Comparative Analysis of Algerian Ports Competitiveness Using Classical Theoretical Models

تحليل مقارني لتنافسية الموانئ الجزائرية عبر النماذج النظرية الكلاسيكية

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Abstract:
This study offers a critical review of classical theoretical models of competitiveness, including Porter's Five Forces model and Diamond model, as well as the Magic Square of Competitiveness proposed by Darbelet & al. The research aims to identify the main determinants of competitiveness and assess their relevance to the Algerian port context. The methodology combines conceptual analysis with an empirical application of Diamond model and Porter's Five Forces to the port sector, including a comparative study of Algiers port and Arzew port. The results show that port competitiveness is multidimensional, shaped by a combination of internal resources, organizational capabilities, and external environmental factors. The study also highlights opportunities for modernization, strategic development, and traffic optimization. Overall, the findings provide a structured framework for understanding port competitiveness and guiding the formulation of development strategies in a complex and evolving international environment.
Keywords: Competitiveness, Port Competitiveness, Five Forces Model, Diamond Model, Square of Competitiveness.
JEL Classification Codes: L91, L11, M10.

ملخص:
تقدّم هذه الدراسة مراجعة نقدية للنماذج النظرية الكلاسيكية للتنافسية، بما في ذلك نموذج القوى الخمس لبورتر ونموذج الألماس، بالإضافة إلى مربع التنافسية المقترح من قبل داربليت وآخرون. تهدف الدراسة إلى تحديد المحددات الرئيسية للتنافسية وتقييم مدى صلتها بسياق الموانئ الجزائرية. تعتمد المنهجية على الجمع بين التحليل المفاهيمي والتطبيق التجريبي لنموذج الألماس ونموذج القوى الخمس لبورتر على قطاع الموانئ، بما في ذلك دراسة مقارنة بين ميناء الجزائر وميناء أرزيو. تُظهر النتائج أن تنافسية الموانئ متعددة الأبعاد، تتشكل من خلال مزيج من الموارد الداخلية والقدرات التنظيمية والعوامل البيئية الخارجية. كما تسلط الدراسة الضوء على الفرص المتاحة للتحديث، والتطوير الاستراتيجي، وتحسين حركة المرور. وبشكل عام، توفر النتائج إطارًا منظّمًا لفهم تنافسية الموانئ وتوجيه صياغة استراتيجيات التنمية في بيئة دولية معقدة ومتطورة
كلمات مفتاحية: التنافسية، تنافسية الموانئ، نموذج القوى الخمس، نموذج الألماس، مربع التنافسية
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INTRODUCTION

Port competitiveness has become a strategic issue for regional and national economic development. In an increasingly globalized environment, ports have evolved beyond their traditional role of cargo handling to become key nodes within global logistics chains, directly affecting trade efficiency and the economic attractiveness of their hinterlands. Consequently, identifying the determinants of port competitiveness has emerged as a major challenge for both policymakers and port authorities.

The existing literature proposes several theoretical frameworks for analyzing competitiveness, notably the classical models such as Porter's Five Forces and Diamond models, as well as the Magic Square of Competitiveness developed by Darbelet & al. These models highlight the influence of external competitive pressures and market structures, alongside internal factors related to resources, organizational capabilities and innovation. However, their applicability to the port sector, particularly within developing economies such as Algeria, remains a subject of debate.

Against this background, this study addresses the following research question:

What are the key determinants of port competitiveness, and to what extent can classical competitiveness models explain the competitive dynamics of Algerian ports?

The study aims to assess the relevance and limitations of these models through their application to the Algerian port sector.

It adopts qualitative and quantitative study aimed at analyzing port competitiveness through the application of classical theoretical models. The methodology is based on two complementary approaches.

First, a conceptual analysis is conducted to review the main classical models of competitiveness, including Porter's Five Forces model, the Diamond model, and the Magic Square of Competitiveness. This step allows the identification of key determinants of competitiveness and their theoretical implications.

Second, an application is carried out using a comparative case study of two major Algerian ports: Algiers Port and the Port of Arzew. The analysis relies on secondary data sources, including port's internal data, published reports and existing academic studies which are used to compare quantitatively the evolution of imports and exports as well as the distribution of cargo types. In addition, the study is supported by qualitative insights derived from field observations.

This research contributes to a better understanding of port competitiveness and provides insights to support strategic decision-making and port development policies in a complex and evolving international context.

1- THE CONCEPT OF COMPETITIVENESS

Competitiveness is a key concept in the analysis of economic dynamics, whether at the level of a country, a sector, or a firm (Porter M. E., 1985) ; (Porter M. , 1990)). Although its definition varies according to the level of analysis, it generally refers to the ability of an actor to sustain itself and progress in a competitive environment. From a general perspective, Latruffe defines competitiveness in the report of the Organisation for Economic Co-operation and Development (OECD) as the ability of firms, industries, regions, nations, and supranational entities to generate relatively high levels of income and factor employment, while being and remaining exposed to international competition (Latruffe, 2010).

