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Analysis of the Supply Chain of Horticultural Production under the SCOR Model in Colombia

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Summary

Efficient supply chain management is crucial to the competitiveness and success of organizations. The SCOR (Supply Chain Operations Reference) model is a widely used tool for assessing and improving the supply chain. This article presents a bibliometric analysis of the scientific literature on supply chain evaluation in the production process under the SCOR model. A systematic search was carried out in scientific databases (Scopus, Web of Science, Google Scholar) using keywords related to the supply chain, production and SCOR model. 50 articles published between 2010 and 2022 were selected. The results show that: i. most studies focus on the evaluation of the efficiency and effectiveness of the supply chain, ii. the SCOR model is mainly used to analyze inventory management, logistics and transportation, iii. Most studies focus on manufacturing industries, especially automotive and electronics, IV. the most cited authors are the Supply Chain Council, Council of Supply Chain Management Professionals and APICS. The analysis reveals the importance of supply chain assessment in production to improve competitiveness and reduce costs. The SCOR model is an effective tool for assessing and improving the supply chain, however, opportunities are identified for research in areas such as sustainability, innovation and technology in the supply chain. This bibliometric analysis provides an overview of the scientific literature on supply chain assessment in production under the SCOR model. The results can be useful for researchers, managers, and practitioners to identify areas for improvement and develop effective strategies to optimize the supply chain.

Keywords: supply chain, production, SCOR model, evaluation, bibliometric analysis

INTRODUCTION

In Colombia, the horticultural supply chain is crucial to ensure food security, rural development and job creation. However, it faces logistical and operational challenges that affect its efficiency and competitiveness in the international market. Factors such as climate, high transportation and storage costs, and lack of technological integration negatively impact the quality and delivery times of products (Martínez & Salazar, 2021).

In this context, the SCOR (Supply Chain Operations Reference) model is presented as an effective tool to analyze and improve the operations of this chain. SCOR offers a framework for evaluating and optimizing planning, sourcing, production, delivery, and return processes. Its application helps identify bottlenecks, measure efficiency and establish improvements that increase competitiveness.

This article aims to analyze the supply chain of Colombia's horticultural production using the SCOR model. The aim is to diagnose their current situation and propose strategies to optimize each stage of the process, improving not only competitiveness, but also promoting sustainable practices that benefit actors in the sector (Rodríguez et al., 2023). The research will contribute to the sustainable development of the horticultural sector, offering a strategic approach for agricultural actors to implement more efficient practices aligned with international standards. This study provides insight into how to optimize the

horticultural supply chain in Colombia, benefiting producers and consumers by ensuring higher quality and fresher products.

The implementation of the SCOR model in the horticultural sector involves several key steps. First, it is essential to conduct a detailed diagnosis of current practices to identify inefficiencies in each phase, from crop planning to distribution logistics, assessing storage conditions and transportation routes. In addition, train the actors in the chain, since the lack of knowledge about best practices and technologies, limits the ability to adapt to a changing market environment, understanding that training programs and workshops can facilitate the adoption of sustainable and efficient methods.

Integrating emerging technologies, such as digital tools for inventory management and shipment tracking, can improve operational efficiency. Digitalization not only improves traceability, but also allows producers to respond quickly to market fluctuations.

Likewise, fostering alliances between producers, distributors and retailers is essential to create a robust ecosystem that facilitates the exchange of information and logistics coordination, resulting in a reduction in costs and delivery times.

Finally, it is vital to promote public policies that support the development of the horticultural chain, such as incentives for investment in infrastructure and subsidies for the adoption of innovative technologies. Collaboration between the private sector and the government will be key to establishing a framework that enhances the competitiveness and sustainability of the sector.

In conclusion, applying the SCOR model in Colombia's horticultural supply chain represents a unique opportunity to transform the sector. Through a thorough analysis, training of actors, integration of technologies and strengthening of strategic alliances, competitiveness can be improved and contribute to the sustainable development of rural communities, thus ensuring food security in the country. This comprehensive approach will allow the Colombian horticultural sector to adapt to the demands of the global market and face future challenges.

Methodology

A scientific mapping defined as "A research methodology that allows you to visualize and analyze the scientific literature on a specific topic, identify connections, trends, and gaps in existing knowledge. It is especially useful for researchers seeking to understand the current state of a field and inform new research" (Villalobos García et al., 2021). In this case, a bibliometric analysis was carried out with the aim of identifying the documents related to the SCOR model. Where the need to describe concepts, evolutions and studies related to the study variables in this case (scor model and horticultural producers) is observed in order to seek solutions for the improvement of the marketing process of these products in the department of Boyacá. Once the results of the documents have been identified, new lines of research can be analyzed and future research can be enriched in the same way

For this study, the databases Science direct, Web of Science®, scopus on **(TS= (supply chain*)) AND TS= (score model*) were investigated**

Based on the compilation of background information and under a systemic conception of the central axes of this work (competitiveness, sustainable development and supply chains), the methodological proposal of this research flows from a perspective of integration of methods and procedures, with the intention of building a paradigm of its own that contributes to meeting the objectives and addressing the complexity of the system under study. Social science is in a process of transition towards a new form of rationality based on complexity (Wallerstein, 2001). Different authors (Maturana, 2006, Canales, 2006, Mejía Navarrete, 2015) assure that an epistemological change is currently being developed that tries to understand the social as a system. Returning to the analysis of complex systems, we understand Clusters, Districts, Value Chains and networks as "social systems" whose "complexity forces us to change the epistemological behaviors" of social research. It is no longer a question of the search for certainties, of determining laws, but of approaching the research process as "an action in search of possibilities" (Gonzalez Casanova 2004 cited by Mejía Navarrete, 2015). In this sense, and expanding the scope of this perspective, Canales (2016) states that the methodology of social research in Latin America clearly evolves towards a dynamic of dialectical interrelation between qualitative and quantitative approaches, overcoming the old dichotomy of both forms

of inquiry and analysis. It underlines the importance of the quantitative and qualitative "Principle of Complementarity" that is essential for studying the structural heterogeneity of agri-food systems.

