) refers to corporate self-awareness. Competitive advantage, corporate image, social or environmental responsibility, etc., fall into this category. Regulatory requirements (RR) refer to the knowledge imposed on companies. Most of them are imposed regulations that stimulate GSCM activities. Internal motivations (IM) are the internal demands of a company.

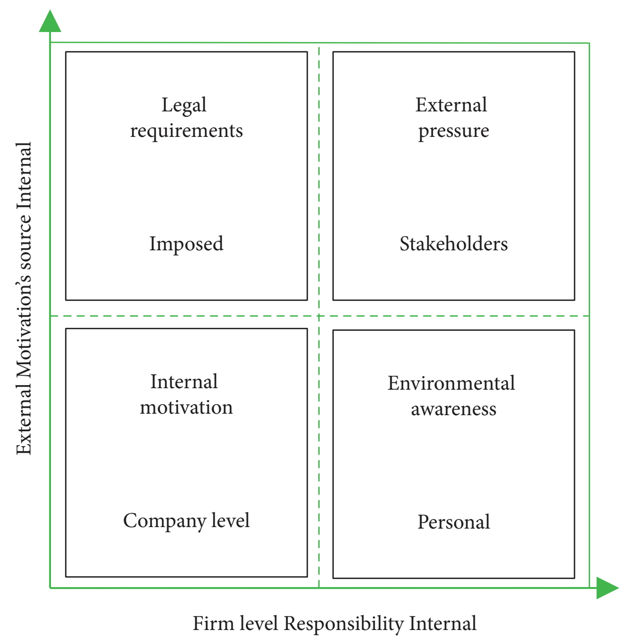

Figure 1: GSCM drivers' grouping [77].

This group requires strategies or goals at the company level that lead to the rapid adoption of green practices. External pressure (EP) refers to supply chain demands. Typically, these requirements are met directly or indirectly by supply chain stakeholders.

3.2.2. SRSC. The principle of corporate legal personality and the existence of corporate independence naturally precludes the extension of one member's liability to another. Therefore, all members of a supply chain are solely responsible for their actions. However, stakeholder theory argues that each member of the supply chain is responsible for the actions of other members. In fact, to achieve social responsibility in a company, it is not enough to control not only the level of social responsibility at the corporate ownership level but also the level of social responsibility must be guaranteed in other partners of the supply chain network [78]. With a more holistic view, organizations and society can be integrated and supported each other in win-win strategies [79]. Ebner and Baumgartner believe that being responsible for the problems of society will lead to organizational stability and ultimately sustainable development [80].

The sales of a major equipment manufacturer can be significantly reduced due to the social abuse of its external supplier [81]. The reputation and positive image of the companies that start CSR activities increases in front of the society and the increased reputation is beneficial for these companies. Increasing the reputation of companies committed to social and environmental goals is due to inspiring a sense of belonging in employees and their greater efforts for the development of the company. Companies such as McDonald's, Mitsubishi, Monsanto, Nestlé, Nike, Shell, and Texas's decline in reputation have been due to the poor performance of each member of their supply chain [82]. The benefits of accepting CSR in the supply chain include reducing risk, recruiting and retaining employees, saving costs, and building good relationships with shareholders [83].

One of the achievements of CSR is to increase employment opportunities and economic development for communities. From a resource-based perspective, if CSR-related resources and capabilities are valuable, rare, inflexible, and irreplaceable, they provide a lasting competitive advantage [84, 85]. CSR has become an important tool for businesses and can be described as the main reason for the company's competitiveness and viability [86]. Therefore, it is necessary to control supply chain management operations as a social responsibility because it affects human health and safety, contributes to the financial success of the company, and leads to the well-being and development of society [87, 88]. Approximately 90% of state-owned companies formed CSR committees in early 2013 [89]. New criteria have been introduced for listed responsible companies in stock exchanges (e.g., the Dominique Social Index 400, the FTSE4GOOD Index, Dow Jones Sustainability, or WIG Respect).

3.2.3. SSC. The phenomenon of population aging, reduction of productive economic force, and consequently increasing consumer population shows the importance of focusing on SSCM [90]. Sustainability has become a key factor in operations and supply chain management, so sustainability should be considered when analyzing and improving operations and managerial decision-making using economic, environmental, and social criteria [91]. Implementing sustainability initiatives not only improves the economic, environmental, and social performance of organizations but also provides them with a competitive advantage by acquiring a set of new competencies [92].

In the literature, SSCM incentives are classified according to their degree of influence and share or importance in the supply chain [93]. According to institutional theory, SSCM stimuli are classified into coercive stimuli, normative stimuli, and imitative stimuli [94]. Internal and external incentives are another classification of SSCM incentives according to institutional theory and stakeholders [93]. Stakeholder theory helps to understand the role of pressure exerted by various stakeholders to implement sustainability initiatives [95].

3.2.4. RSC. Concerns about the prevalence of disturbances and their losses have aroused more attention from researchers to the feature of reliability in the design of supply chain networks. Considering reliability in SCND as a strategic decision makes the chain continue to operate with the least loss in the event of a disruption or failure of one of the components. RSC network design not only seeks to avoid disruption of communication facilities and routes but also ensures the timely delivery of products to points of demand. Customers often expect their products and services to be delivered on time and with no delay [96]. Slow delivery and low reliability can definitely reduce customer satisfaction and loyalty, damage the company's image in the eyes of the customer, and even reduce sales revenue [96].

Retaining existing customers is much easier and more rewarding than searching for new customers. Studies show that attracting a new customer is about six times more expensive than retaining existing customers. Between 21 and 43% of customers whose demand is not met, we refer to competitors. Research shows that 96% of customers never complain about bad behavior and poor quality of goods and services, and 90% of these dissatisfied customers never return to the company [97]. According to research by Esteban Kolsky, each of these dissatisfied customers expresses their dissatisfaction to at least nine people, and 13% of them transfer their dissatisfaction experience to more than 15 people [98]. Hence, the importance of supply chain reliability lies in customer satisfaction. In fact, the reliability factor is a kind of prevention. This prevention creates costs in the system, but ultimately includes broader benefits such as reducing overall chain costs, building credibility and sustainability in competitive markets, and increasing profitability and customer satisfaction. High reliability is an important criterion for measuring the success of the supply chain and achieving its effectiveness and efficiency [20, 99].

3.3. Substrate and Practice

3.3.1. GSC. All parts of the traditional supply chain, including raw materials, production, distribution, consumers, and waste can be a source of environmental pollution [100]. To achieve the best environmental context in GSCM, the concept of green must be considered in most stages of the supply chain such as design, procurement, production, distribution, marketing, and services [29, 101, 102]. Green design, green production, and reverse logistics, as evidenced by [29, 103, 104], are the technical and tangible (hard) aspects of GSCM practices. Although the implementation of GSCM in developing countries is in its infancy, the technical aspect has an almost solid position [105, 106]. However, in emerging markets, little attention has been paid to issues such as senior management commitment, supplier partnership, and customer involvement in essential and nontechnical (soft) practices [106, 107]. Walker et al. stated that GSCM practices include all stages of the product life cycle [108]. GSCM practices can often be explored at the strategic, tactical, or operational levels [109].

