

Sustainable Supply Chain Management in the Oil and Gas Industry in Developing Countries as a Part of the Quadruple Helix Concept: A Systematic Literature Review

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Abstract: Sustainable supply chain management (SSCM) has become a hot topic on which eminent researchers are working on a daily basis. A lack of clarity in the fundamental differences between SSCM and green supply chain management (GSCM) is being observed in this field of research. However, it is regrettable to note that there is a huge deficit of research in the oil and gas (OG) industry, mainly in developing countries (DCs), where this sector of activity is the most lucrative and polluting. The purpose of this research is to present the practices of SSCM in the framework of the quadruple helix approach in the oil and gas industry in specific geographical areas of developing countries by conducting a systematic literature review (SLR) of papers published from 2012 to 2024 focused on both the OG industry and DCs. As part of this study's findings, the authors highlight the distinction between SSCM and GSCM by building a conceptual framework that applies the triple bottom line of SSCM to the OG industry and demonstrates that GSCM, which is more related to environmental issues, is a part of SSCM. Therefore, in order to be more efficient and to have a great impact on their performances, OG companies in DCs should apply SSCM practices, which are close to circular business rather than GSCM practices, especially because their implementation can be influenced by certain barriers and pressures that involve the use of the QHC.

Keywords: supply chain management; oil and gas industry; developing countries; triple bottom line; quadruple helix concept; circular business



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1. Introduction

In recent years, SSCM has become a research area that has received increasing attention. Many literature reviews have been published on different axes, such as green management of the supply chain [1], green purchasing [2], the definition and measurement of SSCM [3,4], and their environmental impacts, while other literature reviews have focused on the social impacts of SSCM [5,6]. Finally, some articles deal with both the environmental and social effects [7]. It is important to mention that corporate competitive pressures elevate companies' attention to the environmental and social impacts of their activities in the value chain [8].

According to [9], SSCM activities include the monitoring, support, and integration of sustainability performance criteria into the supplier selection process. According to [10], effective SCM can be used to strengthen the efficiency of a company through five dimensions, which include customer relationships, supplier relationships, levels of information, levels of information sharing, and postponement. The results from [11] also showed that SCM performance is positively related to company performance. Supply chain management and sustainable development can be integrated to produce three dimensions, which include the economic, environmental, and social issues associated with the development of humans and which are related to the strategies and activities of a company [12,13].

The motivation behind optimal supply chain management is the increase in the competitive advantages of the supply chain [14]. In 1985, Porter defined two types of competitive advantage: “cost leadership and differentiation”. According to [15], increased overall customer satisfaction can ameliorate a company’s profitability and competitive advantage. Similarly, Ref. [16] proposed improvements to SCM to provide higher customer service and economic value through the synchronous management of the physical flow of goods and related information from supply to consumption. According to Porter and Millar (1985) [17], competitive advantage develops fundamentally from the value of the client, which is created by the company, and aims to create a sustainable and profitable position against the different forces that settle competition in the industry. In this regard, it is proposed that the introduction of SCM increases the value and satisfaction of customers, which increases the competitive advantage for the supply chain as well as for each member firm. This definitely improves the profitability of the supply chain and its members. Some researchers offer specific goals to increase the profitability, competitive advantage, and value/satisfaction of the supply chain’s customer base, as well as its participants. For example, the key goal of SCM is to reduce the costs required and to provide the required level of customer service in a particular sector [18,19].

Another key goal is to boost customer service by increasing inventory availability and reducing the time of the order cycle [20]. Customer service goals are also achieved through a customer-enriching procurement system focused on improving innovative solutions and synchronizing the flow of products, information, and services to create unique, customized customer service value sources [21]. Finally, an inexpensive differentiated service helps to create a competitive advantage for the supply chain, which ultimately brings profitability [20,22]. If we differentiate between the customer service operating function and the resulting goal of value and customer satisfaction this discussion leads us to conclude that the effects of CMS are lower costs, better value, and customer satisfaction, all of which help to gain a competitive advantage [23,24].

Since 1992, more than 9000 articles in the management literature associated with SSC have been published, and the most influential works come from a handful of academics, mainly from the United States, Europe, and parts of Asia [1]. There are almost no African academics that have spent a lot of their time conducting research in this field in developing countries. With the knowledge of SSCM as a topic of global interest, the lack of non-Asian and non-Western-originated research is perceived as an unsatisfactory gap/vacuum by suppliers in developing countries who feel under-represented in trade policies and sustainable development strategies [25].

Although there is extensive research available on SSCM in the management and supply chain literature, it has been pointed out that this research does not adequately address the specific problems of SSCM in developing countries [1,26]. Apart from that, many publications are related to green supply chain management only. Also, there is a lack of research conducted on sustainability that reports on the different practices in the context of the oil and gas industry, especially in terms of SCM [27]. The most recent studies have only focused on companies in specific countries, especially European, American, and Asian countries [27], or they have not integrated all sustainability dimensions, namely, economic, environmental, and social factors [4]. Also, there is ambiguity when talking about sustainability and SCM due to the fact that there is no existing theoretical difference between sustainable supply chain management and green supply chain management. Each term is used from one article to another without pointing out the clear difference between the two. It is evident that research is still dominated by green/environmental issues. The social aspects and also the integration of the three dimensions of sustainability are still rare [4].

According to [28], theory building efforts in SSCM remain scarce. There is a predominance of many well-known imported macro-theories. However, this appears to be a weakness for SCM, which deserves a unified theory regarding the consistency of the subject [28].