Results

From the analysis of the bibliographic databases, it was found that, in the last FIVE years, 27.3% of the publications belong to topics related to **Management**, followed by **Industrial Engineering** with 13.6%, as well as **Environmental Sciences** with 13.6%; Management Sciences of Operations Research 10.2%; Computer Information Systems 7.6%; interdisciplinary applications of computer science 7.6%; Multidisciplinary Engineering 6.8%; Environmental studies 6.8%; Business 5.9% and Sustainable and Green Science and Technology 5.9% as shown below:

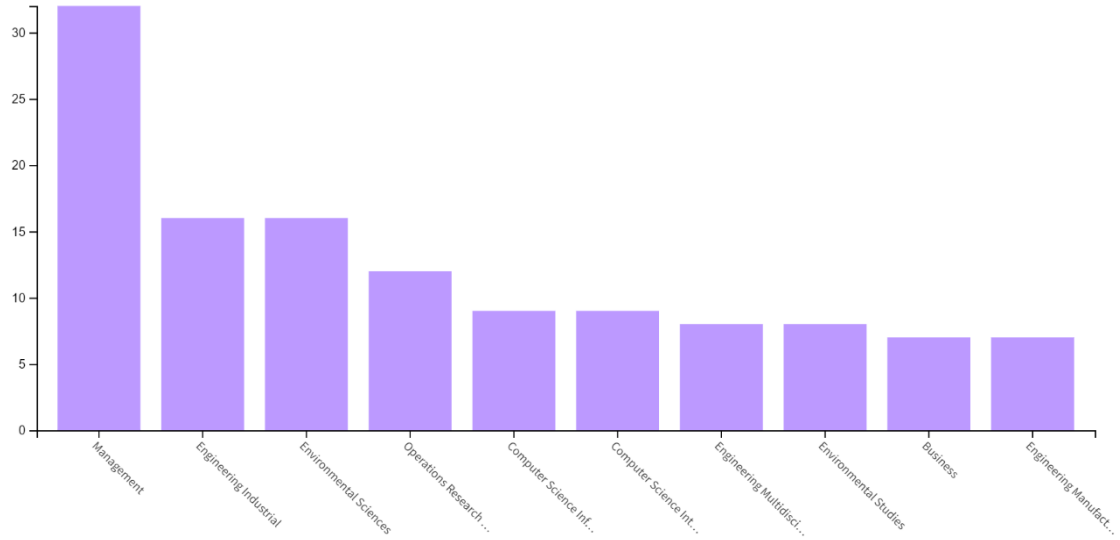

Figure 1. Research areas. Source: Web of Science®

Subsequently, a timeline can be seen with the articles published in the last 5 years, taking into account that 2021 and 2022 was the year that had the highest participation in terms of articles published on topics related to supply chains and the scor model

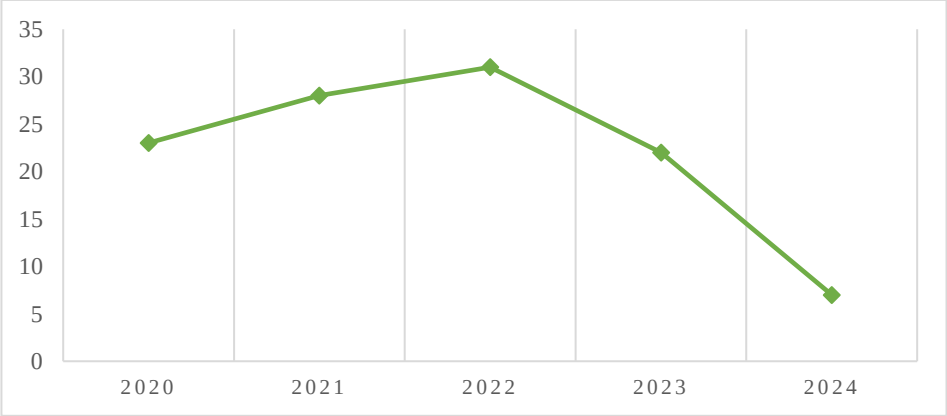

Figure 2. Articles published in the last 5 years. Source: Web of Science®

On the other hand, the **countries with the highest participation in research** related to (TS= (supply chain*)) AND TS= (score model*) stand out, with India with 14%, Iran and the United States with 13% respectively as the main ones, as well as Brazil with 9%.

