CHAPTER 3

DIGITAL CONNECTIVITY AND TRADE LOGISTICS - GETTING GOODS SHIPPED, ACROSS THE BORDER AND DELIVERED

Contributed by the Organisation for Economic Co-operation and Development and the United Nations Conference on Trade and Development

Abstract: *Innovations in the digital economy can reduce the costs of engaging in trade and facilitate the physical delivery of traded goods, making trade potentially more inclusive. This chapter examines the opportunities and challenges brought about by digital connectivity and digital trade along the trading chain. It highlights that digital trade for development requires addressing, in addition to digital connectivity, new and old constraints to market integration and physical connectivity. It underscores the importance of efficient trade logistics services and emphasises the need to co-ordinate investments within regions and across hard and soft infrastructure. It then examines progress in cross-border connectivity and gives an update on the implementation of the WTO Trade Facilitation Agreement. Finally, while many opportunities to reduce trade costs arise from digitalisation, the paper highlights that the ability to adapt to the requirements and characteristics of digital trade flows, can influence the ability to realise the full potential for development.*

INTRODUCTION

Trade has long been a driving force of economic growth. New production systems, integration of global value chains and trends toward reliance on just-in-time delivery systems mean that more than ever, trade needs to be faster and more reliable. This calls for increasing the quantity and quality of information exchange.

Digital connectivity and data flows are supported by hard and soft infrastructure, ranging from cables and wires to data flow regulations, which enable trade transactions in two ways:

First, the digitalisation of many logistics services and regulatory border controls increases the efficiency and the ease of doing trade. Data flows facilitate information sharing among the various actors and bodies participating in the trade logistics chain, thereby reducing the co-ordination costs associated with moving goods from production to consumption.

Second, data flows reduce information asymmetry and lower co-ordination and transaction costs. They make it easier for businesses or consumers to connect with potential trade partner, strike a deal, and get information about regulations and standards as well as about consumer preferences. Increased flows of information have tremendously improved access to knowledge about trade opportunities, reducing the cost of entry into the market, in particular for SMEs. Moreover, goods and services can increasingly be purchased or delivered through digital platforms, opening-up whole new areas of opportunity, in particular for some services that were previously non-tradable.

This chapter discusses how digital connectivity and data flows support the physical delivery of traded goods and services. The opportunities created by digital trade, and in particular the digital delivery of goods and services, are increasing and the process of engaging in trade increasingly involves data flows. Yet trade in goods is still very much a physical process, in particular for items produced in developing countries. This means that while digitalisation provides the opportunity to connect with new trade partners, transforming those opportunities into trade still requires reducing the cost of physically moving goods across (customs efficiency) and behind (trade logistic services efficiency) borders.

Data flows and digitalisation of services, in particular logistics services and regulatory border controls, and innovations in the digital economy can reduce the costs of physical delivery, enabling previously remote areas or small producers and buyers to participate in trade. Across borders, they can support efficient customs services and the implementation of the WTO Trade Facilitation Agreement. Behind the border they can decrease the cost of moving goods by reducing the cost of co-ordination among the various support services needed to make trade happen, from transport to insurance.

However, while digital connectivity can provide new opportunities for developing countries to participate in international trade, traditional trade costs related to physical connectivity can still represent a significant barrier to the physical delivery of goods. In addition, digital trade—and in particular e-commerce (encompassing the physical delivery of goods digitally purchased)—changes how and what is traded (OECD, forthcoming). Customs authorities are faced with an increasing influx of small parcels and low value shipments, requiring different handling than large and bulk shipments. In addition to the additional workload, this increase in trade in small parcels can raise questions about the impact and relevance of *de minimis* thresholds. It can also challenge the capacity of customs authorities to monitor the compliance of traded goods with standards, including, for instance, safety norms for manufactured products, or sanitary and phytosanitary (SPS) measures for agriculture and food products, as well as intellectual property regulations.

The first section of this chapter discusses the importance of traditional physical connectivity to unlock the opportunities created by digitalisation and digital trade. It looks at connectivity behind the border, in particular the importance of efficient maritime and air connectivity, emphasising the importance of co-ordinating investments within regions

and across hard and soft infrastructure for the reduction of trade costs. It then investigates progress on cross-border connectivity, giving an update on the implementation of the WTO Trade Facilitation Agreement and emphasising the challenges for developing countries. The second section focuses more specifically on new opportunities and challenges from digital connectivity and digital trade. It highlights the opportunities offered by data flows and digitalisation for more efficient cross-border operations and logistics chains. However, these opportunities can be challenged by digital connectivity constraints, as well as by lack of capacity on behalf customs authorities and logistics services to adapt to the new ways of doing trade.

TRADITIONAL CONNECTIVITY MATTERS FOR DIGITAL TRADE

While digitalisation has revolutionised trade in services by making it easier to supply services over a distance—including across borders—the physical delivery of goods and services still depends on physical connectivity, including transport networks, intermodal connections, and functioning markets for transport services. This aspect of connectivity entails important bottlenecks, especially in developing countries and the LDCs, with particular challenges for small island developing states (SIDS) and landlocked developing countries (LLDCs). Many LLDCs are in Africa; for them, trade flows and costs depend not only on the efficiency of their own customs and other border agencies, but also on those of neighbouring transit countries. Collier (2008) called this situation the "landlocked with bad neighbours trap". The physical movement of goods is often impaired by poor supply and quality of hard infrastructure which, in addition to difficult regulatory environments and inefficient logistics services, results in a lack of trust in the logistics chain. The following sections goes back to new data and evidence on trade costs, and focuses on both behind-the-border and across-the-border issues, highlighting that traditional connectivity challenges still matter, and might actually be increasingly important in a digital world..

Getting goods shipped and delivered involves many behind-the-border issues

Lead firms in digital trade (in particular digitally enabled purchasers of goods) are well aware of traditional connectivity constraints to their businesses. While digital trade reduces fixed transaction costs (e.g. the cost of searching for and screening trading partners), the negotiation and implementation of a contract, and its monitoring and execution, it might not reduce transport costs. Small businesses face difficulties organising and negotiating prices for their trade logistics. Weight to value still matters and it might be difficult for logistics service providers to supply transport services for small quantities to remote areas, simply because it is not profitable. Such constraints can be a barrier to the benefits of inclusion offered by digital trade. That said, innovations allowed by data flows can also reduce the cost of physical delivery to remote areas.

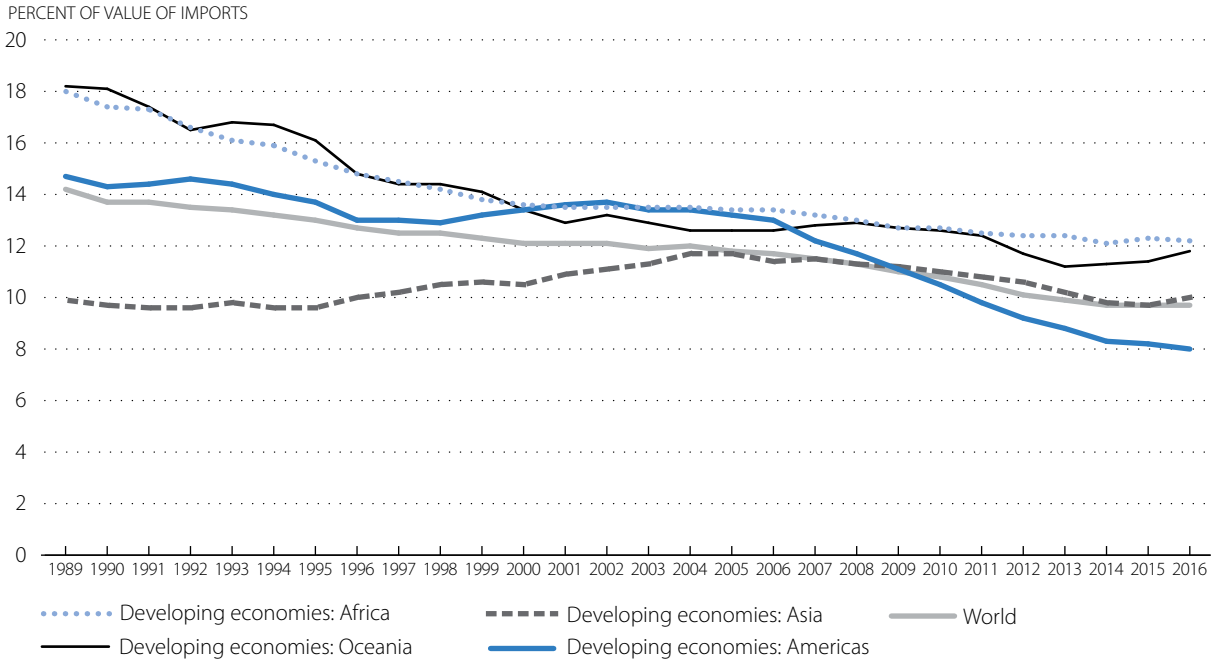
Global trade involves certain transport-related and other transaction costs that, while unavoidable, are in practice often higher than necessary due to unnecessarily bureaucratic trade procedures and documentation requirements. Trade facilitation has tremendously reduced trade costs at the border. However, trade costs relating to the efficiency of trade logistics services have gained in importance.

The following sections focuses on these behind-the-border issues, highlighting that 1) traditional connectivity challenges still matter, and might actually be increasingly important in a digital world; and 2) digitalisation and new ways of organising trade pose both challenges and opportunities for connectivity and market access.

Transport costs: paying for physical connectivity

International transport costs are a key component of trade costs. Recent research in Asia and the Pacific suggests that tariffs account for less than10% of bilateral trade costs, while other policy-related trade costs (i.e., of a non-tariff nature) account for 60-90% of bilateral trade costs. In other words, transport costs, maritime connectivity and procedures have a stronger bearing on trade costs than customs duties (ESCAP 2015). Policy makers and shippers have an interest in understanding the determinants of international transport costs. Being able to explain the differences in the prices traders pay for the international transport of merchandise can help identify possible areas for intervention. Extensive research has helped identify the main determinants of freight costs (ECLAC, 2002; Sourdin and Pomfret, 2012; Cullinane et al., 2012; Wilmsmeier, 2014).

