*Review*

# Sustainable Supply Chain Management: A Comprehensive Systematic Review of Industrial Practices

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**Abstract:** Sustainable business practices are those that allow companies to increase their profit while still considering the triple bottom line of sustainability, which involves economic, environmental, and social aspects. There are a lot of studies exploring various aspects of supply chain practices. However, there remains a gap for the proposal of a complete framework concerning various industries. This research fills this gap by studying existing empirical and review studies. Based on a content analysis of 86 studies, 789 practices are derived and categorized, leading to a comprehensive classification of sustainable practices in supply chains. Moreover, the employed methods to analyze the data are investigated. The practices are cross-checked versus the studied industries showing the current sustainable industries. The details of the studied papers are presented in a comprehensive table. The sustainable framework showing the industrial solutions toward sustainable supply chains is divided into 38 minor practices classified into 11 main categories. This paper provides a novel interpretation of the sustainable solutions addressed by different industries and presents a new and updated classification of the literature identifying future directions. This offers many advantages for practitioners and researchers to transform a supply chain into an improved version in the bigger picture.

**Keywords:** supply chain management; sustainable supply chains; sustainable practices; industrial classification; review

## 1. Introduction

Over the past decades, the term "supply chain (SC)" has been discussed in countless studies. Before raising concerns about the environment, supply chain management (SCM) merely considered the effectiveness and responsiveness of a system from receiving raw materials and production procedures to delivering products to end-users [1]. The next generation of researchers stated that SCM needed to be updated; considering sustainability and the concept of closed-loop production and consumption was unavoidable due to the environmental impact of supply chains and the limitations on resources and raw materials [2]. This led to an ever-increasing number of studies with a particular focus on sustainability in different industries, and consequently added the "sustainable supply chain (SSC)" to the field terminology [3,4].

The changes experienced due to society's awareness about the Earth-threatening activities of industries have forced practitioners to modify industry processes. These activities have been the main causes of the vast creation of solid and liquid trash, air and

water pollution, global warming, and decreases in the world's non-renewable resources and critical materials for many years. Pressure from social media and non-governmental organizations (NGOs), world-wide community requests (e.g., 17 sustainable development goals established by the UN and the recent World Climate Change Conference held in Glasgow in 2021), and various customer and stakeholder sustainability expectations are some of the significant motivations and initiatives that push organizations to shift their SC policy more toward SSCs [5]. Nowadays, companies that use sustainable practices have significant competitive and economic advantages over those that neglect them. As a result, businesses have realized the importance of sustainability and its application in their SC design.

The literature on sustainable supply chain management (SSCM) has been developed in three streams to integrate sustainability into the SC. These include identifying the barriers that is already in its mature stage, at least in developed countries [6], and research on recognizing the practices and performance of companies (see Figure 1). One decade ago, Ashby and Leat [7] suggested there is a need for researchers to develop more practical tools for implementing SSCM, and considerable literature has tried to identify sustainable solutions in different industries to measure performance [8–10] and decision making [11]. Barbosa-Póvoa and da Silva [12] reviewed how sustainability practices are treated through operation research methods. Saeed and Kersten [13] identified 1559 drivers of SSCM and listed 40 unique external and internal drivers. Koberg and Longoni [14] conducted a rigorous systematic literature review (SLR) focused on SSCM in global SCs and contributed to practice by providing managers of focal firms with global SC directions. The role of network structural properties in SC sustainability is investigated by Alinaghian and Qiu [15], who describe the impact of a set of SSCM practices through which firms achieve sustainability goals across their SCs. An SLR by Nilsson and Göransson [16] extracted 14 main categories of critical factors, including collaboration, strategic orientation, culture, practices, and political context for the realization of SSC innovation. Pimenta and Ball [17] uncovered how environmental and social sustainability practices are diffused across SC tiers through supplier development initiatives directly or indirectly by manufacturing firms and the factors that enhance them.
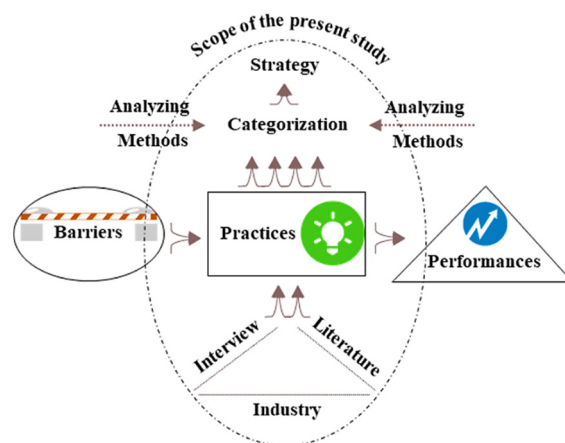


**Figure 1.** The structure of studying SSCs considering practices.

Progressively, the concept of SSCM practices has become vital for businesses throughout the globe, and studies on their influence have obtained an established place in the SSCM literature [18]. These practices refer to tools, solutions, approaches, methods, and strategies that help a company improve its sustainability performance through its SC. An investigation by Bloomberg that targeted 600 companies in Europe and the U.S. showed that sustainability means different for the companies, and accordingly, different practices may be followed up [19]. Although different studies have investigated sustainable practices

for specific industries, there is still a lack of a systematic and comprehensive framework for classifying SSCM practices [8], hindering the effective utilization of them.

The present study systematically gathers the literature and provides a comprehensive framework of practices introduced to improve the sustainability of SCs in different industries. A typical empirical study in this sustainability domain first targets a specific industry and then derives the practices through a literature review or interviews with experts. The practices are analyzed and discussed through qualitative or quantitative methods to propose sustainable strategies for the next step. Figure 1 (dashed part) illustrates the organization of these studies to derive the practices. In order to reach our goals, we investigated the content of 86 studies that followed this process. This is important, as it enables practitioners and researchers to know and compare the sustainability situations of different industries and understand the application of the methods. This is the first study linking solutions, industries, and methodologies to enhance sustainability understanding in SCs. Therefore, this study answers the below questions:

How can we classify the SSC practices extracted from different industries to show a bigger picture?

What are the contributions of different industries to grow SSCs?

What is the procedure of collection and analysis for sustainable practices?

The study is organized in the following structure. The next section explains the research methodology, descriptive statistics based on the initial analysis, and a broad framework to categorize the sustainable practices. The content of the studied papers is described in Section 3 according to the classification connected to a comprehensive table that shows the details of the investigated studies (See Table 1). The results are demonstrated in Section 4. Discussion and suggestions for future research are presented in Section 5. Finally, the paper is concluded in Section 6.

## 2. Research Methodology

We carried out a systematic literature review based on a four-stage procedure. First, a comprehensive database was considered to select previous studies. The next step included presenting the descriptive analysis. Then, to investigate the mentioned questions, a comprehensive framework was presented. The extracted materials were evaluated at the final stage. This methodology is used in similar studies related to sustainable supply chains in the literature [20–23].

### 2.1. Literature Search

In order to search the literature, Scopus, known as the most comprehensive scientific database, was chosen. The combinations of "supply chain management" and "sustainable supply chain" with keywords such as "practice", "solution", "enabler", "adaptation", "implementation", and "execute" were investigated through the database. We focused on journal papers in English that had received considerable citations, and especially papers with content matching the scope of the present study (see Figure 1). Therefore, other areas investigating barriers and performance were excluded. After checking the abstracts, titles and removing duplicated sources, the initial search yielded almost 300 publications, including review papers and original research articles. The content of these references was checked considering the application of sustainable practices in SCs. We gained 80 articles. Using the references of these papers we added six more papers, finally resulting in 86 articles. When updating the search (November 2021), each of the derived papers, on average, received more than 120 ($\approx$10,567/86) citations based on Google Scholar. The oldest reference was published in 2009 [24].

### 2.2. Descriptive Analysis

The overall trend of publishing in the field has shown an increase in publications since 2009. Almost 60 percent of the papers were published after 2017 (See Table 1). Figure 2 shows the contributions of the leading journals which have published at least four papers

since 2009. The associated papers were published across 24 different journals. The broad range of journals confirms the desire of different journals to publish on the subject of SSCM practices and the variety of researchers studying this topic. The *Journal of Cleaner Production* was the one that published the most papers about this subject. This result is consistent with previous research published in this journal, a rapidly growing forum [25,26]. Additionally, it can be found that five leading journals published almost half of the publications. Figure 3 presents the affiliation of the corresponding authors of the selected papers regarding their countries. Indian-affiliated corresponding authors obtained first place with 15 papers, followed by the UK, China, and Germany with 10, 9, and 7 papers, respectively.
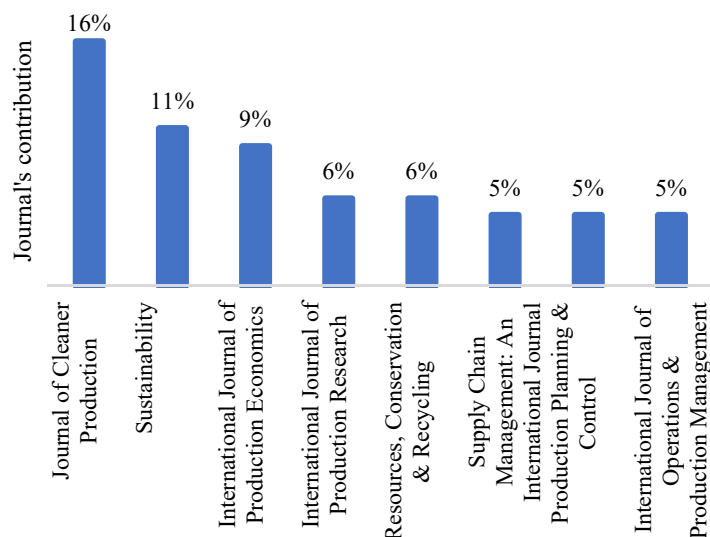


