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Examining the Contribution of Logistics and Supply Chain in Boosting Oman's Trade Network

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Abstract: Economic integration, which in today's global trade is the fundamental component of linking economic ties between countries, is another important factor in the acceleration of economic growth. The provision of trade logistics services is essential to a nation's economic success in international trade activities. It is essential for enterprises engaged in active international trade to achieve competitive advantages. The international trade and localised commercial activity, to a large extent, is dependent on the logistics and supply chain infrastructure and operational capacity. However, the area received little attention from the perspective of applied economics. The in-depth empirical studies on the impacts of logistics on trade efficiency are few and limited. The study aims to investigate the role of logistics and supply chains in international and national trade in a developing country. It uses secondary data for the analysis. The model and software used in the study are the gravity model and GTAP10a. The time horizon used spans 2014–2030. The results show that in order to enhance trading and commercial activities, a developing country should develop logistics and supply chain infrastructure, train people, and design a flexible logistics policy.

Keywords: free trade agreement; trade network; trade infrastructure; logistics; supply chain

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1. Introduction

The past decades have witnessed tremendous growth in global trade, which is twice as much as the world's output. The growth in global trade is attributed to the development of new technologies and the increased number of operations carried out by transnational corporations (Gong and Zhou 2023; Mold 2022). In another dimension, the global trade expansion has been strongly driven by regional dynamics involving proliferation in regional trade agreements (Esteve-Pérez et al. 2020). Trade policies also affect global supply chain networks, altering product flows (Lin et al. 2023; Chen et al. 2023; Feng et al. 2022). According to trade network linkages, intermediate inputs are more important if their suppliers are more concentrated, and industrial chains containing several key intermediate inputs tend to be more complex than those in other sectors (Cui et al. 2023). The impact of global supply chains on countries and regions could be illustrated in the way global supply chain bottlenecks caused inflation in the eurozone during December 2019–June 2022 (Di Giovanni et al. 2022).

As most countries are increasingly dependent on one another for imports and exports and various kinds of resources, any supply chain shock often propagates across the multi-layered structure of global supply chains (Hao et al. 2024). Port logistics and infrastructure have an effect on economic growth in developing nations because of seaborne trade (Mahpour et al. 2023). This effect is significant, as many developing nations invested heavily in developing their port infrastructure, hence controlling 59.5% of the world's cargo (Angelopoulos et al. 2021). Meanwhile, national transportation systems have a considerable potential to prohibit economic activities from occurring but are typically not very effective at promoting them (Halaszovich and Kinra 2020).

Mahpour et al. (2023) observed that despite the important role that logistics play in supporting commercial activity, trade policy has received little attention from the perspective of applied economics. For example, Asian countries depend, to a large extent, on foreign direct investment (FDI) for economic growth, which is further facilitated by the logistics and supply chain networks. The empirical findings demonstrate that the state of the logistics sector influences the global value chain position of any country (Zhao et al. 2023). The key mechanisms causing this promotion impact include levels of human resources, logistics infrastructure, innovation in technology, and a plan to accelerate economic growth. In the academic domain, studies on the impact of logistics and supply chains on trade performance are shallow and few. One of the most probable causes of this shortfall is the absence of numerical metrics covering various sectors determining logistical efficiency. The shortfall underscores the significance of our investigation and enables policy makers and stakeholders to maximize the benefits of the logistics and supply chain operations in enhancing trade policy outcomes.

Salawu et al. (2022) conducted a systematic literature review (SLR) on transportation and logistics for the years 1999 and 2019. The key findings from 134 peer-reviewed articles found that trade logistics affect the development of international trade. Salawu and Ghadiri (2022) empirically showed the positive influence of improved logistics services on the trade volume. Ma et al. (2021) used the improved gravity model to determine the influence of logistics and supply chain on trade between China and 65 countries for the period of 2008 to 2018. It was found that the level of logistics development had substantially aided the growth of international trade. Furthermore, the logistics and supply chain facilities in 31 Chinese provinces had a greater impact on the bilateral trade volume, implying the importance of logistical infrastructure. Katrakylidis (2020) studied the relationships between the logistics performance index (LPI), trade openness, and economic growth. They used data from 39 countries spanning the years 2007–2018. The results show a correlation between trade, economic growth, and LP. The logistics is seen to directly promote economic growth but not trade.

Vrakas et al. (2021) also analysed the literature on the relation between trade, distances, and its impact on trade growth. They noticed that distance significantly influences trade. Soh et al. (2021) found that Asian countries lack policy-based research on logistical performance (LP) and FDI. The country's LP functions as a geographical advantage and consequently helps to draw FDIs from outside due to the link between logistics, trade, and investment (Luttermann et al. 2020). However, there has not been any research on how logistics, economic, and demographic issues affect seaborne trade, particularly in developing nations and with an emphasis on the Middle East (Gani 2017).

More specifically, international trade has played a key role in Oman's strategy for strengthening its economy. Oman is strongly pushing for economic diversification (Oman Vision 2040) towards a less oil-reliant economy by 2040 in the face of fluctuating global oil prices. The Oman Vision 2040 strategic plan places great emphasis on logistics and trade facilitation as important contributors to Oman's economic development (Oman Observer 2020). Oman is a signatory to five free trade agreements (FTAs),[1] each of which was concluded either as a regional bloc or as an individual signatory. There are ongoing negotiations to expand its free trade network. From a strategic policy perspective, it is crucial to understand the impact of Oman's various FTAs on the sectoral and foreign supply chains. The aim is to understand which geographical directions move the source of inputs, specifically if an agreement increases or decreases the use of input from Oman's intra-regional area, the GCC, or other countries (extra-regional).

The Global Trade Analysis Project (GTAP) model and GTAP-VA are recognized techniques for logistics, supply chain, and trade analysis (Antimiani et al. 2018). The uniqueness of this paper is the combination of logistics and supply chain, trade policy, and trade infrastructure investment to analyse the influence of logistics, transportation, and supply chain on international businesses. Secondly, this is the first study to make use of the CGE model in understanding Oman's FTA network, most especially within the GVC context.

While Oman, like many countries in the Gulf and wider Middle East region, aims to become a regional hub in the logistics and supply chain and maintains the values of competitiveness and operational capacity, this study will improve our understanding of the potential development in the logistics and supply chain and improving various aspects of trade facilitation from a policy standpoint. This study will oblige the Omani government to invest in the logistics and supply chain infrastructure, with a particular focus on logistics parks, modern warehouses, and distribution channels. It will also help policy makers to seek innovative policies and changes in the operational capacity of the logistics and supply chain that could align Oman with international requirements and standards, including tariff and non-tariff barriers, through policy interventions. By understanding the importance of specific trade facilitation components, the Omani government and Omani businesses can identify weak areas in their supply chains and focus on removing trade bottlenecks.

The logistics and supply chain play a critical role in the trade networks. The availability and accessibility of logistics and supply chain infrastructure motivate local and international companies to collaborate in the exchange of goods and services. They can conduct imports and exports of raw materials and finished products in a hassle-free environment. Furthermore, an integrated logistics and supply chain with ports and customs reduces the documentation and saves time. A country with renowned logistics and supply chain networks attracts foreign companies to engage in business. These companies bring capital, technology, and know-how and, thus, contribute to the economy.

While focusing on Oman as a case study, this study will have huge implications for the development of the logistics and supply chains in many countries in the Gulf and Middle East region, as well as many developing countries that are in a similar stage of economic development. It is apparent that this study would be beneficial for many neighboring Arab countries that share similar infrastructure and industrialization. Moreover, this study could also serve as a reference point for some of the countries that are interested in effectively and efficiently increasing their trade through the optimization of supply chain management.

The rest of this paper is structured as follows. In the next section, we describe the literature review, followed by a discussion on the research method. The following sections are on the analysis and discussions. The last section draws conclusions and implications.

2. Literature Review

The supply chain involves activities and organizations and consists of a set of actions ranging from planning and coordinating to controlling the flow of materials and services from suppliers to the ultimate customer (Waters 2003). The supply chain also encompasses all material and product flows from suppliers to customers, integrating orders, production, marketing, distribution, and other business activities.

Feng et al. (2022) studied the logistics network in terms of goods flow, market accessibility, trade subsidies, and trade tariffs. Quotas and tariffs both affect the network's equilibrium in comparable ways. The subsidies, if introduced on the export, benefit not only the exporters but also the raw material suppliers, whether local or international, directly and indirectly. The subsidised raw material boosts the production of goods. Logistics and transport are significant factors that influence international trade relations. Halaszovich and Kinra (2020) studied the importance of national transportation systems to FDI in Asia. They analysed bilateral import and export data from the UN Comtrade database for 22 Asian nations. They observed that the components of national transportation systems have a favourable impact on both trade and FDI. Inadequate road construction is at the root of the overall unfavourable effect.

A study by Wang and Xin (2020) found that China's Belt and Road initiative not only enhanced trade ties with neighbouring countries but also let these countries adopt environmentally friendly technology in their logistics sector. Somjai et al. (2019) conducted a study on 35 SMEs in Thailand's manufacturing sector to understand the impact of trade digitization on the supply chain by applying structural equation modelling. The results show that trade digitization considerably moderated the linkages between supply chain

negotiation and supply chain finance and their effects on SMEs' performance. Despite logistics' crucial role in supporting commercial activity, trade practitioners have typically given little attention to analysis and trade policy research (Gani 2017).

