

**Economic changes in maritime logistics and smart port innovation
practical -Case studie Dubai port-**

التغيرات الاقتصادية في الخدمات اللوجستية البحرية والابتكار في الموانئ الذكية
دراسة حالة ميناء دبي-

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**Date of receipt of the
article: 01-12-2024**

**Date of acceptance of the
publication: 28-12-2024**

Abstract:

The technological revolution has reshaped the maritime and logistics sectors, improving the management of physical, informational, financial, and administrative flows. Port competitiveness now hinges on efficient logistics that minimize vessel wait times and ensure smooth cargo transit, essential for attracting foreign investment. Smart ports play a key role by streamlining operations like piloting, cargo handling, and warehousing, while working closely with customs and banks to ensure regulatory compliance. This integration of technology and smart port systems enhances operational efficiency, making ports more attractive on the global stage.

Key words: Ports, Maritime transport, Port logistics, Dubai port.

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ملخص:

أعادت الثورة التكنولوجية تشكيل قطاعي الشحن والخدمات اللوجستية، مما ساهم في تحسين إدارة التدفقات المادية والمعلوماتية والمالية والإدارية. أصبحت تنافسية الموانئ تعتمد الآن على خدمات لوجستية فعالة تقلل من أوقات انتظار السفن وتضمن انسيابية نقل البضائع، وهو أمر ضروري لجذب الاستثمارات الأجنبية. تلعب الموانئ الذكية دورًا محوريًا من خلال تبسيط العمليات مثل الإرشاد البحري ومناولة البضائع والتخزين، بالإضافة إلى العمل عن كثب مع الجمارك والبنوك لضمان الامتثال التنظيمي. يعزز هذا التكامل بين التكنولوجيا وأنظمة الموانئ الذكية الكفاءة التشغيلية، مما يجعل الموانئ أكثر جاذبية على الساحة العالمية.

الكلمات المفتاحية: الموانئ، النقل البحري، الخدمات اللوجستية للموانئ، ميناء دبي.

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Introduction:

Today, the maritime fleet is faster, stronger, and more cost-effective than ever. The creation of canals and the use of satellites have significantly reduced navigation time, while the advent of containers has streamlined unloading and storage processes. In a context where the global demand for food, medicine, and raw materials continues to rise, often needing to be met within increasingly tight deadlines and under ecological considerations, technological advancements have been harnessed to enhance port and logistics operations. This has facilitated the needs of both importers and exporters. Consequently, economic globalization has restructured maritime transport into a competitive industry that requires cutting-edge logistics.

It is important to note that the competitiveness and efficiency of port services no longer rely solely on traffic capacity but also on the quality and extent of all activities related to port operations and logistics. This evolution facilitates the flow of goods and reduces the time vessels and containers spend in ports.

The main question of this research is: **What global challenges do clusters face in adapting to the evolving dynamics of port logistics, particularly at Dubai port, and how do these issues reflect broader trends in the maritime industry?**

1) Maritime trade and developments in port activities:

Among the necessary means of transportation in international trade, we find maritime transport, which is relied upon by most countries, whether developed or developing, due to its characteristics that we do not find in other forms of transportation, such as land and air transport. Hence, the importance of the maritime transport sector for the state in developing its foreign trade becomes clear, which justifies the interest of governments in developing and supporting the maritime transport industry, by allocating a greater amount of investment to develop the activity of this sector in order to reduce its dependence on foreign transport services in transporting exports and imports, and bearing high transport costs that hinder the state's ability to export its products and maintain a competitive position in foreign markets¹. As is known, whoever has a competitive advantage in maritime transport inevitably controls international trade.

1-1) The role of maritime transport to attract investment:

Maritime transport is defined as the conveyance of goods or individuals aboard a fleet of ships, following guidelines established by international conventions. Ports, integral to this transport network, are characterized by the United Nations Convention on the Law of the Sea as part of the territorial sea, specifically located at the boundaries of its delimitation. Ports serve as permanent facilities that extend out into the sea, playing a critical role in the maritime transport system².

The importance of maritime transport in global trade is growing, primarily because it is the most energy-efficient mode of transportation per ton, making it environmentally friendly. The registration of vessels, whether for cargo or pleasure, has facilitated the globalization of ports and enhanced maritime safety. A ship may be registered in one country while its operator and owner are from different nations, which internationalizes shipping services. The choice of registration often depends on the quality of a country's infrastructure and logistical services. Each nation sets its own criteria for granting nationality to vessels, which influences registration conditions and the right to fly its flag. There must be a substantial connection between the state and the vessel for this relationship to be valid.

