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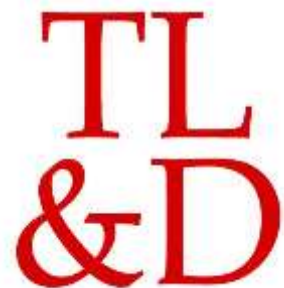
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Christina Wiederer, *The Role of Logistics in Supporting International Trade and Development—A Literature Review*
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THE ROLE OF LOGISTICS IN SUPPORTING INTERNATIONAL TRADE AND DEVELOPMENT—A LITERATURE REVIEW

CHRISTINA WIEDERER*

A sound logistics environment is key to a country's trading opportunities. Poor trade logistics performance—understood as the cost, the time and the complexity involved in import and export activities—precludes many countries from diversifying their economies and can thus hamper trade, growth and employment. This is particularly relevant for developing countries, where a weak logistics environment often impedes trade. Delays in the supply chain, for instance at border crossings, increases transportation and thereby increases product costs, making exports less competitive. They force companies to hold higher inventories to avoid production stoppages due to delays in procuring preliminary products. Increasing supply chain performance can foster trade, growth and competitiveness more than tariff reductions can and is typically politically more feasible. High logistics performance is closely linked to trade facilitation as the latter deals with trade procedures that can impede trade once formal trade barriers such as tariffs have been eliminated. The World Trade Organization's Trade Facilitation Agreement (TFA), which entered into force in 2017, represents a major step forward for fostering trade globally and for developing countries. The TFA can be expected to increase the reliability and predictability of supply chains and thus may support higher logistics performance. The purpose of the paper is to take stock of the current state of knowledge about a country's logistics environment as an enabler of international trade, with a focus on developing countries. The paper is based on the key words logistics, international trade, exports, growth, and development. The studies reviewed underline the strong link between a well-functioning logistics environment and a country's trading opportunities. Logistics often acts as a bottleneck for countries wishing to increase their exports. High logistics performance increases firm productivity and can thus contribute to higher economic growth. Policymakers concerned with the welfare of their countries often strive to provide an enabling environment for private sector actors to export higher volumes and more sophisticated goods. This

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paper shows why it is worthwhile for policymakers to focus some of their efforts on improving the logistics environment. The paper summarizes the state of knowledge in the field. It identifies knowledge gaps and directions for future research. Its findings may be of value to researchers and policymakers, especially in countries with a weak logistics environment or with external constraints such as being landlocked, that wish to foster an enabling environment for high value exports and for integration of their country into global value chains.

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I. INTRODUCTION

A well-functioning logistics environment is vital to a country's opportunities for trade, growth and employment. This is particularly relevant for developing countries,¹ as poor trade logistics performance measured in terms of the cost, the

¹ The term 'developing countries' will denote those countries classified as low or middle income by the World Bank. Income is measured using gross national income (GNI) per capita, in US dollars, converted from local currency using the World Bank Atlas method. Low income countries are those with a GNI of \$995 or less; middle income countries are those with a GNI of \$996 to \$12,055 in the fiscal year 2018. See World Development Indicators, <https://datacatalog.worldbank.org/dataset/world-development-indicators> (last visited Mar. 15, 2019).

time and the complexity involved in import and export activities of the country and preclusion of many developing countries from diversifying their economies, can depress trade, growth and employment.² A well-functioning logistics environment is particularly important for the agribusiness sector as perishable goods rely on logistics infrastructure such as temperature-controlled transport and storage. While logistics services are typically provided by the private sector, national governments play a key role in providing logistics infrastructure, setting regulatory boundaries, oversea border management, and providing a level-playing field for all supply chain actors.

High logistics performance is closely linked to trade facilitation as the latter deals with trade procedures that can impede trade once formal trade barriers such as tariffs have been eliminated. Logistics is the backbone of international trade. A country could produce high-quality, competitively priced goods that would meet ample demand abroad, yet if the logistics environment is inadequate, those goods will not find their way to their destination. Further, logistics shortcomings have ramifications far beyond transport, in as much as major trade policy-related advancements such as the accession of a country to the World Trade Organization could fail to have noticeable effects if a weak logistics environment is unable to sustain an increase in trade.⁴ Factors that strongly influence a country's logistics capabilities include its infrastructure, laws and regulations, and the skills and knowledge of its labour force. The World Trade Organization's Trade Facilitation Agreement (TFA), which entered into force in 2017, represents a major step forward for fostering trade globally, particularly for developing countries. The TFA focuses on administrative and regulatory standards rather than on performance standards for trade logistics.³ Yet the TFA can be expected to increase the reliability and predictability of supply chains and thus may support higher logistics performance.⁴

This paper analyses the current state of knowledge about a country's logistics environment as an enabler of international trade, with a focus on developing countries. First, it introduces key terms and concepts relating to logistics in international trade to facilitate conceptual clarity. Secondly, the article provides an overview of the ways in which logistics act as an enabler and facilitator of trade

² 'Logistics' in the course of this paper will apply to 'macro logistics' (in contrast to the micro level), i.e., logistics viewed at the country level rather than on the level of the individual firm. As for trade, the focus will be on exports rather than imports.

³ See Celine Bacrot & Luisa Rodriguez, *Policy Making after the WTO Trade Facilitation Agreement: Towards a Broader Trade Logistics Approach?* (July 23, 2018), <https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1821> (last visited Apr. 13, 2019).

⁴ *Id.*

and reviews research on how logistics supports trade, and what the logistic needs of internationally operating firms are. Further, it briefly lays out the determinants of trade that are unrelated to logistics. Thirdly, the article focuses on logistics costs including how to measure them at the country level and how they impact international trade. Fourth, it includes policy implications. Finally, the article is concluded by identifying the way ahead in this regard.