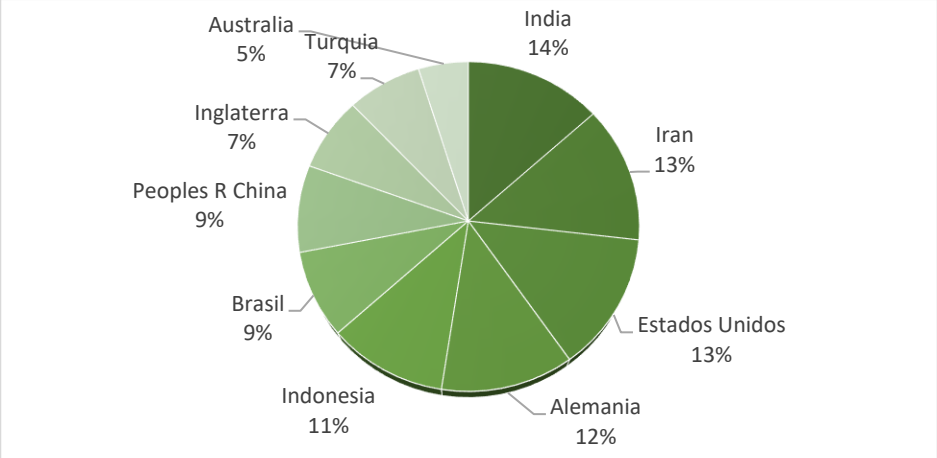

Figure 3. Main countries

It was also found that the most cited authors connect with other research works related to the study variables, in this sense, we find Yusianto, 2022 "Efficiency of food and horticulture supply chain performance using a hybrid model: SCOR - Dynamic system simulation" and Arjuna, 2022 "Measuring Green Supply Chain Performance Using the Ecological SCOR Model in the Agricultural Industry: A Case Study."

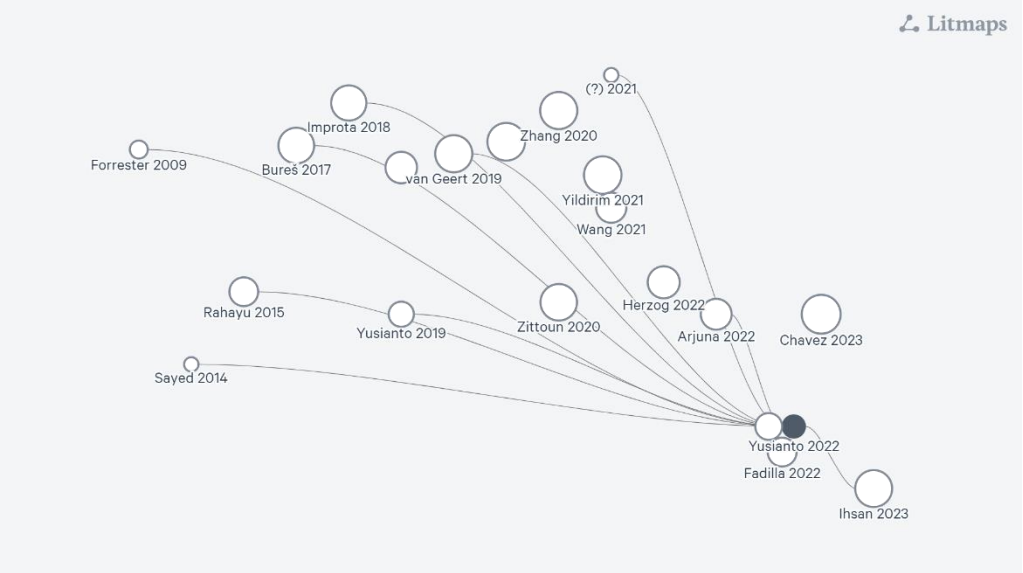

Figure 4. Authors. Source: Litmaps (2024)

Therefore, the results of scientific maps can be used to identify new lines of research to strengthen future academic production (Chen et al. 2015; Echeverri & Vieira, 2019). In this review, Scopus, one of the most important databases of social science research (Bass et al, 2020), was used with the purpose of identifying relevant high-quality documents for the review. It was limited to documents published in journals indexed by this database, under the assumption of guaranteeing a more consistent quality of the documents. The study period was from 1973 to 2023, in the year of the beginning of studies on the topic of interest. As indicated in the previous section, the central theme is "Organizational Studies", which can be defined as an interdisciplinary field of knowledge that focuses on investigating and understanding phenomena related to organizations, including their structure, behavior, decision-making processes, culture and strategy, from an approach that values aspects relegated by classical theories and that are claimed from Organizational Studies. such as the importance of the subject in the organization, particularity as a field of knowledge to understand particular organizational dynamics and the relationship of organizations with the environment (Mintzberg & Waters, 1985; Podsakoff, et al., 2003; Clark & Rowlinson, 2007)

Supply chain

Supply chain management is key to the success of businesses and to the economy as a whole; Having precision in decision-making offers an important competitive advantage (Arango, 2021), on the other hand, (Manrique et al., 2019) They affirm that a supply chain is made up of all those parties involved, directly or indirectly, in satisfying the needs and expectations of a customer. This means that the supply chain includes not only the manufacturer and the supplier, but also the shippers, stockists, retailers and even the customers themselves. It is also important to highlight the definition given by (Pulido, 2014) who defines the supply chain as all the activities related to the transformation of a good, from the raw material to the final consumer. Based on the above, it can be established that the Supply chain It is a system that connects different actors, people and processes to bring a product or service from raw material suppliers, manufacturing, storage, distribution and sale, so that the product reaches the end customer.

Currently, organizations are made up of individuals who have a constant search for work methods or techniques, which allow them to achieve solutions to their problems, since more and more companies are facing new challenges due to globalization and technological advances (Flores Carvajal, 2021).