**Figure 2.** Contributions of the journals that have published at least four papers in the investigated area since 2009.
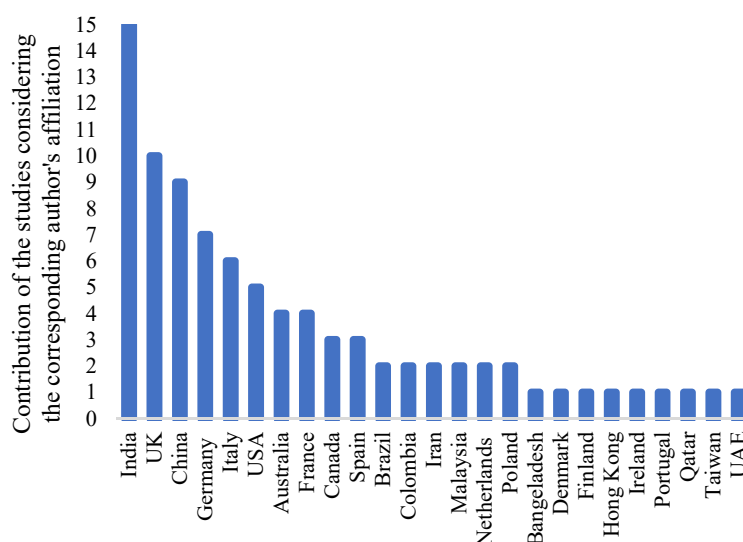


**Figure 3.** Corresponding author affiliations of the collected papers considering country.

In order to conduct deep analysis, the keywords of the papers were investigated and categorized. In total, 460 keywords were derived, and they were classified based on the used frequency. Those which were repeated more than four times are presented in Figure 4. In this figure, "country name" refers to the name of a specific country. Regardless of common keywords related to SC and sustainability (i.e., the first seven keywords with the most frequency), the ones related to "textile industry", "design", "green supply chain", and "environment" were among the most used keywords.
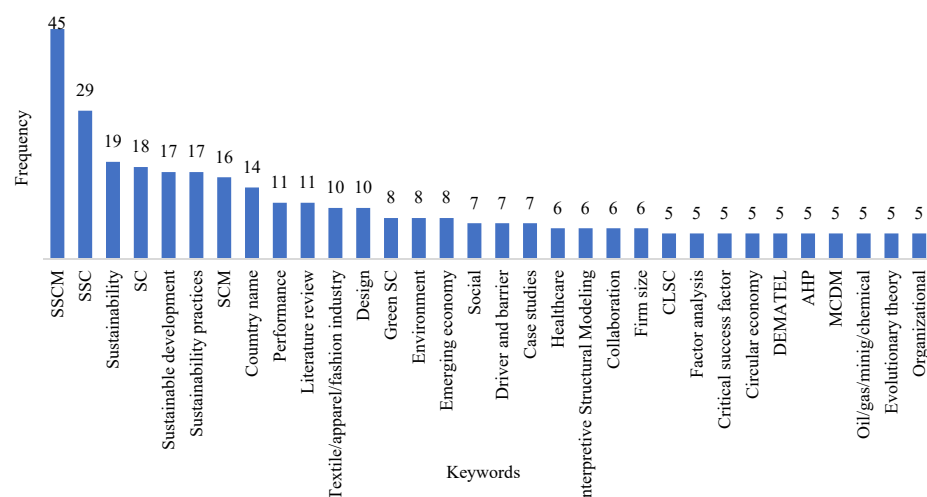
**Figure 4.** Distribution of the keywords in the studied papers.

### 2.3. Category Selection

To reach an unabridged categorization, the papers' content was investigated; especially, tables presented through the body of the gathered papers were screened. This led to extracting 789 practices. At the next step, similar practices that were close to each other regarding the applicability and area were set. This resulted in 11 major categories identified with capital letters: A, B, C, . . . , K. Finally, each main category was classified again to put more similar practices together in subcategories shown with small letters: a, b, . . . , e. The aim was to assign each practice to a specific class; however, the practice was assigned to the nearest classes whenever an overlap was seen between two categories. Figure 5 illustrates the categories and subcategories.



**Figure 5.** Suggested framework for sustainable practices.

These categorizations were organized based on the typical SC concepts (E–K) and structures (A–D). The first and second categories dealt with activities relevant to the production process as the starting point of a SC. The third category (C) targeted the points tying the customer to the chain in a circle. The fourth category (D) was based on providing the material from the suppliers. The 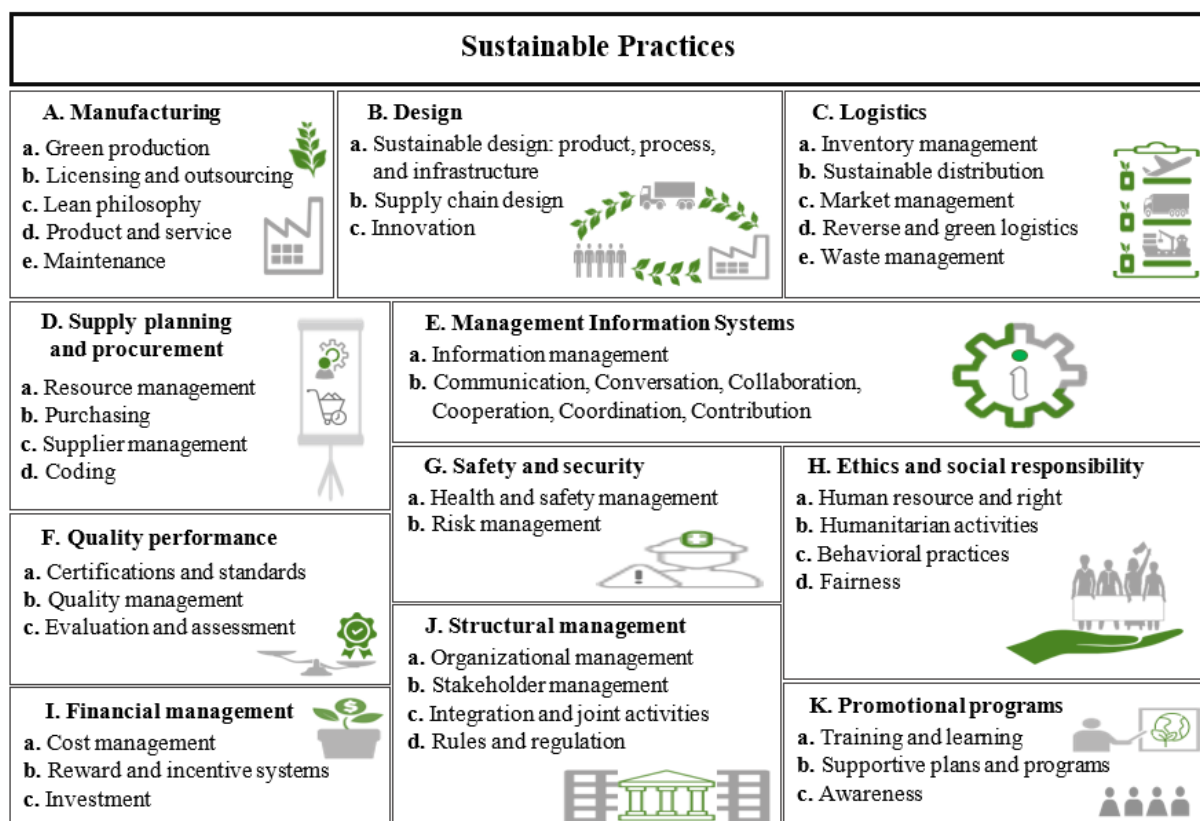fifth category (E) contained the required software skills to manage the SC. The sixth category (F) was about measuring the quality toward sustainability. The seventh category (G) covered risk and safety factors. The eighth class (H) investigated human-based relations to enhance sustainability. Financial matters were considered in the ninth category (I). The practices related to SCM, and incentives were discussed in categories J and K, respectively. In total, sustainable solutions were summarized into 38 categories.

*2.4. Evaluation Stage*

The collected papers were cross-checked with Web of Science (WoS), the world's most trusted publisher-independent global citation database. The authors evaluated the reliability and validity of the selected papers by a deductive–inductive approach. To derive the structural dimension, papers were chosen and then analyzed using the deductive method, while in the inductive technique, these dimensions were developed from the material using generalization [27]. This helped to derive an appropriate classification.

**3. Comprehensive Framework**

In this section, the categorization of sustainable practices is explained based on analyzing the content of the collected papers. As shown in Figure 5, each main practice is subcategorized into a few practices identified with small letters (a, b, c, d, and e). These practices are presented for each paper in Table 1. Columns 2–13 in Table 1 indicate the practice in detail extracted from each paper. For example, the second column in Table 1 is related to the first main practice (i.e., A: manufacturing), which is split into small practices a–e.

*3.1. Manufacturing*

3.1.1. Green Production

Green manufacturing, i.e., employing technologies for cleaner production and process modernization, causes less energy consumption and contamination [28–30], for example, by adopting intelligent factory components, manufacturing machinery renewal, and advanced technology for water-saving and remanufacturing. Different solutions are developed in industries such as the textile industry via biological production, organic cotton, the replacement of solvent-based polyurethane with water-based alternatives and natural dyeing processes [31], and in the food industry via returnable and sustainable packaging. Other practices can be applied to shift toward sustainable production, including digitization, mass customization, lean philosophy, computer-aided design/manufacturing, mobile and remote maintenance, RFID technology, 3D seamless technology, additive manufacturing, and digital printing [31–34].

3.1.2. Licensing and Outsourcing

It is beneficial if companies ask other parties to produce or distribute their services and products in some situations. This can happen by selling a name, design, or process to a third party while exploiting the shared profit [24]. Well-known solutions in these conditions are either licensing or outsourcing. By doing so, the licensor permits to call the licensee to another company to manufacture and/or sell some items in a defined market area.

3.1.3. Lean Philosophy

Mass production systems are switched to just-in-time manufacturing in lean production strategies. The lean philosophy introduced by Toyota promotes sustainability. It is defined as a waste-free system in terms of equipment, materials, parts, and working

time, encompassing only what is required for production [35]. Applying the lean practice, companies can avoid mistakes using the poka-yoke (mistake-proofing) mechanism [30].

