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Trade Networks amid Disruption: Promoting Resilience through Digital Trade Facilitation

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KEY MESSAGES

- The fragmented nature of global value chains (GVCs), which defines present-day trade networks, makes them vulnerable to challenges. The measures rolled out by economies to contain the COVID-19 pandemic, for example, led to ports being shut, goods unable to be loaded/unloaded, and factories having difficulty accessing raw materials. Such issues have brought forth questions of how GVCs could be strengthened and made more resilient.

- These developments have made it apparent that, in improving trade facilitation, minimising trade costs should not be the only consideration; trade resilience is equally (if not more) important. One way of improving trade resiliency is to utilise digital trade facilitation (DTF), or digital tools to facilitate trade. DTF can enhance supply chains in at least three ways: (1) improve operational resiliency; (2) strengthen cross-border connections; and (3) contribute to enhanced data ecosystems.

- Improving operational resiliency through DTF could ensure that disruptions such as extreme weather events and pandemics would have less impact on port operations. Where staffing shortages are a concern, as they were during the COVID-19 pandemic, tools such as artificial intelligence (AI)-guided cranes, aquadrones and sensors could be employed to automate repetitive tasks, thereby reducing the need for manual labour. Digitalising customs documents and introducing integrated e-payment solutions help in minimising the need for people to have close physical contact with one another.

- DTF plays a critical role in strengthening cross-border connections, which provides true resiliency in the context of a globalised trade network. It could be employed to consolidate customs-related documents and information (thereby increasing transparency) as well as to seamlessly connect authorities and traders in different economies (e.g., through blockchain-enabled platforms or regional single windows).

- Besides ensuring the day-to-day resiliency of trade operations, it is important for economies to look at resilience from a broader perspective. DTF could be ‘a cog in the wheel’ of data ecosystems. For instance, economies could take advantage of the volume of data and level of detail captured by DTF tools in formulating credible and well-informed strategies to enhance resilience in key sectors.

- Despite the resilience that DTF could bring to supply chains and the broader economy, successfully implementing it would not be easy. Economies would need to have the infrastructure to support the adoption of digital solutions, the relevant skills to operate and utilise digital tools, and a supportive policy environment. In addition, the interconnectedness of GVCs makes international cooperation and coordination essential for DTF to be effective. APEC can provide the avenue for economies to deliberate, to share experiences and to advance work on DTF.

Global value chains (GVCs) have defined present-day trade networks. Specialisation by each participant along the value chain has enabled more economies to participate in global trade. The fragmented nature of GVCs, however, has also presented challenges, the COVID-19 pandemic being one. As economies rolled out protective measures to contain it, news articles abounded of ports being shut, goods unable to be loaded/unloaded and factories having difficulty accessing raw materials.[1] Such difficulties brought forth questions of how GVCs could be strengthened and made more resilient.

APEC is no stranger to trade facilitation, defined broadly as 'the simplification and rationalization of customs and other administrative procedures that hinder, delay, or increase the cost of moving goods across international borders'. [2] Trade could be facilitated in different ways, including making information more accessible and transparent, promoting paperless trade and/or aligning standards across jurisdictions.

Such measures have substantial benefits. APEC's Second Trade Facilitation Action Plan (2007–2010), for example, resulted in USD 59 billion in savings and led to fewer days to process imports and exports.[3] This was succeeded by the APEC Supply-Chain Connectivity Framework Action Plan (SCFAP) which was implemented in two phases: SCFAP-I (2010–2015) and SCFAP-II (2017–2020). Recognising the resolve of economies to overcome challenges experienced during the COVID-19 pandemic, SCFAP-III (2022–2026) seeks to create a predictable, competitive and digitally interconnected Asia-Pacific region.[4]

This policy brief explores the role of digital trade facilitation (DTF), or the application of digital tools to facilitate trade, in the wake of the COVID-19 pandemic. It highlights the possible ways that DTF could help promote stronger and more resilient value chains, and identifies the key elements as well as policy approaches that policymakers could consider to successfully implement such digital solutions.

1. COVID-19 and Cross-Border Trade

The COVID-19 pandemic disrupted the global economy significantly. Restrictions put in place by economies to minimise the spread of the virus limited business operations. A survey conducted jointly by the International Association of Ports and Harbors (IAPH) and the World Ports Sustainability Program (WPSP) provides insights into the early impacts of the pandemic. [5] Almost half of the surveyed ports [6] reported a decline in container vessel calls between April and June 2020, when many economies were still in the early stages of navigating the changes brought about by the pandemic. Also, 28 percent reported a shortage of port authority personnel and 37 percent reported delays in trucking in/out of the port area in April 2020, suggesting a lower capacity to process goods passing through borders, which could contribute to port congestion even with the decline in vessel calls.

Consequently, global average delays for late vessel arrivals increased, moving from 4.8 days in March 2020 to 6.5 days in January 2021 before peaking at 8.0 days in January 2022 (Figure 1). Meanwhile, shipping costs soared, from USD 1,358 per 40-foot equivalent unit (FEU) containers at the start of the pandemic to USD 3,854 in January 2021. Costs peaked at USD 11,109 in September 2021, representing an increase of more than seven

[1] H. Ellyatt, "Supply Chain Chaos Is Already Hitting Global Growth. And It's About to Get Worse," *CNBC*, updated 19 October 2022, https://www.cnbc.com/2021/10/18/supply-chain-chaos-is-hitting-global-growth-and-could-get-worse.html; L. Gamio and P.S. Goodman, "How the Supply Chain Crisis Unfolded," *The New York Times*, 5 December 2021, https://www.nytimes.com/interactive/2021/12/05/business/economy/supply-chain.html; "Supply Chains, Interrupted: How Singapore and the World Are Coping with Disruptions," *The Straits Times*, updated 17 March 2022, https://www.straitstimes.com/business/economy/supply-chains-interrupted-how-singapore-and-the-world-are-coping-with-disruptions