Both upstream and downstream practices in GSCM are determined by customer-supplier relationships [110]. Green purchasing and supplier evaluation provide input logistics activities (material management) as upstream practices [111, 112]. Downstream practices include outbound logistics activities (physical distribution) such as green distribution and green marketing. Govindan et al., by classifying SCM practices in terms of agility, flexibility, and greenness into three categories, downstream, mainstream, and upstream, presented a conceptual model and evaluated the impact of these practices on the sustainability of Portugal's car supply chain [113]. To provide a conceptual framework for GSCM, Herrmann et al. identified 64 green practices in three dimensions, strategic, innovation, and operational, and organized them into 21 categories in terms of upstream, in-chain, and downstream [114]. 0020Levels of analysis of GSCM practices may cover a wide range of companies, supply chains, industries, and the global trade network [6, 115–118]. Elbaz and Iddik, after a descriptive and content analysis of 46 English articles from 30 international journals related to GSCM, found that the vast majority of published articles (50%) focus on company-level analysis [119].

The literature emphasizes on the need for superior human resources to successfully implement GSCM practices [120, 121]. Recently, an empirical study reported a positive relationship between both green human resource management (GHRM) and customer environmental cooperation with environmental performance in the Indonesian Green Label Certified manufacturing industry [122]. Thus, it can be argued that there is a wide range of contexts and practices of GSCM for the successful implementation of the GSC [20, 123]. However, many companies have not integrated GSC practices. On the contrary, the goals of the researchers are the limitations of GSCM research [48]. Therefore, so far there is no specific consensus on the dimensions of GSCM in [101]. A study with a review of 216 experimental research articles identified 46 practices for GSCM and showed many of these practices overlap. In addition, the inclusion of other perspectives in the classification of GSCM practices may provide a more comprehensive view [124].

3.3.2. SRSC. Today, in general, a job as a human being has responsibilities such as economic, legal, and moral issues [125]. Behavioral codes, organizational culture, anti-stress groups, personnel training, and value reorientation are possible sources of positive ethical influence across supply chains [126]. CSR includes obligations in environmental protection, areas of human resource management, safety and health issues, cultural aspects, and shareholders [127]. According to Schwartz and Carroll, economic, legal, and ethical areas are the most common components of CSR [128]. Organizational governance, human rights, working practices, environment, appropriate working conditions, customer attention, participation, and social development are the main themes of CSR in supply chains based on ISO26000 [36, 129].

3.3.3. SSC. A framework for SSCM is proposed, which consists of six supply chain functions: resource supply, transformation, delivery, value proposition, customers, and recycling [130]. Tajbakhsh and Hassini placed sustainability in seven dimensions: economic, social, environmental, valuable, valid, fair, and sustainable [131]. Sustainable flows of products, services, information, and capital, as well as the possibility of cooperation between supply chain partners, and ways to achieve value maximization for all stakeholders and to meet customer needs are the goals of SSCM [132].

3.3.4. RSC. The strength of each chain is the size of its weakest link, and without knowing and strengthening it, trying and wasting resources to strengthen other links would be fruitless. In fact, it can be said that the existence of a network is only as reliable as its upstream supply chain. Maintaining all the characteristics of the supply chain in the components and communication paths between the facilities is one of the basic requirements in assessing the reliability of the supply chain [60]. Considering the supply chain network as a graph, each node (supply chain levels) and arcs (interlevel paths) are part of the corresponding graph (supply chain network). Thus, to have an RSC, three approaches of node, arc, and network reliability can be considered.

A number of researchers have considered the reliability of the supply chain only at the supplier level with the possibility of disruption [133–135]. A supply chain disruption risk model was proposed to study the effect of decision sequence on increasing reliability with supply disruption risk [136]. Considering random disturbances for distribution centers and suppliers [137], the level of technology of manufacturers [138], and the capacity of suppliers and producers [139], a wide range of reliability can be achieved in SCND.

Forming a path with more reliable links is one of the important factors in optimal supply chain routing. Transport reliability should be considered as a parameter in the cost-benefit analysis process [140]. Cui et al. considered transportation methods as reliable and unreliable [141]. The activity of transport service components, technical and operational characteristics of system facilities, probability of failure of supply chain routes, and time indicators of service delivery are among the factors that have been considered to measure the reliability of transportation in the supply chain [142]. Ohmori and Yoshimoto managed the risks of supply chain disruption using the network reliability method [143].

3.4. Evaluation and Implementation

3.4.1. GSC. Despite the lack of a general methodology, a scattered range of case performance metrics has been developed to assess supply chain environmental performance. In a way, identifying the most appropriate performance evaluation criterion remains a challenging issue [144]. The amount of energy consumed is the oldest measure of the environmental impact of the facilities' established. For example, the average amount of waste produced by each production technology has been used to define environmental and social goals [145]. The carbon effect is the most popular measurement tool for measuring the environmental impact of the supply chain. It is possible to consider all GHG, but for practical reasons, the baseline indicators use only carbon dioxide, methane, and nitrogen dioxide [146].

Life cycle assessment is the most scientific method of studying and testing the environmental impact of a particular product or process, which allows for retrospective and futuristic assessment [147]. In this method, all relevant publications and consumption sources, environmental impacts, health, and issues related to the reduction of resources and related to each product or service are calculated. Environmental experts typically use the life cycle assessment method to assess the impact of organizational activities and processes on the environment. Shen proposed a method based on estimating the life cycle under uncertainty to measure the environmental impacts in a CLSC network related to the production and recovery of button batteries [148]. The most valid structure for evaluating product life cycle is provided by the International Organization for Standardization in the form of the ISO 14000 standard series [149]. Requirements and guidelines of ISO 14044 standard for life cycle assessment, including life cycle assessment principles and framework (ISO 14040), purpose, scope, and inventory of life cycle (ISO 14041), life cycle impact assessment phase (ISO 14042), and interpretation, reporting, and critical review of life cycle evaluation (ISO 14043), life cycle evaluation limitations, the relationship between life cycle evaluation steps, and the conditions for using value choices and optional elements [150]. LCA is a complex, time-consuming, and costly process that must be assessed and interpreted because it considers all supply chain environmental interventions (emissions or consumption of natural raw materials) [151]. LCA results are interpreted using a variety of environmental criteria [152]. Therefore, it does not make sense to use a complex method such as LCA when a valid estimate of the total environmental impact can meet the expectations of the decision maker.

Standard and simplified versions of life cycle assessment have been developed in several ways. These versions are based on life cycle assessment methods and often classify and standardize environmental impacts into midpoint and/or endpoint impact categories to select the appropriate method for assessing environmental impacts. Also, some methods use normalization and weighting mechanisms to quantify the results. A list of these methods and some of their characteristics are given in Table 4.

Companies typically use three basic approaches to GSCM: (1) reactive approach, (2) preventive approach, and (3) value search approach [154]. Zakeri et al classified the GSC models presented in the literature into three categories [155]. The first category includes modeling without a particular focus on regulatory mechanisms and only seeks to minimize the environmental impact of the supply chain, including carbon emissions. References [156–159] fall into this category. The second category focuses on supply chain modeling under carbon pricing terms. Studies by Fahimnia et al. [73, 75, 160] are in this area. The third category includes a number of published articles with a special focus on modeling and analyzing supply chain performance in a carbon exchange environment. Carbon cap and carbon trade price are important emission factors in these models [152, 161, 162] and are existing modeling in this field.