At the firm level, and according to the Competitiveness Observatory, competitiveness is defined as the ability of a firm to increase its market share in a competitive environment, both at the national and international levels (Observatoire de la compétitivité, 2004).

2- PORT COMPETITIVENESS

When applied to the port sector and understood in a larger sense, port competitiveness is often perceived as competition between ports and within ports. However, this approach remains limited and partial in the sense highlighted by Van de Voorde (Van de Voorde, 2002).

Moreover, Yeo and Song argue that port competitiveness results from the ability of port authorities to create added value that enables a sustained level of port activity as well as the development of industrial activities and the hinterland (Yeo & Song, 2006).

Furthermore, according to Bichou (Bichou, 2014), port competitiveness is also reflected in the differentiation of commercial strategies adopted by ports. In other words, seaports seek to distinguish themselves through specific marketing strategies or by specializing in particular services, thereby improving their performance through the positive effects generated by specialization. For Notteboom and Yap, a port’s competitiveness is closely linked to the type of port and the nature of the traffic it handles (Notteboom & Yap, 2012).

Finally, Fraser and Notteboom stress that port competitiveness results from a set of interdependent factors throughout the entire logistics chain (Fraser & Notteboom, 2016). Similarly, (Merkel, 2017) argues that port competitiveness is determined not only by the intrinsic characteristics of the port, but also by the efficiency of the transport modes that ensure its integration into the global logistics chain.

The fifth-generation port model proposed by Lee and Lam (Lee & LAM, 2016) places customer satisfaction at the heart of port strategy, making customer orientation a central lever of competitiveness and differentiation. It is therefore no coincidence that the majority of major Chinese ports, recognized among the most competitive in the world, fully align with the logic of fifth-generation ports.

3- A MULTI-LEVEL APPROACH TO PORT COMPETITIVENESS

According to the World Bank report (World Bank, 2007), port competitiveness can be understood through three levels of competition. The first level concerns inter-port competition, which occurs between different ports seeking to attract the same cargo flows or vessels. The second level is intra-port competition, observed among terminals within the same port, as they compete to capture traffic and provide services to operators. Finally, the World Bank also identifies a third level, intra-terminal competition, which arises when several firms engaged in the same activity, such as cargo handling companies, compete to offer their services within a single terminal.

Figure (1) : Levels of Competitiveness



Source: Prepared by the researchers, based on the World Bank report (World Bank, 2007).

4- CONTRIBUTION OF MODELS FOR ANALYZING PORT COMPETITIVENESS

It should be emphasized that the study of the concept of port competitiveness cannot be conducted rigorously without resorting to analytical models, such as those proposed by Porter ((Porter M. E., 1985) ; (Porter M. , 1990)) or by Darbelet & al (Meier, 2015), which make it possible to systematically analyze the determinants of competitiveness in the international port context.

Among the various analytical frameworks, Porter's models, particularly the Five Forces model (Porter M. , 1985) and the Diamond model (Porter M. , 1990), are the most widely used, as they are considered among the most effective theories for this type of analysis.