Galeshi (2019) conducted surveys to find the relationships between factors related to international trade, logistics, and market accessibility in Southwest Asian countries. The findings of the model's assessment reveal that market accessibility has a favourable impact on trade in several countries, including Iran. The effectiveness of logistics and transportation systems in international trade has greatly risen. Liu et al. (2019) used the gravity model on World Integrated Trade Solution (WITS) tariff data from 2002 to 2013 to examine the effects of tariffs on China's exports. The findings revealed the negative effect of tariffs on exports at the national level. Studies by D'Aleo and Sergi (2017) and Khan et al. (2017) concluded the relationships between a country's economy and LP. The growth in the supply chain and logistics sector undoubtedly has a favourable effect on economic growth (Gani 2017). The growing role of global supply chains in international trade patterns is changing the usual conceptual approach to analysing trade (Riad et al. 2012). Global value chain (GVC) constitutes around 70% of international trade (Miroudot et al. 2013). Indeed, the value of trade in intermediates was about 25 percent higher in the second quarter of 2022 than in the second quarter of 2019 (UNCTAD 2023).

2.1. Logistics and Supply Chain and International Trade

Mahpour et al. (2023) evaluated the effects of logistical, commercial, and analytical factors on trade between Iran, Oman, Pakistan, Qatar, and Turkey, applying the gravity model. They found that for every 1% rise in the LPI of the destination country, an increase in total trade flows of 0.8% can be achieved. According to the findings, a 1% rise in the tariff rate lowers trade value by 0.4%. The growth in population of the destination country also contributes to a 0.5% increase in trade. Additionally, a sensitivity analysis reveals that logistical factors are more important than monetary and demographic factors. It can be inferred that investing in logistics infrastructure increases commerce and that in developing nations, trade decision makers need to concentrate on enhancing logistics efficiency.

Gul et al. (2024) evaluated the effect of the LPI on Pakistan's exports using gravity models. The results demonstrate that optimizing logistics is essential for raising exports. The capacity to track and trace exports, trade and logistical transit requirements, and priced shipments are just a few of the specific indications that can help increase export flows. The LPI includes six different variables. They are the efficiency of customs clearance, logistics and supply chain infrastructure, shipment management, logistical services effectiveness, and the real-time tracing and tracking of shipments (Arvis et al. 2018). Karagoz and Saray (2022) discovered that improving any one of the LPI's components might significantly increase trade flow in a country. These elements are becoming more and more significant in global trade.

The US–China trade war has had a considerable influence on China's industrial supply chain. Fei (2023) conducted an empirical study on the consequences of the trade war on the long-term development of China's industrial supply chain, using data from 2020 to 2022. He found that, as a result of the trade war, China's GDP growth rate has fallen from 14% to 4%. The value of exports from Chinese firms declined dramatically due to a fall in investment and capital flows, affecting production and operations in the intermediate and upper tiers of the supply chain. Countries with limited natural resources rely heavily on global trade to meet their resource needs (Hao et al. 2024). Trade promotes interdependence, and while it might help in the local supply chain shocks, it also exposes countries to supply chain shocks and disruptions that originate elsewhere and spread through trade ties (Gutiérrez-Moya et al. 2021).

Adelajda Zaninović et al. (2021) studied the data from 2010 to 2018 for the influence of trade between several countries, including the EU15, CEMS, and other countries. The findings demonstrate that variations in LPI values have a variety of effects on bilateral commerce, particularly when taking into account trade in various goods classes and groupings

of country pairs. The logistical efficiency affects the trade between countries. Luttermann et al. (2020) investigated the role that LP plays in international trade and FDI. Using secondary data on 20 Asian nations, a panel data analysis was used to empirically analyse this subject. The findings demonstrate a statistically significant correlation between LP and both trade and FDI. Until now, LP has rarely been used to explain why certain nations are desirable as business partners or investment targets. By examining the connection between LP and trade and FDI, the research closes a gap in the literature.

Soh et al. (2021) used the static panel regression method to objectively examine the influence of LP on FDI utilizing 31 Asian nations from 2007 to 2017. The findings show that although LP has a considerable impact on FDI, the relationship between LP and FDI has an institutional quality threshold effect. The effect of LP on FDI is not constant across the perceived level of institutional quality; that is, its beneficial influence on FDI is limited to a specific threshold level of institutional quality, beyond which its effect is reversible. This research supports the notion that innovations integrated within a strong organizational framework are powerful in providing long-term LP-FDI development in Asia.

Using panel data techniques and an augmented gravity model, according to the findings of Sy et al. (2020), a high positive correlation exists between logistics performance (LP) and trade flows in ASEAN. The researchers' finding is based on robust empirical evidence from analyzing the LPI World Bank data for the years 2007 to 2016. Gani (2017) empirically studied relationships between LP and trade. The results demonstrate a positive correlation between LP and trade favourable influence on exports. A country's stand on the global trade depends on the LP (Arvis et al. 2018), and a similar conclusion was drawn analytically by Coto-Millán et al. (2013).

2.2. Logistics and Supply Chain Infrastructure

Zaninovic et al. (2023) studied both physical and non-physical infrastructure in trade, logistics based on institutional effectiveness, and border efficiency. They used the bilateral trade statistics from the UN Comtrade for the years 2000 to 2019. The study found a statistically significant association between trade, physical infrastructure, and soft infrastructure. The biggest effects on both types of trade are ICT and border efficiency. Trade along the supply chain reacts most strongly to increases in institutional effectiveness. Yeo et al. (2020) assessed the impact of logistics and infrastructure performance on economic performance. The findings also imply that increased international commerce volume and improved infrastructure and LP may promote middle-income nations' sustainable growth.

The efficiency and effectiveness of international trade through sea depend on infrastructure and operational management capabilities (Arora and Siddiqui 2022). Furthermore, it is noted that the internal logistics infrastructure for Spanish areas and the LPI of the importing nations have a beneficial impact on trade. Transportation infrastructure has a significant direct impact on logistics as well as trade facilitation (Sénquiz-Díaz 2021). Sénquiz-Díaz (2021) conducted an empirical study to investigate the relationships between the level of logistics, trade facilitation, and trade using a sample of 80 countries for the years 2012, 2014, and 2016, applying partial least squares–structural equation modelling. The study found that logistics and transportation infrastructure, such as roads, seaports, trains, and airports, facilitate trade. The supply chain performance can be improved by developing IT infrastructure in Asian countries (Saengchai and Jermsittiparsert 2019). Trade digitization is a crucial element in supply chain financing and negotiation that influences SMEs' performance (Saengchai and Jermsittiparsert 2019; Somjai et al. 2019). For example, just recently, the European Union introduced the Trade Control and Expert System ("TRACES") to promote the paperless cross-border (https://www.digitalizetrade.org/projects/traces-trade-control-and-expert-system, accessed on 15 December 2023).

Ali et al. (2018) evaluated the moderating role that trade digitalization has in the relationship between supply chain finance (SCF) and company performance. The authors use data from the textile industry to run a hierarchical linear regression model in SPSS 23

and confirmatory factor analysis in AMOS. According to the findings, SCF considerably raises the performance of SMEs. Additionally, the relationship between SCF and SMEs' success is strengthened through trade digitalization. For the trade's ability to compete internationally, geographic characteristics and transportation infrastructure are also crucial (Bensassi et al. 2015). A long-term stable co-integration between the port cargo throughput, traffic volume, and total quantity of import and export is required (Jiang and Wu 2017).

The macro infrastructure consists of various facets, such as transportation networks (Burlacu et al. 2022; Oeschger et al. 2020), which are important for economic growth. The increased seaport nautical access and capacity expansion of ports on the Baltic Sea are expected to reduce ship operating costs and time to shipping operators and shippers (Bernacki and Lis 2021). Raza et al. (2020) used a quantitative technique to investigate the impact of supply chain information infrastructure on the performance of Thai-based organizations. The analysis of 484 respondents' data revealed that flexibility moderates the relationship between cost, training, and development and leads process time and organizational performance. Supply chain information management and infrastructure are regarded as critical in order to help organizations within their supply chains, adding value for both customers and stakeholders (Kittipanya-Ngam and Tan 2020).

2.3. Logistics and Supply Chain Performance

Siddiqui and Vita (2021) examined, using the cases of Bangladesh, India, and Cambodia, the effects of LP on trade between 2001 and 2016. It was discovered that trade is significantly impacted by LP. The study suggested encouraging domestic and international investment in infrastructure development projects. Electronic Data Interchange (EDI) solutions must be implemented to cut down on unofficial payment methods and transportation expenses. To reduce transportation costs and draw competition, it can be specifically advised that Cambodia switch to a multimodal urbanized transport system. Due to their significant trade activity in the garment industry, Bangladesh and India developed their logistical environments. Kaplan and Bozyiğit (2021) conducted a study on the impact of Turkey's LP on international trade from 2007 to 2016 from 24 nations. All LP measurements, with the exception of service quality, had a favourable impact on Turkey's foreign commerce, according to the findings of seven regression analyses. The study demonstrated that Turkey's foreign trade would benefit from the improvements in its LP. Sermsri and Mekhum (2020) investigated how Thailand's supply chain performance affects economic growth using questionnaires with variables such as the inflation rate (IR), investment growth rate (IGR), population growth rate (PGR), and FDI. For the SCP to promote economic growth, the Thai government must make improvements. The Thai government has to keep inflation under control as it affects economic growth and supply chain activities. Buvik and Takele (2019) investigated the LPI components in the context of African countries. They also looked into the impact of those areas' performance on export values. The LPI scores for entities such as customs procedures, the clearance of goods at the border, logistics infrastructure, and its framework have the lowest value for African countries. Improvement in these areas would not only reduce the delivery time of goods but also would lead to enhanced economic growth. Therefore, according to Saslavsky and Shepherd (2014), countries in the process of enhancing their economy should focus on the various elements of LP.