Designed by its initiators, Carayannis et al. (2012), the primary goal of the Quadruple Helix Concept consists of using sustainable solutions to solve entrepreneurial and economic problems in order to positively impact social development [29]. Nowadays, this avant-garde model is widely used in the field of innovation management, and we have noticed a clear absence of this model in the field of SSCM, which in our opinion would be essential to present to all stakeholders in the supply chain, as well as the role played by each of them while highlighting the interconnection between all of them.

The ultimate purpose of this work is aimed at considering the following four concepts under a unified framework: sustainability; supply chain management; DCs; and the OG industry. This is conducted in order to present the practices, pressures, and barriers of SSCM in the framework of the quadruple helix approach in the OG industry in DCs. Therefore, the authors will use a 5W + 1H pattern to help elucidate the phenomenon by setting up the best following research questions [30]:

What: What are the main findings of the related literature review?

Who: Who are the main and active researchers in the area of our research interest?

Where: What are the main countries associated with the published research in that area?

When: When have publications been issued in our area of research?

Why: Why is it useful for researchers to conduct research in this area? Why is it important to further examine this research area if this field of research is so active with a multitude of publications each year?

How: How does SSCM apply to the OG industry in DCs, especially in the framework of the quadruple helix approach?

This review paper is structured as follows: Section 1 provides a brief conceptual framework to better understand the article; Section 2 presents the methodology adopted; Section 3 presents and discusses the results of the study including the descriptive analysis as well as synthesis; and the limitations of the study and possible future research directions, as well as the theoretical and managerial implications of the study, are addressed in the last section.

2. Conceptual Framework

To ensure a better understanding of the present research the authors will proceed in the following to a brief framing of the five key research concepts, namely: (1) the supply chain; (2) sustainable management; (3) developing countries; (4) the oil and gas industry; (5) the Quadruple Helix Concept.

2.1. The Supply Chain (SC)

According to [20,31,32], the definition of “supply chain” appears to be more common among authors than the definition of “supply chain management”. Ref. [31] has proposed “that a supply chain is a set” of companies that transmit materials. Currently, many independent companies are involved in the manufacture of a product and place it in the hands of the end-user in a supply chain; producers of raw materials and components, product assemblers, wholesalers, retailers, and transport companies are all members of a supply chain [31]. The supply chain is made up of all the phases involved, directly or indirectly, in satisfying a customer’s request. It includes not only the manufacturer and suppliers but also carriers, warehouses, retailers, and customers themselves [33]. Thus, supply chain management consists of coordination between production, inventory, location, and transportation in order to obtain the best combination of responsiveness and efficiency for the market served. It is about the management of the various activities necessary to coordinate the flow of products and services in order to best serve the end-customer. All traditional logistics activities are involved, in addition to activities such as marketing, new product development, finance, and customer service. Furthermore, these additional activities are now considered as part of the work required to meet customer demand [34].

2.2. Sustainable Management (SM)

The concept of sustainable management, which comes from sustainable development, was defined for the first time in 1987 by the World Commission on Environment and Development in the Brundtland report as “development that meets the needs of the present without jeopardizing the ability of future generations to meet theirs”. It is often approached through three dimensions—economic, environmental, and social [35]—or all three pillars of sustainable development (3Ps: Profit, Planet, and People). In other words, organizations should make a profit, but not at the expense of the environment (Planet) and society (People). Economic concerns relate not only to profitability objectives financially, but also to the objectives of wealth creation with an equitable distribution. Environmental concerns relate mainly to the concerns about global warming, pollution, natural resource depletion, etc. Finally, social concerns relate to the increase in inequalities at the global level, such as poverty and access to basic needs (drinking water, food, housing, work, care, education, etc.) [36]. Several definitions of sustainable supply chain management have been discussed in the literature. The most common definition used nowadays has been proposed by [4]: “The management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements”. In effect, it consists of managing environmental, social, and economic impacts throughout the life cycle of goods and services. Its objective is to create, protect, and increase the long-term value of environmental, social, and economic benefits for all stakeholders involved in bringing products and services to market [37,38].

2.3. Developing Countries (DCs)

According to [39], developing countries “refers to the low-income and import-dependent nations in Eastern Europe, Latin America, Africa, and Asia that accept the rules, norms and standards regarding workplaces, businesses and global economic practices”. This definition is not far from what has been proposed by the IMF. According to the Bretton Woods Institution, “Developing countries are those countries whose standard of living, income, economic and industrial development remain more or less below average”.

2.4. Oil and Gas (OG)

In the energy market, oil and gas are the principal industry with a crucial role in the global economy as the primary fuel sources in the world [40]. The oil and gas industry is divided into three main segments [40]:

- Upstream: the business of O&G exploration and production;
- Midstream: it regroups companies specialized in transportation and storage;
- Downstream: regroups refining and marketing companies.

It is also known to be one of the largest “carbon-emitting industries” in the world [41].

Figure 1 represents the interaction between all these concepts and their importance in the SSCM field.

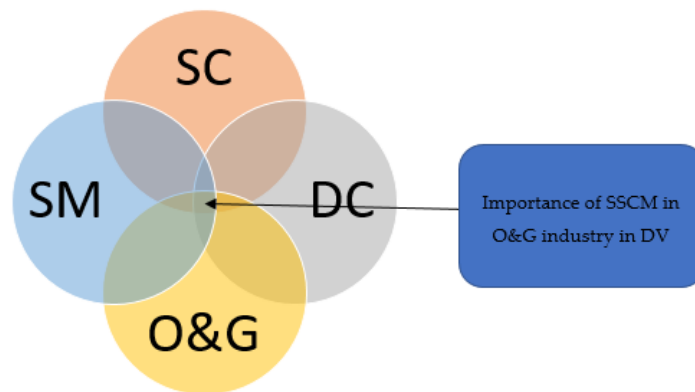


Figure 1. Key concept interactions. Source: developed by authors.