II. DEFINITIONS OF KEY TERMS AND CONCEPTS

Logistics is defined as “the process of planning, implementing and controlling the efficient, effective flow and storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirements”.⁵ Supply chain management is defined as “all activities associated with the flow and transformation of goods from raw materials stage [...] through the end user, as the associated information flows”.⁶ Many scholars believe that logistics and supply chain management as synonymous,⁷ whereas other scholars do not see any direct link between supply chain management and logistics.⁸ In the following, supply chain management and logistics will be regarded as synonymous.

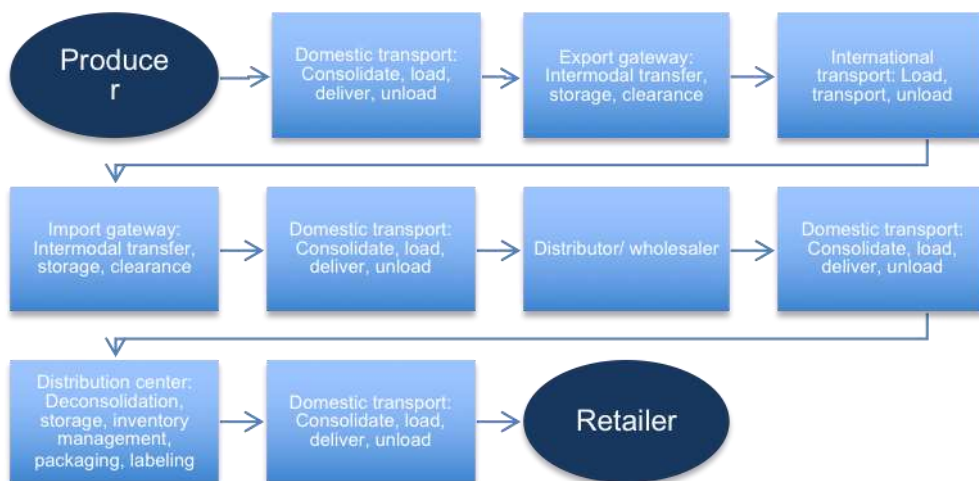
⁵ COUNCIL OF LOGISTICS MANAGEMENT, WHAT IS IT ALL ABOUT? (1986).

⁶ R. B. HANDFIELD & E. L. NICHOLS, INTRODUCTION TO SUPPLY CHAIN MANAGEMENT, 2 (1999).

⁷ D. SIMCHI-LEVI ET AL., DESIGNING AND MANAGING THE SUPPLY CHAIN 1 (2000); I. Göpfert, *Einführung, Abgrenzung und Weiterentwicklung des Supply Chain Managements*, in INTEGRIERTES SUPPLY CHAIN MANAGEMENT 25, 30 (A. Busch & W. Dangelmaier eds., 2002).

⁸ F. Hewitt, *Supply Chain Redesign*, INT'L J. LOGISTICS MGMT. 1, 1 (1994); A. Marbacher, *Demand & Supply Chain Management: Zentrale Aspekte der Gestaltung und Überwachung unternehmensübergreifender Leistungserstellungsprozesse betrachtet aus der Perspektive eines Markenartikelherstellers*, 19 (Dissertation Universität Zürich, Schriftenreihe Logistik der Kühne-Stiftung 2001); M.C. Cooper, D. M. Lambert & J.D. Pagh, *Supply Chain Management: More Than a New Name for Logistics*, INT'L J. LOGISTICS MGMT. 1, 2 (1997).

Figure 1: Logistics services in a typical supply chain⁹



The definition of logistics in context of international trade, termed as trade logistics, is the procedural and documentary background of production and transport logistics which enables freight to change hands by means of commercial transactions. At the heart of trade logistics lies the set of rules governing commercial documents and procedures, banking and financial securities, transport and shipping bills, and manifests which regulate international flows of goods by structuring supply and demand from seller to buyer and of payment from buyer to seller.¹⁰ Further, trade logistics includes “the range of services and processes that are involved in moving goods from one country to another, including customs and administrative procedures, organization and management of international shipment

⁹ See DARIA TAGLIONI & DEBORAH WINKLER, MAKING GLOBAL VALUE CHAINS WORK FOR DEVELOPMENT 166 (2016).

¹⁰ C. De Castro, *Trade and Transport Logistics Facilitation Guidelines 4* (World Bank & Econ. Comm’n for Afr., SSATP Working Paper No. 4, 1993).

operations, tracking and tracing, and the quality of transport and information technology infrastructures”.¹¹

Logistics performance is defined as the trio of cost, time and complexity involved in carrying out import and export activities.¹² As for competitiveness, the term is used in the sense of the “attractiveness of a region or country in terms of business location decisions and/or foreign direct investment (FDI)”.¹³ Logistics performance is tied to competitiveness as “transport system efficiency and industry profitability are closely related. Inventory reduction through high turnover, ability to respond to volatile demand, short lead times and achieving lowest possible transportation costs are essential aspects of a company’s competitiveness”.¹⁴ Global value chain is defined as “all the activities that firms engage in, at home or abroad, to bring a product to the market, from conception to final use”.¹⁵

III. THE ROLE OF LOGISTICS IN FACILITATING INTERNATIONAL TRADE AND DEVELOPMENT

A. *Overview: Logistics as a Pillar of Trade Facilitation and Development*

A country’s logistics performance is an important determinant of its productivity, its ability to participate in international trade and its attractiveness to outside investment.¹⁶ Some countries enjoy less market access than others due to their unfavourable geographic position, for example, landlocked countries and small island states. High logistics performance can make up for some of that distance and help countries gain access to otherwise unreachable markets. A country’s logistics environment provides the infrastructure and spatial connectivity that firms need to connect with customers nationally and internationally.¹⁷

¹¹ J. Korinek & P. Sourdin, *To What Extent are High-Quality Logistics Services Trade Facilitating?*, 4 (OECD Trade Policy Papers No. 108, 2011).

