

SWOT Analysis on the Importance of Egypt and Sudan Logistics Transportation Networks: A Systematic Literature Review

Jilan A. Keshta

Graduate teaching assistant at AASTMT, College of International Transport and Logistics.
Post graduate student at Arab Institute for Trade and Commodity Exchange.

jilan9a@adj.aast.edu

Mai S. EIDine

Assistant Professor at AASTMT, College of International Transport and Logistics.

maysalah@aast.edu

Mostafa Saber

River Transport Research Department at Arab Academy for science, Technology and Maritime Transport.

mo.saber@yahoo.com

Andreea Barbu

University POLITEHNICA of Bucharest, Romania

andreea.barbu2901@upb.ro

Received on: 23 November 2022

Accepted on: 21 December 2022

Published on: 28 December 2022

Abstract

Purpose: The aim of this research is to illustrate systematic literature review, investigating the importance of Egypt and Sudan cooperation in terms of logistics and transport networks through conducting a SWOT analysis to determine the main opportunities and barriers behind this cooperation and how to overcome these barriers.

Design/Methodology/Approach: In order to highlight Egypt and Sudan relations to offer and integrate various transportation networks and methods, a systematic literature review of 34 published research papers on Egypt and Sudan connectivity was conducted over 18 years. The main goal was to report on the most important research studies that matched the research keywords across multiple databases, report the research gap by displaying the research theoretical framework, and state what other researchers should consider. Consequential is the strategic analytical tool, SWOT analysis, which is based on the results of the systematic review analysis to evaluate internal strengths and weaknesses as well as external opportunities and threats that Egypt should address in integrating with Sudan.

Findings: It was determined that an insufficient number of research investigations has used the waterway connection to impede the flow of commerce to ascertain multimodal transportation. There has also been no additional investigation into the border terminals and route networks between Egypt and Sudan, which could potentially help in the enhancement of the countries' import and export operations. Taking into consideration the main results and variables of the study, that should be tested in further studies, it was found that enhancing activities, services, and hubs may be beneficial to the transportation networks, seaports, and logistics networks that surround both nations.

Research Implications/Limitations: The current research presents a narrative and systematic representation of logistics transportation networks resulting in pointing up the research theoretical framework, then a SWOT analysis to highlight the main strength points and opportunities for Egypt and Sudan for their transport and

logistics development and for attaining greater benefits for both nations. Nevertheless, achieving this goal requires additional research and fact-finding.

Originality: *Through identifying the effects of collaboration on the transport sector by enhancing inter-modality services and logistics services between the two nations, the research provides a significant addition to the literature, as there were a lack of studies investigating the cooperation between Egypt and Sudan and limited studies highlighting its importance. The theoretical models and findings from actual investigations developed by the researchers will aid in the infrastructure of transport networks connecting Egypt and Sudan, but this will necessitate extensive research and testing.*

Keywords: *Egypt and Sudan, Multimodal, Logistics Centers/Hubs, Regional Integration and Transport Networks.*

Introduction

Egypt's logistics profile is critical to the country's economic recovery. Aside from its strategic location, Egypt has robust aviation and maritime networks, but the country's utilities and transportation infrastructure still need to be improved. Long-term, Egypt's logistics profile appears optimistic, as the government's efforts to reform the economy have attracted essential investments. The transportation industry is critical to Egypt's economic prosperity (Abd Ellah, 2020). All sectors of the national economy rely on transportation services and facilities to connect production and consumption markets, as well as access to raw materials, services, and equipment. The government and the ministry wish to upgrade Egyptian transportation systems in order to stay up with worldwide technical breakthroughs and to give exemplary service to Egyptian citizens on roads, railroads, and airports. A change in government legislation now permits semi-government entities, such as the Egyptian Railways Company, to issue bonds, increasing the volume of investment (*Egypt Independent*, 2017).

Transport corridors to and from seaports in several countries facilitate trade with global markets. As a result, the physical transport networks in the Nile region have a relatively low level of integration. The countries mostly export agricultural items with minimal added value. Some countries have found or are presently utilizing vast quantities of mineral resources, such as oil, natural gas, and precious stones. These are (or will be) exported using the present modes

of transportation. Over 21,900 kilometers of pipelines delivering condensate, gas, oil, and refined petroleum products are added to the region's bulk transportation network. Over 60% of the basin's present pipelines are located in Egypt (UNCTAD, 2020).

The current paper starts by illustrating narrative literature review, presenting the potentiality of Egyptian-Sudanese relations, the integrated transport and multimodal transportation significance and explaining the importance of the integrated chain of multimodal transportation and logistics hubs and how they will affect the trade and globalization within continents. Subsequently, following the systematic literature review, the research methodology and the results and discussion are presented. Afterwards, the research presents the theoretical framework and conducts the SWOT analysis, summarizes the paper, illustrates the conclusions, and discusses limitations and research perspectives.

The Current Situation of the Egyptian– Sudanese Relations

Industry and commerce have a significant impact on the nation's social and economic prosperity, and boosting them is a major priority, explaining why the Egyptian government prioritizes transportation projects as part of its ambitious plan to provide and integrate various transportation

networks and means to serve the comprehensive development process and achieve a balance between citizens' social, economic, and environmental needs. Great accomplishments and massive projects have occurred in Egypt's transportation sector since June 2014, when it demonstrated a special interest in transportation as one of the most important tools for implementing Egypt's development plans. A more efficient transportation system would not only assist Egypt in achieving its goal of increasing trade with foreign markets, but it would also assist Egypt in managing the rapid growth of its metropolitan areas (Leat and El-Kot, 2022). To achieve these goals, private investments must be increased. It is also important to note the difficulties in navigation in Sudan, particularly on the Nile River. Because it provides the most reliable transit link from Sudan to South Sudan during the wet season, the Sudan-South Sudan reach is one of the most important Nile river routes. Private operators are rapidly expanding, increasing total shipping capacity.