Consequently, high-quality maritime transport services at competitive costs not only bolster the trade of the involved countries but also attract foreign direct investment, acting as a catalyst for development. Globalization has led to increased maritime traffic and the proliferation of ports worldwide. For instance, the number of vessels transporting liquefied natural gas (LNG) has surged significantly over the past two decades, reflecting this trend³.

However, despite this growth, the global fleet of LNG carriers remains relatively small compared to other types of vessels, largely due to the inherent risks associated with transporting such hazardous cargo⁴.

The framework of maritime insurance has also evolved significantly, especially with the introduction of Incoterms, which clarify whether the importer or exporter is responsible for obtaining insurance and bearing transport risks. The main types of Incoterms are⁵:

- sale at Departure: The importer assumes all transport risks.
- sale at Arrival: The exporter assumes all primary transport risks.

Insurance contracts stipulate that one party, the insurer, will compensate another party, the insured, for losses incurred due to specific risks, in exchange for a premium. Once the responsible party for transport risks is established (seller or buyer), the next step is selecting the appropriate insurance policy.

1-2) Logistics and port services:

Renewing and modernizing port infrastructure and equipment are crucial for efficient transport operations and are vital for a country's trade competitiveness. Port logistics can serve as a barometer for the effectiveness of foreign trade policies or highlight deficiencies. For instance, reducing vessel waiting times in harbor and at docks attracts shippers, as it lowers port-related costs.

Investment in port equipment can be categorized into two main types:

1. new Port Projects: Establishing entirely new port facilities.
2. redevelopment and Modernization: Upgrading and enhancing existing ports.

The advent of satellite navigation has greatly aided transport operators in optimizing routes and adapting to varying weather conditions, leading to more accurate travel time predictions. Conversely, countries lacking adequate logistical infrastructure may face higher import costs and limited development opportunities, relying on modest levels of domestic and foreign investment.

In nations with robust logistical systems and easy access to modern technologies and skilled labor, significant investments are observed, particularly in organizational innovations, streamlining administrative and customs procedures, and efficient traffic management among ports ⁶.

International port logistics hinges on the effective management of personnel and cargo flows, ensuring swift loading and unloading while minimizing damages and losses.

Port logistics is closely associated with the expansion of various port services, including piloting, towing, mooring, dredging, bunkering, cargo handling, vessel maintenance and repair, passenger services, and warehousing. Ports are pivotal in both national and international logistics chains, playing an essential role in economic stability. They serve not only as global transport hubs but also as strategic points where value can be added to goods. A port-centric logistics approach focuses on maximizing activities conducted on-site at the port⁷.

The introduction of innovations in international freight transport, notably containerization, has accelerated global trade and driven a wave of innovations that have significantly transformed port communities. Port logistics also includes equipping vessels for commercial navigation, providing captains with essential navigation information for entering and operating in ports, and facilitating the use of powerful marine equipment for mooring and other operations.

2) Innovative approaches in smart maritime ports:

As ports navigate evolving political, economic, social, and environmental landscapes, they are undergoing significant transformations. Port logistics should broaden to encompass local community involvement and business participation, fostering development both within the port and in the surrounding areas. Ports are shifting from traditional, isolated border exchange points to active local business hubs, potentially playing a critical role in the economic growth of their communities.

2-1) The application of cluster theory to smart maritime ports:

The application of cluster theory to maritime ports emphasizes the benefits derived from agglomeration economies among complementary activities related to shipping and cargo handling. This includes a network of interdependent professions—such as pilots, tugboat operators, dockworkers, port authorities, shipping agents, freight forwarders, and various transporters—all working together to ensure the smooth flow of goods. This geographical concentration within urban port areas justifies the classification of these interrelated entities as a cluster⁸.

Clusters represent value chains composed of businesses located in port areas that add value to goods. These businesses often manage various segments of the supply chain. Research has shown that such clusters can significantly reduce costs and enhance productivity. By vertically integrating activities within the port, they minimize unnecessary transportation, decrease truck mileage, alleviate congestion, and reduce greenhouse gas emissions. Additionally, these clusters improve supply chain efficiency, create jobs, and contribute to local economic development.

This economic system is characterized by its local focus and the relationships it maintains with other territorial elements. The interactions among cluster components and external entities are dynamic, changing over time. Clusters typically exhibit specialization in one or more sectors, particularly in logistics activities related to cargo handling, intermediary services, insurance, and consultancy.

Such clusters strengthen the port's role in the region by offering a diverse array of services to port users, generating additional revenue for ports, and creating job opportunities for the local workforce⁹. Furthermore, the activities of these clusters positively influence transport networks by centralizing operations at the port, thereby reducing road traffic and transport times for goods while enhancing overall transport efficiency. Additional benefits of these clusters include access to stored resources, the development of training programs, and the facilitation of knowledge exchange, which promote international trade and attract foreign investment¹⁰.