### 3.1.4. Product and Service (P&S)

Sustainable P&S practices have four aspects, including (i) product stewardship, (ii) product quality, (iii) product safety, and (iv) customer-centric products and services. The first one is an extended product responsibility approach to make industries responsible when designing a product, i.e., by considering the interest of the environment in the product design. Decommoditization (i.e., opposed to commoditization where price tags show the differences in the products within specific categories), designs to facilitate product disposal and disassembly, product value recovery such as using poultry fat, and revamping and refurnishing to extend the product life cycle are examples of this [36,37]. Second, industries should adopt strategies to develop product quality, for instance, founding a quality assessment system and complying with industry quality standards [29]. According to the third practice, consumers' safety and health should always be prioritized (e.g., by omitting or reducing preservatives, gluten, and fat in food products) [38]. Finally, P&S should effectively meet customer needs and consider welfare in each stage, for instance by producing specific categories of consumers, placing additional information on product packaging, offering Lego-based education on how to use some products, and allowing the end-user to monitor the product for its carbon footprint [39,40].

### 3.1.5. Maintenance

One of the efficient solutions to prevent or reduce solid waste is regularly checking machines, hardware, facilities, and equipment with maintenance action plans. Using preventive and maintenance strategies as well as conducting regular inspections increases the efficiency of facilities and equipment; this is even more important in industries such as the oil and gas industry with expensive machines [41–43]. Advanced predictive maintenance helps avoid system shutdown and breakages in the SC, especially in the automotive industry [34].

### *3.2. Design*

### 3.2.1. Sustainable Design: Product, Process, and Infrastructure

Sustainable design aims to improve the environmental performance of companies while minimizing environmental impacts [44]. It can be classified as regarding the design of (i) products and (ii) processes. The first stream is composed of practices to produce products that: reduce consumer health risk, disassemble easily, include green material and less hazardous substances, are compatible with ecology, and use less energy to run [42,43,45–47], for instance, products that can be kept at room temperature and need less storage area in transportation [33]. The second realm focuses on the processes that lead to services and products. It can be described as practices that reduce waste, emissions, and energy consumption, such as applying tools and elements of TQM, JIT, time-based competition, and sustainable packaging [30,40].

### 3.2.2. SC Design

The SC's configuration is a crucial topic for the optimal execution of sustainable practices. Understanding and reducing the supply base complexity by considering commercial disintermediation and rationalization is an essential practice. The number of intermediary levels and suppliers in outbound SC can be decreased by effective facility planning, direct selling, intermodal freight transport, new path configuration, and vending machines or local exchange communities [34,36,38,48]. It results in focusing on a few compliant suppliers to develop sustainable projects. Sometimes designing a short SC is a better approach. This refers to procurement from geographically close suppliers and the creation of a disintermediated SC upstream. Sustainable practices concerning SC design can be categorized as (i) redefinition and (ii) ability to shift. The first one broadly refers to a reconceptualization of the SC design to check business redefinition and exocentric perspectives, such as

working with extra-economic communities (i.e., NGOs and CSOs) [24,49]. Secondly, SCs should be designed to respond to rapid changes quickly and effectively to meet customer or supplier needs [40].

### 3.2.3. Innovation

Innovative solutions accelerate the movement toward sustainability. Sustainability-related innovations are mainly classified as technological innovation and innovations in method and approach [32,50,51]. The first one refers to the adoption of advanced technologies such as nano environmental technology, clean technology and modern information management approaches, high technical ability, and the purchase of modern machine/equipment with reduced energy consumption [37,52–55]. The second one seeks to make the present situation more sustainable with the best available techniques, for example, design innovation for longevity and easy disassembly, simultaneously.

### 3.3. Logistics

### 3.3.1. Inventory Management

Warehousing and inventory management are inseparable parts of SCs. On this subject, SSCM practices have been widely discussed in two categories: (i) keeping inventories under control and (ii) inventory management development [56]. There should be an efficient interaction between inventory control and the information systems to determine the proper order quantity and reorder points. Especially, employing just-in-time systems to reduce hazardous materials and proper storage is effective [35]. Other practices to implement sustainable and carbon-free methods include collaborative inventory management, the deployment of two-bin systems, store consolidation, the deployment of centralized replenishment systems, and use of hybrid stockless systems in which high- and low-volume products are delivered directly to points of care and the central store, respectively [57,58].

### 3.3.2. Sustainable Distribution

Transportation is an inherent part of logistics systems. In this regard, sustainable/green distribution aims to minimize the environmental impact when transporting raw material and final products through the chain. It should be utilized to achieve economies of scale in inbound and outbound transportation [56,59,60]. We can categorize the suggested practices as (i) consolidation and collaboration actions, for instance, multi-drop, multi-pack, and cross-docking by the integration of demand, the consolidation of internal and external site systems, coordinating lot sizes and collaborative warehousing, and cooperation with vendors to decrease packaging size [33,38,57]; (ii) the use of alternative and renewable energy [61]; (iii) the upgrade, redesign, and automation of freight logistics networks, for example, weight and volume reduction, using full-load capacity and full load truck, applying environmentally friendly storage, reducing container weight, improving refrigeration, and decreasing human intervention [31]; (iv) tracking emissions caused in product distribution [62]; (v) the development of services (e.g., the promotion of public transport use and shared-occupancy vehicle use) to minimize or even stop travel (e.g., by telehealth and home healthcare in the healthcare industry, and videoconferencing); and (vi) the identification of shorter routes for product transportation to minimize the relevant costs and emissions [38].

### 3.3.3. Market Management

The main goal of market management is achieving customer satisfaction. Sustainable market management is possible via some practices such as: (i) boosting green brand image, which gives a competitive advantage in the global marketing space leading to increases in market share and profitability [28,63]; (ii) on-time delivery management by increasing supply flexibility and customer relationship management [29,64]; (iii) resolving customer concerns through informing customers of sustainable movements and green initiatives, designing eco-friendly products, distribution systems, and green and sustainable SCs to address the environmental concerns of customers [52,53,60,65]; and (iv) finding

markets for recovered products and accessing new markets in comparison to the company's key competitors [40,59].

### 3.3.4. Reverse and Green Logistics

Product and material recovery is a vital end-of-life practice frequently mentioned in the literature [48,58,66] to acquire the economic value of returned goods in the SC. It can be achieved by adopting nR approaches (i.e., refurbishing, repairing, reusing, remanufacturing, etc.) for green, reverse, and closed-loop SC logistics [67]. It includes a range of different logistics activities such as recycling containers, energy-efficient vehicles, recyclable pallet systems, green investment, the elimination of excess packaging materials and shipping, engaging third parties for product recovery, and integrating production with recovery [40,43].

### 3.3.5. Waste Management

Different types of waste in the forms of solid, liquid and gas are released through the SC process from start to endpoint, for instance, through $CO_2$ emission contributing to the company's carbon footprint. Companies should try to prevent, control, or minimize waste to lead to less pollution [68]. Different approaches are suggested, such as managing by-products and establishing a recycling system for waste products (e.g., the take-back programs of pharmaceutical companies for patients in the healthcare industry), using the waste as a resource (e.g., collecting EoL cell phones), asking suppliers to commit to waste reduction goals, proper segregation, the use of alternatives to incineration, and finally landfill. Following particular protocols can also reduce the probability of contamination, such as hazard analysis and critical control points in the food industry [38,54,69,70].

### *3.4. Supply Planning and Procurement*

### 3.4.1. Resource Management

Due to the scarcity of natural resources, the use of these types of resources (e.g., rare metals) should be optimized. Therefore, there is a necessity for resource management (RM), conservation, and material substitution to minimize resource use in the SC [71]. For instance, limiting meat consumption, opting for organic and locally grown alternatives, composting, and using sustainable sources (e.g., vegetarian meals) is a solution in food SCM [57]. The practices of RM follow four pillars: (i) hazardous management to avoid using toxic and harmful material [72–74]; (ii) water management; (iii) energy-saving management; and (iv) resource based-supplier management. Some practical solutions include the harvesting of rainwater, waterless dyeing, controlling leakage, installing flow restrictors and dual-flush toilets, the use of drought-resistant plants, reclaiming water from services such as dialysis and sterilization, odor treatment, using non-conventional and alternative sources of energy, automatic lighting timers and sensors, updating lighting to LEDs, considering local and close suppliers, supplier proximity, and preventing chemical fertilizers or pesticides [24,38,55].

### 3.4.2. Purchasing

Sustainable purchasing practices require the procuring process to be green and sustainable. The first green practice involves ensuring that the purchased green logo products are recyclable and include environmentally friendly raw materials, for example, meat produced without hormones or antibiotics, certified organic coffee, eco-friendly and lighter-weight packaging, and shopping bags [57,75,76]. The second practice is related to socially responsible purchasing activities, such as considering the human rights impact of procured products (e.g., not purchasing the products which workers produce under non-standard conditions) [77,78]. The most important suggested practice is having a supplier selection strategy based on a code of conduct [36,79]. This leads to transparency in purchasing and strengthening procurement centers and local manufacturers [35,80].

### 3.4.3. Supplier Management

Supplier development plays a pivotal role in SCs moving toward sustainability. The primary practices can be categorized into four parts: (i) certification matters, (ii) technological aspects, (iii) location, and (iv) training. Companies prefer suppliers with environmental certifications, as this should help them obtain authentic certifications [71]. Transferring technology to and sharing knowledge with suppliers to develop their capabilities is an effective strategy [38,63]. In some cases, choosing local and small suppliers is a preferred solution as they can be trained and developed for the future, and thus some issues such as local regulatory and legislative requirements and intermediary problems can be resolved [35,81].

### 3.4.4. Coding

A well-defined code of conduct functions as a map for dealing with suppliers in a sustainable way [38,47]. It allows companies to choose the best suppliers and helps to provide an ethical benchmark. It should be structured based on international guidelines and compliance with government regulations [82]. Companies should be assured that suppliers will commit to the code of conduct in long-term relationships.