Figure 3.1. Freight and insurance costs as a percentage of the value of imports, ten-year moving averages within country groups, 1989-2016



Note: Averages within the country groups are un-weighted, i.e. each country's freight ratio is assigned the same weight when calculating the average. Data is for all modes of transport, representing the cost of international transport and insurance as a percentage of the CIF value (cost, insurance, freight) of the imported goods.

Source: UNCTAD.

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Based on data on merchandise imports, UNCTAD has estimated expenditures for international transport and insurance (all modes) by country group (Figure 3.1). On average, these costs amounted to approximately 9.7% of the total value of imports during the decade 2007-16. Among the main regional groupings, African countries have the highest freight costs, averaging 12.2% in 2016 compared to 8% for developing countries in the Americas. In addition, many countries in Africa and Oceania report low scores in *Doing Business* or the *Logistics Performance Index* (although those figures are also influenced by the composition of imports) (World Bank, 2016; 2017). While transport costs are effectively higher in African and Oceania, they appear to be even more important in proportion to the value of imported goods in the countries in those regions; on average, these countries tend to import relatively lower-value types of manufactured goods than developed economies. In other words, the cars, clothes or tools imported into Africa are of lower value per unit, on average, than those imported into Europe or North America. Therefore, the cost of transport represents a higher share of the import value.

Overall, analyses suggest that developing countries, especially in Africa and Oceania and including many SIDS and LLDCs, pay more for their transport connectivity than developed countries. The main reasons are to be found in these regions' trade imbalances, as well as their lower trade volumes and shipping connectivity. There is potential for policy makers to help remedy this situation through investment, as well as port and trade facilitation reforms, especially in the regions' seaports, transit systems and customs administrations.

Broadly speaking, connectivity relies on various dimensions that can be grouped into three categories: geography, infrastructure and cost-effectiveness (including marginal costs and weight-to-value issues). Many African and Oceanian developing countries are confronted with transport infrastructure bottlenecks. The largest ships that can be accommodated in most of ports in these two regions are far smaller than those that call at ports in other regions. This, along with the fact that private sector participation through concessions is less frequent in Africa and Oceania, contributes to higher transport costs. Also many developing economies, in particular in Africa and Oceania, are particularly negatively affected by their geographical position--far away from most major shipping routes. Because of the distance to large markets and the relatively small size of domestic markets, it is difficult for logistics services to cover their costs when supplying these economies.

The SIDS in Oceania, as well as several smaller Africa economies, have relatively small markets. Because of merchandise trade deficits, ships delivering cargo in Africa and Oceania are likely to arrive fully loaded, but to have spare capacity when returning to Europe, Japan or China. Freight rates for imports thus tend to be higher than freight rates for exports, as transporters make the exporters pay for the losses incurred on the return journey. Although comprehensive data is not available, and available data, as presented in Figure 3.1 only reflects imports, anecdotal evidence suggests that freight rates for exports are indeed lower than those for imports in most countries in Africa and Oceania. As a result, shippers may be confronted with oligopolistic markets, where low levels of competition can lead to higher prices. In this context, it would be a mistake to try to further restrict competition by, for example, introducing national or international cargo reservation regimes.

There is also a clear case for policy makers and port authorities to strengthen transnational co-operation in order to promote the development of efficient systems than can help to prevent regions or countries from becoming peripheral and uncompetitive. While not much can be done about a country's geographical position, there are some policy options that can reduce costs, for example by improving port infrastructure and increasing efficiency in the logistics chain, including through trade and transport facilitation; more efficient port operations; or measures to make a port more attractive as a port of call. This would entail more port investments, trade and transport service liberalisation, and economic reforms to strengthen industry output and trade relations.

Some solutions also exist to increase the efficiency of infrastructure investments, in particular at the regional level. Increasing a country's connectivity does not require making it a regional gateway with immediate connection to main shipping routes and large infrastructure. Isolation can be considerably reduced by relying on a hub-and-spoke model at the regional level—with adequately scaled infrastructure investments for both maritime and land connectivity—and drawing on relative regional locational comparative advantages. Such systems, nevertheless, require the development of regional or sub-regional hub ports; they also call for the upgrading of inter-island connectivity and corridors, ensuring efficient cargo handling and other logistics services to enable the reduction of freight costs from the gateway to the final destination. Another option to be considered is the promotion of infrastructure networks based on regional/sub-regional hub ports that can be serviced by larger vessels, corridors and networks of rural feeder roads, with appropriate inter-modal connectivity and efficient logistics services. In Africa, a number of countries have been able to benefit from their geographical position by offering trans-shipment services. Egypt, for example, benefits from the traffic passing through the Suez Canal; and Morocco and Mauritius have both established important hub ports. Many other African countries, however, are relatively far away from the major East-West shipping routes.

While regional solutions are promising, they are not without issues. A range of vested interests and other political-economy considerations, related to both hard and soft infrastructure, can make the implementation of regional models difficult. These considerations include the appropriation of benefits by a country benefiting from his neighbour's investment in hard infrastructure; ; the appropriation of benefits by intermediaries and the need to ensure competition in logistics services; and finally a range of issues relating more broadly to non-tariff measures (Jouanjean et al, 2016).

The following sections explore relative connectivity constraints for two modes of transport: maritime and air.

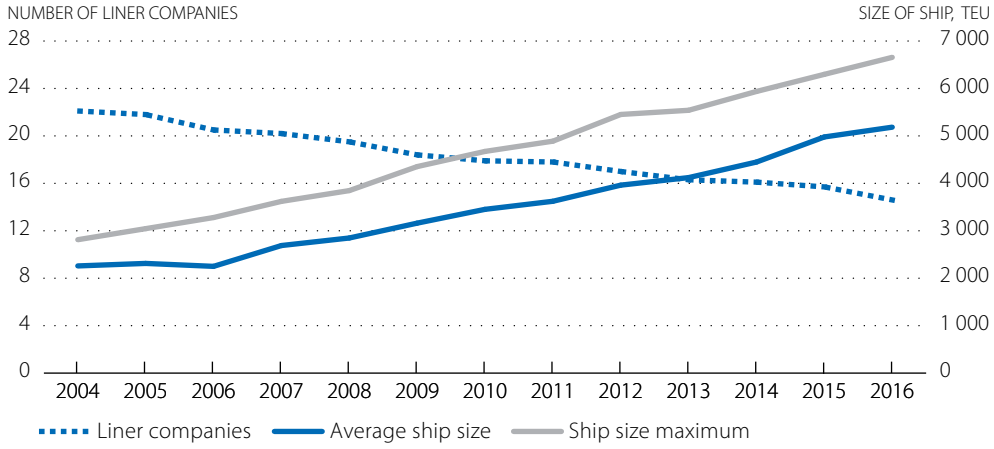
Maritime connectivity accounts for the lion's share of international trade

Containerisation has been one of the most significant innovations in trade logistics, with a greater impact on trade growth than trade liberalisation (Bernhofen et al., 2012). Yet some of the benefits of containerisation are lost if trade facilitation shortcomings, such as the breaking of seals or reloading of content, interrupts their movement.

Maritime trade is estimated to account for 80% of the volume and 70% of the value of international trade; on average, these shares are higher for developing countries (UNCTAD 2016b). Manufactured goods are mostly transported in standardised containers through a global network of regular liner shipping services. This enables small and large importers and exporters of finished and intermediate "containerisable" goods from relatively remote countries to trade with each other, even if their individual trade transactions would not economically justify chartering a ship. Thanks to regular container shipping services and transhipment operations in hub ports, today basically all coastal countries are connected to each other (Hoffmann 2012).

Countries or ports that manage to become transhipment centres benefit in two ways. First, they generate additional income for their own port service providers. Second, their domestic importers and exporters benefit from improved connectivity, i.e. from more frequent and less costly services from and to overseas markets and providers. It would, however, not be realistic for every country to become a transhipment hub; the deployment of carriers is volatile, and there is a risk of overinvestment and overcapacity if all countries try to concentrate cargo in their own ports. The efficiency of hub-and-spoke systems relies on negotiations and long-term strategies at the regional level, which often face political economy hurdles. More analysis is necessary to underscore the benefits "spoke" countries perceive from their neighbours' investments in infrastructure.

Figure 3.2. Average number of liner shipping companies per country, average vessel size (TEU) per country, and average size of the largest ship (TEU) per country, 2004-2016



Note: TEU = twenty-foot equivalent units. Data represents averages per country of vessel deployment in 160 countries.

Source: UNCTAD (2016b) *Review of Maritime Transport 2016*

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The Liner Shipping Connectivity Index (LSCI) indicates the overall position of a country within global container shipping networks (UNCTAD, 2016b). As of May 2016, the best connected countries in East Asia are China and the Republic of Korea; Singapore and Malaysia have the highest LSCI in South East Asia; Sri Lanka and India in South Asia; Morocco, Egypt and South Africa in Africa; and Panama and Colombia in Latin America and the Caribbean.1 All of these countries are hubs in their regions. While the average LSCI has increased continuously since the index was first generated in 2004, several countries do not appear to have improved their liner shipping connectivity over the past decade.

Overall, the LSCI underscores the positive impact of containerisation on maritime connectivity. At the same time, however, there appears to be a consolidation in the industry, with container ship sizes increasing while the number of companies providing services from and to the average country's seaports is going down. This decrease in competition is problematic for port authorities, shippers and intermodal transport providers; it poses particular challenges for smaller trading economies, which already experience low levels of competition. The number of carriers competing for the average country's cargo declined by 34% over 12 years—from an average 21.1 companies in 2004 to 14.6 companies in 2016. While this last number of companies per country should suffice to guarantee a competitive market, the average hides a growing number of countries where there are only a few providers offering container services, leading to potentially oligopolistic markets. In 2004, 44 countries had five or fewer providers, compared to 56 in 2016—an increase of 27%. During the same period, the number of countries with only one provider doubled, from five countries in 2004 to ten countries in 2016. Finally, the industry is also suffering from massive overcapacity.

