The Role of Developing Dry Ports and Logistics Zones in Enhancing the Belt and Road Initiative in Egypt

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دور تطوير الموانى الجافة والمناطق اللوجستية في تعزيز مبادرة الحزام والطريق في مصر

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ABSTRACT

This paper explores the critical role of developing and managing dry ports and logistics zones in advancing the Belt and Road Initiative (BRI) in Egypt.

As global trade expands and international supply chains evolve, dry ports have become essential in alleviating seaport congestion, reducing transportation expenses, and enhancing multimodal logistics operations. Egypt's distinctive geographical position, plentiful natural resources, and the Suez Canal Economic Zone establish it as an essential ally in the Belt and Road Initiative. The study used a mixed-methods approach, integrating theoretical analysis with empirical investigation, to explore the correlation between dry port development and the effective execution of the BRI in Egypt. The results indicate significant positive relationships among the creation and administration of dry ports, the provision of integrated logistics services, and the achievement of BRI objectives. The findings highlight the importance of contemporary logistics infrastructure in improving trade connections, drawing foreign investment, and establishing Egypt as a pivotal logistics center connecting Africa, Asia, and Europe. Policy proposals underscore the necessity for ongoing investment in dry port expansion, intermodal transport integration, and public-private partnerships to maintain Egypt's position within the global commerce network.

Keywords: Belt and Road Initiative, Dry Ports, Logistics Zones, Egypt, Multimodal Transport, Suez Canal, Supply Chain, Trade Facilitation, Infrastructure Development, Economic Connectivity.

ملخص

يختبر البحث العلاقة بين الدور المحوري لتطوير وإدارة الموانئ الجافة والمناطق اللوجستية في دفع مبادرة الحزام والطريق (BRI) في مصر. حيث مع توسع التجارة العالمية وتطور سلاسل الامداد الدولية، أصبحت الموانئ الجافة أساسية في تخفيف ازدحام الموانئ البحرية، وخفض تكاليف النقل، وتعزيز العمليات اللوجستية متعددة الوسائط، كما أن الموقع الجغرافي المتميز لمصر، ومواردها الطبيعية الوفيرة، والمنطقة

الاقتصادية لقناة السويس، تجعلها حليفًا أساسيًا في مبادرة الحزام والطريق. حيث تغطي مبادرة الحزام والطريق التعاون والتبادلات في مجالات التجارة والبنية التحتية والثقافة وتتوافق المبادرة مع الأهداف التنموية للصين والدول العربية. اعتمدت الدراسة نهجًا وصفي تحليلي، لاستكشاف العلاقة بين تطوير الموانئ الجافة والتنفيذ الفعال لمبادرة الحزام والطريق في مصر. وتشير النتائج إلى وجود علاقات إيجابية مهمة بين إنشاء وإدارة الموانئ الجافة، وتوفير الخدمات اللوجستية المتكاملة، وتحقيق أهداف مبادرة الحزام والطريق. تُسلّط النتائج الضوء على أهمية البنية التحتية اللوجستية المعاصرة في تحسين الروابط التجارية، وجذب الاستثمارات الأجنبية، وترسيخ مكانة مصر كمركز لوجستي محوري يربط بين أفريقيا وآسيا وأوروبا. وتوضح التوصيات على ضرورة الاستثمار المستمر في توسيع الموانئ الجافة، وتكامل النقل متعدد الوسائط، والشراكات بين القطاعين العام والخاص للحفاظ على مكانة مصر ضمن شبكة التجارة العالمية.

الكلمات المفتاحية: الموانئ الجافة، المناطق اللوجستية، مبادرة الحزام والطريق، النقل متعدد الوسائط، سلاسل الامداد، تطوير البنية التحتية.

1-1 Introduction

Dry ports have been essential for enhancing trade and increasing Egyptian exports. Customs warehouses have been shown to struggle with accommodating containers, resulting in heightened costs from extended storage on seaport piers and susceptibility to damage. The significance of developing dry ports arises from enhanced competitiveness and the expansion of global trade volume and movement. This has resulted in heightened demand for transportation services and the necessity to enhance them. This is accomplished by the use of logistical principles pertaining to supply chains, distribution centers, dry ports, and more domains. This seeks to lower production expenses, mitigate congestion and overcrowding at seaports, enhance production and distribution processes, and deliver logistical services via an integrated system encompassing multimodal freight transport operations, container handling facilities, suitable infrastructure, and new road, transportation, and communication networks. In recent years, company management has shown a growing interest in logistics operations. Administrative executives are convinced that attaining a competitive edge and enhancing revenues stems from obtaining customer satisfaction at the lowest overall cost while generating additional economic value (Shalaby, 2017). Notwithstanding its contemporary nature, the logistics system has undergone swift

evolution, resulting in the advent of numerous innovative concepts and trends within this domain. The significance of these initiatives is amplified by the worldwide interest in the logistics sector. The logistics sector is a prominent economic domain, contributing significantly to economic growth, job creation, investment attraction, and the facilitation of international trade. These initiatives have established the nations of the region as a nexus in international commerce. A significant area of advantage in this context is the "Belt and Road" program, introduced by China years ago, which aims to connect China with Asia and Europe through a network of land and maritime connections. The Belt and Road Initiative encompasses collaboration and interactions in trade, infrastructure, and culture, aligning with the developmental objectives of China and Arab nations. Since the inception of the China-Arab States Cooperation Forum, particularly following China's initiation of the Belt and Road Initiative in 2013, cooperation between China and Arab states has realized substantial advancements and notable accomplishments across diverse sectors. The Belt and Road Initiative has established a novel platform for China-Arab collaboration, enhancing momentum and expediting the strategic alignment between China and Arab nations. It has persistently intensified economic and trade collaboration, broadened social development partnerships, advanced peace and security cooperation, encouraged different cultural and interpersonal contacts, and facilitated communication across populations. All institutional activities have been conducted in a systematic and uninterrupted fashion.

The program seeks to leverage the substantial resources of over 60 partner nations to develop infrastructure projects, encompassing trains, ports, oil pipelines, communication networks, and utilities. It also seeks to establish the most extensive economic cooperation platform, which can be characterized as the preeminent global economic initiative of the century.

China has advanced technology, whereas Egypt has abundant resources, such as gold, gas, and oil in the Western Desert. Egypt possesses a distinctive geographical situation,

specifically situated between the Levant and the Maghreb, which enables the transit of buses and trucks via various ports for inter-Arab commerce. The ports comprise seven inland ports situated along the eastern, western, and southern borders; eight dry ports; five logistical zones; fifteen commercial seaports adjacent to the Red and Mediterranean Seas; eleven oil ports; seven mining ports; five tourist ports; and four fishing ports. This study aims to elucidate the significance of developing and overseeing dry ports in the context of advancing the Belt and Road Initiative in the Arab Republic of Egypt, in light of the increasing interest in logistics services.

2- Literature review

The establishment of dry ports and logistics zones has become essential in modernising trade and transportation infrastructure, particularly within extensive transnational projects like China's Belt and Road Initiative (BRI). As Egypt attempts to establish itself as a crucial logistics hub linking Asia, Africa, and Europe, comprehending the strategic significance of these infrastructural components is imperative. A thorough literature assessment is essential to examine current academic and policy dialogues about dry port development, logistics zone management, and their relationship with the aims of the BRI in Egypt.

This section intends to analyse pertinent studies and theoretical frameworks that elucidate the economic, logistical, and geopolitical ramifications of dry ports and logistics zones. It will examine how global experiences and exemplary practices might enhance Egypt's endeavors to optimize the advantages of the BRI. This literature review examines the current body of knowledge to identify research gaps, underscore the need of effective development and governance models, and contextualize Egypt within a wider global discoure.

2-1 Dry Ports and Logistics Hubs:

The notion of dry ports is a recent innovation developed for the execution of investment projects. Global trade has flourished, employing innovative methods and concepts to reduce total expenses. Seaport services have changed from being reliant on

geographic location and global trade routes to emphasizing cargo handling and storage operations within the port. The harbor served as the point of origin or destination for incoming or leaving merchandise. Currently, the seaport has integrated into the multimodal transport network, serving as a vital link within this system. Competition among ports has escalated in delivering integrated services for the transport chain, focusing on pricing strategies designed to offer exceptional services at competitive rates to attract new business ventures while retaining current ones. This is accomplished by connecting the seaport to inland regions (dry ports) via a transport network utilizing diverse modalities (land, river, rail) and a contemporary communications system to deliver current information.

2-1-1 What is dry port?

A dry port is an inland multimodal terminal directly linked to ports by high-capacity transit, allowing clients to dispatch or receive standard units as though they were at a seaport.

A dry port is the contemporary term for previously designated off-port storage facilities, currently referred to as public warehouses. These are sites established beyond seaports, and the concept of their establishment has gained prevalence in recent years. A dry port is managed by a governing body that supervises and executes its operations. This community is referred to as the "port community," analogous to terminology employed in seaports. This community comprises a customs committee to supervise operations, law enforcement personnel, representatives from the Export and Import Control Authority, customs brokers, and various governmental agencies to regulate the movement of products, particularly in relation to public warehouses. Nonetheless, a crucial distinction exists between a dry port and a customs warehouse, as the former is designated in the bill of lading as the ultimate destination through a seaport (Al-Nahrawy, 2014). A dry port is an inland multimodal terminal that is directly linked to seaports through multiple transportation methods, allowing customers to distribute or assemble their standard units as if they were at a seaport (Jeevan et al., 2018). A dry port is defined as a fully operational logistics platform that, in

addition to basic services like multimodal transportation and customs clearance, offers comprehensive services including warehousing, consolidation, maintenance, and repair of goods and both full and empty containers (Li et al., 2021).

A dry port is a facility suited for logistics, situated within a country, regardless of its proximity to seaports or industrial areas. It aims to enhance multimodal transportation, execute logistical strategies, mitigate congestion at seaports and airports, and offer value-added activities and services. These dry ports function as customs zones and require a specific infrastructure, encompassing both substructure and superstructure, that links them to several transit modalities and an exceptionally efficient communications network.

2-1-2 Strategies for Planning Dry Ports

In the planning of dry ports, it is crucial to identify the most significant existing and proposed industrial, agricultural, commercial, and mining clusters within the context of the state plan. This must encompass the assessment of existing and projected volumes and trajectories of cargo and container traffic on the principal transportation corridors for both domestic and international trade. This research examines foreign experience in building dry ports, either near to seaports or inland, to facilitate the transfer of best practices in the planning process, which is the initial phase of dry port development. The locations necessary for the establishment of logistics zones or dry ports are selected, and diverse engineering and field surveys are performed to ascertain the most appropriate sites for this initiative. These localities are represented on survey maps at a suitable scale. A timeline for the establishment of these ports and their corresponding logistical zones is formulated, predicated on anticipated requirements. A comprehensive plan for the dry port and the elements of the logistics zones at each location has been developed based on the preceding step. A conceptual design is developed to elucidate the elements of each site, assess the costs associated with the establishment of each dry port and logistics zone, allocate expenses among their components, and ascertain the operational mechanisms between these ports, zones, and all relevant entities. This is succeeded by suggesting ownership structures and alternatives for the establishment, management, and operation of ports and

logistics zones. Subsequent criteria are developed among these possibilities, and the most suitable options are selected based on worldwide experiences and the state's directives to promote the private sector. This is succeeded by assessing the anticipated financial and economic returns from the establishment and operation of these dry ports and logistics zones for each proposed site, as well as estimating the sovereign income generated by granting licenses for these dry ports and logistics zones. The existing pertinent legislation is concurrently examined, alongside the function of the Ministry of Transport, represented by the General Authority for Land and Dry Ports, and its suggested organizational framework, which may occasionally lead to the introduction, enhancement, or enactment of new legislation.

2-1-3 Prerequisites for the Establishment of a Dry Port

The subsequent parameters must be taken into account while designing a dry port are as follows:

- The dry port should be situated in proximity to transportation facilities to conserve substantial financial resources. It must be consistent with the comprehensive transportation infrastructure plan;

- Extensive regions must be accessible to facilitate the future expansion of the dry port;

- Railways, roads, and canals must be linked to the port, convenient access to railroads and roadways. It is advisable to position the port in proximity to places where containers will be delivered by inland waterways;

- The dry port should be situated strategically between production and consuming zones, or between industrial and residential hubs;

- Facilitation of communication among all stakeholders;

- Accessibility of energy, water, telecommunications, sewage systems, and transportation.....etc;

- Facilitation of issuing required licenses if any;

- Integration into the regional roadway system for the collection or distribution of products;
- Closeness to residential zones to entice employees and mitigate commuting and housing expenses.

