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Evaluation of the integration of a supply chain passenger transport services

Evaluación de la integración de una cadena de suministro de servicios de transporte de pasajeros

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ABSTRACT

The objective of this research is to evaluate the integration of a chain of transport services by links in Manabí, Ecuador for the identification of joint strategies and objectives. The research is classified as descriptive and with a quantitative approach. Theoretical methods are used such as: inductive-deductive, analysis-synthesis, historical-logical and modeling to carry out the investigation. The transport service chain is described. A checklist and an integration matrix are systematized to identify the level of integration, strategies and joint objectives. As a result, it was obtained that the study chain presents a high level of integration, and that the strategies focus on long-term contracts and few suppliers, a practical contribution.

Keywords: Evaluation, integration, transport services, logistics, supply chain.

RESUMEN

El objetivo de esta investigación es evaluar la integración de una cadena de servicios de transporte por eslabones en Manabí, Ecuador para la identificación de las estrategias y objetivos conjuntos. Se clasifica la investigación como descriptiva y con un enfoque cuantitativo. Se utilizan los métodos teóricos como: inductivos-deductivos, análisis- síntesis, histórico- lógico y de modelación para la llevar a cabo la investigación. Se describe la cadena de servicios de transporte. Se sistematiza una lista de chequeo y una matriz de integración para la identificación del nivel de integración, las estrategias y los objetivos conjuntos. Como resultado se obtuvo que la cadena de estudio presenta un nivel alto de integración, y que las estrategias se enfocan en los contratos a largo plazo y pocos proveedores, aporte práctico.

Palabras clave: Evaluación, integración, servicios de transporte, logística, cadena de suministro.

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INTRODUCCION

The supply chain is a philosophy that combines the processes and flows of suppliers, factories, warehouses, distribution centers and retail sales; through which raw materials are acquired and transformed, to deliver products or services to the customer (Bautista Santos et al., 2015). This is possible if the transport in all the links favors the synchronization of the activities in the chain. Transportation guarantees the movement of customers to different destinations (Quintero González & Quintero González, 2015). This is an important factor within the national economy. The objective of this logistics activity is to provide these services through an efficient, comfortable system that offers security to citizens or visitors (Camposano Tapia & Serrano Campoverde, 2016). A transport service that provides security and that allows optimization of customer times is the basis of mobility (Moncayo Robinson & Solís Freire, 2017). The integration in transport services influences the connectivity between the different regions of the countries and the continents (Fu et al., 2023), an element still unresolved in Latin America.

In another sense, the planning and control of a transport chain promotes positive results of an economic nature (minimize logistics costs) and allows guaranteeing a service to customers (Schaefer & Konur, 2015). This service must be: safe, fast, comfortable and affordable (fair price), (Sinha et al., 2023).

In this sense, the integration between transport and the rest of the chain favors the balance between the costs of the products and the satisfaction of the needs of the clients. Where the integration aims to interrelate the customer's requirements with the material flows of the suppliers, in order to achieve a balance between customer service, investment in inventories and the unit cost of the product (Bautista Santos et al., 2015).

The integration in the chain is the object of study by several researchers, for example, Alfalla-Luque et al. (2013) defines that the integration of information, the coordination and exchange of resources and the link of organizational relationships are three main dimensions of the integration in the supply chain. At the same time, these elements are fulfilled both upstream and downstream. Based on this study, the authors define a tool with three dimensions and variables. This research is the basic element of the tool that was used in this study.

In a study of the literature of 110 scientific texts related to the topic of integration in the supply chain (Khanuja & Kumar Jain, 2020). In it, it is concluded that the dimensions of SCI are focused on two groups: a group dedicated to internal integration, customer integration, and another group that focuses on supplier integration and information exchange, coordination process, and strategic alliance.