For countries willing to increase their maritime connectivity, evidence suggests that three main policy areas can help in improving their LSCI, in particular if they want to position themselves as hubs in their regions:

The first is the size of the market served by the gateway port, the hinterland. Expanding the market for the port's services requires facilitating international trade and transit to ease access by neighbouring countries to the port. In West Africa, for example, the ports of Benin, Côte d'Ivoire, Ghana, Nigeria and Togo all compete for cargo from neighbouring landlocked countries. Inland transport is expensive, however, and cumbersome border-crossing procedures, combined with road blocks, make it difficult to expand the hinterland. Therefore, one way to improve the shipping connectivity of West African countries would be to improve their intermodal inland transport and trade connectivity. The application of collaborative tools, trade and transit facilitation measures, and the latest technologies can help. Positive examples include programmes by regional initiatives such as TradeMark East Africa, in the East African Community, and the Borderless Alliance in Western Africa. However, the existence of too many gateways in the same region reduces the size of the market served by each, lowering returns on investments.

The second area is the trade logistics market in the gateway country needs to be competitive. Ideally, shippers should be able to choose among various terminals, as well as trucking and shipping companies. Any restriction on transport services, such as cargo reservation regimes for trucking, or cabotage restrictions in shipping, leads to lower maritime connectivity.

Finally, the third area is efficient and modern seaports, with physical infrastructure capable of accommodating ever larger vessels, the necessary water depth and ship-to-shore container handling cranes. Modern port operations and customs also help to avoid delays and uncertainties, which in turn improves transport connectivity.

Air transport has an increasing role in global value chains

Air transport connectivity differs from maritime connectivity in many ways. First, air transport is characterised by point-to-point transport services as compared to liner shipping, whereby a ship may call at a number of countries and ports along a route, with cargo being frequently transhipped. A second difference is the combination of cargo and passenger services, with an important share of air cargo being moved along with passengers. This is rarely the case for sea shipping, mostly because today passengers rarely use vessels for long distance journeys, or if they do it is in very different circumstances. Finally, distance has a far stronger bearing on air transport costs, with higher fuel per tonne-km ratio. As a result, air connectivity is more dependent on the distance to market, while for maritime connectivity the geographic position of the port as well as economies of scale, play a relatively larger role.

However, with the internationalisation of production and the increasing importance of just-in-time models, as well as the evolution of cargo generated by digital trade, air connectivity is increasingly important for countries' participation in global value chains, especially for the transport of high-value intermediate goods.

The air connectivity index (ACI) is a tool developed by the World Bank to measure a country's integration into the global air transport network. Shepherd (2016) finds that air connectivity is very positively associated with the total value of trade. As an indicative order of magnitude, a 1% increase in a country's ACI is associated with a 6.3% increase in total exports and imports. Moreover, air connectivity is very positively associated with global value chain participation. A one point increase in the ACI is associated with a 2.9% increase in global value chain participation. Overall, countries that perform particularly well on air connectivity tend to perform very well on global value chain connectivity metrics. Industry makes extensive use of air cargo linkages whenever possible and the sectors that appear to benefit vary considerably in terms of sophistication and capital intensity, from textiles and clothing to electrical goods and pharmaceuticals.

Once again, regulation matters for the optimisation of air connectivity, which requires a strong supporting framework (ICAO, 2017). This includes, among other things, market access (e.g. liberalisation), optimal air navigation services, aircraft, airport systems, facilitation and security, inter-modality and airline activities.

Whether in maritime or air transport, more investments are necessary for developing counties to increase their connectivity. Beyond investments in hard infrastructure, more needs to be done to support the efficiency of trade logistics services, and in particular to ensure that bottlenecks in this area do not act as weak links in the value chain. For example, maritime connectivity requires efficient hinterland services; spill-overs should be taken into account to maximise the benefits from infrastructure investments. Avoiding bottlenecks, in particular for land-locked countries, and maximising returns on investments also requires co-ordination among neighbouring countries, not only on hard infrastructure but also on the regulatory environment for trade logistics services. Digitalisation can reduce the cost of such co-ordination and support better linkages between transport modes and countries' logistics services.

IMPLEMENTING THE TRADE FACILITATION AGREEMENT FOR CROSS-BORDER CONNECTIVITY

Inefficient procedures at the border represent an important source of trade costs along the value chain, increasing poorly connected countries' remoteness from neighbouring and international markets. For example, it has been estimated that in Central and Eastern Africa, on average, crossing a border with maize, rice or sorghum has the same effect on relative prices as travelling 518 hours between towns in the same country (Brenton et al., 2013).

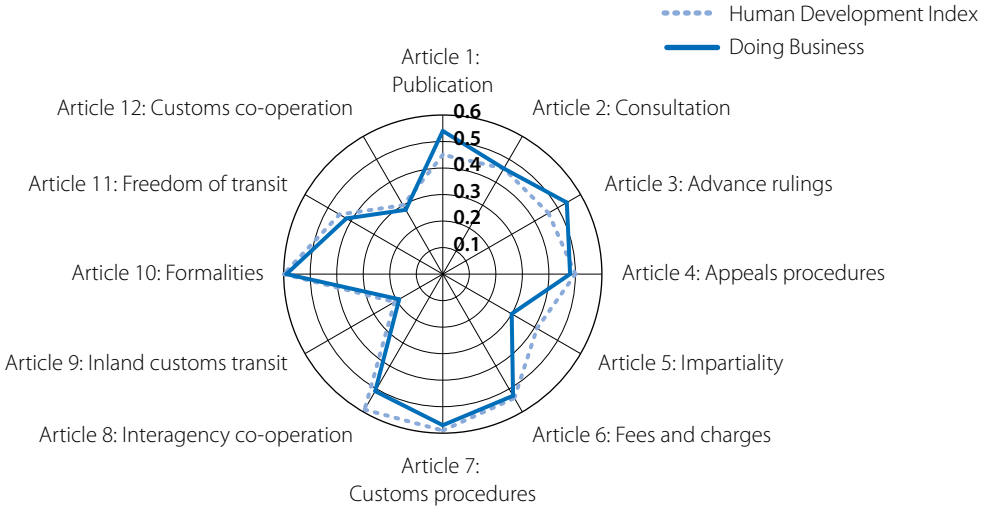
Developing countries are no longer simply providers of raw materials; they increasingly participate in global value chains, importing raw materials and intermediate goods to produce manufactured goods for export. This is evidenced by the fact that the share of developing countries in the total global volume of seaborne imports is estimated to have more than tripled since 1970 (UNCTAD, 2016b). Crossing one border is already burdensome; factors such as the internationalisation of production processes and geography (e.g. the constraints faced by landlocked countries, many of which are developing economies, in accessing gateways to regional and international markets) increase the number of times borders are crossed along production chains before the final goods reach consumers.

Helping goods cross borders efficiently, in particular in a world of internationalised production processes, is broadly recognised by the trade community as a priority and is now firmly on the global trade agenda with the entry into force of the WTO Trade Facilitation Agreement (TFA) in February 2017. Trade facilitation measures have the potential to reduce the time, cost and uncertainty involved in importing and exporting. They improve the day-to-day operations and processes of international production networks and, in more exceptional cases, assist in things such as the rapid delivery of emergency relief goods (Roberts and Mohammed, 2017).

The objective of the TFA is to simplify and harmonise international trade procedures. The agreement contains provisions for expediting the movement, release and clearance of goods, including goods in transit. These provisions have the potential to benefit countries at all stages of development. It is estimated that a complete implementation of the trade facilitation measures arising from the WTO Agreement could reduce trade cost by 16.5% for low income countries, 17.4% for lower middle income countries, 14.6% for upper middle income countries, and 11.8% for OECD countries, boosting global growth and leading to significant welfare gains (Moïsé and Sorescu, 2013). UNCTAD (2016a) demonstrates a close statistical association not only between diverse trade facilitation measures and trade competitiveness, but also between trade facilitation implementation and broader development indicators. Case stories collected by the OECD and WTO for the Aid for Trade Global Review 2017 also provide anecdotal evidence about how the trade facilitation measures promote quick gains in reducing trade costs.

The TFA covers a range of trade facilitation measures, grouped under 12 articles. Countries self-assess and declare their capability and readiness to implement each of these measures without assistance (category A notifications). A country-by-country analysis of the number of notifications on the date of the entry-into-force of the TFA shows a close correlation between the implementation levels of different articles of the Agreement and indicators of trade efficiency. While a statistical correlation does not in itself prove causality, the data suggest that implementing Article 7 on customs procedures and Article 10 on formalities has had a stronger bearing on a country's *Doing Business Index* indicator for trading across borders than, for example, Articles 5 on impartiality and 9 on inland customs transit Figure 3.3).

Figure 3.3. Correlation between trade facilitation implementation, Human Development Index indicators and the Doing Business Index indicator for trading across borders



Notes: The values on the axes represent the partial correlation coefficient, which varies between -1 and +1 (in this figure all correlations are positive, and only values between 0 and +1 are shown). A value of +1 implies that the two variables move together at 100%, while a correlation coefficient of 0 implies that the two variables are not correlated.

Source: Author's calculations, based on individual category A notifications (WTO, 2017), Doing Business Index indicators for trading across borders and the UNDP Human Development Index in 2014.

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The OECD developed trade facilitation indicators (TFIs) in 2012 as a tool for monitoring and benchmarking country performance. These TFIs are used to analyse the impact of cross-border procedures on various trade and global value chain metrics. The TFIs are not designed to assess the compliance of countries with specificTFA provisions, but only to measure effective trade facilitation endeavours, based on worldwide best practice in the areas covered by the WTO TFA. They offer a snapshot of the state of play on trade facilitation around the world and provide a baseline for monitoring future progress. As such, the TFIs can be used by governments as an instrument for targeting initiatives aimed at reducing trade costs across the border. They also highlight the main advances made by countries, as well as the challenges they need to address, on their paths to implementing measures in areas covered by the Agreement.