The White Nile to the south of Khartoum features shallow sections that limit barge carrying capacity, especially during low water periods, and the river has sharp bends. Most of these southern barriers were eliminated as part of the oil exploration and development project, which dug the White Nile shoals and built navigational beacons from Kusti to Bentiu. The spread of water hyacinth, which impedes traffic, has become a greater impediment. Man-made features, most notably the Jabel-Auliadamon the White Nile, have also placed constraints (about forty km from Khartoum). This dam includes locks, but they have not always operated effectively, and the river between Khartoum and Kusti, a railroad crossing 319 kilometers upstream, has not been used much. In 1983, just two sections of the Nile had regular commercial transportation services (OHCHR, 2020).

The White Nile's 1,436-kilometer stretch from Kusti to Juba (known as the Southern Reach: Kosti, Renk, Malakal, Malakal, Shambe, Bor, Mongalla Terakeka, and Juba) provide the country's only normally functional transportation link between its center and southern regions. This

reach is often used all year, despite the fact that it is impeded by non-functional navigation aids, shifting sand, shallow waters, and exposed rocks. Almost all travel, and certainly organized traffic, were halted in 1984. River traffic south of Kusti was not resumed by mid-1991, except for a few heavily armed and guarded convoys (OHCHR, 2020).

Due to the privatization of the River Transportation Authority in Sudan and South Sudan, private firms are now competing to develop and run the river transportation system and river ports. The Port of Kosti is a prime example of Sudan's privatization programmer. Furthermore, while the government owns the present river ports in South Sudan, private entities are increasingly investing in inland ports linked to river ports. On the White Nile, the main river ports in Sudan and South Sudan are Kosti, Malakal, and Juba, which offer the quickest transit time for barges travelling upstream (south) from Kosti to Juba as well as the quickest transit time for barges travelling downstream (north) from Juba to Kosti (Ranganathan and Garmendia, 2011).

Kosti Port is connected to Khartoum, Port Sudan, and other important Sudanese cities via rail and asphalt road. It has an 800-meter shoreline as well as a 115-meter vertical masonry quay with mooring rings and freight handling crane track. The rail siding adjacent to the dock is out of service. Although there is an RTC dockyard for small to medium-sized boat repairs, replacement parts and maintenance have been difficult to get.

Malakal Port is open all year, has a cement pier, is silt-free, and measures 300 meters. Malakal does not have any barge maintenance facilities.

Juba Port, The River Transport Corporation (RTC) provides barge services because no private companies offer regular voyages to Juba. Barges now travel in convoy from Kosti to Juba, and ports can only accommodate two barges at a time. Juba's old port is no longer functioning due to silting, and Juba's new port lacks infrastructure. The route from Kosti to Juba is seasonal and is determined by the weight of the barge. Due to low water levels, barges must

occasionally be partially offloaded in Terakeka.

It is the fundamental national strategy to stimulate industries by increasing trade links with other areas of the world and securing more firm assurances of market access to the larger markets. This method demonstrates a deep engagement of the economy in international free markets in Eastern Mediterranean and African countries. As domestic products face strong quality competition on international markets, exports of materials/products are cruelly scrutinized in terms of market price competitiveness and timely delivery. Globalization and technical improvements have produced a commercial atmosphere in which products and services are offered globally, as well as global partnerships and economic alliances. Having a global view is already required for success (Cheba, Kiba-Janiak 2017).

The Significant Impacts of the Egyptian – Sudanese Relations on their Economy

It is critical for the economy to grow and for future generations to have a greater standard of living. Because of regulation harmonization, commodities may travel freely inside the country, and interoperability of modalities, nodes, and networks is at the heart of it (European Commission, 2010). To accomplish mode integration, it is necessary to have a thorough

understanding of present transportation modes and their relationships to nodes. To provide trustworthy, safe, and cost-effective service, professional logistics management in accordance with the country's expectations is also required.

The terms 'intermodal' and 'multimodal' are used interchangeably to describe the movement of goods from one location to another. To make matters even more complicated, the United Nations' Multimodal Transport Handbook defines both (1995). MTOs are responsible for all transportation activities, from the shipper to the consignee. They assure cargo transportation by organizing and supervising the process from shipper's door to consignee's door, adopting the most efficient and cost-effective methods. In order to apply this concept, simplified documentation, commercial procedures, transit infrastructure, and municipal legislation drawn from appropriate standards are required (Koei, 2018).

The Egyptian transportation system will be illustrated as despite the fact that Egypt offers a variety of transportation options, roads transport 94% of freight while railroads and inland waterways transport 6%. Egypt's transportation infrastructure consists of railroads, a road network, and an inland canal. Egypt's domestic freight volume is 500,000 tons (Ministry of Transport (MOT)). While this volume is hampered by a trade imbalance, the number of empty modes returned to ports is significant. Furthermore, emptied ships depart without cargo, which increases transportation costs (Mega Projects, 2020).

Table 1: Annual Modal Share for Egyptian Freight Movement which Depicts Egyptian Freight Flow

Year	Cargo Volume (1000 tons)				Modal Share (%)			
	Road	Railway	IWT	Total	Road	Railway	IWT	Total
1979	73,700	5,000	4,300	83,000	88.7	6.1	5.2	100.0
1992	165,495	9,642 0	3,214	178,351	92.8	5.4	1.8	100
2000	242,000	11,812	2,161 0	256,000	94.5	4.6	0.8	100
2010	433,361	4,042	2,226	439,630	98. 6	0.9	0.5	100.0

Source: (JICA, 2014)

Egypt must receive industrial inputs from international enterprises located anywhere in the world at the ideal time for manufacturing. More significantly, when it comes to selecting business partners, pricing is a crucial consideration. Companies are becoming increasingly aware that a worldwide freight transportation infrastructure is a vital component of international competitiveness as globalization accelerates. However, Egypt's current transportation development plans are centered on modes, such as sea, road, railway, and inland canal, resulting in sufficient intermodal connectivity and good overall system efficiency for export/import freight operations. The transportation designs themselves did not contain comprehensive and multimodal logistics flow optimization solutions. As a result, Egypt is developing a comprehensive logistics development plan to fulfill existing logistical needs while also reflecting the present shift in freight traffic volume (Oxford Business Group, 2021).