The tourism sector in Ecuador presents a set of limitations, including management in the tourism value chain (Mera Bravo & Sanchéz Veléz, 2023). On this way, access to tourist destinations is a challenge in this chain. Where infrastructure and transportation play an important role. In this sense, the purpose of this research is to evaluate the integration of a chain of transport services by links in Manabí, Ecuador for the identification of joint strategies and objectives.

The parts of this article are based on: the introduction, the materials and methods, the results, the discussion, the conclusions and bibliographical references. The second part describes the chain integration evaluation instrument and the respective calculations. The third describes the supply chain of transport services, the evaluation of the integration variables and their level respectively. At the same time, the integration strategies and their common objectives are defined.

METHODOLOGY

Background of the study of integration in supply chains

The study of the level of integration in the supply chain has several approaches according to the specialized literature. In this sense, this article uses the methodology to assess the level of integration of Sablón Cossio et al. (2021). This estimation has been applied in supply chains of several countries and products, Table 1.

Table 1: Studies of supply chains of various countries y products.

No.	Objects of study	Classification	Developing	Reference
1	Supply chain of tomato puree in Matanzas, Cuba	Product	Medium	(Sablón Cossio et al., 2015)
2	Commercial supply CIMEX, SA, Cuba	Service	High	(Sablón Cossio, 2014)
3	Matanzas medical supply chain, Cuba	Service	High	(Sablón Cossio, 2014)
4	Milk supply chain in Matanzas, Cuba	Product	High	(Sablón Cossío et al., 2018)
5	Panela supply chain in Puyo, Ecuador	Product	Low	(Sablón Cossío et al., 2016)
6	Milk supply chain in Puyo, Ecuador	Product	Medium	(Sablón Cossío, Cárdenas Uribe, et al., 2018)
7	Juice supply chain of Veracruz, Mexico	Product	Medium	(Sablón Cossío, Pérez Quintana, et al., 2018)
8	Chocolate supply chain of the Ecuadorian Amazon	Product	Low	(Cañadas Salazar & Sablón Cossio, 2019)
9	Textile supply chain of northern Ecuador	Product	Low	(Sablón Cossio et al., 2021)
10	Coconut supply chain in the province of Manabí, Ecuador	Product	Low	(Orozco Crespo et al., 2022)
11	Coffee supply chain with the focal company located in Calceta, Ecuador	Product	Low	(Negrín Sosa et al., 2020)
12	Supply chain in the Agroexportadora and marketer Junipertree Cía LTDA	Product	Low	(Loor Zamora & Vergara Espinoza, 2017)
13	Supply chain Andean Hardware of Colombia	Product	Low	(Cossío et al., 2018)
14	Supply chain of drinking water in the city of Portoviejo, province of Manabí.	Product	Low	(Cevallos Mendoza & Vélez Quiroz, 2020)
15	Arabic coffee agrifood chain in the province of Manabí	Product	Low	(Cevallos Cedeño & Charcopa Arías, 2022)
16	Supply chain of the hotel sector, Manabí	Service	High	(Cevallos-Villacreses & Sablón-Cossío, 2023)

Source: In approximation to Muñoz et al. (2020).

Despite the 16 applications of the estimation of the level of integration, in no case has it been applied to a passenger transport chain, the object of this investigation. At the same time, this study enhances the accessibility of tourists to tourist destinations.

The research is descriptive and quantitative approach (Hernández Sampieri et al., 2015). The steps carried out in it are described below.

Stage 1: Characterization of the transport service supply chain.
The field study is carried out to characterize the transport chain. Aspects such as the actors, their fundamental activity and the links in the chain are considered.

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Stage 2: Evaluation of the level of integration of the transport company.

The level of integration of the supply chain is diagnosed through the application of the integration checklist of Sablón et al., (2018). This instrument is made up of 13 elements and 126 characteristics, Table 2.

Table 2. Integration checklist items.

