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INVESTIGACIÓN

Taxonomy for supply chain strategic decision

Taxonomía para caracterizar las decisiones estratégicas de la cadena de suministro

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Abstract

Objective: The characterization framework proposed in this work presents the strategic decisions and their characteristics and the strategic characterization structure of the supply chain.

Methodology: This article presents a framework for the strategic characterization of supply chains. The structure is supported by a group of studies that have identified and established the relationships between the decisions of the supply chain.

Results: The framework defines the various aspects of the chain that are described from the decision-making paradigm in a strategic environment. In this way, a decision-making selection process can be developed and a structure can be created to analyze the effectiveness of its management.

Conclusions: The present work resulted from the discovery of a research gap related to the lack of adequate support methodologies for making strategic decisions, providing a holistic view of the chain's competitors. An attractive future research perspective could also encompass tactical decisions alongside current strategic ones.

Keywords: Characterization, supply chains, strategic decision.

Resumen

Objetivo: El marco de caracterización propuesto en este trabajo presenta las decisiones estratégicas y sus características y la Estructura de Caracterización estratégica de la Cadena de Suministro.

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Metodología: Este artículo presenta una estructura para la caracterización estratégica de cadenas de suministro. La estructura se soporta en un grupo de trabajos que han identificado y establecido las relaciones entre las decisiones de la cadena de suministro.
Resultados: La estructura define los aspectos que describen la cadena desde un paradigma de decisión, en su contexto estratégico, para desarrollar los procesos de toma de decisiones y establece las bases para analizar la efectividad de su gestión.
Conclusiones: El presente trabajo resultó del descubrimiento de una brecha de investigación relacionada con la falta de metodologías de apoyo adecuadas para la toma de decisiones estratégicas, brindando una visión holística de los competidores de la cadena. Una perspectiva de investigación futura atractiva también podría abarcar decisiones tácticas, junto con las estratégicas actuales.

Palabras clave: Caracterización, cadena de suministro, decisiones estratégicas.

1 INTRODUCTION

The evaluation of the characterization of a Supply Chain constitutes one of its basic management needs. According to (Strauss, A. and Corbin, J. (2014).), the characterization of an object corresponds to its organized description, as a probable first step in the systematization of an experience. The characterization is based on exhaustive documentation of the phenomenon in question, from its origins in the past to its current condition.
This work is supported by the systematic literature review ((Xiao, Y. and Watson, M. (2019).), whose deployment is presented below.

- Search the Literature
- Extracting Data
- Analyzing and Synthesizing Data
- Report Findings

Search The Literature

The literature on the topic shows a number of works that have tackled SC characterization, most of them focusing on tactical aspects. In some of these cases, not only is the scope of the decision level unclear, but an adequate theoretical paradigm is also lacking. Table 1 is a summary of some of these works, with an emphasis on the decision levels they address.

Table 1. Summary of SC characterization works

Source: Authors.

Reference	**Research objective**	**Decision framework characteristics and theoretical approach**	**Decision-level approach**
(García-Cáceres, R.G. and Olaya, E.S. (2006).); (García-Cáceres, R.G., Torres-V. S., Olaya-E, E.S., Díaz-G, H.B., Vallejo-D. M.R. and Castro-S., H.F. (2009).); (García-Cáceres, R.G., Núñez-Moreno, A., Ramírez-Ortiz, T. and Jaimes-Suárez, S. (2013).); (García-Cáceres, R.G., Perdomo, A., Ortiz, O., Beltrán, P. and López. K. (2014).); (López-Ramírez, C.A. and García-Cáceres R.G. (2020).)	This work develops a particular approach to network strategy characterization, both at the national and international levels. It details the functioning, synergy, and linkages between the agents of the supply and value chains.	This particular decision framework carries out a thorough analysis of basic functions, with special reference to the works of (Stone, R.B. and Wood, K.L. (2000).), (Stone, R.B., Kurfman, M.A., Rajan, J.R. and Wood K.L. (2001).). On these grounds, it covers four stages: Stage 1, which provides a general description of global agribusiness; Stage 2, which addresses SC agent roles, relevance, and contributions; Stage 3, which details management processes; and Stage 4, which provides insight into the management components of the SC.	The strategic aspects of the network are addressed