### *3.5. Management Information Systems*

### 3.5.1. Information Management

Information and communication technology (ICT) is vastly used in SCM. A basic level of ICT involves gathering and employing information through websites, social media, public reports, and advertisements depending on data availability and provisions. An essential ICT practice is information and knowledge sharing, which ties players in the SC together from end to end. For instance, the integration of IT solutions and exchanging transactional information with multiple stakeholders is a helpful approach [32,47,66,78,83–85]. Sharing environmental regulations, resources consumption, and material flow management with suppliers is a key element. Moreover, advanced methods such as the digitization of SC activities, the adoption of blockchain technology and ma-chine learning algorithms and using internet of things (IoT) technologies and inter-departmental IT linkage systems are suggested by some studies [29,61,65,73,86].

### 3.5.2. Communication, Conversation, Collaboration, Cooperation, Coordination, and Contribution (6Cs)

Studies suggest that different practices in the form of the 6Cs create cross-functional relationships among partners to implement a successful SSCM. It is proposed that these practices should be part of daily routines and decision-making for the main company strategies, rather than add-ons [24]. Regular meetings and open dialogue, establishing educated field personnel, the development of collaborative arrangements, decommodization, collaboration with NGOs, social legitimacy, and accountability, and building trust among employees are among the recommended initiatives to reach the 6C goals [39,57,87–89]. Two vital entities in this regard are specifically addressed by the studies: suppliers and consumers. Client collaboration to facilitate a return [40], the exchange of technical information with customers [44], the joint development of projects with the supplier [76], and collaboration with suppliers for customer demand planning and forecasting [40] demonstrate positive supplier–consumer relationships.

### *3.6. Quality Performance*

### 3.6.1. Certifications and Standards

In order to implement sustainability concepts in SCs and support the establishment of business processes, a variety of accountability and auditing practices are designed. Although some companies are trying to develop their own certifications, some international standards have been designed for different industries, such as: different types of ISO certifications (e.g., series of 9000, 14,000, 26,000, and 50,000), aiming to move towards quality improvement with an eco-friendly approach; the LEED standard, which is the most

widely used green building rating system; the EPD standard, which shows data about the environmental impact of a particular building material; GOTS, which defines world-wide-recognized requirements for organic textiles; EMAS, which is developed by the European Commission for companies and other organizations to evaluate, report, and improve their environmental performance; UNGC, which includes ten universal sustainability principles to support UN goals; and ILO, that sets out basic principles and rights at work [42,50,55,76,79,83]. Especially, the ISO 14000 family, known as the Environmental Management System, is an established platform providing information on organizations' environmental performance and indexes, resource consumption mapping, and advanced environmental data collection systems [31,54]. An essential practice is the regular auditing of suppliers to ensure that they are certified by OSHAS18001 and SAI8000 (employee's occupational health and safety) [24] and provide a fair and decent environment for workers based on the highest social standard [45].

### 3.6.2. Quality Management

Adopting advanced quality improvement techniques such as total quality management, Six Sigma, total productive maintenance, total quality control, and lean program practice are recommended by the studies to move towards SSCM [30,56,57]. Establishing and emphasizing these types of practices assist in removing non-value-added activities in existing SCs and results in continuous improvement [34].

### 3.6.3. Evaluation and Assessment

A company's sustainability performance management systems should be checked regularly to understand the current situation and identify required changes [65]. Therefore, it is necessary to undertake formal or informal assessment practices using well-defined metrics, indicators of sustainability, and benchmarks of sustainability practices [90,91], such as consumption mapping and CO2 calculators [55,76]. Supplier evaluation has a significant impact on SSCM assessment. For example, OEM can send environmental, safety, social, and ethical responsibility questionnaires to suppliers to monitor their compliance [42,57]. Applying life cycle assessment methods to assess the environmental impacts of a product's life from design to the grave or recycle stage is a well-known solution [35,84].

### *3.7. Safety and Security*

### 3.7.1. Health and Safety Management

Health and safety management systems (HSMSs) should be established and implemented in companies to reduce the risk of accidents and ensure environmental safety practices [46]. The execution of HSMSs improves health and safety aspects and decreases the possibility of environmental disasters [28]. In this regard, compliance questionnaires and standard programs are the tools to manage and monitor the different players in the SC, such as suppliers [71,78]. For instance, one of the risks of creating activity in a company environment is the transfer and movement of products through company or trading partner facilities [92]. Transport safety should be ensured by inspecting drivers' health (e.g., driving, resting time, etc.) and location situations [43].

### 3.7.2. Risk Management

Dealing with and identifying factors that expose the SC process to risk is discussed thoroughly in the literature. The perception and management of risk are identified as common practices among industries moving toward sustainability. This involves finding potential sources for competitive advantage and being ready for an emergency [93]. In this regard, the management of operational risk and reducing supplier risk should be taken into account [43,47].

*3.8. Ethics and Social Responsibility*

3.8.1. Human Resources and Rights

On a wider scale, sustainability sophisticatedly aims to affiliate humanity with the environment in order to prompt innovation and conservation. Human resource management is the key point to reaching these goals, and human rights should not be neglected. The axis of practice involves three elements that can be summarized as (i) the employment process, (ii) working environment and welfare, and (iii) skills development. Equity and guaranteeing diversity to ensure strict adherence to gender non-discrimination policies and meritocracy should be considered in employment [51,77,80,92,94]. Companies should provide safe, optimistic, and healthy working conditions for all employees via appropriate workplace management [29,56,88]. They should consider the worker's in terms of job responsibility, ethical behavior, employment stability, flexitime and reducing the necessity of overtime work, salary, funds, award, medical benefits, work–family balance, well-being systems, and empowerment and engagement across the SC. Continued education and capability development opportunities for employees are part of their rights [64].

3.8.2. Humanitarian Activities

Among the social activities related to SSCM, humanitarian activities have received much attention in the literature. SC partners must be encouraged to participate in philanthropic activities by organizations. These voluntary activities include donations, participating in local charities and events, and generating employment for vulnerable people to promote sustainability [29,39,42]. Organizations should minimize the negative impact on communities around SC operations, use low-income companies in SC activities, and support welfare programs for the local community and charity work [71]. The inclusion of NGOs, the community, and charities in decision-making processes is a (re)definition practice of the social SC strategy [95].

3.8.3. Behavior Practices

Organizations need to consider the results of their behaviors, such as breaking laws leading to penalties by governments. This type of performance can damage the image of the company [96]. Successful SSCM involves changing behavior so that all levels of the SC are sustainable [37]. Moreover, companies must monitor customer behaviors, such as being environment-conscious and cooperating in return handling [59]. To understand and promote sustainability measures, companies can encourage critical thinking through their customers [57].

3.8.4. Fairness

A SSC should be equitable and fair on all sides for the involved entities. Fairtrade practices should be considered when redefining the SC strategy [33,45]. In a sustainable business environment, companies fight for fair trade and anti-corruption policies. They are free to sell products and services to clients, choose their suppliers, and refuse bribes from suppliers [29]. Sourcing from fair trade certified suppliers, guaranteeing a minimum price to suppliers, and anticipating 60% final compensation at the beginning of the trade to sustain business survival are examples of fair-trade solutions in an SSC [38].

*3.9. Financial Management*

3.9.1. Cost Management

Although applying sustainable systems leads to reduced cost in the majority of cases, we should know how to complete cost reduction activities. These are actions used to reduce various expenses, including fixed or initial costs, production costs, and distribution costs [29]. They are feasible by establishing an appropriate cost management system, adopting new technology and equipment, managing environmental costs for green SCs, and reducing stoppage and scrap loss [73]. Companies can facilitate suppliers in carrying

out value engineering to reduce the cost of components [56] through lowering production costs [40] and buying on total cost, not price [24].

### 3.9.2. Reward and Incentive Systems

Incentive management and perceptual benefits motivate entities (i.e., employees, suppliers, and consumers) to be involved in a sustainability path that generates a sustainable system. Consumers and companies can also be incentivized by taking back and adopting access revenue models, tax rebates, or soft loans [97]. Regarding employees, measurement, reward, and compensation systems can be linked to the company's sustainability performance [51,67] to apply greener activities. It is possible to offer larger orders or long-term contracts for compliant suppliers with trade credit programs, loans, or better discount rates for suppliers with better sustainability performance [88,98]. For example, Puma and Alibaba Group use an SSC finance (SSCF) system that evaluates suppliers' performance in terms of environmental and social criteria.

### 3.9.3. Investment

Devoting investment and capital specifically to the recovery process is an essential solution to shift to sustainability. The investment should be in technology and resources [78]. In this regard, some practical options are suggested by the studies to grow SSC improvement, such as transforming surplus assets into revenue by selling idle assets, excess inventories, scrap or by-products, and excess capital equipment [33,44,46,62].

### *3.10. Structural Management*

### 3.10.1. Organizational Management

The arrangement and management of organizations should be in a proactive stance, providing sustainability. The scope of sustainable organizational practices is determined by (i) organizational culture and (ii) image and reputation [83,99]. Regarding the culture, initiatives such as reinforcing team-based, flexible, opportunistic, competitive, market-oriented structures, and organizing social responsibility committees, sustainability departments, and chief sustainability officers can positively influence SSCM [52,76]. Presenting the corporate history effectively and improving the reputation relative to the competitors will promote sustainability [91].

### 3.10.2. Stakeholder Management

The role of stakeholders should not be forgotten when thinking about the success of a SSC. The investors or stakeholders have the right to receive their share from company benefits [28]. These communities are not necessarily included in the company or its partners; they mainly refer to people or customers who have environmental concerns or are influenced by the sustainability programs of other competing companies [53,63]. These players should be managed well to reduce the pressure on the company [48]. It is necessary to define sustainable practices in stakeholder management when considering the investors' welfare at trading partner locations [92].

### 3.10.3. Integration and Joint Activities

Jointly built programs and integrated approaches, usually referred to as integrating digital and physical systems, are efficient practices. They help to reduce or eliminate material use and logistics costs and facilitate the SC tracking system for quick responses [77,86,96]. They include activities such as cross-functional integration and joint forecasting/planning. Joint initiatives are discussed in different industries, for instance, in integrated nursing workstations and the consolidation of shipments in healthcare and manufacturing industries, respectively [51,67,100].