Egypt's transportation system was not designed to manage the current volume of visitors. As a result, after decades of underinvestment, President Sisi's administration has made significant tangible efforts to strengthen the industry by investing heavily in modernizing its infrastructure to modernize and enhance the capacity of various modes of transportation; more than \$10 billion has been invested since last year. Investing is likely to continue as a result of investment pledges and memorandums of understanding signed in Egypt Economic Forum in March and subsequent months. Several transportation-related initiatives have been initiated as a result of this investment, including the National Roads Project, the Cairo Metro Line 4 Development Project, the extension of Alexandria and Damietta ports, and the Suez Canal Zone Development Project. Egypt's government has made concentrated efforts to update the country's transportation infrastructure in order to speed up the flow of freight, which has traditionally been transported via Egypt's failing road network. The freight sector has enormous potential for economic growth. This opportunity merits greater consideration and investigation

(Bayoumi et al., 2021). Despite the fact that the Nile has been underused as a passenger and freight transit corridor, there are now substantial measures ongoing to expand water capacity (Egyptian National Network, 2017).

However, transportation authorities still face significant challenges, such as developing a comprehensive asset management strategy, increasing safety to prevent accidents, and lowering transportation-related mortality. Authorities are working to improve revenue generation and management in order to create a self-sustaining transportation industry. They are also attempting to attract domestic and foreign investors while easing the fiscal burden on the government. Until these issues are resolved, Egypt will be unable to boast of a sophisticated multimodal transportation network, which would help the country's economy (EBRD, 2017).

Methodology

The research technique captures the majority of papers that will be evaluated for eligibility and inclusion, for a more flexible framework to accommodate shifts in the research and generalization at the end (Aromataris and Riitano, 2014). Despite the ultimate influence on transportation network and infrastructure on the regional integration for Egypt and Sudan, a comprehensive and updated assessment of the existing literature is still negotiated. The current paper aims to fill this gap by presenting the results of a systematic literature review of bringing out the impact of multimodal on the neighboring countries.

Conducting the review papers was through identification of research scope, selecting relevant studies, assessing the quality of selected studies, extracting data, and synthesizing the selected relevant studies from different journals, conferences, and article papers. Additionally, an interpretation of logistics transportation networks leading to a SWOT analysis features the

main strengths and opportunities for Egypt and Sudan transportation and logistics progression, achieving greater benefits for both countries.

Systematic Literature was gathered on the basis of selected keywords (Multimodal, Logistics Centers/Hubs, Regional Integration and Transport Networks) between the years 2004 and 2022, identified and used to online databases search by collecting information from scientific published literature, previous study, books, periodicals, libraries, dissertations, and reports. The sources were selected to be sufficient to address the topic, depending on the multimodal transportation criterion, the choice of a seaport or airport, the convenience, dependability of pickups and deliveries, strategic locations, and competitive fees.

Results and Discussion

The gathered publications are evaluated in the following table (Table 2), based on the given approach, which serves to synthesize previous research in this topic and to highlight the gaps in each study, with the aim of answering the research questions and outlining a plan for future study. After narrowing the total number of articles retrieved to 34, the articles were assessed according to the topic of the study, and the papers goals and methods were determined. This is then followed by an acknowledgment of the study's major takeaways and its limitations. Finally, the recommendations for further study have been addressing.

Table 2: Authors' Name, Paper Focus, Keywords, Year of Publication and Their Findings

Paper No.	Authors' name	Paper Title	Keyword	Year	Paper Focus	Findings
1.	Jiuping Xu, Liming Yao, and Xiaodan Zhao	A Multi-objective Chance-constrained Network Optimal Model with Random Fuzzy Coefficients and their Application to Logistics Distribution Center Location Problem	Distribution Center Location	2011	Geographic coverage is used to describe a hub's local, regional, and global importance. To clarify, a logistics center may be a freight village, logistics node, or distribution center, depending on the existence and extent of variables.	Proposing no distinction between logistics and distribution centers, relocating it to be consistent in its support of both domestic and international businesses.
2.	Zbigniew Bentyn	Poland as a Regional Logistic Hub Serving the Development of Northern Corridor of the New Silk Route	International Logistics	2016	The region's logistical performance. Identifying countries that could play a significant role in the processes to integrate worldwide supply chains. Attracting investors' attention and is advantageous to both local and regional economies.	Improvement study on logistic performance and playing an important role as a logistic hub for geographic location aiding in functions as a distribution hub for future commerce and logistic operations.
3.	Islam El-Nakib	The Supply and Demand of Logistics Services in Egypt: The Case of Logistics Service Providers and the Egyptian Industrial Sector	Logistics	2011	Evaluating the supply and demand for logistics services in the market, where LSPs represent the supply side and industrial enterprises represent the demand side.	Raising awareness of the critical interest of LSPs' role in helping the manufacturing industrial sector.
4.	Katarzyna Zofia Gdowska, and Roger Książek	Cyclic Delivery-Scheduling Problem With Synchronization of Vehicles Arrivals at Logistic Centers	Logistics	2015	An internal logistics management system controls all goods handling, loading, and discharging activities, as well as document circulation processes. The efficiency of this system leads to the overall efficiency of the logistics center.	Boosting the efficiency of trade logistics infrastructure, suggesting that a strong logistics and supply chain management system could support the initiatives.