The use of the TFIs has permitted the identification of various trade facilitation measures that are particularly important for developing country participation in global value chains. This is achieved by comparing specific sets of trade facilitation measures against the level and intensity of a country's integration into global value chains (Moïsé and Sorescu, 2015). The OECD found that a small increase (+0.1) in TFI performance[2] is associated, on average, with an increase in imports of value added ranging between 1.5% and 3.5%; the increases in exports of value added range between 1% and 3%. More recently, the OECD explored the impact of border processes using a computable general equilibrium model (CGE; Box 3.1).

Box 3.1. Pathways of impact of border processes

Border procedures impact operations of the supply chain by reducing stock management (which is particularly important for perishable goods), speeding up adaptation to consumer preferences and increasing participation in time-sensitive global value chains. The OECD used its TFIs in a CGE model to better understand and identify the pathways of impact of border processes, and to improve understanding of their potential economy-wide effect.

The results of the modelling exercise underscored the extent to which trade facilitation matters both for exports and imports. On the supply side, reduced costs result from better stock management and the ability to rapidly adjust to consumer preferences. Consumers benefit directly from faster delivery of goods, but also indirectly from smooth intermediate trade flows, which ultimately speed up the delivery of the final goods. Full implementation of the WTO TFA is estimated to have the potential to increase trade flows by 0.6% and increase GDP by 0.04% to 0.41%, depending on the country's level of development. A previous estimation of the impact of the WTO TFA on trade costs underscores that reductions in trade costs decrease as country's income levels decrease. The model is able to differentiate effects on trade in intermediates, used as inputs in the importing country, and trade in final goods. The modelling exercise suggests that middle income countries (MICs) are the ones experiencing the strongest growth. Trade in intermediates experiences the strongest growth. Low income countries (LICs) as well as lower middle income countries (LMICs) present a stronger increase in exports than in imports.

Source: OECD (2017a, forthcoming) *Economy-wide impacts of trade facilitation: a metro model simulation*

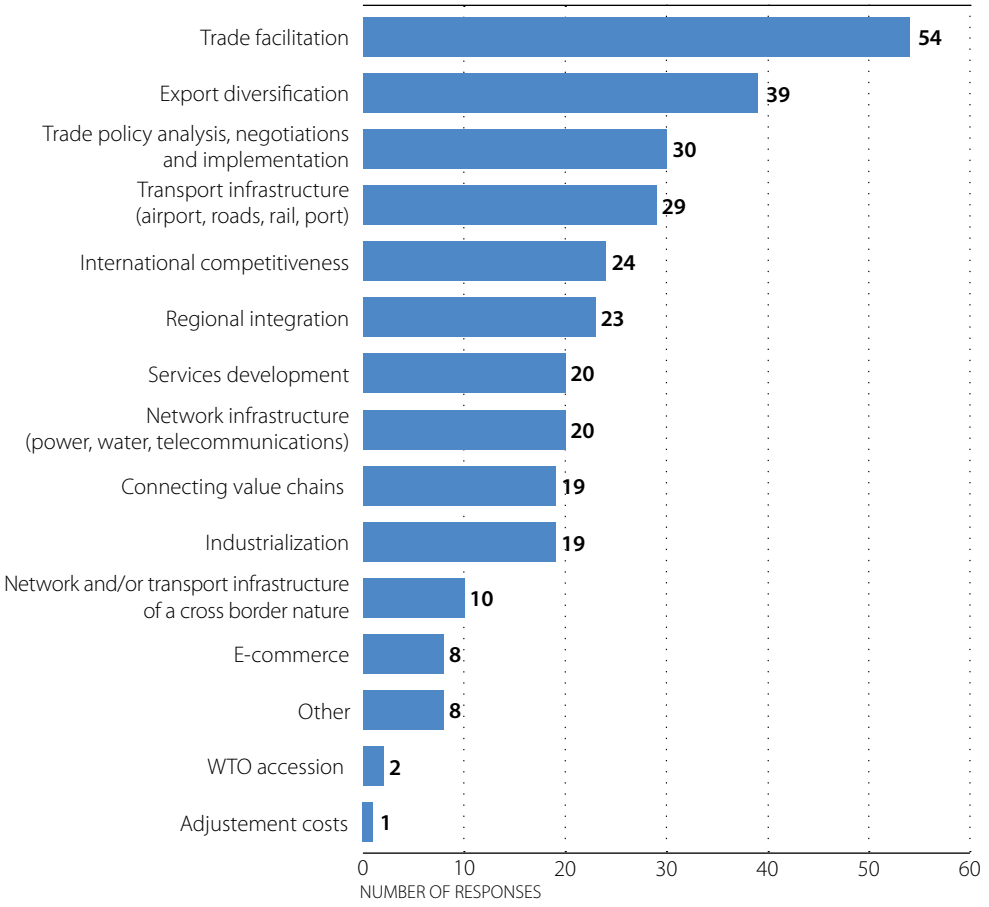
The predictability and speed of the movement of goods across borders is important in shaping companies' sourcing decisions. The measures that appear to have the largest influence on imports of value added are, by decreasing order of magnitude: the availability of advance rulings, the streamlining of border procedures and controls, the proportionality and transparency of import and export fees and charges, and the automation of the border process. For exports of value added, the most impactful measures are: the availability of trade-related information, opportunities for dialogue with the trade community, the proportionality and transparency of import and export fees and charges, the automation of the border process, and the streamlining of border procedures and controls.

Regional integration also crucially depends on the facilitation of cross-border transit and trade, and on co-operation between neighbouring countries. The WTO TFA can help regional connectivity without requiring a multitude of regional trade agreements, often called a spaghetti bowl. Benefitting from preferences provided by those regional

trade agreements often requires the processing of additional paperwork linked to certificates of origin (UNCTAD 2016a). Intra-regional connectivity helps tackle geographical constraints by bringing together many small economies and land-locked countries; intra-regional trade usually grows faster than global trade, and international production networks are often organised by region. It is not just what a country does that matters for its connectivity, but also what its neighbours do. There is a strong positive association between improvements in infrastructure and trade facilitation in neighbouring countries, on the one hand, and greater value chain connectivity at home on the other (Shepherd, 2015).

Aid-for-trade facilitation continues to play a key role in ensuring that partner countries meet their commitments under the WTO TFA, and that they realise trade and development gains. The OECD-WTO 2017 aid-for-trade monitoring exercise confirms that efforts are already under way to implement trade facilitation measures in partner countries. Development partners have provided assistance for initiatives ranging from support for the establishment of national trade facilitation committees to providing hard and soft infrastructure between borders and along corridors. The case stories gathered as part of the monitoring exercise also underscore the importance of regional approaches to measures requiring co-operation among two or more countries, as well as the overall importance of trade facilitation for landlocked developing countries as a means of linking them to their regions, and to global markets. Overall, the aid-for-trade monitoring exercise underscores the priority given by countries to trade facilitation (Figure 3.4).

Figure 3.4. Partner country aid-for-trade priorities



Source: OECD-WTO aid-for-trade monitoring exercise (2017), www.oecd.org/aidfortrade/countryprofiles/.

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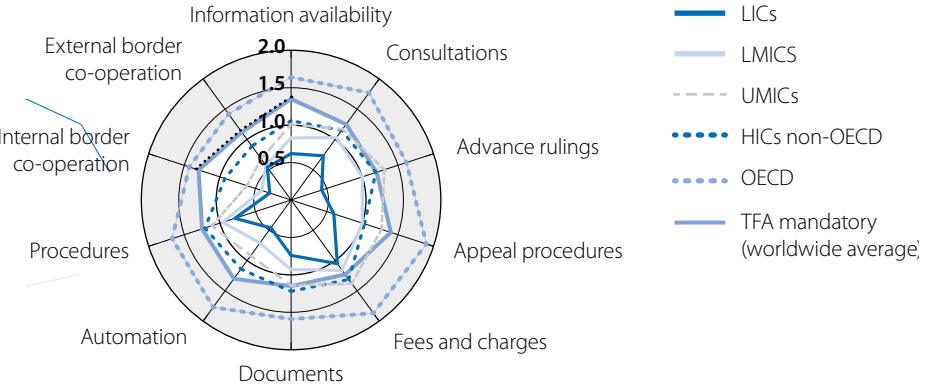
The OECD TFIs demonstrate that when the WTO TFA entered into force, implementation of its various substantive provisions already was well under way among all income groups and across regions (Figures 3.5 and 3.6; OECD, 2017b). While there are some differences across countries and regions, as well as among different income groups, worldwide performance on a number of substantive provisions under the TFA is relatively even. Unsurprisingly, implementation of the best-endeavour provisions is more heterogeneous. Many of these provisions are linked to automation, and more generallydigitalisation and data flows, for internal and external border agency co-operation as well as information availability. For these, progress is closely associated with the income level of the country, emphasising the importance of tackling the digital divide for further trade facilitation.

Figure 3.5. A sample snapshot of TFIs in 2017, by income group

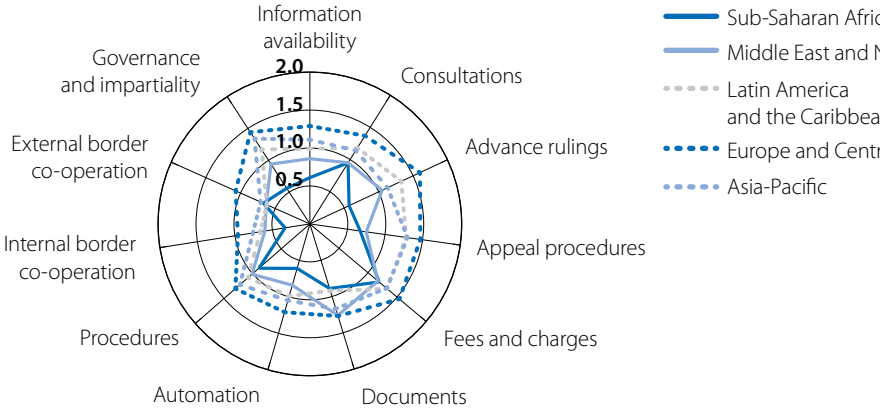


Note: The shaded area depicts measures that go beyond the mandatory provisions of the TFA. The dotted portion of the grey line highlights the fact that all TFA provisions for external border agency co-operation are "best endeavours".