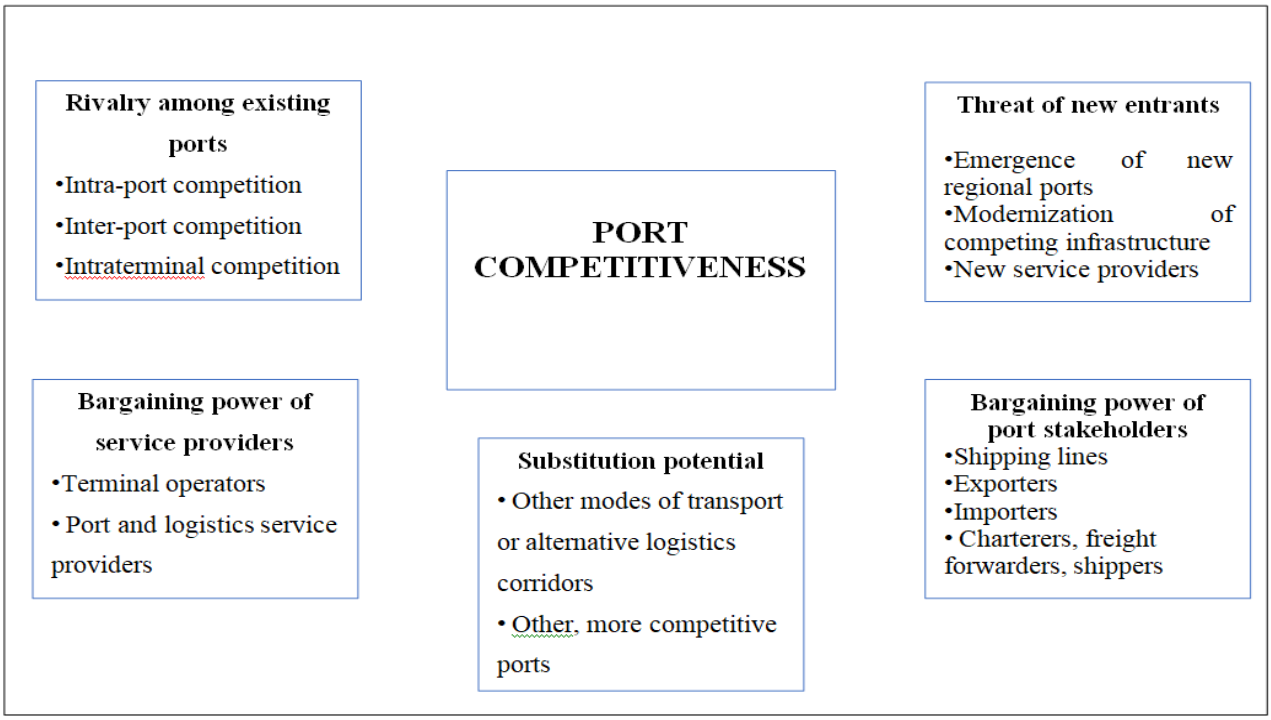
Furthermore, Robinson emphasized that Porter's models are essential for defining port development strategies (Robinson, 2002).

4-1- ANALYSIS OF THE FIVE FORCES MODEL WITHIN THE COMPLEXITY OF THE PORT SYSTEM

Porter's Five Forces model (Porter M. , 1985) constitutes a fundamental analytical framework for assessing the competitiveness and development potential of an industry. According to Michael Porter, the profitability of a sector depends on five interdependent competitive forces: the intensity of rivalry among existing competitors, the threat of new entrants, the bargaining power of suppliers, the bargaining power of customers, and finally the threat of substitute products or services.

Accordingly, the figure below illustrates the Five Forces model as adapted by the authors to the port sector:

Figure (2) : Application of Porter's Five Forces model to the port industry



Source: Prepared by the researchers, based on: (Porter M. , 1985)

First, Porter's Five Forces model is based on a traditional conception of the market, whereas, according to Notteboom and Winkelmans, port competitiveness often relies on forms of strategic cooperation between public and private actors. In other words, competitiveness is built more within a logic of cooperation rather than through pure rivalry between ports (Notteboom & Winkelmans, 2001).

Second, Porter's model primarily addresses market forces and neglects the regulatory and political dimensions, which play a decisive role in port governance. Woo, Pettit, and Beresford argue that strategic decisions are largely influenced by public policies and regulatory frameworks, which departs from the vision of a free and homogeneous market (Woo, Pettit, & Beresford, 2011).

Moreover, Porter's model is based on the idea that the industrial environment is the main determinant of competitiveness, an assumption that appears reductive in the case of ports. In reality, according to Lalinsky, port competitiveness is influenced by a multitude of internal and external factors, such as firm-specific characteristics, beliefs, perceptions, and the availability of information, all of which constitute key determinants of competitiveness (Lalinsky, 2013). As emphasized by Panayides and Cullinane (Panayides & Cullinane, 2002), Porter's model remains focused on industry structure and overlooks the role of specific resources and core competencies in building competitive advantage. In the port context, certain services, such as pilotage, are quasi-public goods provided by the public sector, which further complicates the application of the model.

In the maritime sector specifically, Panayides and Cullinane (Panayides & Cullinane, 2002) note that shipping companies may choose either to call at a public port or to engage in investments aimed at constructing dedicated terminals.

Furthermore, several researchers have attempted to adapt or complement Porter's Five Forces model in order to better reflect port realities. Park & al. (Park, Lee, & Ahn, 2018), for instance, proposed adding the terminal environment, encompassing infrastructure, networks, and related elements. However, this approach remains highly simplified and limited.
Finally, Porter himself later acknowledged these shortcomings, particularly the need to take political and regulatory aspects into account in such analyses. He subsequently proposed the Diamond model in his book named: *The Competitive Advantage of Nations*.

