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Enhancing Implementation of APEC Connectivity Blueprint in the Digital Era: Digital Connectivity for Stronger Recovery

APEC Policy Support Unit

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EXECUTIVE SUMMARY

The pattern of long-term growth and recovery following the COVID-19 pandemic is not yet clear as several uncertainties remain, such as: (i) duration, severity, and spatial pattern of the pandemic; (ii) pattern of demand recovery; and (iii) acceleration of productivity. If these uncertainties become persistent, they can have a spiraling effect that results in weak growth and delays the recovery process. A sustained economic recovery will therefore depend on how economies contain the pandemic.

The first condition for recovery is adequate vaccination of the population; faster vaccine delivery equals faster recovery. Monetary stability and fiscal responses will determine the recovery of aggregate demand. In order for financial markets to remain stable and households to have sufficient liquidity, monetary stability is required. Targeted fiscal stimulus packages are essential for businesses (especially MSMEs) to survive the crisis while adequate spending on health and education are crucial to maintaining a healthy and productive population.

It is important to ensure long-term sustainability of the recovery by maintaining a healthy level of productivity growth. According to the IMF, the COVID-19 pandemic has accelerated investment in intangibles, especially digital technologies. A digital economy could boost productivity if skills gaps, digital divides, and secure cross-border data flows are adequately addressed.

The productivity growth that comes with digitalization is not automatic and constant. As implied by the term 'disruptive technology', the benefits of digitalization can only be realized at a wider scale if firms and businesses are able to resolve the productivity paradox or slowdown by overcoming adoption barriers, time-consuming transformations, and transition costs. By strengthening efforts in the implementation of the APEC Connectivity Blueprint, economies can take advantage of the innovative and productive opportunities offered by greater digital connectivity.

KEY TRENDS AND BEST PRACTICES

Physical connectivity

Physical infrastructure and robust digital connections across economies are top priorities for improving digital connectivity in the APEC region. New technologies facilitate trade by integrating digital technology into common business practices like those that facilitate faster and more secure movement of goods across customs borders or within a supply chain. Trade technology integrates existing economic patterns, trade routes, and the digital economy into one symbiotic system.

Taking into account the needs of digital enterprises when designing infrastructure can be accomplished most effectively by incorporating private sector firms in the planning process. The use of sophisticated data collection and analysis in Smart Cities improves traffic and resource management, for example, in order to better meet the needs of residents. Private firms greatly value the data generated by these projects. Partnerships between government and private companies can be helpful in designing infrastructure that generates most value, while access to data and consumers can encourage more private investment in PPPs.

To achieve the APEC Connectivity Blueprint's objectives, several challenges remain. Private companies' involvement in sensitive infrastructure design or data intensive projects raises privacy concerns. In the digital economy, PPPs may give private companies access to citizens' personal data without their proper consent. Implementing governments must carefully manage these risks. It also remains unclear whether it is appropriate or permissible to share such data across economies.

Institutional connectivity

The lack of interoperability in data policies reinforces existing borders. Without harmonized standards for data treatment, the global digital economy could splinter, preventing wide efficiency gains. As a result, the full benefits of the digital economy may not be realized if these policy challenges are not resolved.

The diversity of digital policies across economies illustrates the tough decisions that policymakers have to make when balancing data protection and trade facilitation. Some economies are experimenting with privacy-friendly workarounds to support the digital economy, while others are focused on developing flexible policy approaches. To improve institutional connectivity for the digital era, collaboration within multilateral bodies should be strengthened, new technologies should be used, and greater harmonization of standards should be pursued.

The tendency for digital innovation to evolve faster than regulation is a particular challenge. In addition to creating interoperable systems, proactive collaboration on digital issues can also prevent regulatory shortcomings. The digital economy presents new dynamics, but many of its challenges (such as its use of sensitive information) have been dealt with in other sectors, namely the financial services industry.