GSCM has been proposed as an essential strategic choice to reduce environmental impact and improve organizational performance on the path to achieving sustainable development [163]. Under the GSCM, the actions of supply chain actors must comply with the environmental requirements of managers, customers, and legislators. The literature has agreed on the need for internal management to improve company performance [164]. The successful adoption and implementation of most innovations, technologies, programs, and activities require the support of senior executives [165]. To ensure complete environmental excellence, senior management must be fully committed [166, 167]. Even the successful implementation of the environmental management system becomes smoother with the support of middle managers [164].

Managers to the reduction of the environmental impact of their organization can redesign the supply chain or change some technical decisions: change the fleet composition of vehicles [168], operational decisions: Optimal order quantity [169], selection of delivery routes [170, 171], and strategic decisions: the location of potential facilities [172]. In CLSC networks, the low quality of return products reduces the number of useable components and thus influences the strategic decision of location and size of the facility. This problem can be solved by adding separation centers in the CLSC network because the initial processing costs are usually less than the costs incurred in the subsequent processing steps. Separation centers can separate substandard products at the beginning of the reverse supply cycle and reduce transportation and distribution costs [173].

3.4.2. SRSC. Identifying the main stakeholders of the supply chain and the interests of each of them is a prerequisite for selecting quantitative criteria to determine and evaluate the social impact of the supply chain [174]. Lee et al., using institutional theory and stakeholder theory, conceptualized the dimensions of CSR in the supply chains of small and medium enterprises [175]. Pishvaee and Razmi have measured CSR according to the interests of different stakeholders [174]. Eriksson and Svensson, reviewing 94 articles from 2009 to 2013, identified sixteen elements affecting social responsibility in supply chains and classified them into three categories: stimuli, facilitators, and inhibitors [176]. With a review of the literature, below are some of the most important and useable indicators of supply chain social responsibility assessment.

Regional development arising from the establishment of facilities, injuries to employees for exposure to chemical elements [177], legitimacy, public responsibility, the direction of management [178], and index of political opposition [179] are some of these indicators. Wong et al. used three criteria to select a supplier based on CSR: occupational health and safety, child labor rights, and an in-house training program [180]. Working conditions, social commitment,

Table 4: Methods of environmental impact assessment [153].

EIA-methods	Covering midpoint impact categories	Covering end-point impact categories	Providing normalization method	Providing weighting method	Requiring goal setting
CML2001	✓		✓		
Eco-indicator 99	✓	✓	✓	✓	
EDIP 2003	✓		✓	✓	✓
EPS 2000		✓			
IMPACT 2002+	✓	✓	✓		
Ecological scarcity	✓	✓	✓	✓	✓
TRACI	✓				
Recipe 2008*	✓	✓	✓	✓	
ReCiPe 2016*	✓	✓	✓	✓	

*, this method can evaluate environmental impacts based on midpoint and endpoint effects.

and customer issues in the framework of Chardine-Baumann and Botta-Genoulaz [181] were used in [4]. Other studies considered equality in access to healthcare systems [182]. In criteria for the number of potentially dangerous products, the number of days lost due to occupational injury, the amount of waste produced, and the number of job opportunities created, it has been used to measure social responsibility in solving the SCND problem [145, 183]. One study has chosen four criteria to measure CSR: welfare and economic growth, shareholder responsibility, mass producer responsibilities, and hiring methods [184]. Tyagi et al. used three criteria in evaluating the supply chain performance based on CSR: human rights, protection against harm and welfare, and community development [102]. The criteria of stakeholder participation, consumer education in shopping, collaborative relationships, employee engagement, and marketing campaigns were used to evaluate the CSR performance of 23 of the world's largest retailers [185].

According to the literature, Table 5 classifies the most important criteria for assessing the social dimension of sustainability in terms of social impacts, stakeholders, and ISO26000 standard issues.

Investing in activities such as reducing emissions and improving working conditions and humanitarian assistance can implement social responsibility [186]. Post formed the first application of CSR in the supply chain by presenting a general approach to responsibility and adding social issues to traditional supply chain economic factors [187]. The most obvious way of CSR in supply chains is to use codes of conduct in large multinational corporations. The first rules of conduct were formulated in 1991 in the international apparel industry. Codes of conduct are usually adopted to avoid pressure from various stakeholders, including the growing impact of socially responsible investment. The number of codes has increased dramatically since the early 1990s [188]. By the end of 2009, there were approximately 300 standards in the field of corporate planning and implementation in the field of business, these standards or codes of conduct derived from local laws and conventions, standards, and international principles such as the United Nations Global Compact, Sullivan Universal Principles, Accountability 1000, Social Accountability 8000, ISO 14001 and ISO 26000, OECD Guidelines for Multinational Corporations, Global Preliminary Reports, and International Labor Declaration on the Principles and Fundamental Rights of Labor [189]. The social aspects of the supply chain are more concerned with competitive standards, the economic aspects with cost, productivity, and efficiency, and the environmental aspects with waste emissions, recycling of materials and products, and reduction of pollutants and hazardous gases. Figure 2 shows the supply chain liability assessment framework.

3.4.3. SSC. Most of the known criteria for assessing social sustainability are subjective and qualitative. Hutchins and Sutherland specifically proposed measurable indicators (employment rights, health care, safety, and philanthropy), although they do not cover all dimensions of social sustainability, that can be used in supply chain decisions [190]. Other criteria, such as the value of recycled waste paper [191], water consumption [192], and biological and noise pollution [169], to measure sustainability have been proposed in the literature. In order to optimally design sustainable biofuel supply chains, an economic goal with a total annual cost, an environmental goal with a life cycle of GHG emissions, and a social goal with the number of local jobs have been created have been calculated [193]. In another study aimed at designing and planning supply chain sustainability, the economic dimension according to supply chain costs, the environmental dimension according to Recipe 2008 method, and the social dimension with four indicators introduced by the sustainability guidelines (worker and decent work activities, human rights, society, and product responsibility) has been examined [194]. A general classification of sustainability assessment criteria according to three economic, environmental, and social dimensions is presented in Figure 3.

Sustainability reporting guidelines are designed to help organizations measure their performance in three dimensions of sustainability [195]. Companies typically use these guidelines to report and monitor developments on sustainable issues because of their ease of use and comprehensiveness [196]. Regulatory pressures and market

Table 5: The most important criteria for assessing social responsibility.

Stakeholder	Social impact	Assessment criteria	Description	ISO26000 subject
Customers	Consumption security	Production risk (amount)	Hazardous materials produced	Consumer issues
Staff	Safety	Sick leave (days)	Work days lost due to work injury	Work style
	Fair working conditions	Job creation (number)	Employment due to the establishment of facilities	Work style
Society	Community development	Job creation (number)	Employment due to the establishment of facilities	Development and community participation
	Quality of environment	Waste (amount)	Useless and unusable materials	Environment

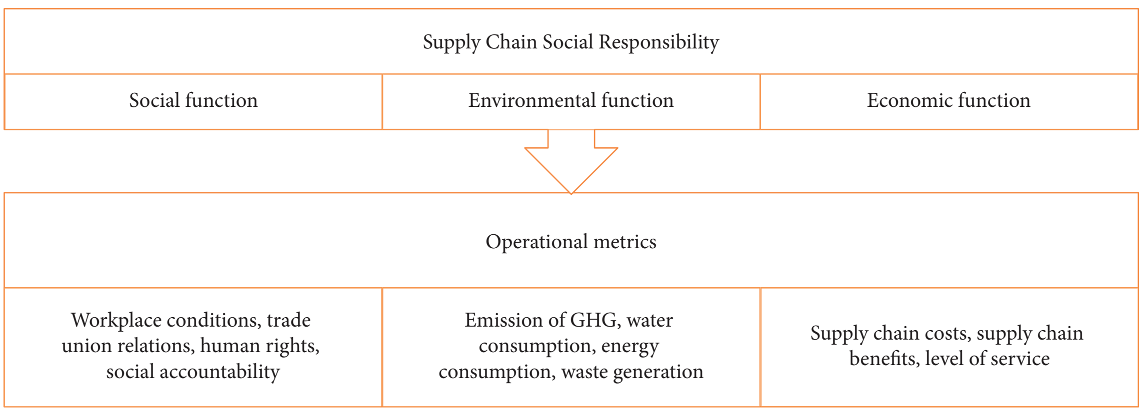

Figure 2: Framework of social responsibility in the supply chain.