Items	Characteristics
Company Strategy	23
Strategic Objectives	6
Formulation of scenarios in the organization	9
contracts	4
Information	10
plans	6
Demand Forecast	10
Shopping	13
Inventory management	14
Suppliers	5
merchandise distribution	17
Indicators for performance evaluation	4
Customers	5
exceptions	5
TOTAL	126

Source: Taken from Sablón-Cossío, Crespo, Pulido-Rojano, Acevedo-Urquiaga, and Ruiz Cedeño (2021).

The Likert scale from 1 to 5 was used for the items measured on an ordinal scale, where the value 1 corresponded to the criterion of very low and 5 to that of very high. On the other hand, ordinal variables En,m y CDn were calculated for each of the companies i. The level of integration of the chain was determined using the following expression:

$$NI_{cs} = \sum_{n=1}^{7} P_n * Mo_n \qquad (1)$$

Where:

Pn: Specific weight of importance granted by experts for dimension n. NIcs: Level of chain integration.

Mon: Mode calculated for each En, m and for each CDn.

i {I = 1, 2 … k}: company i analyzed, where k represents the size of the selected sample (number of companies).

Dn {n = 1, 2 …7}: Dimension n analyzed from the set of dimensions.

En, m {m = 1, 2 … l}: m items measured within the n dimension, where l represents the total number of elements measured within each n dimension.

CDn: Ordinal variable that evaluates the categorized score for dimension n. CMi: Conglomerate of membership of the company i.

CSi: Total collaboration score obtained for the company i.

Mo: Mode calculated for each En, m and for each CDn.

The decision makers of the actors provide the weight or degree of importance to each variable, through the Hierarchy Analytical Process Matrix, in relation to the chain of study. If the result achieved in NICS is greater than zero and less than or equal to one, "Very Low Level"; greater than one and less than or equal to two, "Low Level"; greater than two and less than or equal to three, “Medium Level”, greater than three and less than or equal to four, “High Level” and greater than four and less than or equal to five, “Very High Level”. These five states for NI contributed to the analysis that if the dimensions are well evaluated it is because the NI has reached an adequate level. The determination of the level of integration of the supply chain is based on the actor with the lowest NI value in the chain. This is true as long as the selected actor is directly related to the final product and service of the chain.

Stage 3: Integration strategies

Based on the calculation of the level of integration, the strategies and joint objectives that the chain must follow are defined. For this, the selection matrix of integration strategies in supply chains is used (Sablón, et. al, 2017), Table 3.

Table 3. Types of strategies for the integration of the chain.

Levels of integration	Allocation I	Negotiation II	Association III	Cooperation IV	Coordination V	Collaboration VI
NI	1< NI<=2	1< NI<=2	2< NI<=3	3< NI<=4	3< NI<=4	4< NI<=5
Types of strategies	Resource allocation	Discussion focused on cost leadership, differentiation, focus or niche	They unite goods in critical processes for an end only economic or other interest	Long term contracts	Connection via TIC	Supply Chain Integration
		Relationship as adversaries		Few providers	Share information	Joint planning
						Share technology

Source: Taken from Sablón Cossío et al. (2017).

The joint strategic objectives to meet the types of integration strategies are determined as in Table 4.

Table 4. Types of joint strategic objectives

Types of objectives	Possible targets	
Market Scope	Market segment	Groups of customers in relation to a product or service and Group of clients in which the chain presents greater strength
	Market breadth	Increased market share
Market Scope	Added value to customer needs	Increases in the use value of the product or service, Reduction of cycles and resources in the processes and Increased value in processes
	Competitiveness	Use of TIC, Integration level, resource efficiency, traceability, circularity
		Availability, Variety, Speed, Orders and perfect orders

Source: Taken from Sablón Cossío et al. (2017).