[2] A. Bayhaqi et al., "Trade Facilitation in APEC: Progress and Impact," APEC Policy Brief 25, Singapore, January 2019, https://www.apec.org/docs/default-source/publications/2019/1/policy-brief-trade-facilitation-in-apec-progress-and-impact/tfa-escap-policy-brief_final.pdf?sfvrsn=35a0fbe0_1

[3] APEC, "APEC's Achievements in Trade Facilitation 2007–2010: Final Assessment of the Second Trade Facilitation Action Plan (TFAP II)" (Singapore: APEC, 2012), https://www.apec.org/docs/default-source/publications/2012/1/apecs-achievements-in-trade-facilitation-2007-2010---final-assessment-of-tfapii/2012_psu_tfap2-report.pdf?sfvrsn=bd3af777_1

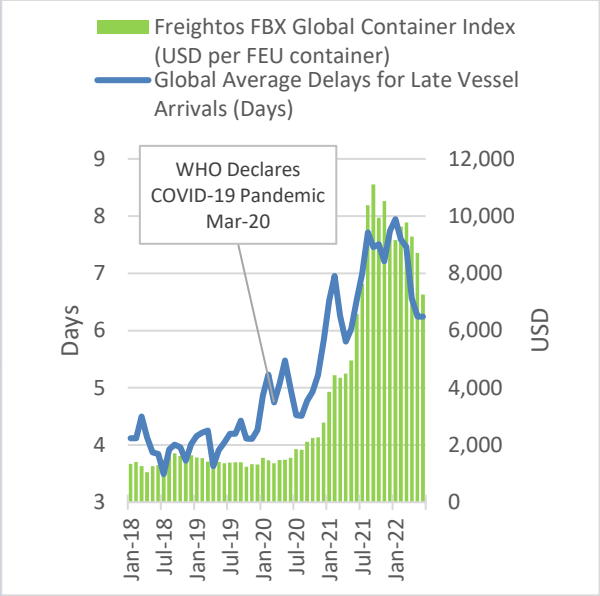
[4] APEC, "Phase Three of Supply-Chain Connectivity Framework Action Plan 2022–2026 (Endorsed, 23 August 2022)" (*Third Committee on Trade and Investment Meeting*, Chiang Mai, Thailand, 26–27 August 2022), http://mddb.apec.org/Documents/2022/CTI/CTI3/22_cti3_012.pdf

[5] T. Notteboom and T. Pallis, "IAPH-WPSP Port Economic Impact Barometer One Year Report: A Survey-based Analysis of the Impact of COVID-19 on World Ports in the Period April 2020 to April 2021" (International Association of Ports Harbors, 2021), https://sustainableworldports.org/wp-content/uploads/IAPH-WPSP-Port-Economic-Impact-Barometer-20-21-View.pdf

[6] More than 120 ports participated globally although the actual number of respondents varied across each survey period (week). There were 48 to 104 respondents at any given time, of which about 30–54 percent are from Europe, 9–32 percent are from Central and South America, 7–29 percent are from North America, 3–11 percent are from Africa, 3–17 percent are from North Asia, 3–12 percent are from Southeast Asia and Australasia, and 0–4 percent are from the Middle East and Central Asia.

times since March 2020, before moving to USD 9,167 in January 2022.

Figure 1: Impact of COVID-19 on late vessel arrivals and shipping cost, Jan 2018–Jun 2022



FBX= Freightos Baltix Index; FEU=40-foot equivalent unit; WHO=World Health Organization

Source: APEC Policy Support Unit (PSU) calculations using data from: Sea-Intelligence, "Schedule Reliability Improves to 40% in June 2022," 3 August 2022, https://www.sea-intelligence.com/press-room/155-schedule-reliability-improves-to-40-in-june-2022; Freightos Data, "Freightos Baltic Index (FBX): Global Container Freight Index," accessed 2 September 2022, https://fbx.freightos.com/

2. How Can Digital Trade Facilitation Promote Stronger Supply Chains?

The impacts on port and vessel operations revealed gaps in existing efforts to enhance trade facilitation. More specifically, the pandemic made it apparent that minimising trade cost should not be the only consideration; trade resilience is equally (if not more) important. This point is particularly important given the high possibility of longer, more frequent disruptions of various types, such as extreme weather events (e.g., typhoons), trade disputes, data breaches or pandemics, going forward. According to one study, the world can expect to experience disruptions lasting a month or longer every 3.7 years.[7]

One way of improving trade resiliency is to utilise digital tools to facilitate trade (collectively labelled DTF). DTF can enhance supply chains in at least three ways: (1) improve operational resiliency; (2) strengthen cross-border connections; and (3) contribute to enhanced data ecosystems.

2.1. Improve operational resiliency

DTF could ensure that various disruptions affecting port operations would have less impact. For example, DTF avoids the need for paper documents and allows for easy replication and reproduction of documents, which means resilience against an adverse event (e.g., flood, typhoon, and fire). DTF could also prevent corruption and manipulation/sabotage by enabling multiple copies that could be cross-checked against each other in real-time (e.g., through blockchain). Having servers in many locations or in the cloud can also build resilience to infrastructure damage and ensure business continuity. Specifically, in the context of the COVID-19 pandemic where widespread infections could lead to staffing shortages, tools such as artificial intelligence (AI)-guided cranes, aquadrones and sensors could be employed to automate repetitive tasks, thereby reducing the need for manual labour.[8]

In Australia, the port of Melbourne has utilised software and robots to automate cranes and boat-to-quay operations. This is expected to improve port handling capacity by another 400,000 20-foot equivalent unit (TEU) containers — an increase of about 40 percent from the current capacity.[9] Meanwhile, in Rotterdam, smart infrastructure has enabled the port to collect various information, which could then be used to determine whether a particular ship is allowed to enter the port.[10] By creating synergies between digital and physical flows, smart infrastructure makes ports more resilient to labour disruptions, such as the staffing problems reported during the pandemic.