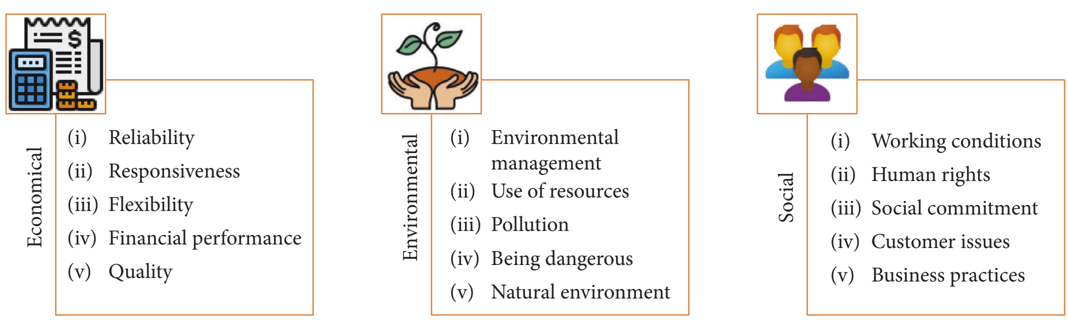

Figure 3: Classification of sustainability indicators [176].

pressures are the most important factors in implementing supply chain sustainability [197]. Moreno-Camacho et al., after identifying the sustainability assessment indicators used in 113 articles on SCND in the period 2015 to 2018, stated that 96.5% of the articles focused on environmental issues and 45.2% on social issues [198]. From identified 68 indicators of sustainability performance in the literature to evaluate organizations and their supply chain sustainability performance, 47% originated from the environmental dimension, 31% from the social dimension, and 22% from the economic dimension [199].

3.4.4. RSC. Supply chains, as complex systems, consist of many interactive components (subsystems) and therefore acquire new properties that cannot be reduced to the surface properties of the subsystem. Obviously, in the supply chain, a distinction must be made between links (supply chain participants) and elements (operations performed in the chain). Such a breakdown allows a particular supply chain to be considered as a set of companies and the operations they perform, thus enabling it to be evaluated. The reliability of each component affects the reliability of the entire supply chain. The scope of assessment in supply chain reliability assessment can be extended from one component to several different components of the chain (even the whole chain). Of course, the greater the number of components is, the more complex the calculation of reliability will be. Accordingly, researchers find the method to measure the concept of reliability a challenging issue.

Various criteria have been used to measure supply chain reliability in the literature, including wear-induced malfunction [200], estimating product life using a multi-criteria decision model [201], service life [202], determining engine life, neural network washing machine [203], potential failure [204], regression analysis for used cars [205], complete and reliable delivery [137], function estimation breakdown severity [206], quality of manufactured products [207], average amount of products delivered to customers [208], failure rate in remanufacturing operations [209], decrease facility capacity [210], and failure rate of parts [211]. Some studies, believing in the occurrence of accidental failure for supply chain facilities, have used the average of submitted products as a criterion for assessing reliability [212, 213]. Specifically, the exponential distribution function to describe this definition of reliability was used [208, 214, 215]. Failure rates in some studies only for routes between facilities have been considered [141, 216].

Operations and supply chain managers need to use two types of information to select appropriate strategies and to reduce the impact of disruptions: firm-level characteristics such as reliability, flexibility, and supplier availability and evaluation of transportation channels that can be used to minimize the impact of supply disruption and delivery risk [217]. Using strategies such as multiple source sourcing, facility strengthening, facility capacity development, transportation routes (rerouting), outsourcing, and emergency inventory maintenance is effective to increase network resilience and deal with disruption risks [218]. In general, there is no specific operational strategy to deal with supply chain disruption that is generally better than the other method because the choice of operational strategy to gain a competitive advantage according to competitive priorities (cost, quality, speed, and flexibility) is formed [219]. The internal and external characteristics of organizations are directly influential in this choice.

Lukinskiy et al. considered three basic approaches to assessing supply chain reliability. First is the technical approach based on the theory of complex systems reliability, in which chain elements are related in series, parallel, and combined with different types of active/hot redundancy and Standby/cold [60]. Second is economic approach such as the "perfect" or "ideal" order model [220, 221] and the "supply and demand" model [222], which is based on procurement costs, breaches of obligations and contracts (penalties, etc.), or key performance indicators. Third is a contingency approach such as the "timely" model, which involves recording the time parameters of the business process in the supply chains and is especially based on the basic concepts of just in time, quick response, and so on [223].

According to the first approach, knowing the reliability of each component in the system is necessary to calculate the reliability of the network. In this approach, designing the system structure in the form of a reliability block diagram is useful for calculation. Since the existence of a supply chain consists of different elements, it can be thought of as a system. Therefore, the redundancy allocation problem can be used to assess supply chain reliability. Some researchers in their studies have used a systemic approach to assess reliability [224–233].

According to the second approach, supply chain reliability can be defined as the probability that the planned (initial) capacity of the chain components can respond effectively to demand fluctuations. Hagspiel specifically mentions the possibility that a supply chain with a certain capacity will not be able to meet potential customer demand as a supply shortage risk [234, 235]. Similarly, the potential for complementary supply risk is known as supply chain reliability. Disconnection of supply, increase of demand due to the change of seasons, and sudden increase of demand lead to an imbalance of supply and demand. From equilibrium conditions between supply and demand to assess the reliability of the natural gas supply chain in another study used [236], this approach is summarized in how supply and demand are planned in the supply chain and is explained in Table 6.

4. Results

This section is completed by presenting quantitative and qualitative results about the reference articles and answers to the research questions. The unit of analysis of this research is an individual article (single source). From this section onwards, a code (consisting of the letter R and a number) between square brackets is used to identify the cited references. These codes are provided in front of 42 selected articles in the end references. The first research question 1-1 refers to the identification of the relevant literature review. This question is answered with the bibliographic data of the reference articles and with the supplementary information available in Appendix.

4.1. Emergence of the S&RSC Paradigm. On June 17, 2020, Canada's Minister of Natural Resources during a joint statement about Cooperation together between Canada and the United States on vital minerals stated "The Government of Canada remains committed to investing in Canadian exploration and mining projects and seeks to establish itself as a reliable and sustainable supplier of vital minerals." The emergence of the sustainable and reliable supply chain (S&RSC) paradigm is the result of understanding the relationship between concepts, such as supply chain (SC), supply chain management (SCM), reverse logistics (RL), green supply chain (GSC), closed-loop supply chain (CLSC). Socially responsible supply chain (SRSC), sustainable development (SD), sustainable supply chain (SSC), reliability engineering (RE), and reliable supply chain (RSC), which are ahead of each other in terms of time (see Figure 4).