¹² W. H. Hausman et al., *The Impact of Logistics Performance on Trade*, 22 PRODUCTION AND OPERATIONS MGMT. 236, 237 (2013) [hereinafter Hausman et al. (2013)].

¹³ D. Celebi & L. Ojala, *The World Bank’s Logistics Performance Index (LPI) and Drivers of Logistics Performance*, Roundtable on Logistics Development Strategies and their Performance Measurements, Queretaro, Mexico, International Transport Forum, 7 (2015).

¹⁴ *Id.*, at 6.

¹⁵ Org. for Econ. Co-operation & Dev. (OECD), *Interconnected Economies: Benefiting from Global Value Chain*, at 8, (2013), <http://www.oecd.org/sti/ind/interconnected-economies-GVCs-synthesis.pdf> (last visited Nov. 20, 2018).

¹⁶ Hausman et al. (2013), *supra* note 12, at 237.

¹⁷ R. Banomyong et al., *Assessing the National Logistics System of Vietnam*, 31 ASIAN J. SHIPPING & LOGISTICS 21, 24 (2015).

Competitiveness is elusive for countries with an inefficient logistics environment since firms need to be able to move goods quickly across borders at low cost and with high reliability as supply chains are only as strong as their weakest link.¹⁸ Consequently, all links of a supply chain must be strengthened if countries want to attract FDI and participate in international production networks or global value chains. Supply chain networks are put to test when firms spread out geographically.¹⁹ A lack of logistics infrastructure is one of the main reasons for companies to abstain from extending their procurement network to emerging and developing countries.²⁰ Increasing the performance of supply chains can foster trade, growth and competitiveness more than a tariff reduction and is typically a more feasible political alternative.²¹

Korinek and Sourdin examined the influence of trade logistics quality on the volume and value of international trade.²² According to them, the quality of trade logistics positively, significantly and robustly impacts bilateral trade—and exports in particular—by using indicators such as the World Economic Forum’s Global Enabling Trade Report and the World Bank’s Logistics Performance Index as proxies for logistics quality.²³

B. *The Relevance of the WTO’s Trade Facilitation Agreement for Logistics*

Trade facilitation and logistics are closely linked, and thus the entry into force of the WTO TFA has ramifications for logistics performance across the world. Unlike earlier conventions, the WTO TFA is subject to the WTO’s binding trade disciplines.²⁴ While it is too early to gauge actual impacts of the 2017 agreement on logistics performance, it is likely that the TFA will have positive effects on logistics through at least three channels:

1. Increasing supply chain transparency
2. Increasing supply chain predictability

¹⁸ J. F. ARVIS ET AL., *CONNECTING TO COMPETE 2014: TRADE LOGISTICS IN THE GLOBAL ECONOMY 9 (2014)* [hereinafter *CONNECTING TO COMPETE (2014)*].

¹⁹ F. STRAUBE & H. C. PFOH, *TRENDS UND STRATAGIEN IN DER LOGISTIK- GLOBALE NETZWERKE IM WANDEL 12 (2008)*.

²⁰ F. STRAUBE ET AL., *INTERNATIONAL PROCUREMENT – CHALLENGES AND OPPORTUNITIES IN EMERGING MARKETS 24 (2011)*.

²¹ Julio A. Gonzalez et al., *Improving Logistics Costs for Transportation and Trade Facilitation 8 (World Bank Policy Research Working Paper No. 4558, 2008)*.

²² Korinek & Sourdin, *supra* note 11, at 13.

²³ *Id.*

²⁴ J. F. ARVIS ET AL., *CONNECTING TO COMPETE 2016 – TRADE LOGISTICS IN THE GLOBAL ECONOMY, 22 (2016)* [hereinafter *CONNECTING TO COMPETE (2016)*].

3. Increasing cooperation between the private and public sector

The first, supply chain transparency, can be expected to increase as a result of the WTO TFA as the agreement will enhance access to information for all supply chain actors through so-called trade portals,²⁵ i.e., online platforms that act as a repository for all trade-related regulations relevant for exporting and importing, making the information easily retrievable to traders and logistics professionals.

The second, supply chain predictability, can be expected to increase as a result of the WTO TFA as formalities at the border will be harmonized across countries, eliminating the need for traders and logistics professionals to deal with differing formalities in each country that they do business in. In addition to increasing supply chain predictability, this can be expected to lower time and cost associated with the logistics processes. The introduction of National Single Windows and increased automation in border clearance will further support this, though they will require sustained government efforts for implementation.²⁶ The TFA includes mutually agreed standards that can be targeted by countries that do not yet meet the minimum standards as laid out in the agreement.

Thirdly, the WTO TFA, through the establishment of National Trade Facilitation Committees (NTFCs), is likely to increase collaboration and alignment between the public and the private sector, including with logistics professionals.²⁷ Article 23.2 of the TFA stipulates the establishment of National Committees on Trade Facilitation, with the objective to “facilitate both domestic coordination and implementation of the provisions of this Agreement”.²⁸ The NTFCs will facilitate dialogue between the private sector and government. This will enable the logistics community (for example, freight forwarders, exporters, importers, and operators of trade-related infrastructure) to draw attention to the constraints they face in their day-to-day operations and will allow the government to reply to the private sector’s concerns. Through the promotion of dialogue, NTFCs will help foster the ownership of both the private and public sector in facilitating trade. This is in line with the whole-of-government approach of the TFA, which implies that the

²⁵ Trade Facilitation Implementation Guide (Sep. 2012), <http://tfig.unece.org/details.html>; World Trade Organization, *Implementing the Trade Facilitation Agreement*, in AID FOR TRADE AT A GLANCE, 109 (2015).