Digitalising customs documents could also reduce (if not eliminate) the need for physical proximity, which is particularly useful in minimising infection risk during a pandemic. For example, the Automated System for Customs Data (ASYCUDA) developed by the United Nations Conference on

[7] This figure is based on a study exploring four categories of disruptions, namely, catastrophes (e.g., typhoons), anticipated events (e.g., trade disputes), unanticipated events (e.g., industrial accidents) and outliers (e.g., pandemics). A survey was then conducted among experts in four industries, namely, automotive; pharmaceuticals; aerospace; and computers and electronics. See McKinsey & Company, "Risk, Resilience, and Rebalancing in Global Value Chains," 6 August 2020, https://www.mckinsey.com/business-functions/operations/our-insights/risk-resilience-and-rebalancing-in-global-value-chains

[8] G. Lawton, "7 Use Cases for RPA in Supply Chain and Logistics," TechTarget, 10 June 2020, https://www.techtarget.com/searcherp/feature/7-use-cases-for-RPA-in-supply-chain-and-logistics

[9] "4 Real World Use Cases of Robotic Process Automation (RPA) for Ports," CiGen, 4 June 2019, https://www.cigen.com.au/4-real-world-use-cases-robotic-process-automation-rpa-ports/

[10] "Smart Ports, Leaders in Innovation," Prosertek, accessed 15 November 2022, https://prosertek.com/en/blog/smart-ports-leaders-in-innovation/

Trade and Development (UNCTAD) enabled economies to implement solutions that allow the remote processing of customs transactions during the pandemic.[11]

Integrated e-payment solutions (e.g., credit and debit card payments, bank transfers, mobile money) also help in minimising close contact between individuals. Additionally, they facilitate faster, more convenient payment, which saves traders from rent-seeking practices[12] and reduces the burden on logistics (e.g., in having to ensure secure transport of cash). [13] An example is CustomsConnect, an online platform that allows traders to conveniently and securely pay customs duties and related fees to the Royal Thai Customs at any time of the day.[14]

2.2. Strengthen cross-border connections

Improving operational resiliency is important, but true resiliency, especially in the context of a globalised trade network, comes from enhancing cross-border connections.

DTF solutions could be employed to consolidate customs-related documents and information (thereby increasing transparency) as well as to seamlessly connect authorities and traders in different economies. For example, the Pan Asian e-Commerce Alliance (PAA), a partnership involving trade and customs service providers across several economies that includes 11 APEC members, [15] utilises blockchain technology that is interoperable with various platforms already in use by economies. Through this initiative, traders are able to submit documents online and have them remotely processed by customs officials, reducing customs clearance times from half a day to just 15 minutes.[16]

Another way of connecting economies is to create a common anchor point such as single windows (SWs) and expanding it in multiple stages to the point of enhancing cross-border connections. An SW evolves over five stages (Figure 2). It starts domestically, with forms being digitised and e-payment options adopted by a customs administration (Stage 1). [17] The benefits at this stage are usually siloed to customs activities. Other regulating agencies (e.g., phytosanitary) could continue to require physical forms.

Stage 2 is reached when the SW is connected to other government back-end systems and more documents are digitally exchanged between agencies. This eventually expands to include connections with the larger port community (e.g., airlines, duty free zones or ship agents) (Stage 3). Over time, the SW matures into an integrated domestic logistics platform or an electronic data interchange (EDI) connecting an even bigger domestic community (i.e., government, port community, banks, insurance companies and logistics service providers) (Stage 4).

The final stage is reached when different SWs are regionally connected (Stage 5), strengthening cross-border connections. The SWs of APEC member economies vary in terms of their evolutionary stages. Although some economies are just starting their journey, others are already at Stage 5. Additionally, the progression to Stage 5 may not be linear.[18]

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[11] United Nations Conference on Trade and Development (UNCTAD), *ASYCUDA Newsletter*, UN, Geneva, April 2020, https://unctad.org/system/files/official-document/dtlasycudainf2020d2_en.pdf; UNCTAD, "ASYCUDA Compendium 2022: Digital Connectivity for Inclusive Trade" (Geneva: UN, 2022), https://unctad.org/system/files/official-document/dtlasycuda2022d1_en.pdf

[12] Digitalisation, by limiting in-person transactions and by making (non-cash) payments traceable, has been shown to reduce rent-seeking practices. For instance, an empirical investigation of two ports has shown that reducing in-person contact between clearing agents and officials (e.g., through electronic processing of documents) reduces the opportunity for corruption (e.g., bribes). See S. Sequeira and S. Djankov, "An Empirical Study of Corruption in Ports," 2010, https://warwick.ac.uk/fac/soc/economics/seminars/seminars/conferences/peuk10/programme/sequeira.pdf. This is supported by another empirical analysis showing a negative correlation between digital transactions and perceived corruption across 111 developing economies. See T.K. Setor, P.K. Senyo and A. Addo, "Do Digital Payment Transactions Reduce Corruption? Evidence from Developing Countries," *Telematics and Informatics* 60 (2021): 101577, https://doi.org/10.1016/j.tele.2021.101577

[13] United Nations (UN), "Trade Facilitation Implementation Guide: Electronic Payment of Customs Duties and Taxes," accessed 15 November 2022, https://tfig.unece.org/contents/electronic-payment-customs-duties-and-taxes.htm