2.5. Quadruple Helix Concept

In terms of innovation, according to [42], the Quadruple Helix Model admits four major actors in the innovation process: science, policy, industry, and society. The Quadruple Helix Concept is the successor to the triple helix model, which had been considered to be lacking in integration; this new model highlights the interaction between the four main stakeholders involved in the innovation process. Moreover, the very normative character and the real lack of theoretical bases is the reason why researchers, such as those in [43], quickly developed an improvement in the triple helix model:

- **Science:** Also known as university or academia, this actor represents the temple of knowledge. In other words, it is the place where all the theories are born. Its interaction with public authorities is based on the fact that each university, public or private, is regulated by law, as set out by the government. Likewise, it could receive subsidies from the state. With regard to industry, it constitutes the main training area for future employees. And, in return, certain companies finance research and usually implement their results for improvements [44].
- **Policy:** This refers to the government. Through all its departments, the government is omnipresent in the functioning of every modern nation. Indeed, it constitutes the main regulator of society and ensures a fair and proper interaction between all economic actors present in the country as well as those abroad. Consequently, it has a great impact on all the other actors, as demonstrated previously. According to this model, a large majority of governments are prioritizing greater public involvement in innovation processes.
- **Industry:** Considered the main engine of the economy, companies are the preferred partners of the public authorities. By employing citizens and paying taxes, this actor is far away from one whose cooperation with the government is very essential. In return, the government could also grant them subsidies.
- **Society:** For a long time neglected in the conceptual approach, this actor made up of civil society, non-governmental organizations, employees, and the general public, nowadays represent a key link in the process [29]. By applying pressure and participating in daily life, these actors appear as the fundamental elements of stable and sustainable socio-economic development.

Henceforth, the Quadruple Helix Concept better suits this study because, as stated by [45,46], it better meets the needs of the future. Widely used since its creation in the socio-political field, it has recently been borrowed by authors in the economic field, particularly in business management.

3. Methodology

In accordance with the objective of this review, this paper is based on a two-pronged approach: a bibliometric analysis [47,48] and a systematic review [49].

Using visualization tools (like VOSviewer), the bibliometric analysis summarizes large amounts of bibliometric data to present the state of the art and trends emerging from a topic or research area. As for the systematic literature review, it summarizes and synthesizes the conclusions of the existing literature on a subject or a field of research [50].

3.1. Research Strategy

Coming from the Medical field, this systematic literature review has been adapted to the field of management to provide an authentic pool of knowledge and increase practice by evolving “context-sensitive research” [51]. This systematic review of the literature was conducted based on the guidelines of PRISMA 2020 statement (Preferred Reporting Items for Systematic Review and Meta-Analysis) (see Supplementary Materials). The basics of Scopus and ScienceDirect data were searched by applying the following search terms: (Supply Chain) AND (sustainable OR sustainability OR Green OR echo) AND (OR) AND (Oil and Gas). Note that the research terminated in January 2024.

3.2. Inclusion Criteria

By combining all four key concepts, the authors found no articles in almost every database. Therefore, they had to eliminate the key concepts of developing countries and the Quadruple Helix Model/Concept.

The inclusion criteria for the type of documents included the following: articles; reviews; conference papers; and reviews of conferences and books.

The exclusion criteria included the following: Any documents that were not written on developing countries or emerging countries. Also, the authors excluded non-relevant publications after reading. In total, we obtained 38 articles based on reliable results obtained from a solid and replicable methodology. The ranking of journals was also a good criterion in terms of the reliability of a publication. Figure 2 synthesizes the research process with the number of included articles according to the 2020 PRISMA diagram.

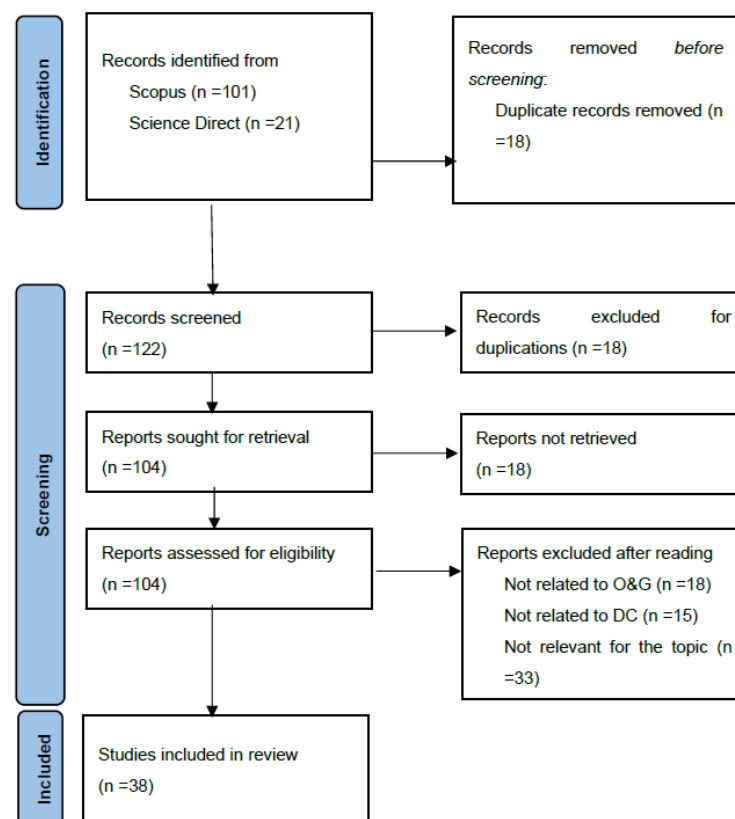


Figure 2. PRISMA diagram of the SLR based on the literature review.