2-1-4 Elements of Dry Ports

To enable dry ports to fulfill their roles, various criteria and requisite equipment must be accessible, as outlined by Hamed (2015); (GALDP) :

- Yards designated for incoming containers, empty containers, outgoing containers, and transit containers that have surpassed their designated waiting period at seaports;
- A facility for the loading and unloading of containers;
- Parking facilities;
- Customs offices and diverse exhibition and management facilities;
- Workshops for equipment, as well as for the preparation, cleaning, and repair of containers;
- Container lanes, cranes, hoists, and gates for the elevation and conveyance of containers;
- A weighbridge;
- A contemporary communications systems office for MTS Corporation.
- A loading platform for railway tracks.
- Sectors for facilitating commercial services (shipping agencies, customs, insurance firms, banking institutions, transportation contractor offices, customs clearing, and cafeterias).
- Enclosed and uncovered storage facilities.
- Refrigerated and frozen storage facilities.
- Cargo staging zones external to the port.

2-1-5 The primary functions of dry ports are:

1) Activating multimodal transport connections: The mode of transport is altered in dry ports as multimodal transport entails the conveyance of commodities using a minimum of two distinct modalities (maritime, aerial, terrestrial, or fluvial). Dry ports serve as the nexus and connection between various transportation modalities, and they are under the customs jurisdiction of each respective nation.

2) Realizing logistics concepts: Dry ports are crucial in facilitating transport logistics, linking networks, expediting customs clearance, and assuring the secure transfer of commodities across various transport modalities. The worldwide multimodal carrier is dedicated to executing supply operations to factories and distributing final products to the consumer market within stipulated timeframes, at minimal cost, and in a manner that satisfies consumer preferences. The logistics system integrates physical supply and distribution processes into a cohesive network, enhancing oversight of all transportation stages to minimize transportation costs and provide goods at competitive pricing. Dry ports for the procurement of raw materials facilitate logistics strategies by minimizing transportation costs for industrial components and enabling bulk purchasing to secure optimal pricing. Dry ports for the assembly of completed products minimize transportation expenses by combining all orders and dispatching them simultaneously. This minimizes distances owing to market proximity, while lowering manufacturing costs by decreasing inventory in factories, accommodating unforeseen orders, and alleviating administrative responsibilities and expenses linked to each order. Dry ports facilitate product distribution to markets by fulfilling logistical objectives through the preparation of specific market orders for all items, which are dispatched in a single batch tailored to each market's requirements. This facilitates the uninterrupted availability of products in marketplaces according to consumer

preferences and requirements, while also diminishing transportation expenses from manufacturers to the dry port for bulk shipping of commodities.

3) Mitigating congestion at seaports: Dry ports represent a contemporary initiative and a significant innovation within the globalization framework, owing to their integral role in the advancement of global trade and the utilization of containers for goods transportation, employing novel methodologies and concepts to minimize expenses and alleviate congestion at seaports. Seaports have evolved into integral components of the transportation network, and logistics zones have transitioned from mere sites for loading, unloading, and storage to facilities that incorporate dry ports for storage while also offering value-added logistical services. This has resulted in the mitigation of congestion at seaports, enhanced trading rates, augmented capacity, elevated productivity, and improved performance, hence providing a competitive edge over international ports in foreign trade. These ports are situated in the interior region.

2-2 What are the domains of logistics?

Logistics entails the administration of the movement of diverse resources, including goods, energy, information, and human services, from the production sector to the consumption sector. It also includes the methods and procedures that guarantee the transportation of items and materials from one location to another using various modes of land, sea, and air transport. The following table (1) illustrates the variability of logistics services:

Table 1- Types of logistics services

Basic logistics services	Supporting logistics services (added value services
• Transportation Services	• Quality control.
• Warehousing Services	• Repacking.
• Supply Services	• Assembly.
• Loading/Unloading of Goods	• Order processing.
• Container Packing	• Labeling and pricing.
• Providing general and specialized warehouses for refrigerated goods and general merchandise	• Merchandise inspection.
• Distribution Centers	• Packaging.

Basic logistics services	Supporting logistics services (added value services
• Receiving Shipments	• Repair and maintenance.
• Coordinating and Unloading Goods	• Reuse (recycling).
• Customs Clearance of Goods	• Labeling.

Source: General Authority for Land and Dry Ports, modified by the researchers.

2-2-1 Transport Services

The effective transportation of commodities and products to augment the value of logistics operations is crucial in converting resources into beneficial items for the end user. A freight broker is described as the entity that orchestrates a comprehensive transportation process and assumes contractual liability throughout, irrespective of whether they physically execute the transportation stages (Mustafa, 2017). The transportation function links the facility's resources and markets, making the expenditure on transportation and shipping services the predominant share of logistics sector cost. The ratio of transportation expenses to overall logistics costs fluctuates based on the industry's characteristics.

The significance of the transportation function arises from its capacity to confer spatial advantages to the product, as the velocity of product movement between locations is contingent upon the efficacy of this function (Dovbischuk, 2022). The mode of transportation influences the velocity of material delivery to the company, the degree of their safety, and the assurance against damage. The escalating utilization of containers, coupled with technological advancements that have enhanced freight transport systems across various modalities, has exerted a direct and substantial influence on the transport sector in all its manifestations and services. This is evident in maritime transport, where ports are vying to establish themselves as global hub ports. Organized shipping lines and international transport intermediaries have entered this competitive arena, extending beyond mere freight handling to vie for a share of the added value generated during the transport process from the origin to the destination. This competition has also permeated internally through logistics zones that offer comprehensive services, including container terminals, diverse storage solutions, packing and unloading services, retail and assembly

services, and packaging services. Consequently, notions have grown interwoven and interconnected, resulting in logistics services evolving into a holistic notion encompassing numerous integrated components.

The attainment of competitive advantage has become challenging without considering the critical role of logistics centers in the container transport system, international multimodal transport operations, the growing dependence on comprehensive service management to align with trade flows, and the ongoing enhancement of the electronic information exchange system (Ali, 2018).

The primary objective of the transportation function within the supply chain is to determine the most effective transportation methods and the most efficient operational processes to establish a transport network that delivers services to the consumer. The transport chain encompasses a series of activities pertaining to the technical and organizational movement of items from the supplier to the client. Contemporary machinery and technology apparatus have significantly contributed to the advancement of processes throughout diverse transportation industries. Trucks facilitate entrance and egress services between various transport modes (maritime and aerial), in addition to providing connectivity between these modes and railways (Mustafa, 2017). Transportation links diverse operations within the supply chain. In the absence of transportation, the entire system ceases to function. Consequently, transportation serves as the cohesive element that unifies the entire system. Moreover, an effective transportation system constitutes the foundation of a robust economy. Transportation has been crucial in the advancement of all industrialized nations. Consequently, transportation is the paramount activity inside the logistics system owing to its influence on customer service standards and cost framework.

It is feasible to differentiate between inbound and outbound logistics. Inbound pertains to the transfer of goods across various departments within warehouses, whilst outbound refers to the conveyance of products from the supplier to the customer. In this regard, transportation -as one of the core logistics activities- comprises items, modes of transport, and the transportation process. Time is crucial for the success of transportation logistics in

all its modalities, which depend on the ongoing advancement of the programs they employ. The internet's pivotal role is undeniable, as it has substantially decreased the time necessary for transportation operations by establishing an integrated network for information and data exchange, facilitating the tracking of goods, their movement, and the duration required to reach their destination.

2-2-2 Warehousing services

Warehousing services constitute an essential component in any firm, irrespective of its scale. This indicates their commitment to inventory management, encompassing raw materials, work-in-progress, finished goods, and other equipment. This constitutes a substantial proportion of overall service expenses (Herbert W. Davis & Co., 2005). Considering the significance of concentrating on the foundational principles of these operations, including maintaining labor flow and establishing essential systems for maintenance, repair, and spare parts, several objectives can be identified based on the nature of the activity. Identifying the purpose of warehousing is a crucial consideration when selecting a warehouse location. The objective may involve customer service (distribution), market expansion, or production services. The objective is to oversee customer service. The warehouse location must be proximate to the consumer, ensuring transparency and delivering optimal service. This provides reassurance owing to the psychological effects of proximity. Customers also excel in coordination, time management, and financial resources due to the proximity (Dovbischuk, 2022). Nonetheless, if the objective is to facilitate production management via the formal registration of production, the location must be proximate to production facilities, with licensing being of secondary importance to the delivery timeline. Furthermore, registration should occur only after the purpose of establishing the storage has been explicitly defined (Mustafa, 2017).

2-2-3 Distribution services:

This is the process by which products and services are acquired, responsible for delivering the appropriate materials at the right location, at the right time, in the right quantity, and at the right price. The primary aim of distribution is to fulfill customer demands by optimizing resource use, encompassing the allocation of capabilities, inventories, and labor. Distribution theoretically seeks to connect supply and demand while maintaining low inventory (Mostafa, 2017). The Just-in-Time production system is regarded as a pivotal supply chain methodology, and its contemporary implementation has substantially influenced the reduction of supply costs.

Logistics services converge to create supply chains, which consist of a series of organizations—facilities, functions, and activities—engaged in the production and distribution of products and services. The sequence commences with the primary providers of raw materials and radiates outward to the ultimate client, encompassing the following:

Facilities include warehouses, factories, operational centers, distribution hubs, and trade and agency offices.

Functions and operations include forecasting, procurement, inventory control, information management, quality assurance, scheduling, production, distribution, delivery, and customer support.

2-2-4 Logistical Services in Dry Ports:

The principal aim of dry ports is to facilitate multimodal transportation to fulfill logistical goals. Nonetheless, they require an infrastructure that links them to diverse transportation modalities and a highly effective communication network to avert congestion at maritime and aerial ports, so enhancing the nation's value. Consequently, dry ports have become essential to enhance trade and exports, as it has been demonstrated that customs warehouses cannot sufficiently hold containers. This results in heightened burdens from containers remaining on port docks for extended durations, along with their susceptibility to damage. The significance of developing dry ports arises from enhanced competitiveness and the expansion of global trade volume and movement (Shalaby, 2017).

This has resulted in heightened demand for transportation services and the necessity to enhance them through the use of logistics principles associated with supply chains, distribution centers, dry ports, and similar entities. This seeks to diminish production expenses, mitigate port congestion, enhance production and distribution processes, and offer logistics services via an integrated system comprising multimodal freight transport operations, container handling facilities, suitable infrastructure, and transportation and communication networks. Establishing supply chain infrastructure is a significant problem for governments and enterprises in their pursuit of an efficient logistics network to implement competitive strategies (Arora et al., 2016).

Dry ports serve as a strategic solution to mitigate seaport congestion, supply chain delays, and transportation costs while minimizing environmental impact. They enhance connectivity between ports and inland areas, alleviate land-related constraints that hinder seaport expansion, streamline the operation of the seaport supply chain, and bolster regional economic development (Feng et al., 2013). Ports are crucial in connecting transportation patterns, organizing cargo flows, and enhancing the utilization rate of transport modes. They additionally facilitate transit logistics, network connectivity, secure cargo distribution, and expedited customs clearance. Additionally, dry port concepts are categorized into three types: seaport-based dry ports, city-based dry ports, and border dry ports. To attain swift and superior development, secure additional cargo, and entice more shipping companies to utilize international dry ports in proximate regions, competition among dry ports has predominantly transitioned to international dry port logistics supply chains (Host et al, 2018). Consequently, dry ports may be seen as both standalone logistics systems and integral components of an extensive supply chain, offering a diverse array of value-added logistics services through integration and collaboration.

Several Egyptian ports are poised to adopt advanced logistics systems, encompassing all necessary services, infrastructure, and provisions for transiting vessels from arrival to departure. Maritime transport specialists ascribe this trend, alongside the increasing

impetus for modernization and alignment with global advancements, to the substantial rise in vessel traffic at Egyptian ports, which is partially due to early indications of enhancement in import and export activities.

2-3 The Belt and Road Initiative (BRI)

The Belt and Road Initiative (BRI) is a strategic development project aimed at reviving the ancient Silk Road through an integrated network of land and maritime routes, oil and gas pipelines, electricity transmission lines, telecommunications infrastructure, and airports. Its primary objective is to establish a new model for regional and international cooperation. Essentially, the BRI is a long-term development strategy launched by Chinese President Xi Jinping in 2013, positioning it as a major driver of both China's domestic policy and foreign policy. The initiative operates within the framework of China's soft power strategy, seeking to enhance its global status and influence as a responsible and peaceful nation (Al-Badrani & Nafi', 2020). Subsequently, the Chinese Ministry of Foreign Affairs and the Ministry of Commerce jointly issued an official document titled *Vision and Actions on Jointly Building the Silk Road Economic Belt and 21st-Century Maritime Silk Road*, which is regarded as the first official governmental document outlining the objectives of the BRI.

In pursuit of its aspiration to become a leading global and economic power, China has engaged in a series of ambitious agreements with multiple countries. As a major state located in a region marked by emerging markets, China has faced significant infrastructure gaps that have historically limited trade and economic growth potential. To address this, significant shifts in economic policy have been observed. Over recent decades, China has invested billions of dollars not only in developing countries across Africa and Asia but also in major global economies, including those in Europe and the United States (Shuai et al., 2019).