²⁶ CONNECTING TO COMPETE (2016), *supra* note 24.

²⁷ United Nations Conference on Trade & Dev., *Transport and Trade Facilitation for Development., National Trade Facilitation Committees: Beyond Compliance with the WTO Trade Facilitation Agreement?*, UNCTAD/DTL/TLB/2017/3 (2017), https://unctad.org/en/PublicationsLibrary/dtlb2017d3_en.pdf.

²⁸ Protocol Amending the Marrakesh Agreement Establishing the World Trade Organization (Agreement on Trade Facilitation), Feb. 22, 2017.

agreement is not just focused on customs but on all divisions of government concerned with international trade, for example, sanitary and phytosanitary agencies.

The 2016 Logistics Performance Index report suggests that several of the issues that the TFA tries to address are prevalent in countries that exhibit low logistics performance as measured by the LPI.²⁹ These issues include red tapeism and the adherence to general customs principles, for example, the ability to process customs declarations online, the ability to choose the location of final clearance, the share of physical inspections of import shipments, and the share of multiple inspections of import shipments.³⁰ The TFA addresses this via the tiered structure of categories. Developing countries may select which parts of the agreement become binding immediately after entry into force or after a short transition period (Category A), which parts will be deferred (Category B), and which parts will become binding only once technical assistance for capacity building is received (Category C).³¹ Further, the TFA ensures a stronger system for technical assistance delivery and capacity building for developing and least developed countries.³²

C. *Measuring the Effect of Logistics Performance and Transport Infrastructure on Exports*

The main channel for logistics which influences economic performance, including exports, is via the effect on cost, time and reliability. Time refers to lead time, i.e., the time it takes for goods to reach the purchaser after the order has been placed.³³ Costs include direct costs such as costs for transporting goods and indirect costs such as inventory holding costs when goods are in transit.³⁴ Reliability refers to the certainty as to how and when the deliveries will occur.³⁵

Studies showing that improvements in transport and logistics are linked to export performance can be traced back to the 1990s. Any improvements in transport infrastructure enhances trade, and this effect is more pronounced for middle-

²⁹ CONNECTING TO COMPETE (2016), *supra* note 24.

³⁰ *Id.*

³¹ J. F. ARVIS ET AL., CONNECTING TO COMPETE 2018 – TRADE LOGISTICS IN THE GLOBAL ECONOMY, 27 (2018).

³² *Id.*

³³ Hausman et al. (2013), *supra* note 12, at 241.

³⁴ Warren H. Hausman, et al., *Global Logistics Indicators, Supply Chain Metrics, and Bilateral Trade Patterns*, 3 (World Bank Policy Research Working Paper No. 3773, 2005) [hereinafter Hausman et al. (2005)].

³⁵ CONNECTING TO COMPETE (2014), *supra* note 18, at 2.

income rather than high-income or low-income countries.³⁶ High income countries may also have carried out the improvements with the highest benefits whereas in low income countries, gains from improvements in transport infrastructure may be impeded by problems that are even more trade-inhibiting than poor infrastructure, for example, lack of security, political stability or legal certainty.³⁷

Using the example of Spanish firms, some scholars conducted a research to explore the impact of investment in transport infrastructure on firms' export market participation.³⁸ The results showed that transport infrastructure investments increase firms' probability of exporting.³⁹ This is because infrastructure investments lower domestic transport costs and thus lower international trade costs, providing firms with a cost advantage in supplying goods to international markets.⁴⁰ The authors found that the results are most pronounced for small and medium-sized enterprises. As for the magnitude of results, the authors found that lowering road accessibility time to international markets by thirty minutes, export probability for firms with up to two hundred employees increases by 0.5% to 1.5%.⁴¹

This result has two important implications for transport infrastructure investments in developing countries. First, these countries' economy is often dominated by small and medium-sized enterprises rather than large multinational ones, so transport infrastructure investments would predominantly favour the former. Second, developing countries are often far away from international markets which is exacerbated by poor transport infrastructure. The influence of transport costs on trade levels is evident from the fact that a 10% point reduction in transport costs goes along with a 20% point increase in trade volumes, with poor infrastructure accounting for 40% of predicted transport costs.⁴²

The gains from improving logistics performance are especially high in poorer countries. Increasing the logistics performance of a low-income country to the average performance of a middle-income country can increase trade by 15% or

³⁶ Korinek & Sourdin, *supra* note 11, at 18.

³⁷ *Id.*

³⁸ Pedro Albarran et al., *Domestic Transport Infrastructure and Firms' Export Market Participation*, 40 SMALL BUS. ECON. 879, 879 (2013).

³⁹ *Id.* at 889.

⁴⁰ *Id.* at 879.

⁴¹ *Id.* at 895.

⁴² N. Limão & A.J. Venables, *Infrastructure, Geographical Disadvantage, Transport Costs and Trade*, 15 WORLD BANK ECON. REV. 453 (2001).

more.⁴³ However, increased trade does not translate into increased income for everyone. Negative impacts of more trade include unemployment of dislocated workers and fewer sales for domestic producers. Complementary policies can mitigate but not prevent them.⁴⁴

Once countries had reduced their import tariffs (which for most States occurred by the 1990s), transport costs emerged as one of the main or even the main barrier to trade for many countries.⁴⁵ This holds true for several Latin American countries wishing to access the U.S. market.⁴⁶ Their focus is on maritime transport the cost of which is closely tied to port efficiency. Raising a port's efficiency from the 25th to the 75th percentile is associated with an increase in bilateral trade of around 25% and a reduction in transport costs by 10% to 12%.⁴⁷ As port efficiency is partly influenced by the state of a country's infrastructure, investments in port infrastructure hold the potential to increase port efficiency and thus bolster trade. Regulating market power in shipping and liberalizing port services, which in many countries are in the hands of state-owned operators, could help lower shipping costs by around 30%.⁴⁸

As for which transport mode benefits most from logistics improvements (in terms of trade level increases), scholars differentiate between maritime and aerial transport and conclude that the effects of improvements in trade logistics are particularly strong for airborne transport.⁴⁹ The reason might be that time-sensitive goods tend to rely on air transport more than time-insensitive goods and time-sensitive goods put higher demands regarding quality of logistics services providers. Therefore, air transport benefits particularly strongly from

⁴³ Zia Qureshi, *The G-20 and Global Development*, in POSTCRISIS GROWTH AND DEVELOPMENT, 119, at 148 (Sharokh Fardoust, Yongbeom Kim & Claudia Sepúlveda eds., 2011).