The design of agrifood supply chains is mainly defined by the interests of the agents that make them up, and in this sense, the interests must be directed towards the equitable and fair distribution of yields left by the efficient flow of agricultural raw materials, processed products and information along the value chain (Tapia, 2017)

In relation to the phases of the supply chain Pires & Carretero, 2007 They mention that, in general, the supply chain, seen from a conception of its primary links, is composed of 3 phases: **Procurement phase**, includes the locations where raw materials are sourced, which are managed between procurement points (initial suppliers) and processing plants; **Production Phase**, by which materials are transformed into a finished product, and **Distribution phase**, where the final product is transferred to the places of sale to be stored and subsequently acquired by the consumer.

Components

According to (Sánchez et al., 2020) The supply chain of agricultural products is defined by five links: production of raw materials, processing, manufacturing, product presentation and final consumer.

On the other hand (Tchonkouang et al., 2024) mentions aspects of the food supply chain, including **production, processing, transportation, wholesale, retail, and consumption.**

Importance in horticulture

According to (Defraeye et al., 2021) The fresh horticultural supply chain plays a crucial role in supplying horticultural crops with acceptable quality and a remaining shelf life to the consumer. For (Manrique et al., 2019) the importance of the supply chain is evidenced, then, due to the value generated through its management, in this regard they cite Chopra and Meindl (2008) who indicate that **The goal of a supply chain should be to maximize the total value generated**. The value generated by a supply chain is the difference between the value of the final product to the customer and the costs incurred in the chain to fulfill the customer's request.

According to the above, it can be established that the supply chain in the agricultural sector is a complex process that ranges from production to the arrival of food products to final consumers. This process involves several stages and actors, each with specific roles that contribute to the efficient and sustainable functioning of the country's agri-food system.

Herself identified that the main challenges facing the horticultural sector (J. García & Lotero, 2021) they are related to the lack of coordination and the number of intermediaries that reduce the competitiveness of small producers. In this sense, three problems were found concerning the design of the supply chain: i. excess of intermediaries, ii. seasonality of production, iii. difficulty and cost overrun of transportation and iv. lack of value-generating practices.

On the other hand, one of the most important challenges faced by SMEs is logistics, they have difficulties in guaranteeing the quality and freshness of their products during transport and distribution. These challenges can hinder your ability to optimally meet the demand for fresh produce. Challenges can include inefficiencies in transportation processes, warehousing and distribution issues, lack of timely information, and ineffective management of logistics indicators (Campos, 2023).

All aspects of the food supply chain, including production, processing, transportation, wholesale, retail, and consumption, are susceptible to various environmental changes and natural disturbances. Climate change has effects that extend beyond local supply chains and are felt along longer supply networks (Davis et al., 2021). One of the main challenges that the horticultural sector has to project itself into the future in a sustainable way is related to Automation and digitalization, since the **ICTs** (Information and Communication Technologies) are a tool that can be applied during the food supply chain and thus reduce fruit and vegetable waste, which would positively favor food insecurity due to its great expansion and rapid growth. The shelf life of fresh products, such as fruits and vegetables, is decisive for their sale and consumption (Muñiz et al., 2021)

In the same way (Martínez & Mesías, 2021) mention that the **Industry 4.0**. It represents a change of great importance in the model of the food industry, affecting all the links in the chain, from start to finish. These changes will be reflected in a growing digitalization that, through the systematic analysis of large amounts of data, will drive decision-making in a more agile, intelligent and competitive way. For (Nasiri et al., 2020) The supply chain and its digital transformation can be positively impacted with the use of **AI techniques** In its solutions, it is aspects such as: business integration, cost reduction, optimization of time, resources, among many uses, allowing to visualize how supply chains should be digitally transformed.

Blockchain technology It is probably the most disruptive since the arrival of the Internet and is capable of transforming industries by decentralizing trust, generating an exchange of goods and services without the need for third parties. This is possible because the information that circulates through the shared accounting records is verified. Blockchain technology can provide a means to ensure the permanence of records and potentially facilitate the exchange of data between the various actors in the agri-food value chain (Borrero, 2019)

Characterization of the horticultural sector

Economic importance

Colombia is the third Latin American country in horticultural production, with more than 966 thousand hectares cultivated between fruits and vegetables, with an estimated production of 10.7 tons that are part of the national offer available to consumers. (Asohofrucol, 2018).

Horticultural production allows the economic development of some endemic regions of Colombia, its exploitation allows the generation of employment and the strengthening of the first links of the supply chain (Muñoz et al., 2020).

(Rincón & Guerrero, 2024) they pointed out what was exposed by (Minagricultura, 2020) where horticultural production in Colombia is carried out under peasant economy schemes and is mainly used to meet domestic demand The horticultural producer is a small producer, where 75% of the farms have a size of less than 3 ha. and 40% are less than 1 ha. The production of vegetables in Colombia is made up of more than 30 types of crops. The largest harvest area for peas, tomatoes, bulb onions, carrots, ahuyama and branch onions. The highest volume of tomato crop production. The highest yields for tomato production under cover (greenhouse).

The vegetable chain in Colombia is estimated to generate about 220 thousand total jobs annually, of which approximately 70 thousand are direct jobs and around 150 thousand are indirect. (Minagricultura, 2019)

According to (Agronet, 2024) for the year 2021, the production of various vegetables in Colombia was 75676.97 (ton) with a yield of 11.55 (ton/ha), presenting a decrease compared to the previous year. For (ODEB, 2024) according to the report of the Agricultural Sector Price and Supply Information System (SIPSA) The supply of vegetables was 73,726 tons (ton) in January 2024 and increased 8.1% compared to the same period in 2023. The main producing departments at the national level are Boyacá, Cundinamarca and Antioquia, handling a little more than a third of the national fruit and vegetable production, due to their productive culture and their high cultivated area. Thus, in "Cundinamarca, the presence of potatoes stands out with more than 60% of the total, followed by mangoes and carrots; in Boyacá, the large participation of potatoes is evident with 57%, followed by tomatoes and onions (both branch and bulb). Finally, in Antioquia, bananas participate with around 35%, followed by potatoes, table tomatoes and tree tomatoes" (Asohofrucol, 2018).