People-to-people connectivity

Since the COVID-19 pandemic, the management of the movement of people across borders has changed, perhaps permanently. Digital strategies are increasingly being used to operationalize solutions to these problems. Several digital technologies, including digital visas and health records, are being used to share data between governments and assist individuals crossing borders. Their successful installation can make travel more efficient. But there are still gaps in their usefulness, transferability, and accessibility.

Data security is naturally a concern when it comes to the digitalization of personal information, especially when it pertains to health records that are important for post-pandemic travel. Online platforms and multiple transfers of highly sensitive information increases security risks. Several firms have experimented with storing personal health data in centralized systems maintained locally rather than within travel documents themselves.

A few important factors to consider in improving people-to-people connectivity include digital economy access, data privacy and cybersecurity concerns, skills gaps, and differences in worker treatment across economies. Addressing many of these challenges will require concomitant progress on the physical and institutional connectivity fronts.

CASE STUDY SUBMISSIONS

In this report, APEC members have submitted eight case studies that offer avenues for discussing policy experiences, identifying gaps in digital connectivity, and making recommendations. Four APEC members submitted eight case studies on initiatives and programs that promote physical, institutional, and people-to-people connectivity. Topics covered by the submissions range from Internet protocols to digital identification, data portability, skills building, e-learning strategies, and cross-border interoperability of systems.

1. **Consumer Data Right (CDR) [Australia].** The Consumer Data Right (CDR) is a regulatory framework to enable data portability and empower consumers to receive benefits from the personal data that businesses hold about them. Businesses and individuals can benefit from the CDR by securely sharing data held about them with accredited third parties. In addition to giving consumers more choice, it also eases switching between products and services, fosters competition and saves households and businesses money. The framework places strong emphasis on data privacy and security, has a consumer-centered approach, and encourages consumer-centric technology development. The CDR is an economy-wide reform through a process of assessment and designation.

2. **Digital Identity System [Australia].** Through the Australian Government's digital identity provider, myGovID, people can create a digital identity online and use it to access government services connected to the Government's Digital Identity System. For example, it allows people and businesses to login to myGov, which is the primary portal to access digital services from the Australian Government. Currently, Australia is working on developing biometric verification capabilities for the Digital Identity System that will enable online access to more services on an end-to-end basis.

3. **Large-Scale Deployment of Internet Protocol Version 6 (IPv6) [China].** In a collaborative effort, China has significantly contributed to the large-scale deployment of Internet Protocol Version 6 (IPv6). IPv6 will greatly improve the carrying capacity and quality of service of the Internet. With the innovation of network information technology, emerging technologies such as 4G/5G, cloud computing, big data, and artificial intelligence can be supported more efficiently.

4. **Smart Customs, Smart Borders and Smart Connectivity [China].** In January 2020, the 3S initiative (Smart Customs, Smart Borders, and Smart Connectivity) was launched by the Chinese government to enhance customs control, governance, and cooperation through innovative measures and the implementation of new-generation technologies. At the start of 2021, efforts to put the initiative into action were strengthened through the introduction of several projects, including: 1) 'Click & Clear' by Guangzhou Customs; 2) China-ASEAN SPS Cooperation Information Website; and 3) China-Singapore Digital Border Information Connectivity Project.

5. **APMEN (Asia-Pacific Model E-Port Network) Visualization of Sea Freight Logistics and Digitalization Air Freight Logistics [China].** This case study consists of two components: the Visualization of Sea Freight Logistics and the Digitalization of Air Freight Logistics. Transparency, integrity, and visibility of cross-border trade were the objectives of the Visualization of Sea Freight Logistics project. Through system connections and data exchange between industry stakeholders, the Digitalization of Air Freight Logistics Pilot Project aims to eliminate paper documents from both air import and export processes.