[14] Citi, "Thai E-payments Service Benefits Importers and Exporters," citigroup.com, accessed 15 November 2022, https://www.citigroup.com/citi/citiforcities/ports_of_entry/cs_royal_thai_customs.htm

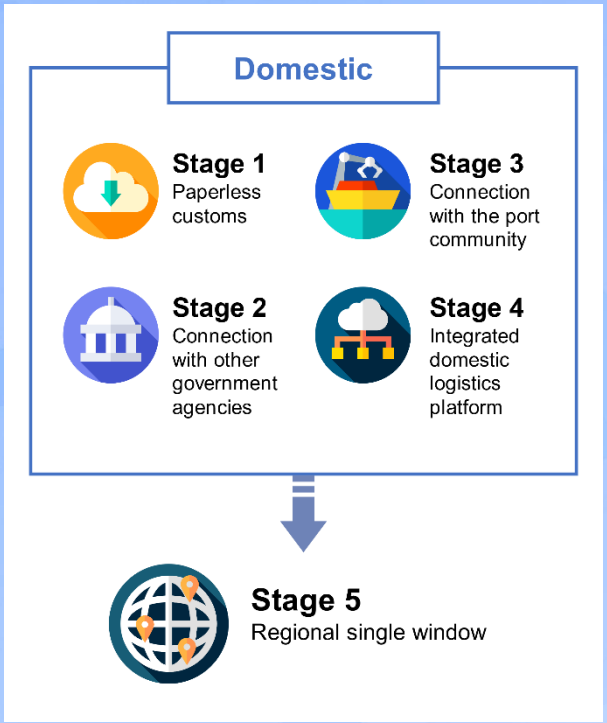
[15] The Pan-Asian e-Commerce Alliance (PAA) involves 14 economies, of which 11 (italicised) are APEC economies: *China*; *Hong Kong, China*; France; India; *Indonesia*; *Japan*; *Korea*; *Malaysia*; *New Zealand*; *the Philippines*; *Singapore*; Sweden; *Chinese Taipei*; and *Thailand*.

[16] APEC, "Utilizing Digital Technology in the Field of Trade Facilitation under the Current COVID-19 Pandemic and Beyond: Beyond Practices Sharing Workshops" (Singapore: APEC, 2021), https://www.apec.org/docs/default-source/publications/2021/12/utilizing-digital-technology-in-the-field-of-trade-facilitation-under-the-current-covid-19-pandemic-and-beyond-beyond-practices-sharing-workshops/221_cti_utilizing-digital-technology-in-the-field-of-trade-facilitation.pdf?sfvrsn=5f4be66c_2

[17] Asian Development Bank (ADB), "National Single Window: Guidance Note" (Manila: ADB, 2022), https://dx.doi.org/10.22617/TIM220175-2

[18] APEC, "Compendium of Best Practice Technology Solutions for Single Window Interoperability" (Singapore: APEC, 2019),

Figure 2: Five evolutionary stages of a single window



Source: Adapted from Asian Development Bank (ADB), "National Single Window: Guidance Note" (Manila: ADB, 2022), fig. 3, https://dx.doi.org/10.22617/TIM220175-2

One example of a regional SW initiative is the ASEAN Single Window (ASW). The ASW is a regional initiative that connects and integrates SWs across ASEAN member economies, thereby expediting cargo clearance and facilitating faster and better trade facilitation. It has been operating in ASEAN member economies since December 2019. Examples of forms that are digitally exchanged through the ASW is the ASEAN Trade in Goods Agreement electronic Certificate of Origin (ATIGA e-Form D), which grants preferential tariff treatment based on ATIGA and the ASEAN Customs Declaration Document (ACDD). During the pandemic in 2020, the ASW was able to process more than 800,000 electronic exchanges of the ATIGA e-Form D.[19]

Progress notwithstanding, it should be noted that more could be done to further enhance the ASW. For example, the inclusion of other customs documents, such as the electronic phytosanitary certificate (e-Phyto), animal health certificate (e-AH) and food safety certificate (e-FS), is still a work in progress.[20] Efforts to expand the coverage of the ASW beyond ASEAN, such as to its dialogue partners also need to be sped up.[21]

2.3. Contribute to enhanced data ecosystems

Besides ensuring the day-to-day resilience of trade operations, it is important for economies to look at resilience from a broader perspective. Indeed, some APEC economies have developed strategies, action plans and the like to enhance their resilience in certain key sectors. For instance, Singapore's '30 by 30' initiative, which aims to build the agri-food industry's capacity to produce 30 percent of the economy's nutritional needs locally and sustainably by 2030, is driven by the desire to strengthen its food security (through reducing its reliance on food imports and providing a buffer in the event of supply disruptions).[22] Similarly, the United States, through the CHIPS and Science Act of 2022, aims to strengthen supply chains and invest in research and development in industries such as nanotechnology, clean energy, quantum computing and AI.[23]

Formulating credible and well-informed strategies requires economies to have access to a range of data and tools. For example, if the objective is to ensure minimal disruptions in accessing a specific product, economies would need to have a good understanding of the trade networks for that product, to identify potential bottlenecks and to devise ways to minimise the possible disruptions that could arise under various situations. At the implementation stage, data would be needed to determine if the strategies have led to the desired objectives (or at least some progress toward them) or whether they need to be revised accordingly. As an illustration, artificial neural networks have been used by UNCTAD to predict the impact of trade policies on trade flows.[24]

https://www.apec.org/publications/2019/11/compendium-of-best-practice-technology-solutions-for-single-window-interoperability

[19] S. Suvannaphakdy and K. Neo, "Assessing the Benefits of the ASEAN+6 Single Window for ASEAN Members," *Trends in Southeast Asia* 1, ISEAS Publishing, Singapore, 2020, https://www.iseas.edu.sg/wp-content/uploads/2021/12/TRS1_22.pdf

[20] "ASEAN Single Window," Association of Southeast Asian Nations (ASEAN), accessed 15 November 2022, https://asean.org/our-communities/economic-community/asean-single-window/#:~:text=AMS%20are%20also%20looking%20for,ASEAN%20through%20the%20ASW%20environment

[21] ASEAN, "ASEAN Single Window."