An industrial chain becomes increasingly vulnerable as it expands in length and comprises more production processes and nations. Liu et al. (2020) used network analysis and input–output correlation to explore the distribution of economic shocks across regions and industries as a result of supply chain disruption. It is necessary to have more diverse supply chains along with government support in order to avoid supply chain bottlenecks (Ramanayake and Marwah 2022). The Japanese supply chain is prone to losses generated by Chinese, European, and US shocks, and these shocks are comparable to those produced by global shocks (Inoue 2021). The risks associated with the disruption of the supply chain were investigated by Van den Brink et al. (2020). Abeysekara et al. (2019) examined supply

chain performance utilizing the theoretical framework of supply chain vulnerability. It was found that companies suffer losses as a result of their supply chain's sensitivity and bottleneck. The policies and regulations severely affect the supply chain performance, and it can cause lower productivity, agility, capacity, and increased costs (Ahumibe 2018). The legal–political considerations and market rivalry have a favorable impact on supply chain performance efficiency and flexibility in Indonesian free trade zones (Fernando et al. 2016).

3. Research Method

3.1. Sources of Data

The study used the GTAP database. The time horizon used a span of 2014–2030, where the agreement takes over ten years. The GTAP database version GTAP10a contains information on up to 141 regions and nations, 65 industries, and 5 (five) endowments for the year 2014. The United Nations Statistical Office's COMTRADE data are used to build the GTAP database, which facilitates import and export flows. Several reliability indicators from the data on countries having trade, whether imports or exports, were used in the analysis. The "MacMap" database was used to extract the data on tariffs. Considering Oman's important sectors and trading partners, we worked with an aggregation of 38 countries and 32 sectors. Labour is split into two categories, namely skilled and unskilled labour. The "business as usual" baseline was built by projecting the GDP, population, and labour supply. Policy scenarios represent Oman's current agreements.

The study used the LPI data from the World Bank for the years 2012 to 2023. The database on LPI from the World Bank reflects number of variables affecting the logistics and supply chain (Martí et al. 2014). The six LPI dimensions are (a) transportation infrastructure; (b) customs and border management; (c) logistics services quality and efficiency; (d) ease of regulating shipments at competitive prices; (e) shipment traceability and tractability; and (f) delivery frequency and timeliness. The variables in this study are derived from the study conducted by researchers (Sunitiyoso et al. 2022; Soh et al. 2021; Alexander and Merkert 2021; Han 2018; Papapostolou et al. 2014). Table 1 provides aggregation details.

Table 1. Trading areas, factors, and corresponding countries.

Countries/Regions	Trading Areas	Factors
China	Paddy rice	Land
Japan	Wheat	Unskilled Labour
Korea	Other grains	Skilled Labour
Indonesia	Fruit and Vegetables	Capital
Malaysia	Cattle (bovine animals and other ruminants)	Natural Resources
Singapore	Dairy products	
Thailand	Forestry	
India	Fishing	
United States of America	Heavy Manufacturing	
Pakistan	Light Manufacturing	
Brazil	Oil	
France	Gas	
Germany	Minerals	
Italy	Vegetable Oils	
Netherlands	Other prepared food	
United Kingdom	Tobacco and Beverages	
Norway	Leather and textile manufacturing	
Switzerland	Lumbering and paper manufacturing	

Table 1. *Cont.*

Countries/Regions	Trading Areas	Factors
Bahrain	Petroleum and coal products	
Iran	Chemical sector	
Jordan	Non-ferrous metals	
Kuwait	Steel and iron	
Oman	Metal products	
Qatar	Manufacture of computer, electronic, and electrical equipment	
United Arab Emirate	Manufacture of machinery	
Saudi Arabia	Motor vehicles	
Egypt	Transport equipment	
Morocco	Utilities	
Tunisia	Transport services	
Oceania	Commercial services	
Rest of South America	Business services	
NAFTA	Public services	
Rest of EU27		
EFTA (excluding countries mentioned in this table)		
MENA (excluding countries mentioned in this table)		
North Africa (excluding countries mentioned in this table)		
Africa (excluding countries mentioned in this table)		
World (excluding countries mentioned in this table)		

Source: GTAP database version 10A, the reference year 2014. Note: EU: European Union, EFTA: European Free Trade Association, MENA: Middle East and North Africa, NAFTA: North America Free Trade Agreement.

3.2. Analysis Techniques

The study used gravity model for analysis. In the last few decades, gravity models have been widely employed (Bektas 2017; Ghisolfi et al. 2022). The gravity model emerged as a potent tool for export evaluation of the impact of trade integration (Head and Mayer 2014). The key competitive advantage of gravity model is its capacity to use the actual data for measuring the impact of policy on the trade. Martí et al. (2014) assessed the gravity model effectiveness in measuring the trade between two countries, taking the case of Ecuador and Germany. Two different versions of GTAP model, the GTAP-VA ("Value Added") (Antimiani et al. 2018) and the GTAP-RD model (Aguiar et al. 2019), exist. For the empirical analysis, we used the GTAP-RD model (Aguiar et al. 2019).

GTAP-RD model was employed considering our objectives of (i) understanding how Omani FTAs impact the supply network and (ii) evaluating the synergy between the Oman trade network and the investment in trade and transport capability. GTAP-VA is useful for capturing and backward linkage in trade. The GTAP-VA model involves the trade assessment and understanding of goods and services influencing trade flows. GTAP-VA comprehensively and consistently covers both gross and value-added measurements, evaluating economic policies for the interregional and national level trade and, thus, assessing the overall regional trade agreements. The GTAP-RD was employed for the latter objective. Using the GTAP-RD, researchers can simulate the long-term trade policy implications. It allows capital accumulation together with international capital mobility.

3.3. Assumptions and Scenarios

In all cases, we assume that the agreement is fully applied within ten years, with proportional tariff cuts. The simulation starts from the level of tariffs provided by the GTAP database and is gradually reduced until free trade. However, the expansion of trade goes beyond considering only tariff reduction.

For instance, non-tariff measurements in the form of policy design and implementation for the manufacturing of goods and trade may be considered. The outcome of FTA on the economy is different than usual trade between the countries. The border effect of increasing trade by FTAs should be reflected in the reduction of costs and reduction of days for border clearance, i.e., firms trading within a given set of rules provided by FTAs have lower fixed and variable costs (Fugazza 2013). However, the current database has not explicitly marked the non-tariff costs such as custom clearance expenses; therefore, we added them in our analysis as non-tariff shocks as "*effective price*" of goods I and imported from country r at local prices in destination markets. The effect of non-tariff measurements on the cost of imports from a specific exporter is highlighted by the coefficient "AMS". Hence, the lowered costs of local goods *i* exported from *r* to *s* is a result of higher AMS (Hertel et al. 2001), as seen in Equation (1).

$$PMS^1_{i,r,s} = PMS_{i,r,s} - AMS_{i,r,s} \quad (1)$$

where

AMS = import *i* from region *r* augmenting technical change in region *s*;

PMS = percentage change of local costs for *i* supplied from *r* to region *s*;

PMS^1 = percentage change of effective import costs of *i* supplied from region *r* to region *s*.

Following the idea of binding overhang (Francois and Martin 2003), we then introduce a constant increase in trade productivity, i.e., reduction of iceberg cost, for the FTA partners by 0.3 percentage points each year to arrive at a final rise of 3%. To evaluate the link between the FTA network and the trade investments of Oman towards a stronger position as a global logistics hub and transit gateway, we modelled the same scenarios twice, with or without trade facilitation improvements in the shipping capability of Oman. The scenarios represent individual FTAs.

4. Analysis and Results

We checked foreign value-added changes for each sector under each FT: Oman and the USA; Modernisation of the Gulf Cooperation Council agreement (GCC); Greater Arab Free Trade Area (GAFTA); GCC and EFTA countries (Swizterland, Norway, and Lichtenstein); GCC and Singapore.

We conducted an analysis using the GTAP-VA model, focusing on the manufacturing sectors through the lens of the backward participation index. The backward participation index[2] measures the share of a country's sectoral export. The aggregate index used in the study consists of measuring regional and non-regional imports and exports. The "intra-regional" is when Oman supplies intermediate inputs to the GCC countries, while "extra-regional" is the complement export of intermediate inputs to all other countries excluding the GCC. Since GCC is relevant as a common regional trade market, we consider it as "intra-regional", where production chain integration and spill overs can happen. The idea is to check what happens to Oman's sectoral foreign supply chains in the different scenarios analysed (Fusacchia et al. 2022). The aim is to understand the geographical directions that dictate the source of inputs, specifically if an agreement increases or decreases the use of inputs from Oman's intra-regional area, the GCC, or other countries (extra-regional). Figures 1–5[3] show the impact on FVA of Omani exports in all the FTAs analysed. In other words, Oman needs both domestic and imported inputs for its exports. Imported inputs can be sourced from its regional area of reference (GCC) or extra-regional suppliers (all other countries). Then, an FTA can reinforce or weaken one of the two sources of inputs. Accordingly, sectoral investment strategy, transport network cooperation, and the joint project should follow.