4. Results

The authors analyzed 38 publications. In this section, we will present and discuss the results obtained.

4.1. Descriptive Analysis

As shown in Figure 3, it was in 2015 that the enthusiasm of researchers increased consistently. There was an increase of one publication per year for the previous years to three publications that year. Then, this number continued to grow until 2018, when a total absence of studies (0 publications) was noted. The year 2019 changed to three publications, followed by an increase in 2020 and 2021, with a record of six publications for each year. This number dropped to five the following year, stabilizing at four in 2023.

Documents by year

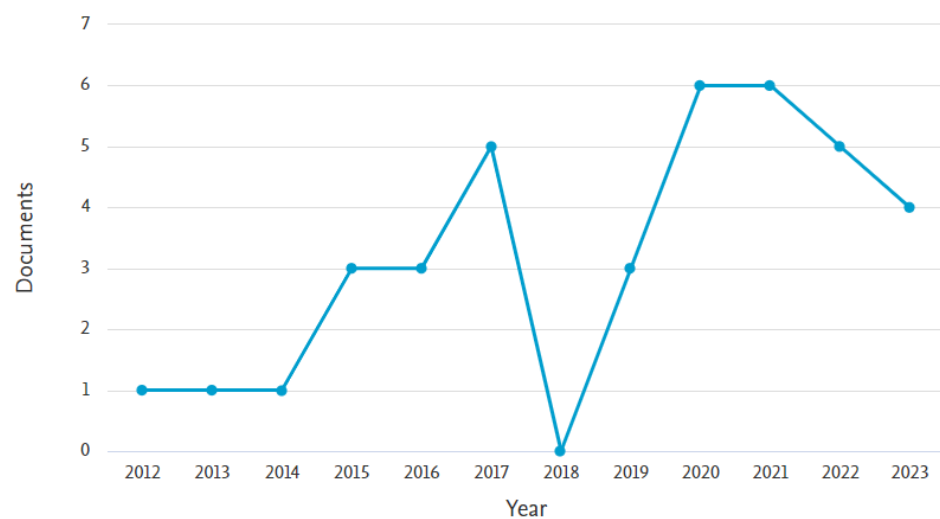


Figure 3. Documents per year. Source: Scopus.

Figure 4 is an illustration of the most active authors in the field. It can be observed that Rezaei, J. is the most active, with a total of six publications. They are followed by Tavasszy, L. A. It should be noted that both researchers are from the Netherlands, which is the country from which the most publications have been made, as shown in Figure 5.

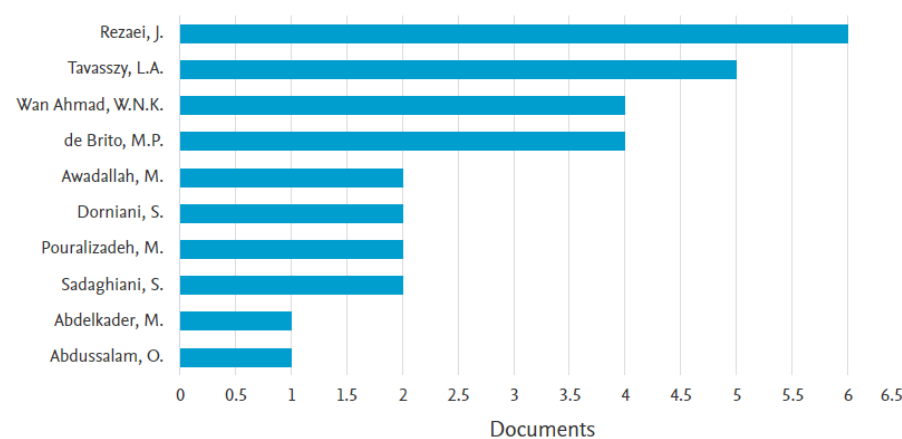


Figure 4. The most active authors. Source: Scopus.

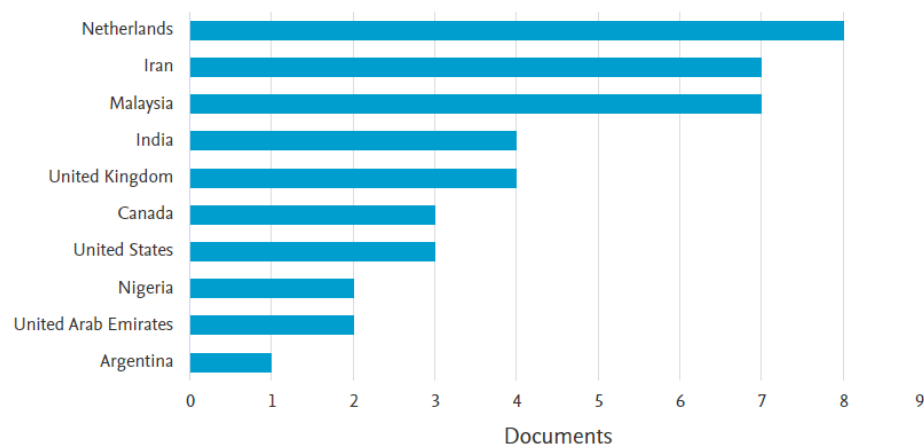


Figure 5. Documents by country or territory. Source: Scopus.