The table below presents an analysis of port competitiveness in Algeria through the application of Porter's Five Forces model:

Table (1): Application of Porter's Five Forces Model to the Algerian Port Sector

Porter's Five Forces	Theoretical Elements of Porter's Five Forces Model (Port Sector)	Application to the Algerian Port Sector
Rivalry among existing ports	- Inter-port competition (national, regional, international) - Intra-port competition -Intra-terminal competition	- Low competition in the majority of ports "public". - Emergence of internal competition in certain terminals operated under concession contracts (such as: DP World, Portek). - Very strong regional rivalry: ports of Tanger Med, Valencia, Algeciras, Radès, etc.
Bargaining power of service providers	- Terminal operators - Logistics service providers and cargo handlers	- High bargaining power in terminals operated by private operators (DP World, Portek) in terms of management, productivity, and attraction of shipping lines. -Limited competition among public stevedoring operators, but stronger competition in terminals under Public-Private Partnership (PPP) arrangements. - Freight forwarders and exporters are influential.
Threat of new entrants	- Construction of new ports -Infrastructure modernization -New port service providers	- Recent regional hubs or newly modernized terminals: ports of Bizerte and Radès, Gioia Tauro and La Spezia, Said port, Tanger Med port. - Rapid modernization of ports and terminals within the same region. - Presence of high-performing private ports at the regional level. -The El Hamdania port project represents a potential future threat to other Algerian ports, due to its enhanced multimodal connectivity and strategic geographical advantages, which could attract a significant share of national and regional traffic.
Bargaining power of buyers	- Shipping companies - Importers / Exporters - Freight forwarders, shippers	- Very high bargaining power of shipping companies; they can divert their services to more efficient or better-connected ports. - Low bargaining power of exporters and importers due

		to the limited number of existing ports. -Freight forwarders are influential but remain dependent on port capacities.
Potential substitutes	-Alternative logistics corridors -More competitive rival ports	-High risk of substitution toward the aforementioned ports. -Low transport multimodality (lack of rail transport), leading to shifts toward foreign ports for certain cargoes.

Source: Prepared by the authors based on (Porter M. , 1985)

The Algerian port system is characterized by low internal competition within public ports, although concession-based terminals (DP World, Portek, etc.) introduce competitive dynamics and enhance productivity as well as the attractiveness of shipping lines, which constitutes a positive aspect. Regional rivalry remains very strong, with modern hubs such as Tanger Med, Valencia, and Algeciras, while the rapid modernization of terminals in the region further intensifies this pressure. The bargaining power of shipping companies is high, as they can divert traffic to better-connected ports, whereas the bargaining power of exporters and importers remains limited, exposing the system to a risk of substitution toward foreign ports. Conversely, the gradual development of efficient private terminals and the future commissioning of the El Hamdania port offer opportunities to enhance national competitiveness. Overall, according to Porter's Five Forces model, Algerian ports must balance internal modernization, attractiveness to operators, and resilience in the face of regional hubs in order to remain competitive.

4-1-1- Case Study Overview

This study focuses on two major Algerian ports:

Port of Arzew : According to information provided on the official website of the Port of Arzew, it is established as a Public Economic Enterprise and fully owned by SERPORT, manages both the ports of Arzew and Bethioua over a 22 km maritime strip. Benefiting from a strategically advantageous location and highly functional, specialized infrastructure, these ports are primarily dedicated to hydrocarbon-related traffic. However, no detailed data on cargo types are publicly available.

The Arzew port plays a central role in Algeria's energy logistics, serving as a major gateway for hydrocarbon exports. Thanks to their significant production and handling capacities, supported by facilities specifically adapted to liquid bulk cargo, the port has consistently ranked among the leading national ports. According to the same official source, it accounts for approximately **52%** of the total national hydrocarbon traffic, underlining their strategic importance within the Algerian port system.

Port of Algiers: Strategically located, it is Algeria's main commercial port. Its hinterland covers central and southern regions, handling a variety of cargo, including agri-food goods, containers and petroleum products.

These descriptions provide a basis for analyzing cargo traffic distribution, as illustrated in Table (2) for the Port of Algiers. While detailed data are available for Algiers, information remains limited for Arzew's port. Nevertheless, the comparison highlights clear structural differences: Arzew's port is highly specialized in hydrocarbons, whereas Algiers handles a diversified cargo mix, which directly influences their respective competitive dynamics within the national port system.

Table (2): Distribution of imported Cargo Traffic at Algiers Port for the 2nd quarter of 2025 (%)