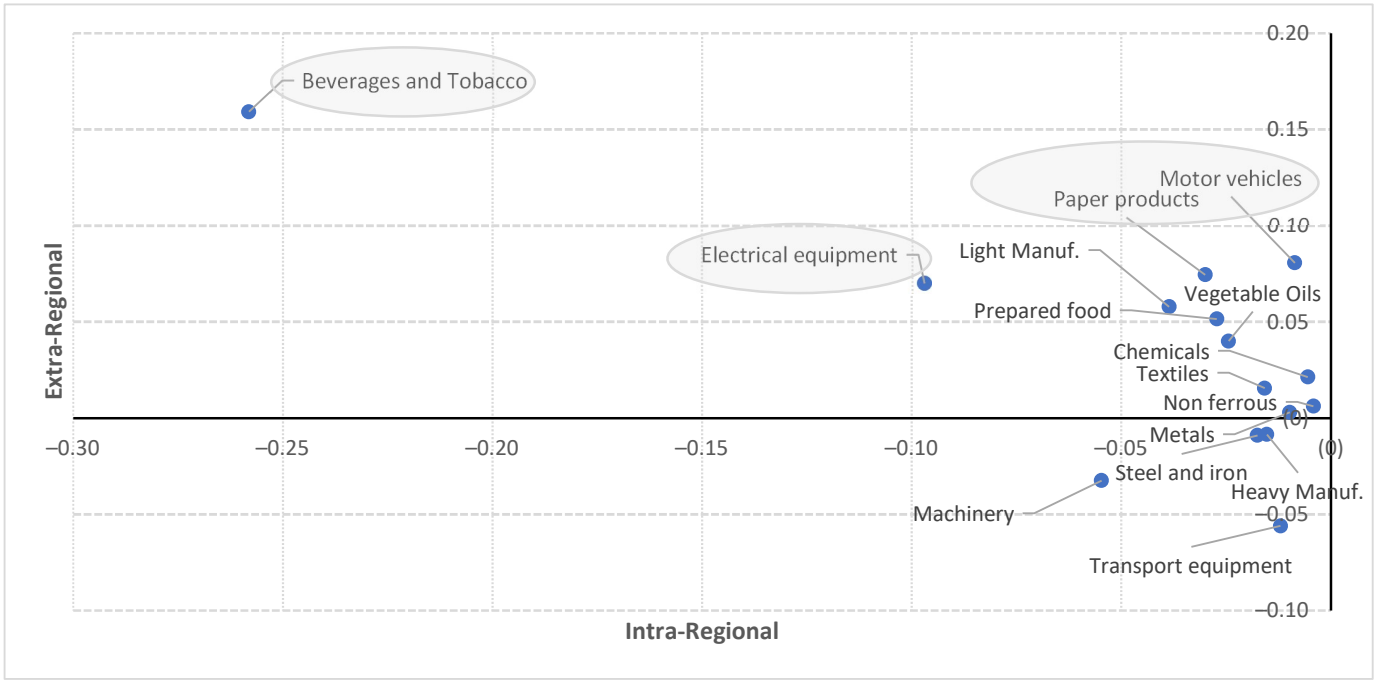


Figure 1. Omani FTA with EFTA (Source: authors calculation based on GTAP results).

4.1. GTAP Analysis: FTAs between Oman and EFTA Countries (Switzerland, Norway, and Lichtenstein)

Figure 1 shows the impact on the FVA of Omani exports with EFTA analysed using GTAP. The results indicate that beverage and tobacco[4] reduce the importance of the intra-regional in supplying inputs to the advantage of the extra-regional. In Oman, tobacco is mainly re-exported rather than used for local consumption.

4.2. GTAP Analysis: FTAs between Oman and the USA

We experience a growth in gross export; the FTA with the USA agreement would pull input supply from extra-regional areas, with a shrink in domestic output. For chemicals, results show an increase in both gross export and output, with a moderate diversion of input supply between intra- and extra-regional countries. Further, looking at the domestic value-added[5], we observe that it increases. Then, for the chemical sectors, the gross export and the output increase and the value-added, turning out to be a positive outcome of the agreement for Oman. However, it must consider the diversion in inputs supply: the USA will divert intra-regional sources of inputs linked to Oman's export of chemicals. The textile sector shows an increase in both export and output and a strong rise in the domestic value added. At the same time, we did not observe an increase in FVA from the USA. Then, for both chemicals and textiles, the agreement with the USA represents a developing driver for Oman.

Nevertheless, for the first, a policy strategy is required since the agreement would increase competition between GCC partners and the USA in input supplying for chemicals. In particular, consideration should be given to textile products because they have been specifically governed by the "yarn forward" rules of origin under the USA–Oman FTA. In the case of the USA FTA, results highlight a lower shift from intra- to extra-regional dimension. Indeed, compared to EFTA, the size of the impact is half. Figure 2 shows the impact on the FVA of Omani exports with the USA analysed using GTAP.

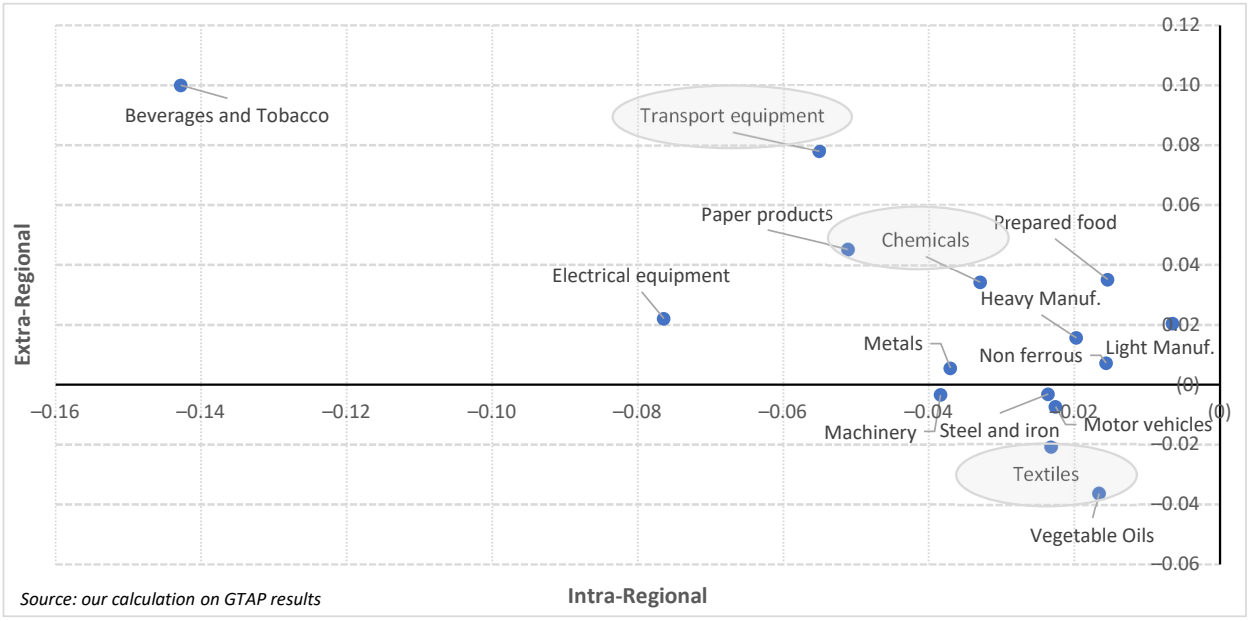


Figure 2. Omani FTA with USA (Source: authors calculation based on GTAP results).

4.3. GTAP Analysis: FTAs between Oman and Singapore

Moving to the agreement with Singapore, Figure 3 helps us understand this agreement's potentiality for Oman's trade: for some sectors, namely machinery, beverages and tobacco, light manufacturing, and chemical and motor vehicles, Oman increases its economic integration with both intra- and extra-regional dimensions. Indeed, this agreement can bring spillover effects. This is to say that the Singapore agreement can serve as a gateway for Oman's integration into the global value chain through the Asian market. Looking at the results, all sectors, which showed a significant influence on output and export, show a low impact on the composition of the source of foreign inputs supply. In addition, looking at the domestic value added, not all sectors are affected except a part of transport equipment. Figure 3 shows an impact on the FVA of Omani exports with Singapore analysed using GTAP.

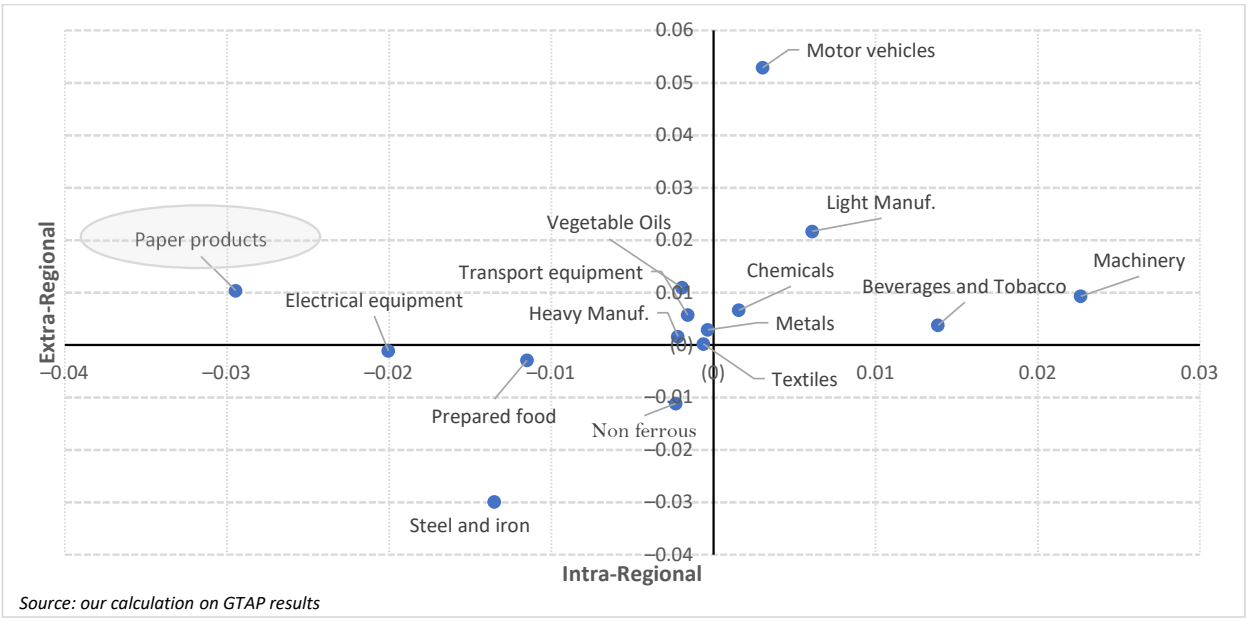


Figure 3. Omani FTA with Singapore (Source: authors calculation based on GTAP results).