### 3.10.4. Rules and Regulations

Governments and social planners adopt effective policies and regulations for companies to reduce environmental pollution. Following the established guidelines that are enforced by environmental laws is an obligation that leads to sustainability. It is necessary to know the regulatory frameworks at regional, national, and international levels. These governmental policies are legal frameworks and structures for sustainability implemented through pressure, supportive systems, or international environmental agreements. For example, Article 191 of the Treaty on the Functioning of the European Union (EU) expresses that combatting climate change is an explicit objective of EU environmental policy [52,53,99]. At the national level, some governments have established environmental rules about safety, such as the management of hazardous and toxic waste, that companies must comply with; otherwise, they will be penalized [28]. Moreover, companies should choose external parties who follow standards and environmental regulations [96].

### *3.11. Promotional Programs*

### 3.11.1. Training and Learning (T&L)

T&L is a mutual key practice to enhance knowledge factors among different SC entities [50,83,89,101]. It includes educational programs for top managers and all employees to enhance awareness about the benefits of sustainability [28,70]. It will help them to make eco-friendly decisions which lead to adopting top-rated SSCM practices. Especially, studies target three groups: (i) staff, (ii) suppliers, and (iii) consumers. T&L practices to engage employees in the reduction of waste [40], procurement staff conducting supplier prequalification assessments [81], transport safety training for drivers [43], providing environmental training seminars and facilitating suppliers [40], and consumer education about healthier habits [39] are examples of T&L practices.

### 3.11.2. Supportive Plans and Programs

A sustainable development strategy is pivotal to reaching sustainability goals [91]. Prestigious companies have sustainability policy statements based on the triple bottom line approach published periodically [33,47]. This helps to deal with the institutional pressures which can affect a company's reputation. These programs can be written under different names, for instance, corporate social responsibility programs to enhance creating wealth [28]. The studies recommend two more practices to reach the goals: (i) top management commitment and support and (ii) financial support. An efficient plan not only needs top managers' commitment and a fixed annual budget, but also adequate participation from middle managers and micro-budgets for sustainability projects [31,70]. The strategies require the involvement and support of employees, consumers, suppliers, and stockholders.

### 3.11.3. Awareness

Awareness in sustainable practice refers to the attempts to increase society's general consciousness [48,50]. Consequently, promoting public environmental awareness boosts and facilitates adoption strategies [34,65]. By engaging people in sustainability programs, environmental plans' social and economic benefits should be realized in society to enhance sustainability literacy [30]. Focusing on enhancement in social consciousness beyond the workplace can be provided in many ways. For instance, environmental slogans with convincing concepts on companies' products, trucks, websites, or even as an icon on their logos attracting people's attention can help people to understand the issue and improve awareness [55,76].

## 4. Results

We gathered 789 practices classified into 38 practices in 11 major groups. The radar chart in Figure 6 depicts the contribution of each group by comparing the percentages of usage. Analysis of these categories showed that, among the SSCM leading practices,

logistics solutions (C) were studied most over the others, followed by supply planning and procurement (D) and quality performance (F) practices. Regarding category C, the results showed the importance of attention to focal points (i.e., distributor, inventory, market, reverse and waste management centers) in a SC to enhance sustainability. The radar chart revealed that ethics and social responsibility (H), financial management (I), and safety and security (G) solutions have received less attention. Specifically, practices related to health, safety, and risk management have not received enough consideration. We can say that 50 percent of solutions were consistently used in most industries.
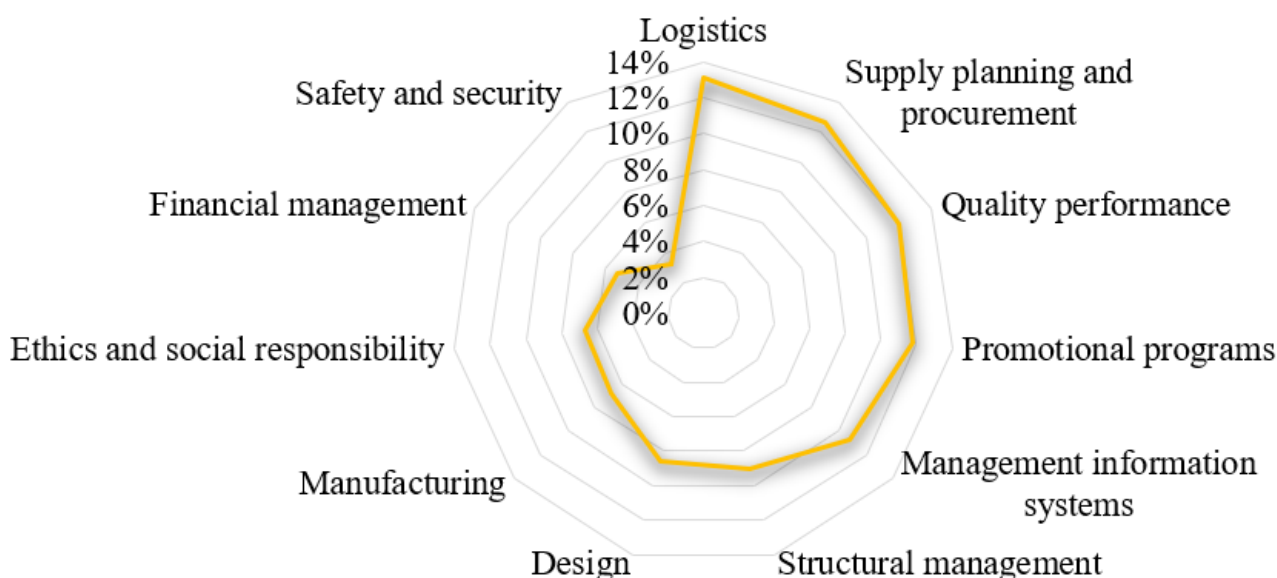


**Figure 6.** Comparison between main categories of SSC practices.

We can investigate the application of practices by analyzing the subcategories in-depth. Concerning the frequency, the subcategory 6Cs, of the main practice (E) (i.e., management information systems), was the best practice to enhance sustainability in the SC. This highlights the importance of communication regardless of the type of industry. After that, supportive plans and programs related to the main category promotional programs (K) had priority, showing how reward and incentive mechanism can effectively catalyze SSCs. The licensing, outsourcing and behavioral practices from the major categories of manufacturing (A) and ethics and social responsibility (H) were applied in fewer cases. This shows that most of the sustainable systems have been developed as centralized cases instead of decentralized ones. Figure 6 uses the radar chart to show the frequency of each main category, and the details are illustrated in Figure 7, where the horizontal and vertical letters are consistent with those of the comprehensive categorization in Figure 5.

Figure 8 presents the geographical distribution of case studies in different countries. India was the leading country with respect to proposing sustainable practices in supply chains based on empirical studies, followed by China, the UK, and Germany. However, there were studies discussing multinational cases in more than one country [36,76]. Continentally, most cases were conducted in Asia and Europe, and Africa had a poor contribution. The results were consistent with sustainable development growth in developing countries such as India and China. Some interesting observations are seen in Table 1, in the columns called "Industry" and "Case country." The table shows that the manufacturing, oil, gas, mining, and automotive industries were mainly discussed and explored in Asian countries. European and Australian countries worked more on food and household industries.

As illustrated in Figure 9, the research on sustainable practices was not limited to a particular industry. The figure shows the wide range of industries that have been explored considering SSCM practices. This helps to find the gaps and clarify the applicability of

this area of research. The manufacturing industry has been the target of many studies since the onset of operation research, and SCs have historically been associated with manufacturing. Moreover, the production process is one of the focused areas of sustainable development. The second one in this ranking was the textile and apparel industry, followed by the automotive industry. Almost 8 percent of the collected literature was conducted on different industries shown as "multiple industrial sectors." The ones related to the food, mining, oil, and gas industries also had high rankings. The chemical industry and those which targeted household appliances are at the end of the list. It should be noted that some studies are merely considered as "general" in Table 1, which are pure review papers that do not focus on any specific industry (column "Industry").
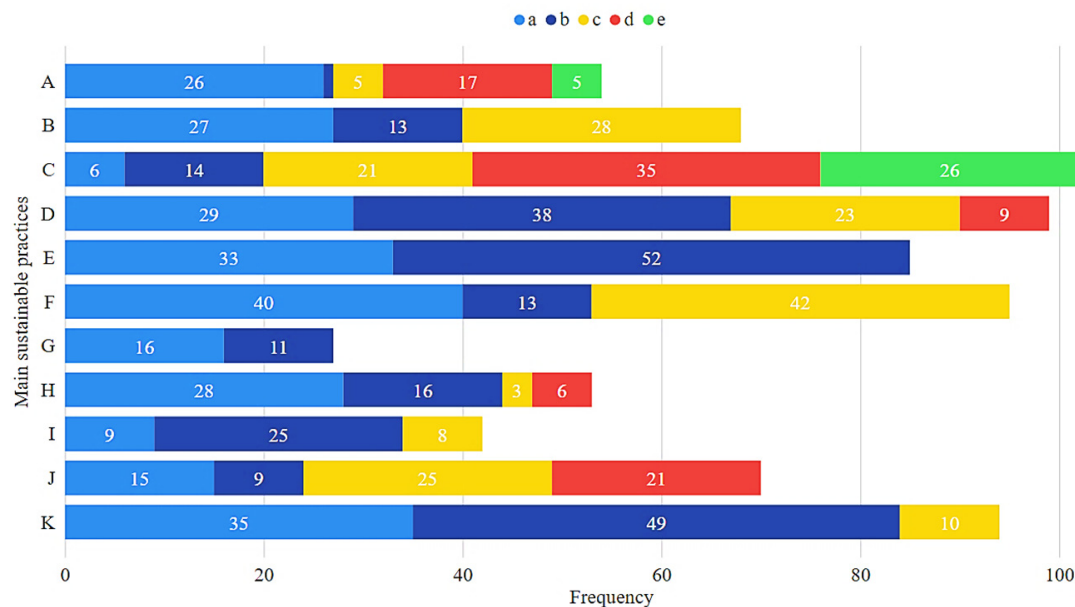