Source: OECD (2017c), *Trade Facilitation Indicators*, www.oecd.org/trade/facilitation/indicators.htm (accessed on 01 February 2017).

StatLink http://dx.doi.org/10.1787/888933525759

Figure 3.6. A sample snapshot of TFIs in 2017, by regional grouping



Note: The geographical groupings include OECD members.

Source: OECD (2017c), *Trade Facilitation Indicators* www.oecd.org/trade/facilitation/indicators.htm (accessed on 01 February 2017)

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NEW OPPORTUNITIES AND CHALLENGES ARISE FROM DIGITALISATION AND DIGITAL TRADE

Because of digital technologies and digitalisation of processes and information, data are being generated everywhere, and at an exponentially increasing rate, by all actors of the economy. For the movement of goods across borders, this includes government agencies, as well as private actors along the trading chain.

The following section explores new opportunities and challenges arise from digitalisation and digital trade. The two parts focus on the cross-border dimension. First, it looks at how trade facilitation benefits from the new tools made available by technological advances. Measures such as customs automation, electronic documents and single windows—platforms that enable parties involved in trade and transport to fulfil all import-, export- and transit-related regulatory requirements through a single facility—make all of these steps easier to implement today than when trade facilitation negotiations started at WTO a decade ago. Second, it looks at the challenges created by digital trade for customs authorities. Finally, the third part underscores the benefits and challenges of digitalisation and data flows on trade logistics services.

Data flows and digitalisation contribute to trade facilitation

Digitalisation can support the reduction of trade costs at the border by increasing the efficiency of customs and transit logistics, thereby reducing costs and supporting the implementation of the WTO TFA. Co-ordination and exchange of data among public and private entities, for instance customs authorities and freight services, can facilitate the implementation of transit agreements, helping to generate returns on investments in technology. Traders investing in the latest technologies expect their counterparts in control agencies to use them. Digitalisation of customs management also helps to increase transparency and thereby reduce opportunities for corruption while limiting uncertainty (*OECD-WTO aid-for-trade monitoring exercise 2017*, Public sector case story 35).

Case stories from Ghana and Senegal also show how the establishment of electronic single windows has improved their World Bank *Doing Business* rankings and logistics performance. Senegal was ranked best reformer in *Doing Business* 2009 and is now among the top ten worldwide. In the framework of South-South partnerships, Senegal offers its expertise and technology transfer to other developing countries, including Kenya and Burkina Faso. The Ghana National Single Window (GNSW) programme enables e-payment of customs duties, reducing the time and costs of import procedures per consignment by 400 hours and USD 50, respectively; Ghana's ranking in the World Bank *Trading Across Borders Report* has also substantially increased, from 167th place in 2016 to 154th in 2017. Similar improvements were registered in the *World Bank Logistics Performance Index*, where Ghana rose from 100th place in 2014 to 88th in 2016, the largest improvement since the survey was launched in 2007 (*OECD-WTO aid-for-trade monitoring exercise 2017*, Public sector case stories 128, 135).

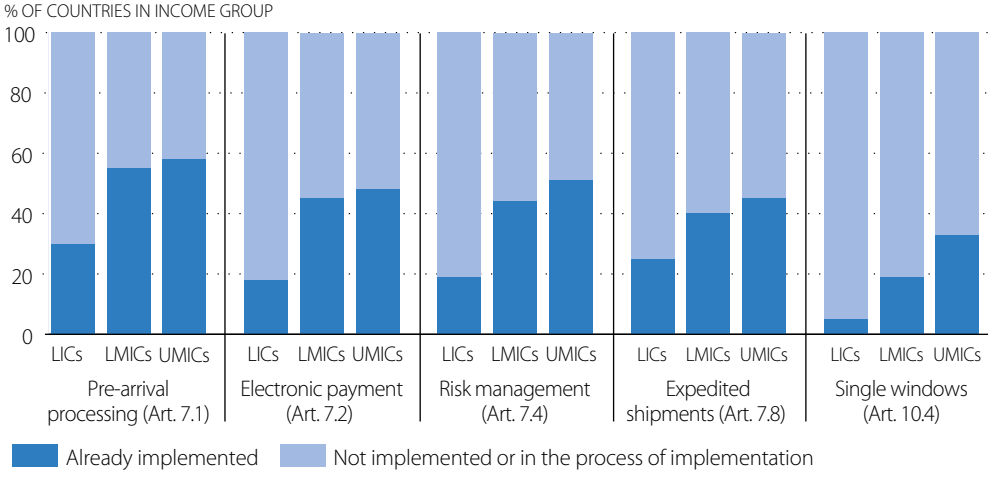
In Rwanda, a customs-centred electronic single window system was implemented at a cost of USD 3.3 million. Its high-impact results include a decrease in the time needed to clear goods, from 11 days in 2010 to 34 hours in 2014. The cost of clearance was reduced from 30 000 RWF to 4 000 RWF in just a one-year period (2013-14). Improved inter-agency co-operation through information sharing was facilitated by the use of UNCTAD's Automated System for Customs Data (ASYCUDA). This, in turn, streamlined work by reducing the need for multiple verifications of the same consignment (TMEA 2015).

The importance of data flows and digitalisation for border management is evidenced by its high position on the agenda of the World Custom Organisation (WCO), which declared "Data Analysis for Effective Border Management" its theme for 2017. The objective is to support initiatives aimed at leveraging the potential of data to help address the concerns and expectations of traders, transport and logistic operators, and governments, with a particular focus on investigating best practices in e-commerce. The WCO has underscored the need to improve the digitalisation of processes, the sharing of information among e-commerce stakeholders, and customs risk management and harmonisation in low-value shipment processes.

Digitalisation of information paves the way for effective identification of risks. It also allows for management of the large volumes of data that are required by import regulations--for instance SPS regulations; these volumes are increasing with the increase in trade flows. Efficiency in the management of import regulations can be boosted, for example, through the adoption of electronic documents documents (see *OECD-WTO aid-for-trade monitoring exercise 2017*, Public sector case story 101). Registration of information online and e-certification can speed-up clearance at the border. Border agency co-operation and the creation of single windows to support efficient and transparent cross-border trade require the co-ordinated use of information. The digitalisation of information and inter-operability of documents and systems can help reinforce and lower the cost of border agency co-operation, including the implementation of single windows. This could involve, for example, sharing inspection and control results among agencies involved in the management of cross-border trade and supporting the delegation of control, or the co-ordinated and shared use of infrastructure and equipment at the domestic and cross-border level. While seamless data flows require co-operation among institutions, digitalisation of information and processes can also decrease costs associated with the implementation of inter-agency co-operation itself.

Numerous provisions of the WTO TFA are linked to automation and more generally to digitalisation: risk management, expedited shipments, pre-arrival processing, electronic payment systems and single windows (Figure 3.7). According to the 2017 TFIs, risk management is implemented in an automated environment in 35% of the countries in the sample--mainly UMICs; the rest of the countries (largely LMICs and LICs) either do not have such automated environment or are in the process of implementing them. Information on expedited shipments and associated release procedures shows that for 65% of the surveyed countries, certain types of goods may benefit from expedited release, depending on specific qualifying criteria (i.e. either goods entering through air cargo facilities or low-value goods).

Figure 3.7. Automation tools in place, by type of tool and by country grouping



Source: OECD (2017c), *Trade Facilitation Indicators* www.oecd.org/trade/facilitation/indicators.htm (accessed on 01 February 2017)

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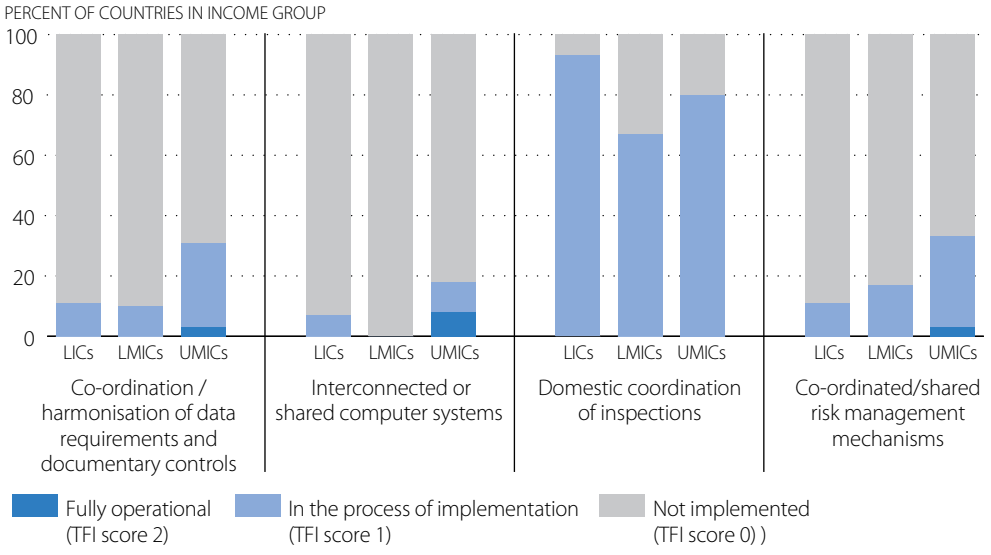
As regards features such as pre-arrival processing and its application in an automated environment, around half of the MICs seem to have systems for the electronic payment of duties, taxes, fees and charges, integrated with an automated declaration/cargo processing system, as well as digital certificates and signatures; implementation of these features remains much lower in the LICs. The most challenging area, as already highlighted by the 2012 and 2015 TFIs, is the set up and operation of single windows. Most information technology (IT) systems in the LMICs' and UMICs' are ready for electronic data interchange (EDI) EDI systems, which are essential for reducing the complexity of document submission.

