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ORIGINAL

Challenges and opportunities for the La Guaira container terminal in multimodal transport

Desafíos y oportunidades del Terminal de Contenedores de La Guaira en el transporte multimodal

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ABSTRACT

Introduction: international maritime transport faces geopolitical and commercial challenges that have impacted Venezuela, causing a 60 % decrease in its port activity. This situation highlights the necessity to analyze and optimize the existing port infrastructure.
Objective: the purpose of this study was to analyze the challenges and opportunities of the Specialized Container Terminal (TEC) in La Guaira to support its development as a central node for multimodal transport in the country.
Method: a qualitative methodology with a descriptive-exploratory approach was used, employing methodological triangulation to validate the findings. The data collection instruments included: a documentary review of 41 sources, non-participant observation, and conducting 9 semi-structured interviews with key sector stakeholders.
Results: the results indicate that TEC-La Guaira operates at only 10 % of its installed capacity of 1,2 million TEU/year. The analysis revealed three main barriers limiting its development: technological obsolescence (56 % of the cranes are over 15 years old), legal fragmentation (there are 7 contradictory regulations in port management), and intermodal disconnection (only 12 % of the cargo integrates land and maritime transport).
Conclusions: despite its strategic importance, there is a lack of empirical studies proposing comprehensive solutions for the modernization of this terminal. As a contribution, a Multimodal Strategic Plan (PEM) is proposed, structured around four pillars: technological: adoption of blockchain for supply chain management, financial: public and private investment in 4.0 infrastructure, legal: unify regulations under UNCTAD standards, and sustainable: implementation of green corridors (SDGs 9 and 13).

Keywords: Multimodal Transport; Container Terminal; Port; Port Competitivenes; Venezuela.

RESUMEN

Introducción: el transporte marítimo internacional se enfrenta a desafíos geopolíticos y comerciales que han impactado a Venezuela, provocando una disminución del 60 % en su actividad portuaria. Esta situación resalta la necesidad de analizar y optimizar la infraestructura portuaria existente.
Objetivo: el propósito de este estudio fue analizar los desafíos y oportunidades del Terminal Especializado de Contenedores (TEC) en La Guaira para fundamentar su desarrollo como un nodo central para el transporte multimodal en el país.
Método: se utilizó una metodología cualitativa con un enfoque descriptivo-exploratorio, empleando la triangulación metodológica para validar los hallazgos. Los instrumentos de recolección de datos incluyeron: una revisión documental de 41 fuentes, observación no participante y la realización de 9 entrevistas semiestructuradas con actores clave del sector.

Resultados: los resultados indican que el TEC-La Guaira opera a solo el 10 % de su capacidad instalada de 1,2 millones de TEU/año. El análisis reveló tres barreras principales que limitan su desarrollo: obsolescencia tecnológica (56 % de las grúas con más de 15 años de antigüedad), fragmentación legal (existen 7 normas contradictorias en la gestión portuaria) y desconexión intermodal (solo el 12 % de la carga integra el transporte terrestre y marítimo).
Conclusiones: a pesar de su importancia estratégica, existe una escasez de estudios empíricos que propongan soluciones integrales para la modernización de esta terminal. Como contribución, se propone un Plan Estratégico Multimodal (PEM), estructurado en cuatro ejes: tecnológico: adopción de blockchain para la gestión de la cadena de suministro, financiero: inversiones públicas y privada en infraestructura 4.0, legal: unificar las normativas bajo los estándares de la UNCTAD, y sostenible: implementación de corredores verdes (ODS 9 y 13).

Palabras clave: Transporte Multimodal; Terminal de Contenedores; Puerto, Competitividad Portuaria, Venezuela.