6. **2020 APEC e-Learning Training (AeLT) Program [Korea].** "Educational Policies and Responses in the Post COVID-19 era: Cases from the Republic of Korea and APEC member economies" was chosen as the theme for the 2020 APEC e-Learning Training (AeLT) Program, a virtual capacity building program for education policymakers. To ensure quality, inclusive, and sustainable teaching and learning in the region, the program involved online lectures, collaborative study sessions, and workshops on e-learning case studies and best practices.

7. **APEC School Leadership Program (ASLP) [Korea].** The APEC School Leadership Program (ASLP) recognizes that excellent school leadership contributes to student learning outcomes and is critical to setting up and implementing a digital education system. The goal of this capacity-building program is to help school leaders gain a better understanding of educational technologies and better operate remote/hybrid learning.

8. **Strengthening Digital Connectivity in the Eurasian Economic Union (EAEU) [Russia].** Russia has taken four major initiatives in support of the Eurasian Economic Union's (EEU) Digital Agenda in order to integrate more information and communication technologies and to lay the groundwork for future digital collaborations. The projects include the following components: 1) Integrated Information System (IIS); 2) Unified Search System 'Work Without Borders'; 3) Ecosystem of Digital Transport Corridors in the EAEU; and 4) Transboundary Space of Trust.

In addition to the case studies submitted for this report, APEC members provided information on relevant initiatives for the 2020 Mid-Term Review of the APEC Connectivity Blueprint. There had been a number of measures taken by APEC members at that time to foster digital connectivity. These initiatives include measures to improve digital connectivity domestically, such as expanding broadband access and digitalizing government services, as well as measures to advance regional connectivity, such as enhancing PPP projects to build high quality ICT infrastructure.

The submitted case studies and relevant measures which have been taken illustrate a variety of approaches by APEC economies towards improving digital connectivity. The case study initiatives and actions undertaken address many of the digital connectivity challenges by, for instance, addressing labor force readiness for the digital economy, formalizing data rights, and sharing best practices for developing high quality PPPs. Based on a review of the case studies submitted for this report, the approaches among APEC members to improve digital connectivity can be grouped into three major themes: 1) building a reliable data ecosystem; 2) developing interoperable data systems to facilitate digital transformation; and 3) improving digital education and e-learning strategies to better equip the workforce for the digital economy. Analysis of these economies' experiences offers insights and instructive examples to policymakers on how best to support and regulate the digital economy. It also provides a better understanding of what challenges remain to improve digital connectivity across the region.

KEY CHALLENGES TO GREATER DIGITAL CONNECTIVITY

APEC members have made significant progress towards achieving the objectives of the APEC Connectivity Blueprint. However, in order to achieve greater digital connectivity in the region, several key challenges remain which will require innovative solutions from both the public and private sectors. The region is facing four main challenges: 1) reducing the digital divide; 2)

improving interoperability of digital systems and ensuring data security; 3) fostering greater regulatory cooperation to support the digital economy; and 4) maximizing digital dividends and spillover benefits. Implementing the APEC Connectivity Blueprint in these areas will allow economies to maximize the benefits of the digital economy. In the wake of the COVID-19 pandemic, these challenges have assumed a new urgency and effective responses are necessary to ensure inclusive and sustainable growth in the digital economy.

1.   INTRODUCTION

1.1   POST COVID-19 ECONOMIC LANDSCAPE

When the APEC Connectivity Blueprint was agreed in 2014, world trade was growing more or less in line with global GDP growth of 2.4 percent.[1] At that time, the Blueprint identified the following key challenges to connectivity: disparity in access to and quality of physical and information and communications technology (ICT) infrastructure; existing regulatory constraints or lack of capacity; and existing barriers to interaction and mobility of people. The Blueprint also stated the need to connect growth poles in the region and bring APEC closer together as a community.