In most of the LICs, these systems are still in the process of implementation. Information on the progress achieved on IT and EDI systems, as well as on wide-ranging challenges in the area of border agency co-operation, suggest that the missing link in the development of single windows is the quality of co-operation and information exchange among the numerous government agencies, customs departments, and border control posts (OECD, 2017b).

Cross-border co-operation can be facilitated by the creation of infrastructure, including information and communication technology (ICT) infrastructure, to ensure efficient connectivity among country systems enable information flow, and allow systems to understand each other. Digitalisation of customs documents and information about shipments, however, is not without challenges. For example, the adoption of electronic documents involves the recognition of electronic signatures, standardisation of data exchanges and inter-operability across applications and systems, cybersecurity, and legal validity of electronic documents.

The OECD (2016) has identified key management areas of domestic border agency co-operation and critical for ensuring effective and sustainable cooperation: --communication and information exchange, standardised and efficient communication, and information exchange among the various agencies. A formal agreement among all participating agencies can clarify which information will be shared and with whom, and how the information will be exchanged and traced. An effective early warning system, be it through contact points in individual agencies or using IT solutions, can greatly enhance information exchange efficiency. The domestic co-ordination of inspections is increasingly well understood. On the other hand, co-ordinated or shared risk management mechanisms among agencies involved in the management of cross-border trade, as well as interconnected computer systems and the harmonisation of data requirements, are still work in progress for all LICs and UMICs (Figure 3.8). Finally, the 2017 TFIs show that in developing countries, the co-ordination or harmonisation of computer systems, co-operation in risk management, and the systematic sharing of control results among neighbouring countries at border crossings to improve risk analysis are still at a very early phase (OECD, 2017c).

Figure 3.8. Automation tools for domestic border agency co-operation



Source: OECD (2017c), *Trade Facilitation Indicators* www.oecd.org/trade/facilitation/indicators.htm (accessed on 01 February 2017).

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USAID (2012) highlighted the flow of information between customs authorities in the East African Community (EAC) as one of the most important constraints for border crossing through transit corridors. Electronic customs management systems, nationally owned and managed, were not able to communicate seamlessly with each other within the EAC. Moreover, information on goods crossing the border could not be shared with private sector clearing agents in charge of the documentation. As a consequence, information had to be filled out by the transporter at each border crossing, and therefore was only available on arrival; this resulted in errors and prevented agents from initiating administrative processes ahead of a shipment's arrival. More recently, various regional initiatives have been implemented using software solutions that are owned, operated, and maintained by the region's revenue authorities, enabling advance completion of customs declarations and saving hours of transit time at border crossings.

The inter-operability of electronic documentation systems is more easily ensured if, from the outset, the use of international standards is agreed. For instance, countries can adopt United Nations (UN) data and trade document standards and tools, such as those developed by the UN Centre for Trade Facilitation and Electronic Business (UN/CEFACT). These data standards are used extensively throughout the world, facilitating inter-operability and scalability at the national, regional and global levels. UN/CEFACT's EDI standard is the leading global data interchange standard. The exchange of data, for instance on risk profiles, reduces both the number of documents required and the physical control of goods crossing the border.[3]

Finally, transparency, digitalisation of information and automation, and the additional, predictability and simplification of trade procedures have proven efficient in reducing incentives and opportunities for corruption. Transparency allows market participants and stakeholders to better understand the conditions and constraints for entering and operating in a market. Predictability--enabled by the non-discretionary and consistent application of rules--guarantees efficiency and integrity in border agencies. The simplification and streamlining of border procedures diminishes the discretionary power of customs and other border officials, fostering integrity. Automation provides support in harmonising the interpretation and implementation of regulations across all border points (OECD, 2015b).

In Ghana, the GNSW reduces unnecessary human interface in trade transactions, allowing most processes to be undertaken automatically and thereby greatly increasing transparency and reducing the possibility of irregular interventions and payments. Automation of the application and issuance of certificates of origin by the Kenya National Chamber of Commerce and Industry has reduced the average time needed to obtain a certificate of origin from 84 to 12 hours. Also, since traders are no longer required to physically travel to obtain certificates, logistics costs have fallen from USD 75 to USD 17; the reduction in human interaction also has limited the occasions for illicit activities.

New actors and the evolving nature of consignments present challenges for customs authorities and trade facilitation

While data and information exchange can facilitate the implementation of the TFA, digital trade is also changing traditional trade patterns and potentially create new challenges. Digitalisation is changing some of the traditional determinants of trade. Conventionally, analysis testing the determinants of trade flows (using gravity equations) emphasises the importance of distance as well as historical links and common legal systems. While these are still significant determinants, they decrease in importance as variables explaining digital trade flows values (Austin and Olarreaga, 2012). In particular, the influence of distance decreases drastically with digital trade, while shipping costs and language have a greater impact on cross-border digital trade than on offline trade.

But also, digital trade is changing the "who" and the "how" of trade. The "who" of trade: Digital trade enables the entry of new actors into cross border transactions. Reductions in the costs of entry enable smaller businesses, and even consumers, to participate directly in international trade. While trade was previously a largely business-to-business (or government) operation, digital trade has enabled the direct involvement of consumers in cross-border transactions

through business to consumer (B2C) and also consumer to consumer (C2C) transactions. Consumers, but also MSMEs, have limited knowledge and experience in regulations, however, and are not well versed in liability issues; they also can be confronted by traditional regulatory barriers at the border. An analysis by the World Economic Forum (WEF), in collaboration with the World Bank and Bain & Company (WEF, 2013) and using data provided by eBay, highlighted that small businesses seemed to suffer disproportionately from both regulatory and logistical barriers to trade. Understanding and navigating the regulations, policies and procedures governing the export market, as well as the trade logistics chain, entails a high entry cost and upfront investment for small firms, independent of volumes traded. For this reason, merchants selling goods internationally on the eBay platform have a tendency to sell to buyers in countries whose regulations are easier to navigate than the average. This is why various platforms develop projects aimed at supporting MSMEs in navigating the regulatory regimes of importing countries as well as international trade logistics (see *OECD-WTO aid-for-trade monitoring exercise 2017*, Private sector case story 28).

The "how" of trade: The direct interaction between sellers and buyers on online platforms, bypassing the need for wholesalers that usually trade in bulk, reduces the size of internationally traded shipments. So while digital trade is not necessarily changing the nature of what is traded, it is changing the nature of shipments. The composition of trade flows in relative terms features fewer large or bulk shipments and higher numbers of low-value small shipments.[4] Small parcels do not always follow the same pathway as large shipments. Moreover, logistics companies reduce costs by consolidating containers, mixing cargos of different types, originating from different sellers, in the same container, resulting in reduced accuracy in terms of the information about each cargo in the container (UNECE, 2011).

In addition, small parcels are more costly to trade. In its input to the *OECD-WTO 2017 aid-for-trade monitoring exercise*, Paraguay highlights that the high cost of small-parcel shipments, as well as warehousing, storage and packaging difficulties, among the challenges faced by micro, small and medium enterprises (MSMEs) engaging in cross-border e-commerce transactions. To counter this, some of the large digital platforms are providing services to MSMEs selling on their platforms, negotiating freight forwarding contracts on their behalf. Using their position as holders of key information—which allows them to reach scale and reduce logistics costs—online portals such as Amazon and Alibaba are themselves becoming players in the transport of cross-border trade (Transport Intelligence, 2017). Large market place platforms and actors of the express delivery industry are also providing training and various services, such as warehousing services or management of orders, to inform and simplify global operations of small and isolated actors (see *OECD-WTO aid-for-trade monitoring exercise 2017*, Private sector case stories 88, 98).

These changes in the nature of consignments, and the proliferation of small packages crossing the border via postal or express services, challenge the capacity of customs authorities to monitor the enforcement of standards and trade in counterfeit products using border risk-management strategies.

Customs agencies use informed compliance, risk management and audits to increase the efficiency of cross-border trade while still fulfilling their monitoring mission, and this despite increasing trade flows.[5] These strategies exploit the increasing amount of data available to customs agencies using a range of new algorithm and data analysis tools[6] (Jeacocke and Kouwenhoven, 2017). Data analytics has become increasingly important, enabling selective approaches to and techniques for cargo processing. These techniques allow customs agencies to concentrate their resources on checking consignments with the highest risk profiles, and therefore potentially representing a higher probability of non-compliance with domestic standards, or greater health or phytosanitary risks. They also allow compliant exporters to benefit from more efficient border procedures: unnecessary delays are eliminated and the costs of crossing the border are reduced. These selectivity systems not only promote increased efficiency by reducing the number of examinations required, but also increase the discovery of non-compliance and thereby increase trust in the quality of imported goods. Also, the targeting and simplification of procedures offer an opportunity to reduce the discretion of individual officers and limit opportunities for irregular payments.

However, risk assessment can be difficult to implement for small shipments, which are often used by traffickers of counterfeit products to avoid detection and minimise the risk of seizure by customs authorities. It is also difficult to monitor whether goods comply with standards. For instance, the horticultural industry has expanded globally through the emergence of e-commerce; using an automated search algorithm to survey e-commerce trade on ten major online auction sites, such as eBay, shows that biosecurity is not effectively regulated in the online plant trade (Humair et al., 2015).