Boyacá

As for the Department of Boyacá, there is evidence of the participation of national production of 84.8% with 601,419 tons through 84 producer organizations (Secretary of Agricultural Development of Boyacá, 2018), generating an important dynamic in the generation of income of 25% (Asohofrucol, 2018), the municipality of Duitama concentrates a large part of the production of vegetables, which is why a group of producers consolidates an association for horticultural production and marketing, presenting a shortcoming from the socio-organizational management since it only has 22 producers who show weaknesses within the association, generating among them mistrust, lack of credibility and commitment on the part of the associates.

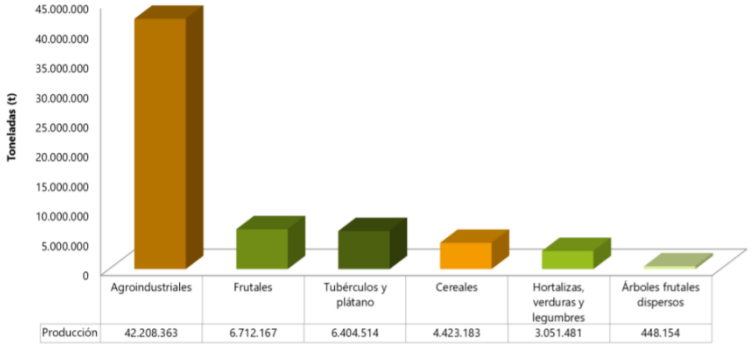

Figure 5. Statistics. Fountain: (DANE, 2019)

In the graph above it can be seen that according to the National Agricultural Survey – ENA 2019 indicated that the total production recorded was 63,247,863 tons, of which 42,208,363 tons correspond to the agro-industrial group (66.7%), 6,712,167 tons to fruit trees (10.6%), 6,404,514 tons to tubers and bananas (10.1%), 4,423,183 tons to cereals (7.0%), 3,051,481 tons to vegetables, vegetables and legumes (4.8%) and 448,154 tons (0.7%) to scattered fruit trees (DANE, 2019).

The municipality of Duitama it continues to be essentially agricultural and livestock, which benefits from the richness of its existing natural resources. Over the years it has been characterized by the existence of traditional crops such as potatoes, vegetables and fruit trees. Over the years it has been characterized by the existence of traditional crops such as potatoes, vegetables and fruit trees; However, and according to information provided by the Municipal Development Secretariat, these crops have been affected by some variables such as: climate changes, diseases and pests; absence of research organizations and low technology; aspects that have directly influenced production and performance. In the municipality, vegetables such as (onion, broccoli, potato, cilantro, lettuce, cabbage, carrot, and peas) among others and cereals such as (corn, beans) are grown. Likewise, there are the traditional fruit orchards of apple, peach, feijoa, strawberry, plum, tree tomato, cape gooseberry and although this production has been decreasing due to high costs and lack of technification. Taking into account that the municipality is a producer of vegetables and fruits, large producers do not sell to rural or local collectors or regional intermediaries, but sell their products directly in trucks, to sell them in the wholesale market of Duitama, presenting a different situation among small producers who sell to the intermediary on the farm and sometimes take their product to the wholesale market. handling small volumes at prices that do not compensate for their labor; they do not make trips to other cities, since the volume of production is low compared to the levels they handle in supply centers (Cely, 2018).

Municipalities of the province of Tundama

Province of Tundama made up of the municipalities of (Belén, Cerinza, Duitama, Floresta, Paipa, Santa Rosa de Viterbo and Tutazá)

Growth and changes in demand

According to the United Nations Agricultural Organization, worldwide the production of fruits and vegetables has experienced sustained growth in recent years (Flórez, 2013). In recent years, global trends in food consumption have undergone important changes and, precisely, fruits and vegetables have been crucial in the eating habits experienced by consumers, who have **orienting their preferences towards healthier products** (Chaparro, 2017). Recently, the agricultural industry has become more dependent on

information, which requires a wide spectrum of scientific and technological data for the agricultural community to achieve efficient decision-making(Manrique et al., 2019)

Evaluation and improvement models: score model

Description of the score model

The SCOR model is a diagnostic tool for supply chain management (SCM) that allows users to understand the processes involved in a business organization and identify the vital characteristics that lead to customer satisfaction. SCOR is organized around five management processes (Plan, Procure, Manufacture, Deliver, and Return) that are subdivided into categories of processes, elements, tasks, and activities (Ntabe et al., 2015)