4.2. Descriptive Analysis

4.2.1. Release Process. Descriptive analysis of the documents according to the view of Seuring and Gold [237] lays the groundwork for the category and content analyses that follow. Figure 5 analyses the evolution of articles over time, considering the year of publication and the number of citations received by each article.

The results show that 42 studies identified in the previous stage were published between 2014 and 2022. The data collection phase was performed at the beginning of August

Table 6: Supply and demand planning in the supply chain.

Confrontation of supply and demand	Market conditions	Inventory control cost	Solution
Supply = demand	Balance	No cost	Ideal
Supply < demand	Lack of supply	Missed sales cost	Supply management-production management
Supply > demand	Supply surplus	Inventory maintenance cost	Demand management-marketing management

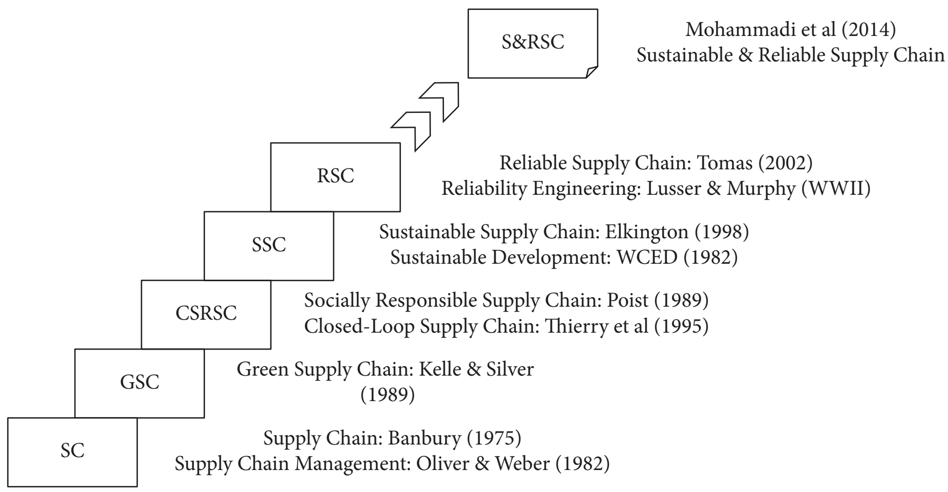

Figure 4: History of the emergence of an S&RSC management paradigm.

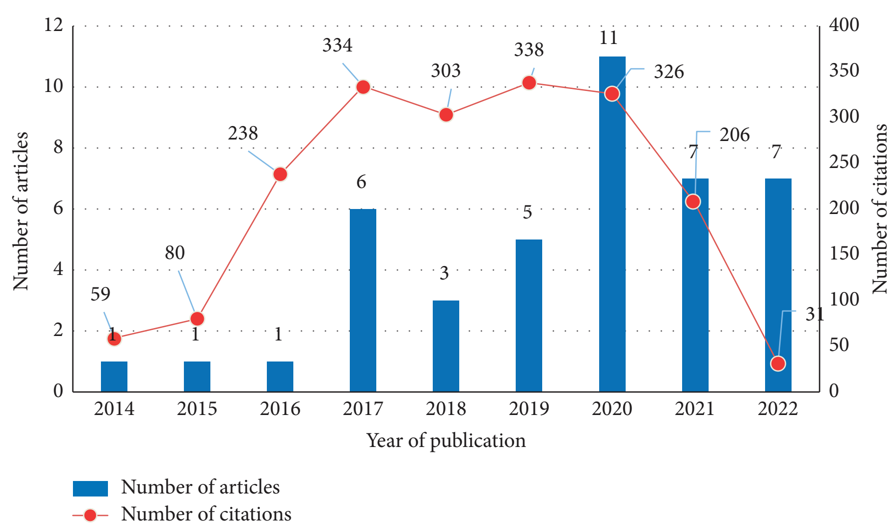

Figure 5: The number of articles and citations received based on the year of publication.

2022, and therefore, only seven articles published in 2022 were retrieved. The first article in our sample was published by Mohammadi et al. in December 2014 [238]. The highest number of citations with 238 is related to the article by Fahimnia and Jabbarzadeh [135]. Only three articles were published between 2014 and 2016, and the highest number of published reviews on this topic (11 articles) was recorded in 2020. Figure 5 also shows that nearly 93% of SCND studies focusing on sustainability and reliability issues have been published since 2017. This result may be due to the increasing demand for research on the application of social theories in the supply chain management literature [239]; almost 90% of public companies formed CSR committees in early 2013 [89]. It may even be due to the increasing importance of risk and disruption management to the academic and industrial community [240]. Therefore, the integration of sustainability and reliability in SCND can be a promising and evolving topic in the current literature. Based on the citations received in Google Scholar until August 1, 2022, Figure 5 shows that there are two peaks in 2017 and 2019, which are 334 and 338 citations, respectively. While there are six articles in 2017 and five articles in 2019.

4.2.2. Distribution of Articles among Journals. Of the 42 selected articles, only one is a conference article [241] and

Table 7: Distribution of articles in each journal.

Journal	Issue area classification												No. articles	No. citations	Citation/ article
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII			
Cleaner Production	✓	✓	✓	✓									7	316	45.14
Transportation Research Part E	✓		✓		✓	✓							5	605	121
Annals of Operations Research					✓								3	141	47
Engineering			✓										2	29	14.5
Clean Technologies and Environmental Policy	✓			✓				✓					2	26	13
Computers and Industrial Engineering			✓				✓						1	29	29
Production Economics	✓		✓		✓			✓					1	66	66
Production Research	✓		✓		✓								1	191	191
Manufacturing Systems			✓				✓						1	80	80
Applied Energy		✓	✓	✓									1	20	20
Applied Soft Computing							✓						1	24	24
Complexity							✓			✓			1	0	0
Energy Science and Engineering		✓	✓										1	14	14
Energy		✓	✓	✓					✓				1	56	56
Environment, Development, and Sustainability				✓		✓		✓					1	14	14
Human and Ecological Risk Assessment				✓									1	63	63
Hydrogen Energy		✓									✓		1	11	11
Supply and Operations Management	✓		✓		✓	✓							1	45	45
Advanced Manufacturing Systems	✓		✓				✓						1	17	17
Numerical Algebra, Control, and Optimization									✓				1	67	67
RAIRO-Operations Research					✓		✓		✓				1	67	67
South African Journal of Chemical Engineering		✓				✓						✓	1	0	0
Operations Management Research	✓		✓		✓								1	0	0
Sustainable Production and Consumption		✓	✓	✓									1	10	10
Uncertain Supply Chain Management	✓				✓								1	2	2
Journal of Industrial and Systems Engineering			✓										1	0	0
Cogent Mathematics	This journal is not supported by the Scimago												1	19	19
IEEE	This article is a conference type												1	3	3
Total	9	7	15	7	8	4	6	3	3	1	1	1	42	1915	45.6

the remaining 41 are research articles. The identified and selected articles that deal with the issue of sustainability and reliability in SCND have also been reviewed in terms of the number of publications in each journal and subject area. In this regard, 27 unique journals were identified. Among these, 22 journals have had a share of 52% in the distribution of articles by publishing one article. However, the share of the top five journals is close to 45%. In order to identify the subject areas covered by the journals, have been using the capabilities provided by the journal ranking platform, i.e., Scimago (http://www.scimagojr.com). The subject areas of the journals are in the following categories: (I) Business, Management, and Accounting, (II) Energy, (III) Engineering, (IV) Environmental Sciences, (V) Decision Sciences, (VI) Social Sciences, (VII) Computer Science, (VIII) Economics, Econometrics, and Finance, (IX) Mathematics, (X) Multidisciplinary, (XI) Physics and Astronomy, and (XII) Chemical Engineering. The multidisciplinary nature of the identified subject areas represents a wide research field for the scientific community. A summary of the number of published articles, total citations, and the ratio of citations to each article separately for each journal is presented in Table 7.