5.	Indonesian and Dutch organizations and knowledge centers with technical support from the World Bank office in Jakarta	State of Logistics Indonesia	Logistics	2015	Based on surveys of international freight forwarders, this report provides an overview of the logistics of undertaking international trade (exports and imports at ports and airports). Measuring six logistical variables that international freight forwarders believe are crucial.	Over the last several years, it has improved its logistics performance, particularly in the areas of infrastructure, border agencies, and logistical expertise. It demonstrates that the growing interest in logistics from both the public and commercial sectors in Indonesia is now paying dividends.
6.	JICA Study Team	Logistics-related Facilities and Operation: Land Transport	Logistics	2019	Investigates the present state of land transportation modes and facilities. Egypt's transportation modes, including highways, trains, and inland waterways are evaluated, with an emphasis on their functions in the logistics system.	Improving the logistics system, as well as the involvement of commercial stakeholders and the major governmental institutions whose responsibilities have an influence on logistics, bottlenecks are discovered, and solutions are suggested to achieve an efficient system of logistics.
7.	Claudine A. Soosay, and Paul W. Hyland	Driving Innovation in Logistics: Case Studies in Distribution Centers	Logistics Centers	2004	Most firms respect the notion of innovation in order to generate and maintain competitive advantage. Firms must innovate in order to stay competitive.	Investigating and contrasting variables driving innovation in distribution centers in Australia and Singapore, a sector of the logistics function that has been hesitant to adapt in the past.
8.	Drs. L.M. Van der Lugt., and Drs. M.H. Nijdam	The Changing Nature of Logistics Centers: Implications for Ports and Terminals	Logistics Centers	2005	Ports' function as a venue for logistical activities evolves in tandem with the growth of the logistics idea, moving away from central coordination and toward more decentralized physical distribution.	Analyzing the increasingly essential subject of what logistical activities may be drawn by ports and what is the best method to achieve this.
9.	Chin-Shan Lu, and Ching-Chiao Yang.	Evaluating Key Logistics Capabilities for International Distribution Center Operators in Taiwan	Logistics Centers	2006	Key logistical skills for international distribution center operators are objectively evaluated.	Revealing that the customer response capabilities of public and private international distribution center operators vary greatly.
10.	leva Meidutė, and Jurgita Raudeliūnienė	Evaluation of Logistics Centers Establishment External and Internal Factors	Logistics Centers	2011	Logistics centers are pushed to provide competitive and high-quality categories of services to the market, increase their profitability, and minimize environmental interference with their operations.	The growth and development of logistics centers are leading to increased functionality and service quality, as well as the unification of widely used criteria for their establishment.
11.	Olga Girvica	New Supply Chain Creation for Logistics Center Work Optimization	Logistics Centers	2011	The challenge of the decision-making process for the construction of the logistics center's new supply route was noted. The objective is to make decisions on the method of selection, from raw materials to the product invention that enables a corporation to maximize earnings.	The numerical sample of the decision-making process for the Logistics center's new supply and sales channel development in order to maximize profit.

12.	Nasser Saeidi, Hassan Jafari, and Ali Ameli Maryam Barahi	Evaluation the Role of Logistics Centers in the Development of Iranian Seaports	Logistics Centers	2013	It has a unique geographical location in the region and globally, making it a prospective logistic country. Due to the country's strategic location, improving and growing its ports, as well as developing its port value-added services can benefit national reproduction and revenue.	In order to perform international transportation, a logistic center should be offered and supported by well-organized broad range of transportation routes, such as roads, trains, oceans, inner waterways, and air services for a good distribution network.
13.	KTI and GYSEV	Business Case for the Extension of the Intermodal Logistics Center in Sopron	Logistics Centers	2014	The Sopron Logistics Service Centre (SILK), which was owned by GySEV Zrt and operated by GYSEV CARGO Zrt, was largely focused on railway border services, with a focus on multimodal transportation.	Capacity to expand into a continental logistics center between the North-West, South-East (Balkans), and Baltic and Adriatic European territories; utilize the transit potential of the routes that intersect our nation in West-Europe. By the competitive supply of a growing logistics service provider and the activities with a high added value.
14.	Kristina Rimienė, and Dainora Grundey	Logistics Centre Concept Evolution and Definition	Logistics Centre Concept	2007	Determining the concept of logistics centers by pointing to their emergence and background, as well as evaluating existing logistics center understandings and definitions.	Researchers in logistics have made little attempt to create a unified logistics center concept. Rectifying the hierarchy of logistical facilities and constructing the criteria of logistics center is critical for every researcher interested in logistics theory.
15.	Christophe Theys, Dong Keun Ryoo, and Theo Notteboom	Towards a Generic Framework for the Development of Logistics in Seaports: Lessons from the Busan Case.	Logistics Hubs	2008	Providing a general framework for port logistics growth and cooperation with hinterland regions.	Terms of logistics activity are fairly clearly explained. This framework expressly adds port and hinterland features to the list of important elements in the selection of logistics activity locations.
16.	Islam El-Nakib	Egyptian Firms' Location Preferences for Logistics Hubs: Focus on the Southeast African Region	Logistics Hubs	2010	Presenting the major factors that are considered important when deciding where to locate Regional Distribution Centers (RDCs), as well as identifying the gaps in order to achieve the goal of building a successful regional logistics hub.	Improving coverage and harmonization and promoting the wider use of information and communication technology in trade processes.
17.	MSc. Nguyen Xuan Tinh	Port and Logistics Infrastructure in Vietnam Opportunities for Cooperative Development	Logistics Infrastructure	2018	Utilizing natural circumstances for the long-term growth of the seaport system.	Developing navigation facilities in all channel systems comprehensively.
18.	Bogusz Wiśnicki	Determinants of River Ports Development into Logistics Tri-modal Nodes, Illustrated by the Ports of the Lower Vistula River	Logistics, Multimodal	2016	Network of river logistics hubs along the Vistula. The notion implies river logistics hubs and their linkages to port agglomerations. This map shows the organizational and technological aspects of river logistics.	Allowing for the use of the provided technique for the creation of river logistics hubs in other places.