Fast forward to 2021 and the global landscape has changed as many economies grapple with economic recovery and adapting to a new post COVID-19 reality. As the COVID-19 pandemic spread around the world in 2020, many governments responded by implementing lockdowns, sharply reducing domestic manufacturing output as factories and ports were closed. But as economies are interconnected through trade and global value chains (GVC), these domestic lockdowns and closures – especially in several key manufacturing hubs – created a ripple effect which continued to spread through international supply chains and logistics facilities. As a result, supply chain disruptions further slowed global production and growth. Figure 1.1 illustrates the possible implications of the COVID-19 pandemic.

Figure 1.1. Mapping of possible implications of the COVID-19 pandemic

Pandemic starts: Direct impact
- domestic lockdowns
- factory and port closures
- drop in domestic manufacturing activities and output
- increased demand for essential goods

Short-term: Trade impact
- supply chain disruptions
- delays in shipments and customs clearance
- temporary COVID-19-related trade-restrictive measures

Medium-term: Investment impact
- lower investment
- possible location shifts
- business interest to balance the supply chain: off-shoring, near-shoring and on-shoring manufacturing

Long-term: Recovery
- possible realignment of trade and investment networks
- post-pandemic economic landscape
- importance of digital economy and technology

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[1] WTO (2016). World Trade Statistical Review.

Note: Based on information gathered from several sources[2]. The economic impacts in the medium-term (1-2 years) and in the long-term are still evolving.

As businesses and governments continue to react to the crisis, possible alignment could be seen in the global investment arena as firms plan to relocate their investment or postpone expansion due to uncertainties in the outlook for economic recovery. For instance, a survey of executives conducted by Ernst & Young in April 2020 found that 83 percent of respondents were considering reshoring or nearshoring to mitigate the impacts of the COVID-19 pandemic. In a follow-up survey carried out in October 2020, that share had dropped to 37 percent, reflecting the sticky nature of global supply chains.[3] The pattern of long-term recovery will therefore depend on how businesses and policies adjust to the new post COVID-19 economic landscape. However, the pattern of long-term growth and recovery is not yet clear as several uncertainties remain, such as: (i) duration, severity, and spatial pattern of the pandemic;[4] (ii) demand recovery pattern; and (iii) acceleration of productivity. These uncertainties, especially if they become persistent, may cause a spiraling effect that results in weak growth and delays recovery.[5]

Sustained recovery will depend on how economies are able to contain the pandemic. Adequate vaccination of the population is seen as the first necessary condition for recovery; faster vaccine delivery equals quicker recovery.[6] Recovery of aggregate demand will in part depend on fiscal responses and monetary stability. Targeted fiscal stimulus packages are necessary to support businesses (particularly MSMEs) to survive the crisis while adequate fiscal expenditures on health and education are of utmost importance in maintaining a healthy and productive population. Monetary stability is required to ensure a stable financial market and sufficient liquidity for firms and households.[7] Last but not least, it is important to maintain a healthy level of productivity growth to ensure long-run sustainability of the recovery.

According to the Conference Board, growth in global output per worker fell 0.9 percent in 2020, but is expected to rebound to 2.9 percent growth in 2021.[8] At the macroeconomic level, learning from earlier episodes of recessions, growth expansions after crises are typically supported by a rapid increase in investment, trade, fiscal and financial flows[9]. These contributing factors, however, may have waned in the most recent episode of global expansion following the 2009 recession, which exhibited (i) weaker trade and investment growth; (ii) slower productivity growth; and (iii) lower liquidity and fiscal expansion compared with earlier episodes (Table 1.1).

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[2] On trade restrictions see WTO (2021); for supply chain disruptions see Haren, P., & Simchi-Levi, D. (2020); for investment and relocation see UNCTAD (2021) and ASEAN & UNCTAD (2021); on supply chain realignment or balancing: BakerMcKenzie (2021) and UNCTAD (2020).

[3] "Is a Wave of Supply-chain Reshoring around the Corner?" The Economist, 16 December 2020.

[4] Brodzicki, T. (2021, February 3).