China has undertaken a rigorous global effort to bridge the infrastructure gap through the BRI, working in partnership with various multilateral development banks. The initiative connects numerous countries across East Asia and the Eurasian mainland, particularly those geographically proximate to China, thereby fostering enhanced regional trade. It is

estimated that total investments in this project could reach one trillion USD over a ten-year period (Rahman & Rahman, 2019). However, the volume of China's outward foreign direct investment (FDI) to host countries is influenced by several factors, including domestic business dynamics in China and the specific conditions prevailing in the participating countries of the BRI (Kankanam Pathiranage et al., 2020).

2-3-1 Historical Background of the Belt and Road Initiative

The ancient Silk Road originated from the Mediterranean region and historically extended from Greece towards the far south, facilitating the flourishing of international trade across the world. The total length of the Silk Road was approximately 12,000 kilometers, beginning from major commercial centers in northern China and branching into two main routes. The northern route passed through Eastern Europe, the Black Sea, the Crimean Peninsula, and ultimately reached Venice. In contrast, the southern route passed through Syria and extended either towards Egypt and North Africa or through Iraq and Turkey to the Mediterranean Sea (Mohamedien, 2022).

Historically, the road stretched approximately 5,000 miles, crossing many countries as it connected China with Persia, Syria, India, and finally the Mediterranean coast. The starting point of the road was the Chinese city of Chang'an, from where it followed the Wei River Valley towards the upper reaches of the Huang River on the northern edge of the Tibetan Plateau. From there, it turned northwest along the Nan Shan Mountains, passing through the Gansu Corridor, which constituted the natural western route. The city of Dunhuang marked the last Chinese station before the road entered the Taklamakan Desert. Beyond the desert was one of the greatest crossroads in Asia, where the Silk Road intersected with the north-south route connecting the Eurasian steppes to the north and the Indian plains to the south.

The route then continued to the city of Balkh, which served as a key junction leading towards the city of Antioch (modern-day Antakya). It passed through the Persian Plateau, reaching the ancient city of Hecatompylos, also known as the "City of a Thousand Gates."

The road then stretched to Ecbatana (modern-day Hamadan), located on the western edge of the Iranian Plateau. Finally, it descended from the Zagros Mountains towards the cities of Babylon, Seleucia, and Ctesiphon. The historical Silk Road was discontinued during the rule of the Ottoman Empire over Constantinople.
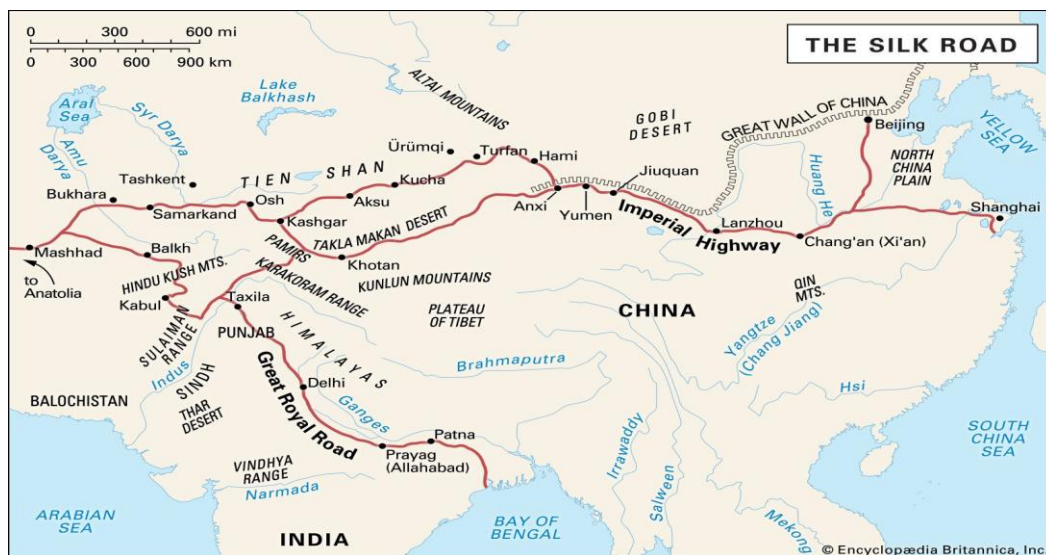

Fig., (1) Map of the Silk Road and Trade Routes in Asia.

Encyclopædia Britannica

According to the World Bank (2018),However, in the 1990s, initiatives emerged to revive this trade route under the name of the "New Silk Road." Among the most notable revival attempts during that period was the establishment of the Euro-Asian Land Bridge, which aimed to connect China, Russia, Mongolia, and Kazakhstan to Germany through an extensive railway network .

The initiative is divided into two main routes: a land-based route and a maritime route. The land-based route comprises an extensive network of roads and railways designed to connect China with Asian and European countries through three major corridors: the New Eurasian Land Bridge, the China-Mongolia-Russia Economic Corridor, and the China-Central and Western Asia Economic Corridor. The maritime route, on the other hand, aims to ensure secure maritime transport across the Indian Ocean, passing through the Suez

Canal by linking and developing key ports along the way. This route includes three major corridors: the China-Pakistan Economic Corridor, the Bangladesh-China-India-Myanmar Economic Corridor, and the China-Indochina Peninsula Economic Corridor.

Fig., (2), *Modern Belt and Road Initiative (BRI) Trade Routes: Land and Maritime Corridors*
https://www.worldbank.org/en/topic/regional-integration/brief/belt-and-road-initiative

2-3-2 The Belt and Road Initiative Currently

China's Belt and Road Initiative (BRI) functions as both a geo-economic and geopolitical mechanism within the framework of its peaceful rise strategy, which emphasizes economic development while avoiding political confrontation with the West. The BRI is grounded in multilayered economic partnerships with a broad spectrum of countries willing to participate—whether located along the land or maritime Silk Road routes or benefitting from them in any form. Beyond its economic and trade dimensions, the initiative incorporates cultural and environmental aspects, aiming to foster positive engagement and avoid reducing the project to a purely commercial exchange. This

positions the BRI as a strategic pivot in China's evolving interaction with the global economic order, marking a shift from passive adaptation to active participation in shaping the international environment (Al-Sharif, 2020).

Furthermore, China's approach reflects the emergence of a third generation of economic globalization——characterized by cooperation and inclusivity——contrasting with earlier phases: the first generation, dominated by U.S. hegemony, and the second, driven by Western corporate control (Radwan, 2021).

China has emerged as one of the world's leading economies in recent decades. It ranks second only to the United States as a global importer of goods, commodities, and raw materials, and held the top position in global exports of goods in 2017. This transformation marks China's shift from a developing country to a major economic power capable of challenging U.S. dominance in industrial and commercial sectors. Chinese multinational corporations now compete with American counterparts across diverse global markets (Shuai et al., 2019). This economic leap was facilitated by policies promoting openness and integration with emerging markets, most notably through the launch of the Belt and Road Initiative (BRI). The BRI is expected to open vast development opportunities for participating countries, including Iraq, which may benefit from key infrastructure projects such as the Grand Faw Port and the Dry Canal, should it join the initiative (Al-Humaidi, 2021).

Since the 1990s, China has worked to strengthen its economic and trade relations across various global regions, aiming to integrate its economy into the international system and position itself among leading regional and global economic powers. To this end, China pursues a strategy of diversifying partnerships to avoid overreliance on any single region. It has prioritized relations with resource-rich countries——particularly those with large markets and abundant natural resources, such as oil and minerals——given its status as the world's second-largest consumer of oil after the United States. These regions serve as both sources of energy and destinations for Chinese industrial and technological exports (Visvizi et al., 2019).

Moreover, China seeks to reshape the international economic order, traditionally dominated by the United States, toward a more multipolar system governed by diversified economic blocs and international actors. A central strategy in this vision is the Belt and Road Initiative, which encompasses land, maritime, and digital routes. Through this initiative, China aims to promote an alternative model of globalization—one that supports international economic cooperation across continents (Al-Khatib, 2019).

The Belt and Road Initiative (BRI) represents a natural extension of China's cumulative domestic and foreign economic policies. Among the key factors behind China's economic success has been its focus on infrastructure development, which—supported by substantial public investment—played a central role in revitalizing the economy by facilitating the movement of goods and people at lower costs (Jiang, 2020).

China envisions applying this developmental model globally through the BRI, aiming to promote economic growth along the Belt and Road corridors by strengthening infrastructure connectivity. This approach is intended not only to stimulate regional economic development but also to deepen China's economic integration with participating countries. Over the past five years, the initiative has expanded significantly. The number of participating countries has increased from 60 to 125, in addition to 29 regional and international organizations that have signed cooperation agreements and memoranda of understanding with China. This expansion reflects the BRI's growing global reach, extending its influence to Latin America and Africa.

2-3-4 The Objectives of the Belt and Road Initiative

The Belt and Road Initiative (BRI) seeks to revive the historical Silk Road routes— both maritime (the "belt") and overland (the "road")—which historically connected China with the rest of the world through the exchange of goods, ideas, and cultures. Rooted in the principles of the UN Charter and the Five Principles of Peaceful Coexistence—such as mutual respect for sovereignty and territorial integrity, non-aggression, non-interference

in internal affairs, and mutual benefit——the BRI reflects China's commitment to peaceful international engagement (Wei et al., 2019).

The BRI's operational framework emphasizes political coordination, trade facilitation, and open dialogue among participating countries to create enabling conditions for economic development. The initiative includes approximately 1,000 planned projects aimed at constructing an extensive network of roads, railways, ports, airports, free trade zones, energy pipelines, power grids, digital infrastructure, and communication networks to link Asia, Africa, and Europe. More than 70 countries, including several Arab and Middle Eastern nations, have actively engaged with the initiative through cooperation agreements and memoranda of understanding (Shuai et al., 2019).

The geographic scope of the BRI spans three tiers:

- **Core regions**: China, Russia, and the five Central Asian republics.
- **Adjacent regions**: Members and observers of the Shanghai Cooperation Organization, and the nine members of the Eurasian Economic Union (India, Pakistan, Iran, Afghanistan, Mongolia, Belarus, Armenia, Ukraine, and Moldova).
- **Peripheral regions**: Countries in West Asia (including Arab states), the European Union, Japan, South Korea, and other East Asian countries.

Within the peripheral regions, **Egypt plays a particularly strategic role** in the BRI, especially within the Maritime Silk Road component. Owing to its geographic position and control over the **Suez Canal**——a vital global trade artery connecting the Red Sea to the Mediterranean——Egypt serves as a critical transit hub linking Asian, African, and European markets. China has invested significantly in Egyptian infrastructure, particularly in the **Suez Canal Economic Zone**, recognizing Egypt as a key partner in the initiative's regional development strategy.

The BRI's overarching objective is to enhance infrastructure, trade, and investment ties between China and 86 participating countries, which together represent over 30% of global GDP, 62% of the world's population, and 75% of known energy reserves. It is

estimated that up to $1 trillion may be invested in BRI-related projects, with China expected to contribute as much as $150 billion annually to infrastructure development (World Bank, 2018).

Over the past five years, China's trade with BRI countries exceeded $5.5 trillion, accompanied by more than $80 billion in non-financial investment. Beyond bilateral cooperation, the BRI is increasingly recognized by the international community as a mechanism for enhancing global connectivity, promoting shared development, and addressing disparities in global economic growth (Suleiman, 2019).

Financing Mechanisms of the Belt and Road Initiative

- **Asian Infrastructure Investment Bank (AIIB)**: Proposed by China in 2013 and officially launched in 2015, the AIIB serves as a major funding mechanism for BRI projects. As of 2015, more than $160 billion in investments were either under review or implementation through AIIB financing.

- **Silk Road Fund**: Established in Beijing on December 29, 2014, with a capital of $40 billion, the Silk Road Fund is a limited liability company created under Chinese corporate law. It supports medium- and long-term investments aligned with BRI objectives in participating regions. The fund is market-driven and invests primarily in assets, loans, and financial instruments. Notably, it is not financed through foreign aid or grants, ensuring financial sustainability.

2-3-5 The Importance of the Belt and Road Initiative for Arab Countries

China aims to maximize the benefits of the Belt and Road Initiative (BRI) by significantly expanding trade with Arab countries in the coming years and increasing non-financial investment in the region over the next decade. Additionally, it seeks to enhance trade volumes with Africa, as the Silk Road routes connect most Arab countries, positioning them as key actors in regional development (Al-Badrani & Nafi, 2020).

To achieve these goals, several strategic steps are required:

1. **Political Coordination**: Engaging in dialogue on economic development strategies and policies, while designing joint plans and implementation mechanisms for Arab-Chinese cooperation.

2. **Transport Network Integration**: Gradually connecting cross-border roads and integrating Arab transport and logistics networks with those of Asia, Europe, and Africa.

3. **Trade Facilitation**: Digitizing trade procedures to enhance investment efficiency, remove commercial barriers, and accelerate economic activity, thereby optimizing the strategic potential of Arab countries involved in the BRI.

4. **Monetary Cooperation**: Promoting currency exchange using local currencies through bilateral and multilateral clearing systems. This includes establishing regional financial institutions for development. Notably, Egypt incorporated the Chinese yuan into the currency basket for Suez Canal transit fees and central bank operations. In December 2017, the Central Bank of Egypt also signed a bilateral currency swap agreement with the People's Bank of China.