19.	Maritime Transport Sector	The Egyptian Maritime Transport Strategy, Development and Increasing the Competitiveness of Ports	Maritime Logistics	2018	Meeting economic demands for the expansion and development of the maritime transport industry, as well as establishing plans to assure its efficiency and quality of performance	Expanding the capacity of seaports and improving the efficiency of logistics services performed
20.	Wang Qingyun	Ideology and Practice of Systems Engineering in Multi-Modal Transport Planning	Multimodal	2008	Based on the foundation of the formulation of the multi-modal transport network planning and description of the recent development of the national multi-modal transport network from the standpoint of systems engineering.	Building a strong indication capable of recognizing the importance and its contribution beginning with network performance and establishing a multi-modal transportation system of comfort, smoothness, high efficiency, and safety.
21.	Agachai Sumalee, Kenetsu Uchida, and William H.K. Lam	Stochastic Multi-modal Transport Network under Demand Uncertainties and Adverse Weather Condition	Multimodal	2011	Offering a multi-modal transportation network assignment model that takes into account uncertainty on both the demand and supply sides of the network.	Developing a stochastic network model for a multi-modal transportation network that takes into account vehicle, bus, subway, and pedestrian modes.
22.	Vasco Reis, J. Fabian Meier, Giuseppe Pace, and Roberto Palacin	Rail and Multi-modal Transport	Multimodal	2013	Defining inter- and multi-modal travel and comparing their performance. Following an assessment of internal and external hurdles to effective multimodal transport, an analysis of the benefits and drawbacks of merging rail and road is carried out.	A conversation on energy efficiency in rail.
23.	Adriaan Hendrik van der Weijde [†] , Erik T. Verhoef, and Vincent A.C. van den Berg	Competition in Multi-modal Transport Networks: A Dynamic Approach	Multimodal	2013	Examining the distinction between markets with a monopolistic public transportation operator that operates all public transportation connections and markets with individual operators owning each public transportation link.	Employing computer simulations to demonstrate that, contrary to the findings of standard vertical competition research, monopolistic rates are not necessarily cheaper than duopolistic fares; the converse can also occur. In addition, investigating how various characteristics affect the price disparity and how this influences welfare.
24.	G.L.L. Reniers, W. Dullaert.	A Method to Assess Multi-modal Hazmat Transport Security Vulnerabilities: Hazmat Transport SVA	Multimodal	2013	Assessing the relative security risk levels of various modalities of hazardous freight transportation.	Analyzing the security risk levels of various route segments and routes of hazardous goods transportation, and adopting countermeasures from a unimodal as well as a multi-modal viewpoint.
25.	Markus Friedrich	Evaluating the Service Quality in Multi-modal Transport Networks	Multimodal	2016	A technique for assessing the service quality of full trips between an origin and a destination point based on a six-level service assessment scheme (LOS).	Recognizing network flaws not only at the OD-pair level, but also to identify important network parts.
26.	Petri Mononen, Pekka Leviakangas, and Harri Haapasalo	From Internal efficiency to Societal Benefits of Multi modal Transport Safety Agency's Socio-economic Impact Analysis	Multimodal	2017	Pressures to reduce public spending and providing great value for money from initiatives that employ scarce public funds may be found all over the world.	Methods for mapping effect processes; measurement of service socioeconomic impacts.

27.	Anastasija Bolkovskaa, and Julija Petuhova	Simulation-based Public Transport Multi-modal Hub Analysis and Planning	Multimodal	2017	The notion of a multimodal transportation system, transportation system management technologies, and other researchers' relevant studies of multimodal hub planning are examined.	Recommendations are made to improve the operation efficiency of the bimodal transport hub train - international bus.
28.	Xiaodong Liu, Yuan Zhou, and Andreas Rau	Smart Card Data-Centric Replication of the Multi-modal Public Transport System in Singapore	Multimodal	2019	Using a smart card database to precisely replicate Singapore's multi-modal public transport system. Exogenous passenger demand is replicated, and various operational details are provided, including passenger inter-modal travel.	Delivering reliable quantitative information on a variety of topics to aid decision-making, such as accurate temporal and geographical travel demand analysis, transfer pattern analysis, traffic situation inquiry, and bus utilization analysis.
29.	Nodir Jumaniyazov	Creating Multimodal Logistics Centers Prospect for Development in Central Asia	Multi-modal Logistics Center	2010	A logistics centre is a center of commerce where different operators carry out transport, logistics, and commodities distribution operations for both domestic and international transit.	A logistics centre should be serviced by a range of transport options to promote multimodal commodities handling (roads, rail, sea, inland waterways, and air).
30.	Maritime Transport Sector 'Arab Republic of Egypt'	The Egyptian Maritime Transport Strategy, Development and Increasing the Competitiveness of Ports	Regional Integration	2018	Highlighting that the Egyptian Ministry of Transport (Marine Transport Sector) has designed an integrated maritime strategy that is congruent with the overall national policy, approach aimed at improving the efficiency of the marine transportation system.	Improving the capacity of seaports and the effectiveness of services supplied.
31.	Ariel Dinar, and Getachew S. Nigatu	Distributional Considerations of International Water Resources under Externality: The Case of Ethiopia, Sudan and Egypt on the Blue Nile	Regional Integration	2019	Examining the distributional implications of various water allocation strategies used in Africa for the Blue Nile. Water trade is created to show how such an institution might improve current institutions' effectiveness in obtaining incremental advantages from collaboration.	It is discovered that when a core exists, it is relatively tiny, indicating a frail basis for cooperation.
32.	Elin Hellquist	Regional Sanctions as peer review: The African Union against Egypt (2013) and Sudan (2019)	Regional Integration	2020	Presenting a fresh argument on regional sanctions from the field of scholarly publishing. Through their reliance on community-derived authority, equality, and the rationale for African Union (AU) sanctions against Egypt (2013) and Sudan (2019).	Contributing to the successful implementation of democratic standards beyond the immediate crisis, the AU sanctions are pragmatic and resolution-oriented, with the goal of avoiding chaos rather than establishing perfect democracy.
33.	Radwan G. Abd Ellah	Water Resources in Egypt and their challenges, Lake Nasser Case Study	Regional Integration	2020	Water resource challenges will be one of the century's most critical economic and social issues. Egypt is one of the nations that will face significant issues, including groundwater, rainfall, and desalination water limitations due to its fixed share of Nile water.	Depending on the water intake through the Nile discharge and the water outflow through the High dam, there is still water loss due to evaporation and minor water seepage from Lake Nasser. The Tushka initiative is part of a nationwide plan to alter this trend of uneven population potential distribution.

