

Enhancing Taba Port for Efficient Maritime Connectivity in Aqaba Gulf Region

Prepared By
Hossam Al-Masri

Arab Academy for Science, technology and Maritime Transport (AASTMT)

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المستخلص:

تبحث هذه الورقة البحثية في تحسين ميناء طابا لزيادة قدرته وكفاءته. تشمل التحسينات المقترحة استيعاب السفن السريعة (HSC) القادرة على نقل الركاب والسيارات والحافلات من خلال تركيب رصيف عائم ثلاثي. كما يقترح البحث مساراً بحرياً من محطة الركاب في العقبة إلى ميناء طابا ليحل محل المسار الحالي من محطة يخوت العقبة. بالإضافة إلى ذلك، يوصي البحث باعتماد العبارات ذات النهاية المزدوجة وتنفيذ نظام النافذة الواحدة بين موانئ طابا والعقبة. يحلل البحث بيانات إحصائية على مدى سبع سنوات حول حركة البضائع والركاب، مما يبرز الانخفاض في أعداد الركاب والحاجة إلى فصل العمليات بين حركة البضائع والركاب. باستخدام تحليل نقاط القوة والضعف والفرص والتهديدات (SWOT)، تستكشف الدراسة نقاط القوة والضعف والفرص والتهديدات لتوجيه التدخلات الاستراتيجية. تهدف هذه التحسينات إلى زيادة حركة الركاب، وتعزيز السياحة، والمساهمة في التنمية الاقتصادية للمنطقتين مع تعزيز الاستدامة والكفاءة التشغيلية.

الكلمات الرئيسية: ميناء طابا، ميناء العقبة، المسار التجريبي، رصيف عائم ثلاثي، العبارات الكهربائية ذات النهاية المزدوجة

Abstract:

This research paper investigates the enhancement of Taba Port to boost its capacity and efficiency. The proposed improvements include accommodating Hover Speed Craft (HSC) capable of transporting passengers, cars, and buses by fitting triple pontoons. A new marine route from Aqaba Passenger Terminal to Taba Port is suggested to replace the current route from Aqaba Yacht Terminal. Additionally, the adoption of double-ended ferries and the implementation of a single-window system between Taba and Aqaba ports are recommended. The paper analyzes seven years of statistical data on cargo and passenger movements, highlighting the decline in passenger numbers and the need for operational segregation between cargo and passenger traffic. Utilizing SWOT analysis, the study explores strengths, weaknesses, opportunities, and threats to inform strategic interventions. These enhancements aim to increase passenger traffic, boost tourism, and contribute to the economic development of both regions while promoting sustainability and operational efficiency.

Keywords: Taba port, Aqaba port, Pilot route, Triple pontoons, Electric double-ended ferries.

1- Introduction

Taba Port, located on the northern edge of Egypt's Sinai Peninsula, is an important link in the Gulf of Aqaba's maritime network, close to the border and just 13 kilometers south of Eilat. It serves as a key gateway for trade and tourism between Egypt and neighboring countries. The maritime corridor between Aqaba Port in Jordan and the Egyptian ports of Nuweiba and Taba is crucial for regional trade and tourism. While Aqaba Port has robust infrastructure, Taba Port faces challenges due to its compact size and limited facilities, hindering efficiency and sustainable connectivity.

Over the past seven years, data on cargo, passenger, and car movements between Aqaba and Nuweiba ports shows a decline in passenger numbers, highlighting the need for this research. Segregating cargo and trucks from passengers, cars, and buses is crucial for operational efficiency. **The aim of this research paper** is to provide insights and recommendations for enhancing Taba Port's infrastructure and capabilities to address the declining number of passengers between Jordan and Egypt and position the area as a prominent port for passenger travel and tourism in the region. **The objectives** include identifying the factors contributing to the decreasing number of passengers, assessing the current state and challenges of Taba Port, and proposing enhancements to improve passenger comfort, eco-friendliness, and maneuverability.

A **SWOT** analysis will be conducted to examine the strengths, weaknesses, opportunities, and threats of the Taba and Aqaba maritime system. This analysis will guide strategic interventions aimed at improving the corridor's efficiency and sustainability. The success of the maritime voyage relies on three critical factors: Taba and Aqaba ports, the navigational route, and the vessels in operation.