This is a particularly important topic for the International Plant Protection Convention (IPPC), which is concerned with the potential impact of e-commerce on the implementation of phytosanitary measures[7] designed to minimise the risks of contamination with pests and plant diseases when importing plants and plant products into domestic markets (IPPC, 2012). Previously, regulations were primarily geared to managing bulk shipments or consignments of commodities moving through traditional transportation pathways (overland freight, air freight and ocean freight). With digitally enabled trade, plants and plant products are increasingly traded through other pathways, such as postal services, express delivery in small packages or mixed consignments. No traditional risk analysis can be implemented for such packages. They are not separately identifiable from any other parcels, and the plant or plant product traded is often not accurately described and therefore is by-passed by traditional national plant protection screenings. IPPC analysis of websites selling insects, or plants and plant products, highlights that very few provide information about the requirements for import in different countries, or whether or not these restrict shipment to specific locations.

An example of these challenges is provided by Yemen in its input into the OECD-WTO 2017 monitoring exercise (see Yemen contribution to OECD-WTO, 2017). In Yemen, application of regulations on exports depends on the size of the consignment. Digitally enabled trade in goods coming from Yemen usually involves small quantities transported via air shipment using express carriers, and the transactions are considered non-commercial. As a consequence, for the export of one kilo of honey or coffee by air from Yemen, all or most requirements are waived.[8] Large shipments (more than 20 kilos) face requirements such as export certificates, SPS certificates and certificates of origin—which have become prohibitively expensive. All of this favours trade in small quantities.

Monitoring of small shipments, however, implies additional costs. Without adaptation in how checks are implemented, digitalisation could increase the burden on customs authorities, potentially challenging their capacity to fulfil their mission. The ongoing increase in the quantity of small parcels is also challenging the relevance of *de minimis* thresholds. In addition to the shifting cost-benefit of collecting duties and taxes, compared to the cost of tracking payment, small parcels can require increased handling, and therefore can represent an additional burden for already stretched customs authorities. *De minimis* thresholds vary considerably among countries and according to the Global Express Association, in April 2016 some countries did not have any *de minimis* provision at all (e.g. Bahrain, Costa Rica, El Salvador, Guatemala and Saint Lucia). This means that their customs inspect and collect duties, if applicable, on all arriving packages. In other countries, thresholds are as low as USD 0.33 (the Philippines) or as high as USD 1 000 (Azerbaijan, but only for 50 kg non-commercial shipments; for all postal shipments below the threshold it is USD 200 per 20kg). In the European Union (EU), duties are not collected for products below a USD 170 threshold and in the US the threshold is USD 800 (Global express association, 2016).

Further work is needed to explore the role of *de minimis* provisions in the context of digital trade, and in particular how they shape the decisions of both firms and consumers. Preliminary analysis seems to highlight that increasing the *de minimis* threshold might not change consumer behaviour, as other parameters matter more to consumers—in particular the quality of the product and the reputation of the trading partner (Hintsa et al., 2014). Raising the *de minimis* threshold would allow customs administrations to reallocate resources to higher priorities, such as security or illicit trade risks, unless innovative customs processes were to allow for the application of risk management approaches to packages under the threshold. Increased digital connectivity therefore requires not only investment in new types of infrastructure; it also requires thinking about new systems, better adapted to new ways of trading.

INFORMATION FLOWS ENABLE THE TRADE LOGISTICS CHAIN

Data flows and digitalisation are not only necessary for trade partners to purchase and order goods or services online; they also underpin co-ordination of international production networks as well as trade logistics. Information is a key resource for trade and global value chains, creating trust, reducing transaction costs and enabling better management of stocks and production processes. Time-related uncertainty, which requires traders to hold inventories or to build redundancies into supply chains, has a cost. Ansòn et al. (2017) find that time and uncertainty are particularly important for the movement of intermediate goods, in other words for international production networks as developed in global value chains. It is, therefore, important for developing countries wishing to bolster their economic development to address issues of time and uncertainty. Being able to access real-time information about the location of a shipment is crucial to the organisation of global value chains. Moreover, the availability of information about products traded, for instance through traceability, increases trust in the quality of the goods exchanged.

Co-ordination is increasing among buyers and sellers in international production networks. However, the physical movement of goods also implies co-ordination among a large range of actors with diverse responsibilities along the trade logistics value chain, requiring different levels of knowledge about the characteristics of the transported goods. The concept of trade logistics was traditionally organised around a division of responsibilities; and with no one actor in the chain, in particular the consignor, taking full responsibility for dispatching the goods, the financial interests of both buyer and seller were protected and the liability of the carrier minimised. Containerisation in the twentieth century revolutionised trade by dramatically reducing transport costs, but it also considerably increased the complexity of co-ordination. In search of efficiency and cost reduction, the trade logistics chain has increasingly outsourced activities and adopted strategies of consolidated cargos, as well as multi-modal transport chains. In addition, carriers are now transporting goods in sealed containers and rely on the shipper's declaration for the identification of goods.

The idea that electronic information and co-ordination is critical for international trade is not new. Electronic data interchange (EDI) was already starting to be implemented at the beginning of the 1990s (Cuyvers and Janssens, 1992) when it was presented as a key trade facilitation tool (Schware and Kimberley, 1995). EDI is an umbrella term for various methods of automatic electronic transfer of orders, order confirmation and bills. These supply-management tools are based on a co-operative inter-organisational information system, providing electronic exchange of information among trade partners along the entire supply chain, from the original supplier through multiple production and logistics operations to the final consumer. Information about business transactions, such as orders, invoices and feedback about products, is sent directly, computer-to-computer, on private Internet networks. These fully automated systems enable the management of the movement of raw materials, stock and finished goods, organising the flow of information from one end of the supply chain to the other. Various EDI systems exist and most of them are compatible. While EDI systems were rapidly identified as means of speeding up the important functions of international trade, such as securing customs approval for shipments, implementation initially lagged behind in developing countries; it is now increasing.

Despite the increasing amount of information available, however, there is still a general lack of transparency along the trade logistics chain, with large discrepancies in access to information about the movement of goods between the country of origin and the final destination (UNECE, 2011). In a trading world, in which knowledge about product origin has economic value for logistics management as well as for consumers, being able to pass on information together with the traded goods throughout the trading chain can create a competitive advantage. However, information is often passed from one agent to another and can be lost along the way. For example, in order to reduce costs, freight forwarders consolidate shipments to take advantage of all the space available in containers, often called "less than full containers", by mixing consignments from different origins. According to the United Nations Economic Commission for Europe (UNECE, 2011), in doing so, they often provide only summary data to the shippers; the more detailed information about the consignment is lost. More generally, data gaps, asymmetry of information about logistics services and their prices, as well as the use of paper documents make the evaluation of costs uncertain and complicate the evaluation

of profit margins for firms. This is evidenced by the heterogeneous costs paid by firms at similar border crossings and gateways. Jouanjean et al. (2016) found that clearing costs in the same country could vary markedly at different border crossings, and also according to the type of exporter using the same crossing.

It is not only information about the nature of the transported cargo that matters. Real-time information about the location and status of the shipment is equally important for all actors along the trading chain, and in particular for transit systems and mandatory transit support services, such as insurance. Yet customs authorities and logistics services alike face numerous inter-operability issues that constrain the flow of such information among actors in the chain. Reliable information systems can considerably reduce the costs of transit, not only through expedited border crossing and better management of reporting regarding the movement of transit vehicles, but also by potentially reducing the risks of fraud and thereby reducing insurance costs.

While containerisation has reduced trade costs, it also has resulted in an increase in the loss of container goods due to theft, piracy, accidents and damage (Miler R.K., 2015). This is a problem not only for the seller and buyer, but also for customs authorities; in order to allow for a clear attribution of customs duties, customs authorities need to know whether cargo has left the country through which it is transiting. Importers expect reductions in transit risks to result in a decrease in additional costs and insurance premiums, thereby increasing the overall competitiveness of the trade logistics chain.

Various transit management systems allow customs officers to record the passage of cargo at borders (UNECE, 2013), providing revenue authorities with information on the last border crossed by a specific cargo as well as the current country location. Such integrated systems help eliminate off-loading of undeclared goods and the need for physical escort and monitoring of sensitive cargo, such as batteries, fuel and cigarettes. The OECD/WTO case story 79 mentions how Ugandan cargo owners would frequently lose their goods in transit unless they employed physical police escort at a cost of USD 250 per day. In Rwanda, physical escorts are estimated to increase transit time from one day to three to four days, resulting in an estimated increase in transport costs of about USD 400-500 (The New Times, 2017).

Countries in the Eastern African Community (EAC) have been using electronic cargo tracking systems for real-time tracking of shipments for several years (*OECD-WTO aid-for-trade monitoring exercise 2017*, Public sector case story 79). However, each country implemented its own tracking system and the resulting multiple stand-alone tracking systems and platforms along the corridors in the region made it necessary for trucks or containers to be equipped with systems for all countries crossed or served. Recently, the revenue authorities of Kenya, Rwanda, and Uganda joined in commissioning the Regional Electronic Cargo Tracking System (RECTS), which will consolidate the three countries' systems and enable them to jointly track cargo from port to destination (TMEA, 2017).

Stricter traceability requirements have not only increased the need to track the location of a cargo; they also make it necessary to maintain a data thread along the value chain. Data flows accompany the production and exchange of goods and services every step of the way. Re-creating information lost along the chain, such as the name and address of the producer or information about handling, is costly and time consuming, if not impossible. Complete data threads increase transparency in the value chain and can enable market access for particularly sensitive sectors, for instance agriculture and food chains and, in particular, livestock, dairy and meat trading.

Nonetheless, digitalisation is not only a way to increase transparency in the trade logistics chain. The reduction in transaction costs enabled by digitalisation can support the participation of smaller actors in the market. Many analyses have documented, for example the detrimental effect low competition and cartels have on logistics in Africa, in particular for trucks. However, low population density, vast geographical spread, and limited investment and productivity mean that reaching producers effectively is extremely costly. The supply of logistics services in low-production areas is characterised by high levels of risk and low returns, and trade logistics service providers might find it difficult to cover their marginal costs. The resulting limited supply of services to producers, and the high costs of reaching local markets, weigh

heavily on profits and therefore on decision to participate—or not—in the market (Teravaninthorn and Raballand, 2008; Engel and Jouanjean, 2015; Jouanjean et al, 2016). The increased use of mobile phones across East Africa presents new opportunities to overcome these issues through the development of trading platforms that can help to better organise the logistics underpinning market access and reduce the associated price.

