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DEVELOPMENT AND MODERNIZATION OF PORT INFRASTRUCTURE IN ALGERIA A CASE STUDY OF THE PORT OF SKIKDA

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ABSTRACT

This study examines the evolution of port systems and analyzes the modernization strategies of the Skikda Port Authority (Entreprise Portuaire de Skikda, EP Skikda) as a case study. The research aims to assess the extent to which the authority's strategy aligns with contemporary port models. Methodologically, the study employs a qualitative case study approach, based on the analysis of official port documents and technical reports. The findings reveal that the Skikda Port Authority is successfully functioning as a modern strategic logistics hub, transcending its traditional role in transit shipping operations. Its integrated administrative approach—combining advanced infrastructure with a focus on digitalization, safety, and stakeholder integration, ports as a competitive actor within global supply chains. The study concludes that EP Skikda offers a replicable model for other port authorities seeking to enhance both competitiveness and sustainability. By bridging traditional port operations with contemporary logistical demands, the case of Skikda provides valuable insights for emerging economies aiming to modernize their maritime infrastructure.

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1 INTRODUCTION

A port is a designated area located at the edge of oceans, seas, rivers, or lakes where vessels undertake loading and unloading operations for cargo or passengers. Ports can be categorized functionally as cargo ports (handling freight exclusively), passenger ports (handling passengers exclusively), or multi-purpose ports (managing both cargo and passenger traffic). Commonly, ports are cargo-oriented, dealing with general and bulk shipments. (Kuhn et al., 2021)

General cargo (non-bulk dry goods) refers to merchandise of varied sizes and weights, shipped either as loose, break-bulk items (packaged or unpackaged) or in standardized units, primarily via containers. In contrast, bulk cargo consists of homogeneous commodities—such as grains, ores, or liquids—loaded directly into a vessel's holds through specialized systems without intermediate packaging or containerization.

The concept of a port extends beyond maritime facilities in many contexts. The term may encompass airports and intermodal hubs such as rail terminals. Modern ports are not merely interchange points between sea and land but also function as integrated logistics and production centres. Additionally, ports may serve specialized roles, such as fishing harbors or naval bases. Activities not directly linked to maritime transport also fall under a broader definition of ports; for example, dry ports—inland logistics centres without direct water access—act as interfaces between land transport and seaports, providing multimodal distribution and logistics services. (Herath et al., 2026)

The maritime industry in general, and maritime transport in particular, constitute the cornerstone of global economic growth and development. These sectors are closely linked to the function of ports, which serve as vital infrastructure for economic expansion. Consequently, academic attention to port-related topics has increased, particularly in fields centred on issues of sustainability, development, and maritime policy (Diniz et al., 2024).

This paper will seek to examine the strategy of port development and modernisation in Algeria by highlighting the case of Skikda Port, considered one of the most significant ports in the country.

2 THE EVOLUTION OF COMMERCIAL PORTS

Thus, a port integrates three fundamental, interrelated elements: (Zaucha & Matczak, 2018)

- The Geographic Factor: The physical area and water space occupied by the port.
- The Administrative Factor: The governing body responsible for managing the port as a public facility.
- The Economic Factor: The port's role as a commercial and maritime gateway, providing shelter for vessels and facilitating trade.

In its simplest conceptualization, a port is a water area adjoining a coastline or riverbank, specially equipped with infrastructure and services to ensure the transfer of cargo between ships and other transport modes and to assist in passenger embarkation and disembarkation.

Scholars have proposed various classifications for ports. Talley (2009), for instance, categorizes ports based on the cargo handled:

General Cargo Ports: These ports handle non-containerized, break-bulk cargo loaded and unloaded directly to/from ships using slings, cranes, or similar equipment. Examples include steel, timber, logs, automobiles, and heavy machinery. It is noteworthy that before the advent of containerization, most cargo was handled as general cargo. Due to the operational efficiencies of containers, there has been a significant global shift towards containerized freight.