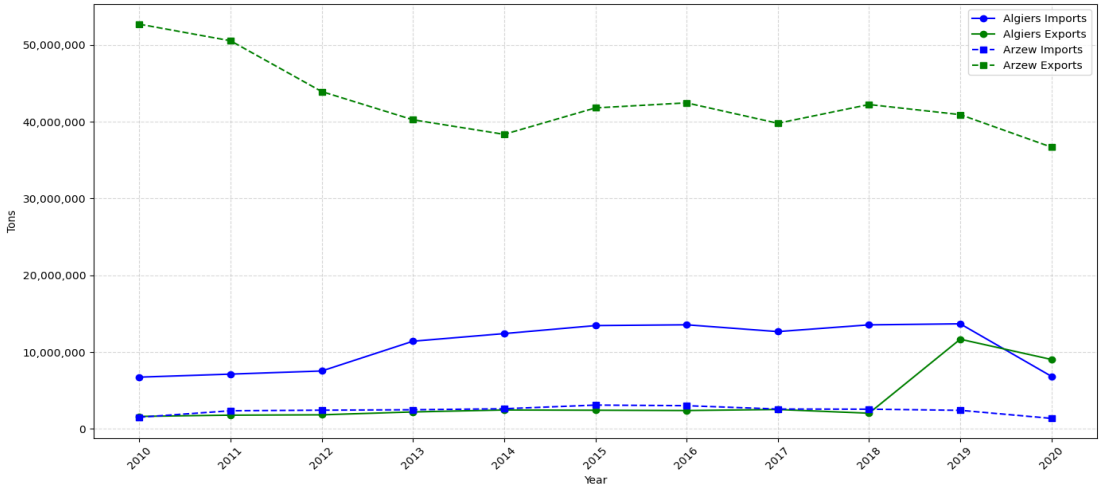
Cargo Type	Share (%)
Petroleum Products	34
Agri-food Products	34
Containers	29
Chemical Products	1
Various	2

Source: Prepared by the authors based on Algiers port 2nd quarter of 2025 report.

The data clearly shows that the Port of Arzew is highly specialized in hydrocarbon-related traffic, whereas the Port of Algiers exhibits a diversified cargo structure. This difference has a direct impact on competitive dynamics, as specialization tends to reduce internal rivalry, while diversification increases exposure to multiple competitive pressures.

To further illustrate these differences, Figure (3) presents the evolution of imports and exports in both ports over the period 2010–2020.

Figure (3): Total import and export flows of Algiers and Arzew ports for the period (2010-2020)



Source: Prepared by the researchers based on (BACHOUCHE, H & TAHRAOUI, F., 2025).

The evolution of import and export traffic clearly shows distinct operational patterns between the two ports. The Port of Algiers maintains a relatively balanced and diversified traffic, reflecting its multipurpose role. In contrast, Arzew port exhibits extremely high export volumes dominated by hydrocarbons, confirming its functional specialization. These differences in cargo structure and growth trends directly impact competitive dynamics and strategic positioning within the national port system.

- **Port Competitiveness and Competitive Forces: Comparative Insights from the Ports of Arzew and Algiers**

To conduct this analysis, Porter's Five Forces framework was applied to evaluate the competitive dynamics of two major Algerian ports: the Port of Algiers (EPAL) and the Port of Arzew. The assessment involved a qualitative examination of each force: rivalry among ports and terminals, threat of new entrants, bargaining power of suppliers and customers, and threat of substitutes, the analyse is based on port specialization, traffic composition, infrastructure, and ongoing or planned strategic projects. The evaluation combines insights from the literature with the specific characteristics of Algerian ports to provide a comparative perspective on how each force shapes overall port competitiveness.

Table (3): Comparative Application of Porter's Five Forces to Algerian Ports: The Cases of the Port of Arzew and the Port of Algiers

Porter's Force	Port of Arzew	Port of Algiers	Comments
Rivalry among existing ports / terminals	**Low to moderate** -Highly specialized hydrocarbon port, -Limited internal competition	**Moderate** -Multiple terminals (containers, bulk, general cargo) leading to service-based rivalry (intraterminal, interport & intraport)	Port rivalry is stronger in multipurpose ports like the port of Algiers, where terminals compete on efficiency, turnaround time, and service quality. Arzew's port specialization in hydrocarbon trafic reduces direct competitive pressure.
Threat of new entrants	**Moderate** -Strong entry barriers remain, but future competition may emerge indirectly from new national mega-port projects and foreign specialized ports	**Moderate to high** -Despite high regulatory and capital barriers, competitive pressure is expected to intensify due to the El Hamdania deep-sea port project, the development of other Algerian ports, and competition from foreign regional hub ports, such as Tanger Med port	The threat materializes through mega-port projects, such as El Hamdania port, designed to capture container and transshipment traffic currently handled by existing ports. This threat is particularly significant for Algier's port, whose container traffic and hinterland overlap with the strategic objectives of El Hamdania port. In contrast, the Port of Arzew remains relatively protected due to its hydrocarbon specialization and limited exposure to container competition.
Bargaining power of suppliers	**High** Dependence on specialized service providers (hydrocarbon handling, maintenance)	**Moderate to high** Multiple service providers but strong demand for diverse port services	Supplier power is higher where services are highly specialized and less substitutable, as in Arzew port. The Port of Algiers benefits from a relatively diversified supplier base; however, it remains dependent on a limited number of critical port services that are essential to its operations.
Bargaining power of customers (shippers/exporters)	**Low** Exporters (public companies) are captive to specialized hydrocarbon terminals	**Moderate** Exporters can choose among terminals and, to some extent, alternative national ports	Customer power increases with the availability of alternatives. Algier's port diversified traffic gives shippers more negotiation leverage than in Arzew's.
Threat of substitutes (other modes / foreign ports)	**Low** Arzew port is the most efficient hydrocarbon port in Algeria, however, some cargo may be redirected to other national ports or pipelines	**Moderate** -Limited substitutes, depending on cargo type and destination -Very limited other transport modes	Substitution is constrained by geography and logistics costs and also by the nature of the product. However, certain traffic segments may shift to alternative ports (Algerian or regional) or transport modes