(Torres, S. and García-Cáceres, R.G. (2008).)	A reference framework is introduced, allowing the characterization of SC structures under diverse governance forms	A four-dimensional analysis model is developed in order to provide insight into different exchange modes along the SC. These correspond to "forms of interaction and coordination", "economic incentive types" and "legal contracts". The model integrates several disciplines, such as economics, strategy analysis, marketing, and organizational theory. This strategic, organizational, and governance approach is associated with the Transaction Costs Theory proposed by (Coase, R.H. (1937)) and (Williamson, O.E. (1975).), (Williamson, O.E. (1991).).	The authors approach the selection of an organizational strategy

(Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. (2011).); (Stephens, S. (2001).)	A conceptual interpretation of the network's structure is introduced.	A four-dimensional analysis model is designed to characterize SC exchanges: Interaction and coordination forms, legal contracts, and economic incentive types. The strategic characterization focuses on the design of the spatial deployment of the network. The configuration of the model addresses: - Aggregate demand planning levels and their information sources. - Product and raw material supply source location. - Production plant location, and production methods. - Distribution channels, inventory, and product deployment. - Location and return methodologies.	Although this holistic approach covers strategic aspects, it certainly emphasizes tactical ones, especially SC functions. The characterization process is not specifically treated, except for an SC network analysis.

		The theoretical underpinning of the Supply Chain Operations Reference (SCOR) model focuses on business reference standards integrated with the supply chain paradigm.	
(Cooper, M.C., Lambert, D.M. and Pagh, J.D. (1997).), (Lambert, D.M. and Cooper, M.C. (2000).); (Lambert, D.M. and Enz, M.G. (2017).)	This work introduces a supply chain management conceptual framework, addressing both strategic and tactical elements, with an emphasis on SC network functions.	The concept of supply chain management is largely applied. In terms of network characterization, this work describes a series of methods to map the supply chain and identify those actors with whom key business activities can be carried out.	Characterization is not particularly emphasized, except for SC network treatment.

A clearly strategic approach to the SC has been developed by (García-Cáceres, R.G. and Olaya, E.S. (2006).), (García-Cáceres, R.G., Torres-V. S., Olaya-E, E.S., Díaz-G, H.B., Vallejo-D. M.R. and Castro-S., H.F. (2009).), (García-Cáceres, R.G., Núñez-Moreno, A., Ramírez-Ortiz, T. and Jaimes-Suárez, S. (2013).), (García-Cáceres, R.G., Perdomo, A., Ortiz, O., Beltrán, P. and López. K. (2014).), (López-Ramírez, C.A. and García-Cáceres R.G. (2020).), and (Martinez-Albarracín, K.D., Rivera-Roncancio, L.M. and García-Cáceres, R.G. (2019).) paying special attention to network decisions. This body of work intends to feature SCs in the context of local and international markets, especially in terms of facility network structure and agent identification, roles, and relationships. In turn, (Torres, S. and

García-Cáceres, R.G. (2008).) have addressed SC organization and governance forms about outsourcing and vertical integration. (Stephens, S. (2001).) has characterized SC processes, while (Lambert, D.M., Cooper, M.C. and Pagh, J.D. (1998).), (Lambert, D.M. and Cooper, M.C. (2000).), and (Lambert, D.M. and Enz, M.G. (2017).) have studied SC facility deployment. Therefore, the current review of the literature reveals that none of the available CS characterization studies have focused on the selection of decisions mentioned in (Riopel, D., Langevin A. and Campbell, J.F. (2005).) and (Campbell, D. and Craig, T. (2005)). In this context, this article develops a holistic conceptual framework for the characterization of strategic CS decisions.

Table 2. Strategic decisions

Source: Authors.

Decision Category	**Decision**	**Aspects considered**
Strategic Planning	Performance objectives	According to (Riopel, D., Langevin A. and Campbell, J.F. (2005).), decision-making is conditioned by factors such as organizational mission and strategies, customer expectations, the competitive environment, financial resource availability, and the logistic system, the latter comprising facilities, infrastructure, equipment, and information and communications systems.
	Vertical integration and outsourcing degrees	(Coase, R.H. (1937)) and (Williamson, O.E. (1975).), (Williamson, O.E. (1991).) explained the behavior of these parameters through the Transaction Cost Theory, which contemplates a series of conditioning factors: the specificity of key human or material assets dominating the commercial relationship; agent performance measuring difficulties among SC actors; and uncertainty in the relation between agents.