The performance of a port cluster is evaluated based on job creation and regional value addition. In this context, the port authority plays a crucial role in organizing the cluster, enhancing the competitiveness of enterprises by facilitating access to innovations, promoting the port's commercial viability, developing workforce skills, and providing strategic management tools in collaboration with educational institutions.

2-2) Case studie Dubai port:

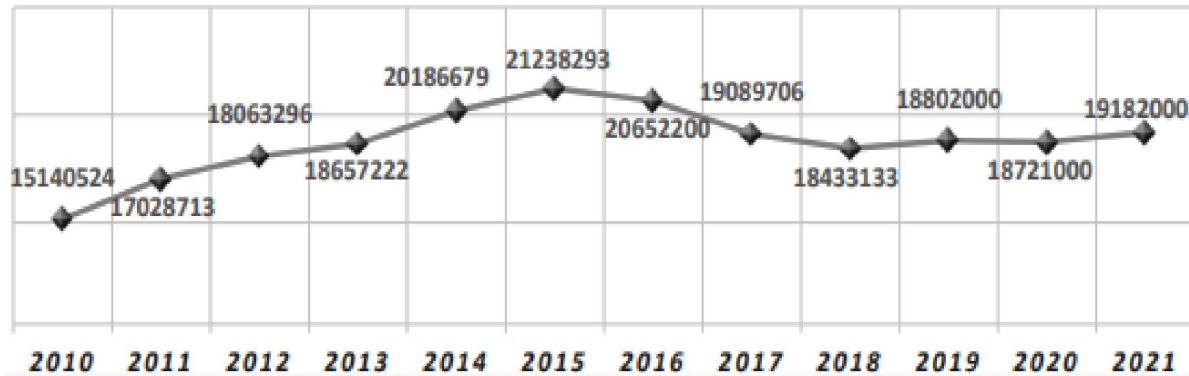
DP World was officially established in September 2005 following the merger of Dubai ports authority and Dubai ports international, becoming one of the world's largest port operators. In 2008, DP world recorded a sharp growth, with the number of containers handled reaching 11.8 million. DP

World is one of the world's largest marine terminal operators, operating more than 78 ports and marine terminals across the world's continents¹¹.

The ports cluster, part of the AD ports group, manages ten ports and terminals that facilitate trade while enhancing capacity and connectivity for Abu Dhabi to the global market. This cluster aims to promote sustainable growth by establishing partnerships with market leaders, both local and international, including ADNOC, COSCO SHIPPING Ports, CMA CGM Group, MSC Shipping, and Autoterminal Barcelona. The emphasis is on diversifying and expanding capacities to meet the diverse needs of customers, thereby solidifying Abu Dhabi's position as a global hub for trade and logistics.

In this context, the Dubai maritime cluster office, established by the dubai maritime city authority (DMCA), plays a vital role in supporting Dubai's maritime sector. This office is responsible for implementing the dubai maritime sector strategy (mss), which aims to position the emirate as a global leader in the maritime industry. By promoting cooperation among government agencies, private entities, and local, regional, and international maritime organizations, the office strengthens Dubai's global competitiveness. The importance of Dubai port is evident from the increasing number of containers passing through this important port, as shown in the following figure:

Figure - Container flow at dubai ports during the period (2010-2021)



Source : محمد لمين حلاط كيحل (2024)، «دور لوجستيات النقل البحري في نمو تجارة إعادة التصدير-دراسة تجارب عض الدول المصدرة للنفط-»، أطروحة دكتوراه ل.م.د.الطور الثالث في العلوم التجارية، تخصص تسويق دولي، كلية العلوم الاقتصادية والعلوم التجارية وعلوم التسيير، جامعة غرداية، ص 137 (نقلا عن: البنك الدولي، «حركة النقل في موانئ الحاويات (وحدات تعادل 20 قدما)» بيانات مجموعة البنك الدولي، على الخط، <https://data.albankaldawli.org/indicator/IS.SHP.GOOD.TU>

Container traffic at Dubai ports has grown by 21% in recent years during the period (2010-2021), and the period (2014-2016) witnessed record growth, exceeding the threshold of 20 million standard containers that were handled during this period. In contrast, the years that followed witnessed a slowdown in growth by -9.18 % in 2017 to reach 19 million containers and by -3.86% in 2018, with a total of 18.43 million containers. During the year 2021, container handling at the UAE ports increased to exceed the threshold of 19 million containers, with a growth of 2.71% compared to the previous year.

When fully operational DWC will comprise six clustered zones with estimated employment opportunity for 750,000 people. The following facilities will be provided within the complex¹²:

- five parallel runways;
- three passenger terminals including two luxury facilities;
- multiple concourses;

- sixteen cargo terminals;
- executive and Royal jet centres;
- hotels and shopping malls, office and residential areas;
- support and maintenance facility for aircrafts;
- a high speed express rail system linking with the city of Dubai proper.