Most of the authors used resource-based view theory [52], which consists of obtaining access to another company's core competencies in order to acquire a competitive advantage [53]. This theory confirms that the most important assets of a firm are its resources and capabilities. SSCM involves the interconnection between many companies and how each company in that chain manages to be unique in terms of competitiveness. This theory can be related to the economic aspects of SSCM because the economic dimension is very often measured in terms of market share, sales, operational efficiency, and especially upgrading [54].

4.2. Bibliography Analysis

VOSviewer was used to visualize a keyword co-occurrence network for the publications included. A total of 13 out of 404 met the threshold (higher or equal to 4). Figure 6 illustrates these insights.

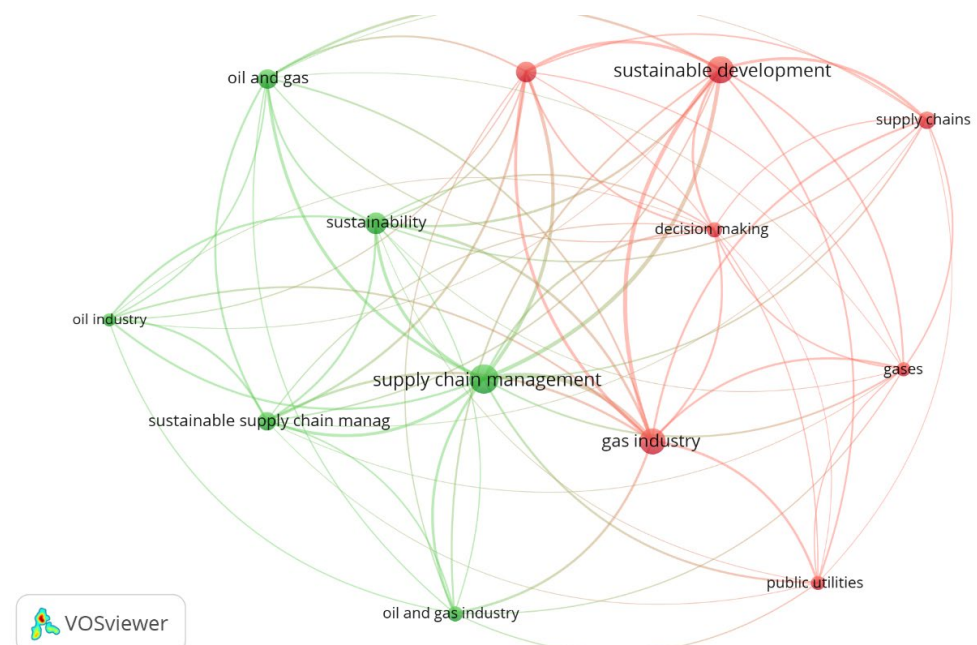


Figure 6. Keyword network. Source: VOSviewer coming from the literature review.

According to [47], the size of the node and the font depends on the weight of the keyword. The larger the weight, the more often the keyword appears and the larger the corresponding nodes will be; the line between the nodes indicates that a keyword appears

in common with another keyword. This means that two keywords are co-occurring. The keywords grouped together in the same “cluster”, or the “group of keywords”, can be closely related to a given concept. This allowed us to carry out grouping around the keywords, as indicated in Table 1.

Table 1. Keyword grouping.

Keywords	Related Concepts
Supply chain management	Supply chain; decision making.
Sustainable development	Sustainability; public utilities; sustainable supply chain; sustainable supply chain management.
Gas industry	Oil industry; oil and gas industry; gases; oil and gas.

Source: developed from the literature review.

VOSviewer also allows us to view the links between the authors who have collaborated on the same topic. Each cluster in the network of co-authors represents a community of collaboration, the size of the nodes represents the number of publications per author, and the thickness of the links indicates the level of collaboration.

For our review, as shown in Figure 7, only 10 out of 106 authors responded to the criterion of carrying out a minimum of two collaborations. The network revealed one author with nine collaborations (Awadallah M.), eight authors with seven collaborations, and two authors with the minimum collaboration. Thus, we can note that there is increased interest from the authors vis-à-vis the subject.

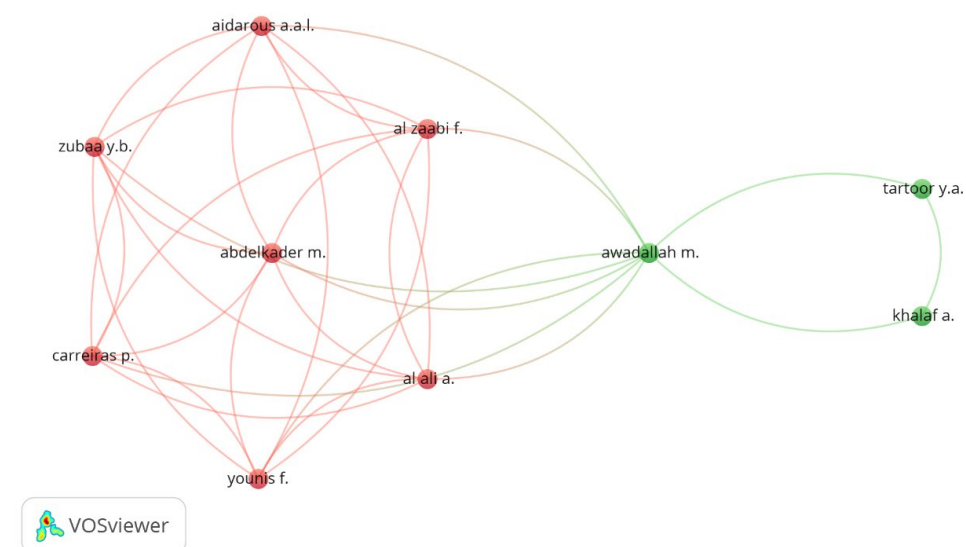


Figure 7. Collaboration between authors. Source: VOSviewer coming from the literature review.