Source: Researchers analysis, based on Porter (1985).

The table highlights that the Port of Algiers experiences higher competitive pressures compared to the Port of Arzew, due to its multipurpose traffic and multiple terminals.

Conversely, Arzew's focus on hydrocarbon handling reduces internal rivalry and substitution threats but increases reliance on specialized suppliers. This comparison demonstrates how port specialization, traffic diversity, and strategic developments influence the intensity of Porter's Five Forces in the Algerian port sector.

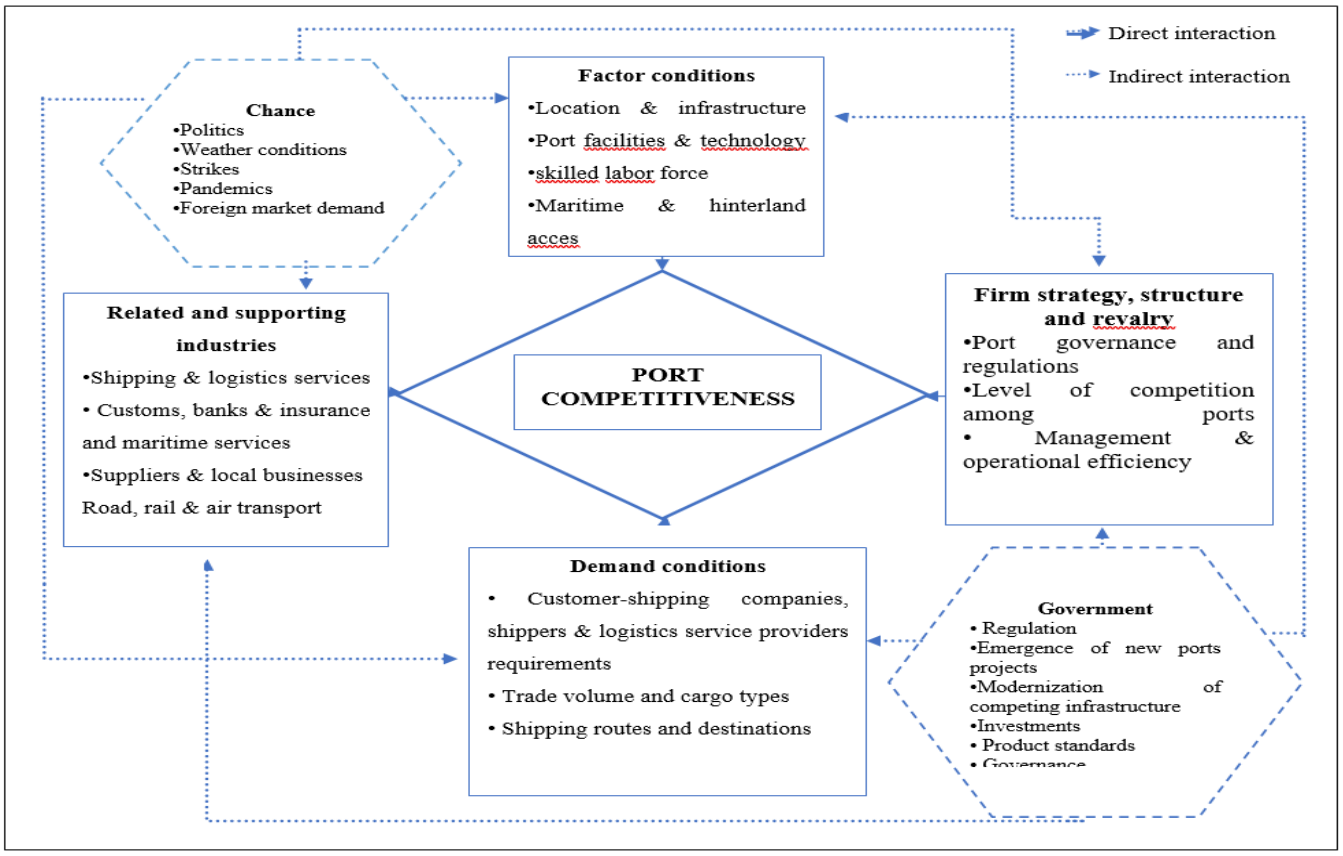
Despite the limited internal competition, the role of state policy remains crucial in shaping the competitive environment of Algerian ports. The Port of Arzew has shifted from a service port model to a landlord port approach, emphasizing public-private partnerships and strategic infrastructure development. A notable example is BPM (Bethioua Port Minéralier), a joint venture between the Port of Arzew and SPA TOSYALI, which, according to KORBAA,F & GADI, I ., (2021), manages the mineral terminal and conveyor operations. Such arrangements allow the state to maintain regulatory oversight while delegating operational management, supporting the port's specialization in hydrocarbon and mineral traffic. This policy orientation reduces competitive pressures, ensures coordinated stakeholder engagement, and reinforces Arzew's structural advantage, complementing the dynamics highlighted by the Porter's Five Forces analysis.