By focusing on these factors, the SWOT analysis will highlight the strengths and opportunities within the system. Enhancing these through infrastructure improvements, operational enhancements, and technological innovations will ensure smoother maritime operations. This paper explores potential enhancements for Taba Port, emphasizing the port's strategic geographical location, multi-modal transportation capabilities, and strong trade relations.

Opportunities identified include the potential for infrastructure upgrades, eco-friendly transportation solutions, and advancements in digital transformation technology. Specifically, the study considers accommodating Hover Speed Craft (HSC), introducing new marine routes, and implementing advanced operational systems. These enhancements aim to transform Taba Port into a more efficient and sustainable maritime transportation network, leveraging its strengths and capitalizing on emerging opportunities in the region.

2- Research Framework and Methodology.

This research addresses the decline in passenger traffic between Jordan and Egypt, caused by traffic congestion and operational challenges. The lack of efficient segregation between cargo and passenger traffic is a key factor. The focus is on enhancing Taba Port and introducing comfortable, eco-friendly, and maneuverable equipment and vessels. By improving Taba Port's infrastructure, the goal is to establish it as a leading port for passenger travel and tourism in the region.

The research purpose is to propose solutions for enhancing Taba Port to improve efficiency, promote sustainable connectivity, and foster regional economic development. By addressing challenges in passenger traffic between Jordan and Egypt, the goal is to create a smoother travel experience and boost trade and tourism. The research questions focus on the importance of Taba port regionally, the main challenges it faces, potential enhancements to overcome these challenges, and the benefits and impacts of these enhancements on the port's efficiency, sustainability, and economic development.

This study adopts a mixed-methods approach, combining qualitative and quantitative research techniques to achieve its objectives. The methodology ensures the accuracy and reliability of the findings through a structured approach. Data on cargo and passenger volumes between Aqaba, Nuweiba, and Taba Ports over the past seven years were gathered from ASEZA (2023), reports, and relevant databases. Careful criteria were applied to select data, focusing on relevance and reliability, ensuring trustworthiness.

A thorough examination of the collected information was conducted using SWOT analysis, identifying strengths, weaknesses, opportunities, and threats in the maritime transportation system. The research process was transparent, with clear documentation of data sources, selection criteria, and analysis methods, allowing others to review and replicate the research. Ethical standards were maintained, with proper citation of all data sources to uphold academic integrity, and only existing data was used for research purposes.

A case study from Aqaba port, facing similar challenges, was utilized to enrich the research. Additionally, seven years of statistical data were analyzed to provide historical context. Acknowledging limitations such as potential biases in existing data and the absence of primary data collection methods, efforts were made to address these by critically analyzing data from multiple sources. The research paper used SWOT analysis to examine cargo and passenger volumes between Aqaba, Nuweiba, and Taba Ports, employing a descriptive and analytical approach while prioritizing transparency and ethical standards. The goal was to contribute to advancements in maritime trade.

3- Taba Port Overview

Taba Port, located at the northern tip of the Gulf of Aqaba in Egypt's Sinai Peninsula, serves as a marina terminal for small passenger ferries and catamarans. Despite its size and limited infrastructure, it attracts tourists due to its scenic beauty and strategic location, acting as a key entry point for visitors from neighboring countries (Ismail, 2019).

Taba Port has a rich history, serving as a key trading terminal since ancient times, dating back to the pharaohs. Over the years, it has been renovated and expanded to support growing trade and tourism (Ismail, 2019). Managed by the Egyptian Ministry of Transport, the Taba Marine Passenger Terminal offers services for both cargo and passenger vessels. It features modern facilities, including a passenger terminal building, parking areas, and cargo-handling equipment (Brida et al., 2018).

A market analysis shows Taba's strategic Red Sea location attracts small passenger ferries. Proximity to destinations like Petra and the Sinai Peninsula boosts its appeal. Developing Taba as a homeport for small cruise ships can enhance tourism and regional economic growth. The port has the infrastructure and services needed to support cruise market growth (Brida et al., 2018).