[22] Singapore Food Agency, "30 by 30," accessed 15 November 2022, https://www.ourfoodfuture.gov.sg/30by30

[23] The White House, US, "Fact Sheet: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China," 9 August 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/

[24] D. Hopp, "Economic Nowcasting with Long Short-term Memory Artificial Neural Networks (LSTM)," UNCTAD Research Paper 62, 2021, https://unctad.org/webflyer/economic-nowcasting-long-short-term-memory-artificial-neural-networks-lstm

Having comprehensive data ecosystems capable of generating, collecting, merging and analysing quality data is key to the above endeavour. DTF could be 'a cog in the wheel' of those data ecosystems, given the volume of data and level of detail that could be collected by DTF tools — the importance of data privacy and security notwithstanding. In fact, tools such as TradeLens have led to improved supply chain visibility (TradeLens is a blockchain-based platform where key players across the GVC, such as operators, ports authority personnel, logistics providers, and traders, can share data with each other). [25] Meanwhile, Singapore's Networked Trade Platform (NTP) has stitched disparate digital islands across the entire trade ecosystem (i.e., connected traders' enterprise resource planning systems and other proprietary systems to freight forwarders and freight management systems, to last mile delivery and tracking services), and this has brought many advantages that come with connected data, including accuracy gains.[26]

3. How Can Economies Support Digital Trade Facilitation?

Despite the resilience that DTF could bring to supply chains, successfully implementing them is not easy. This is shown by the varying levels of success achieved by individual economies as they scrambled to keep their trade links open amid the pandemic.[27]

Fundamentally, economies need to have the infrastructure to support the adoption of digital solutions. Also, relevant skills are imperative to operating and utilising the myriad of digital tools. Supportive regulations and openness to cooperating and coordinating with other economies are also critical to optimising the benefits of DTF. These factors, and the policy approaches that could be considered by policymakers to address them, are discussed below.

3.1. Enhance digital and physical infrastructure

Having the right infrastructure, both digital and physical, is essential in supporting DTF. For example, adopting e-payment mechanisms would be challenging if the digital infrastructure is weak, while deploying digital tools such as blockchain-enabled platforms and the internet of things (IoT) would be difficult if legacy systems (i.e., paper processes or analog machines) are not first upgraded.

It is worth noting here that statistics on digital infrastructure and digital engagement specific to ports are important for monitoring and evaluating DTF, but publicly available data at the micro level remain limited. This section utilises several broader indicators to generate insights, including the 2021 United Nations Global Survey on Digital and Sustainable Trade Facilitation. This survey shows APEC making good strides in some areas. For instance, 15 economies already have internet connectivity for their customs authorities and other related agencies, and 13 APEC economies have already implemented their own domestic SW. [28] Other measures that have been fully implemented by many APEC economies include: automated customs system; electronic submission of customs declarations; electronic submission of sea cargo manifests; and e-payment of customs duties and fees.[29]

However, APEC still has room for improvement. The survey shows that some measures are only partially implemented (including those at the pilot stage of implementation) or not implemented at all. For example, several economies have only partially implemented the electronic submission of air cargo manifests (six economies) and electronic application for customs refunds (also six economies).[30] This could be due to the measures being implemented only in some, not all, targeted locations, such as key border crossing stations.[31] Some measures are not being implemented at all by some economies, such as the electronic

[25] APEC, "Utilizing Digital Technology."
[26] Singapore Customs, "Going beyond the National Single Window," *WCO News*, October 2018, https://mag.wcoomd.org/magazine/wco-news-87/going-beyond-the-single-window/
[27] APEC, "Utilizing Digital Technology."
[28] APEC Policy Support Unit (PSU) calculations based on the 2021 UN Global Survey on Digital and Sustainable Trade Facilitation (https://untfsurvey.org). Data for Hong Kong, China; Chinese Taipei; and the United States are unavailable.
[29] According to the survey, these economies include Australia; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Peru; the Philippines; Russia; Singapore; and Thailand. Brunei Darussalam has already implemented in full all the measures mentioned, except for an automated customs system.
[30] According to the survey, the electronic submission of air cargo manifests is partially implemented in Canada; Malaysia; New Zealand; Papua New Guinea; Russia; and Viet Nam. The electronic application for customs refunds is partially implemented in Canada; China; Indonesia; the Philippines; Thailand; and Viet Nam.
[31] A measure is considered to be partially implemented if at least one of the following is true: (1) the trade facilitation measure is in partial (but not in full) compliance with commonly accepted international standards, recommendations and conventions; (2) the economy is still in the process of rolling out the implementation of the measure; (3) the measure is being used but on an unsustainable, short-term or ad-hoc basis; (4) the measure is implemented in some (but not all) targeted locations (such as key border crossing stations); or (5) some (but not all) targeted stakeholders are fully involved.

application for customs refunds, and electronic application for and issuance of preferential certificate of origin.