4.4. GTAP Analysis: FTAs between Oman and GCC, GAFTA

The first relevant outcome is that both the GAFTA and GCC agreements mutually reinforce each other. Indeed, both GAFTA and GCC are larger agreements; however, both agreements pull the Omani economy towards the same specialisation patterns with a boost of the intra-regional supply market. In short, the USA and EFTA, and the GCC and GAFTA, show similar results, but conversely, Figures 4 and 5 show an impact on the FVA of Omani exports with GAFTA and GCC analysed using GTAP.

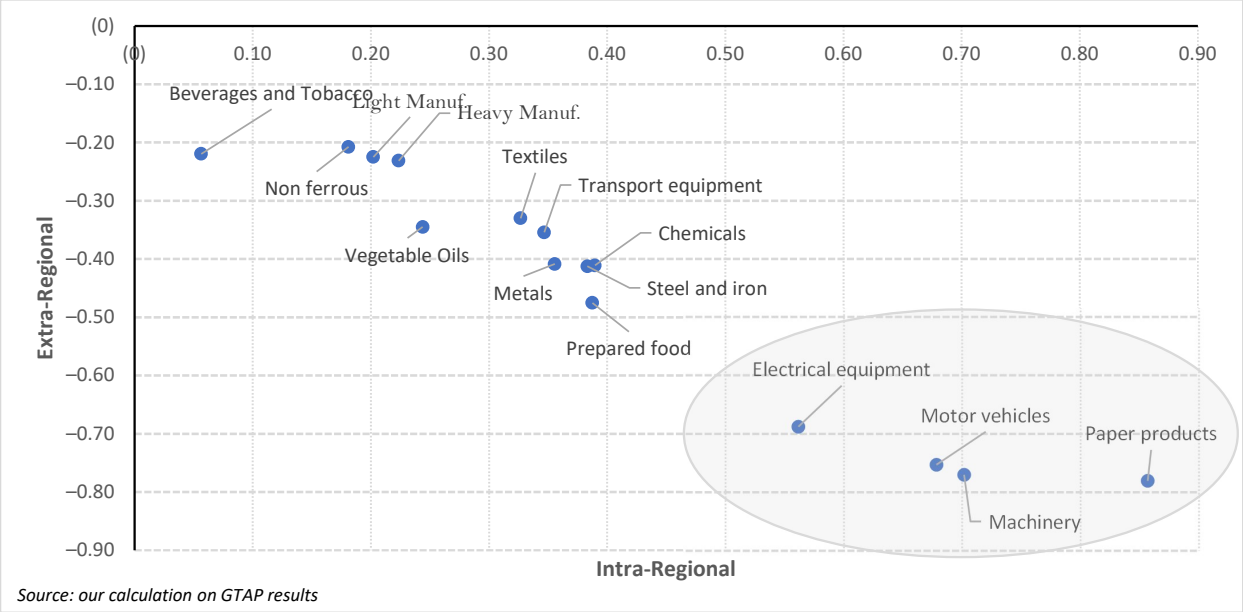


Figure 4. Omani FTA with GAFTA (Source: authors calculation based on GTAP results).

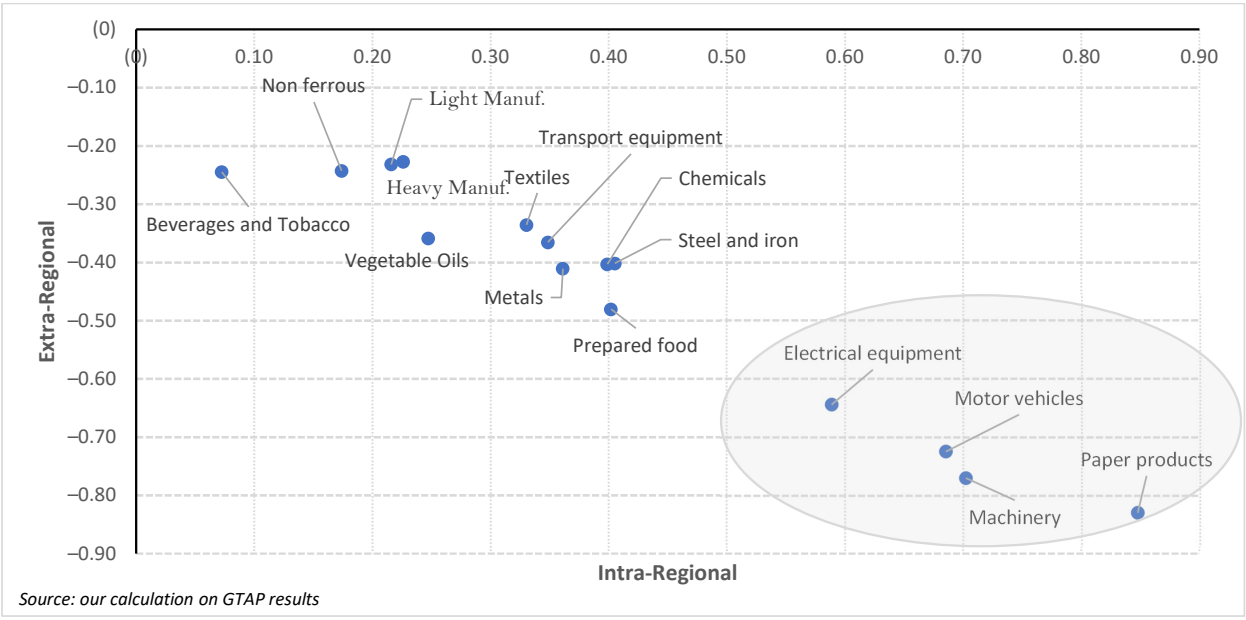


Figure 5. Omani FTA with GCC (Source: authors calculation based on GTAP results).

4.5. GTAP Analysis: FTA Scenarios with and without Trade Facilitations (Millions in USD)

The change in Oman's total trade (imports and exports) in FTA scenarios with and without trade facilitations (millions in USD) is shown in Table 2. The FTAs are the EFTA, with the USA, GAFTA, with Singapore, and GCC.

Table 2. Change in Oman's total trade (imports and exports) in FTA scenarios with and without trade facilitations (millions in USD).

Total trade	EFTA		USA		GAFTA		Singapore		GCC	
	Without transport investements	With transport investements	Without transport investements	With transport investements	Without transport investements	With transport investements	Without transport investements	With transport investements	Without transport investements	With transport investements
Paddy rice	12.807	12.907	12.907	13.007	13.107	13.207	12.807	12.907	13.107	13.207
Wheat	6.751	6.791	6.761	6.801	6.871	6.911	6.751	6.791	6.861	6.911
Other grains	4.349	4.36	4.35	4.371	4.372	4.392	4.349	4.36	4.371	4.392
Fruit and Vegetables	11.22	11.34	11.22	11.34	11.36	11.4	11.21	11.33	11.27	11.4
Cattle (ruminants)	33.37	33.64	33.39	33.65	33.81	33.91	33.36	33.62	33.64	33.9
Dairy products	34.92	35.18	34.99	35.25	35.56	35.66	34.93	35.19	35.39	35.65
Forestry	0.32	0.322	0.321	0.323	0.325	0.327	0.32	0.322	0.325	0.327
Fishing	4.15	4.18	4.17	4.19	4.2	4.21	4.15	4.18	4.19	4.21
Heavy Manufacturing	71.1	71.8	71.5	72.1	73.3	73.4	71.1	71.7	72.6	73.3
Light Manufacturing	72.98	73.49	73.1	73.61	74.01	74.31	72.95	73.46	73.8	74.3
Minerals	157.6	158.7	157.6	158.8	160	160.2	157.6	158.7	159	160.1
Vegetable Oils	22.2	22.5	22.3	22.6	22.8	22.9	22.2	22.5	22.6	22.9
Other prepared food	50.2	50.7	50.3	50.8	51.6	51.8	50.2	50.7	51.3	51.8
Beverages and Tobacco	14.815	14.818	14.827	14.831	14.739	14.739	14.826	14.83	14.735	14.739
Textiles, wearing and leather	21.761	21.879	21.767	21.885	21.87	21.97	21.76	21.878	21.851	21.97
Paper products and lumber	17.5	17.64	17.51	17.66	17.86	17.96	17.5	17.64	17.81	17.95
Petroleum and coal products	125.4	125.5	125.5	125.5	126.6	126.6	125.4	125.5	126.6	126.6
Chemical sector	149	151.1	150.4	153.5	161.2	162.2	149.2	151.2	158.6	160.8
Non ferrous metals	39.04	39.76	39.12	39.94	41.1	41.4	38.94	39.77	40.5	41.4
Steel and iron	147.3	149.6	149.1	151.5	160.3	161	147.2	149.5	157.9	160.4
Metal products	142.2	144.5	144.4	146.8	153.2	153.4	142.2	144.5	150.9	153.2
Electronic and electrical	177.93	178.2	177.86	178.14	178.4	178.4	177.59	177.86	178.07	178.4
Manufacture of machinery	184.44	184.68	184.61	184.85	186.19	187.19	184.42	184.67	185.9	187.19
Motor vehicles	411.22	412.27	411.28	412.33	413.41	414.41	411.21	412.26	413.36	414.41
Transport equipment	60.1	60.304	60.102	60.206	60.514	60.614	60.099	60.302	60.411	60.614
Utilities	7.23	7.28	7.32	7.37	7.48	7.49	7.24	7.28	7.43	7.48
Transport services	70.29	70.62	70.53	70.86	71.7	71.8	70.28	70.61	71.44	71.8
Commercial services	23.91	24.04	24.08	24.2	24.6	24.6	23.91	24.04	24.4	24.6
Business services	358.2	358.7	358.9	359.4	361.7	362.7	358.2	358.7	361.2	362.7

Source: authors' calculation based on GTAP results.