5. **Establishment of an Arab Maritime Bloc**: Enhancing regional and global trade by leveraging the maritime dimension of the BRI, as mandated by Resolution No. 60 of the Executive Office of the Arab Ministers of Transport Council (April 2018).

According to the World Bank's Logistics Performance Index, the Gulf Cooperation Council (GCC) countries ranked among the top six performers in the Arab world, with notable global standing in sub-indices such as timeliness and international shipments. These findings underscore the strategic importance of establishing a unified Arab logistics hub that capitalizes on each country's comparative strengths in logistics services. The performance of GCC states in global logistics further highlights the need to sustain and increase investment in this critical sector.

2-4 Trade Relations Between Egypt and China

Trade relations between Egypt and China have witnessed consistent growth, reflecting the economic strength of both countries. In 2022, the volume of bilateral trade reached

approximately **USD 12.86 billion**, with **Egyptian exports to China totaling USD 863 million** (General Organization for Export and Import Control, 2022). Key Egyptian exports to the Chinese market included **agricultural products**, **leather goods**, and **footwear**.

On the import side, **Egypt imported goods worth USD 12 billion** from China, primarily consisting of **construction materials**, **chemical products**, **fertilizers**, **engineering and electronic goods**, as well as **textiles and ready-made garments**.

Ain Sokhna Port, located on the Red Sea, is Egypt's primary port for receiving Chinese goods and is one of the major maritime hubs along the **Maritime Silk Road** under the Belt and Road Initiative (BRI). Below is a list of the key Egyptian ports that handle Chinese imports and lie along the maritime routes of the BRI.

Port	2020	2021	2022
El-Sokhana	2,795	5,717	6,556
Port Said	2,080	1,802	1,808
El-Dekhilah	1,856	1,524	1,359
Alexandria	1,814	1,540	1,262
Damietta	807	585	697
Suez	100	170	248
Safaga	52	72	61
Newiab	1	2	9
El-Adbyiah	0.003	0.149	0.009
El-Arish	0.145	-	-
Grand Total	9,506	11,412	12,000

Source: General Organization for Export and Import Control (adapted by the researchers).

2-4-1 Egypt's Role in the Belt and Road Initiative

Egypt—China relations date back to ancient times, predating the Common Era. Historically, well-established trade routes connected the two civilizations, evolving over centuries into what became known as the Silk Road—a pathway used by caravans transporting silk, perfumes, and incense across Asia to Egypt and neighboring regions. With the expansion of trade routes to include maritime corridors alongside land and rail

networks, China adopted a broader strategic vision under the name **Belt and Road Initiative (BRI)**, where the "belt" refers to the maritime routes and the "road" to overland infrastructure.

Arab countries, with Egypt at the forefront, have welcomed the BRI. Successful implementation of the initiative, however, requires participating governments to ease trade barriers, simplify customs procedures, and modernize physical, digital, and administrative infrastructure. Egypt plays a **central role in the BRI** due to its **strategic geographic location**, enabling it to provide critical **logistics services** for both the Middle East and Africa.

The **Suez Canal** is a pivotal element of the Maritime Silk Road. As the primary shipping route connecting East and West, it is essential for trade flows between Asia and Europe. Likewise, it is a key transit point for goods bound for both West and East Africa, particularly **landlocked countries** such as Chad. Consequently, the **Suez Canal Economic Zone (SCZone)** is positioned to become a **logistics hub** for cargo—whether transiting through the canal or destined for African markets via Egypt's territory.

In this context, Egypt is actively working to enhance the role of its ports located along the Maritime Silk Road corridor, aiming to transform them into **investment hubs**, particularly for **transit trade**. This includes offering **logistics services** and **multimodal transport facilities** to support regional and global trade (Suleiman, 2019).

Furthermore, the significance of **Egypt–China cooperation** is heightened by China's strategic orientation toward Africa. The former model of direct sales of Chinese goods in Africa has become less effective. Instead, China now prioritizes **long-term investment** on the continent. This shift reinforces Egypt's role as **Africa's gateway** and positions it as a highly suitable destination for **foreign investment** (Ling, 2020).

2-4-2 Egypt's Vision for Maximizing the Benefits of the Belt and Road Initiative

Egypt has adopted a strategic plan aligned with its national development vision to maximize the benefits of the Belt and Road Initiative (BRI), particularly through the development of the Suez Canal Economic Zone and its six affiliated ports. This plan supports Egypt's role along the BRI corridor and complements the modernization of its logistics infrastructure. Central to this vision is a shift toward value-added production and reducing reliance on raw material exports. Achieving this requires the establishment of dry ports and integrated logistics zones as hinterlands for maritime ports.

China has actively supported the localization of industries within the Suez Canal Economic Zone—Egypt's main hub on the BRI route—where substantial Chinese investments have been made, particularly in Red Sea port facilities such as Ain Sokhna. Since the launch of the zone, Chinese investments have reached nearly **USD 5 billion**, while bilateral trade has grown to **USD 12 billion** (General Organization for Export and Import Control, 2022). A framework agreement has also been signed between the Suez Canal Economic Zone and a Chinese consortium, including the China-Africa Development Fund, the China Development Bank, and Qingdao Port, to develop Ain Sokhna Port. Additionally, China Harbour Engineering Company has invested in container terminals across various Egyptian ports.

The BRI offers significant potential to generate added value for Egypt's economy by **reducing unemployment**, narrowing the **trade and balance of payments deficits**, and enhancing Egypt's position as a strategic gateway to **emerging markets in Africa and Europe**. With its central geographic location, relatively low production costs, and growing industrial capabilities, Egypt presents an attractive platform for **manufacturing and re-export**, particularly as China deepens its investment footprint in Africa (Ling, 2020). Egypt's numerous trade agreements with African, European, and Arab countries also enable preferential access to key international markets, further increasing its strategic appeal (Gamal, 2022).

China's long-term strategy in Africa increasingly relies on investment rather than the direct export model it once followed. In this context, **Egypt serves as a launch point for Chinese engagement across the continent**, supported by its **positive economic indicators** and growing transition toward a real economy based on **industry and agriculture**.

The BRI also leverages strong Arab infrastructure to localize industries and meet growing demand along the trade routes, with **Egypt emerging as the principal beneficiary**, given its role as a conduit for several African nations. The **African Continental Free Trade Agreement (AfCFTA)** enhances Egypt's position further by offering **tariff exemptions** and increasing access to regional markets (Suleiman, 2019). The agreement eliminates tariffs on 90% of tariff lines within five years and facilitates **intra-African trade**, encourages **foreign investment**, and strengthens **regional value chains**, particularly by allowing Egyptian exports to reach up to **37 African markets** (Mohamedin, 2022).

Within the BRI framework, participating countries aim to align their development strategies. Egypt is central to this process as a vital link between **East Asia and Africa**. Its **strategic location** and the scale of trade with China underscore the need for a **comprehensive infrastructure investment plan**. Egypt is once again positioned as a geopolitical and economic center—akin to its historical status during the British Empire—reinforcing its pivotal role in global trade dynamics (Suleiman, 2019).

2-4-5 Strategic Initiatives Implemented by Egypt's Ministry of Transport

To enhance the contribution of Egypt's maritime transport sector within the BRI framework, the Ministry of Transport has implemented several key measures:

1. **Port Development and Efficiency Enhancement**: In line with Egypt Vision 2030, a comprehensive strategy was launched to improve the competitiveness of seaports based on current capacity and optimal resource use. In June 2018, the Ministry signed a contract with the Arab Academy for Science, Technology, and Maritime Transport to develop a master plan for Egyptian ports through 2030.

2. **Strengthening Ports on the Maritime Silk Road**: Efforts aim to transform these ports into **investment hubs**, particularly for **transit trade**, **logistics services**, and **multimodal transport**.

3. **Integration of Maritime, Inland, and Dry Ports**: Ports are being linked to investment zones via the national road and transport networks under a unified development strategy.

4. **Private Sector Involvement**: The Ministry is encouraging private sector participation in the development of transport infrastructure and logistics services.

5. **Establishment of an Egyptian Maritime Cluster**: In collaboration with the European Union, this initiative aims to develop Egypt's maritime industry by involving all key stakeholders, thereby enhancing the national economy.

6. **Investment Promotion**: A series of seminars are being organized to showcase investment opportunities in Egyptian ports and the Suez Canal Economic Zone to attract major logistics and shipping alliances.

2-4-6 Strengthening Arab Maritime Collaboration within the BRI

The Ministry also emphasized the importance of developing Arab ports connected to the BRI as investment gateways through the following initiatives:

1. **Forming a Joint Arab Port Working Group**: This group will identify ongoing projects and investment opportunities in maritime transport, roads, railways, and logistics zones to advance mutual interests with China.

2. **Unified Arab Vision for Investment**: Arab countries are encouraged to coordinate efforts and present **non-competitive, integrative project proposals** to the Chinese side to attract greater investment through the **Union of Arab Ports**.

3. **Establishment of an Arab Maritime Bloc**: This would enhance the collective strength of Arab maritime industries and ensure active participation in the BRI.

3- Research Methodology

3-1 Research Problem:

Egypt's Vision for Developing Dry Ports and Logistics Zones in the Context of the Belt and Road Initiative

In alignment with **Egypt Vision 2030**, the Ministry of Transport has adopted a comprehensive strategy to establish **dry ports and logistics zones** aimed at supporting the commercial sector, reducing road congestion, and ensuring sustainable infrastructure usage. The plan involves constructing several dry ports, which will be connected to key economic centers through an integrated **railway network** for efficient cargo transport.

The **General Authority for Land and Dry Ports** has developed a detailed plan for the construction and management of these ports in coordination with key stakeholders, especially the **Customs Authority** and the **General Organization for Export and Import Control**, which play essential roles in port operations. Locations for these

facilities have been selected based on proximity to **industrial zones** and **new urban communities**, following recommendations from the **Japan International Cooperation Agency (JICA)**. The plan ensures geographic equity by distributing
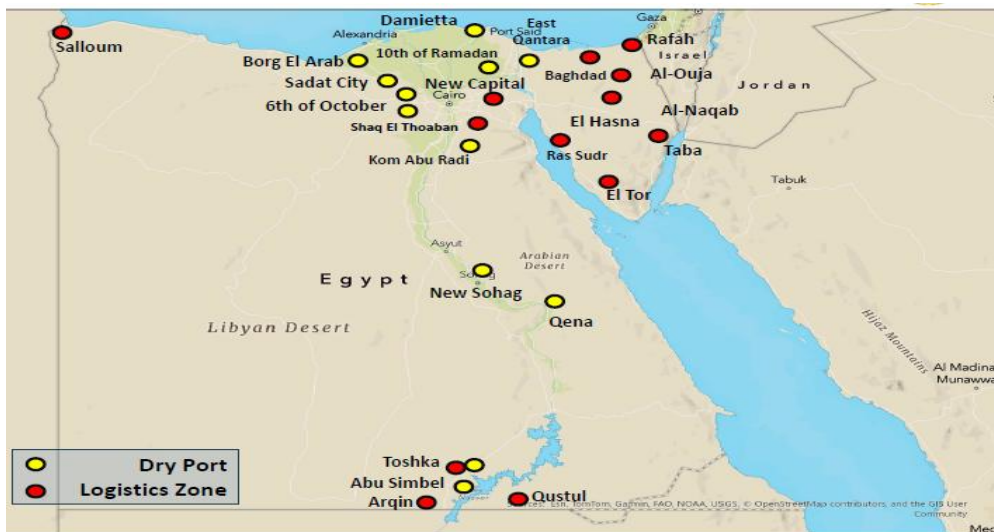

Fig., (3), Distribution of dry ports and logistics zones in Egypt. Yellow markers indicate dry ports, while red markers denote logistics zones. The spatial distribution reflects Egypt's strategic positioning in supporting multimodal connectivity under the Belt and Road Initiative. Developed by researchers a*dapted from Maritime Transport Sector; Ministry of transport*

facilities across both **Upper and Lower Egypt**, including cities such as **6th of October, 10th of Ramadan, Sadat City, New Borg El Arab, Beni Suef, New Sohag, El-Tor, New Damietta, and New Fayoum**, along with **border logistics zones** (Salloum, Qustul, Arqin) and **strategic logistics hubs** (6th of October and 10th of Ramadan), as shown in figure (3) .

A flagship project within this initiative is the **100-acre dry port in 6th of October City**, launched as Egypt's first dry port. It has entered the pilot operational phase and will be followed by the phased development of additional ports in accordance with the Authority's master plan.

As part of the **Belt and Road Initiative (BRI)**, Egypt is expected to benefit from Chinese **technological support**, while contributing its vast natural resources, upgraded **infrastructure**, and reformed **investment legislation** to create an attractive investment climate. Egypt's strategic location between the **Mediterranean and Red Seas** positions it as a crucial node along the **Maritime Silk Road**, contributing to the BRI's broader objective of global connectivity and enhancing Egypt's **long-term economic potential**.