**Figure 7.** Comparing subcategories of sustainable practices.
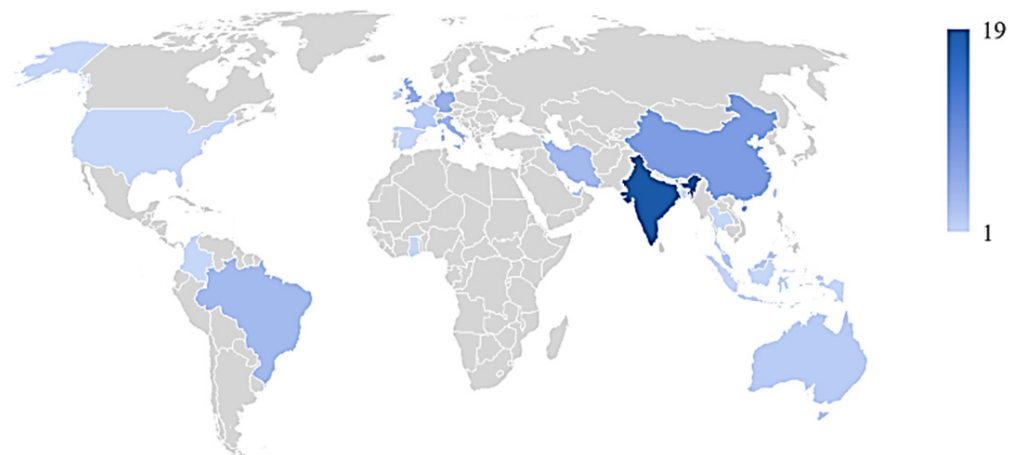


**Figure 8.** Contribution of empirical studies considering different countries.

Different methodologies have been used to collect and analyze the effect of sustainable practices. In order to collect data in the empirical studies, the prevalent methods included interviews, conducting different types of literature reviews, and designing questionnaires (see the column called "data collection" in Table 1). The main techniques to analyze the data are displayed in Figure 10. They consist of a variety of statistical, multi-criteria decision-making, and mathematical methods detailed in the last column of Table 1. The most usual method was structural equation modeling (SEM), which is composed of a set of statistical

techniques to measure the relationships of observed and latent variables in experimental and observational research. Methods employed only once are gathered in the category "Others" in Figure 10, including moderation analysis–subgroup analysis, Delphi, the best–worst method, univariate statistical analysis, and TOPSIS. To model the uncertainty, the fuzzy theory was combined with some of these methods [41,102]. Most of the papers on the manufacturing industry used the survey-based method.



**Figure 9.** Classification of studies with regard to industries.
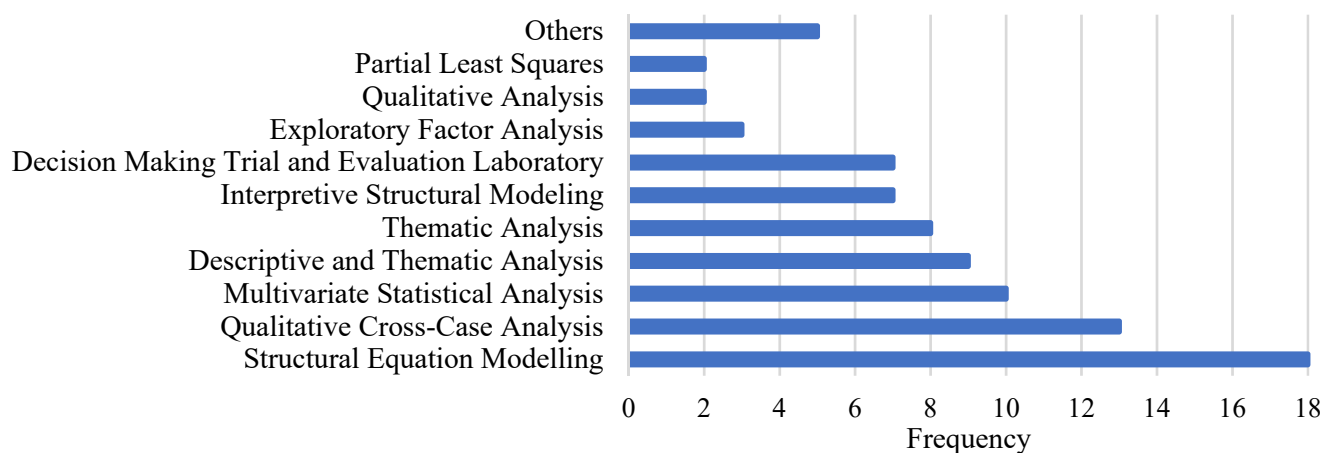


**Figure 10.** Different techniques used for data analyses.

**Table 1.** Categorization of practices.

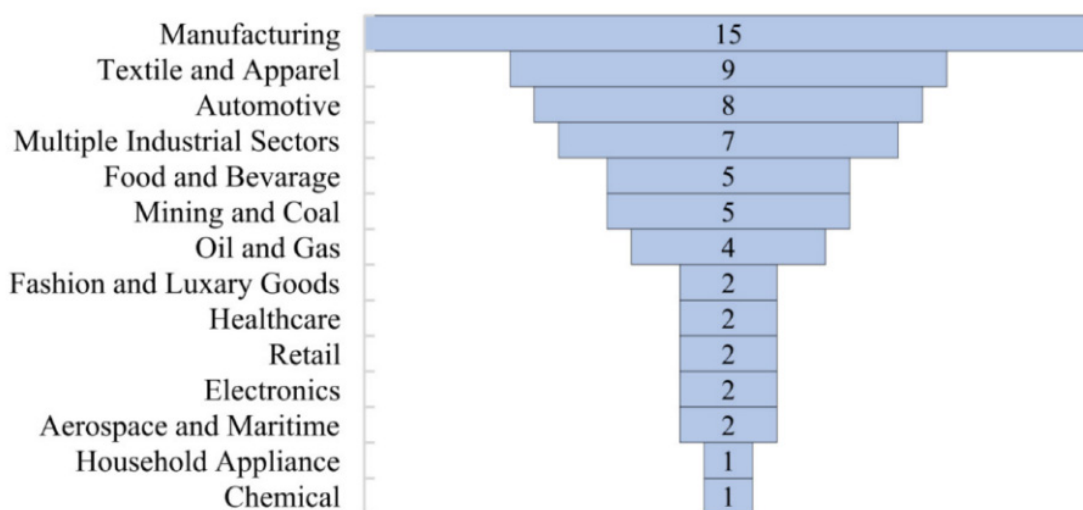| Author (Year) | Practices Class | | | | | | | | | | | Industry | Case Country | Type of Practice | Data Collection | Data Analysis Technique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | | | | | |
| Pagell and Wu [24] | bc | b | d | a–c * | ab | a–c | b | a | ab | ac | b | Multiple | | General | V | QCCA |
| Faisal [65] | | | c | | ab | c | | | d | bc | | | DC ** | General | LR, V | ISM |
| Gimenez and Tachizawa [91] | | c | | ab | b | a–c | | | | ac | ab | General | | For suppliers | SLR | TA |
| Tachizawa, Thomsen [103] | | | | | | ac | | | c | a | | Different sectors | Spain | GSCM | SSQ | MSA (cluster analysis) |
| Walker and Jones [104] | d | | | bc | ab | c | | | | | ab | Aerospace, retail (Pharmaceuticals, food, and drink) | UK | General | V | QCCA |
| Wittstruck and Teuteberg [100] | | | d | | a | a | | | | ab | | Electrical | Germany | Recycling networks | SLR | DTA |
| Zailani, Jeyaraman [75] | a | a | e | ab | | c | | | | | | Manufacturing (400 firms) | Malaysia | GSCM | SSQ | MSA (C&R) |
| Delai and Takahashi [64] | | | c | | | | | a | | | | Retail | Brazil | E | V | QCCA |
| Beske and Seuring [105] | | c | | | ab | c | b | | bc | b | | General | | General | SLR | TA |
| Beske, Land [93] | | c | | | b | c | b | | bc | ab | | Food | | Dynamic capabilities | SLR | TA |
| Diabat, Kannan [73] | d | | c | ab | | | a | ab | ac | d | | Textile | India | 13 selected | LR, V | ISM |
| Mitra and Datta [59] | a | a | b–e | a–c | | ac | | c | b | | c | Manufacturing | India | GSCM | SSQ | SEM |
| Stiller and Gold [49] | | b | | c | ab | | | | | | b | Seed sector | India | S | V | QA |
| de Sousa Jabbour, de Oliveira Frascareli [44] | | a | | b | b | a | | | c | | | Leaders | Brazil | GSCM | V | QCCA |
| Jia, Diabat [70] | a | a | de | a | b | ac | a | | | ab | | Mining and Minerals | India | SSCM | LR, V | ISM |
| Luthra, Garg [63] | | c | c | ac | a | | | ab | a | bd | a–c | Automobile | India | GSCM | SSQ | EFA |
| Marshall, McCarthy [45] | | ab | | cd | | ac | | d | b | | | | Ireland | S | SSQ | MSA (Hierarchical R) |
| Wan Ahmad, de Brito [81] | | | bc | | bc | | | | | | a | Oil and gas (30 companies) | | General | SSQ | Descriptive |