4.6. Logistics Performance Analysis: FTAs between Oman and EFTA, the USA, GCC, GAFTA, and Singapore

To deepen the analysis, we ran the above scenario of FTAs with Oman's investment in trade facilitation[6], i.e., new port and airport. The results show trade facilitation, as we can expect, increases the impact on trade (OECD 2017). The LP indicator of Oman and GAFTA is compared. The LPI of Oman has been consistently higher than GAFTA since 2016. Oman has been able to improve its logistics infrastructure. The infrastructure score of Oman has been consistently higher than GAFTA since 2016. Figure 6 shows the LP indicator of Oman and GAFTA.

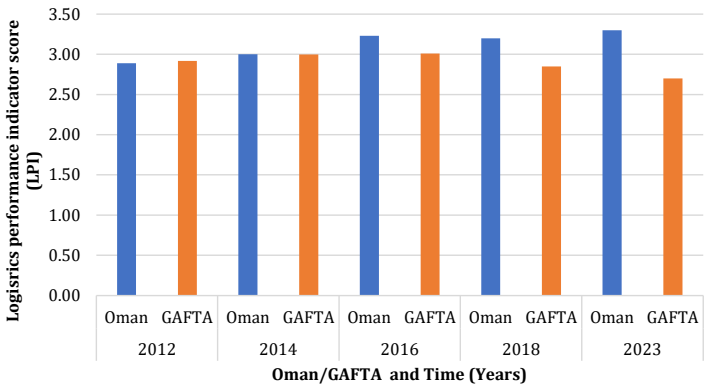


Figure 6. Logistics performance indicator for Oman and GAFTA, 2012–2023.

However, it is worth knowing that trade facilitation does not affect the sectoral composition of the FTAs' impact. In other words, investment in transport services can boost the impact of trade liberalization (Lai et al. 2019). In addition, given the sectoral specialisation of Oman, trade facilitation supports the development of the manufacturing sector and business services.

It is crucial to understand the impact of any signed FTA to design and implement an intra-national infrastructure project according to its nature: regional or bilateral agreement. The LP with major trading partners is compared. The LPI score of Oman is higher than Egypt and Kuwait but lower than many countries, including Saudi Arabia, Qatar, Bahrain, India, China, the UK, the USA, Singapore, the UAE, Korea, and Switzerland. Figure 7a shows the logistics performance indicator for Oman and major trading countries.

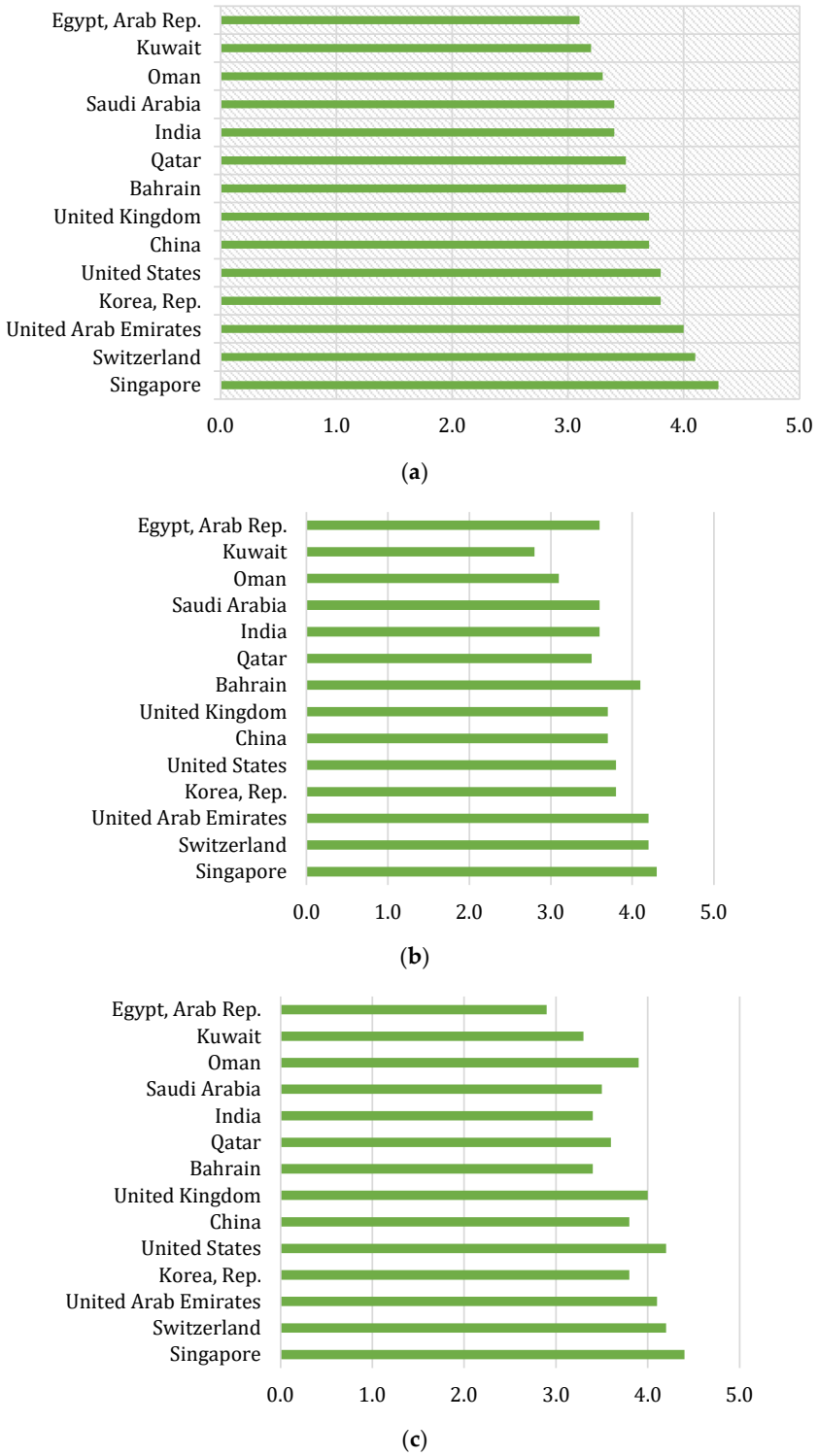
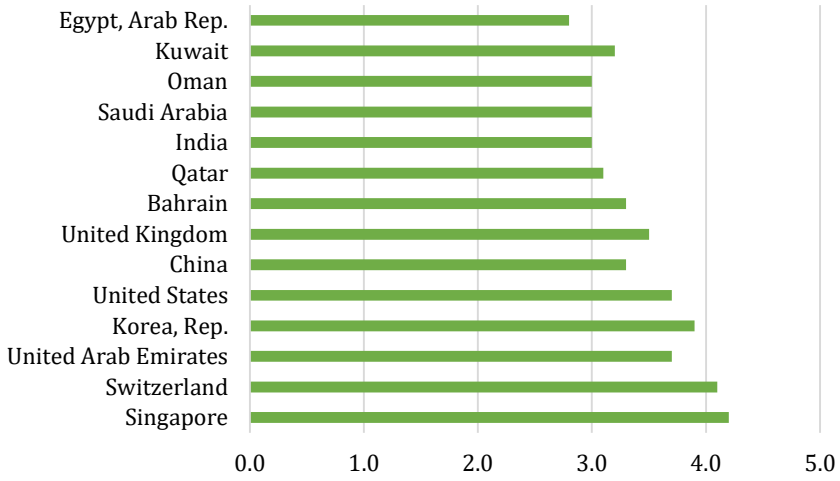
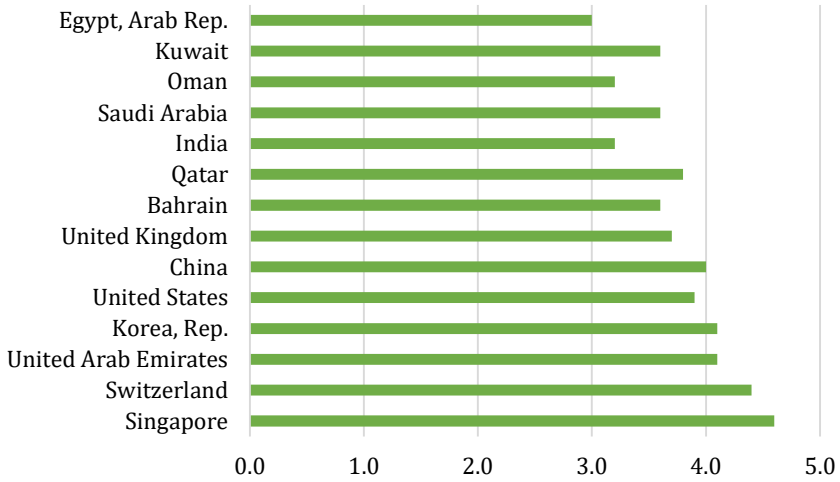


Figure 7. (**a**) Logistics performance indicator for Oman and major trading countries. (**b**) Timeliness score. (**c**) Tracking and tracing score.

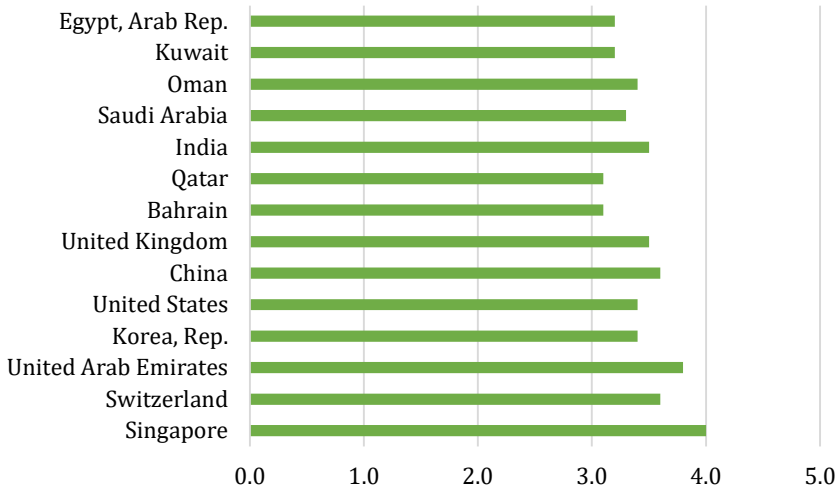
Meanwhile, Figure 8 illustrates Oman's scores of customer service (a), infrastructure (b), international shipment (c), and logistics competence and quality (d).