4.3. Sustainable Supply Chain Management in O&G Industry in Developing Countries

4.3.1. Sustainable Supply Chain Management: The Triple Bottom Lines

In an increasingly competitive market, the optimization of the supply chain by organizations must take into account the three pillars of sustainable development (economic, environmental, and social) [50]. Thus, the supply chain plays an essential role in the achievement of the Sustainable Development Goals. According to [55], the trend of the implementation of a sustainable supply chain has several motivations, such as the requirements of stakeholder satisfaction, improving public image, and retaining the loyalty of long-term customers, thus maintaining a competitive advantage [56].

In general, the sustainability of the supply chain is based on three pillars, namely, the economic, environmental, and social aspects (or the 3Ps of profit, planet, and people) [57]. Supply chain sustainability management can be defined as “the management of supply chain operations, resources, information and funds to minimize environmental impact and maximize profit and social welfare” [58]. Otherwise, “the management of flows of capital, information and of materials throughout the Supply Chain, taking into account the three dimensions of sustainable development” [59]. Each aspect should be fully explained, and its criteria highlighted. By referring to [57,60,61], we present the three dimensions of the supply chain in Table 2.

Table 2. The triple bottom line of SSCM.

Environmental	Economic	Social
<p>It concerns inputs, such as energy, water, materials, etc., and outputs, such as waste, emissions, etc.</p> <p>It takes into account greenhouse gas emissions, atmospheric emissions, water emissions, energy efficiency, and solid waste disposal.</p> <p>It can be implemented through the adoption of a management system in a standardized environment, such as ISO 14001 [62].</p>	<p>It concerns the optimization of resources and the various costs, the distribution of wealth, the optimization of the execution time of orders, the minimization of the rate of default, maximizing the level of productivity and the profitability ratio, etc.</p> <p>Other criteria are taken into greater consideration, such as the integration of monitoring tools.</p> <p>Information and communication technologies as an intangible asset allow increased process efficiency.</p> <p>It can be implemented through the adoption of an ISO 9000 [63] quality management system standard for continuous process improvement.</p>	<p>It consists of the ways in which a company honours its commitments to its social and human capital or other stakeholders (suppliers, customers, etc.). It is concerned with their well-being, good relations with suppliers and customers, career development opportunities for its human capital (through training, more promotions, etc.), safety, healthcare benefits, etc.</p> <p>It can be implemented through the adoption of a standardized system for committing to operate in a socially-responsible manner, such as the ISO 26000 standard [64].</p>

Source: developed by the authors from the literature review.

We also found out that successful SSCM can affect the different aspects of company performance, i.e., “Environmental performance”, “Customer performance”, “financial performance”, “Information technology Performance”, “Social Performance”, “Risk performance”, “Logistics performance”, “Operational performance” [65], “Organizational performance” [66], and “performance of innovation and growth” [67].

4.3.2. SSCM in Oil and Gas Industry in Developing Countries

The literature review clearly showed us the difference between green supply chain management and sustainable supply chain management. From the 38 selected papers, the authors noticed that 14 focused only on the environmental dimensions of SCM, and these clearly stated that the study limitations consisted of the need to incorporate the economic and social dimensions of SCM. However, some of them, instead of mentioning the concept of SSCM while studying the environmental dimensions, replaced this concept with green supply chain management. Only five publications, while mentioning SSCM, studied the three dimensions of the SCM.

Developing and emerging countries present three main barriers that constitute a considerable obstacle to the implementation of sustainable management in the supply chain of the oil and gas industry [68]:

- **Corruption:** According to the annual corruption ranking, NGO Transparency International argues that developing countries are the most corrupt in the world. For instance, a recent decision made by the Arbitral Court of London convicted the MNE Glencore for acts of corruption in a dozen DCs: Nigeria; Cameroon; the Ivory Coast; Equatorial Guinea; the Democratic Republic of the Congo; Venezuela; and Brazil.

- **Lack of infrastructure** (pipelines, railways, roads, airports, ports, fibre optic technologies, the Internet, etc.). This is one of the main characteristics of DCs, and it presents a real challenge in the implementation of SSCM.
- **Political stability and social crises:** Most countries in the Global South, regarded as important oil and gas producers, are in the grip of socio-political crises: Iraq; Syria; Nigeria; South Sudan; etc.

Developing countries that own important reserves of mineral resources or are reputed as producers of oil and gas have observed a boom in this particular industry, while other industries are struggling, which often leads to poverty. The reason for this mismatch is due to the fact that the main operators in that industry in almost all developing countries are MNEs, which are mainly focused on the exportation of crude oil and natural gas. Therefore, the exportation of other products from other industries (in extroverted economies as they are) is internationally uncompetitive because of a high exchange rate [69]. In other words, DCs are very natural-resource-dependent, as stated by [70], such as Azerbaijan.

Nigeria also needs to be taken as an example. How can we explain that the first economy in Africa and the first producer of oil and gas on the continent is the one with around 69% of its population living below the poverty line? [71] In fact, the country hosts one of the poorest communities in the world. All the giants in the oil and gas industry globally, such as Total Energies, EXXON Mobil, etc., operate in Nigeria, and they are making great profits, as per their annual reports, but the paradox is the fact that the surrounding populations of their main installations (refineries) are among the poorest in the country according to the Nigeria Bureau of Statistics, in many of its statements of the past years.