Transforming ports by introducing digital-ready systems is thus critical, but that is not in itself sufficient. The value of such digitalisation will be limited if the larger domestic ecosystem does not catch up and users are unable to benefit from such tools. It is thus important to monitor the state of digital infrastructure in the economies more broadly. In the APEC region, access to fixed broadband has improved from around 12 subscriptions per 100 inhabitants in 2010 to nearly 30 subscriptions per 100 inhabitants in 2021.[32] Access to mobile broadband has fared even better, increasing from 20 subscriptions per 100 inhabitants to 114 subscriptions per 100 inhabitants during the same period — likely contributed by a combination of factors including improved network coverage in developing economies.[33]

Further, entry-level mobile broadband services are generally affordable across most APEC economies (i.e., well within the United Nations Broadband Commission for Sustainable Development's benchmark of below 2 percent of monthly gross national income (GNI) per capita). Notwithstanding these encouraging numbers, actual access and affordability can vary across and within economies. For instance, the cost of data-only mobile broadband (2GB), in international USD, ranges from USD 3.1 to USD 49.8 whereas the cost of fixed broadband (5GB) ranges from a low of USD 7.1 to a high of USD 83.6.[34] In some economies, accessibility differs by gender (e.g., males have relatively better access than females).[35]

Policies that encourage competition and investment in high-speed networks, and those that are open to innovative approaches to services provision, could boost the interest of service providers in widening their network coverage and ensuring that the quality of their services is maintained.

One approach is to encourage more flexible public-private partnerships (PPPs), which would be beneficial to the government (e.g., less capital outlay) as well as the private sector (e.g., improved market conditions).[36] Thailand, for instance, has a PPP with Huawei to improve the economy's digital infrastructure,[37] whereas Canada has multiple funds such as the Universal Broadband Fund that provides capital for high-speed internet and broadband infrastructure PPPs that would connect rural and remote communities.[38]

Economies would also need to upgrade legacy systems to support and employ digital tools such as blockchain-enabled platforms and IoT. This could be done through grants, subsidies and other incentives.

3.2. Improve digital skills

Digital skills are also important in implementing DTF. Although relevant indicators for the APEC region show a population with digital skills, or that the situation has improved over time, those same indicators paint a different picture when analysed at the level of the individual economy. For example, 82 percent of APEC's population aged 15 and above had actively engaged in digital payment transactions in 2021, up from just 54 percent in 2014.[39] But, within that, there is a wide gulf between individual economies, from a low of 37.2 percent to a high of 98.9 percent.[40]

The same can be said for data from the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA), which tests 15-year-old students in key subject areas (reading, mathematics, science) and focuses on their ability to use their knowledge and skills to

[32] APEC PSU calculations based on data from the World Telecommunication/ICT Indicators Database (https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx). Missing data are approximated using previous year data.
[33] ITU, "Measuring Digital Development – Facts and Figures 2021" (Geneva: ITU, 2021), https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf
[34] APEC, "APEC in Charts 2022" (Singapore: APEC, 2022), https://www.apec.org/publications/2022/11/apec-in-charts-2022
[35] F.M.A. Quimba, M.A.D. Rosellon and S.C. Calizo Jr, "Digital Divide and the Platform Economy: Looking for the Connection from the Asian Experience," Philippine Institute for Development Studies, December 2020, https://www.pids.gov.ph/publication/discussion-papers/digital-divide-and-the-platform-economy-looking-for-the-connection-from-the-asian-experience
[36] APEC, "Enhancing Implementation of APEC Connectivity Blueprint in the Digital Era: Digital Connectivity for Stronger Recovery," APEC, Singapore, 2022, https://www.apec.org/docs/default-source/publications/2022/3/enhancing-implementation-of-apec-connectivity-blueprint-in-the-digital-era/222_psu_enhancing-implementation-of-apec-connectivity-blueprint-in-the-digital-era.pdf?sfvrsn=6df7cff3_2
[37] Huawei, "Huawei Partners with NBTC to Develop 'Giga Thailand' Digital Infrastructure," 29 November 2021, https://www.huawei.com/en/news/2021/11/giga-thailand-digital-infrastructure-fiber
[38] https://ised-isde.canada.ca/site/high-speed-internet-canada/en/universal-broadband-fund
[39] Data for Brunei Darussalam and Papua New Guinea are unavailable. See APEC, "APEC in Charts 2022."
[40] APEC PSU calculations based on data from the World Bank Global Findex Database 2021 (https://www.worldbank.org/en/publication/globalfindex/Data)

meet real-life challenges, including potentially succeeding in a digital world. In APEC, nine economies scored below the OECD average across all subjects in 2018, the latest year where data are available.[41]

Furthermore, optimally benefitting from specific smart machinery and digital technologies would require workers who know how to utilise or operate them. As much as 80 percent of the world's 4,900 ports lack digital capabilities, [42] and the long-standing skills imbalance and talent mismatch in many economies including APEC could be one of the factors constraining the number of qualified workers available.[43] The situation may have been further exacerbated by maritime logistics not being the first choice of digital talents and by ports having to compete with other industries in attracting high-skilled workers, according to an industry insider.[44]

This means that, for a start, economies would have to ensure that their customs officials have the requisite skills to use the digital tools needed to fulfil their day-to-day responsibilities. In other words, as digital tools such as SWs are being rolled out to cover more documents and agencies, economies would need to expand training.

Also, new jobs such as data analysts and scientists, AI developers and IoT specialists would be needed since DTF involves programming machines and modelling AI solutions, among others. While different APEC economies have recognised the importance of digital skills and have provided upskilling and reskilling opportunities, [45] more needs to be done to boost talents in such critical skills. This could include encouraging more females to consider career paths in data science and data analytics (females accounted for only 28 percent and 40 percent of tertiary graduates in engineering and computer sciences, respectively, in 2018), thereby enlarging the existing digital talent pool (only 22 percent of AI professionals in 2018 are female).[46]

At a broader level, economies would have to ensure that the users of such tools (e.g., traders) have the capability and willingness to utilise them to their benefit. This could involve workshops and other forms of engagement. In addition, economies could also generate increased interest in relevant sectors via awareness campaigns focusing, for example, on the talents needed to operate modern ports and the available career paths for potential hires.