INTRODUCTION

In recent decades, the evolution of maritime transport has accelerated due to the emergence of mega container ships and the transition to smart ports.[1] The latter are defined by [2] as facilities that use advanced technologies (IoT, big data, AI) to optimize operations and minimize environmental impact (SDGs 9 and 13), improving overall efficiency. In this context, Container Terminals (CTs), facilities specializing in the handling of intermodal containers, have emerged as crucial players.[3]

The current landscape is defined by a concentration of traffic in mega-ports, where Asia, and China in particular, stand out as leaders. According to 2022 statistics, China is home to seven of the world's ten busiest ports.[4] At the top of the list, the Port of Shanghai (47,3 million TEUs) exemplifies modern success, having integrated advanced technologies to reduce operating costs by 30 %.[2] However, while Chinese dominance is evident, global flow is sustained by a network of strategic nodes that includes the Port of Singapore (37,3 million TEUs), Busan in South Korea, and Rotterdam in the Netherlands. However, this narrative of efficiency is not without its challenges; even the Los Angeles/Long Beach complex faces chronic congestion problems that underscore the universal need for continued investment.

In this context, the Specialized Container Terminal of the Port of La Guaira (TEC-La Guaira) in Venezuela began its modernization process in 2011 as a transshipment alternative in the Caribbean.[5] However, it faces structural challenges due to critical limitations in its port infrastructure, which is defined as the set of facilities and systems necessary for the efficient operation of a port.[6] These deficiencies in docks, storage, and technology affect its competitiveness compared to countries such as Panama, Brazil, and Colombia.[7]

The modernization of port infrastructure in Venezuela was undertaken through an agreement with Teixeira Duarte (Portugal) and the consulting firm Puertos del Alba. This agreement, formalized through Decree No. 6.839 (published in Official Gazette No. 39.230), was initially supervised by the Ministry of Water and Air Transport (MPPTAA).[8] Since 2017, responsibility for the sector has been transferred to the Ministry of Popular Power for Transportation (MPPT).

Therefore, this research aims to analyze the challenges and opportunities faced by TEC-La Guaira, to propose strategies that enhance its competitiveness and position it as an efficient logistics hub within the context of multimodal transport.

METHOD

This research employed a qualitative, descriptive-exploratory approach, utilizing methodological triangulation as a key strategy for analyzing complex phenomena in contexts characterized by a scarcity of quantitative data. A document review of 41 sources between January and April 2025 was combined with searches in specialized academic databases (Scopus, Web of Science, SciELO), institutional repositories of multilateral organizations (ECLAC, UNCTAD, CAF, World Bank), and scholarly search engines (Google Scholar). To this end, the following search equations were used in Spanish and English: ("transporte multimodal" OR "multimodal transport") AND (Venezuela OR "Latin America"), ("port competitiveness" OR "competitividad portuaria"), ("La Guaira" OR "TEC La Guaira") AND (terminal OR port).

The inclusion criteria were: peer-reviewed publications (scientific articles, book chapters), technical and statistical reports from international organizations, Venezuelan legal regulations and official decrees, news and reports from the specialized logistics and port press, solely to contextualize specific events (e.g., inaugurations, regulatory changes), and documents covering the period from the conception of the TEC-La Guaira (2011) to the date of the research (2025). The following were excluded: sources without identified authorship or clearly established origin, opinion articles not supported by empirical data, duplicate or redundant sources,

prioritizing in those cases the most recent and complete publication and information before 2010, as it was considered that it did not reflect the current context of the terminal under study, highlighting an absence of recent specific studies.

The fieldwork was conducted on-site at TEC-La Guaira in October 2024. It included systematic non-participant observation and semi-structured interviews with nine key actors: two shipping company managers, four BOLIPUERTOS officials, and three customs agents. Through these interviews, the following variables were explored:

- Operational and Technology Variables: The condition and age of the infrastructure and equipment were investigated, with a particular emphasis on cranes, as well as the level of digitization in cargo management processes and communication with shipping companies. The efficiency of loading and unloading processes was also evaluated, identifying bottlenecks and waiting times.
- Management and Legal Framework Variables: The clarity and consistency of current port regulations, as well as collaboration between different institutions (BOLIPUERTOS, customs, and shipping companies), were examined. Additionally, links with external entities, such as the National Foreign Trade Association (ANALDEX) and the Economic Commission for Latin America and the Caribbean (ECLAC), were examined to understand the integration of external policies and data into operations.
- Challenges and Opportunities Variables: Interviewees were asked to identify and prioritize the most significant obstacles and, in turn, the opportunities for expanding services, such as multimodal transport. The information gathered on these variables was crucial to the development of the DOFA matrix, which served as the basis for the proposed strategies for modernizing the terminal.