Digital technologies and related innovations can be a first step toward the integration of smallholders or pastoralists into modern value chains. The process of modernising agriculture and food value chains entails increasing organisation and co-ordination among stakeholders, as well as a degree of institutionalisation (Box 3.2). In particular, it requires the standardisation of the quality and safety--and often traceability--of products to allow for the reduction of transaction costs along the value chain, as well as to meet consumer demands. From the producer side, access to information, as well as enforcement mechanisms and infrastructure, are equally important to guarantee the quality and safety required in the modern food chain. From the buying side, traders need to have access to information about production processes and this information needs to follow the product all the way to consumers in case of traceability requirements.

Box 3.2. Data exchange in agriculture and food chains

There is a growing need for downstream actors in the agriculture and food chain to have better access to data, in particular with the increasing demand for traceability and transparency throughout the chain. Traceability and transparency, as well as the management of stocks of perishable goods, require increasingly large amounts of data. Sharing this data seamlessly and managing it in a cost effective way can only be achieved digitally. As a consequence, food processors are increasingly asking farmers to collect data to improve their planning and logistics, support tracing and tracking, and substantiate sustainability claims at the retail level.

At the same time, data flows accompany the production and exchange of goods and services every step of the way. A circular "digital thread" connects processes from design to end use, drawing on data from users and delivering instructions for the production process, which itself is increasingly digitally co-ordinated. Agriculture is no exception to digitalisation; it increasingly relies on the use of ICT-based services, for instance for prescriptive farming and predictive maintenance, and is therefore both using and producing data that can help to address challenges along the food chain. A manufacturer of milking robots, for example, monitors operational data from products sold to farmers and uses the data to give farmers advice.

Data-sharing is confronted by barriers, however, such as the lack of uniformly accepted standards and, in particular, inter-operability issues. Such challenges are particularly acute in agriculture, a sector characterised by a large number of small players. A large dairy co-operative, for example, would have to be able to exchange data with 10 000 farmers.

But the problem of inter-operability is even more complex when thinking about the multitude of actors that could use the data for various purposes, thereby increasing efficiency. For instance, the accountant of a co-operative requires access to its electronic invoices, but also data from the cows milked by the robot need to be accessible to the veterinarian and for the herd book. All these actors would need to have access to the system to be able to read and transfer data. One key issue would be whether the system is proprietorially developed, for example, by the global players in the food chain, or if it relies on open systems.

The important challenge of standardised and mainstream data exchange needs to be addressed in order to benefit from big data analytics, as well as other data-driven business opportunities.

Source: OECD (2015a), *The role of new data sources in greening growth: The case of drones.*

The development of digital platforms to bring together pastoralists and traders in East Africa is a promising way of enabling isolated pastoralists to connect to the market and increase their livelihood opportunities, reaping the benefits of unexploited trade opportunities in the region (Box 3.3). These platforms reduce the high transaction costs generated by chains of middlemen in the process of livestock trading. Digitalisation can potentially transform the whole livestock and meat value chain by increasing the amount of information available throughout the chain, from livestock inputs and production to transport, processing, and distribution, enabling traceability.

Virtual marketplaces also allow pastoralist to register information about their cattle on digital platforms and to localise them using connected chips. Through such systems they are able to provide information on cattle prices, vaccines and various certifications to traders across the border. Using these platforms, pastoralists and buyers can not only be informed about current supply and demand; they can also settle trading agreements. This can spare them travelling--often long distances--with their cattle to the market, without the certainty that this will result in a transaction or knowledge of the conditions of the transaction. It allows pastoralists to make an informed choice about selling their cattle in advance, based on information about market prices and without having to incur transport costs to the market. It also allows traders to better organise and co-ordinate their activities. In addition, traders can get better and transferable health and safety information about the livestock, which they can then feed into traceability processes. Moreover, these platforms usually propose additional services, including payment solutions, such as mobile-money payments, escrow to facilitate payments, and cut-out-cash transactions. They also often assist in the arrangement of transportation following a purchase.

Overall, various exchange systems can facilitate trade by increasing co-ordination among public and private trade operators, thereby boosting the efficiency of trade logistics and, finally, of market access. However, these systems still face issues of inter-operability, as well as constraints to the free flow of data.

Box 3.3. The potential of digitalisation for livestock and meat trading in Africa

The example of livestock and meat trading in Africa demonstrates how digital transformation can address various types of market failures (Carabine et al. 2015, Engel and Jouanjean, 2014). Livestock trading (cattle, camels, sheep and goats) is an important source of livelihoods in the Horn of Africa and has great trade potential in the region thanks to increasing demand. While livestock exports are a key element of the livelihood systems of pastoral and agro-pastoral populations in the region, they have long been undervalued by national governments, despite estimates showing that livestock trade from regional pastoral production systems reached USD 1 billion in 2010 (Akilu et al. 2013, Catley et al. 2013). The true extent of the trade is also likely to be underestimated due to the high level of informality in the sector. In Kenya, for example, informal livestock economic activity may contribute as much as 150% more to GDP than government estimates suggest (Behnke and Muthami, 2011). Furthermore, the value chains involved in these sectors involve a large number of people and are important sources of regional employment. Exports from the region, mostly to the Middle East through Djibouti, are organised around a regional cross-border trade network arranged through a series of clan-based corridors linking interior rangelands to the ports. USAID (2010) estimated that cross-border livestock trade supported--either directly or indirectly--about 17 million people in the region, covering a wide range of actors including livestock producers, traders, trekkers, fodder traders, brokers and intermediaries. However, because of the extensiveness of pastoralism in the region, coupled with the poor supply of infrastructure, pastoralists experience difficulties in accessing markets and information; when they do, the high access costs mean that they only obtain small margins in return.

CONCLUSIONS

The linkages between digital and physical connectivity are twofold:

First digital connectivity provides new opportunities for providers of physical connectivity in the form of innovative technologies for customs management and cargo tracking, automation and the electronic transmission of information among customs authorities and transport providers.

Second, it means that the way physical connectivity is operated--shipping networks, cross border operations, intermodal connections--has to adapt to the new requirements of global trade and global value chains. These include just-in-time deliveries and traders' demands for speed, reliability and transparency, as well as those brought about by digital trade and the changing way goods are delivered.

Digital trade for development requires, in addition to digital connectivity, addressing new and old constraints to market integration and physical connectivity. Digitalisation and data flows provide an opportunity to reduce the investments needed to address some traditional connectivity bottlenecks, both at the border and behind the border, and in particular to decrease transaction and co-ordination costs. They offer an opportunity to lower the costs of participating in trade, facilitating the inclusion of smaller and marginal buyers and sellers.

In terms of trade facilitation, digitalisation can decrease the transaction costs associated with co-ordination and create positive spill-overs for both public and private actors. The advantages include increased transparency, decreased risk management costs for customs authorities, improved efficiency of customs operations and greater reliability for the private sector, coupled with decreases in the opportunities for corruption, among others. However, digitalisation of processes is still lagging behind in many developing countries. The main reason for this is the lack of ICT infrastructure. Co-ordination in and among countries also remains a problem, even where such infrastructure exists. Therefore, a further push by the donor community for the creation of the ICT infrastructure that can unlock those spill-overs is welcome. Various case studies and experiences demonstrate the benefits of regional systems for smoothing transit processes. They provide real-life examples of the positive spill-overs resulting from increased data sharing.

However, while it presents opportunities, digital trade is also creating new challenges for customs authorities. New actors, and in particular the capacity of consumers to make cross-border purchases of goods sent in small parcels and using different trade pathways than traditional business-to business-trade, force policy makers and customs authorities to rethink traditional enforcement tools. In particular, digital trade questions existing risk management strategies based on traditional pathways of cross-border trade, as well as the relevance and the level of *de minimis* thresholds for customs duty.

There are other requirements and needs that must be addressed to improve physical connectivity in today's trading environment. Traditional connectivity constraints involve not only hard infrastructure, but also the provision of efficient trade logistics--in particular the transport services that move goods from production sites to where they are consumed. It is important to avoid weak links or bottlenecks in the trade logistics chain. For instance, good maritime connectivity requires more than efficient port infrastructure and competitive shipping lines. It also calls for reliable hinterland services, as well as competent customs and transit operations for land-locked countries. Such complementarities are particularly important to make the most of spill-overs and benefits from infrastructure investments. Maximising returns on investments requires co-ordination among neighbouring countries, both on hard infrastructure and on the regulatory environment for trade logistics services.

Digitalisation can reduce the cost of co-ordination, support better co-ordination among logistics modes and among countries' logistics services, and increase co-ordination among public and private trade operators. This in turn can increase the efficiency of trade logistics and therefore improve market access for smaller buyers and sellers, for whom the costs of participation in trade were previously too high. However, issues such inter-operability, as well as constraints to free flows of data, can limit the gains available from digitalisation.

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NOTES

1. For the LSCI of all coastal countries from 2004 to 2016, see http://stats.unctad.org/maritime.
2. TFI values range between 0 and 2, where 2 denotes the best performance possible for a given indicator.
3. An example is the co-operation between Switzerland and the EU (OECD, 2016)
4. Low-value shipments does not refer to shipments with low value-to-weight ratio. They are, rather, shipments of small quantities, even small parcels, which often tend to have a higher value-to weight-ratio than bulk shipments.
5. For example, the US Customs and Border Protection (CBP) sends informed compliance letters to notify importers that an audit or enforcement action may follow.
6. For instance, cognitive computing for customs agencies.
7. Set and monitored by national plant protection organisations.
8. Note, however, that commercial flights to Yemen have ceased to operate regularly since March 2015 due to ongoing conflict.