[5] Menon, J., & Suvannaphakdy, S. (2021, March 10).

[6] Patterson, L., & Dhaliwal, M. (2021).

[7] Monetary Authority of Singapore (2020) and Galhau, F. V. de. (2021).

[8] *Global Productivity Growth Remains Weak, Extending Slowing Trend* [Press release #8067]. (2021). The Conference Board. Retrieved November 19, 2021.

[9] Kose, M. A., Sugawara, N., & Terrones, M. E. (2020).

Table 1.1. Global expansion (excluding initial years) after four global recessions (1975, 1982, 1991, 2009), average annual growth rates

	1977-81	1984-90	1993-2008	2011-19
Global				
Output per capita	1.4	1.8	1.8	1.6
Output per capita (PPP)	1.4	1.8	2.4	2.3
Industrial production	2.8	3.7	3.0	2.3
Trade	4.4	5.7	6.9	3.9
Investment	2.9	4.1	3.8	3.7
Credit	3.6	6.8	4.2	3.5
Advanced economies				
Output per capita	2.3	3.2	1.8	1.4
Output per capita (PPP)	2.3	3.2	2.0	1.4
Trade	4.6	6.9	6.2	3.4
Credit	3.5	7.1	3.5	1.5
Government expenditure	4.1	3.3	2.8	1.2
EMDEs				
Output per capita	1.4	1.1	3.4	3.3
Output per capita (PPP)	1.4	1.2	3.6	3.6
Trade	4.1	2.8	8.6	4.7
Credit	6.1	1.9	10.1	9.9
Government expenditure	5.8	2.4	7.2	5.7

Note: EMDEs are Emerging Market and Developing Economies. Numbers shown are average annual growth rates.
Source: Data from Kose, et al. (2020), Tables 9 and 10. Note: Output per capita in this context is used as a proxy for productivity.[10]

Learning from earlier episodes of recovery and expansion following recessions, labor productivity growth supported by acceleration of technological innovation [11] can bring significant economic expansion if it is also supported by broad-based aggregate demand growth. Kose, et al. (2020) noted that: "The longest global expansion, 1992–2008, coincided with the information technology revolution, the integration of China and many other emerging market economies into the global economy, a sharp increase in commodity prices, and rapid growth in international trade and financial flows".

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[10] Dieppe, A. (Ed.). (2021).
[11] For instance, Gordon (2010) argues that the US productivity surge from 1.47 percent in 1973-95 to 2.51 percent in 1995-2000 and then slightly to 2.48 percent in 2000-07 was due to the significant contribution of information and communication technology (ICT) capital, including the lagged response of productivity growth to the 1990s ICT boom.

Figure 1.2 illustrates four major periods of global expansion and productivity growth following previous recessions. Quadrant I (1984-90) and quadrant II (1977-81) are characterized by stagflation in the form of high unemployment and inflation as the preceding recessions were due to the oil price shock of 1973-74 and the debt crisis of 1982. During these two episodes of growth and recovery following recessions, global output per capita (in PPP terms) grew at an annual rate of only 1.4% between 1977 and 1981 and 1.8% between 1984 and 1990 (see Table 1.1). In comparison, quadrant III (1993-2008) and quadrant IV (2011-19) exhibited higher productivity growth rates following recessions in 1991 and 2009.