⁴⁴ Org. for Econ. Cooperation & Dev. (OECD), *Aid for Trade and Value Chains in Transport and Logistics*, 16 (2013), https://www.oecd.org/dac/aft/AidforTrade_SectorStudy_Transport.pdf (last visited Apr. 9, 2019) [hereinafter *Aid for Trade*].

⁴⁵ The average tariff rate in Asia decreased from 30% at the beginning of the 1980s to 14% at the end of the 1990s; and for Latin America average tariffs decreased from 31% to 11%. These numbers reflect simple averages of countries' unweighted tariffs; for weighted tariffs; the result would be even lower. See Ximena Clark et al., *Port Efficiency, Maritime Transport Costs and Bilateral Trade 1* (Nat'l Bureau of Econ. Research, Working Paper No. 10353, 2004).

⁴⁶ *Id.* at 3.

⁴⁷ *Id.* at 7.

⁴⁸ Carsten Fink et al., *Trade in International Maritime Services: How Much Does Policy Matter?*, 16 WORLD BANK ECON. REV. 81, 101 (2002).

⁴⁹ Korinek & Sourdin, *supra* note 11, at 4.

improvements in logistics services. As it is high value rather than low value products that are shipped via air, this result has positive implications not just for a country's trade volume but also for its trade value. Air transport is gaining in importance in global value chains that increasingly rely on fast and just-in-time delivery, which is easier to achieve with air transport than with other modes. Air cargo facilities are also crucial for quickly transporting high-value perishable agricultural goods such as specialty produce and flowers.

Some scholars examined the effect of international logistics performance on developing countries' exports and found that the effect's magnitude was dependent on the country's size, with higher results for larger countries.⁵⁰ An improvement in logistics performance of one standard deviation equals a 14% reduction in distance between countries and would raise exports by around 37% for a country of average size.⁵¹ Since most countries are small, the typical effect is only 8%.⁵² Even though this equals only around 20% of the average-size country result, this is still a significant export increase. One should also consider that a complete overhaul of logistics in a small country is cheaper than in a large country, bolstering the welfare gain for logistics reforms in countries of all sizes.⁵³

The reliability of a supply chain is a more important factor in determining transaction costs than the distance between trading partners.⁵⁴ Unpredictable delays and lack of reliability are more detrimental to supply chains than high costs and long transport times.⁵⁵ When material and intermediate products do not arrive on time due to unreliable supply chains, firms have to keep extra inventory, driving up the cost of production and keeping the funds from being used more productively.⁵⁶ For transporters and logistics services, a delay that is predictable is more manageable than an unpredictable situation where the best outcome (delivery) might be very fast, but where there is a chance (no matter how small) that the delivery might be late.⁵⁷ Delays harm economic performance in at least

⁵⁰ Alberto Behar et al., *Exports and International Logistics*, 4 (World Bank Pol'y Research Paper No. 5691, 2011).

⁵¹ *Id.*

⁵² *Id.* at 26.

⁵³ *Id.*

⁵⁴ Org. for Econ. Co-operation & Dev. [OECD], *Rapport d'évaluation Maroc: Cadre Juridique du Développement des Zones Logistiques*, 9 (2015), [hereinafter *Rapport d'évaluation Maroc*].

⁵⁵ J. F. ARVIS ET AL., *CONNECTING TO COMPETE 2012: TRADE LOGISTICS IN THE GLOBAL ECONOMY*, 22 (2012).

⁵⁶ Hausman et al. (2005), *supra* note 34, at 6.

⁵⁷ *Aid for Trade*, *supra* note 44, at 12.

two ways: (a) by reducing exports (by as much as 1% per day of delay),⁵⁸ and (b) by hampering export diversification.⁵⁹

Export diversification can happen in two ways: diversification at the intensive margin or diversification at the extensive margin. Diversification at the intensive margin occurs when the volume of export goods at low aggregate values grows faster than the volume of those at high aggregate values; it thus does not involve exporting any new products.⁶⁰ Diversification at the extensive margin occurs when a country adds new products to its export basket.⁶¹ Increase in the extensive margin is more meaningful from a development view as they increase value added. The impact of logistics on development is an indirect one, with increased trade acting as an intermediary: High logistics performance facilitates trade. Trade liberalization in turn fosters productivity growth in developing country firms.⁶² Productivity growth positively influences economic growth and technological upgrading.⁶³ Raising the ratio of trade to GDP by 1% raises income per person by between 0.5 and 2%.⁶⁴

D. *The Role of Logistics in Facilitating a Country's Participation in Global Value Chains*

Global value chains (GVCs) have gained importance in international trade. This goes hand in hand with the rising importance of logistics and transport, since high logistics performance is a sine qua non for joining and strengthening participation in global value chains. Logistics performance and GVC integration (both on the buyer and the seller side) are positively correlated.⁶⁵ A smooth physical movement of goods along the value chain requires cost-effective logistics services, streamlined procedures for imports and exports, and good connectivity.⁶⁶ This is especially true

⁵⁸ Simeon Djankov et al., *Trading on Time*, 16 (World Bank Research Pol'y Paper No. 3909, 2006).