4.2.3. Distribution of Articles by Author. The geographical origin of the reference articles in terms of the geographical location of the corresponding author is scattered in 12 countries. Iran has the most production with 26 articles and Turkey with three articles. The USA, Australia, and Denmark are next with two articles each. The countries of Italy, India, Japan, South Korea, Malaysia, Taiwan, and Bangladesh have also contributed to the formation of an S&RSC paradigm article. One hundred and thirty seven authors participated in writing the selected articles. Figure 6 shows authors with two or more contributions. The contribution of the authors is considered regardless of their position in the article.

4.2.4. Distribution of Articles Based on the Case Study. In terms of real-world cases, it is evident that S&RSC design issues are mainly applied to local chains (in a single country). Table 3 shows the applied case studies. Iran is a country that has had more study cases. Some articles conduct case studies with transnational chains. These works are related to

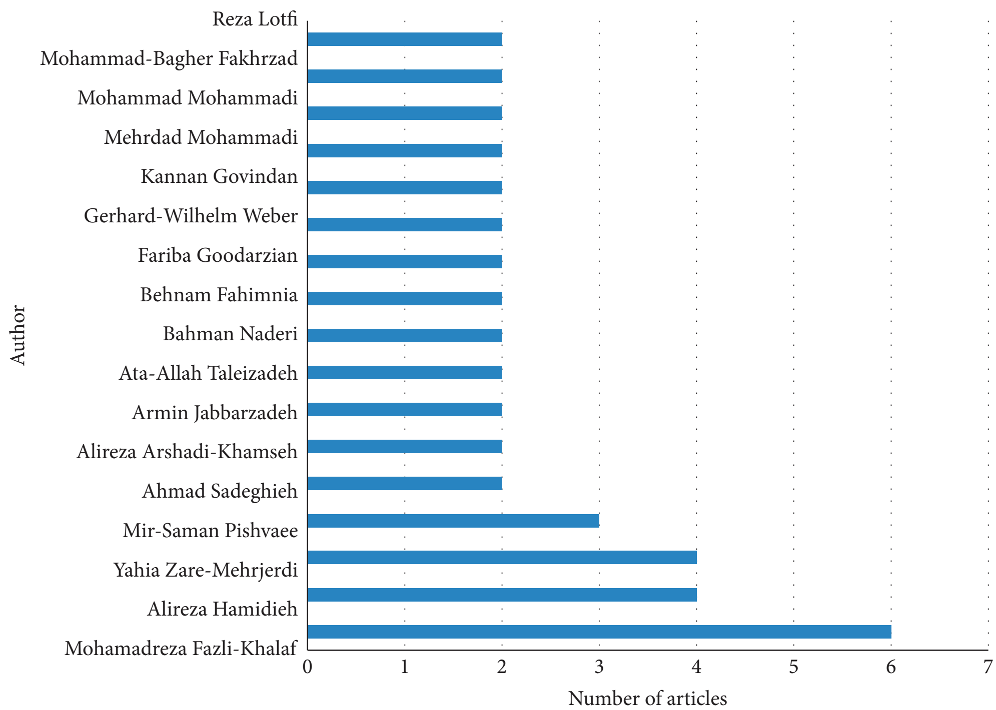

Figure 6: Distribution of articles by the author.

Table 8: Distribution of study cases by industry.

Industry (contribution percentage)	Case study	Article code
Energy (23%)	Biofuel	[R10], [R14], [R19]
	Hydrogen	[R20]
	Power generation	[R21], [R27]
	SATBA (Renewable Energy and Energy Efficiency Organization of Iran (SATBA))	[R38]
Healthcare (13%)	Health and treatment network	[R1], [R37]
	Pharmacology	[R7]
	Vaccine supply chain	[R35]
Rubber and plastic (13%)	Plastic pipes	[R11]
	Tire	[R28], [R29], [R32]
Car manufacturing (10%)	Car manufacturing	[R16], [R31]
	Recycling used cars	[R34]
Electrical machines and devices (10%)	Semiconductor	[R8], [R24]
	Battery	[R4]
Machinery and equipment (10%)	Teaching aids and teaching aids	[R5], [R12]
	Household appliances	[R30]
Food (6%)	Palm oil	[R40]
	Refined products	[R25]
Information and communication (3%)	Information technology	[R26]
Textiles (3%)	Production and distribution of sportswear	[R3]
Metal mining (3%)	Copper	[R36]
Computer (3%)	Cartridge manufacturing/remanufacturing center	[R39]

neighboring countries that can be considered as extensions of local chains, for example, ACO is a multinational company active in the production and distribution of sportswear, with headquarters located in Australia and factories in four Asian countries: China (Guangzhou), Vietnam (Ho Chi Minh), Cambodia (Phnom Penh), and Bangladesh (Dhaka)

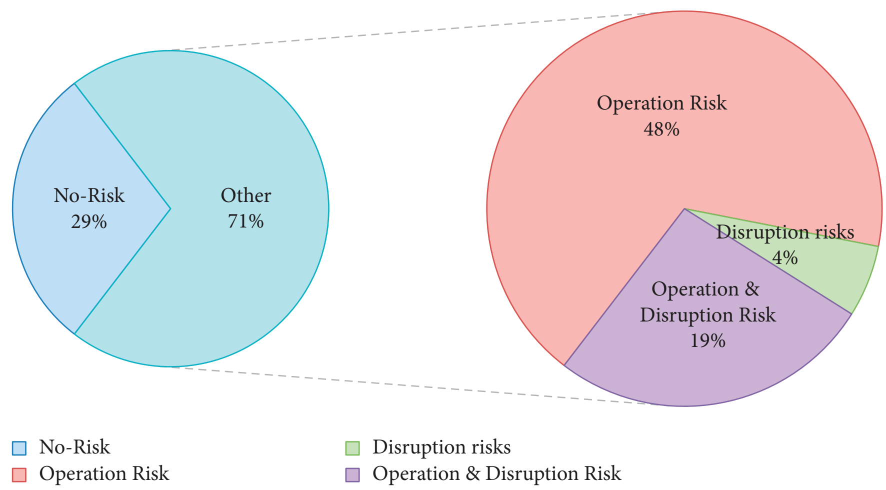

Figure 7: Display of operational risk and disruption risk articles.

[135]. Kabadurmus and Erdogan [242] are the only one who address global processes using a hypothetical but realistic case study.