Figure 1.2. Episodes of global expansion and productivity growth
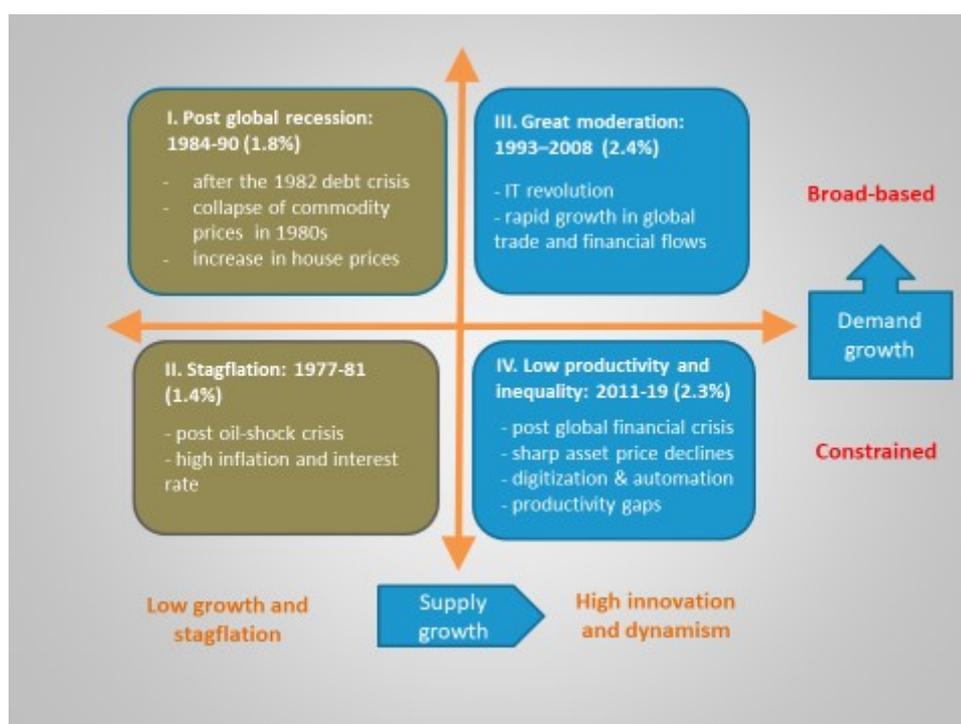
Note: Percentages shown in each quadrant are global output per capita in PPP.
Source: Adapted from Mischke et al. (2021) with data from Kose *et al.* (2020).

Quadrant III represents what is usually labeled as the Great Moderation and is marked by decreased macroeconomic volatility in advanced economies, resulting in a period of low inflation and positive economic growth. In this longest period of economic expansion (16-17 years), global productivity (as measured by output per capita in PPP) grew at a rate of 2.4% per year from 1993 to 2008. This growth was driven entirely by emerging market and developing economies (EMDEs), in which per annum productivity growth tripled from 1.2% between 1984 and 1990 to 3.6% between 1993 and 2008.

Quadrant IV represents the economic expansion following the Global Financial Crisis of 2007-2008. While this period was also marked by high innovation in the form of digitalization and automation, the pace of productivity growth, averaging 2.3% per year between 2011 and 2019, was slightly lower than it had been in the previous expansion episode. Notably, productivity growth in advanced economies during this period dropped to an average of 1.4% per year compared with 2.0% growth in the previous growth period of 1993-2008.

In the early 1980s, information and communication technology (ICT) was seen as the major driver of innovation, as shown by the increased number of patents filed during this time. Europe, the USA, and Japan began developing the 4th Industrial Revolution (4IR) technologies[12] in the mid-1990s and had become the main innovation centers by 2016.[13] Varian (2001) notes that "the increase in productivity growth in the late 1990s is often attributed to the investment in IT during the first half of that decade"[14].

Figure 1.2 illustrates that while the periods specified in quadrants III and IV both featured strong innovation in ICT or 4IR technologies, productivity growth is higher in quadrant III (particularly in advanced economies) as it was supported by broad based consumption growth. Global industrial production grew at an average rate of 3.0% per year between 1993 and 2008 compared with 2.3% average annual growth between 2011 and 2019. Remes et al. (2018) argue that maximizing productivity potential may require promoting both demand and digital diffusion along with adopting the usual supply-side approaches.[15]

1.2   DIGITALIZATION AND PRODUCTIVITY

Can there be any silver lining from the global pandemic? The IMF suggests that the "COVID-19 pandemic has put a premium on digitalization and automation" as "the pandemic has propelled investment in intangibles, especially digital technologies".[16] Digitalization could boost productivity if the issues of skills gaps, digital divide and secure cross-border data flows can be addressed satisfactorily.