34.	Mary Richard Akpana, *, Nsiong Udom Isemima, Arit Esio Udohb, and Diane Ashiru-Oredopec	Implementation of Antimicrobial Stewardship Programmers in African Countries: A Systematic Literature Review	Regional Integration	2020	Evaluating the degree to which antimicrobial stewardship programmes (ASPs) are being implemented in African nations, as well as the stated outcomes.	The findings of this analysis demonstrate a scarcity of data on ASP implementation in African nations. The accomplishments documented in the included studies demonstrate that additional African nations may adopt similar programs.
-----	---	--	----------------------	------	--	---

(Authors, 2022)

Few studies have tried to examine the effect of agreements between both nations, namely Egypt and Sudan, to decide which route is most efficient to develop a highway for their reach, and even fewer have utilized the river connection to disrupt the trade flow in order to assess multimodal transportation. Moreover, there have been no recent analyses of the border terminals and route networks between Egypt and Sudan, which might increase the effectiveness of commerce between them, especially via the modernization and upgrading of ports in the countries of the Nile Basin.

Despite the fact that additional hubs, activities, and services might be beneficial to the transportation and logistics networks in both countries. These results were discovered in earlier

research on Egyptian-Sudanese development projects in logistics and transportation. Additionally, there have been no more studies into the route networks and border crossing points between Sudan and Egypt. These may enhance import and export operations for both nations, particularly concerning the modernization and upkeep of ports in the Nile Basin nations. Although both countries' logistics and transportation infrastructures could use more hubs, activities, and services.

Based on the previous reviews, the foundation of the research theoretical framework is featured (shown below in Figure 1), recognizing the impact of trade cooperation, agreements, and logistics performance on Egypt-Sudan logistical transportation networks.

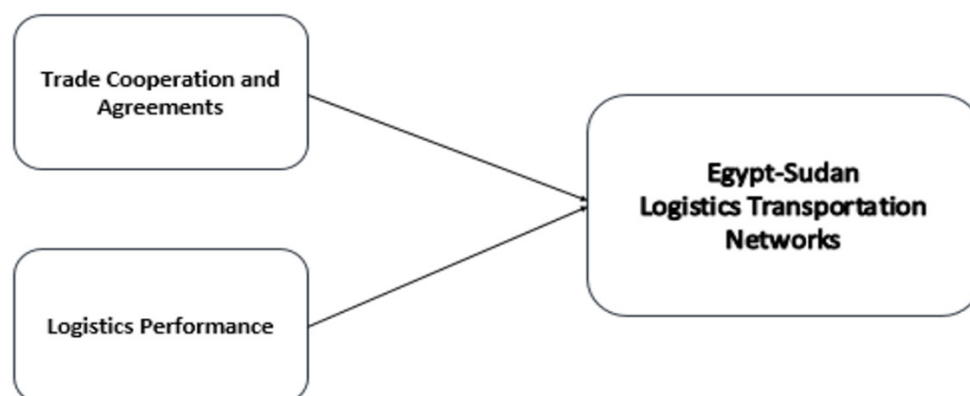
INDEPENDENT VARIABLES**DEPENDENT VARIABLES**

Fig. 1: Theoretical Framework
(Authors, 2022)

To be outlined in a tabular form, A SWOT analysis (Table 3) is performed to work on trade and

logistics facilitation between Egypt-Sudan in order to remove impediments and barriers in

this research to emphasize that the strengths, weaknesses, opportunities, and threats for Egypt and Sudan can take various forms, including the following:

Table 3: The SWOT Analysis – Egypt and Sudan Cases

Internal	External
❖ Strengths 1. In terms of infrastructure, border agencies, and logistical know-how, evidencing that the governments and different sectors are now realizing the benefits of their increased focus on logistics. 2. Improved efficiency and higher-quality services are two outcomes for the booming logistics industry, as is the standardization of key requirements for establishing facilities. 3. Suggestions, to be implemented in both countries, are obtainable to enhance the effectiveness of the train-international-bus transportation hub. 4. Egypt and Sudan offer low prices by a rapidly expanding logistics service providers and high-value services companies provide.	❖ Opportunities 1. Unimodal and multimodal analyses of the security risks posed by different segments and routes of hazardous commodities movement, and the implementation of countermeasures. 2. Enhancing the efficiency and capability of seaports. 3. Several modes of transportation should feed into a Logistics Centre to encourage multimodal goods processing (roads, rail, sea, inland waterways, and air). 4. Enhancing navigational infrastructure in all existing channel networks. 5. Building a multi-modal transportation system that is pleasant to use, easy to navigate, highly efficient, and safe requires first establishing a powerful indicator capable of detecting significance and its contribution. 6. Permitting the approaches to be used in other regions to build river logistics hubs. 7. Improving the effectiveness of logistical services and increasing the capacity of seaports.
❖ Weaknesses 1. Whenever a development is suggested, it is found to be rather from a small enterprise, suggesting a weak foundation for countries' cooperation. 2. Define the wide gap between Egypt-Sudan public and private international distribution center, operators' pathetic ability to respond to client inquiries and complaints about the service provided, and results from countries' weak corporation. 3. Neglecting the importance of energy efficiency in the train industry. 4. Still examining the question of how ports might effectively attract logistical operations.	❖ Threats 1. Techniques for tracing the causes of an effect; estimating the societal and economic value of a service. 2. To establish an effective logistics system, obstacles must be identified and remedies proposed. This requires not just a better logistics system but also the participation of commercial partners and the key governmental organizations whose tasks have an impact on logistics. 3. Few attempts have been made by logistics researchers to develop a standard model for a logistics hub.