(**a**)

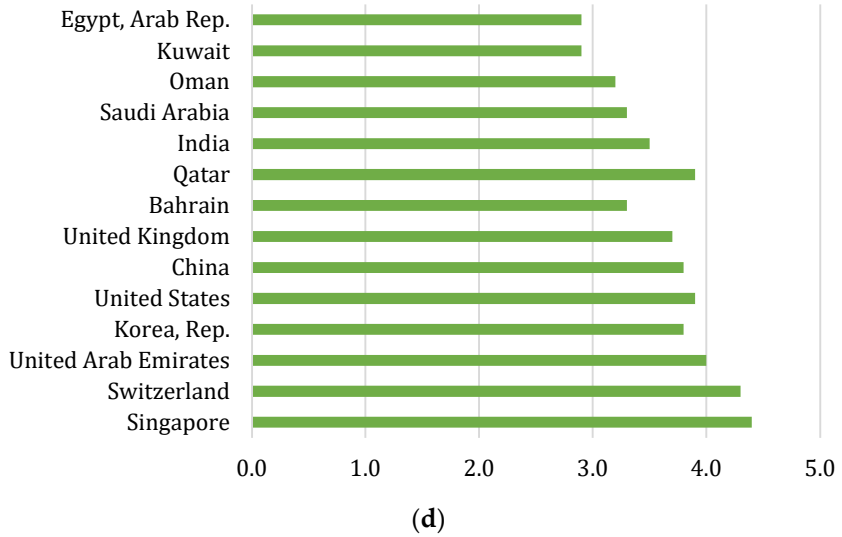


(**b**)



(**c**)

Figure 8. *Cont*.



(**d**)

Figure 8. (**a**) Customer service score. (**b**) Infrastructure score. (**c**) International shipment score. (**d**) Logistics competence and quality score.

4.7. Summary of GTAP Results

The first important FTA effect is that both GAFTA and GCC agreements mutually reinforce one another. Indeed, both agreements push the Oman economy toward similar specialisation patterns while boosting the intra-regional supply market. In short, the USA and EFTA, as well as the GCC and GAFTA, provide similar but opposing consequences, with Singapore being the only one moving Oman closer to a "global" dimension. This is to argue that the Singapore agreement can act as a gateway for Oman's integration into the global value chain via the Asian market. Looking at the results, all sectors that had a substantial impact on output and export have a minor impact on the composition of the source of foreign input supply. Furthermore, in terms of domestic value added, only a portion of the transportation equipment industry is affected.

The Oman and Singapore FTA shows potentiality for Oman's trade; for some sectors, namely machinery, beverages and tobacco, light manufacturing, chemicals, and motor vehicles, Oman increases its economic integration with both intra- and extra-regional dimensions. The negotiations with Singapore should center on the transportation equipment sector, where Oman can boost exports and local value added. Furthermore, it may indicate a synergy with the US. Beyond the benefits of trade liberalization brought about by global value chains (GVCs), lower import intermediate prices result in more competitive exports for countries. Furthermore, in other circumstances, even if the exporter added a part of the value to the exporting product, duties are imposed on the entire import.

Indeed, from a national/regional trade standpoint, the value-added account and supply chain strategy shape trade policy. According to the possibilities demonstrated by the research, the agreement between GAFTA and the GCC should include a variety of organizations. For example, labor norms and rights, intellectual property standards and protection, methods for resolving import and export disputes, FTA and FDI facilitation and promotion, as well as economic and technical cooperation and customs cooperation, all contribute to a vast FTA network.

In short, the FTA with the USA and EFTA, and the GCC and GAFTA, show similar results but opposite directions.

5. Discussion

A trade agreement results in more than just increased exports. FTAs can strengthen business ties between nations. Industrial hubs and manufacturing areas should be regionally located, specifically for Oman. To achieve economies of scale and draw investments, developing nations must strengthen regional economic ties in the manufacturing sector.

Oman's FTA impacts the intermediate input import flows, comparing the GCC region versus the rest of the World. Our findings confirm earlier findings of interdependence between bilateral trade and LP, and it is statistically significant. By employing advanced technology and resource optimization and developing manufacturing policies, the resulting efficient logistics and transportation in international trade will lead to economic growth. To reduce government obligations towards financial backing, employment generation, and economic freedom, it is important to focus on free trade agreements, FDI, and local entrepreneurship. Numerous factors are influenced by economic freedom, but one of the most crucial ones is international trade or the volume of exports and imports. According to the World Trade Organisation (WTO)[7], Oman ratified the Trade Facilitation Agreement (TFA) and fully implemented the commitment under the agreement in 2020. The implementation and ratification of the TFA are expected to strengthen the development of Oman's logistics sector, establish an attractive environment for attracting FDI, and stimulate economic growth. Oman, in recent years, has prioritised investment in logistics and trade-enabling infrastructures (Al Shamakhi et al. 2018; Hamed Al-Wahaibi 2019; Simpson and Strachan 2018).

A trade policy's effects would spread throughout the world's supply chain network and have an impact on numerous supply chain participants. Lin et al. (2023) discovered that increased Sino-US trade policy uncertainty dramatically decreased corporate supply chain efficiency. Therefore, increased trade policy uncertainty can dramatically lower the performance of an enterprise's supply chain. Cui et al. (2023) conducted a trade network analysis for quantifying supply chain vulnerabilities using panel data from 2017 to 2020 of key economies during China–US trade tensions. In the global trade network, sophisticated economies' supply chain vulnerabilities are concentrated in electrical, mechanical, and chemical products, with spatial distribution determined by trade communities. Other developing economies, unlike China, have a greater range of supply chain vulnerabilities and rely heavily on China and its regional community.

Understanding the effects of trade policy in highly competitive global supply chain networks is essential (Feng et al. 2022). Galeshi (2019) concluded that, in international trade, the logistics and supply chain are crucial, and this leads to the development of manufacturing sectors. However, due to the dynamic environment and emerging technologies, the trade policies need to be updated to serve the current needs. Górecka et al. (2022) studied the LP effect on the EU's energy trade flows for both exports and imports. The findings show that all performance subcomponents of logistics are highly significant and have a favourable impact on the export of liquid energy products but not on solid or gas products.

The effects of a trade policy spread throughout the global supply chain network affect many supply chain participants. It is critical to have a thorough understanding of the effects of trade policy in competitive global supply chains (Cui et al. 2023). Feng et al. (2022) investigated the impact of trade policies such as tariffs, quotas, and subsidies on the global supply chain networks. The subsidies on the exports contribute to the local and international raw material suppliers. The subsidy placed on export final products boosts the output of both domestic and foreign raw material suppliers, as well as domestic final product manufacturers. The trade policies on the supply side improve the competitiveness of domestic raw material suppliers while harming domestic end-product companies. The trade policies on the demand side assist domestic final product producers while harming foreign final product producers.

In the end, trade flow benefits all nations; however, countries should regularly re-evaluate their current customs procedures and border clearance requirements. The integration of operations for border and customs management, as well as performance enhancement, is proven to benefit from effective information communication technology. The delivery of goods may incur various costs, including transportation, wholesale and retail distribution, tariff and non-tariff barriers, information costs, contract enforcement, and currency exchanges (Tsioumas et al. 2021). The effectiveness of the country's logistics network, as well as a clear system for facilitating cross-border trade, are essential to its

ability to compete internationally (Gul et al. 2024). (Renaldi et al. 2022) used data from the 10 ASEAN+3 countries for 11 years (2008–2018) in LP impact on the export and trade.

The GAFTA region has to develop and modernise its infrastructure in order to have a more integrated logistics system. Furthermore, a significant factor in determining growth in bilateral commerce flows is the calibre of logistics services. Alexandro and Basrowi (2024) highlighted the significance of supply chain infrastructure and comprehensive policy initiatives on supply chain smoothness and a country's economic growth in the BRICS countries (Brazil, Russia, India, China, and South Africa). By implementing standard operating procedures for the delivery of logistical services, this might be accomplished. Good logistics services are crucial for facilitating trade. Ineffective logistics services increase time and financial costs, which slows down trade as a result. All three modes of transportation have an impact on the trade volumes (imports and exports); however, in the case of Asia, investments (FDI inflows and stocks) are less reliant on ports and are more concerned with intra-country mobility (Halaszovich and Kinra 2020). As a result, although they are not sufficient on their own, highly developed international transportation infrastructures are a must for conducting business internationally (Halaszovich and Kinra 2020).

The macroeconomic infrastructure consists of energy systems, transport networks, communication channels, and other facilities that form the backbone of supply chain operations (Awan and Ali 2022; Debnath et al. 2022). It is important to construct and enhance infrastructures for logistics operations. Poor infrastructure is regarded as one cause of significant logistical issues in the literature. A number of nations, such as China, Thailand, and Indonesia, recognized the importance of infrastructure for logistics and made it a significant component of their national logistics plans. The modernisation of transportation sectors through high-speed rail, waterways, the development of new port terminals, and the use of ICT should be tailored to particular industries. The aforementioned methods can be used to make it simpler to arrange for affordable overseas shipping. This is significant because launching commerce and controlling trade flows require effective shipments in terms of costs and deliveries. The policy intervention by the country's administrative authority and partnership with the private sector can bring competitive and effective sea-based trade. The delivery time, transit time, and customs clearance time of goods depend on infrastructure and ICT use in the logistics sector.