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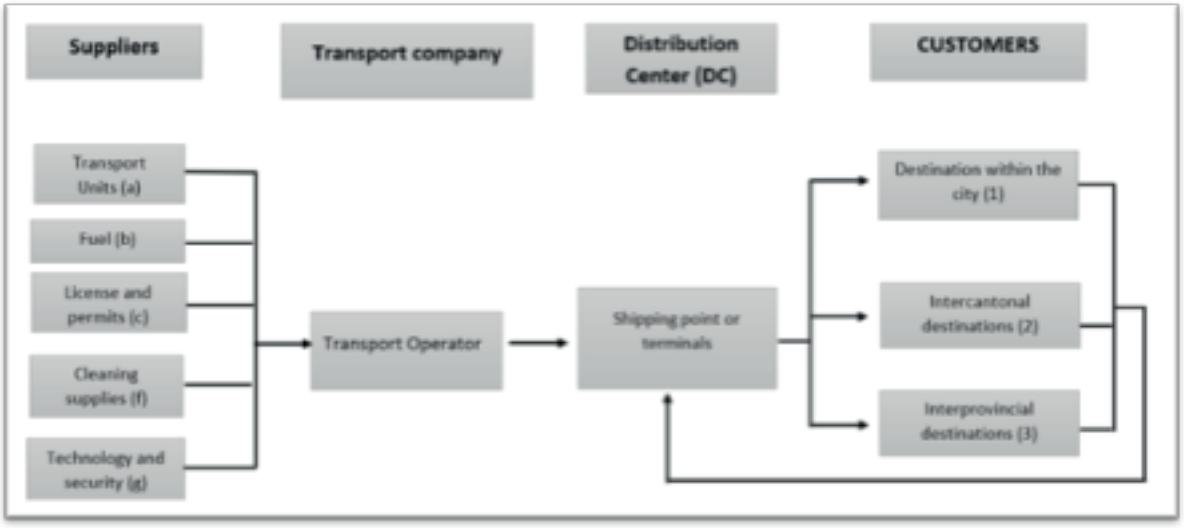
RESULTS

The transport chain that was analyzed is aimed at the passenger transport service and the parcel service in Manabí, Ecuador. This transport chain is distinguished by being a system with great capacity to satisfy the demand of the population with passenger transfer needs. It is characterized by providing a shipping service to a Central Distribution Center (CI), in other words, to a terminal or point of reference where all transport users arrive, so that they later opt for an intermodal transport that directs them to its final destination, since the chain, despite being a direct trip, is not a specialized service (López-Rodríguez & Pardo-Rincón, 2019). Although it is important to note that you must take into account the different shipping routes, the means of transport that will be used and the capacity it has to offer said service.

The transport chain is made up of 4 links: the suppliers that are the ones that provide the necessary supplies for the transport operator to work; the transport company that establishes the infrastructure, human and monetary resources to offer the service to users; the service distribution centers, in this case the land terminals or shipping points characterized by being the entry and exit points in the transportation process. Lastly, customers or users are those who agree to hire and purchase the services of the transport operator, Figure 1.

Figure 1. Mapping of the chain of transport services in Portoviejo



The chain of transport services is made up of 4 links, which are an essential and functional part for the chain to fulfill its objective effectively. Here is its description:

1. Suppliers

The suppliers within the transport chain are a fundamental part of the transport activity in charge of the operators or companies dedicated to this item, here 5 main actors are recognized as the suppliers of:

a) Transport units: It is characterized by being a type of land transport and routine routes, that is, they pass through various boarding points to reach their final destination. These mobile units are twelve meters long and approximately three meters wide, with the objective of transporting a maximum of 45 passengers who will be directed to the destination for which they paid for the service. In this case, the focal company has a capacity of more than 10 buses that depart from the Portoviejo terminal at different times. The units are imported from the city of Quito by the world-renowned automotive company Mercedes Benz, being the only supplier for this transport operator.

b) Fuel: Portoviejo has 18 stations that provide gasoline for the automotive population of the canton. The focal company in question refuels its buses before leaving to promote the local economy, since its consumption is between 30 to 120 liters of gasoline per day, depending on the trip to be made and the distance to be covered. The main supplier of fuel is the PRIMAX station, which manages agreements with the transport operator.