(Authors, 2022)

Conclusion and Future Studies

Concluding with the researchers' proposals for how to expand the opportunities between Egypt and Sudan as well as how to improve their existing commercial issues:

- Studying ways to enhance logistical performance and positioning oneself geographically to serve as a distribution center for future commercial and logistical activities is a priority.
- A greater focus on LSPs' vital role in assisting the manufacturing industry and improving trade logistics infrastructure, which may be aided by a robust logistics and supply chain management system.
- Quantitative representation of the deliberative process guiding the expansion of the Logistics Core's supply and sales channels in pursuit of maximum profit.
- In order to carry out international transportation, a logistics hub must provide and be backed by a well-organized wide variety of transportation channels, including roads, railroads, seas, inner canals, and air services.
- Port and hinterland characteristics are explicitly included as factors that matter when deciding where to conduct logistics operations.
- Increased use of information and communication technologies in trade procedures, including efforts to improve coverage and harmonization.
- Building a stochastic model of a transportation network that incorporates car, bus, subway, and foot traffic.
- Everyone doing research in logistics theory must work to fix the skewed hierarchy of logistical facilities and provide criteria for what constitutes a logistics center.
- Taking use of computational modelling to show that, contrary to the results of traditional studies of vertical competition, monopolistic rates are not always more expensive than duopolistic fares. In addition,

looking at the role that different factors play in creating pricing discrepancies and how they impact welfare.

- Identifying critical nodes in the network and spotting problems beyond the origin destination pair level.
- Providing precise quantitative data on issues including travel demand at certain times and locations, transferring patterns, traffic condition inquiries, and bus usage analyses, all of which may be used to guide decisions.

Despite the requirement for sophisticated logistics infrastructure as an institutional investment product, economic development, supply chain restrictions, and the advent of e-commerce have all contributed to the expansion of European markets. Warehouse and logistics facility building might benefit from having ready access to a large land investment bank. Lower Egypt's well-established infrastructure and facilities, as well as its highly developed industrial firms, suggest that the area has potential for further investment and growth.

In light of the result and contribution, the researchers propose that future research could include the theoretical framework to be verified and tested using primary data, concluded through interviews with multimodal transport operations workers in Egypt and Sudan who work in various zones, as well as contacting Sudanese transport authority managers and Egyptian firms in Sudan in order to discuss the key findings of this study and conduct the conceptual framework.

References

- [1] Abd Ellah, R.G. (2020) 'Water resources in Egypt and their challenges, Lake Nasser case study', *Egyptian Journal of Aquatic Research*. Available at: <https://doi.org/10.1016/j.ejar.2020.03.001>.
- [2] Edoardo, A. and Dagmara, R. (2014) 'Systematic Reviews: Constructing a Search Strategy and Searching for Evidence', *American Journal of Nursing*, 114(5). Available at: <https://doi.org/10.1097/01.NAJ.0000446779.99522.f6>.

- [3] Bandekar, S.R. and Vijayalakshmi, C. (2019) 'Optimization algorithm in supply chain management', *International Journal of Innovative Technology and Exploring Engineering*, 8(12). Available at: <https://doi.org/10.35940/ijitee.L2724.1081219>.
- [4] Bayoumi, E.O. et al. (2021) 'The Role of Road Transport Infrastructure Investments on Logistics Performance: A Research Agenda', *International Business Logistics*, 1(2). Available at: <https://doi.org/10.21622/ibl.2021.01.2.016>.
- [5] Bentyn, Z. (2016) 'POLAND AS AN REGIONAL LOGISTIC HUB SERVING THE DEVELOPMENT OF NORTHERN CORRIDOR OF THE NEW SILK ROUTE', *Pressademia*, 3(2). Available at: <https://doi.org/10.17261/pressademia.2016219941>.
- [6] Bolkovska, A. and Petuhova, J. (2016) 'Simulation-based Public Transport Multi-modal Hub Analysis and Planning', in *Procedia Computer Science*. Available at: <https://doi.org/10.1016/j.procs.2017.01.169>.
- [7] Dinar, A. and Nigatu, G.S. (2013) 'Distributional considerations of international water resources under externality: The case of Ethiopia, Sudan and Egypt on the Blue Nile', *Water Resources and Economics*, 2-3. Available at: <https://doi.org/10.1016/j.wre.2013.07.001>.
- [8] El-Nakib, I. (2010) 'Egyptian Firms' Location Preferences for Logistics Hubs: Focus on the Southeast African Region', 8th International Conference on Supply Chain Management and Information Systems. Available at: <https://doi.org/10.13140/RG.2.1.1431.5364>.
- [9] El-Nakib, I. (2011). 'The supply and demand of logistics services in Egypt: the case of Logistics Service Providers and the Egyptian industrial sector', the 23rd Nordic Logistics Research Network (NOFOMA) conference, hosted by Department of Business Administration and Social Sciences, Harstad University College, Harstad, Norway. Available at: <https://doi.org/10.13140/RG.2.1.1087.4728>.
- [10] Engler, D. et al. (2021) 'Antimicrobial stewardship activities in public healthcare facilities in South Africa: A baseline for future direction', *Antibiotics*, 10(8). Available at: <https://doi.org/10.3390/antibiotics10080996>.
- [11] van der Baan, C., Meeuws, R. and Sandee, H. (2015) 'State of Logistics Indonesia 2015', *Center of Logistics and Supply Chain Studies, Institut Teknologi Bandung (ITB), Asosiasi Logistik Indonesia, STC-Group and the World Bank*. Available at: https://www.researchgate.net/publication/313366687_State_of_Logistics_Indonesia_2015.
- [12] Reniers, G.L.L. and Dullaert, W. (2013) 'A method to assess multi-modal Hazmat transport security vulnerabilities: Hazmat transport SVA', *Transport Policy*, 28. Available at: <https://doi.org/10.1016/j.tranpol.2012.05.002>.
- [13] Gdowska, K. & Książek, R. (2015). 'Cyclic Delivery-Scheduling Problem with Synchronization of Vehicles' Arrivals at Logistic Centers. *LogForum, Scientific Journal of Logistics*. 4(11). 341-350. Available at: <https://doi.org/10.17270/J.LOG.2015.4.3>.
- [14] Ghoneim, A. & Helmy, O. (2010). 'Maritime Transport and Related Logistics Services in Egypt', *Egyptian Center for Economic Studies*. Available at: https://www.researchgate.net/publication/228376043_Maritime_Transport_and_Related_Logistics_Services_in_Egypt.
- [15] Hellquist, E. (2021) 'Regional sanctions as peer review: The African Union against Egypt (2013) and Sudan (2019)', *International Political Science Review*, 42(4). Available at: <https://doi.org/10.1177/0192512120935530>.
- [16] Rimienė, K. and Grundey, D. (2007) 'Logistics Centre Concept through Evolution and Definition', *Engineering Economics*, 4(4). Available at: <https://doi.org/10.5755/J01.EE.54.4.12286>.
- [17] Leat, M., & El-Kot, G. (2022). The impact of the Covid-19 pandemic on teleworking and the logistics of work in Egypt. *International Business Logistics*, 2(1), 24-40. Available at: <http://dx.doi.org/10.21622/ibl.2022.02.1.024>.
- [18] Liu, X., Zhou, Y. and Rau, A. (2019) 'Smart card data-centric replication of the multi-modal public transport system in Singapore', *Journal of Transport Geography*, 76. Available at: <https://doi.org/10.1016/j.jtrangeo.2018.02.004>.