⁵⁹ *Aid for Trade*, *supra* note 44, at 11.

⁶⁰ Allen Dennis & Ben Shepherd, *Trade Facilitation and Export Diversification*, 34 WORLD ECON. 101, 103 (2011).

⁶¹ *Id.*

⁶² Nina Pavcnik, *Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants*, 69 REV. ECON. STUD. 245, 262 (2002).

⁶³ *Aid for Trade*, *supra* note 44, at 16.

⁶⁴ Jeffrey A. Frankel & David Romer, *Does Trade Cause Growth?*, 89 AM. ECON. REV. 379, 388 (1999).

⁶⁵ TAGLIONI & WINKLER, *supra* note 9, at 118.

⁶⁶ TAGLIONI & WINKLER, *supra* note 9, at 12.

in the agri-food sector, where each country involved in the chain is required to have a well-functioning transport and logistics sector.⁶⁷

Sound logistics benefit countries in two ways. First, logistics, and particularly the more comprehensive concept of supply chain management, allow companies with higher degrees of specialization and sophistication to move up in the value chain.⁶⁸ Second, modern logistics increase employment as national and multinational companies require more and other services including specialized logistics services and employment around logistics zones.⁶⁹

Producing and exporting more sophisticated and diversified goods allows a country to grow economically. Up until the mid-1980s, a country wanting to export had to first build a deep and wide industrial base. Since the late 1990s, it is possible for countries to join an existing supply chain, become part of a global value chain—for example, for cars—and move up the value chain to increase value addition.⁷⁰ Countries such as China and Vietnam provide examples, as does Mexico. The higher a country is in a value chain, the more important it becomes to move goods and services rapidly, cheaply and reliably.⁷¹ This is true for all countries but especially for geographically remote ones such as landlocked countries and small island states.⁷² Good logistics also come into play in determining the costs of sourcing from and supplying to global markets; inland transport to the export gateway is one of the largest constraints for exports of firms in middle-income countries with even higher obstacles for smaller and younger firms.⁷³

Logistics' role in international trade becomes more pronounced as more countries shift production from products with comparatively lower logistics demands, such as traditional manufacturing, to engage in international vertical specialization.⁷⁴

⁶⁷ *Aid for Trade*, *supra* note 44, at 11.

⁶⁸ The World Bank, *Success Factors for Improving Logistics in a Middle-Income Country*, 1 (Oct. 2006),

<https://openknowledge.worldbank.org/bitstream/handle/10986/11771/383220TRN0350Marocco0Logistics.pdf?sequence=1>.

⁶⁹The World Bank, *La Logistique du Commerce et la Compétitivité du Maroc*, at i, (May 30, 2006), <http://documents.worldbank.org/curated/en/796641468274199799/La-logistique-du-commerce-et-la-competitivite-du-Maroc>.

⁷⁰ Richard Baldwin, *Trade and Industrialisation after Globalization's 2nd Unbundling: How Building and Joining a Supply Chain are different and why it matters* 5 (Nat'l Bureau of Econ. Research, Working Paper No. 17716, 2011).

⁷¹ *Aid for Trade*, *supra* note 44, 18.

⁷² *Id.*

⁷³ TAGLIONI & WINKLER, *supra* note 9, at 12.

⁷⁴ Korinek & Sourdin, *supra* note 11, at 5.

Using the example of machinery, scholars distinguish between trade in final goods and trade in parts and components when it comes to sensitivity to logistics performance.⁷⁵ A country's score on the Logistics Performance Index is used as a proxy for logistics performance.⁷⁶ Other variables whose influence is examined include gross domestic product (GDP), the distance between two countries, trade between two countries, a common language, exports from one country to another, contiguity (sharing a common land border), and historical ties through colonialism.⁷⁷ They show that trade parts and components are significantly more sensitive to improvements in logistics performance than trade in final goods is.⁷⁸

This result has implications for international production networks and global value chains, as when countries first join international production networks, they are likely to do so as parts and components suppliers and not as makers of final products. The difference in sensitivities and logistics performance implies that policymakers can support their countries' aspirations to join international production networks by improving logistics performance. Measures to support performance vary from infrastructure and building competencies in logistics professions to border procedures and regulation of transport and related services.

E. Why 'Soft' Logistics Infrastructure is as Important as 'Hard' Infrastructure

'Hard' infrastructure such as roads, railways and ports are only one part of a country's trade logistics quality. The other part is 'soft' infrastructure made up of the processes and regulations associated with international trade, i.e., border administration, product standards, sanitary and phytosanitary regulations, labour conditions, environmental protection, and legal transparency. Differences in logistics performance can be explained in part by differences in the quality of hard infrastructure, but much more often they stem from differences in the soft infrastructure.

Weaknesses in the logistics system that often wreak more havoc than poor infrastructure include policy and institutional constraints including overly bureaucratic processes, long clearance times at ports and border crossings, restrictive protocols on cargo movement or the lack of enforcement of rules of engagement.⁷⁹ For instance, close to 100% of imports into Sri Lanka and Nigeria

⁷⁵ Daniel Saslavsky & Ben Shepherd, *Facilitating International Production Networks: The Trade Logistics*, 23 J. INT'L TRADE & ECON. DEV. 979, 989 (2014).

⁷⁶ *Id.* at 983.

⁷⁷ *Id.*

⁷⁸ The difference in the semi-elasticities of trade in final goods versus trade in parts and components is over 45%.

⁷⁹ Hausman, et al. (2013), *supra* note 12, at 237.

are subject to comprehensive inspection by customs authorities, while the number for Germany is 2% and for Canada only 1%.⁸⁰ High inspection rates slow the movement of goods and decrease reliability in the supply chain.