RESULTS

Diagnosis of the TEC-La Guaira infrastructure

TEC-La Guaira is strategically located in north-central Venezuela, in the Port of La Guaira. Its proximity to Simón Bolívar International Airport (5 minutes) and the Capital District (30 km) makes it a key logistics hub. The port is built on 88 hectares, with a 1 096-meter breakwater and 28 berths (figure 1):

Figure 1. La Guaira Specialized Container Terminal (TEC-La Guaira) in Venezuela

The TEC-La Guaira project was conceived in 2011 as a strategic response to the historical deficiencies of Venezuela's port infrastructure. One of its objectives was to capitalize on the expansion of the Panama and Suez Canals, with the capacity to receive Post-Panamax ships of up to 6 500 TEU. Through a partnership with the Portuguese company Teixeira Duarte, formalized by Presidential Decree, an investment of $400 million over 20 years was planned.[9] Although the project was partially inaugurated on April 28, 2017, it has not managed to reach its potential.[10] Currently, the terminal operates at only 10 % of its installed capacity, a situation that highlights a significant gap between the ambitious initial plan and its operational reality.

The technical specifications of TEC-La Guaira position it as a high-capacity facility. Operating continuously, its 693-meter pier and 15,20-meter draft are designed to simultaneously receive up to two Post-Panamax vessels, which translates into a projected cargo handling capacity of 1 200 000 TEUs per year. This capacity is supported by considerable onshore infrastructure (table 1):

Table 1. Distribution of the TEC-La Guaira port area

Storage Areas				Operating Area		
Port area	**Storage yard**	**Refrigerated Equipment Storage**	**Total Capacity**	**Berths**	**Maximum draft**	**Type of vesse**
17,72 hectares	15 hectares	800 units	1 200 000 TEU	2	15,20 meters	70 000 DWT (Post-Panamax vessel)

TEC-La Guaira has not only invested in physical infrastructure, but also in security and cutting-edge technology. To ensure the safety of its operations, the terminal features a high-resolution video surveillance system comprising fifty (50) cameras, as well as a biometric system for personnel access control. In addition, the implementation of the NAVIS SPARCS N4 terminal operating system, a software designed to optimize operational activities, is being explored. This system, accessible from data terminals and portable devices, uses a color scheme to improve the planning and use of specialized port equipment (table 2):

Table 2. Machinery and Equipment for Moving Containerized Cargo –TEC-La Guaira

Machinery and Equipment	Quantity
*Rubber-Tired Gantry (*RTG) Cranes, 45-ton capacity	15
Ship-to-shore (STS) gantry cranes, 65-ton capacity	6
Container Tractors / *Terminal Tractors*	44
Front loader for full containers / *Reach Stacker (RS)*. Capacity: 45 tons.	13
Front loader for empty containers / *EMPTY-HANDLERS (EH)* Capacity: 10 tons.	6
Semi-trailers for containers (TARA)	7
Forklifts	49
Terminal trailers / *Bomb carts*	50
Power Pack	5

The governance model of TEC-La Guaira, a determining factor in its efficiency, has shifted from a private participation scheme to one of total state control. Inaugurated under the Landlord Port model, where the public authority leases the operation to private entities,[3] the terminal reversed its management in 2020. Since then, it has operated as a *Service Port*, centralizing the operation and administration of all its facilities in BOLIPUERTOS.