Bulk Cargo Ports: These ports handle unpackaged, homogeneous commodities poured or pumped directly into vessel holds. Some researchers include bulk cargo under the general cargo umbrella. Bulk ports are further subdivided into:

Dry Bulk Ports: Handling granular or particulate dry commodities such as grains, sand, wood chips, or iron ore, typically using pneumatic suction or conveyor systems.

Liquid Bulk Ports: Handling liquid commodities such as crude oil, petroleum products, chemicals, or edible oils, transferred via pipelines and loading arms.

Container Ports: Representing the modern, secure method for freight transport, these ports are dedicated to handling standardized shipping

containers. Due to the overwhelming reliance on containerization for goods movement, many traditional general cargo ports have developed specialized container terminals with dedicated berths and handling equipment. Container handling involves specific operational protocols and equipment tailored to various container sizes and types.

This typology reflects the primary operational specialization of ports within the global supply chain, highlighting the evolution from conventional break-bulk handling to highly mechanized bulk and containerized operations.

Ports have undergone significant evolution, corresponding with advances in operational methods, management practices, and technological development, profoundly impacting global economies. This evolution can be distinguished into distinct generational models (Haidine, Ait-Allal, Aqqal, & Dahbi, 2021)

- **First Generation Ports (Traditional Ports)**

Encompassing all ports established prior to the advent of containerization in the 1960s, these traditional ports are characterized by the following: The port is considered an independent unit with minimal commercial integration, primarily functioning as a point of origin and destination for goods and a node for modal transfer (a link between sea and land transport) ; Investments are heavily concentrated on basic quay infrastructure; Cargo handling relies on conventional, labor-intensive break-bulk methods using semi-standardized equipment; Information systems are localized, suitable only for internal port operations, resulting in superficial relationships between the port and its users; Consequently, the value-added generated by the port for the supply chain is relatively low.

- **Second Generation Ports (Industrial Ports)**

Emerging after 1960 following the introduction of containers and specialized container vessels requiring non-standardized handling equipment, these ports are distinguished by key features: They function as integrated centers for transport, trade, and industry, expanding beyond classical logistics activities (loading, unloading, storage) to include manufacturing and processing services; The port footprint expands significantly compared to first-generation ports, extending into the hinterland to accommodate related industries such as refineries and logistics zones; There is a shift towards higher capital intensity and a corresponding decrease in reliance on labor-intensive operations; A closer relationship develops between the port and its users, leading to an increase in the economic value-added generated by port activities (Helling & Poister, 2000).

- **Third Generation Ports**

By the late 1980s, third-generation ports emerged, driven by increasing vessel sizes, the expansion and diversification of container types (e.g., refrigerated, tank containers), and the rise of intermodal transport.

The port becomes a link within a broader transport chain, rather than merely an endpoint; Significant investment is made in creating and providing diverse transport linkages connecting ports to markets, mines, quarries, and oilfields; Port activities expand to include transit trade, free zones, supply chain centers, and integrated logistics services.

This period coincides with the adoption of advanced information technology and specialized cargo-handling equipment.

This rapid development opens avenues for multifaceted investments and value-added activities, such as automotive industries, processing and packaging, re-export businesses, container manufacturing and maintenance, thereby stimulating economic growth and employment.

- **Fourth Generation Ports (Information Technology Ports)**

Emerging in the early 2000s, fourth-generation ports are characterized by their reliance on modern technology to manage operations. Key features of this generation include the adoption of advanced information systems and fully integrated internal transport networks encompassing both road and rail infrastructure. Fourth-generation ports focus on meeting user needs and expectations through the use of sophisticated technologies (Heilig, Lalla-Ruiz, & & Voß, 2017), while improving service speed and performance at a reasonable cost.