The IMF further highlights that investment in intangible capital has risen significantly in the last 25 years.[17] In some advanced economies, the value of investment in intangible capital has reached more than 10 percent of value added. Investment in intangible capital is associated with higher labor productivity: a 10 percent increase in intangible investment is associated with around a 4½ percent increase in productivity, while a similar increase in tangible investment is associated with a 3½ percent rise in productivity.[18]

Importantly, productivity growth that comes with digitalization is not automatic and persistent. As hinted by the term 'disruptive technology', the benefits of digitalization can only be realized at a wider scale if governments and businesses manage to resolve the productivity paradox or slowdown by overcoming issues such as adoption barriers, time-consuming transformations and transition costs.[19] A productivity paradox may result from the lack of technological diffusion: frontier firms' productivity is increasing while non-frontier firms' is stagnating. The

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[12] The Internet of Things (IoT) and other technologies, such as cloud computing and artificial intelligence, are driving the 4th Industrial Revolution (Ménière et al., 2017).
[13] Ménière, Yann & Rudyk, Ilja & Valdés, Javier. (2017).
[14] Varian, H. R. (2001).
[15] Remes, J., Mischke J., & Krishnan, M. (2018).
[16] IMF (2021, June).
[17] Intangible capital assets cover (i) brand, organizational capital, and training ("economic competencies"); (ii) research and development, design, artistic originals, mineral exploration, and financial innovation ("innovative property"); and (iii) software and databases ("computerized information," including digital technologies). (IMF, 2021)
[18] IMF (2021, June).
[19] Remes, J., Mischke J., & Krishnan, M. (2018).

lack of technological diffusion is also caused by network effects, policy uncertainty, and skills gaps, making it risky and expensive for firms to adapt to new technologies.[20]

There are three key potential factors that may start a productivity boom: the proliferation of technological advances, the compressed timeframe caused by the COVID-19 pandemic, and a full capacity economy (which can be characterized by low unemployment).[21] In this regard, strengthening efforts in the implementation of the APEC Connectivity Blueprint will allow economies to grasp innovative and productive opportunities from digital connectivity to support global economic recovery. The case studies that have been submitted by APEC members for this report provide avenues to discuss policy experiences and best practices, identify gaps in digital connectivity, and offer forward-looking policy recommendations.

Chapter 2 of this report describes recent trends in enhancing digital connectivity, presenting a number of best practices as well as discussing challenges in each of the three pillars of physical, institutional, and people-to-people connectivity. Strengthening efforts in the implementation of the APEC Connectivity Blueprint in these areas will allow economies to reap the greatest possible benefits provided by the digital economy. Chapter 3 summarizes the eight case studies received from four APEC members that describe initiatives to advance digital connectivity in the region and includes an analysis of some of the insights gleaned from the case studies.

Also, discussed in Chapter 3 are four main challenges in digital connectivity currently facing the region: 1) reducing the digital divide; 2) improving interoperability of digital systems and ensuring data security; 3) fostering greater regulatory cooperation to support the digital economy; and 4) maximizing digital dividends and spillover benefits. Managing and recovering from the COVID-19 pandemic has brought new urgency to these challenges and requires effective responses to ensure that growth, particularly in the digital economy, is both inclusive and sustainable. Policy recommendations to promote greater digital connectivity in the region and progress towards achievement of the goals of the APEC Connectivity Blueprint are included in Chapter 4.

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[20] APEC Policy Support Unit (2018, November).
[21] Brynjolfsson, E., & Petropoulos, G. (2021, June 10).