Customs clearance process at TEC-La Guaira

Despite having this first-class infrastructure, the real efficiency of TEC-La Guaira is defined by the agility of its operational processes. To understand the bottlenecks, the customs clearance process is summarized below:

- Phase 1 (Arrival and unloading): this includes the coordinated arrival of the ship, document planning, and the unloading of containers with gantry cranes into the yard by BOLIPUERTOS and the Port Authority.
- Phase 2 (Nationalization): the customs agent submits the required documentation. The inspection (gauging) is carried out by officials from the National Integrated Customs and Tax Administration Service (SENIAT) and the Bolivarian National Guard (GNB). Subsequently, the payment of taxes and duties is processed or made through the *Sidunea World* platform, culminating in the authorization for release (levante).
- Phase 3 (Withdrawal): the consignee coordinates ground transportation and, after performing a final verification, removes the container from the port premises.

This process is subject to audits by entities such as the National Institute of Aquatic Spaces (INEA) and may vary depending on the type of merchandise and current regulations.

Context of Multimodal Transport in Venezuela

The complex customs process is a microcosm of the fragmentation that characterizes national logistics, reflecting the absence of an integrated multimodal transport system. This concept involves the movement of cargo using at least two modes of transport under a single contract.[11]

Venezuela faces severe obstacles to its implementation. The main barrier is the absence of a coherent legal framework, which creates legal uncertainty.[12] Added to this is the physical disconnect between port and road infrastructure, exacerbated by the lack of an efficient rail connection, as the Railway Development Plan has

not materialized.[13] The coexistence of multiple disjointed regulations increases bureaucracy and slows down logistics processes.[14]

In response, in 2019, the government established the creation of an Integrated Multimodal Transport System (SITM), designed to interconnect the national territory.[15] Although its implementation represents enormous potential for reducing downtime, attracting investment, and adopting clean technologies (SDGs 9 and 13), structural challenges and a lack of coordination have limited its effective execution to date.

Globally, maritime transport rebounded in 2023 after contracting in 2022.[16] In contrast, Latin America and the Caribbean (LAC) faced supply chain disruptions due to factors such as port congestion, container shortages, and geopolitical events.[1]

Despite investments, comparative analyses of port efficiency reveal that Venezuela ranks low in container handling. The ANALDEX report, based on data from the World Bank (WB) and ECLAC, highlights the persistence of challenges in competitiveness.[17] For example, Venezuela does not rank among the leaders in the WB's "2021 World Container Port Index." At the regional level, the same report highlights the leadership of ports such as Cartagena and Buenaventura in Colombia. At the same time, Venezuela does not appear in the top 10 terminals by performance for the 2020-2021 period.[17,18]

The poor quality of Venezuela's port infrastructure, rated as one of the worst in the region, is confirmed by a series of international indicators.[19] The 2019 Global Competitiveness Report already showed chronic stagnation, placing the country with a score of only 41,83. This diagnosis is exacerbated in the World Bank's most recent Logistics Performance Index (2023), where Venezuela scores 2,3 out of 5 and ranks 123rd. This result contrasts sharply with global leaders such as Singapore (4,3) and the Latin American benchmark, Brazil (ranked 51st, with a score of 3,2).

TEC-La Guaira has demonstrated technical improvements following its modernization, including a 680 % increase in unloading productivity and a reduction in ship turnaround time from 48 to 15 hours (table 3). However, these specific investments are insufficient to compensate for systemic deficiencies in national logistics, which require the integration of advanced technological solutions to optimize the entire supply chain.[20]

Table 3. Comparison of the Port of La Guaira before and after automation

Services	Port of La Guaira	TEC-La Guaira	Variation
Maximum berthing depth	10,5 m	15,2 m	4,7 m
Average containers per call	402	800	199
Ship-to-shore (STS) gantry cranes at the dock	None	6	100
Average ship unloading productivity (containers per hour)	11	75	680
Average ship layover time in port	48 hours	15 hours	320