	Outsourcing	Outsourcing, onshore, nearshore, and offshore decisions have been observed to be affected by a diversity of criteria ((Kedia, B.L. and Mukherjee, D. (2009).); (Pisani, N. and Ricart, J.E. (2015).); (Lahiri, S. and Kedia, B.L. (2011).); (Slepniov, D., Brazinskas, S. and Vejrum Wæhrens, B. (2013).); (Ruivo, P., Rodrígues, J., Neto, M., Oliveira, T. and Johansson, B. (2015).); and (Panova, Y. and Hilletofth, P. (2016).). The most relevant of these criteria are intellectual property rights, political stability, economic stability, cultural affinity, geopolitical reasons, and domestic or regional demand in the area of influence of the organization. The other criteria are logistics, communications, and power infrastructure, as well as labor availability, quality, and cost.
Strategic Network level	Facilities	In terms of the logistics network, the actual outsourcing conditions depend on geographic factors at the regional, national, multinational, or global levels ((Shapiro, F. (2001).); (García-Cáceres, R.G. (2018).)). According to these authors, the decision-making criteria correspond to production costs (associated with scale economies); location costs, depending on the particular site where the facility is built; and Assignation costs, which are a function of those supply and distribution costs implied in satisfying demand and building facilities.Facility-related decision-making is usually supported by operations research (OR) and management science (MS) models.

	Communication and Information (C&I) Network	The C&I network and its associated decisions imply the existence of a shared information system all along the SC (Bayles, D.L. (2000)); (Edwards, P., Peters, M. and Sharman, G. (2011).); (Lewis, I. and Talalayevsky, A. (1997).); (Bowersox, D.J., Daugherty, P.J. (1995)); (Nickles, T., Mueller, J. and Takacs, T. (1998)); (Tilanus, B. (1997).); (Gunasekaran, A., Subramanian, N. and Papadopoulos, T. (2017).); (Pal, K. and Yasar, A.U.H. (2020).). The design of this system has to take into account a network strategy that thoroughly addresses the structure and organization of the chain. A series of significant decisions impacted the design of this network, including but not limited to information management. The degree of process centralization (such as centralized versus distributed data), adequate application loci, such as those associated with rental or purchase processes, or centralized versus distributed modes, among others; the degree of integration of an organization's diverse systems, such as those related to e-commerce and ERP (Enterprise Resource Planning), and finally, the development environment, which encompasses hardware, software, operational systems, and vendor standards.

2 Extracting Data

Methodological proposal

In approaching SC decisions and relationships at the strategic and tactical levels, (Riopel, D., Langevin A. and Campbell, J.F. (2005).) found five strategic decisions taking place in a hierarchical structure comprising two levels. In turn, (García-Cáceres, R.G. and Olaya, E.S. (2006).) have characterized SC problems and their interaction with SC decisions. These works provide a rigorous description of the

context surrounding SC characterization, the strategic aspects of which constitute the focus of the present work. Table 2 sets out the strategic decisions of the SC and the aspects considered under each of them.

The strategic decisions explained in Table 2 are related to each other by a nested hierarchy ((Riopel, D., Langevin A. and Campbell, J.F. (2005).), which, in turn, impacts tactical decisions. The top levels of this hierarchy can be seen at the top of the table, while the lower levels can be seen at the bottom. According to the literature review, the only strategic planning processes supported by a theoretical background are those based on the Economic Theory of Transaction Costs. Otherwise, the decision-selection processes found in the literature are based on SCM.

3 Analysing and Synthesizing Data

The current SC characterization framework details the strategic decisions in question, which it couples to the SC strategic characterization structure. This framework identifies the relevant features that need to be characterized and embeds them in a hierarchical decision structure. The SC strategic characterization here developed can be seen in Table 3.

4 Report findings - conclusions and research perspectives

The present work resulted from the discovery of a research gap related to the lack of adequate methodologies to support the selection of strategic decisions. Since it is aimed at decision-makers, some usage guidelines deserve attention: the strategic decisions themselves and their characteristics, and the actual supply chain characterization framework, which provides decision-makers with a holistic view of the competitors in the chain.