The same phenomenon can be observed in Venezuela and Cameroon and, in fact, in many DCs all around the world.

Despite these barriers, the following are SSCM practices, inventoried from the literature sources, which are practiced in developing countries in the oil and gas industry. We have identified nine:

- **Green purchasing:** The adoption and integration of sustainable development principles into purchasing processes and decisions while ensuring that they meet the requirements of the company and its stakeholders. This covers both the sustainability of products and materials, as well as the responsibility of supplier practices. The following are the main benefits of green purchasing: better control of risks; lowered costs; promotion of innovation and differentiation; increased turnover; improved purchasing indicators; and improved talent acquisition and retention.
- **Supplier environmental collaboration:** “Collaboration can include providing suppliers with resources such as materials, standards or technologies; jointly developing more environmentally-friendly products; and helping them to implement sustainable production processes” [54].
- **Reverse logistics:** Reverse logistics or return logistics concerns all operations linked to the reuse of products and materials. It is the process of moving goods from the final delivery location in order to capture additional value or dispose of them appropriately. Repair and remarketing activities can also be included in the definition of reverse logistics [72].
- **Green manufacturing:** Green manufacturing can be defined as a process of product manufacturing in which manufacturers use fewer natural resources by reducing pollution and waste. It is also characterized by the recycling and reuse of materials and, of course, the moderation of emissions during these processes [73]. It is becoming more and more obvious that circular economy business models will have a long-term impact on the present economic model and that countries will have to adopt new ways of thinking and management, particularly when tackling resource efficiency and recovering the value of by-products and materials prior to becoming waste [74].
- **Eco-design:** Eco-design is a twin practice to eco-conception. Eco-conception is strongly related to the development and manufacturing of part of a product, while eco-design concerns the aesthetic and functional part of the product. Considered an ecological

and eco-responsible approach to the object, its goal is to limit the environmental impact of a product while working on aesthetic aspects and optimal functionality. This very well-known practice of SSCM is a concrete adaptation of the diagram from [75], which originally discusses circular recovery, circular use, and circular design while discussing circular business.

- **Legislation and regulation:** Legislation refers to a set of laws and rules that equally apply to all individuals in a specific geographical area, whereas regulations impact only people who are working in a position of responsibility for those regulations.
- **Green information systems:** This is defined as the application of an IS in achieving environmental objectives [76].
- **Cooperation with customers:** “It is process perspective, which concerns types of customer relationships that occur in. Customer pressure is a primary driver for enterprises to improve their environmental image and practices” [77].
- **Investment recovery:** Investment recovery is the practice of recouping the value of assets no longer needed by a company by identifying and reusing or disposing of surplus assets [78].

The authors adapted the above results to Figure 8 in order to highlight the importance of the interaction between all parties in the process of SSCM.

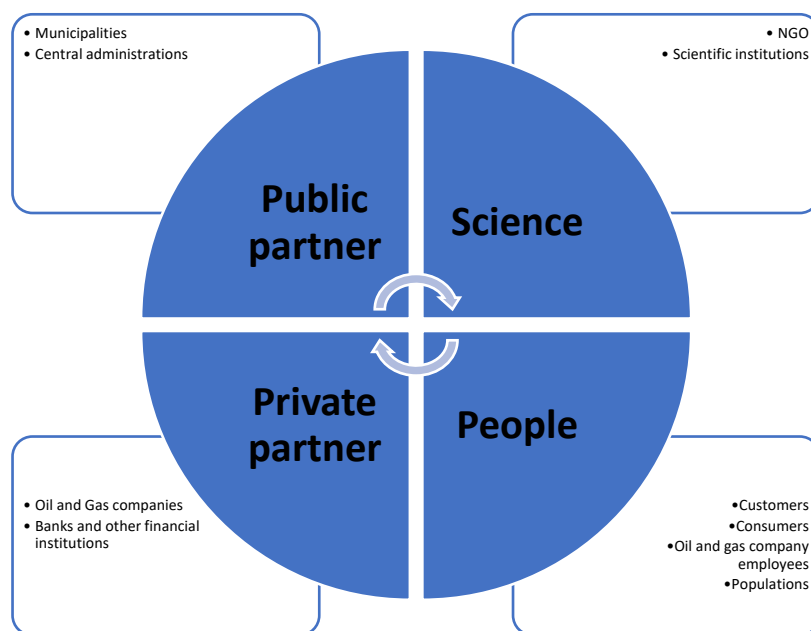


Figure 8. Possible structure of S4P (public–private–people–science partnership) applied in SSCM developed by the authors based on the QHC adapted by [29].

5. Discussion

5.1. Low Interest in Developing Countries

The descriptive analysis demonstrated a high interest in the topic by researchers. And despite the importance of this topic, researchers pay very little attention to DCs, as stated by [1]. This is probably because there are insufficient funds to finance this research. It might also be the reason why the few existing authors who have written on the topic are from developing countries, where research is at the center of attention. If authors collaborated more in this particular field of research by increasing participation in conferences and seminars at universities located in developing countries, or by increasing the number of scholarships granted to researchers from developing countries in the field of sustainable supply chain management in the oil and gas industry, we would have a significant number of publications.

5.2. The Lack of a Unique Theory

Since most of the papers focus only on the aspect of the environment, it explains the fact that the dominant theory used is resource-based theory [28]. As has been demonstrated, this theory cannot cover the triple bottom line of SSCM. Some authors who tried to cover at least two of the triple dimensions had to mix at least two theories.