Research by Brida et al. (2018) highlights the importance of Taba Marine Passenger Port in providing a positive visitor experience. The study suggests improvements such as increasing staff to manage passenger traffic and enhancing communication about port procedures and facilities. These changes will improve the overall service quality at Taba Marine Passenger Port (Brida et al., 2018).

4- Aqaba Passenger Terminal

The Aqaba Passenger RORO Terminal, also known as Al-Yarmouk Terminal, is vital for connecting Jordan with the Middle East and beyond. It features modern facilities, including a customs clearance area, a passenger terminal building, and parking for 500 cars, facilitating the transport of people and goods between Jordan and regional countries, especially the Gulf States (Al-Kharabsheh and Al-Qudah, 2020).

The Aqaba Passenger Terminal is favored by shipping companies for its efficient services and modern facilities. It provides a reliable and cost-effective transportation solution, handling various types of cargo, including vehicles and containers. With a capacity of up to 500,000 passengers annually, it is a key gateway for regional trade and tourism (Aqaba Development Corporation, ADC) (2023)

Case Study: Implementing Aqaba Passenger Terminal with Triple Pontoon

The Aqaba Port Authority's implementation of a triple pontoon at the passenger terminal has been successful, despite challenges. This innovative solution increased the terminal's capacity for import and export activities by allowing simultaneous docking of up to three ferries. The triple pontoon has optimized operational efficiency and streamlined processes, contributing to the terminal's growth and success (Cargotec, 2012).

5- Data and SWOT Analysis

5-1 Data of Cargo and Passengers for the Last 7 Years

Transportation analysis between Aqaba Port and Nuweiba Port from 2016 to 2022 shows fluctuating trends. Passenger numbers fell from 318,028 in 2016 to 166,946 in 2022, with car transportation also decreasing from 7,071 in 2016 to 1,905 in 2021. Truck transportation peaked at 42,341 in 2022 and hit a low of 18,816 in 2020. These trends highlight concerns about efficiency and demand. Factors influencing these trends include trade shifts and economic fluctuations, affecting transportation dynamics. The decrease raises efficiency and sustainability issues, with negative economic and environmental impacts. Recommendations include prioritizing safety, promoting environmental sustainability, and modernizing infrastructure for long-term success (Alamouh et al., 2022). The table provides a summary of passenger, car, and truck transport

between Aqaba Port and Nuweiba Port from 2016 to 2022, highlighting transportation trends over this period. Source: ASEZA (2023).

Table (1) Cumulative Summary of Passenger, Car, and Truck Transport

Year	Number of Passenger	Number of Cars	Number of Trucks
2016	318028	7,071	37,173
2017	286994	5,555	35,302
2018	271092	5,649	41,672
2019	254446	4,353	41,507
2020 (Due to Corona Pandemic)	67479	390	18,816
2021	215967	1,905	27,058
2022	166946	3,914	42,341

Table (1) Cumulative Summary of Passenger, Car, and Truck Transport between Aqaba Port and Nuweiba Port (2016-2022). Source : (ASEZA. 2023)