c) Licenses or permits: For the issue of licenses and permits, the municipal permits of each embarkation point to operate within said city or canton are considered. In addition, the transport activity is regulated by the National Transit Agency and the Internal Revenue Service (SRI).

d) Cleaning supplies: For the maintenance of land transport units (buses) and for the good condition of offices or service points, the following are needed: disinfectants, chlorine, brushes, brooms, shovels, mops, among other chemical supplies.

e) Technology and security: The company supplies itself with vehicular technology services that allow it to have comprehensive control and security. In addition to preventing risks of theft and alerting of situations that could endanger the transport unit or any of the facilities. The local company has a provider of security systems that guarantee the location and current situation of all buses before, during and after any trip. This element shows the traceability of the string in one direction.
In this link, 5 main actors were found, which are part of the operation of the transport chain.

2. Transport company
In the second link is the transport operating company. It has a capacity to transport a minimum of more than 500 daily passengers. However, this depends on the influx of users in each collection area. The entity has more than 50 years in the land transportation industry for passengers in the Portoviejo canton, being the main matrix. Currently, it offers parcel transportation as additional services.

3. Boarding points or terminals
As a third link are the "boarding points" or branches of the transport company, which is the means by which transport services are distributed. The company has its main headquarters in the Portoviejo canton; however, it has branches in the cities of Manta, Quito, Esmeraldas, Quevedo, Santo Domingo, Santa Elena and El Empalme (Table 5).

Table 5. Shipping points or terminals part of the transport chain.

Terminals by cantons	N° Terminals or boarding points	N° Trips to the average destination
Manta	1	Greater than 5
Quito	1	Less than 5
Portoviejo	1	Greater than 10
Esmeraldas	1	Less than 5
El Empalme	1	Less than 5
Quevedo	1	Less than 5
Santo Domingo	1	Less than 5
Pichincha	1	Greater than 5

Daily trips add up to more than 40 in the 8 seasons. It is observed that the greater the distance to the boarding points, the fewer daily trips are made. It should be noted that since Portoviejo is the main matrix, there are a large number of trips to this city. They are considered in this investigation as the destination centers or distribution centers because the transport services are characterized by reaching these direct reference points. These terminals are the key link for the Ecuadorian transport industry and for the construction of any land transport chain.

4. Customers
The "clients" link is characterized by being the last, but the most important in the chain of transport services, without the clients the transport company would not have income to sustain the other links in the chain. Within this link, the following aspects are considered:

1) Destinations within the city: The transportation service will not exceed the limits of the Portoviejo canton, when mentioning that they are destinations within the city, it is understood that they are non-centric places that several of the clients choose to lack.
2) Intercantonal Destinations: Customers purchase these transportation services in cases where they have to leave the Portoviejo canton and their destination is a city that does not exceed the provincial limits, for example, the city of Manta, Montecristi, Chone, among others.

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3) Interprovincial Destinations: In these cases, the transportation service purchased by customers is outside the limits of the province of Manabí, they are characterized by longer travel times than cantonal trips and with a higher value.

Evaluation of the level of integration of the chain

The checklist was applied to 30 actors in the transport chain. Cronbach's Alpha is 0.889, this affirms that the instrument is valid and reliable.

Being this result a positive indicator, with a high range level, in other words, the coefficient "is good", for which, there is a high reliability in the data collection instrument used and the data provided can be trusted. with the same.

The evaluation of the elements of the supply chain integration model is shown in Table 6. The values of the variable range between 3.07 (Information, the weakest variable) and 3.72 (Plans, the strongest variable).