**Table 1.** *Cont.*

| Author (Year) | Practices Class | | | | | | | | | | | Industry | Case Country | Type of Practice | Data Collection | Data Analysis Technique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | | | | | |
| Wan Ahmad, Rezaei [43] | de | a | de | b–d | ab | c | ab | | b | ac | ab | Oil and gas | | Firm internal factors | QD, V | MSA (EFA, R) |
| Esfahbodi, Zhang [62] | | a | b | ab | b | ac | | | c | | | Manufacturing | Iran, China | E | SSQ | MSA (Multiple R) |
| Gopal and Thakkar [48] | | bc | cd | | ab | a | | b | | a–d | ac | Automotive | India | ES | SSQ, QD | SEM |
| Gopal and Thakkar [94] | c | c | | | b | c | b | a | c | | | Automobile | India | General | SSQ | SEM |
| Kusi-Sarpong, Sarkis [68] | | c | de | c | ab | ac | | b | c | ab | | Mining | Ghana | GSCM | LR, V | DEMATEL |
| Lu, Lai [47] | | a | e | d | ab | c | | a | d | ab | | Maritime | Taiwan | Inter/external collaboration | SSQ | SEM |
| Mejías, Paz [35] | ac | ac | ad | bc | b | bc | b | b | c | | | General | | General | SLR | DTA |
| Chen and Kitsis [87] | | | | | ab | | b | | | | | General | | Relational | SLR | TA |
| Das [56] | a | a | ab | c | | ab | a | ab | a | | | Manufacturing | India | ES, OP | SSQ | EFA |
| Esfahbodi, Zhang [61] | | a | b | ab | b | a | | | c | d | | Manufacturing (146 firms) | UK | EG | SSQ | SEM |
| Golini, Moretto [38] | d | a–c | b–e | abd | ab | c | | bd | b | c | b | Food | Italy | Economic, E | V | QCCA |
| Kausar, Garg [53] | | c | c | | a | | | a | b | abd | b | | India | 12 selected | LR, V | ISM |
| Köksal, Strähle [88] | | | | | b | | | a | b | | b | Textile | | S | SLR | TA |
| Mathivathanan and Haq [84] | | | d | c | | ac | | b | d | ab | | Automotive | India | 10 common SSCM | QD, V | MSA (ANOVA) |
| Oelze [89] | | | | | b | | | | | ab | | Textile | Germany | IE | V | QCCA |
| Raut, Narkhede [28] | ad | a | cd | ab | ab | a | a | a | ab | abd | ab | Oil and gas | India | 32 selected | LR, V | ISM |
| Wu, Santoso [54] | | c | e | a | | a | | | | | | Coal | Indonesia | General | LR, V | DEMATEL-ANP |
| Ciccullo, Pero [95] | ad | | d | | | ac | | ab | | | | General | | Agile and sustainable | SLR | DTA |
| Croom, Vidal [106] | | | | | | | | ab | | | | | US | S | SSQ | MSA (CFA, R) |
| Das [85] | | a–c | abde | c | | a | a | | | bc | a | Manufacturing | India | ES, OP, SCI | SSQ | SEM |

Table 1. *Cont.*

| Author (Year) | Practices Class | | | | | | | | | | | Industry | Case Country | Type of Practice | Data Collection | Data Analysis Technique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | | | | | |
| Das [60] | a | a | a–c | | | a | a | ab | | c | | Manufacturing | India | ES, OP, SCI | SSQ | SEM |
| Hussain, Ajmal [99] | | c | e | a | b | ab | | ad | | abd | c | Healthcare | UAE | S | SSQ | SEM |
| Hong, Zhang [101] | | | | a | b | | b | | | | ab | Manufacturing | China | Five categories | SSQ | SEM |
| Das [30] | acd | ac | de | a | b | a–c | | | | cd | bc | | | Lean | Secondary data | Mathematical modelling |
| Luthra and Mangla [37] | d | c | | | b | c | | c | | | ab | Automotive | India | Nine key strategies | LR, V | ISM-fuzzy MICMAC |
| Mathivathanan, Kannan [67] | ad | ac | d | b | b | ac | a | b | c | | ab | Automotive | India | ESG | LR, V | DEMATEL |
| Moretto, Macchion [76] | a | b | | abd | ab | ac | | ab | | a | a–c | Fashion | Ita, Ger, Fra | ES | V | QCCA |
| Prasad, Pradhan [78] | | | cd | b | | c | a | | c | ad | ab | Steel sector | India | General | SSQ | EFA |
| Thong and Wong [71] | | | de | acd | | ac | ab | abd | b | | | General | Malaysia | General | SSQ | SEM |
| Vargas, Mantilla [40] | ad | ab | cd | bd | ab | ac | a | ab | ab | ad | ab | Different sectors (industry (59.5%), services (30.2%), commerce (6.3%), agriculture (1.6%), mining (1.6%), and construction (0.8%)) | Colombia | E | SSQ | PLS-SEM |
| Wang and Dai [42] | ae | a | ce | b | b | ac | a | ab | | cd | ab | General (172 firms) | China | IE management | SSQ | SEM |
| Wu, Zhang [96] | e | | c | bc | a | a | | ab | a | ad | ab | Manufacturing | China | Economic, ES | SSQ | SEM |
| Andalib Ardakani and Soltanmohammadi [74] | | | de | ab | b | a | a | | | d | b | General | Iran | GSCM | SSQ | PLS-SEM |
| Baliga, Raut [77] | a | a | cde | b | | a | a | a | | | | General | | E | SLR | DTA |
| Bressanelli, Perona [97] | | | | | ab | | | b | | c | | Household appliances | Italy | SC redesign for the CE | V | QCCA |
| Broemer, Brandenburg [107] | | abc | | ac | | ac | | | | ac | a | Chemical | Germany | Intra/inter organizational | Single case | QA |
| Cousins, Lawson [86] | | c | d | ab | | | | | | c | | Manufacturing | UK | GSCM | SSQ | MSA(EFA) |

**Table 1.** *Cont.*

| Author (Year) | Practices Class | | | | | | | | | | | Industry | Case Country | Type of Practice | Data Collection | Data Analysis Technique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | | | | | |
| Duque-Uribe, Sarache [57] | a | ab | abde | a–c | ab | b | | ac | | c | ab | Healthcare | | General | SLR | TA |
| Jadhav, Orr [82] | | | de | ad | ab | c | | | | | b | Manufacturing | Australia | Internal ES | SSQ | SEM |
| León-Bravo, Caniato [39] | a d | | e | ab | ab | c | | ab | | | ab | Food | Italy | A few selected | V | QCCA |
| Li, Fang [29] | ad | a | cd | b | | | | abd | a | | b | General | China | For supplier | LR, V | TOPSIS |
| Zimon, Tyan [72] | a | c | bde | ab | b | ac | | | | c | b | Manufacturing | Taiwan | Reactive, cooperative, dynamic | SLR | TA |
| Balon [108] | | | de | b | | ab | | | | | | General | | GSCM | SLR | Bibliometric |
| Choudhary, Kumar [32] | a | c | d | b | b | b | | | | | b | Automotive | India | E | LR, V | DEMATEL |
| Ciccullo, Pero [36] | ad | b | | bc | b | a | | | | | | Different industries (10 exploratory case studies in different industries and four explanatory cases in the furniture industry) | Canada, US, Italy | General | V | QCCA |
| Cloutier, Oktaei [90] | | b | | | ab | c | | | b | cd | | | | Collaborative | SLR | DTA |
| Geyi, Yusuf [46] | d | a | | c | b | ac | a | a | c | | ab | Manufacturing | UK | Agile practices | SSQ | SEM |
| Gloet and Samson [83] | | c | | c | ab | a | b | | ac | | ab | Food and beverage | Australia | Knowledge and innovation management | V | QCCA |
| Heidary Dahooie, Zamani Babgohari [41] | e | a | d | b | ab | | | | | | ab | Mining | Iran | General | LR, V | Fuzzy DEMATEL |
| Hong, Guo [52] | | c | c | b | | | b | | b | ad | b | Manufacturing (Chinese manufacturers in the Yangtze River Delta region: 209 firms) | China | SSCM | SSQ | MSA (C&R) |
| Islam, Perry [31] | ad | c | be | ab | a | ac | | | | | ab | Textiles | | ES | SLR | DTA |

**Table 1.** *Cont.*

| Author (Year) | Practices Class | | | | | | | | | | | Industry | Case Country | Type of Practice | Data Collection | Data Analysis Technique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | | | | | |
| Jabbour, Janeiro [109] | | | | c | ab | | | | b | d | | Case companies (Brazilian companies that have ISO9001 regarding the level/intensity of adoption of practices/initiatives for justice in supply chains) | Brazil | S | SSQ | MSA (C&R) |
| Jaegler and Goessling [69] | | | bce | a | b | | | | | | | Luxury goods (11 European luxury good companies) | France | Specified for industry | SSQ | USA |
| Jia, Yin [110] | d | | de | | | | | | | | | Textile | | PDS, E | SLR | DTA |
| Jia, Zhang [98] | | | | | | | | | b | | | General | | Financial | SLR | DTA |
| Kumar, Moktadir [51] | | c | | b | c | | a | b | a | ab | | Footwear | Bangladesh | Behavioral | LR, V | DEMATEL |
| Wang, Zhang [66] | | c | d | b | a | bc | | | b | | b | General (172 firms) | China | General (IE) | SSQ | SEM |
| Laosirihongthong, Samaranayake [102] | a | | bd | b | | | | | | | | Electronics (electronics parts/components manufacturing organizations) | Thailand | Five selected | LR, V | Fuzzy AHP |
| Mani, Jabbour [92] | | | | | | | a | ab | | bd | | SME manufacturer | India | S | SSQ | SEM |
| Narimissa, Kangarani-Farahani [80] | c | | ce | b | | c | | a | b | | b | Oil and gas | Iran | 112 selected | SLR | Delphi |
| Stekelorum [111] | | | | | | | | | b | | | SME general | | CSR practices in SC of SMEs | SLR | DTA |
| Silvestre, Silva [55] | ad | c | ce | a | ab | ac | | | a-c | | | Five SC cases | Brazil | General | V | QCCA |
| Warasthe, Schulz [79] | | | | bc | ab | ac | | | | c | | Textile | Germany Ethiopia | Internals and externals | V | QCCA |
| Yadav, Luthra [34] | ae | b | cd | ab | ab | b | a | b | | c | bc | Automotive | India | Industry 4.0 | LR, V | BWM-ELECTRE |