4-2- ANALYSIS OF PORTER'S DIAMOND MODEL WITHIN THE COMPLEXITY OF THE PORT SYSTEM

Porter's Diamond model, or the "National Competitive Advantage Determinants" model, seeks to explain why some nations or regions are more competitive than others in specific sectors. Presented in his book "The Competitive Advantage of Nations" (Porter M. , 1990), this theoretical framework is built around four main, closely interconnected determinants: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry, as well as two external factors: the role of government and chance.

In this research, Porter's Diamond model have been adapted to the port environment, which is schematically represented as follows:

Figure (4): Theoretical application and analysis of port competitiveness according to Porter's Diamond model.



Source: Prepared by the researchers, based on: (Porter, M., 1985)

Porter's Diamond model (Porter M. , 1990) emerged to address the shortcomings observed in the Five Forces model (Porter M. , 1985), aiming to move beyond its strictly competitive and market-focused nature. Unlike Porter's Five Forces framework, which centers on market pressures, Cerceau & al. argue that the Diamond model introduces structural and non-market factors, such as factor conditions, demand conditions, related and supporting industries, to explain port competitiveness (Cerceau, et al., 2014). This approach acknowledges that ports are not merely reactive entities within their environment but are actors capable of shaping their own competitive trajectory through innovation, cooperation, and strategic territorial planning.

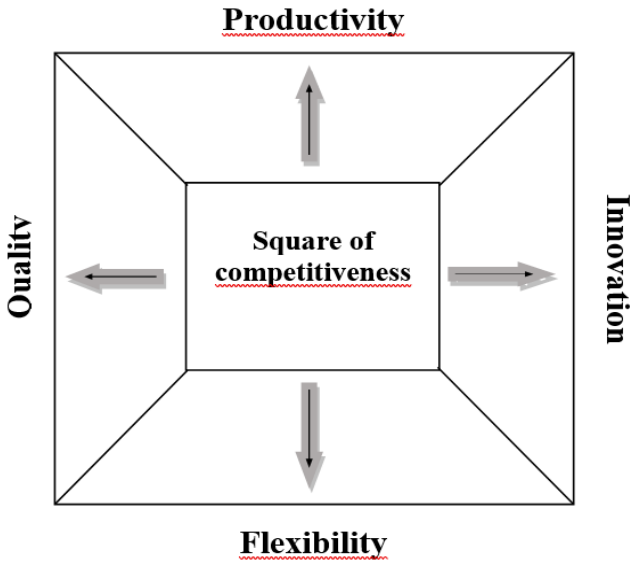
4-3- THE MAGIC SQUARE MODEL OF COMPETITIVENESS

Complementing Porter's models, which focus more on external determinants of competitiveness, Darbelet & al. (as cited in (Meier, 2015) propose an internal and systemic approach to competitiveness through the Magic Square model of competitiveness.

However, despite these contributions, several limitations remain in applying this model to the port environment. First, Huybrechts & al. argue that the role of government is treated merely

as a complementary factor, whereas in reality, it often constitutes a central actor in port governance and regulation (HUYBRECHTS, Meersman, Van de Voorde, & Van Hooydonk, 2002).

Figure (5): The Magic Square of Competitiveness



Source: (Meier, 2015, p.6)

This model highlights four key competitiveness requirements that any organization must balance to maintain a sustainable level of competitiveness: productivity, flexibility, quality, and innovation.

According to Darbelet & al. (as cited in (Meier, 2015)), who proposed the model, the first requirement "productivity" refers to the relationship between the output produced and the total resources mobilized to achieve it. This particularly requires the rational and efficient management of production factors, labor, equipment, technology, infrastructure, and work organization, with the goal of reducing production costs and, consequently, improving the firm's price competitiveness.