Despite these developments, Egypt remains relatively **less experienced** in implementing and managing dry ports compared to neighboring countries, particularly those in the **Gulf region**. This inexperience presents several challenges to the full integration of the BRI framework. Nonetheless, the increase in container traffic and vessel movement at Egyptian ports, and the associated growth in import and export volumes, underscore the **urgent need** for the adoption of this model across the national port system.

Thus, evaluating the influence of dry ports and logistics zones on diverse stakeholders is essential for determining their contribution to augmenting supply chain efficiency, improving coordination between internal clients and seaports, and ultimately facilitating Egypt's position as Africa's gateway within the Belt and Road Initiative. This setting delineates the principal research challenge of the study as follows: **To what degree can Egypt achieve the goals of the Belt and Road Initiative via the establishment and administration of dry ports and logistics zones? In this context the study examines four key areas to address the topic:**

1- What are the functions and roles of dry ports and logistics zones?

2- What is the Belt and Road Initiative, and what benefits does it promise to provide to Egypt?

3- What are the implementation strategies and success elements of the BRI in Egypt?

4- What is the correlation between dry port development and the achievement of the Belt and Road Initiative's objectives in Egypt?

3-2- Study Objectives

This study seeks to accomplish the subsequent objectives:

- To delineate and characterize the principal variables and aspects of the study, considering their relative novelty—specifically, the creation and operation of dry ports and related logistical services (independent variable), and the Belt and Road Initiative (BRI) in Egypt (dependent variable).

- To investigate and assess the correlation among the study variables.

- To offer recommendations to the General Authority for Land and Dry Ports in Egypt, grounded in the study's findings, which may facilitate the effective execution of the BRI in Egypt. These ideas underscore the importance of logistics services and the necessity of building and managing dry ports.

3-3 Research Hypotheses

The primary hypothesis posits a statistically significant correlation between the development and management of dry ports, logistics services, and the successful implementation of the Belt and Road Initiative in Egypt.

From the primary hypothesis, three subordinate hypotheses are formulated:

- A statistically significant relationship exists between the establishment of dry ports and the realization of the Belt and Road Initiative in Egypt.

- A statistically significant relationship exists between the management of dry ports and the realization of the Belt and Road Initiative in Egypt.

- A statistically significant relationship exists between the provision of logistics services and the realization of the Belt and Road Initiative in Egypt.

3-4 The Study Significance

This study is significant as it seeks to fill a research gap identified in the literature, specifically regarding the limited academic focus on the relationship and impact of dry port

establishment and management, logistics services, and the implementation of the Belt and Road Initiative (BRI) in Egypt.

The practical significance arises from the Egyptian government's increasing focus on the development and improvement of national logistics services, as well as the necessity to investigate effective methods to bolster their developmental impact on the national economy. This is especially important given the current challenges confronting the Egyptian economy, necessitating innovative solutions that address both regional and global dynamics.

3-5 The Study Method and tools

The researchers employed a descriptive-analytical approach to fulfill the study's objectives and evaluate its hypotheses. The theoretical framework was established by reviewing a range of sources, including Arabic and international literature, academic theses (both published and unpublished), scholarly articles, specialized journals, and online databases.

A survey method was utilized for empirical data collection. A structured questionnaire was developed utilizing insights from existing literature, with modifications implemented to enhance its relevance to the study's context.

3-6 Study Population, Sampling Unit, and Sample

The study population comprises 445 employees from the General Authority for Land and Dry Ports in the Arab Republic of Egypt, as recorded during the field study. The sampling unit refers to the individual employee who received the questionnaire; therefore, it encompasses the staff of the Authority. A census sampling method was employed, distributing 400 questionnaires to the target population.

4- Statistical Analysis

A confirmatory factor analysis (CFA) was performed on all items in the scale pertaining to the establishment and management of dry ports and logistics services, encompassing a total of 29 statements across the identified dimensions. The initial confirmatory factor analysis results showed that all questionnaire items had adequate factor loadings, with no

items exhibiting low saturation points that would necessitate exclusion. Consequently, no items were excluded from the scale.

The table below displays the results of the confirmatory factor analysis paths for the dimension statements, including unstandardized regression coefficients (UC), standardized regression coefficients (SC), standard errors (SE), critical ratios (CR), and significance levels (P-values) for each path. The results validate the reliability of the factors considered in evaluating the effectiveness of dry port establishment, management, and logistics services.

Table 4-1: Results of Confirmatory Factor Analysis for Dimension Scale Statements Establishing and administering dry ports and logistical services

No.	phrase	Dimension	Standardized regression	Coefficient of regression	Standard error	Test T (CR)	(P value)
X1	Analysis of the current status of the port and the extent of optimal utilization of available capabilities.	establishing dry ports	.901	1,000	-	-	-
X2	Proximity to existing industrial, agricultural, commercial and mining clusters and those planned to be established in the future within the framework of the state plan.		.889	.984	.041	24.042	***
X3	Identification of the most appropriate areas and sites where the dry port is required to be established.		.885	.981	.041	23.779	***
X4	Providing the necessary land areas for port activities, taking future expansion into consideration.		.897	1.038	.042	24.556	***
X5	Determining the size and directions of current and future movement of cargo and containers.		.931	1.134	.042	27.271	***

No.	phrase	Dimension	Standardized regression	Coefficient of regression	Standard error	Test T (CR)	(P value)
X6	Designing a timetable for establishing the dry port in light of future needs.		.909	1.009	.040	25.487	***
X7	Proximity to residential areas.		.874	.849	.037	23.042	***
X8	Providing roads for the passage of containers, cranes, hoists and gates.		.889	.917	.038	24.043	***
X9	Providing areas for auxiliary commercial services.		.914	.979	.038	25.835	***
X10	Establishing industrial activities in the hinterland.		.893	.916	.038	24.272	***
X11	Establishing relationships between dry port management and importers and exporters at the local and international levels.		.955	1,000	-	-	-
X12	Linking dry ports to investment areas.		.903	.886	.030	29.998	***
X13	Achieving integration and cooperation between the parties concerned with port management and customs.	managing dry ports	.971	1.014	.024	42.912	***
X14	Geographically distributing containers from the port of arrival to the dry port without interference from the shipping agent.		.971	1.037	.024	42.799	***
X15	Tracking containers by satellite from their arrival at the port of arrival until their entry into the dry port.		.962	.985	.024	40.450	***
X16	Connecting the port to a modern communications network to provide information at any moment.		.950	.963	.026	37.698	***

No.	phrase	Dimension	Standardized regression	Coefficient of regression	Standard error	Test T (CR)	(P value)
X17	Providing workshops for equipment, and for preparing, cleaning and repairing containers.		.944	.991	.027	36.342	***
X18	Developing infrastructure facilities to suit the expected demand for port facilities.		.879	.851	.031	27.221	***
X19	Availability of high-level administrative and technical cadres and manpower to manage and direct the movement of containers within the port.		.857	.835	.033	25.182	***
X20	The port applies a balanced structure for service costs and fees.		.892	.867	.030	28.623	***
X21	Providing continuous monitoring and follow-up of the movement of goods within the port.		.848	.783	.032	24.375	***
X22	Allocating an independent department specialized in logistics activities within the dry port.		.660	1,000	-	-	-
No.	**phrase**	logistics services	**Standardized regression**	**Coefficient of regression**	**Standard error**	**Test T (CR)**	**(P value)**
X23	Analyzing the necessary logistics information and data to make decisions in an effective manner.		.883	1.029	.079	12.954	***
X24	Using the latest technology to reduce the time required for logistics activities.		.828	1.053	.085	12.330	***
X25	Providing training programs for employees to familiarize them with logistics management and its dimensions.		.808	.919	.076	12.086	***

No.	phrase	Dimension	Standardized regression	Coefficient of regression	Standard error	Test T (CR)	(P value)
X26	Enhancing the role of the private sector in participating and providing facilities and services to facilitate investment.		.747	.701	.062	11.322	***
X27	Using smart electronic programs in managing logistics operations.		.480	.517	.068	7.628	***
X28	The port deals with all means of transportation (trucks, railways) to avoid traffic congestion.		.713	.738	.068	10.883	***
X29	The port is interested in the pattern of commercial relations with customers.		.440	.404	.057	7.041	***

** Indicates that the calculated value is statistically significant at a 1% significance level.

Source: Results of statistical analysis of the program AMOS.

The results presented in the confirmatory table allow for the evaluation of the measurement model concerning the dimensions of **Establishing Dry Ports, Managing Dry Ports, and Logistics Services.**

- The association between the dimension of **establishing dry ports** and each corresponding item is statistically significant, with a significance level below 0.001 (P < 0.001). The standardized regression coefficients demonstrate robust relationships, affirming the reliability of these items in assessing this dimension.

- The relationship between the dimension of **Managing Dry Ports** and its respective items is statistically significant at P < 0.001, exhibiting high standardized regression coefficients, which confirms the validity of the measurement model.

- The relationship between the dimension of **Logistics Services** and its associated items is statistically significant at P < 0.001, thereby affirming the robustness of these relationships and the suitability of the items for assessing logistics services.

The results indicate that the measurement model accurately reflects the intended dimensions, with all items showing strong and statistically significant relationships with their respective constructs.

As the figure (4-1) shows Confirmatory factor analysis model for dimensional scale statements establishing and managing dry ports and logistics services:
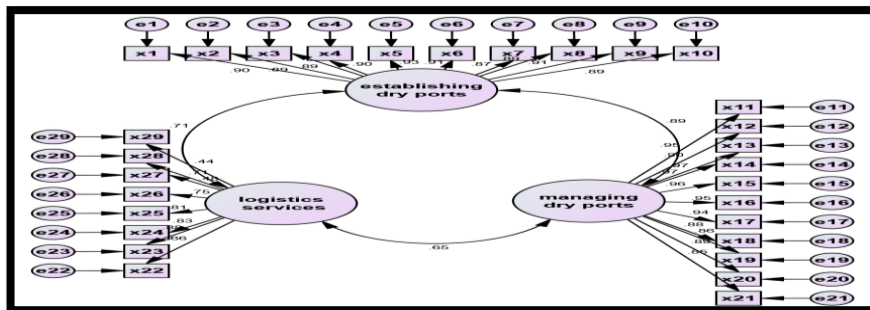

Figure No. (4-1)

Confirmatory factor analysis model for the statements of the dimensions of establishing and managing dry ports and logistics services

The results in the table (4-2) indicate that the confirmatory factor analysis (CFA) model for establishing and managing dry ports and logistics services demonstrates an acceptable to strong model fit based on various fit indices. The Standard Chi-Square Index (CMIN/DF) is within the acceptable range (2.865 < 3), RMSEA (0.075) suggests a reasonable approximation, and key indices such as GFI (0.957), NFI (0.976), and TLI (0.976) indicate a strong fit. While the Comparative Fit Index (CFI = 0.813) suggests a moderate fit, the overall results confirm that the model is statistically acceptable and adequately represents the underlying structure of the scale.

Table No. (4-2)

Indicators of the quality of the fit of the confirmatory factor analysis model of the scale

establishing and managing dry ports and logistics services

Indicator	Standard value	Index value
Standard chi-square indexNormed Chi-square (CMIN/DF)	less than or equal to 3	2.865
root mean square error of estimate Root Mean Square Error of Approximation (RMSEA)	less than 0.08	0.075
Goodness of fit index Goodness of Fit Index (GFI)	The closer its value is to one, the better the fit of the model to the sample data.the study	0.957
Comparative Matching Quality IndexComparative Fit Index (CFI)		0.813
Standardized Quality of Fit IndexNormed of Fit Index (NFI)		0.976
Tucker Lewis IndexTucker-Lewis Index (TLI)		0.976

The results in **Table (4-3)** indicate that the **Cronbach's alpha coefficient** for reliability is **0.795 for Establishing Dry Ports, 0.814 for Managing Dry Ports, and 0.801 for Logistics Services**. Since all values exceed **0.7**, this confirms the **internal consistency** of the scale statements related to establishing and managing dry ports and logistics services. The overall Cronbach's alpha for the scale is **0.840**, indicating a high level of reliability.

Table (4-3): Reliability & validity coefficients of the dimensions of the establishing & managing dry ports and logistics services

variable	Number of phrases	Cronbach's alpha coefficient	Self-reliability coefficient
Establishing dry ports	10	0.795	0.892
Managing dry ports	11	0.814	0.902
Logistics services	8	0.801	0.895
Total	29	0.840	0.917

Source: Results of statistical analysis of the program SPSS.

Additionally, the **self-reliability coefficients** for each dimension are **0.892 for Establishing Dry Ports, 0.902 for Managing Dry Ports, and 0.895 for Logistics Services**, with an overall self-reliability coefficient of **0.917**. These high values confirm that the measurement items

effectively assess the intended dimensions, ensuring the validity of the scale in evaluating the factors related to establishing and managing dry ports and logistics services.