3.3. Ensure a supportive policy environment

A conducive policy environment for digital transactions is important for DTF. After all, the transition to DTF, even with the right digital infrastructure and skills, will be challenging if policies are fragmented or inadequate. For example, if an economy does not recognise or treat an electronic signature as functionally equivalent to a non-electronic one, then traders would find themselves dealing with the inconvenience of having to submit physical forms despite already submitting them online. Mapping policies across APEC, a 2020 APEC Policy Support Unit (PSU) report[47] reveals that most economies already have laws and regulations related to electronic or digital signatures. Yet, relatively fewer economies have ongoing initiatives in areas such as e-invoicing, which is relatively more efficient as compared to traditional, paper-based invoicing methods.

Considering that multiple agencies are usually involved in facilitating trade, economies would also have to improve coordination between agencies, including having a whole-of-government approach, strategy, or action plan to increase digitalisation. A situation whereby different agencies or levels of government interpret policies inconsistently can

[41] The nine are Brunei Darussalam; Chile; Indonesia; Malaysia; Mexico; Peru; the Philippines; Russia; and Thailand (out of 20 APEC economies with data). See OECD, "PISA 2018 Results: Combined Executive Summaries, Volume I, II, III" (OECD, 2019), https://www.oecd.org/pisa/Combined_Executive_Summaries_PISA_2018.pdf. See also A. Wirjo, Nguyen Thu Quynh and S. Calizo Jr, "Resiliency in a Post-Pandemic APEC: Approaches to Driving Growth in Digital Services," Policy Brief 47, APEC, Singapore, August 2022, https://www.apec.org/publications/2022/08/resiliency-in-a-post-pandemic-apec-approaches-to-driving-growth-in-digital-services

[42] S. Chambers, "80% of Ports Missing Out on the Benefits of Digitalisation, Creating Last Mile Risks," Splash247.com, 4 February 2021, https://splash247.com/80-of-ports-missing-out-on-the-benefits-of-digitalisation-creating-last-mile-risks/

[43] Among the 11 APEC economies with data, talent mismatch (based on the Hays Global Skills Index) has increased in Australia; Hong Kong, China; Japan; New Zealand; and Singapore. See APEC, "APEC Economic Policy Report 2021: Structural Reform and the Future of Work" (Singapore: APEC, 2021), https://www.apec.org/docs/default-source/publications/2021/11/2021-aepr/2021-aepr---main-report.pdf?sfvrsn=7cf56bae_2

[44] M. Verkest, "Smart Port Disruptors: The Talent Paradox," Speed, 2020, https://www.smartportsecosystem.com/smart-port-disruptors-the-talent-paradox/

[45] APEC, "APEC Economic Policy Report 2021."

[46] United Nations Educational, Scientific and Cultural Organization (UNESCO), "UNESCO Science Report: The Race against Time for Smarter Development" (Paris: UNESCO, 2021), https://www.unesco.org/reports/science/2021/en/download-report

[47] APEC, "Assessment of Capacity Building Needs to Support WTO Negotiation on Trade Related Aspects of E-commerce" (Singapore: APEC, 2020), https://www.apec.org/Publications/2020/12/Assessment-of-Capacity-Building-Needs-to-Support-WTO-Negotiation

result in confusion or inefficiency. For instance, mixing both digital and physical transactions can place the former at risk of being rendered useless (or invalid) at some stage. The same report shows that a majority of economies have already formulated a domestic digital or e-commerce strategy. [48] Economies need to build on these strategies to push for the public sector to be a trailblazer in digitalisation efforts as well as for better coordination across agencies.

Economies also need to take into account the reality that technologies evolve with time. Even as they encourage the adoption of the latest DTF solutions, they would need to be forward-looking and recognise that there could be better solutions. As such, it is critical that economies encourage innovation and are open to implementing trials of nascent technologies as they become viable through mechanisms such as regulatory sandboxes.

At the same time, economies should recognise that new technologies carry potential risks and that it is important to build trust. They should proactively manage the risks associated with their adoption, which would involve balancing hard law and more flexible approaches to regulation.[49]

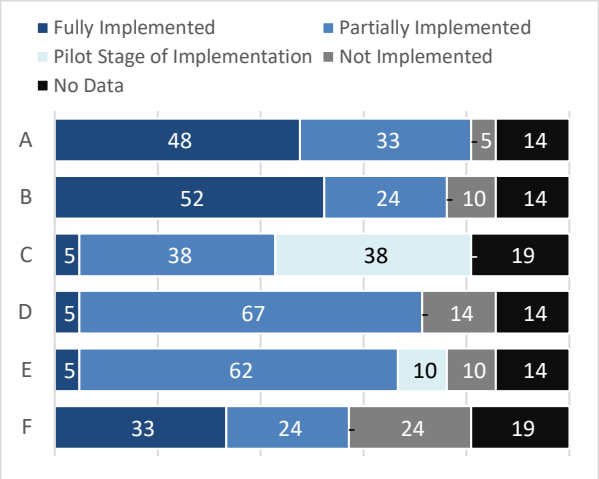
3.4. Leverage regional and international cooperation

International cooperation and coordination are essential for effective trade facilitation. For example, the usefulness of a regional SW is arguably defined by its ability to facilitate cross-border trade between economies seamlessly. After all, multiple fragmented SWs may confuse traders and translate to extra administrative costs (e.g., from having to familiarise themselves and keep up with, and maintain information on, multiple SWs) or costly delays (e.g., due to mismatch between how different SWs process customs documents).