This research reveals a marked lack of official, up-to-date, and auditable operational data on port performance in Venezuela, which represents a fundamental methodological obstacle. This limitation is due to the discontinuity in the publication of official information by BOLIPUERTOS and the systematic classification of data as "undeclared" (ND) between 2018 and 2025, as well as the difficulty in accessing executive and managerial personnel, which constituted a significant obstacle. This lack of information negatively impacts risk assessment, distorts comparative parameters, and hinders the implementation of effective policies.[21]

As a result, the availability of reliable data was limited to the 2017-2018 period, according to the report, which highlights a critical systemic problem: the marked lack of transparency in Venezuelan port management.[22] This report shows that, in 2018, Puerto Cabello ranked 34th and La Guaira 56th among 118 ports in the region (table 4):

Table 4. Port traffic in TEU in the Venezuelan port system

Ranking	Port	(TEU) 2017	(TEU) 2018
34	Puerto Cabello	ND	418 295
56	Puerto La Guaira	ND	149 708
96	Maracaibo	ND	13 718
101	Guanta	ND	7 351
104	El Guamache	ND	3 302
Total			592 374

The magnitude of this lag becomes evident when comparing Venezuela's performance with that of the main

logistics hubs in Latin America during the same period, which handle orders of magnitude higher TEU volumes (table 5):

Table 5. Comparison of operational capacities: TEC-La Guaira vs. Main Latin American ports

Metric	TEC-La Guaira (Venezuela)	MIT, Manzanillo International Terminal (Panama)	Port of Santos (Brazil)	Port of Manzanillo (Mexico)	Port of Cartagena Bay (Colombia)
Installed capacity TEU/year	Estimated: 1,2 million (data not updated)	4,2 million	4,8 million	3,4 million	5,0 million
Loading efficiency (containers/hour)	Data not available	38-42	44	30-35	35-40
Average waiting time	Data not available	6-10 hours	8-12 hours	24-36 hours	12-18 hours
Investment in automation	Limited	Yes (IoT and big data)	Yes (autonomous cranes)	Partial	Yes (smart management)

Discussion of the results reveals a paradox: despite having modernized infrastructure, TEC-La Guaira exhibits critical underutilization. While hubs such as MIT Panama have capitalized on their geographical position with high efficiency, TEC-La Guaira remains disconnected. The structural barriers that explain this gap are discussed below.

A fundamental barrier is political and administrative in nature. The investigation into the management of the construction company Teixeira Duarte for alleged corruption precedes the current Service Port management model, where the state, through BOLIPUERTOS, administers all operations.[23] This model of state control discourages private participation. Added to this is the failure to implement the 2019-2030 National Port Development Plan (PLANDEP) proposed within the framework of the Great Transport Mission, through the Ministry of Popular Power for Transport (MPPT) and BOLIPUERTOS.[24] This plan includes seven strategic lines (ports as the epicenter of import and export, safe ports, port-city relations, creation of a port school, green ports, among others). Still, it has not yet been implemented nor is it publicly available, which shows that the port's inefficiency is a symptom of the absence of an integrated and coherent national strategy.

In this vein, within the framework of the Great Transportation Mission, the Ministry of Popular Power for Transportation (MPPT, 2020) and BOLIPUERTOS have begun drafting the 2019-2030 National Port Development Plan (PLANDEP).[25] This plan includes seven strategic lines (ports as the epicenter of import and export, safe ports, port-city relations, creation of a port school, green ports, among others). Still, it has not yet been implemented nor is it publicly available, which shows that the port's inefficiency is a symptom of a lack of an integrated and coherent national strategy.

Secondly, the terminal operates in isolation due to the country's severe deficiencies in its connection infrastructure. Multimodal transport is in its infancy, with only 12 % of roads in optimal condition and a railway plan that has yet to materialize.[26] This physical disconnection is compounded by legal fragmentation that creates legal uncertainty.[14]

Ultimately, the port's performance is closely tied to the adverse economic and commercial context. The "technical closure" of private foreign trade, combined with the state monopoly on imports, has resulted in reduced cargo volumes.[25] This situation is part of an economy of reprimarization,[27] heavily dependent on oil,[28] and characterized by a history of high inflation[29] that discourages investment. The decline of the national merchant fleet is another symptom of this deterioration.[30] The interaction of these barriers and potentialities is summarized in the following SWOT matrix (table 6).