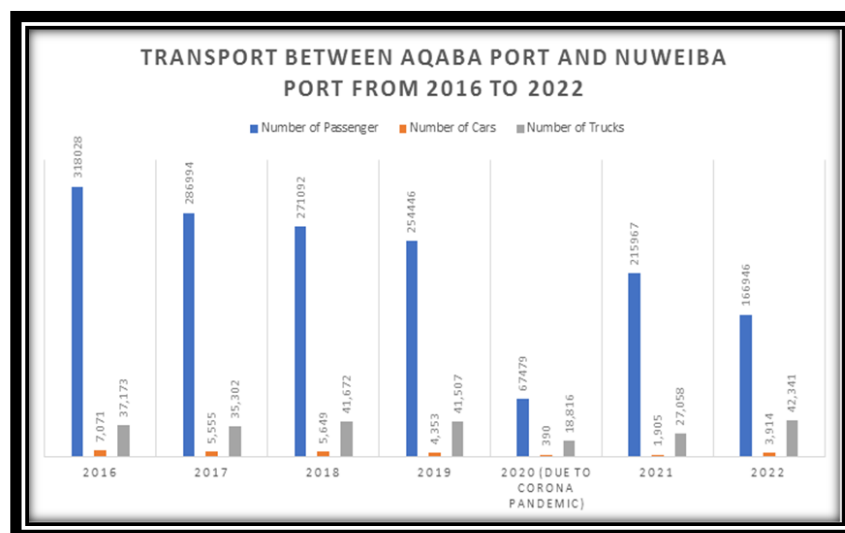


Figure (1): Transport between Aqaba Port and Nuweiba Port from 2016 to 2022. Source : (Al-Masri.H 2023)

The figure represents transport trends between Aqaba Port and Nuweiba Port from 2016 to 2022, showing numerical and percentage declines in transportation volumes. This visual aid complements the table data, helping to understand the observed trends in passenger and cargo transportation. Source: Al-Masri.H (2023).

5-2 Factors Contributing to Decreasing Passengers and Cargo

Passengers traveling between Aqaba, Nuweiba, and Taba ports face various difficulties. This section analyzes these challenges and explores factors contributing to the decline in passenger and

cargo numbers over the past seven years, including issues with the ferry fleet operating between these ports effected by:

Outdated Equipment and Technology: Outdated equipment at marine terminals negatively impacts passenger experience. Older ferries require frequent maintenance, causing disruptions and higher emissions. Prioritizing safety, adopting sustainable practices, and modernizing equipment can improve transportation and promote environmental sustainability (Melnyk et al., 2021).

Delays and Congestion: Factors such as adverse weather conditions and high passenger demand contribute to delays and congestion, resulting in long waiting times and overcrowded ferries (Medeiros, 2018).

Customs and Inspection Procedures: Customs and inspection procedures at border crossings further contribute to delays and inconvenience for passengers (Medeiros, 2018).

Limited Transportation Options: Limited transportation options at marine passenger terminals can hinder passengers' accessibility to their final destinations, making it inconvenient for travelers (Sharaan et al., 2017).

Environmental Implications: The transportation sector, including marine passenger terminals, affects the environment. Emissions from ships and ferries contribute to air and water pollution and climate change (Sharaan et al., 2017).

By addressing these difficulties, prioritizing safety and comfort, adopting sustainable practices, and modernizing equipment, Aqaba, Nuweiba and Taba ports can enhance passenger experience, promote environmental sustainability, and ensure efficient flow of people and goods.

5-3 SWOT Analysis for Enhancing the Transportation System between Taba and Aqaba Ports

This section utilizes a SWOT analysis to enhance the transportation system between Taba and Aqaba Ports, based on data showing declining cargo and passenger volumes from 2016 to 2022. The analysis considers infrastructure, operations, regulations, technology, market demand, competition, and environmental sustainability. The SWOT framework, a widely accepted strategic tool, evaluates internal and external factors affecting the transportation system (Macías Párraga et al., 2019).

Identify Strengths: Explore benefits of proposed solutions for enhancing maritime connectivity.

Understand the necessity of these solutions for future development (Ceyhun, 2019).

Recognize Weaknesses: Highlight challenges in implementing the proposed solutions.

Identify areas needing improvement (Mouzakitis et al., 2022).

Uncover Opportunities: Identify potential areas for further improvement in the maritime transport system (Ceyhun, 2019).

Capitalize on emerging trends and unmet needs (Munim et al., 2021).

Acknowledge Threats: Examine external risks to the successful implementation of proposed solutions.

Address and mitigate potential obstacles proactively.

4.3.1 SWOT Analysis of the Maritime Transport System between Taba and Aqaba Ports

This SWOT analysis provides insights into factors shaping the performance of the Taba and Aqaba Ports Transportation System. By examining strengths, weaknesses, opportunities, and threats, stakeholders can enhance efficiency and sustainability. Table 2 summarizes key findings.