An attractive prospect of future research could also encompass tactical decisions along with current strategic ones.

Table 3. SC Strategic Characterization Structure

Source: Authors.

Deciding on the performance objectives	
Aspects	**Characterization**
Organizational mission and strategies	At this point, it is necessary to identify the strategies of the organization. It is notorious that in most cases, they are not public, along with their mission, objectives, types of products and services, and associated production and distribution coverage, among others (Campbell, D. and Craig, T. (2005)); (Fisher, M.L. (1997).). The purpose of this section is to identify and describe directional trajectories (cf. (Dermol, V. and Širca, N.T. (2018).) & Kirca, 2018) and to analyze the coherence between what CS agents express and what they develop.
Customer expectations	This stage identifies customer service performance and the assessment procedures employed by the company to evaluate it (cf. (Marand, A., Tang, O. and Li, H. (2018).), Tang, and Li 2018). The proper way to use these performance metrics must be carefully analyzed so that the service can be weighed and traced (cf. (Cyplik, P., Adamczak, M. and Hadas, L. (2013).), Adamczak, and Hadas, 2013). Among these metrics, cash, customer order, and SC cycle times certainly stand out, together with lost sales percentage, raw material average payment time, and timely delivery rate. The purpose of this assessment is not only to identify and describe the quality of performance and the level of standardization of core customer service processes. It analyzes the coherence between the organization's mission, strategies, and customer expectations.

Competitive environment	Identify and describe the competitive environment of SC in aspects such as market share percentages of rival SCs. Analyze the forms, times, places, and modes of ownership associated with their levels of innovation and value creation, among other aspects. This characterization makes it possible to establish the benchmarks necessary to understand the market and thrive in it.
Financial resource availability	The reputation and financial capacity of the SC should be determined, as they indicate its soundness and investment possibilities over time.
Logistics system	Describe the different information and communication systems and equipment in terms of technology, level of use and ownership, and overall effectiveness in supporting CS processes and management. Facilitating the creation of value and strengthening customer satisfaction competencies and capabilities.

When identifying SC transaction costs, you need to define how your agents should be organized. This involves identifying the dimensions of CS, which, according to (Coase, R.H. (1937)) and (Williamson, O.E. (1975).), (Williamson, O.E. (1991).), are: the difficulty of measuring agent performance; the inertia in the relationships between economies of scale and agents; and the specificity of the most important teams or human assets that control business relationships. It should be noted that when the values assigned to transaction cost dimensions are high, it can be said that the transaction costs themselves are also rising. As a consequence, there is a greater need to migrate towards hierarchical forms of governance.

Outsourcing decision
The outsourcing alternative (offshore, nearshore, or onshore) in which the SC is developed must be described. It is also necessary to determine if it is wise to persist with this alternative or if it is necessary to opt for another one. For this purpose, the relevant criteria that support the decision must be studied: Distance to the location of the factory; regard for intellectual property rights; affinity with the local culture; proficiency of local officers in the language used by the company to operate; logistics; communications and electrical power infrastructure; availability, quality, and cost of local labor; control of the actual operation of the organization; production costs; and timely delivery rates. In this regard, the search for greater control will privilege the near-shore option, while lower costs, especially production ones, tend to favor the offshore option. In any case, the criterion values tend to change from one country to another, so a rigorous analysis is required.
Facilities
The facility network of the SC has to be described, as well as checking if its design, implementation, and operation have made use of Decision Support Systems (DSS). The design of the logistic network depends on the selected logistic strategy: Flexibility or cost efficiency. In the former case, the decision objectives focus on optimizing production, location, and allocation costs, subject to a set of constraints that condition the flow of materials. On the contrary, if the SC seeks flexibility to expand and contract both in production and distribution, the development of contracts with third parties that facilitate operating under these conditions will be sought.

C&I **Network**
The C&I network of the SC should be described, specifically, in terms of the degree of centralization or dispersion of information; development approach, which, among others, could revolve around rent, purchase, in-house centralized, or internally distributed models; the level of integration of the corporate system, which implies paying close attention to ERP (Enterprise Resource Planning) systems and e-commerce; and (iv) Development environment, specifically as it relates to hardware, software, operating systems, and vendor standardization. In summary, this objective aims to identify the value added by the computer network in its contribution to the development of the CS.

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