- **Fifth Generation Ports (Local Integration)**

This generation of ports has emerged to support sustainability in the relationship between the port and the local community, with a focus on the integration of hub and feeder ports. These ports are distinguished by the involvement of global management companies in their operations and governance. (Hall & Jacobs, 2010)

This generational framework illustrates the port's transformation from a simple cargo interchange point to a complex, integrated logistics and industrial node within global supply chains. (Heilig et al., 2017)

Maritime transport constitutes an integral and indispensable component of international logistics, accounting for approximately 80 percent of global trade volume by tonnage. While the physical movement of goods necessitates multimodal transport systems, maritime shipping remains the backbone of international commerce. (Haidine et al., 2021)

Maritime transport activity complements other economic sectors—industrial, agricultural, services, and tourism—by supplying them with essential inputs and facilitating the distribution of their outputs to global markets. It contributes to increasing rates of both physical and human capital formation. By facilitating the transfer of technological knowledge, maritime services enhance productivity and stimulate economic growth, thereby strengthening a key determinant of economic development. Moreover, countries that own significant fleets or port infrastructure can generate substantial revenues by leveraging these assets through high operational efficiency or by leasing capacity to other nations. (Helling & Poister, 2000)

Furthermore, maritime transport improves a nation's balance of payments by boosting export capacity and earning foreign exchange for the national treasury. It also supports import substitution by supplying raw materials to export-oriented industries and by offering alternatives to certain imports.

Characterized by its ability to transport thousands of tons of cargo per voyage—such as crude oil, bulk commodities, and containerized goods—maritime shipping is essential for the smooth flow of a country's foreign trade, both in exports and imports. The availability of efficient maritime transport services is a prerequisite for unimpeded trade, promoting not only commercial exchange but also technological diffusion, which in turn raises productive capacity and supports long-term economic development. (Zaucha & Matczak, 2018).

3 MARITIME PORTS IN ALGERIA

Algerian maritime freight transport serves as a vital artery and a principal medium for the country's international trade exchanges.

To oversee this strategic sector, the Directorate General of Merchant Marine and Algerian Ports (DGMAP) was established, with its key responsibilities encompassing:

- Proposing merchant marine and port-related policies, as well as implementing legislative and regulatory texts within its jurisdiction.
- Developing and executing a comprehensive strategy to apply international maritime regulatory mechanisms.
- Establishing quality management systems within the merchant marine and port sectors.
- Defining the modalities for managing and operating ports and auxiliary activities, and ensuring their oversight.
- Formulating the national program for maritime and port security.
- Regulating, supervising, and promoting trades and professions related to the merchant marine, ports, and port logistics.
- Monitoring the activities of bodies and institutions under its purview and preparing related reports, while negotiating bilateral and multilateral international agreements concerning the merchant marine and ports in coordination with relevant bodies.
- Digitalizing maritime and port activities.
- Ensuring compliance with and implementation of quality audit programs within its domain.
- Monitoring the activities of the Maritime Safety and Security Information Center, participating in the promotion of the blue economy in liaison with relevant ministerial departments, and managing a centralized database pertaining to the merchant marine and ports.

4 CASE STUDY OF SKIKDA PORT

This case study analyzes the Skikda Port Enterprise (Entreprise Portuaire de Skikda – EP Skikda), a key Algerian public economic entity managing the commercial and industrial port infrastructure in the Skikda region. Established by Decree No. 82-284 of August 14, 1982, and restructured as a joint-stock company on March 21, 1989, EP Skikda operates under the sole ownership of the port services group SERPORT Spa, with a registered capital of 9,000,000,000 Algerian dinars.

Table 1 *Infrastructural Comparison: Skikda's Old and New Commercial Ports*

Feature	Mixed Port (Old Port)	New Port
Access Channel	120 m wide, 15 m deep	250 m wide, 18 m deep
Turning Circle	360 m diameter	550 m diameter
Sheltered Water Area	43.3 ha	61 ha
Quay Length	2,180 m	240 m (general cargo), plus specialized berths
Berthing Positions	14 general cargo berths, 3 oil berths	1 general cargo berth, 7 oil/gas berths, 2 offshore SPMs
Protective Structures	Main jetty: 1,625 m; Secondary: 300 m	Main jetty: 1,875 m; Secondary: 650 m

Source: (Port of Skikda, 2025)

The enterprise holds multiple international certifications, including ISO 9001:2015, ISO 14001:2015, OHSAS 18001:2007, and ISPS Code compliance, reflecting its commitment to quality, environmental management, safety, and maritime security.