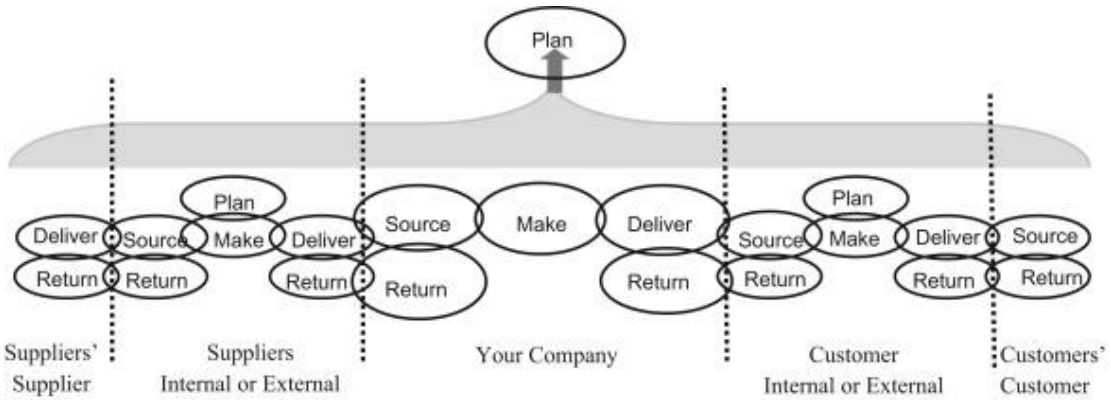

Figure 6. SCOR management processes. Source: (Adapted fromSupply Chain Council, 2010).

In 2002, the Supply Chain Council (SCC) introduced and developed a well-known Supply Chain Performance Measurement (SCOR) that was developed to describe the management process associated with all phases involved in meeting customer demand. There are five main supply chain management processes defined in this model, namely: plan, source, manufacture, deliver, and return (Ikatrinasari et al., 2020)

According to (Curbelo & Delgado, 2014) The SCOR model has been able to provide a basis for supply chain improvement in global projects as well as in specific local projects. It should be noted that this model allows describing the business activities necessary to satisfy a customer's demand, is organized around the five main management processes: Planning, Procurement, Manufacturing, Distribution and Return or Return, and also contains three levels of process detail: Higher Level (Types of Processes), Configuration Level (Process Categories) and Level of Process Elements (Process Decomposition).

Benefits of the model

The field of application is very wide, because SCOR can be used in new or existing chains but without a performance measurement system. By constructing planning, procurement, production, distribution, return, and support using process blocks, the model can be used to characterize supply chains that are either very simple or very complex using a common set of definitions (Tapia, 2017)

According to (Zuluaga et al., 2014) The importance of this model lies in the fact that it standardizes the language for understanding the supply chain and allows the system to be seen in its entirety and inferred at the level of detail that is required.

The evaluation of the supply chain in the Colombian horticultural sector reveals that, despite its economic importance and for food security, there are several logistical obstacles that affect the efficiency and competitiveness of the sector. Martínez and Salazar (2021) mention that climate variability, poor transport infrastructure, and high production costs limit the ability of producers to meet market demand. According to Serrano et al. (2022), these challenges cause inefficiencies in distribution and reduce the profitability of horticultural chains.

In this context, the SCOR model provides a comprehensive structure to address the challenges. Bolstorff and Rosenbaum (2007) explain that SCOR allows for a detailed evaluation of key supply chain processes (planning, sourcing, production, delivery, and return), facilitating the standardization and comparison of performance metrics. In Colombia, applying this model could optimize the horticultural supply chain.

Proper demand-driven production planning, together with efficient logistics practices, could reduce costs and improve delivery times, as indicated by Quintero and Rodríguez (2022), who found that SCOR can increase efficiency in agricultural chains.
Desk analysis suggests that a key area of improvement in the horticultural supply chain in Colombia is the sourcing process and the integration of advanced technology. González et al. (2023) highlight that the lack of technology in inventory management and the absence of communication platforms between actors are obstacles to an efficient flow of products. This problem could be mitigated with the digitization of processes and data analysis tools to forecast demand and adjust production, which would increase efficiency and allow for a more agile response to fluctuations.
Sustainability is another priority. Rodríguez et al. (2023) point out that it is increasingly relevant in agricultural chains, especially in the face of climate change and current environmental demands. The application of the SCOR model in this area facilitates the integration of sustainable practices in each phase of the chain, promoting a smaller ecological footprint. In addition, Quintero and Rodríguez (2022) highlight that sustainable supply chains improve the image and competitiveness of horticultural products in the markets.

In the same way , a bibliometric analysis of the most relevant studies was carried out, grouped into two topics: the first is on supply chains in the horticultural sector and the second on the research that has been carried out considering the variables of the problem.
International investigations (Yang et al., 2022) in his article "**Improving Collaboration in the Vegetable Supply Chain: A Case Study in Vietnam**" This study provides new and illuminating results on how to collaborate with fragmented smallholder farmers in subsistence farming and how to improve the role of agricultural cooperatives in the vegetable industry in Vietnam. It also provides information to policymakers to support the sustainable development of subsistence vegetable agriculture and maintain its sustainability.
According to (Borrero, 2019) proposes in his study **"Agri-food supply chain traceability system for fruit and vegetable cooperatives based on Blockchain technology"** a traceability system for an agricultural cooperative based on blockchain technology, to solve the crisis of confidence in the supply chain of agri-food products.
Likewise, (Campos, 2023) in the article entitled **"Diagnosis of Logistics Indicators in Fruit and Vegetable Distribution SMEs in Chiriqui, Panama"** it is accentuated on the need to maintain and improve logistics management in the context of SMEs dedicated to the transport and distribution of fruit and vegetables. The application of indicators, technology and customer service are key aspects, while the identified opportunities for improvement must be addressed to optimize the efficiency of the supply chain. From a business, economic and social perspective, the study highlights the relevance of these SMEs in Panama and their impact on food security and local economic development.
For its part (Giménez et al., 2021) in **"Strategies to reduce the loss and waste of fruits and vegetables in the last stages of the agri-food chain: progress and challenges in Uruguay"** It focuses on those strategies used at the level of marketing and consumption, among the strategies with the greatest potential are improvements in logistics and infrastructure, communication campaigns, price reduction, as well as redistribution and reuse strategies. In particular, the implementation of communication campaigns with messages that positively affect the perception of quality associated with fruits and vegetables with aesthetic imperfections or messages related to environmental sustainability have been shown to have a positive impact on consumer behavior.
The results of the research proposed by (Barlow & Lostak, 2023) **"Retailer-Producer Relations and Supply Chain Pressures in English Horticulture: Lived Experience"** They showed that the supply chain is highly pressurized and many producers struggle to survive and often risk capital to remain efficient and competitive. The effects of both the Covid-19 pandemic and Brexit have further highlighted the flaws and pressures within the system and the availability of labour has been further affected.
In addition, the work of (Drechsler & Holzapfel, 2023) titled **"Horticultural Supply Chain Network Design for Small and Medium-sized Enterprises" in Germany** in which the results show that the entire sector depends on reliable information on the market situation, necessary for accurate planning in the face of the