4-1 Confirmatory factor analysis to the Belt and Road initiative in Egypt:

A Confirmatory Factor Analysis (CFA) was conducted to examine the validity of the measurement model comprising 26 observed items associated with the Belt and Road Initiative (BRI) in Egypt, as shown in table (4-4). These items were distributed according to predefined theoretical dimensions. The initial CFA results indicated that none of the questionnaire items exhibited insufficient factor loadings that would justify their exclusion. Specifically, the model did not reveal any significant deterioration in fit indices that would necessitate the removal of any item.

However, it is important to critically assess this conclusion. While most items demonstrated acceptable standardized regression coefficients (i.e., loadings), Item Y26 presented a standardized loading of .193, which is considerably below the conventional threshold of .40 for acceptable indicator reliability (Hair et al., 2014). Although the t-value (CR = 3.238) was statistically significant (p = .001), the very low loading suggests weak convergent validity and may warrant further theoretical justification for retaining the item in the final scale.

The table below summarizes the key CFA parameters reported for each item, including the standardized regression coefficient (SC), unstandardized coefficient (UC), standard error (SE), critical ratio (CR), and significance level (P-value):

Table No. (4-4) : Results of confirmatory factor analysis model for the Belt and Road initiative scales in Egypt

Phrase number	phrase	Standardized regression	regression coefficient	Standard error	Test T (CR)	(P value)
Y1	Automation of trade procedures in the Belt and Road Initiative.	.616	1,000	-	-	-
Y2	Removal of trade and investment barriers in the Belt and Road Initiative.	.680	1.102	.109	10.131	***
Y3	Increase the speed of the economic cycle.	.631	.856	.090	9.553	***
Y4	Trading currencies through clearing in local currencies.	.670	.983	.098	10.013	***
Y5	Publishing relevant laws and regulations, and any changes thereto, in a timely manner before they come into force.	.782	1.294	.115	11.243	***
Y6	Facilitating the flow of buses and trucks through ports.	.839	1.396	.118	11.822	***
Y7	Having an agenda for dealing with investments.	.842	1.329	.112	11.850	***
Y8	Implementing a risk management system for cross-border trade and pre-registration of shipments.	.782	1.183	.105	11.245	***
Y9	Customs exemption between some countries and Egypt in accordance with the free trade agreement that links some countries.	.653	1.126	.115	9.814	***
Y10	Removing all unnecessary elements and duplication in trade formalities, operations, and procedures.	.822	1.199	.103	11.656	***
Y11	Attracting investments through the incentives provided by the initiative to investors.	.826	1.267	.108	11.690	***
Y12	Capacity building for managers and employees responsible for implementation.	.860	1.265	.105	12.019	***
Y13	Holding information courses and training for all participating parties.	.810	1.085	.094	11.536	***
Y14	Using trade facilitation indicators at all stages of the process.	.774	1.457	.130	11.167	***
Y15	Consultation and cooperation with stakeholders of the reform program.	.790	1.176	.104	11.325	***
Y16	Establishment of monitoring points that allow for easy assessment of the objectives of the trade facilitation initiative.	.852	1.382	.116	11.943	***
Y17	Conclusion of customs transit agreements to facilitate transit transport by a common transit document.	.838	1.273	.108	11.806	***
Y18	A comprehensive analysis of the main factors that hinder cross-border trade.	.849	1.378	.116	11.915	***
Y19	Reliance on standards for crossing requirements.	.782	1.375	.122	11.245	***

Phrase number	phrase	Standardized regression	regression coefficient	Standard error	Test T (CR)	(P value)
Y20	Tracking the path of international shipments along transport and shipping lines.	.809	1.242	.108	11.519	***
Y21	Contributing effectively to building the Digital Silk Road.	.734	1.381	.129	10.735	***
Y22	Stimulating the technical, administrative and logistical capabilities of the road thanks to its distinguished location.	.740	1.361	.126	10.803	***
Y23	Exploiting the distinguished location in establishing industrial zones in the Suez Canal.	.752	1.130	.103	10.934	***
Y24	Investing in developing ports (East Port Fouad Port in Port Said) to become a center for providing all services needed by sea vessels passing through the Suez Canal.	.755	1.212	.111	10.961	***
Y25	Contributing to creating job opportunities from the Belt and Road Initiative.	.762	1.092	.099	11.032	***
Y26	Implementing a huge industrial zone in the Suez Canal that works on manufacturing and exporting raw materials.	.193	.188	.058	3.238	.001

** Indicates that the calculated value is statistically significant at a 1% significance level.

Source: Results of statistical analysis of the program AMOS.

The majority of items exhibited standardized coefficients above the accepted threshold, with critical ratios (t-values) indicating statistical significance at the 1% level, further reinforcing the scale's construct validity. Nevertheless, the exclusion or theoretical retention of outlier items such as Y26 should be addressed explicitly in future model refinements. In conclusion, the CFA results suggest overall model adequacy.

4-2 Measurement Model Evaluation and Structural Representation

Based on the results presented in Table (4-4), it is possible to evaluate the adequacy of the measurement model for the Belt and Road Initiative in Egypt. The CFA results provide empirical support for the construct validity of the measurement scale, with most items displaying strong factor loadings and significant critical ratios.

Furthermore, Figure (4-2) illustrates the path diagram of the confirmatory factor model as generated by AMOS. This diagram visually represents the relationships between observed variables and their underlying latent construct(s), offering a comprehensive view of the standardized path coefficients.
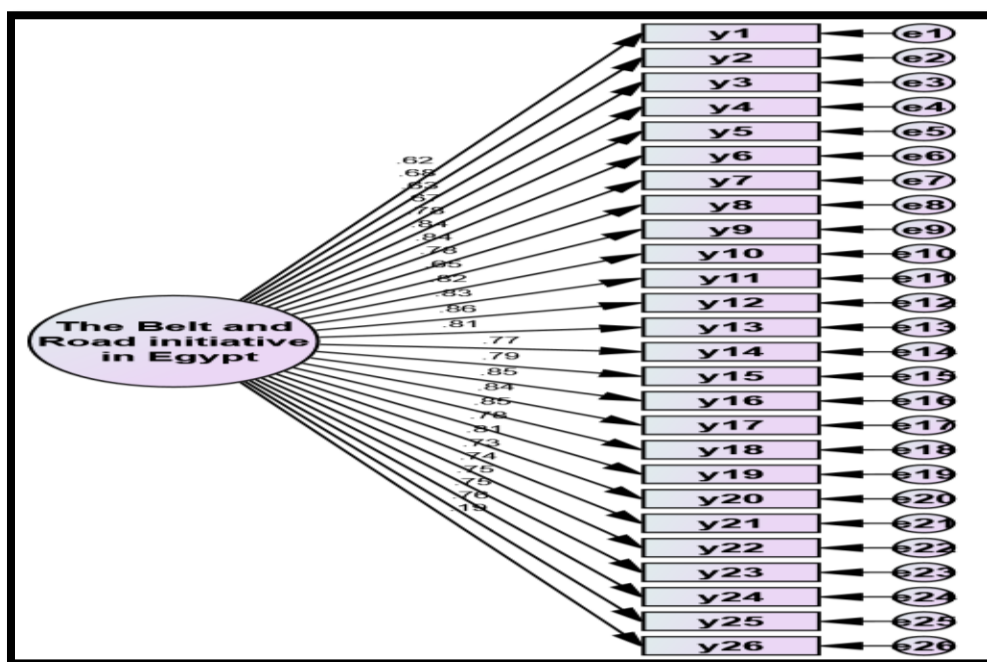

Figure No. (4-2)

Confirmatory factor analysis model for the Belt and Road initiative scales in

Egypt

Source: Results of statistical analysis of the program AMOS.

4-3 Model Fit Indices and Reliability Assessment

To further evaluate model adequacy, Table (4-5) presents standard model fit indices as calculated through AMOS:

Table (4-5): Model Fit Indices for the CFA Model of the Belt and Road Initiative in Egypt

Indicator	Standard value	Index value
Standard chi-square indexNormed Chi-square (CMIN/DF)	less than or equal to 3	2.931
root mean square error of estimate Root Mean Square Error of Approximation (RMSEA)	less than 0.08	.077
Goodness of fit index Goodness of Fit Index (GFI)	The closer its value is to one, the better the fit of the model to the sample data.the study	0.889
Comparative Matching Quality IndexComparative Fit Index (CFI)		0.929
Standardized Quality of Fit IndexNormed of Fit Index (NFI)		0.921
Tucker Lewis IndexTucker-Lewis Index (TLI)		0.894

Source: Results of statistical analysis of the program AMOS.

The results indicate that all key indices fall within acceptable ranges, confirming an adequate model fit. While the GFI and TLI fall just short of the optimal threshold of 0.90, their proximity to the cut-off values still supports the overall adequacy of the measurement model.

4-4 Internal Consistency and Reliability of the Scale

Table (4-6) presents a summary of the internal reliability coefficients for the BRI scale, calculated through SPSS. The Cronbach's alpha value of 0.856 surpasses the minimum recommended threshold of 0.70, indicating a strong level of internal consistency. The composite reliability coefficient of 0.925 indicates that the items consistently measure the latent construct of interest.

Table (4-6): Reliability and Validity Coefficients for the Belt and Road Initiative Scales in Egypt

variable	Number of phrases	Cronbach's alpha coefficient	Self-reliability coefficient
the Belt and Road initiative in Egypt	26	0.856	0.925

Source: Results of statistical analysis of the program SPSS.

4-5 Descriptive Statistics and Correlation Analysis

The table (4-7) presents the results of the study sample's responses to the dimensions of all variables:

Table (4-7): Summary Descriptive Statistics for the Study Variables

Variables	Mean	Standard deviation	T value	Significance test	General trend
Independent variable (Establishing and managing dry ports and logistics services)	3.77	.935	16.045	.000	Available
Establishing dry ports	3.60	1.170	9.973	.000	Available
Managing dry ports	3.55	1.190	9.016	.000	Available
logistics services	4.17	.684	33.026	.000	Available
Dependent variable (the Belt and Road initiative in Egypt)	4.02	.765	25.786	.000	Available

From the previous table, the following can be observed:

- The **dimension of establishing dry ports** is perceived to be available among the sample of port and logistics professionals, with a mean of 3.60 and a standard deviation of 1.170.

- The **dimension of managing dry ports** is also considered available, with a mean of 3.55 and a standard deviation of 1.190.

- The **dimension of logistics services** demonstrates the highest level of availability among respondents, with a mean score of 4.17 and a standard deviation of 0.684.

- The **composite independent variable** (establishing and managing dry ports and logistics services) also indicates a general perception of availability, with a mean of 3.77 and a standard deviation of 0.935.

- The **dependent variable** (the Belt and Road Initiative in Egypt) is perceived as available by respondents, with a mean of 4.02 and a standard deviation of 0.765.

These values reflect statistically significant deviations from the neutral point on the Likert scale (assumed to be 3.00), with all p-values less than 0.001. This supports the

conclusion that respondents positively perceive the availability of both independent and dependent variables under study.

4-6 Correlation Analysis

To test for statistically significant relationships between the study variables (Establishing and Managing Dry Ports and Logistics Services and the Belt and Road Initiative in Egypt), Pearson's correlation coefficients were calculated for each dimension of the independent variable and the dependent variable. These results are summarized in the following table:

Table (4-8): Correlation Analysis Between Study Variables

	Establishing dry ports	Managing dry ports	logistics services	Establishing and managing dry ports and logistics services	The Belt and Road initiative in Egypt
Establishing dry ports	1				
Managing dry ports	.891**	1			
logistics services	.674**	.647**	1		
Establishing and managing dry ports and logistics services	.960**	.954**	.800**	1	
The Belt and Road initiative in Egypt	.740**	.726**	.845**	.823**	1

** Indicates that the calculated value is statistically significant at a 1% significance level.

Source: Results of statistical analysis of the program SPSS.

From the correlation matrix in Table (4-8), the following observations are made:

- There is a statistically significant positive correlation between the **independent variable** (establishing and managing dry ports and logistics services) and the **dependent variable** (the Belt and Road Initiative in Egypt), with a Pearson coefficient of **.823**.

- Each dimension of the independent variable also correlates positively and significantly with the dependent variable:
  - **Establishing dry ports**: $r = .740$, $p < .01$

- o **Managing dry ports**: r = .726, p < .01
- o **Logistics services**: r = .845, p < .01
- The correlations among the dimensions of the independent variable are also strong and statistically significant:
  - o Establishing dry ports & managing dry ports: r = .891
  - o Establishing dry ports & logistics services: r = .674
  - o Managing dry ports & logistics services: r = .647
- These results indicate strong linear relationships between the infrastructure dimensions—including establishing dry ports, managing dry ports, and logistics services—and the BRI in Egypt. All coefficients suggest large effect sizes (r > .50), according to Cohen's criteria.

The analysis confirms that enhancing each dimension of dry port and logistics service infrastructure—particularly establishing and managing dry ports, alongside logistics services—is strongly associated with increased perceived success or availability of the Belt and Road Initiative within the Egyptian logistics context.

4-7 Test of Hypotheses

4-8 To empirically evaluate the impact of dry port development on the execution of the Belt and Road Initiative (BRI) in Egypt, a set of hypotheses was established and evaluated as follows.