Table (2): SWOT Analysis of the Maritime Transport System between Taba and Aqaba Ports

Strengths	Weaknesses
Strategic geographical location.	Outdated equipment and technology
Multi-modal transportation capabilities.	Delays and congestion due to weather and high demand
Strong trade relations between Jordan and Egypt.	Limited transportation options at terminals
Digital transformations improve efficiency	Challenges in implementing digital transformations

Opportunities	Threats
Potential for infrastructure upgrades and technological advancements.	Environmental implications of emissions from ships and ferries.
Increasing eco-friendly transportation solutions.	Competition from alternative transportation modes.
Collaborative initiatives to streamline customs and inspections.	Political and regulatory uncertainties impacting cross-border trade.
Advancements in digital transformations technology	Digital security risks

Source: (Author. 2024)

• **Strengths:**

Multi-Modal Transportation Capabilities: Multimodal transport refers to the seamless movement of goods under a single contract but performed with at least two different modes of transport. This can include combinations of maritime, road, rail, and air transportation. The objective is to leverage the strengths of each mode to ensure efficient, cost-effective, and timely delivery of goods. The Multimodal Transport could be Achieved by: Integrated Infrastructure,

Intermodal Facilities, Standardized Documentation, Coordination and Communication, Regulatory Framework (Wisetrungrot, 2020)

This enhances accessibility and flexibility in logistics operations, allowing for optimized routing and cost savings, and improving overall supply chain efficiency (ABM, 2023).

Strategic Geographical Location: Facilitates trade routes between the Red Sea and the Mediterranean (Al-Kharabsheh and Al-Qudah, 2020).

Ideal for transshipment activities and fostering regional connectivity.

Strong Trade Relations: Robust trade ties between Jordan and Egypt ensure consistent cargo flow.

Established partnerships support economic growth and regional cooperation.

Digital transformations improve efficiency: Automation of tasks and real-time analytics contribute to safety and security (Mouzakitis et al., 2022).

• Weaknesses:

Outdated Equipment and Technology: Outdated infrastructure and technology hinder operational efficiency and passenger experience (ABM, 2023).

Urgent upgrades needed to modernize facilities and enhance competitiveness.

Delays and Congestion: Adverse weather conditions and high passenger demand often result in delays and overcrowding at terminals (Liebreich et al., 2021).

Limited Transportation Options: Insufficient variety of transportation services at marine terminals limits passenger convenience and cargo throughput (Macías Párraga, et al., 2019).

Challenges in implementing digital transformations: Managing large datasets effectively requires substantial investment and raises ethical concerns regarding privacy (Ceyhun, 2019).

• Opportunities:

Infrastructure Upgrades and Technological Advancements: Modernizing terminals, equipment, and digital systems can enhance efficiency, safety, and customer satisfaction (Liebreich et al., 2021).

Eco-Friendly Transportation Solutions: Growing demand for sustainable transport options presents an opportunity to explore electric ferries and green practices (Liebreich et al., 2021).

Collaborative Initiatives with Stakeholders: Engaging customs, inspection agencies, and logistics partners in collaborative initiatives can streamline processes and improve system performance (Al-Kharabsheh and Al-Qudah, 2020).

Advancements in digital transformations technology: Technological advancements present opportunities to improve forecasting accuracy and enable real-time data collection (Munim et al., 2021).

• Threats:

Environmental Implications: Emissions from ships and ferries contribute to pollution, increasing regulatory pressure to adopt cleaner technologies (ABM, 2023).

Competition from Alternatives: Rival transportation modes, such as land-based routes and air transport, pose a threat to the maritime corridor's market share (Macías Párraga, et al., 2019).

Political and Regulatory Uncertainties: Geopolitical shifts and regulatory changes can disrupt cross-border trade, affecting the corridor's stability and profitability (Al-Kharabsheh and Al-Qudah, 2020).

Digital security risks: Digital security risks like cyberattacks and regulatory challenges related to compliance with evolving laws (Munim et al., 2021).

By leveraging this SWOT analysis, stakeholders can make informed decisions to enhance economic growth and promote environmental responsibility in the maritime sector (Munim et al., 2021).

6- Implementation of Voyage Key Factors

The focus is on implementing Key factors for the Taba-Aqaba maritime voyage. These include port infrastructure, navigation routes, and vessel operations. The aim is to enhance these elements to ensure efficient and sustainable transportation operations.