Another important aspect in analyzing articles is the type of product or specific industry for which the supply chain is designed. As it is clear, almost 50% of the cases are concentrated in the three industries of energy supply, healthcare, and rubber and plastics. The preference of selected studies for these industries shows their sensitivity toward providing stable and reliable strategies. The specific products of the case studies in these industries are detailed in Table 8. It should be noted that 12 articles have no case study and were designed for the general supply chain.

4.2.5. Distribution of Articles Based on Modeling Features. Lack of access to correct and accurate information adds to the complex and dynamic nature of supply chains and leads to uncertainty of parameters. In addition, supply chains are threatened by various risks. Kleindorfer and Saad [243] and Tang [244] classify supply chain risks into two main categories: (1) operational risks resulting from uncertainty in matching supply and demand, such as machinery breakdowns, power outages, and demand fluctuations, and (2) disruption risks resulting from natural disasters such as earthquakes, droughts, floods, and hurricanes, as well as human disasters such as war, labor strikes, financial crises, and terrorist attacks. Although disruption risks occur with less frequency compared to operational risks, they have greater impacts [244]. Therefore, traditional deterministic optimization is not suitable for accurately understanding the behavior of real-world problems. Information sharing among supply chain members leads to reduced uncertainty and improved visibility [245]. This advantage is more valuable for CLSC with more members. In addition, the design of reliable supply chains is a method that researchers have used to reduce and deal with the adverse effects of disruptions (disruption risks) and uncertainties (operational risks) [246].

According to the definition of risk as uncertainty about the future, which is often one of the assumptions of the SCND under uncertainty, its multiperiod model. Out of a total of 20 articles that are designed in a multiperiod way, 17 articles have included risk in their model. The importance of these risks has encouraged most researchers in the field of S&RSC network design to consider random parameters (23 articles) or disruption risks (2 articles) or combined operational and disruption risks (9 articles) in their research. Figure 7 shows this result clearly. In addition, reference articles with an uncertainty approach are expected to have a real case study. By exploring the reference articles, it was found that 79% of the models designed in the context of risk have been studied.

In addition, to evaluate the main features of the proposed models in the reference articles, the classification of Farahani et al. [247] has been followed. The structure of the supply chain network in the articles is generally open loop (forward or reverse) and closed loop. To classify sustainability, almost 76% of reference articles, economic, environmental, and social dimensions are formulated as separate objectives in the model. The mathematical model of three articles is of mixed integer nonlinear type and the other 39 articles are modeled based on mixed integer linear programming. These features can be seen in Figure 8.

5. Research Gaps

Although the importance of applying the concepts of sustainability and reliability in SCND has been confirmed by researchers separately, very few studies have integrated these two concepts in the field of SCND. A full understanding of the S&RSC paradigm requires additional research efforts to test the structures, concepts, and theories that emerge in the historical course of the emergence of this paradigm, and the result of this effort is to provide a common ground for future research. Prior to this study, Centobelli et al. [248] worked based on a structured identification of research gaps in 94 secondary studies in the sustainable supply chain literature

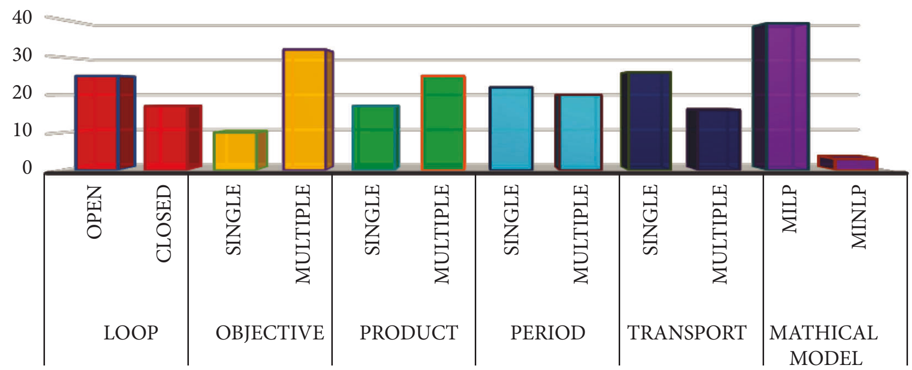

Figure 8: Modeling features of reference articles.

and highlighted the need for new integrated paradigms, holistic, and conceptual models as research proposals. Experimental research, despite being relevant and useful, is very rare. One of the main problems is that few companies may implement sustainability and reliability in their supply chain at the same time. To understand companies' perspectives on S&RSCs, further studies at the company level are needed to determine which drivers, practices, and indicators of joint performance appraisal are used by companies. Identifying and ranking the best practices for S&RSCs requires real practice, empirical evidence, and industry application. For example, transforming the supply chain structure design of traditional linear into closed configurations to facilitate the adoption of sustainable and reliable supply chain operation practices has been identified, as an outstanding research need. More than this, considering multimode logistics by providing more choices can increase the reliability and sustainability of the designed network. In addition, reliability is often evaluated at the level of network nodes (facilities), while the fault-free operation of the supply chain requires the reliability evaluation of network arcs (routes) as well.

5.1. Future Research. According to the current literature on designing an S&RSC network, the general basis for further research agenda is defined as follows:

(1) Integrating the three aspects of sustainability with reliability has rarely been considered a complementary issue in recent studies. More studies on social pillar integration are often requested in assessing supply chain sustainability [249]. Also, the concepts of resilience and risk are used instead of reliability.

(2) To deepen the theme of sustainable network design, reverse logistics and closed-loop can be used to implement green supply chain practices. Also, standards and indicators of CSR can be considered for socially responsible supply chains.

(3) Define and separate reliability and resilience metrics from each other with incorporation into the sustainable supply chain network to support management decisions.

(4) Further studies are needed to better understand the trade-offs and synergies between sustainability and reliability and to build a knowledge base in the area of an S&RSC paradigm. Attracting managers' support for planning and investing in the development of an S&RSC requires an understanding of how the integration of both the concepts of sustainability and reliability affects the supply chain.

(5) There are limited indications in the literature of drivers, methods, and indicators for evaluating S&RSC performance. Identifying and developing an S&RSC is needed, both for practice and research, to fully evaluate relationships and integrated outcomes.

(6) The development of decision support tools helps decision makers to evaluate S&RSC alternatives [250]. The complexity, ambiguity, and uncertainty of supply chain design provide a good opportunity for uncertainty-based programming approaches and decision-support development.

(7) Integrating tactical and operational planning issues into current strategic models can stimulate researchers' interest in modeling and solving SSC network design problems.

(8) Design models for measuring the degree of compatibility between sustainable and reliable strategies can develop through new integrated paradigms such as the circular economy and Industry 4.0 technologies.

6. Conclusion

On the one hand, sustainability and reliability in the SCND as the competitive advantage increases customer satisfaction and sustains businesses. On the other hand, supply chains are under pressure from stakeholders to improve the sustainable performance and quality of their products.

The importance of integrating sustainability and reliability into supply chains has been emphasized in this literature review. This study can be a preliminary step or starting point for research in the field of S&RSC. The innovative contribution of this literature review, in addition to examining the evolution process of the emerging paradigm of the sustainable and reliable supply chain from the path of

Table 9: Summary of research background.