Each additional day spent on trade procedures for preparing goods for export and import lowers trade by around 4%.⁸¹ The same amount of time spent on border procedures is more harmful than the same amount spent during sea transport, for instance. This mostly reflects the detrimental effect of uncertainty of durations. Aspects of trade logistics such as customs procedures, logistics competence as well as tracking and tracing services impact trade more than variables such as distance from markets and transport costs. Moreover, while the latter group of characteristics does not lend itself to policy intervention, the former one does.⁸² Human resources (i.e., the right skills and competencies mix of the logistics workforce) are important for the logistical performance of businesses and countries.⁸³

IV. LOGISTICS COSTS AND THEIR IMPACT ON INTERNATIONAL TRADE

A. *Measuring Logistics Costs*

Trade transactions involve costs, and logistics costs are part of this. There is no set definition of logistics costs and no established method of measuring them, neither on the level of the entire economy nor on the level of individual firms. The logistics costs at the firm or micro level involves transportation, packaging, warehousing, inventory carrying, value added services, and administration as its components.⁸⁴ At the level of the individual firm, logistics costs are made up transportation, transport packing, warehousing, inventory carrying, and logistics administration.⁸⁵ With the exception of value-added services, this matches the definition by Straube and Pfohl.⁸⁶ In other words, logistics costs can be defined as

⁸⁰ *Id.*

⁸¹ Korinek & Sourdin, *supra* note 11, at 4.

⁸² *Id.*

⁸³ A. MCKINNON ET AL., LOGISTICS COMPETENCIES, SKILLS, AND TRAINING – A GLOBAL OVERVIEW, xii (2017).

⁸⁴ STRAUBE & PFOHL, *supra* note 19, at 49.

⁸⁵ T. Solakivi et al., *Finland State of Logistics 2014*, MINISTRY OF TRANSP. AND COMMS. FIN. 12 (2015).

⁸⁶ STRAUBE & PFOHL, *supra* note 19.

the cost of all “resources required for moving goods from an origin to a point of consumption”.⁸⁷

At the macroeconomic or country level, according to Rantasila and Ojala, logistics costs can be measured via three main concepts:⁸⁸

1. Share of aggregated sales or turnover;⁸⁹
2. Share of GDP; and
3. Absolute costs.

These different logistics costs concepts can be measured through the following methods:⁹⁰

1. Statistics-based studies which use statistical data, models and methods to determine the level of logistics costs, using national accounting figures, for instance.
2. Surveys, i.e., using questionnaires to collect data from respondents, for example, logistics experts at the company level. Examples include surveys carried out among 897 German and 155 EU-based companies by Straube and Pfohl and the Finland State of Logistics survey, which is the most comprehensive study so far with 1,812 respondents in 2010.⁹¹
3. Case studies and other studies. These tend to be used when neither statistics-based studies nor surveys are available, for example, due to a lack of reliable data and interview subjects.

Another scholar describes following three ways of measuring logistics costs:⁹²

1. Logistics costs as a share of total firm costs. This approach is found, for instance, in the writing of Straube and Pfohl. It captures logistics intensity: the higher the share of logistics costs in total costs, the more logistics

⁸⁷ G. Cedillo, *Supply Chain Performance Measurement in Latin America*, in LOGISTICS DEVELOPMENT STRATEGIES AND THEIR PERFORMANCE MEASUREMENTS, 97-119 (Int'l Transport Forum, Org. for Econ. Cooperation & Dev., 2015).

⁸⁸ K. Rantasila & L. Ojala, *Measurement of National-Level Logistics Costs and Performance 9* (Int'l Transp. F., Discussion Paper 2012.04, 2012).

⁸⁹ Sales and turnover denote the same concept with the minor exception of how to treat the inclusion of value added tax. *See Id.*

⁹⁰ *Id.* at 16.

⁹¹ *Id.* at 3.

⁹² B. Shepherd, *Logistics Costs and Competitiveness: Measurement and Trade Policy Applications*, 5 TRANSPORT RES. SUPPORT PROGRAM, THE WORLD BANK (2011).

intensive the sector. This allows predicting the sectoral impacts of logistics performance increases.

2. Logistics costs as a share of GDP (or some other economic aggregate). This approach is found, for instance, in Rodrigues.⁹³ It allows measuring the size of the logistics sector, though not its level of performance. Another drawback of this method is that the final result can be inflated if intermediate inputs in the logistics sector are not removed from the calculation.
3. Using a performance variable as proxy. Such a proxy could be the World Bank's Logistics Performance Index. This approach does not produce a direct cost measure. Logistics costs have to be calculated by converting the performance variable into a cost-like measure and using econometrics to isolate the share of logistics costs.

One of the measuring methods described by Shepherd in terms of share of GDP is similar to the method described by Rantasila and Ojala.⁹⁴ One of them is similar (share of total firm costs rather than share of aggregated sales), and one of them is different (absolute costs versus proxying costs using a performance variable). While defining logistics costs, another scholar's definition focuses on international trade and slightly differs from the definitions cited above. It includes:⁹⁵

1. Transaction costs related to transport and trade: Processing of permits, customs, standards
2. Financial costs: Inventory, storage, security
3. Non-financial costs: Insurance

The lack of a constant logistics costs definition poses problems for cross-country comparisons. Cross-country comparisons are unreliable if measurements use heterogeneous methodologies, databases and base years.⁹⁶

B. *Logistics Costs' Impact on International Trade*

Logistics costs are a major determinant of a country's competitiveness. Logistics is one of the main expenditures of manufacturing firms, therefore high logistics costs

⁹³ A.D. Rodrigues, et al., *Estimation of Global and National Logistics Expenditures, 2002 Data Update*, 26(2) J. BUS. LOGISTICS 4 (2005).

⁹⁴ Rantasila & Ojala, *supra* note 88.

⁹⁵ Gonzalez et al., *supra* note 21.