6-1 The feasibility of implementing pilot route.

A pilot route is a trial phase for testing a new transportation route on a smaller scale before full implementation, aiding in data collection, feasibility evaluation, and operational adjustments for success (Chou et al., 2021). While a suggested maritime route is a proposed path for maritime transportation, typically recommended based on factors like navigational safety, efficiency, and economic considerations, often involving the identification of optimal routes between ports or destinations (Entringo, 2020).

Implementing a pilot route between Taba and Aqaba ports for RORO passenger ferries is crucial for testing the feasibility of a new transportation route on a smaller scale before full implementation. The suggested maritime route aims to optimize transportation between Taba and Aqaba ports by addressing several key factors. Firstly, it offers a more direct and shorter distance, enhancing comfort for passengers. Secondly, Aqaba Passenger Terminal can accommodate cars, unlike Aqaba Marina, making the route suitable for both passengers and cars. Thirdly, maneuvering with double-ended ferries is easier, streamlining operations. Lastly, using electric ferries promotes eco-friendliness by reducing emissions. Cooperation between government entities is crucial, and monitoring passenger satisfaction and economic impact is essential for further improvements. Overall, the pilot approach enables feasibility evaluation, identifies challenges, and fosters enhanced connectivity between Taba and Aqaba ports (Liebreich et al., 2021). Changing the departure point to Aqaba Passenger Terminal reduces the trip distance from 10 NM to 6 NM, as shown in Figures (2) and (3), highlighting the route's efficiency.

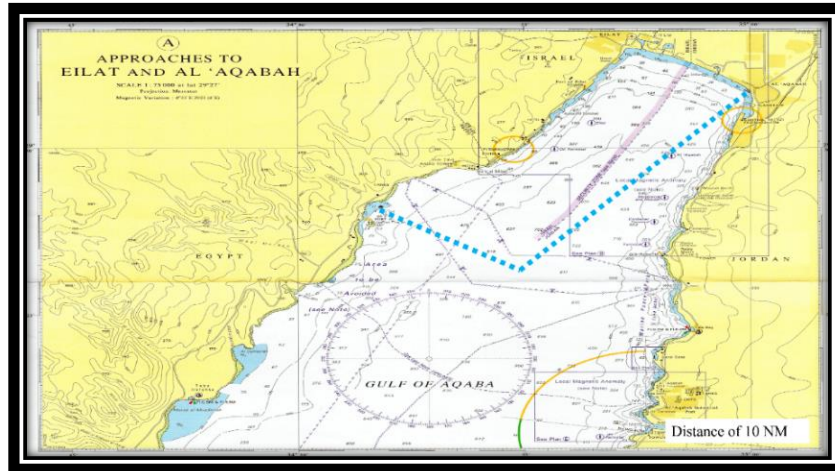


Figure (2): Route and Distance between Taba Marina Port and Aqaba Passenger Marina. Source: (Admiralty. 2021)

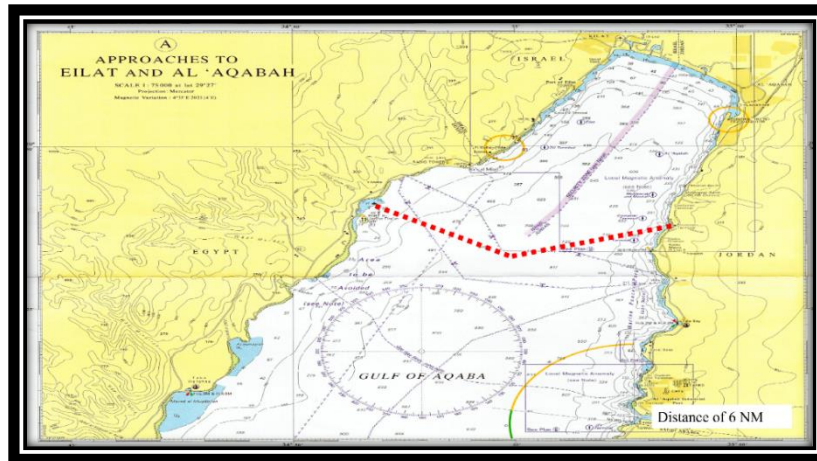


Figure (3): Suggested Route and Distance between Taba Marina Port and Aqaba Passenger terminal. Source: (Admiralty. 2021)