Moreover, FTAs can produce different impacts on a country's economy if supported or not by trade facilitation investments and infrastructures. However, investments in infrastructure do not necessarily produce a uniform impact among the FTAs. Indeed, the impact of a trade infrastructure can increase the economic impact of an FTA, but the size of such impact can be different according to the quality of infrastructure, the economic specialisation of a country, and its geographical position (Bora et al. 2004; Olarreaga 2016). In addition, countries need to consider Oman's investments in trade-enabling infrastructures (ports) and its strategic geographical location; this paper also evaluates the synergy between the Oman trade network and the investment in trade and transport capability.

According to Halaszovich and Kinra (2020), a developing economy's capacity to draw in trade and investments is determined by several factors, for instance, the country's strategic location, trade, and economic development initiatives, in addition to the national transportation systems. Therefore, it can also be argued that the environment of logistics systems is crucial for FDI and commerce. Although it must be acknowledged that highly developed national transportation systems are a requirement for international economic activities, they are not sufficient on their own and typically serve as a barrier. Uncertainty surrounds how trade liberalization will affect the environment and environmentally friendly growth of the country's logistics sector (Wang and Xin 2020). Gani (2017) forecasted the favourable effect of investments in logistics services and infrastructure.

The pay and working conditions, a lack of knowledge and instruction regarding the application of new policies, as well as unfair and inequitable practices in nations with poorer institutional quality are some factors that contribute to poor implementation (Soh et al. 2021). These could undermine the credibility of purportedly enhanced institutional

measures, reduce LP, and decrease investor trust, which would obstruct fresh FDI or renewal. Investor confidence could be undermined by political instability brought on by the implementation of democratic changes intended to promote governance and freedom that go wrong (Soh et al. 2021).

As the world is moving forward, the importance of soft infrastructure (ICT) is increasing. While an organization's supply-chain efficiency is required for trade, the ICT infrastructure and custom policies have a significant role in enhancing trade, particularly traditional commerce (Zaninovic et al. 2023). Shikur (2022) explored the contributions of each LP factor to merchandised products and services trade. The findings indicate that compared to other emerging nations, African nations have much poorer LP aspects. The present study demonstrated that the LP dimensions, such as real-time monitoring, customs policies, shipment management, infrastructure, and quality, determine the trade of products in a positive and meaningful way.

Oman is strategically located between the trade routes of Asia, the Middle East, and Africa. Therefore, Oman has unexploited trade potential with countries surrounding the Indian Ocean (Boughanmi et al. 2019). Investment in trade infrastructures is crucial in realising Oman's expected gain from its trade networks because transport costs were found to restrict trade more than tariffs (Bora et al. 2004). A strong Leverage on this trade route by Oman could be a gateway to accessing new markets, along with improving her GDP.

6. Conclusions

This paper explains the contribution of the logistics and supply chain to the enhancement of Oman's trade networks. It also underscored the significance of trade as the engine of economic growth and development. A country's export strategy increases trade's ability to foster long-term economic growth. Trade, however, is intentionally planned; tactics are created to lessen financial risks and create a robust economy. The paper also explained that FTAs can reinforce the extra-regional supply chain that pulls toward national programs; on the contrary, FTAs can also increase the regional purchase of inputs towards regional strategy policies. Our results also confirm the relevance of linking trade policy and logistics and supply chain. In the case of Oman, the country should expedite the development of cross-border intelligent logistics systems and invest in export logistics infrastructure, as well as improve the capacity of its ports for customs clearance and logistics hubs.

This paper also revealed that the two largest FTAs that Oman has (GAFTA and GCC) mutually reinforce each other and that both agreements pull the Omani economy towards the same specialisation patterns with a boost to the intra-regional supply market. At the same time, the USA and EFTA, on the one hand, and the GCC and GAFTA, on the other, show similar but opposite results. Singapore is the only FTA bringing Oman towards a "global" dimension. This finding means that the Singapore agreement can serve as a gateway for Oman's integration into the global value chain through the Asian market. Looking at the results, all sectors, which showed a significant influence on output and export, show a low impact on the composition of the source of foreign inputs supply. In addition, looking at the domestic value added, not all sectors are affected except a part of transport equipment.

When reviewing the FTA with Singapore, government officials should focus on the transport equipment sector, for which Oman could increase export and domestic value-added. This could create a synergy for the agreement with the USA. The paper also highlights the benefits and positive spillover effects that go beyond trade liberalization because of global value chains (GVCs), while lower import intermediate prices result in competitive exports for countries. From a trade perspective, our paper reveals that the value-added account and the supply chain strategy can easily reshape the trade policy. According to the potentiality showed by the results, the interaction or overlap between GAFTA and the GCC can entertain several entities, including labour rights, standards and protection of intellectual property rights, mechanisms to clear the import and export disputes, FTA and FDI facilitation and promotion, economic and technical cooperation,

and customs cooperation, and all of these could pull the country towards a huge FTA network. The case of Oman reveals that each FTA can influence the intermediate supply and, accordingly, trade policy, infrastructure investment, hub design, and network resilience should follow. Oman's trade strategy should achieve complementarity between national and regional programs. This area requires further investigation. We also suggest that future research ought to cover critical aspects such as digitization in logistics and supply chain networks and its impact on enhancing international trade, particularly in the context of the Gulf and wider Middle East region, which are hardly examined in the literature.

Theoretical and Practical Implications

The findings of this article are meant to help us understand the possible improvements in the supply chain by enhancing some aspects of trade facilitation from a policy perspective. The findings presented here are meant to spark debate among decision makers and other interested parties about how to first prioritize their trade facilitation initiatives. By appreciating the significance of specific trade facilitation components, nations and enterprises can pinpoint weak points in their supply chains and concentrate on eliminating trade bottlenecks. Trade facilitation enables businesses to have easier access to foreign inputs. Trade facilitation benefits all nations, regardless of whether they import or export commodities, and it motivates them to participate more in global value chains. This will help practitioners improve their understanding of trade logistics strategy and international trade development.

The logistics industry can undoubtedly help in fostering deeper integration in global production networks (Saslavsky and Shepherd 2014). However, developing logistics expertise is a multifaceted process that involves things like the regulation of transportation and allied industries, border controls, infrastructure, and the challenging growth of the private sector. Therefore, governments should prioritize removing obstacles such as tariff and non-tariff barriers through policy interventions. This research, along with other recent works in the literature covered in this study, demonstrates the need for better logistics and trade facilitation as a key component of the policy mix.

The strategy uncovered by this study is to improve LP, boost international trade, and rank among the top economies on the planet. This study is expected to add to research on the potential effects of LP on trade. The governments, particularly those of middle-income countries, are keen on improving exports and imports and increasing trade effectively and efficiently through the optimization of supply chain management (Salawu and Ghadiri 2022). The best strategy for middle-income countries is to improve logistical infrastructure, LP, and update the framework for import and export for economic prosperity (Yeo et al. 2020). The government should focus on enhancing the role that global logistics play in global trade, implement a free trade policy, improve the training of the logistics workforce, intensify the building of port infrastructure, and quicken the development of a bonded area logistics system (Jiang and Wu 2017).

The government can think of a green technology-based supply chain. Governments should make a sincere effort to combat fraud and corruption among logistics and international trade professionals. Governments should also enhance global logistics systems and infrastructure, which will boost productivity, cut down on intermediary processes, and enhance departmental cooperation. Utilizing technology to digitize processes may result in greater transparency and visibility by enabling the flow of products and services across borders, improving LP benefits for both importers and exporters. Policy makers should be aware of this and eliminate bureaucratic obstacles that provide openings for fraud (Salawu and Ghadiri 2022).

As for Oman, the government must make considerable investments in developing the logistics and supply chains sector to uphold a competitive edge and operational capacity. More attention should be paid to accelerating digitalization and upgrading the ICT sector to lower costs, enhance quality, facilitate innovation, and increase the effectiveness and efficiency of the logistics and supply chain sector. Priority should be given to logistics parks,

modern warehouses, and distribution channels, as well as enhancing trade facilitation to optimise the effects of the growing trade network on the economy.

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Notes

1 The five FTAs are Gulf Cooperation Council (GCC), Greater Arab Free Trade Area (GAFTA), Gulf Cooperation Council-Singapore Free Trade Agreement (GSFTA), European Free Trade Association (EFTA) and GCC Free Trade Agreement and USA-Oman. Some ongoing agreements include GCC-UK and GCC-Korea.

2 Backward GVC participation from the "Buyer side" = ratio of the "Foreign value-added content of exports" to the economy's total gross exports.

3 In the graph vertical axis is the Oman's FVA change in the extra-regional, while for the horizontal axis it is for intra-regional. That's the chart is divided in four "zones", where top right means increase in both, intra and extra regional; the opposite for the bottom left. Then, in the top left area an FTA pulls extra-regional FVA, but shrinks the intra-regional, vice versa for the bottom right. Here we are looking at the change in composition. Where both intra and extra are negative, results show an increase of domestic value added.

4 The descriptive statistics using International Trade Centre data shows that most of the trade in Tobacco by Oman is re-export.

5 GTAP-VA allows us to decompose the entire supply chain between domestic and foreign, between markets of destination, sources of input supply for trade, and so on. For a sake of simplicity, we are presenting a share of the results, detailed result can be provided when needed.

6 We introduce a positive shock in the equation that computes the bilateral demand for international transportation services of Oman. We add the potential for input-augmenting technical change. It represents the fact that the demand for services along any given route is proportionate to the quantity of merchandise carried. Technological improvements reduce the margins services required for Oman's imports and export. Trade facilitation investments dampen the cost of shipping to and from Oman, thereby lowering the CIF price implied by a given FOB value.

7 Accessed on 10 October 2023 https://www.wto.org/english/tratop_e/tpr_e/tp518_crc_e.htm.

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