5.3. Difference between Green Supply Chain Management and Sustainable Supply Chain Management

The definition offered by [12] defines GSCM as “the provision of goods and services from manufacturers and suppliers to the end users using cash flows, information flows, and material flows, with reference to the environment”. In accordance with our findings, the main difference between the two concepts comes from the fact that GSCM only focuses on environmental dimensions, whereas SSCM includes all three aspects (economic, environmental, and social). In other words, GSCM is a part of SSCM.

5.4. Pressures, Barriers, and Practices

In developing and emerging countries, factors such as institutional voids, environmental turbulence, and pressures “prevent supply chains from learning, innovating, and evolving at an appropriate pace on their sustainability trajectory” [68]. In addition, Ref. [79] has demonstrated that in developing and emerging economies, business environments present a higher degree of complexity and uncertainty “because they are more turbulent than the business environments encountered in developed countries”. It is clearly demonstrated that when it comes to developing a sustainable supply chain in developing countries, the combination of the aforementioned factors often leads decision makers to face extreme ambiguity when making their decisions.

The results of this research clearly demonstrate that SSCM cannot be effective without the complete implementation of a circular business, as indicated by the different practices mentioned by the authors. By applying the model of circular economy, companies realize significant economic gains and, therefore, earn more money.

Poverty, difficult living conditions, and socio-political crises, which characterize the conditions of some developing countries, are parameters that make it difficult to implement a sustainable supply chain management policy. Consequently, what seems obvious for developed countries is still a luxury for countries in the Global South. In addition, and according to [80], the Quadruple Helix Model can be used in order to build a new management approach that focuses on broader multi-stakeholder involvement in circular value co-creation [54].

6. Conclusions

Although being a very hot topic, sustainable supply chain management today still presents grey areas that are unexplored by researchers. This is the case, for example, of SSCM in the OG industry in DCs. When we know the essential role of this industry in DCs, it becomes more than urgent to investigate it.

6.1. Theoretical Implications

In the context of this article, which represents a valuable resource for researchers, we first succeeded in making a clear and distinct difference between the concepts of sustainable supply chain and green supply chain, which has often been confused in the research. The first concept encompasses a three-dimensional aspect (social, economic, and environmental) of the supply chain as well as all related practices, while GSCM is only limited to the environmental dimension. Therefore, a sufficient study on this area must use a combined theory, which is the SSCM theory.

The simultaneous use of the following concepts for the first time: sustainability; supply chain management; OG industry; and DC, has highlighted a new approach to developing empirical research in the field by researchers. By using the 5W + 1H pattern, we were able

to provide clear and precise answers to our research questions and achieve our objectives. The simultaneous use of analysis tools, such as PRISMA and VOSviewer, allowed us to draw a better picture of the literature review within the geographical context of DCs in the specific industry of OG.

Finally, the implementation of the Quadruple Helix Concept by involving the circular business in the field of SSCM in the oil and gas industry is quite innovative since the concept has previously not been used in this particular field.

6.2. Practical Implications

The other beneficiaries of this study are of course supply chain management practitioners in DCs. Indeed, in this article we make a precise study on the few rare cases of management of the supply chain in the oil and industry in the DCs, which has allowed us to notice that the practices and barriers in these countries are not the same as in developed countries.

We were able to note that companies that want to settle in these countries, particularly MNEs, will have to face several barriers, such as corruption and a lack of infrastructure, as well as pressures from public authorities and NGOs. All of this taints the healthy practice of a sustainable supply chain. This article offers already-established companies some ideas on what can be achieved for the sustainable management of their supply chain. For instance, in this paper the authors have shown how circular business allows companies to make more economic gains. Also, as has been demonstrated, the management of the supply chain, precisely in the oil and gas industry, is a big challenge for DCs. And an increase in such articles would help to clarify any misconceptions. Projects like this, which aim to finance research in this neglected field, are very beneficial because their results constitute a real tool for analysis and decision making for both public authorities and all stakeholders in the chain, as the Quadruple Helix Concept recommends interaction between all actors for effective performance. Thus, this study clearly states who must do what for better harmonization.

6.3. Limitations and Further Research

This review paper presents some limitations: The first limitation is that we only used ScienceDirect and Scopus databases. Although we have noticed that almost the same papers appear in both databases, there is a chance that by not checking other databases we may have omitted some relevant articles. Also, we limited ourselves to English publications, which opens up the possibility that we omitted relevant publications in other languages. For further research we propose the use of more databases in order to ensure we have considered all publications. Also, other languages should be considered.

Another limitation is that the study only focuses on developing countries. For more insights future studies should present a comparative analysis between what has been achieved in developed and developing countries.

Sustainable supply chain management is a very large field of research, and claiming to be able to cover all its dimensions in a single paper is overly ambitious. It is for this reason that the authors limited their work to the geographical context of developing countries and the specific industry of oil and gas. However, the disadvantage of this approach lies in the fact that in the end there is a fairly small number of publications on which the authors could provide results. Henceforth, the need to make a meticulous, long, and careful selection in order to choose only the best publications, which are sometimes not free of charge, could be a limitation, especially when the researchers concerned do not have sufficient funds or funding. Nevertheless, the simultaneous use of the concepts of sustainability, supply chain management, OG industry, and DC, to which we linked the QHC, in a single article, appears as a real novelty that opens the door to a multitude of future research.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su16051776/s1>, PRISMA 2020 Checklist. Reference [81] is cited in the supplementary materials.

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