Maritime clusters in Dubai serve as engines of transformation, creating an integrated ecosystem that fosters innovation, efficiency, and sustainability. They are essential for addressing future challenges and driving economic growth in the emirate, positioning Dubai as a leading global maritime center. Clusters play a critical role in transforming Dubai's ports into smart operational centers. They optimize maritime operations through an integrated approach that encourages collaboration among various stakeholders. It is also known as additional obligations related to access and use of port services on reasonable and non-discriminatory terms for services commonly available in ports such as guidance and towing operations and navigational facilities, refueling and provisions, waste disposal and emergency operations for ships for example, ship repair is an important activity in ports, as many ships may break down in ports for any reason, which requires repairing those malfunctions, and these ships resort to carrying out maintenance work inside those ports in order to save costs while they are on them due to loading and unloading operations. Maintenance operations are not limited to repairing the ship's hull only, but also include repairing many sensitive devices operating in it and used in ships, including navigation devices that use satellites, sonar, radar, wireless and other navigation devices¹³.

This effectiveness is shown through several indicators, the most important of which is the short duration of ships docking at the port, such that despite the large number of ships passing through the port of Dubai, the duration of docking does not exceed one day, as shown in the following table:

Table – Duration of container ships docking at dubai ports during the period (2018–2020)

Years	Duration of berthing	Number of container ships
2018	0.91	7111
2019	0.93	7082
2020	0.95	7612

Source : محمد لمين حلاط كيجل, *op.cit*, p. 137.

In general, the duration of ships' stay in the Dubai ports does not exceed one day, which is considered a very positive element for global shipping companies, in order to complete their sea voyage, which usually involves stopping at several international ports. The longer they stay in the ports, the longer the delivery period of goods increases, and thus additional costs. We also note that during 2019, there was a decrease in the number of ships stopping in the dubai ports due to the recession that the world witnessed as a result of the outbreak of the corona pandemic, which affected several sectors, including the industrial sector, which resulted in the closure of factories and consequently the contraction of exports due to a shortage of supply. However, during 2020, after the situation recovered, the ports witnessed an increase in the number of container ships docking with 7,612 stops, which is the largest number recorded during the period (2018-2020), and this affected the duration of their docking as a result of the congestion of containers in the UAE ports and the handling operations taking a long time. Akbar, as the anchorage period in 2020 was 0.95 days, while in 2018 it was only 0.91 days¹⁴.

Here are key points illustrating the importance of clusters in Dubai's port sector:

- synergy among stakeholders: clusters facilitate collaboration between maritime businesses, local authorities, and academic institutions, fostering a dynamic ecosystem that encourages innovation;
- improved efficiency: enhanced coordination within clusters leads to more efficient management of cargo flows, reducing wait times and increasing productivity at the ports;
- attracting investments: a well-organized cluster presents an attractive value proposition for investors, reinforcing dubai's reputation as a prime destination for maritime enterprises;
- sustainable development: clusters promote sustainable practices, contributing to reduced carbon footprints in port operations and the preservation of the marine environment;
- skill development and training: initiatives like the Dubai maritime training center aim to build the necessary skills within the maritime sector, ensuring a competitive and sustainable workforce;
- technological innovation: clusters encourage the adoption of advanced technologies, such as the internet of things (iot) and data analytics, to enhance port management and optimize logistics services.

Conclusion:

The expansion of maritime trade is inherently tied to innovations in port and logistics services. The reliability of the maritime system is maintained through coordination among various stakeholders, including operators, freight forwarders, shippers, dockworkers, customs officials, and vessel services such as piloting and towing. Therefore, establishing efficient logistics is not merely an option but an essential asset for adapting to economic changes.

Clusters can greatly assist port authorities in seamlessly integrating their operations into wider transport networks while fostering a positive relationship with their surrounding environments. This dual approach allows ports to effectively balance economic growth with social and environmental responsibilities. As a result, ports are positioned to play a vital role on international, national, and local levels, significantly contributing to regional development.

In the context of Dubai, the strategic development of maritime clusters has elevated the emirate's status as a global trade hub. By leveraging advanced technologies and fostering collaboration among various stakeholders—including government entities, private companies, and academic institutions—Dubai's ports enhance operational efficiency and attract foreign investments. These clusters not only streamline logistics and improve service delivery but also promote sustainable practices, positioning Dubai as a leader in maritime innovation. This commitment to balanced growth ensures that the port contributes positively to the local community and environment, reinforcing its role as a key player in both regional and global economic landscapes.

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