Article code	Network structure	Multiconfiguration				Problem conditions		Sustainability			Emission policy	Reliability		
		Objective	Product	Period	Transport	Modeling	Uncertainty type	Economic	Environmental	Social		Index	Entity	Method
[R1]	OL	M	S	S	S	MILP	F, S	C	—	SD	—	PD	D	SB
[R2]	CL	M	M	S	S	MILP	D	π	Score	—	Max	PQ	P	FR
[R3]	OL	M	M	S	M	MILP	F, S	C	Score	Score	—	DR	S	SB
[R4]	CL	M	S	S	S	MILP	F, R, S	C	E	—	Min	DR	D	SB
[R5]	CL	M	M	S	S	MILP	F, R	C	—	DC	—	DT	D	Min
[R6]	OL	S	M	S	M	MILP	R	C	E	—	Cap	DR	M, D	SB
[R7]	OL	M	M	M	M	MILP	F, S	C	EC	JC	C&T	TD	M	FR
[R8]	CL	M	S	S	S	MILP	F	C	—	DC	—	TD	P	SB
[R9]	CL	M	S	S	M	MILP	R	C	—	DC	—	Re	TM	Max
[R10]	OL	S	S	M	M	MILP	F, S	C	EC	AT, JC, SA	Cap	CD	W	FR
[R11]	OL	M	S	S	S	MILP	F, S	C	Score	Score	—	CD	S, M	FR
[R12]	CL	M	S	S	S	MILP	R	C	—	DC	—	ST	P	Max
[R13]	CL	M	M	M	M	MILP	F	C	E	—	Min	DD	S	Max
[R14]	OL	M	S	S	S	MILP	D	C	E	—	Min	PD	S	FR
[R15]	OL	S	S	S	S	MILP	D	C	EC	—	Tax	DI, MB	M	FR
[R16]	CL	M	M	M	S	MILP	S	C	CE	JC	Min	DR	M, W, CC	SB
[R17]	OL	S	M	M	M	MINLP	D	C	E	—	C&T	DR	S	Min
[R18]	CL	M	S	S	S	MILP	F	C	E	—	Min	DD	W	Max
[R19]	OL	S	M	M	M	MILP	F, R, S	C	E	—	Cap	DR	S	SB
[R20]	OL	M	M	M	M	MILP	F, R	C	E	JC, SD	Min	DD	M, W	FR
[R21]	OL	M	S	M	S	MILP	F, R	C	EC	ED, JC	Min	FE	M, D, R	Min
[R22]	OL	S	M	S	M	MILP	D	C	E	—	C&T	DR	S	FR
[R23]	OL	M	M	S	M	MINLP	S	C	EC	—	C&T	Re	S, M, W, RE, TM	SR
[R24]	OL	M	M	M	S	MILP	F	C	Score	Score	Max	DD	S, W	FR
[R25]	OL	S	S	M	M	MILP	D	C	E	—	Min	DD	S, C	SB
[R26]	OL	M	M	M	M	MILP	D	C	—	JC, ED	—	DD	W, V	FR
[R27]	OL	M	S	M	S	MILP	F, R	C	EC	RE	Cap	DT	R	SB
[R28]	CL	M	M	M	S	MILP	R	π	Score	—	Min	DT	P	Max
[R29]	CL	M	S	S	S	MILP	F	C	E	JC, RE, IP, DP	Min	DD	M	FR
[R30]	OL	S	M	S	S	MILP	S	C	E	—	Cap	DD	R	SB
[R31]	CL	M	M	M	S	MILP	S	C	CE	JC	Min	DR	M, W, CC	SB
[R32]	CL	M	M	S	S	MILP	F	C	E	JC	Min	DR	S, IC	SB
[R33]	OL	M	M	S	S	MILP	R	C	Score	Score	Max	DR	S	SB
[R34]	OL	S	M	M	S	MILP	R	C	EC	JC, SD	Min	CD	M, CC, RE	Min
[R35]	OL	M	S	M	M	MILP	F, R	C	E	JC, DC	Min	DT, DD	M, W	Max
[R36]	CL	M	M	S	S	MILP	D	π	CE	IP	Min	DR	S	SB

Table 9: Continued.

Article code	Network structure	Multiconfiguration				Problem conditions		Sustainability			Emission policy	Reliability		
		Objective	Product	Period	Transport	Modeling	Uncertainty type	Economic	Environmental	Social		Index	Entity	Method
[R37]	OL	M	M	M	M	MILP	S	C	E	DC, ED	Min	FE, PQ	D, W	Min
[R38]	OL	S	M	M	S	MILP	F, R	π	EC	JC	Min	DR	M	Min
[R39]	CL	M	S	S	S	MILP	D	π	E	DP	Min	DR	S, D	SB
[R40]	OL	M	S	S	S	MILP	F	C	E	—	Min	Re	S, P	Max
[R41]	CL	M	M	M	S	MILP	S	C	E	JC, SD, ED	C&T	Re	S	SR
[R42]	CL	M	M	M	M	MINLP	D	π	EC	JC, SD	C&T	DD	S, M, D, CC, RE, R, V	FR

Table guide. Network structure (OL: opened-loop, CL: closed-loop). Configuration (S: single, M: multi). Problem conditions uncertainty type (D: deterministic, F: fuzzy, R: robust, S: stochastic). Sustainability economic (C: cost, P: profit). Sustainability environmental (E: GHG emission, EC: emission cost). Sustainability social (AT: annual turnover, RD: responsiveness to demand, EG: economic growth, JC: job creation, SA: social acceptance, SD: sick leaves). Reliability index (DR: disruption risk/risk value, DeR: deresiliency, Re: reliability, DI: defective items, DT: delivery time, TD: technology disruption, CD: capacity disruption, DD: delivery demand/order, PD: potential downtime, PQ: products quality, MB: machine breakdown). Reliability entity (S: supplier, M: manufacture/power plant/production process, D: distribution/pole center/distributed generators, W: warehouse/storage center, C: customer/demand zone, CC: collection center, P: product/parts, RE: recycling center, R: route/line, TM: transportation mode, V: vehicle). Reliability model (SB: scenario-based, SR: structural reliability, FR: failure rate).

explaining the differences between the four basic supply chain paradigms (i.e., green, social responsibility, sustainability, and reliability), provides a systematic and repeatable method for other study areas to other researchers. Therefore, the contribution of this article is twofold.

In general, the historical review of any scientific subject can provide the path to the development of knowledge frontiers in any specialized field for researchers. In particular, conducting real case studies can introduce more applications for designing an S&RSC network. In addition, to complete the discussion, it is necessary to evaluate supply chains in more specific contexts such as responsible/sustainable and reliable/disrupted. In this regard, interesting insights can be obtained and illuminate the future research path. Despite the accumulated studies, there is still insufficient research to apply this emerging paradigm to SCND.

The journals covered 12 main subject areas. Most subjects are related to engineering (15 cases), business, management, accounting (9 cases), and decision sciences (8 cases), respectively. About half of the surveyed S&RSCs adopt a TBL perspective, and more than 36% consider environmental perspectives. However, the social perspective (six articles) is still under addressed in the literature and offers significant research opportunities.

The review method and analytical perspective adopted can be part of the limitations of this study because the reference articles included only 42 cases [135, 138, 139, 232, 236, 238, 241, 242, 246, 251–283]. Hence, some relevant studies may not have been included in the final sample due to the database used, search strings, or exclusion criteria.

Appendix

Table 9, while providing a more detailed classification of the subject, shows the gap in the literature by including the characteristics of the described studies.

Data Availability

The data that support the findings of this study can be obtained from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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