4-7-1 Main Hypothesis:

There is a statistically significant relationship between the establishment and management of dry ports and their logistics services, and the Belt and Road Initiative (BRI) in Egypt.

From this overarching hypothesis, the following three sub-hypotheses are derived:

1. There is a statistically significant relationship between the establishment of dry ports and the implementation of the Belt and Road Initiative in Egypt.
2. There is a statistically significant relationship between the management of dry ports and the implementation of the Belt and Road Initiative in Egypt.

3. There is a statistically significant relationship between the provision of logistics services and the implementation of the Belt and Road Initiative in Egypt.

4-7-2   Sub-Hypothesis 1: There is a statistically significant relationship between the establishment of dry ports and the implementation of the Belt and Road Initiative in Egypt.

Table 4-9 presents the findings of the basic linear regression analysis, which assesses the impact of the independent variable ("Establishing dry ports") on the dependent variable ("Belt and Road Initiative implementation in Egypt").

Table No. (4-9)

Simple linear regression model results between Establishing dry ports and the Belt and Road initiative in Egypt

| Independent Variable	R	R^2	B	Beta	T-Test		F-Test	
					T	Sig.	F	Sig.
Constant	.740ᵃ	.548	2.274		26.371	.000***	452.459	.000***
Establishing dry ports			.484	.740	21.271	.000***		

Source: The results of the statistical analysis of the SPSS program.

***Statistically significant at the significance level (0.001)**

****Statistically significant at the significance level (0.01)**

- **The researchers deduced from the aforementioned table that:**

1. **Coefficient of Determination (R^2):** The coefficient of determination (R^2 = 0.548) indicates that approximately 54.8% of the variance in the dependent variable (BRI implementation) can be explained by the independent variable (Establishing dry ports). The remaining 45.2% of the variance may be attributed to unexplained factors, such as omitted variables not included in the regression model or random error. This suggests a moderately strong explanatory power of the model, assuming other classical assumptions hold.

2. **Significance of the Independent Variable (t-test):**The **t-value** of 21.271 associated with the predictor "Establishing dry ports" is highly significant (p < 0.001), indicating that the independent variable has a statistically significant positive effect on the dependent variable. Therefore, we reject the null hypothesis of no relationship and conclude that the establishment of dry ports significantly contributes to the implementation of the Belt and Road Initiative in Egypt.

3. **Overall Model Significance (F-test):**The **F-statistic** value of 452.459 is statistically significant at p < 0.001. This confirms that the regression model as a whole is statistically significant, meaning that the linear regression model provides a better fit than a model with no predictors. Thus, the establishment of dry ports has a significant collective effect on the outcome variable.

4. **Normality of Residuals:**One of the classical assumptions of linear regression is the normal distribution of residuals. As illustrated in **Figure 3**, the histogram of residuals indicates an approximately normal distribution with a mean close to zero and a standard deviation near one (0.999), which supports the assumption of normality.
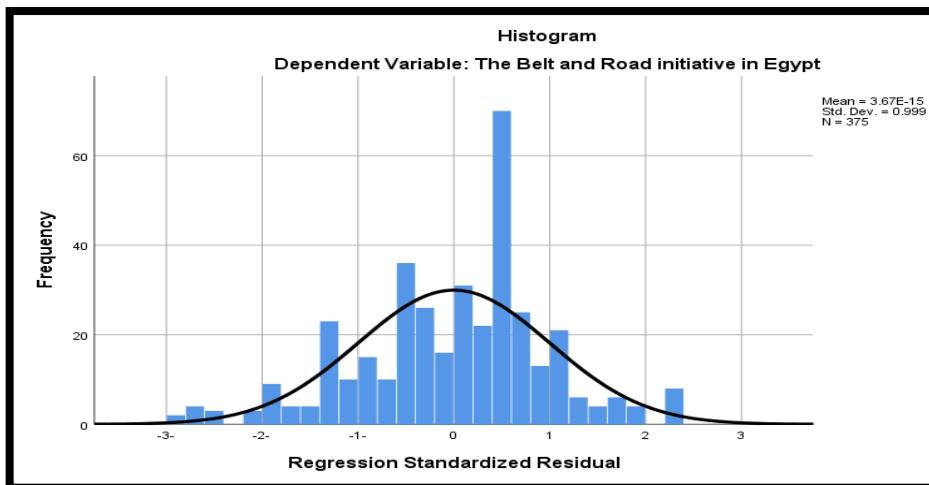
Figure (4-3): Histogram of Regression Standardized Residuals – Establishing Dry Ports and the BRI

Source: The results of the statistical analysis of the SPSS program.

The plot in figure (4-4) indicates a strong linear association, with predicted values closely approximating the observed values, which further supports the model's adequacy and the reliability of the regression estimates.
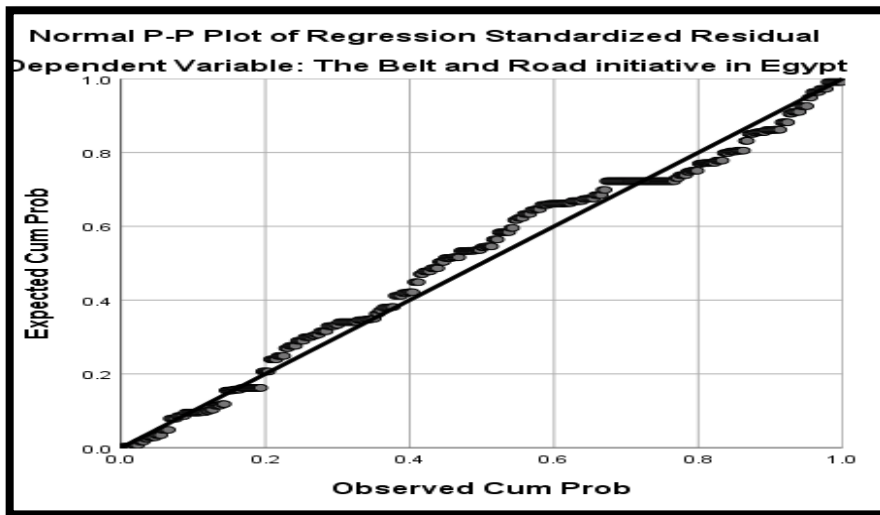

Figure 4-4

Scatter Plot of Actual vs. Predicted Values for the Dependent Variable (BRI Implementation)

Based on the above Figure the Regression Equation:

BRI Implementation in Egypt= 2.274+ 0.484 Establishing dry ports

4-7-3   Sub-Hypothesis 2: Managing Dry Ports and the BRI

There is a statistically significant relationship between the management of dry ports and the implementation of the Belt and Road Initiative in Egypt.

Table (4-10)

Simple linear regression model results between Managing dry ports and the Belt and Road initiative in Egypt

Independent Variable	R	R²	B	Beta	T-Test		F-Test	
					T	Sig.	F	Sig.
constant	.726ᵃ	.527	2.360		27.486	.000***	415.101	.000***
Managing dry ports			.467	.726	20.374	.000***		

Source: The results of the statistical analysis of the SPSS program.

***Statistically significant at the significance level (0.001)

**Statistically significant at the significance level (0.01)

- **The researchers deduced from the aforementioned table that:**

1. **Coefficient of Determination (R^2):**

   The model explains **52.7% of the variance** in BRI implementation, indicating moderate explanatory power. The remaining 47.3% may be attributed to omitted variables or inherent model error.

2. **T-Test for Predictor:**

   The predictor variable "Managing dry ports" is statistically significant (**t = 20.374, p < .001**), confirming its positive and significant contribution to BRI implementation.

3. **F-Test for Model Fit:**

   The regression model is statistically significant (**F = 415.101, p < .001**), validating the overall goodness of fit.

4. **Normality of Residuals:**

   As shown in **Figure 5**, residuals approximate a normal distribution with a mean close to zero and SD ≈. This supports the assumption of error normality.
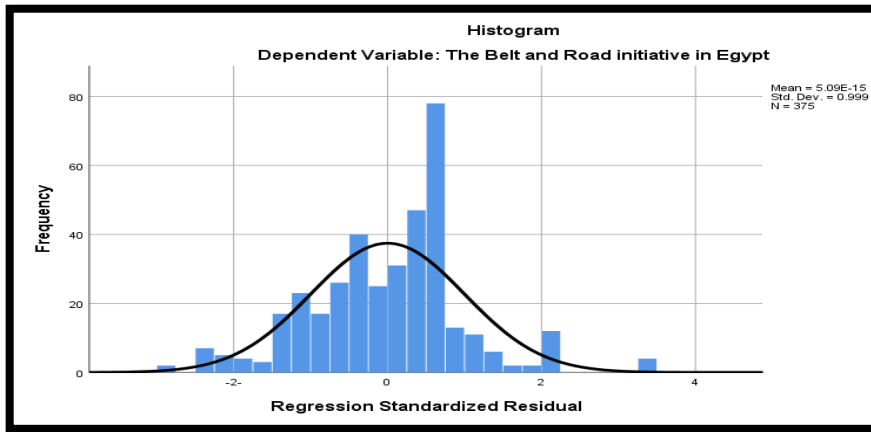
Figure (4-5) : Histogram of standard errors for the linear regression of Managing dry ports on the Belt and Road initiative in Egypt

Source: The results of the statistical analysis of the SPSS program.

> **Regression Equation: BRI Implementation = 2.360 + 0.467 (Managing Dry Ports)**

4-7-4   Sub-Hypothesis 3: Logistics Services and the BRI

There is a statistically significant relationship between the provision of logistics services and the implementation of the Belt and Road Initiative in Egypt.

Table 4-11: Simple Linear Regression Model Between Logistics Services and the Belt and Road Initiative in Egypt

Independent Variable	R	R^2	B	Beta	T-Test		F-Test	
					T	Sig.	F	Sig.
constant	.845ª	.714	.081		.622	.535	932.298	.000***
Logistics services			.945	.845	30.534	.000***		

Source: The results of the statistical analysis of the SPSS program.

***Statistically significant at the significance level (0.001)

**Statistically significant at the significance level (0.01)

The researchers deduced from the aforementioned table that:

1. **$R^2 = 0.714$:**

   This model explains **71.4% of the variance** in BRI implementation, indicating high explanatory power.

2. **T-Test and Predictor Significance:**

   Logistics services is a **highly significant predictor** ($t = 30.534$, $p < .001$).
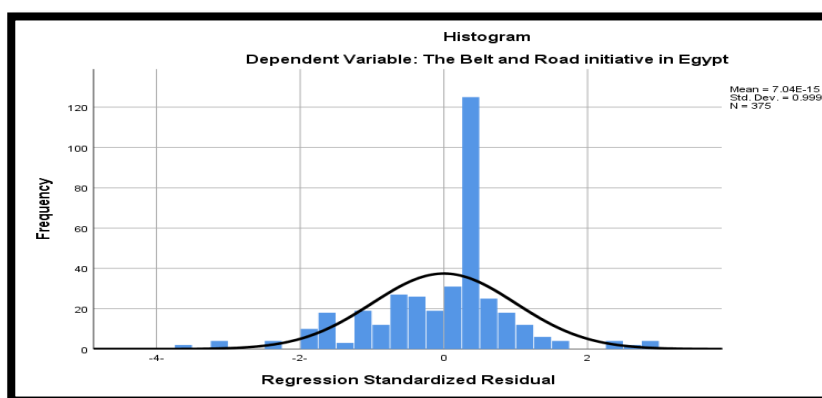
   (Note: Original text incorrectly stated ">0.05". It is actually <0.001.)

3. **F-Test:**

   The model has strong predictive validity ($F = 932.298$, $p < .001$).

4. **Residuals Normality:**

   Figure 4-7 confirms error distribution is near-normal (mean ≈ 0, SD ≈ 1).

Figure (4-7): Histogram of standard errors for the linear regression of Logistics services on the Belt and Road initiative in Egypt

Source: The results of the statistical analysis of the SPSS program.

Regression Equation: BRI Implementation = 0.081 + 0.945 (Logistics Services)

This implies that a one-unit increase in the logistics services score increases BRI implementation by 0.945 units—demonstrating the strongest effect among the three variables.

4-7-5 Multiple Regression: Combined Effects of All Predictors

A multiple linear regression analysis was done to assess the combined effect of dry port development dimensions on the execution of the Belt and Road Initiative (BRI) in Egypt. This model sought to evaluate the collective predictive capacity of three independent variables: the creation of dry ports, their administration, and the logistical services they offer.

Table 13 : Multiple Linear Regression Model Predicting BRI Implementation from Dry Port Establishment, Management, and Logistics Services

Dependent Variable	Independent Variables	R	R^2	B	Beta	T-Test		F-Test	
						t	Sig.	F	Sig.
the Belt and Road initiative in	Constant	.880ᵃ	.774	.340		2.845	.005***	424.431	.000b
	Establishing dry ports			.105	.161	2.839	.005***		
	Managing dry ports			.117	.182	3.321	.001***		
	logistics services			.692	.619	18.364	.000***		

*** Statistically significant at the significance level (0.001)

** Statistically significant at the significance level (0.01)

* Statistically significant at the significance level (0.05)

- **The researchers deduced from the aforementioned table that:**

1. **Model Fit (R² = 0.774):**

   Combined, the three independent variables explain **77.4% of the variance** in BRI implementation in Egypt.