Table 6. SWOT matrix of the challenges and opportunities of the TEC - La Guaira -Venezuela

INTERNAL FACTORS OF THE TEC-LA GUAIRA	EXTERNAL FACTORS OF THE TEC-LA GUAIRA
Weaknesses (-)	Threats (-)
1 Low investment in technology, machinery, and specialized equipment	1 International economic sanctions imposed by the US on Venezuela.
2 Bureaucracy and complex customs procedures.	2 Complexity and rigidity in the procedures for controlling, inspecting, and clearing goods at ports, compared to other modes of transport.
3 Lack of specialized human capital.	3 Better logistics practices in land transport modes and foreign ports that compete with domestic ones.

4	Limitations of appropriate management models to encourage private capital participation in ports and multimodal transport.	4	Trade concentrated in a few ports
5	Absence of multimodal transport.	5	Rapid transformation of maritime and port activity at the international level.
6	Stagnation of the road and rail network.	6	Lack of legal reforms (customs legislation, ports, multimodal transport).
7	Lack of a national port development and management plan.	7	Low competitiveness compared to other ports at the regional and international level.
8	High operating costs of port services.		
9	Underutilization of cargo capacity.		
Strengths (+)		Opportunities (+)	
1	Venezuela's privileged geographical position allows it to access other markets in the Andean Group countries of the Caribbean Atlantic Ocean area, the Panama Canal, the southern United States, Central America, and Europe.	1	Interest of private companies in adding value to ports.
2	Presence of operating and shipping companies with world-class standards, advanced technology, and broad private sector participation.	2	High potential for developing the cruise and nautical tourism industry.
3	Adequate installed capacity to meet immediate demand.	3	Development of new markets and maritime routes.
		4	Possibility of investing in road and rail infrastructure.
		5	Possibility of implementing digital trade and green corridors towards the decarbonization of transport.

In summary, the convergence of these systemic barriers manifests itself in daily operational challenges that undermine the competitiveness of TEC-La Guaira. As confirmed by fieldwork and ratified by previous studies, "Venezuelan ports continue to suffer from long waiting times for loading and unloading, cumbersome bureaucratic processes, and a chronic lack of investment in infrastructure and human capital".[19]

CONCLUSIONS

This research concludes that TEC-La Guaira operates in a state of severe underutilization, functioning at only a fraction of its installed capacity. The findings reveal that this inefficiency is the result of the convergence of three critical barriers: profound technological obsolescence, outdated regulatory fragmentation, and a near-total lack of integration with other modes of transport.

The implications of this situation are profound. The operational paralysis of TEC-La Guaira not only represents a direct economic loss but also places Venezuela at a severe competitive disadvantage, acting as a bottleneck for the entire national economy.

To reverse this situation, this study proposes the articulation of a Multimodal Strategic Plan (PEM), based on three axes: (1) reform of governance and the legal framework; (2) technological and operational modernization; and (3) development of connection infrastructure and human capital.

The first pillar requires the creation of a unified multimodal law and the transition to schemes such as Public-Private Partnerships (PPPs) that attract investment. The implementation of policies such as PLANDEP is crucial. The second pillar focuses on the adoption of Smart Port technologies, such as Terminal Operating Systems (TOS), VUCE 2.0, and blockchain, to improve security and efficiency (32). The third pillar addresses the critical need to rehabilitate national connection infrastructure (roads, railways) and invest in the training of qualified personnel.

Finally, it is necessary to acknowledge the limitations of this study, marked by a scarcity of specialized literature and a lack of transparency that has prevented access to auditable official data since 2017. This absence of data not only hindered the research but also represents a critical gap for port management itself. Overcoming these challenges and restoring the sector's reliability will be crucial to attracting investment and ensuring a competitive future for maritime transport in Venezuela.

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