EP Skikda's core missions encompass the comprehensive management of port operations, including:

- Stevedoring, handling, and storage of goods;
- Towing, piloting, and mooring services;
- Port police and security operations;
- Maintenance and development of port superstructures;
- Collaboration with relevant authorities on port infrastructure projects;
- Passenger terminal services.

The company's territorial jurisdiction covers two main facilities: the Mixed Port of Skikda (the older multi-purpose port) and the New Port of Skikda, which primarily serves hydrocarbon exports.

4.1 Port Infrastructure and Technical Capabilities

4.1.1 Physical and Operational Characteristics

This section provides detailed comparative data for the two ports:

The New Port is designed to handle very large tankers, with two Single Point Mooring (SPM) buoys capable of servicing vessels over 320,000 DWT.

Both ports are equipped with modern navigational aids, including lighthouses and channel markers.

- **Cargo Handling and Storage Capacity**

Annual Throughput Capacity:

- General cargo: 4.5 million tons
- Hydrocarbons: 30 million tons
- Storage Areas:
- Open storage: 54.5 hectares (within port) + 37 hectares (extra-port zone)
- Covered storage: 2 hectares (warehouses & hangars)
- Specialized Facilities:
  - Grain silo (20,000 tons capacity)
  - Animal feed storage (35,000 tons)

- Public weighbridges (80–120 tons)
- Passenger terminal (1,200 passengers)
- Roll-on/roll-off facility with three dual-lane gates
- Fishing boat slipways (3 units)
- Railway network: 2,660 m of tracks (7 lines), with a station 100 m from the Mixed Port

Detailed table outline berth lengths, drafts, and compatible cargo types for both ports, highlighting flexibility in handling containers, bulk grains, hydrocarbons, metals, rolling stock, and specialized products such as liquefied natural gas (LNG), aromatics, and petroleum derivatives. Hydrocarbon berths are equipped with high-capacity loading arms (250–6,500 m³/h) and pipelines ranging from 6 to 16 inches in diameter.

4.2 Port Management and Operational Framework

EP Skikda positions itself as a vital link in national trade, striving for recognition based on performance, professionalism, and corporate citizenship. Its strategic policy is built on five pillars:

- Human Resource Development – Continuous training, HSE competency enhancement, and staff motivation.
- Client and Stakeholder Satisfaction – Adherence to regulatory, safety, and environmental standards while improving service quality.
- Operational Performance Improvement – Infrastructure optimization, market share growth, and modernization of equipment.
- Internal and External Communication – Enhanced communication channels with port community and stakeholders.
- Professionalism and Civic Responsibility – Commitment to worker safety, pollution prevention, and community relations.

The enterprise explicitly commits to legal and regulatory compliance, resource allocation for management systems (QHSE), pollution prevention (marine, soil, atmospheric), and regular management reviews.

EP Skikda maintains substantial anti-pollution and emergency response resources, including:

- 8 tugs equipped with anti-pollution and fire-fighting gear;
- 3 additional fire-fighting tugs;
- Oil spill containment booms (over 2,000 m total length);
- Skimmers, absorbents, storage caissons, and high-pressure cleaners;
- Two waste recovery barges.

This reflects a proactive approach to environmental stewardship and operational safety in a high-risk industrial port setting.

4.3 Port Digitalization and Customer Services

- Single Window Service (Guichet Unique): A centralized administrative office for container-related procedures, staffed by 32 agents working in two shifts to expedite cargo release.
- Intranet and Information System: The integrated port management system SIGNE supports real-time operational coordination and offers external client interfaces via a dynamic website.
- Reception Office: Located at the main entrance of the Mixed Port to assist clients and visitors.
- Access Protocols: Structured procedures for trucks, regular/occasional clients, and visitors, involving coordination with the Port Facility Security Officer (PFSO) and the Maritime Border Police.