2. **Predictor Significance:**

   All predictors are statistically significant (p < .001), with **logistics services** having the largest standardized coefficient (Beta = 0.619), followed by managing dry ports (Beta = 0.182), and then establishing dry ports (Beta = 0.161).

3. **F-Test for Overall Model:**

   The model is highly significant (F = 424.431, p < .001), supporting the inclusion of all predictors.

4. **Residual Normality:**

As shown in **Figure 11**, residuals follow a normal distribution (Mean ≈ 0, SD = 0.996).

Dependent Variable	Independent Variables	R	R^2	B	Beta	T-Test		F-Test	
						t	Sig.	F	Sig.
the Belt and Road initiative in Egypt	Constant	.880ª	.774	.340		2.845	.005***	424.431	.000b
	Establishing dry ports			.105	.161	2.839	.005***		
	Managing dry ports			.117	.182	3.321	.001***		
	logistics services			.692	.619	18.364	.000***		

*** Statistically significant at the significance level (0.001)

** Statistically significant at the significance level (0.01)

* Statistically significant at the significance level (0.05)

> **Regression Equation: BRI Implementation = 0.340 + 0.105 (Establishing Dry Ports) + 0.117 (Managing Dry Ports) + 0.692 (Logistics Services)**

Thus, each dimension significantly predicts BRI implementation, with logistics services having the **strongest influence**. Furthermore, the standardized regression coefficients (Beta values) indicate that among the three predictors—**logistics services**, **managing dry ports**, and **establishing dry ports**—the variable **logistics services** exerts the strongest influence on the dependent variable (the implementation of the Belt and Road Initiative in Egypt), followed by managing dry ports and then establishing dry ports. This ordering underscores the relative importance of these dimensions, with logistics services emerging as the most substantial contributor to enhancing the overall implementation of the Belt and Road Initiative within the Egyptian port and logistics sector.

All variables significantly contribute to explaining the BRI implementation in Egypt.

4-7-6 Construction of the Structural Model for Research Variables

To deepen the analysis, the researchers employed **path analysis** to test the structural relationships among the study variables. Path analysis represents one of the foundational forms of **structural equation modeling (SEM)** and is particularly appropriate when all variables in the model are **observed variables**——as opposed to latent variables used in **confirmatory factor analysis (CFA)** (Byrne & Kelloway, 2019). In this context, path analysis allows the inclusion of **multiple exogenous (independent) and endogenous (dependent) variables**, providing a flexible framework that surpasses the limitations of traditional multiple regression models, which allow only a single dependent variable (Awad, 2019, p. 172).
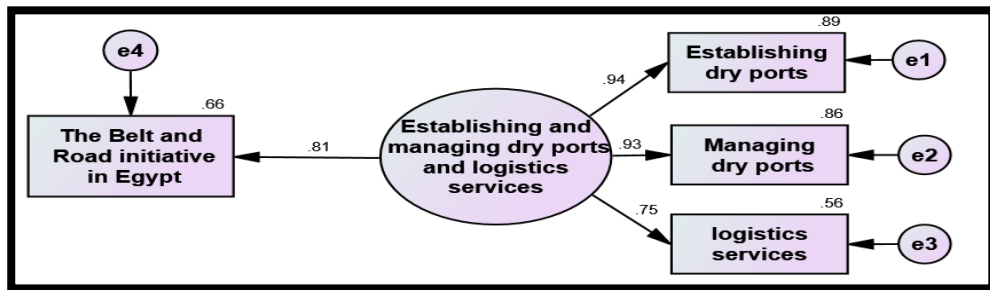

Figure 4-13

Structural Model of the Study Variables

Source: AMOS output of the structural model analysis.

The structural model in Figure 4-13 illustrates the hypothesized causal pathways between the composite construct **"Establishing and Managing Dry Ports and Logistics Services"** and its individual dimensions, as well as their effect on the **implementation of the Belt and Road Initiative (BRI) in Egypt**.

Table 4-14: Path Analysis Results for the Study Variables

The path		Standardized regression coefficient	regression coefficient	Standard error	test T (CR)	(P value)
independent variable	Dependent variable					
Total scale Establishing and managing dry ports and logistics services	Establishing dry ports	.943	1,000	-	-	-
	Managing dry ports	.927	1.000	.032	31.427	***
	logistics services	.748	.464	.024	19.284	***
	Total scale to the Belt and Road initiative in Egypt	.813	.564	.025	22.842	***

***p < 0.001

Indicates statistical significance at the 0.05 level.

Source: AMOS output.

From Table 4-14, it is evident that all **standardized path coefficients** are **statistically significant at the 0.001 level**. The construct "Establishing and Managing Dry Ports and Logistics Services" exhibits **strong and significant effects** on:

- Each of its underlying dimensions (establishing dry ports, managing dry ports, logistics services), and
- The dependent variable "Belt and Road Initiative implementation in Egypt".

The model explains approximately **67.7% of the variance** in BRI implementation, indicating a high level of explanatory power and suggesting that improvements in dry port infrastructure and services are substantially associated with BRI advancement in Egypt.

Table 4-15 : Model Fit Indices for the Structural Model

Indicator	Standard value	Index value
Standard chi-square indexNormed Chi-square (CMIN/DF)	less than or equal to 3	2.670
root mean square error of estimate Root Mean Square Error of Approximation (RMSEA)	less than 0.08	.053
Goodness of fit index Goodness of Fit Index (GFI)	The closer its value is to one, the better the fit of the model to the sample data.the study	0.805
Comparative Matching Quality IndexComparative Fit Index (CFI)		0.853
Standardized Quality of Fit IndexNormed of Fit Index (NFI)		0.952
Tucker Lewis IndexTucker-Lewis Index (TLI)		0.918

Source: AMOS output.

The table 4-15 demonstrates that all structural model fit indices reside within statistically acceptable limits. The RMSEA value of 0.053 signifies commendable model parsimony, whilst the Normed Chi-square (CMIN/DF) of 2.670 falls comfortably within the permissible range (<3.0), affirming that the model is not overfitting. Despite the Goodness-of-Fit Index (GFI) being somewhat below the optimal threshold of 0.90, other indices, including the NFI (0.952) and TLI (0.918), offset this shortcoming and together affirm the model's adequacy in depicting the observed data.

4-7-7 Hypothesis Testing Conclusion

Based on the results of the path analysis and fit indices:

- The **null hypothesis** stating that "There is no effect of establishing and managing dry ports and logistics services on the implementation of the Belt and Road Initiative in Egypt" is **rejected**.

- The **alternative hypothesis** is **accepted**, confirming that **significant causal effects** exist among the dimensions of dry port development and the advancement of the BRI in Egypt.

As for the **sub-hypotheses**, they are **fully and partially supported**, depending on the strength of the paths identified. All individual dimensions contribute significantly, albeit to varying degrees, to the overarching BRI outcome variable.

5- Conclusion, Proposed Model and Recommendations

This study set out to empirically examine the relationship between **establishing and managing dry ports**, the provision of **logistics services**, and the extent to which these dimensions influence Egypt's participation in the **Belt and Road Initiative (BRI)**. Using **simple and multiple regression analysis**, followed by **structural equation modeling (SEM)** via **path analysis**, the study provides robust evidence that dry port development plays a **significant, multidimensional role** in advancing BRI objectives within the Egyptian context.

The results demonstrate that the latent construct——**"Establishing and Managing Dry Ports and Logistics Services"**——significantly predicts the implementation of the BRI, with a **standardized path coefficient of β = 0.813 (p < .001)**. Among the internal dimensions, **logistics services** emerged as the most influential factor (β = 0.748), followed by **managing dry ports (β = 0.927)** and **establishing dry ports (β = 0.943)**. The model explains approximately **67.7% of the variance** in BRI implementation, confirming its **high explanatory power**.

All model fit indices, including **CMIN/DF = 2.670, RMSEA = 0.053, TLI = 0.918**, and **NFI = 0.952**, fall within the acceptable range, affirming the **theoretical validity and empirical adequacy** of the proposed structural model. The significance of all paths confirms the robustness of the hypothesized relationships.

5-2 Proposed Model from the Study

The model illustrated in Figure 5-1 depicts the proposed directional relationships among the primary latent construct——Establishing and Managing Dry Ports and Logistics Services——and its subdimensions (Establishing Dry Ports, Managing Dry Ports, and Logistics Services), as well as the dependent outcome, Implementation of the Belt and Road Initiative (BRI) in Egypt. The model was estimated through the use of

AMOS software, utilizing path analysis with observed variables. presents the conclusive structural model obtained from the examination. This model serves as a validated framework for policymakers and researchers aiming to analyze the relationship between inland logistics infrastructure and transnational trade initiatives in Egypt.
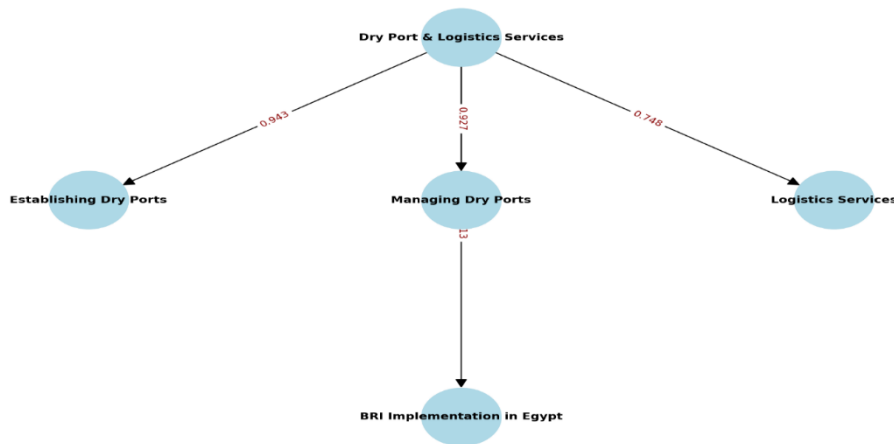
5-3 Strategic Policy Recommendations

In light of the empirical findings and the proposed model, the following recommendations are advanced to guide national strategy:

1. Strengthen Logistics Service Integration

Given the dominant influence of logistics services in the model, Egypt must:

- Prioritize investment in **multimodal logistics hubs**, cargo handling facilities, and real-time information systems,
- Develop **intelligent logistics platforms** integrated with customs, transport, and tracking systems to reduce transit time and improve transparency.

2. Professionalize Dry Port Management

The statistically significant role of **dry port management** highlights the need to:

- Enhance governance structures through the implementation of **performance-based contracts** and **private sector participation**,

- Institutionalize **international management standards (e.g., ISO 28000)** and adopt **digital port community systems** to improve operational efficiency.

3. Expand and Strategically Align Dry Ports

Although "establishment" has a slightly lower predictive weight, its significance warrants:

- Strategic spatial planning to align dry ports with **national logistics corridors** and **BRI overland routes** (especially connections to the **Suez Canal Economic Zone** and inland industrial zones),
- Utilize **railway revitalization** and **inland waterways** to ensure sustainable port-hinterland connectivity.

4. Integrate BRI into Egypt's National Logistics Vision

The Belt and Road Initiative offers an unprecedented opportunity for Egypt to:

- Emerge as a **logistics gateway between Asia, Europe, and Africa**, leveraging its geographic position,
- Develop **special economic zones and dry port clusters** along BRI routes,
- Collaborate with Chinese and other international partners on **technology transfer and joint infrastructure development**.

5-4 Recommendations for Future Research

The current study provides a validated conceptual model; however, future researchers are encouraged to extend and refine the model using the following directions:

1. **Longitudinal Studies;** Assess how the impact of dry port development on BRI participation evolves over time, especially in response to policy shifts or infrastructure investments.

2. **Mediation and Moderation Modeling;** Investigate the **mediating role of digitalization**, and whether variables such as **institutional readiness** or **political stability** moderate the relationships proposed in the model.

3. **Cross-Country Comparative Analysis;** Benchmark Egypt's dry port strategy against other BRI corridor countries (e.g., Kenya, Pakistan, Kazakhstan) to extract lessons and tailor interventions.

4. **Geospatial Simulation Modeling;** Incorporate **GIS tools and spatial econometrics** to assess the optimal location and catchment areas of future dry ports under varying BRI scenarios.

Finally

The study provides empirical clarity and theoretical depth on how **dry port infrastructure and logistics services** serve as **strategic levers** in Egypt's engagement with the BRI. The **proposed structural model** serves as a blueprint not only for academic research but also for guiding infrastructure policy, institutional reform, and international collaboration. If adopted in a coordinated manner, these recommendations will empower Egypt to assume a **leading logistics and trade facilitation role** within the evolving global trade architecture shaped by the Belt and Road Initiative.

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