In the port sector, Bottasso & al (Bottasso, Conti, Ferrari, & Tei, 2014) show that a 10% increase in port productivity is associated with a 6–20% increase in regional Gross Domestic Product "GDP" and a 5–18% increase in the GDP of neighboring regions. According to Moschovou and Kapetanakis (Moschovou & Kapetanakis, 2023), higher port productivity translates into an increased capacity to generate revenue and provide higher value-added services, thereby strengthening overall profitability and port competitiveness.

Regarding the quality component of ports, Chen and Hasan (Chen & Hasan, 2023) emphasize that shipping goods at competitive costs, the ability to track cargo, and the reliability and

punctuality of transport have profoundly transformed logistics networks and international connectivity. Moreover, the performance of port infrastructure and logistics facilities significantly contributes to the growth of bilateral trade between countries, highlighting the central role of port and infrastructure quality as a mediator of logistics performance and competitiveness.

Concerning port flexibility, Russell, Ruamsook, and Roso (Russell, Ruamsook, & Roso, 2020) underline its essential role in managing uncertainty in logistics chains. A port's capacity depends on complex interactions among its land, maritime, and terminal resources and varies according to port type and cargo. Effective flexibility enhances resilience and overall port competitiveness.

Finally, innovation, whether digital or organizational, represents a major strategic lever. Vanelslander & al (Vanelslander, & al., 2019) indicate that recent digital innovations in cargo flow management have been key in maintaining and enhancing port competitiveness. Jenssen (Jenssen, 2003) highlights that innovation is central to creating competitive advantage in the transport sector and plays a strategic role in ensuring the competitiveness of national maritime and port industries.

In addition, Gadiri and Kerbouche (Gadiri and Kerbouche, 2025) show that innovative marketing positively influences competitive advantage, highlighting its essential function in the growth of a company's position within the market.

CONCLUSION

The analysis of classical theoretical models shows that they provide a useful framework for understanding competitive dynamics but present certain limitations in the port context.

Indeed, Porter's Five Forces model remains a reference strategic framework for evaluating competitiveness. However, we concluded that its application to the port sector is insufficient for analyzing port competitiveness, as it does not fully reflect the complex, evolving, and interconnected nature of this environment. Its application does not adequately account for the important role of the state or the impact of specific resources and core competencies in building competitive advantage.

The application of Porter's Five Forces to the Algerian context reveals low internal competition dominated by public operators, but high bargaining power of shipping companies and significant regional threats. Public–private partnership terminals and new port projects illustrate opportunities for modernization and traffic redistribution. These results suggest that Porter's Five Forces model remains relevant for assessing the strengths, vulnerabilities, and prospects of the Algerian port system. In the same context, the analysis highlights low to moderate rivalry at Arzew port and moderate at Algiers port, which are public operators,

contrasted with strong bargaining power of shipping companies and increasing regional competitive pressures. At the same time, public–private partnership terminals and large-scale port projects represent significant opportunities for modernization, efficiency improvement, and traffic redistribution.

Moreover, the comparative insights underline that diversification of cargo types and strategic specialization are key levers that can enhance resilience and optimize competitive positioning at both national and regional levels.

Porter's Diamond model, on the other hand, offers a systemic view of competitiveness, based on the interdependence of internal and external factors within an economic environment. Unlike Porter's Five Forces model, which focuses on sector-level competition, the Diamond model adopts a broader perspective at the macroeconomic and territorial levels. It highlights that the competitiveness of all actors influencing industrial sectors derives not only from rivalry among firms but also from the quality of the national context in which they operate, taking into account factors such as government intervention and chance.

In the Algerian port context, this suggests that enhancing regulatory frameworks, improving multimodal connectivity, and fostering innovation networks are crucial for building sustainable competitive advantages.

Nevertheless, this model does not always capture the strategic role of port authorities. These limitations underscore that port competitiveness should be considered a multidimensional phenomenon, dependent on internal and external, structural and operational factors.

Finally, the approach of the Magic Square of Competitiveness, based on four determinants: productivity, quality, flexibility and innovation, provides operational tools for understanding and achieving competitiveness as described by the Diamond model. These interconnected dimensions show that port competitiveness does not depend just on size or infrastructure, but on a combination of strategic, organizational, and technological factors. Therefore, the integration of digitalization, automation, and flexible operational practices, alongside targeted human capital development, emerges as a critical strategy for Algerian ports seeking to align with global best practices.

Based on these results, it is recommended that policymakers and port authorities adopt an integrated approach to competitiveness, combining infrastructure investment with institutional reforms, innovation policies, and enhanced coordination between public and private actors. Finally, future research could extend this analysis by incorporating quantitative performance indicators, governance models, and sustainability dimensions, as well as by comparing Algerian ports with leading international hub ports.

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