It serves as a dematerialised data exchange platform, facilitating seamless logistics for the flow of goods from the moment a vessel is announced until the cargo is evacuated by its owner. It is defined as a facility that allows parties involved in trade and maritime transport to submit information and documents through a single-entry point in order to complete all official formalities related to import, export, and transit. The system aims to ensure high reliability in import and export procedures while reducing cargo clearance times within the port.

At the Skikda Port Enterprise, the Single Window has been operational since August 2021 and is equipped with human and material resources that meet the needs of all stakeholders. In line with this vision, the Port Services Group (SERPORT) has provided its subsidiaries with a value-added

telecommunications network through the implementation of the Algerian Ports Community System (APCS). This system enables all port sector professionals and the customs administration to exchange data and messages in complete confidentiality and security. It manages the physical, administrative, commercial, and customs tracking of goods, allowing for the dematerialised completion of administrative, customs, and fiscal formalities related to port operations.

This community system, which functions as an interfacing platform federating the other systems of port stakeholders, is operational at the Skikda Port Enterprise. It is fed with real-time information via an Internet connection from the port enterprise's systems, the customs administration, shipping agents, freight forwarders, and other administrations operating within the port area (including trade, phytosanitary, veterinary services, etc.). This electronic portal simplifies and facilitates the provision and sharing of information necessary for completing all trade-related formalities, for both commercial operators and public authorities. Furthermore, the system ensures improved service quality and a reduction in document management costs.

Based on data, total cargo traffic reached 23,691,031 tonnes, marking a slight decrease of 0.1% compared to previous year. General (non-oil) cargo remained stable at 4,015,618 tonnes, although this represented a substantial increase from previous year levels. In contrast, dry bulk cargo declined by 17%, while liquid bulk (primarily hydrocarbons) continued to dominate overall activity, accounting for 19,675,413 tonnes. Container traffic exhibited notable growth, rising by 15% in volume and 18% in total weight. A clear dual structure characterises the port's trade flows: imports (2,718,003 tonnes) are dominated by China, Argentina, Russia, France, and Turkey, which together supply nearly 45% of incoming general cargo, including agricultural products, metallic materials, and transport equipment. Exports (19,150,771 tonnes), by contrast, are overwhelmingly hydrocarbon-based, with national coastal shipping (cabotage) playing a prominent role, followed by the United States, France, South Korea, and China as leading destinations (Port of Skikda, 2024).

5 CONCLUSIONS

The Port of Skikda represent a critical infrastructure node in Algeria's economic landscape, combining multi-purpose cargo handling with specialized hydrocarbon export capabilities. EP Skikda demonstrates a structured, certification-driven approach to port management, emphasizing safety, environmental compliance, and customer service. Its dual-port system allows for functional specialization—the Mixed Port serving general cargo and containers, and El Djedid Port focusing on energy exports, supported by deep-water berths and offshore loading facilities.

The development of port infrastructure can facilitate the improvement of transport routes and port connectivity, as well as the recovery of ancillary services and related activities (Peričin & Grbić, 2025) .

The enterprise's commitment to continuous improvement, stakeholder engagement, and risk management positions it as a model of public port governance in the region. Future challenges may include capacity expansion, digital transformation, and adapting to global energy transition trends, but the existing framework provides a solid foundation for sustainable growth.

The hydrocarbon sector dominates export activities at the Port of Skikda, with shipments directed primarily towards major American, Asian, and European markets, alongside a significant role played by national coastal shipping (cabotage). In contrast, imports via this port consist mainly of agricultural products (notably cereals), metallic materials, and transport equipment, with China, Argentina, and Russia ranking as the leading supplier countries. Furthermore, a marked growth in container traffic is observed, which may reflect a gradual shift towards the diversification of trade routes.

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