Of primary importance in these cross-border transactions is interoperability, that is, how domestic systems developed by various economies could work with one another, which usually involves multiple layers (e.g., laws and regulations, systems, communication protocols, data security, etc.).

One indication of the challenges of achieving interoperability can be seen in the implementation of cross-border paperless trade measures. Despite a significant share of economies having put in place the legal basis for cross-border paperless trade systems (i.e., laws or regulations for electronic transactions and/or a recognised certification authority), full implementation of electronic exchange of documents (customs declarations, certificates of origin, sanitary and phytosanitary certificates) have a noticeably lower breadth of implementation of just 5 percent (Figure 3).

Figure 3: APEC implementation of cross-border paperless trade measures, 2021 (% of economies)



A=laws and regulations for electronic transactions; B=recognised certification authority; C=electronic exchange of customs declaration; D=electronic exchange of certificate of origin; E=electronic exchange of sanitary and phytosanitary certificate; F=paperless collection of payment from a documentary letter of credit
Note: Data for Hong Kong, China; Chinese Taipei; and the United States are unavailable. Information about Papua New Guinea's electronic exchange of customs declaration is unavailable. Information about Malaysia's paperless collection of payment from a documentary letter of credit is unavailable.
Source: APEC PSU calculations using data from United Nations, "Digital and Sustainable Trade Facilitation: Global Report 2021" (Bangkok: United Nations, 2021), https://untfsurvey.org

Internationally, the United Nations Commission on International Trade Law (UNCITRAL) has developed three model laws relevant to DTF which are helpful for minimising regulatory heterogeneity between economies. First is the UNCITRAL Model Law on Electronic Commerce (MLEC), which adopted the fundamental principles of non-discrimination, technological neutrality and functional equivalence important for creating an internationally conducive environment for e-commerce.[50] Second is the UNCITRAL Model Law on Electronic Signatures (MLES), which grants

[48] APEC, "Assessment of Capacity Building Needs."
[49] OECD, "Regulatory Effectiveness in the Era of Digitalisation," June 2019, https://www.oecd.org/gov/regulatory-policy/Regulatory-effectiveness-in-the-era-of-digitalisation.pdf
[50] United Nations Commission on International Trade Law (UNCITRAL), "UNCITRAL Model Law on Electronic Commerce (1996) with Additional Article 5 bis as Adopted in 1998," 12 June 1996 (and 1998), https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_commerce

legal recognition for different forms of electronic signatures.[51] Third is the UNCITRAL Model Law on Electronic Transferable Records (MLETR), which grants electronic forms of documents (e.g., bills of lading and promissory notes) legal recognition (i.e., functional equivalence akin to paper-based forms).[52]

These model laws are formulated with the intent to encourage economies to enact or revise their relevant laws, although each economy also has the flexibility to depart from these model laws. The UNCITRAL Secretariat maintains a list of economies that have adopted these model laws, but it is based on notification by economies and therefore, should be treated only as an indicative list. As of October 2022, 15 APEC economies have notified their adoption of the MLEC in some form or capacity. However, notifications for both the MLES and the MLETR remain relatively low, only six economies in the case of the MLES and two in the case of the MLETR. Legislative adoption of both the MLES and MLETR could affect recognition and interoperability of trade documents and hence their utility across borders.[53]

International cooperation and coordination can also include capacity building, information sharing and joint initiatives. International and regional fora such as APEC provide the avenue for economies to deliberate, to share experiences and to advance work on DTF. For example, a workshop to share best practices on the utilisation of digital technology in trade facilitation was held in 2021.[54] Also, a (non-exhaustive) set of best-practice guidelines is being developed to assist traders with updating their electronic customs procedures to align with the systems and legislative frameworks implemented by APEC economies and their customs authorities.[55]

In addition, APEC has put forward several regional initiatives. One example is the Asia-Pacific Model E-port Network (APMEN), which empowers economies to implement their SW through projects such as the visualisation of sea freight logistics and the digitalisation of air freight logistics.[56]

4. Final Remarks

COVID-19 has highlighted the challenges faced by GVCs, in particular questions on its resilience. By improving operational resiliency, strengthening cross-border connections, and contributing to enhanced data ecosystems, DTF could strengthen the resilience of supply chains and the broader economy. Realizing the benefits of DTF, however, will require a collective effort – both domestic and beyond – on several fronts, including infrastructure, skills and policy environment.

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[51] UNCITRAL, "UNCITRAL Model Law on Electronic Signatures (2001)," 5 July 2001, https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_signatures
[52] UNCITRAL, "UNCITRAL Model Law on Electronic Transferable Records (2017)," 13 July 2017, https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_transferable_records
[53] R. Renard et al., "Digitalizing Trade in Asia Needs Legislative Reform," Asian Development Bank, 2021, https://www.adb.org/sites/default/files/publication/704041/digitalizing-trade-asia-legislative-reform.pdf
[54] APEC, "Utilising Digital Technology in the Field of Trade Facilitation under the current COVID-19 Pandemic and Beyond: Best Practices Sharing Workshops", 2020, https://aimp2.apec.org/sites/PDB/Lists/Proposals/DispForm.aspx?ID=2696
[55] APEC, "Best Practice Guidelines for Paperless Trading", 2021, https://aimp2.apec.org/sites/PDB/Lists/Proposals/DispForm.aspx?ID=2739
[56] Asia-Pacific Model E-Port Network (APMEN) Operational Center, "Asia-Pacific Model E-Port Network", presentation, n.d., https://www.unescap.org/sites/default/files/Special%20S1_APMEN.pdf