uncertainties faced by the sector in relation to aspects such as quality fluctuations, pests, demand trends and meteorological impacts on plant growth and end customer demand. This study is the first to provide a systematization and model of logistics systems in the horticulture business.

Likewise, the statement by (Messner et al., 2021) **"From Surplus to Waste: A Study on Systemic Overproduction, Surplus, and Food Waste in Horticultural Supply Chains**"We found the following results: Australian horticulture supply chains encourage the production of surplus food, but lack mechanisms to prevent food waste; The creation of food waste is reinforced by powerful locking mechanisms that depend on the surplus and resist reducing it**;** Systemic food waste prevention must target food waste creation processes along the entire supply chain**;** Transparent tracking and disclosure of surpluses in food chains is an essential requirement for food waste prevention.

On the other hand, the investigation of (Keates, 2022) **"Actionable Insights for Horticulture Supply Chains through Advanced IoT Analytics" in Australia** It addresses one of the key challenges facing the horticulture industry: disruption, both on-farm and post-harvest through the supply chain. A novel concept was developed to achieve this level of autonomy using geospatial enhancements in supply chain event records, generated by GPS (Global Positioning System) trackers, to enable autonomous supply chain monitoring and compliance verification.

(Dewi et al., 2015) **"Identification of Horticultural Supply Chain Performance at Brenjonk Cooperative in Trawas, Mojokerto" in Indonesia** The purpose of this study is to provide information on the conditions of the horticultural supply chain through the identification of constraints. The restrictions are more numerous in manufacturing and the most dominant elements contained in the brand. The results of the first stage were followed by the analysis of phase 2. In stage 2, elements were found that affect the product in stock (S1), the manufacture to order (M2), the delivery of product in stock (D1) and the return of defective product (SR1) and the delivery of product returned in excess (DR3).

It is important to highlight the results of the study carried out by (Pérez-Mesa et al., 2019) at work **"Fresh Food Suppliers' Response to Sustainability Supply Chain Management of Large European Retailers" in Spain,** where They show that retailers tend to set up more simplified (i.e., shorter and more vertical) supply chains, essentially demonstrating their interpretation of a sustainable supply chain. In contrast, horticultural marketing companies have concentrated more on tactical and operational issues, so they neglect environmental, social, and logistical management. From the consumer's point of view, close supplier-retailer relationships have resolved food safety issues.

On the other hand, the author (García, 2020) in his article **"Influence of European distribution on the management of the supply chain of the horticultural exporter" in Spain** He highlights that the results show that companies at origin have been able to respond to issues related to the quality and healthiness of production, but that there are unresolved problems in the logistics field. In order to analyse this weak point, the obstacles that can be encountered in the logistics processes involved in the handling and transport of highly perishable products such as fruit and vegetables are studied. To this end, a gravity model is used as a theoretical framework to determine the impact of transport costs on the volume of exports.

For its part (Yusianto et al., 2022) exposes in "**Food & Horticulture Supply Chain Performance Efficiency Using a Hybrid Model: SCOR - Dynamic System Simulation" in Indonesia** that the measurement of SC performance consists of six perspectives, namely, Plan, Obtain, Manufacture, Deliver, Return and Enable. The best scenario we propose is Scenario I, which is a reduction in indirect performance labor costs of IDR 600,000 in three months and an efficiency increase of 11.08%.

In this article **"Study of the logistics chain of the production and marketing of organic coffee using the SCOR model" in Peru** exposed by (Calderón Pazce, 2020) the current state of the supply chain is analyzed; those factors, processes and activities that impact the added value of the product and costs are highlighted. The scope of the research is identified through the top level of the SCOR model. Likewise, the SCOR model through its levels allows the root cause of deficiencies to be identified, thus improving the supply chain. After having identified both gaps and causes, a series of proposals for improvement are proposed.

In the same way (Rodríguez, 2023) in his doctoral thesis entitled **"Design of a model to improve the competitiveness of the supply chain of the Ecuadorian flower sector"** A comparative analysis of the

supply chain models: ABC, BSC and SCOR was carried out, a literature review was applied, it was found that the SCOR model is a very powerful tool for structuring, evaluating and comparing supply chain practices and performance. The SCOR model proposes an integrated approach that is based on the conception of an interconnected structure that unites processes, includes performance metrics, best practices and technology with the aim of continuous improvement of the supply chain.