**Table 1.** *Cont.*

| Author (Year) | Practices Class | | | | | | | | | | | Industry | Case Country | Type of Practice | Data Collection | Data Analysis Technique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | | | | | |
| Zimon, Tyan [58] | a | a | abde | ab | b | c | | | b | | b | | UN SDGs | General | SLR | TA |
| Kouhizadeh, Saberi [112] | | | | | a | | | | | | | | | Blockchain technology | LR, V | DEMATEL |
| Qorri, Gashi [33] | a | ac | bd | b–d | b | ac | | ad | bc | | ab | | | S | MAR | MA-SA |
| Sabuj, Ali [50] | | c | d | | ab | a | | | | cd | a–c | Garment | Bangladesh | General | LR, V | ISM |

\* The small letters a, b, c, d, and e are based on Figure 5. If a hyphen is used, it includes all the letters, for example, a–c means abc. \*\* For columns 2–12: A: Manufacturing; B: Design; C: Logistics; D: Supply planning and procurement; E: Management information systems; F: Quality performance; G: Safety and security; H: Ethics and social responsibility; I: Financial management; J: Structural management; K: Promotional programs. For columns 13–17: DC: developing countries; SSCM: sustainable supply chain management; GSCM: green supply chain management; E,S,G: environmental, societal, governmental; OP: operational; SCI: supply chain integration; IE: internal and external; PDS: product design and stewardship; V: interview; LR: literature review; SLR: systematic literature review; QD: questionnaire development; SSQ: structured survey questionnaire; SEM: structural equation modelling; ISM: interpretive structural modeling; PLS: partial least squares; QCCA: qualitative cross-case analysis; R: regression; MSA: multivariate statistical analysis; DEMATEL: decision-making trial and evaluation laboratory; ANP: based analytic network process; USA: univariate statistical analysis; QA: qualitative analysis; DTA: descriptive and thematic analysis; C&R: correlation and regression; MAR: meta analytical review; EFA: exploratory factor analysis; MA-SA: moderation analysis–subgroup analysis; BWM: best–worst method.

## 5. Discussion and Future Research

According to the categorization, it is observed that most of the practices were proposed based on category C (logistics) and D (supply planning and procurement). This shows that connection channels that link business with consumers are essential regardless of the type of the industry. The better these relations, the more the level of sustainability of a SC will be improved. In this regard, sustainable purchasing (forward direction) and reverse logistics-based solutions were the most frequent actions among the different industries. This highlights how approaches such as closed-loop and circular SCs can be important and effective to increase sustainability. Although inventory management (in category C) is well developed in the literature, it has been neglected in sustainability dimensions. This is also evident in previous studies [113], and reveals a new opportunity for further research.

According to Figure 7, quality performance practices (F) were studied almost to the same extent as promotional programs (K). The first one concerns the quality of each layer of the SC and the involved entities, and the second one shows the importance of human-based plans in the SC. Although there have been efforts to boost societies' attention to SSCs, more practices should be developed. For example, social media is a powerful tool; however, its influence is not well-investigated [114], affirming another future direction. Having a strong and non-stop relationship called as 6Cs between all the composing elements of the SC is another key factor towards sustainability. In Figure 11, this is shown with a straight and continuous line through the chain. In contrast to other practices, which are usually focused on a player, section, or topic, category E consists of the whole chain.
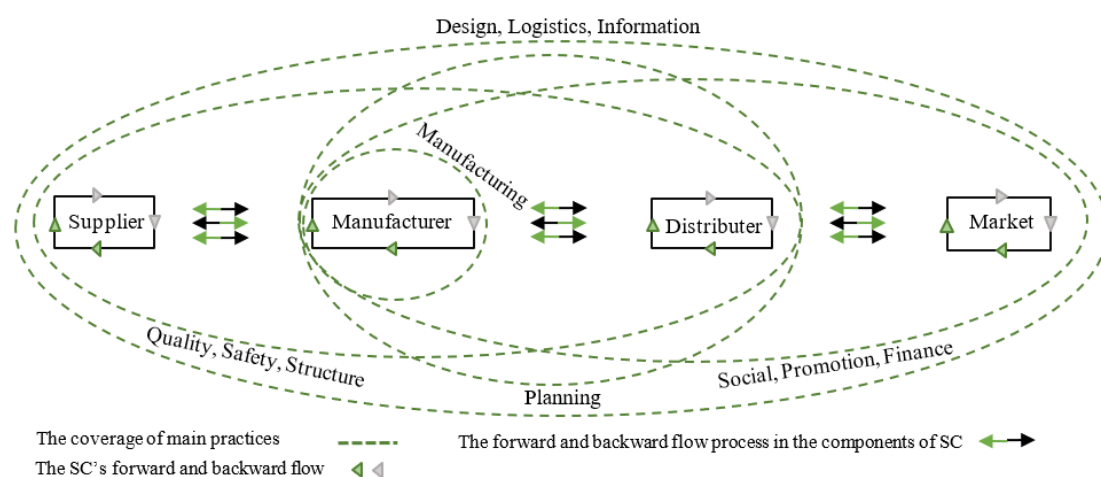


**Figure 11.** The distribution of practices through supply chains.

On the next level, we suggest practices related to the management of products and people, classified as B and J, respectively. It was shown that the most applied solutions concerning these practices were innovation and joint activities. It is necessary to change the traditional format of products to enhance sustainability and facilitate relationships between the staff and stockholders. In this regard, sustainable product development and designing circular products are new trends [115] that can promote sustainability through SCs. Practices related to manufacturing and social responsibility (AH) achieved the same priority. However, practices related to these categories did not obtain the same attention. The discussed practices are illustrated in Figure 11 to give a whole picture of a typical SC platform.

The column called "Type of practice" in Table 1 shows the axis of discussion regarding the investigated solution in each paper. The simultaneous investigation of this column and the one named "Industry" reveals the papers' shortcomings. Among the ESG (i.e., environmental, societal, governmental) factors, social and environmental practices have been studied in several cases. However, governmental practices that can affect sustainability through the supply chain are not addressed well, specifically how the government

can promote SSCs nationally and internationally, suggesting political, management, and leadership strategies. Future research should investigate bureaucratic flexibility to create and maintain accountable sustainable policies in SCs.

Table 2 shows the industries vs. practices. The researchers explored the practices from three perspectives: general, selective, and focused. Although the number of the studies dealing with the practices in the big picture and considering a general framework is still increasing, there is still a gap in analyzing the effect of specific solutions. For instance, the ones covering dynamic capabilities, agile, lean, and innovative practices need more investigation. Considering the structure of the SC, the focus is usually on suppliers. However, the roles of the other parties, such as retailers, and developing specific practices for them, are ignored.

**Table 2.** Overview of the industry based on the type of practice.

| | Industry | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Practice** | **Aerospace** | **Chemical** | **Clothing** | **Electronics** | **Energy** | **Food** | **Healthcare** | **Luxury** | **Manufacturing** | **Maritime** | **Retail** | **Steel** |
| Selected | | | √ | √ | √ | √ | | √ | √ | | | |
| General | √ | | √ | | √ | | √ | | √ | | √ | √ |
| GSCM | | | √ | | √ | | | | √ | | | |
| SSCM | | | | | √ | | | | √ | | | |
| Environmental | | | √ | | | | | | √ | | √ | |
| Social | | | √ | | | √ | √ | | √ | | | |
| Environmental and Social | | | √ | | | | | √ | √ | | | |
| Environmental and Governmental | | | | | | | | | √ | | | |
| Environmental, Social and Economic | | | | | | √ | | | √ | | | |
| ESG factors | | | | | | | | | √ | | | |
| Digitalization | | | | | | | | | √ | | | |
| Agile | | | | | | | | | √ | | | |
| Dynamic capabilities | | | | | | √ | | | √ | | | |
| Innovation management | | | | | | √ | | | | | | |
| Internal and external | | √ | √ | | √ | | | | | √ | | |
| Behavioral | | | √ | | | | | | | | | |
| Cooperate social responsibility | | | | | | | | | √ | | | |

Compared to other industries, the manufacturing industry is studied from a more practical point of view. Traditional industrial sectors related to "textiles, garments, leather, and footwear" and "oil, gas, coal, and mining", classified generally as the clothing and energy industries, were the topic of several studies. In terms of global SCs, some industries such as the chemical sector and aviation industry have rarely been discussed. Moreover, there is a vacant place for some industries such as banking and real estate, specifically considering financial practices.

Another substantial finding is the absence of more advanced and complicated data techniques. Despite the wide usage of traditional qualitative and quantitative data analysis techniques, there is a great opportunity for state-of-the-art data mining methods, artificial intelligence, and machine learning approaches to implement sustainable practices and make positive differences. Despite the existence of many outstanding mathematical models in the supply chain and sustainable supply chain, there is not a considerable mathematical model that uses sustainable practices as the main feature of the model.

## 6. Conclusions

The present paper studied the application of sustainable practices to move traditional SCs toward improved versions called SSCs. We conducted a literature review and analyzed the results to provide a bigger picture concerning sustainable practices. Different aspects, including the type of industry and the applied methodologies, along with depicting a comprehensive categorization for the practices, were investigated. The details of the practices in each subcategory were presented in a cross-referenced database (Table 1).

This provided an opportunity to see the progress of recent years, and how examine the situation in different countries regarding the industries. Besides the statistical method, we pointed out a roadmap for future research and discussed the gaps. These findings will be useful for researchers and practitioners, allowing them to see and compare the application of sustainable solutions considering all investigated industries. The new and updated categorization showed the shortcomings of new practices and considered the ignored industries. Future research can identify the situation of SSCs based on barriers and performance based on the present format.

**Author Contributions:** Conceptualization, E.S.; methodology, E.S.; software, E.S.; validation, E.S.; formal analysis, E.S.; investigation, E.S.; resources, E.S.; data curation, E.S.; writing—original draft preparation, E.S., B.I. and A.Z.; writing—review and editing, E.S. and A.Z.; visualization, E.S., A.Z. and B.I.; supervision, E.S.; project administration, E.S.; funding acquisition, E.S. and J.M. All authors have read and agreed to the published version of the manuscript.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

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