Table 6. Assessment of the elements of the level of integration

Variables	Middle value	Weight	
Company Strategy	3.62	0.076	Integration level
Strategic Objectives	3.41	0.076	
Formulation of scenarios in the organization	3.5	0.076	3.48688
Contracts	3.4	0.076	
Information	3.07	0.076	
Plans	3.72	0.076	
Demand forecast	3.61	0.076	
Shopping	3.66	0.076	
Inventory management	3.41	0.076	
Suppliers	3.61	0.076	
Merchandise distribution	3.66	0.076	
Indicators for performance evaluation	3.64	0.076	
Customers	3.57	0.076	

As an indicator of the level of integration of the chain, it results in an average value of 3.49. This value places the chain at the cooperation integration level (Table 7), where the development of strategies is promoted: long-term contracts and few suppliers.

Table 7. Selection of the types of strategies for the integration of the chain.

Levels of integration	Allocation I	Negotiation II	Association III	Cooperation IV	Coordination V	Collaboration VI
NI	1< NI<=2	1< NI<=2	2< NI<=3	3< NI<=4	3< NI<=4	4< NI<=5
Types of strategies	Resource allocation	Discussion focused on cost leadership, differentiation, focus or niche	They unite goods in critical processes for an end only economic or other interest	Long term contracts	Connection via TIC	Supply Chain Integration
		Relationship as adversaries		Few providers	Share information	Joint planning
						Share technology

On the other hand, competitiveness is a fundamental aspect for the success of the passenger transport chain because it can improve customer satisfaction, increase competitive advantage, increase operational efficiency, among other issues. Given this, it is vital to recommend that, in this chain, the medium-term goal be developed to trace the chain with the goal of facilitating user access and the routes defined in Google Maps, improving the experience and user satisfaction and optimization of the operation of the passenger transport chain for a better use of resources, cost reduction and increased profitability. All this will allow the chain to have a competitive advantage over others. In this case, the chain of study presents a threat that is the risk due to the levels of insecurity in the country.

DISCUSSION

The integration model was applied in two case studies, in the coconut chain (Acevedo Urquiaga, Sablón Cossío et al. 2021) and in the textile chain, (Orozco Crespo, Sablón Cossío et al. 2018), (Table 8). Both investigations were carried out in Ecuador.

Table 8. Assessment of the elements of the level of integration and the calculation of the level of integration in different case studies

Variables	Coconut Chain	Textile Chain	Case study
	Acevedo Urquiaga et al. (2021)	Orozco Crespo et al. (2018)	
Company Strategy	2.16	1.75	3.62
Strategic Objectives	1.69	1.8	3.41
Formulation of scenarios in the organization	1.28	1.59	3.5
Contracts	1.01	1.13	3.4
Information	1.09	1.48	3.07
Plans	1.58	2	3.72
Demand Forecast	2.00	1.82	3.61
Shopping	1.72	1.62	3.66
Inventory management	1.17	1.81	3.41
Suppliers	1.77	1.66	3.61
Merchandise distribution	1.02	1.85	3.66
Indicators for performance evaluation	2.80	1.58	3.64
Customers	1.71	1.93	3.57

In all three cases, hiring and information make up the weakest variables in the chains. In the case of the coconut chain, the distribution of merchandise is also added to the previous ones. In this chain, the variable with the greatest strength is the indicators for performance evaluation, in the textile chain the greatest strength is the clients and in the object of study it is the plans. These results differentiate the strengths and weaknesses of the 3 study chains. In the last string, the variables show a high level.

Regarding the level of integration, the two previous studies show a low level and the study chain reflects a high level. This demonstrates the competitiveness of the study chain.

CONCLUSIONS

At present, the integration in the chains of transport services for passengers and parcels is a factor that influences the rest of the competitiveness of other chains and of the actors. This is because it facilitates the mobility of people in time and the delivery of parcels. At the same time, it is an element that promotes the implementation of common strategies and objectives. In this research, an integration analysis of the transport services chain in Manabí, Ecuador was presented as a case study. The study included the application of the Sablón et. al, (2018) to evaluate the integration of 30 actors, seeking to propose a set of strategies and objectives aimed at improving the sector. The results obtained show that the chain under study presents a high level of integration. This research is the beginning of the application of this tool in the transport sector in the study area, an element that shows the way for future research.

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