- [19] Lu, C.S. and Yang, C.C. (2006) 'Evaluating key logistics capabilities for international distribution center operators in Taiwan', *Transportation Journal*, 45(4). Available at: <https://doi.org/10.2307/20713652>.
- [20] Meidute, I. and Raudeliuniene, J. (2011) 'Evaluation of logistics centres establishment: External and internal factors', *Business: Theory and Practice*, 12(2). Available at: <https://doi.org/10.3846/btp.2011.18>.
- [21] Mononen, P., Leviäkangas, P. and Haapasalo, H. (2017) 'From internal efficiency to societal benefits – Multi modal transport safety agency's socio-economic impact analysis', *Research in Transportation Economics*, 66. Available at: <https://doi.org/10.1016/j.retrec.2017.05.002>.
- [22] Nazemzadeh, M. and Queiroz, C. (2018) 'The Role of Modern Ports in the National Economic Development: An Application to Iran and the Port of Bandar Abbas', in *International Conference on Transportation and Development 2018: Planning, Sustainability, and Infrastructure Systems*. Available at: <https://doi.org/10.1061/9780784481561.018>.
- [23] Jumaniyazov, N. (2010) 'Creating multi-modal logistics centers: Prospect for development in Central Asia', *Perspectives of Innovations, Economics and Business* [Preprint]. Available at: <https://doi.org/10.15208/pieb.2010.70>.
- [24] Notteboom, T.E. (2008) 'The relationship between seaports and the inter-modal hinterland in light of global supply chains: European challenges. Discussion Paper No. 2008-10', *Transport*, 10(March). Available at: <https://doi.org/10.1787/20708270>.
- [25] Reis, V. et al. (2013) 'Rail and multi-modal transport', *Research in Transportation Economics*, 41(1). Available at: <https://doi.org/10.1016/j.retrec.2012.10.005>.
- [26] Soosay, C.A. and Hyland, P.W. (2004) 'Driving Innovation in Logistics: Case Studies in Distribution Centres', *Creativity and Innovation Management*, 13(1). Available at: <https://doi.org/10.1111/j.1467-8691.2004.00292.x>.
- [27] Sumalee, A. & Uchida, K. & Lam, W. (2011). Stochastic multi-modal transport network under demand uncertainties and adverse weather condition. *Transportation Research Part C: Emerging Technologies*. 19. <https://doi.org/10.1016/j.trc.2010.05.018>.
- [28] Phuong Vu, T., Grant, D.B. and Menachof, D.A. (2020) 'Exploring logistics service quality in Hai Phong, Vietnam', *Asian Journal of Shipping and Logistics*, 36(2). Available at: <https://doi.org/10.1016/j.ajsl.2019.12.001>.
- [29] Theys, C., Ryoo, D.K. and Notteboom, T. (2008) 'Towards a generic framework for the development of logistics in seaports: lessons from the Busan case', *Journal of International Logistics and Trade*, 6(2). Available at: <https://doi.org/10.24006/jilt.2008.6.2.1>.
- [30] Tseng (2005) 'The Role of Transportation in Logistic Chain', *Journal of the Eastern Asia Society for Transportation Studies*, 5. Available at: <https://www.semanticscholar.org/paper/THE-ROLE-OF-TRANSPORTATION-IN-LOGISTICS-CHAIN-Tseng-Yue/5a5ce0c4f011c336da2a5f59e8c2adafb1d348c2>.
- [31] van der Lugt, L.M. and de Langen, P.W. (2005) 'The changing role of ports as locations for logistics activities', *Journal of International Logistics and Trade*, 3(2). Available at: <https://doi.org/10.24006/jilt.2005.3.2.059>.
- [32] van der Weijde, A.H., Verhoef, E.T. and van den Berg, V.A.C. (2012) 'Competition in Multi-Modal Transport Networks: A Dynamic Approach', *SSRN Electronic Journal* [Preprint]. Available at: <https://doi.org/10.2139/ssrn.2169964>.
- [33] Wang, Q.Y. (2008) 'Ideology and practice of systems engineering in multi-modal transport planning', *Jiaotong Yunshu Xitong Gongcheng Yu Xinxi/ Journal of Transportation Systems Engineering and Information Technology*, 8(1). Available at: [https://doi.org/10.1016/s1570-6672\(08\)60006-9](https://doi.org/10.1016/s1570-6672(08)60006-9).
- [34] Wiśnicki, B. (2016) 'Determinants of River Ports Development into Logistics Trimodal Nodes, Illustrated by the Ports of the Lower Vistula River', in *Transportation Research Procedia*. Available at: <https://doi.org/10.1016/j.trpro.2016.11.054>.

- [35] Xu, J., Yao, L. and Zhao, X. (2011) 'A multi-objective chance-constrained network optimal model with random fuzzy coefficients and its application to logistics distribution center location problem', *Fuzzy Optimization and Decision Making*, 10(3). Available at: <https://doi.org/10.1007/s10700-011-9105-6>.
- [36] Yue, Y. et al. (2021) 'Evaluating the capacity coordination in the urban multimodal transport network', *Applied Sciences (Switzerland)*, 11(17). Available at: <https://doi.org/10.3390/app11178109>.