⁹⁶ *Id.*

severely impact a firm's competitiveness.⁹⁷ Logistics costs influence a country's ability to trade, offer competitive products and join global value chains in two ways:⁹⁸

1. Poor quality infrastructure and inefficient logistics services result in higher transport costs and longer delivery times (for all sectors).
2. If one sector is more sensitive to infrastructure quality than others, then the quality of infrastructure could lower or increase the country's comparative advantage, even though the result does not reflect the country's true strengths. A possible outcome of bad transport infrastructure is that a country loses or never attains its comparative advantage in sectors such as perishable agricultural goods, textiles, auto parts, or electronics, where timeliness is more important than in the mining sector or in non-perishable foodstuffs.

A well-functioning logistics environment helps in lowering the production costs. This works not just by lowering 'direct' logistics costs, i.e., transport, storage and administrative costs but also indirectly by allowing companies to lower inventories at each production stage as the need for backup material and thus working capital decreases.⁹⁹ This lets countries attain their 'true' comparative advantage by consolidating freight movements, reducing the proportion of empty trips and promoting the exchange of information between carriers.

Good logistics infrastructure helps reduce the transaction costs of international trade, and this effect is even more pronounced in less developed countries where logistics costs typically make up a higher share of transaction costs than in further industrialized ones.¹⁰⁰ High logistics costs are particularly detrimental to developing countries as the value of their export goods (per container) tends to be lower than those from more industrialized countries rendering high logistics costs all the more punishing.¹⁰¹ Logistics costs influence trade costs more than tariff barriers in most countries.¹⁰² For the majority of African countries, the impact of logistics costs (measured as the share of international transport costs in total trade value) is five

⁹⁷ Ruth Banomyong, *Logistics Challenges in Cambodia, Lao PDR, Myanmar, and Vietnam*, in A STUDY ON UPGRADING INDUSTRIAL STRUCTURE OF CLMV COUNTRIES 392, 394 (Ruth Banomyong & Masami Ishida eds., 2010).

⁹⁸ *Rapport d'évaluation Maroc*, *supra* note 54, at 19.

⁹⁹ *Id.* at 20.

¹⁰⁰ *Id.* at 2.

¹⁰¹ Note by the UNCTAD Secretariat, *Efficient Transport and Trade Facilitation to Improve Participation by Developing Countries in International Trade*, 2, TD/B/COM.3/60 (2004).

¹⁰² Gonzalez et al., *supra* note 21.

times higher than the impact of tariffs (measured as ad valorem of total trade value).¹⁰³

V. POLICY IMPLICATIONS

Even though logistics services are typically provided by the private sector, there are several implications for policymakers when it comes to improving a country's logistics environment. National governments play a key role in providing logistics infrastructure, setting regulatory boundaries, overseeing border management, and providing a level-playing field for all supply chain actors. A country's logistics performance partly determines its productivity, trading opportunities, and attractiveness to foreign direct investment.

Some countries enjoy less market access than others due to their unfavourable geographic position. High logistics performance can partially make up for this, for example, in landlocked countries or those far away from major trading centres. Improving the reliability of a supply chain is a way to lower trade transaction costs.

For countries wishing to facilitate exports of time-sensitive goods to far-away markets, for example, specialty produce or flowers, facilitating air transport is crucial. But while 'hard' infrastructure such as roads, railways and airports are important to a country's trading opportunities, 'soft' logistics infrastructure such as processes and regulations associated with international trade is equally important. Policymakers should strive to make border administration, product standards, sanitary and phytosanitary regulations, and legal transparency work as smoothly as possible.

Lowering logistics costs is another aspect that should be high on policymakers' minds as logistics is one of the main expenditures of manufacturing firms and agricultural producers. To facilitate exports from developing countries, good logistics infrastructure is needed as logistics costs typically make up a higher share of trade transaction costs than in more industrialized countries. While logistics policymakers have few recourses to influence hidden cost such as currency fluctuations, logistics interventions can significantly lower the trade transaction costs of firms, mostly by lowering logistics costs at the national level and by increasing supply chain reliability.

VI. SUGGESTIONS FOR FUTURE RESEARCH

¹⁰³ *Rapport d'évaluation Maroc*, *supra* note 54, at 19.

Several researchers have examined the importance of well-functioning trade logistics for a country's trade volume, economic growth, and integration into the world economy. Others have looked at how policymakers can entice private sector firms to invest in low and middle-income countries, allowing them to move up in the global value chain. Yet little research has been done regarding which aspects of the trade logistics environment to focus on for a country wanting to increase trade and growth in a particular sector. Many developing countries have identified logistics as a bottleneck for exporters' competitiveness and are seeking to enable supply chain improvements. It would be worthwhile to design a tool to help policymakers decide which measures to prioritize to improve the logistics environment.

While the WTO Trade Facilitation Agreement does not contain any requirements regarding how members organize their logistics environment, it would be worthwhile to study further how improvements in logistics performance can act as trade facilitating measures. One possible area of research is the role of modern supply chain technologies such as automated port handling, electronic bills of lading, or digitalized tracking via radio frequency identification. These technologies improve the efficiency, reliability, and predictability of a supply chain and can thus act as trade facilitators. Progress in applying these modern technologies can help countries automate trade transactions (related to Article 7 of the WTO TFA on the release and clearance of goods) and simplify trade procedures. Another area of research is how an increase in education and government-sponsored professional and vocational training in logistics can act as a trade facilitating measure.

To evaluate and monitor logistics performance at a national level, it would be desirable to have a standardized method of measuring logistics costs at the country level. Such a method is currently not available, not even a unified definition of logistics costs is. The ability to compare logistics performance and costs including their main drivers is indispensable for fact-based policy making, especially in transport policy, but also in all other sectors that use logistics as an input.