(Choque & Salinas, 2023) **"Application of the SCOR model to improve inventory management in a company in the Agroindustrial sector, Arequipa 2023" in Peru** Once the main problems were identified, improvements in the inventory management of the supply chain were proposed, such as the application of inventory policies to improve the macro processes of planning and sourcing and the implementation of metrics proposed by the SCOR Model for the return process in the category of excess inventories. Finally, the technical evaluation of the supply chain was carried out, obtaining improvements in the macro-planning process by 33.1%; in supply by 22.4% and in the macro return process by 13.2%; and economic evaluation obtaining positive indicators.

(National Investigations) (Muñoz et al., 2020) **"Robust design of the horticultural supply chain: case study of horticulturists in the municipality of Cajicá"** The model used for the study is a Mixed Integer Linear Programming (MIP) model that allowed establishing the configuration of the horticultural chain, opening of cross docking centers. The most robust configuration of the horticultural chain was established, for which the locations that were most convenient to enable were defined, as well as the vehicles to be acquired for when there are low, medium and high levels of supply of vegetables, this involving variations in sales prices in the different links of the chain.

In the studio **"Characterization of the production and marketing systems of horticulture in the Colombian Southwest"** Developed by (Rincón & Guerrero, 2024) states that as a result of the research, the need to strengthen the management of a territorial agri-food system is established that allows the segment of local horticultural producers to coordinate actions aimed at promoting agroecological transition processes that reduce environmental impacts, establish marketing relationships reducing the degree of intermediation and generating better sales agreements. it can constitute a platform that influences the design and orientation of sectoral public policy in the region.

Likewise, (Tapia, 2017) **"Design of the agri-food supply chain of eggplant in Cordoba-Colombia through the integration of the SCOR model and the optimization approach"** in which it establishes that the SCOR model (Supply Chain Operations Reference Model) applied in the Agri-Food Supply Chain of Eggplant in Córdoba (CSABC) allowed the setting of objectives and goals related to the generation of profits, via cost reduction and increase in customer satisfaction, which in turn are subject to a deployment of indicators (KPIs) to link the basic logistics processes (planning, procurement, production, delivery, returns and support) at a strategic and operational level.

(Ochoa-Valero, 2020) "**Analysis of the supply chain in the dry coffee production process under the SCOR model, and its contribution to the improvement of competitiveness: case study of Finca la Alicia, sanctuary, Risaralda"** in this research it was determined that the adequate identification and configuration of the supply chain through the SCOR model provides a series of opportunities for improvement that would grant the expected competitive advantage by the aforementioned organization, as well as different metrics that give it the ability to analyze and evaluate its different processes and performance attributes in general.

For (Nayibe & Rozo, 2012) in his article **"Design of logistics management for the production chain of the native potato in the municipality of El Rosal Cundinamarca. Case of suppliers of inputs"** show how diagnostic tools and application of logistics management models -such as the SCOR model- can be used to determine productivity statuses. It is shown that with this type of tools, high degrees of competitiveness are generated and the growth of the agricultural sector is enhanced, since higher levels of development and sustainability are achieved in the long term.

In the work carried out by (I. García et al., 2016) **"Supply Chain Assessment of the *Solanum Tuberosum* the supreme pastusa variety in Cundinamarca, under the guidelines of the viable system model and the SCOR model"** it is evident that from the diagnosis made with the viable system model and the SCOR model, the critical factors that negatively impact the performance of the supply chain are determined,

among which are the decentralization of the productive units that intervene in the process, the lack of communication between the links of the chain, the lack of intervention and control by government entities, the lack of interest in research and development for the improvement of processes.

Local investigations The work developed by (Mountain, 2016) **"Market research in vegetables for the Associative Work Company "Horti-Tocogua"** in Duitama, Boyacá", exposes one of the most notorious difficulties in the supply chain and highlights that producers from different villages who dedicate their lives to the production and distribution of organic vegetables on a small scale, present great difficulty in the commercialization of the products because they are marketed informally, therefore it is important to advance family farming programs that can benefit small and medium-sized farmers.

Conclusions

Studies show that the application of the SCOR model in vegetable supply chains can significantly improve planning, procurement, manufacturing, delivery and return processes. Standardization and continuous monitoring help identify and eliminate inefficiencies. In addition to this, the implementation of practices based on the SCOR model has resulted in a significant reduction in operating costs. Optimizing transportation routes, improving inventory management, and reducing waste are key factors.

The SCOR model facilitates the complete traceability of products, from production to final delivery. This ensures that quality and food safety standards are maintained throughout the supply chain. Studies indicate that companies that implement the SCOR model are in a better position to adopt sustainable practices. Waste reduction, efficient use of resources and a decrease in the carbon footprint are some of the benefits observed.

The integration of technologies such as the Internet of Things (IoT), artificial intelligence (AI) and big data within the framework of the SCOR model has enabled more accurate and efficient management of the vegetable supply chain. Likewise, the digitization of the supply chain facilitates communication and collaboration between the different actors, resulting in greater agility and responsiveness to changes in demand or interruptions in the chain.

Efficiency and improved supply chain management allow them to offer products of higher quality and freshness, which translates into greater customer satisfaction, which also differentiates them from the competition through better management of costs, quality and sustainability.

The studies analyzed suggest that adopting the SCOR model in the horticultural supply chain in Colombia could significantly improve its efficiency and sustainability. Implementing best practices in planning, sourcing and production, along with leveraging advanced technologies, will enable this agricultural sector to respond more effectively to current and future challenges. These findings also provide a basis for future research, which could focus on case studies of Colombian horticultural producers and on the evaluation of impacts following the adoption of SCOR in various scenarios.

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