6-2 Infrastructure Development at Taba Port

Improve Taba Port's infrastructure to accommodate both passengers and cars, enhancing services and offering environmentally friendly transportation options. Necessary upgrades needed to enable the loading and unloading of cars alongside passenger traffic (Abdul Azim, 2017). Additionally, Cargotec designed, built, and installed a specialized floating pontoon linkspan in Aqaba Port, Jordan, facilitating RORO and passenger ferry traffic (Cargotec, 2012).



Figure (4): Triple-berth pontoon linkspan

Source: (Cargotec, 2012)

The pontoon completed in 2011 and prefabricated in Croatia, features three 25-meter-wide ferry berths and a 15-meter-wide by 26-meter-long Linkspan Bridge, accommodating three vehicle lanes and two walkway lanes. It is independent of tidal variations and ship trim, demonstrating Cargotec's engineering and supply chain management expertise. This project serves as a best practice example for developing Taba passenger terminal to handle cars and passengers simultaneously (Cargotec, 2012).

6-3 Enhancing Ferries Performance and Operations

Enhancements to the ferry services should improve maritime travel between Taba and Aqaba. This includes two-end ferries capable of accommodating cars and buses alongside passengers, aiming to enhance the overall travel experience. Additionally, the suggestion involves utilizing eco-friendly electric ferries to reduce emissions and promote environmental sustainability. These upgrades aim to optimize transportation efficiency and contribute to a greener maritime industry (Munim et al., 2021).

To conduct this proposal, the funding aspect is crucial. Given that this is a small project with high income potential, it should be a governmental project managed by the Arab Maritime Bridge Company (ABM). The ABM company was established through the cooperation of three governments: the Egyptian, Jordanian, and Iraqi governments. This governmental backing ensures that the project has the necessary support and resources to succeed. Additionally, the high-income potential of this project makes it an attractive investment, further justifying its management under a governmental framework by ABM (ABM 2023).

Conclusion and Recommendation

6-4 Conclusion

In conclusion, this research paper highlights key challenges and opportunities within the Taba and Aqaba Ports Transportation System. By addressing operational inefficiencies, infrastructure limitations, and environmental concerns, identifying areas for improvement. Enhancing port

infrastructure, streamlining operational procedures, promoting intermodal transport, and segregating passenger and cargo traffic are crucial steps to optimize efficiency and sustainability. To address these challenges comprehensively recommended the implementation of pilot routes, vessel upgrades, and operational enhancements. By introducing new ferries capable of accommodating cars and buses, utilizing eco-friendly electric ferries, and improving emergency response preparedness, stakeholders can enhance the overall travel experience and promote environmental sustainability. These measures aim to transform the Taba and Aqaba Ports Transportation System into a model of efficiency, connectivity, and environmental responsibility. In summary, embracing these recommendations and fostering collaboration among stakeholders will ensure the continued growth and prosperity of the maritime corridor. This approach will contribute to economic development, enhance regional connectivity, and pave the way for a greener future.

6-5 Recommendation:

To optimize the Taba and Aqaba Ports Transportation System, stakeholders should:

- 1- Implement pilot routes for RORO passenger ferries between Taba and Aqaba ports.
- 2- Upgrade Taba Port infrastructure to accommodate cars alongside passengers.
- 3- Upgrade vessels to accommodate cars and buses and adopt eco-friendly electric ferries.
- 4- Improve operational procedures to minimize waiting times and reduce congestion.
- 5- Develop and update emergency response plans.
- 6- Encourage intermodal transport connections for improved efficiency.
- 7- Segregate passenger and cargo traffic to reduce congestion and emissions.

These actionable recommendations intended to guide stakeholders involved in the Taba and Aqaba Ports Transportation System. By implementing these measures, the maritime corridor can transition toward a more sustainable and efficient future while maintaining its crucial role in regional and international trade.

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