2.   LITERATURE REVIEW

The digital economy has grown exponentially in recent years, at roughly two and half times the rate of global GDP growth over the past fifteen years.[22] Businesses are making ever greater investments in their digital capacity and consumers are spending more and more of their time and money on digital platforms. Notably, the market size of 11 frontier technologies reached USD 350 billion in 2018 and is expected to reach USD 3.2 trillion in 2025 (Table 2.1). Governments have attempted to keep pace with these trends through new digital and data policies.

Table 2.1. Market size estimates of Frontier Technologies, USD billions

Frontier technology	2018	2025
IoT	130	1,500
Drones	69	141
Solar PV	54	344
Big Data	32	157
Robotics	32	499
AI	16	191
3D Printing	10	44
Gene Editing	3.7	10
Nanotechnology	1	2
Blockchain	0.7	61
5G	0.6	277
Total	350	3,226

Source: UNCTAD (2021). Technology and Innovation Report 2021.

Although there is no standardized definition, IMF (2018) pointed out the following characteristics for the digital economy: (i) online platforms and economic activities originating from such platforms and (ii) all activities that utilize digitized data.[23] The G20 Digital Economy Task Force recently proposed the following definition: "The Digital Economy incorporates all economic activity reliant on, or significantly enhanced by the use of digital inputs, including digital technologies, digital infrastructure, digital services and data. It refers to all producers and consumers, including government, that are utilising these digital inputs". This definition encompasses a wide range of activities, including digitally-enabled transactions of trade in goods and services (that can be either digitally or physically delivered), the transmission of data across borders[24], as well as services that enable smart manufacturing.

This chapter discusses the key trends, best practices, and remaining challenges in each of these three pillars, particularly as to how digital economy can be better facilitated and supported.

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[22] Huawei and Oxford Economics. (2017).

[23] https://www.elibrary.imf.org/view/journals/007/2018/016/article-A001-en.xml. APEC Digital Economy Steering Group includes a similar definition on their website: https://www.apec.org/Groups/Committee-on-Trade-and-Investment/Digital-Economy-Steering-Group

[24] Digital trade—OECD. (n.d.). Retrieved November 19, 2021, from https://www.oecd.org/trade/topics/digital-trade/

Each part of a digital economy needs access to labor that can create and build a digital space through physical infrastructure and operate within it. Meanwhile, regulations must enable secure digital interactions between parties based in different physical locations. The greatest gains are possible when these elements operate under harmonized regulations across borders so that they can connect with ease. Promoting such interoperability between systems remains a priority for future regulatory efforts to manage digital spaces across economies.

The digital economy also brings about a number of policy issues that need to be addressed in order for economies to reap the maximum potential benefits. Labor, whether accessed digitally across borders or found in industries operating within the digital economy (such as platform workers), raises questions about labor rights within the digital space. In addition, the data exchanges that comprise digital transactions raise concerns about data security and privacy. The COVID-19 pandemic has accelerated the transition to more digitally-based activities for many in the region, such as increased digital delivery of services, adding greater urgency to address these issues.

2.1 PHYSICAL CONNECTIVITY

To improve the physical infrastructure and support the digital economy, efforts range from ensuring access to a stable Internet connection to incorporating advanced technologies into screenings by customs agencies. Improving physical connectivity is essential for increasing trade among APEC members as more expeditious processes and more advanced technologies can increase the capacity for trade throughout the region. Pursuing policies in this area has the potential to create new investment opportunities in the region, such as funding necessary infrastructure upgrades and new business opportunities due to more digitally adept trade.

APEC has identified four elements of physical connectivity that member economies should strive to improve under its Connectivity Blueprint. These objectives are: 1) Expand trade routes and corridors and strengthen regional quality transportation networks; 2) Advance cross-border energy networks and interconnections; 3) Achieve universal and high-speed broadband access; and 4) Develop and improve well-designed, sustainable, and resilient infrastructure by implementing, at the outset, a multi-year plan on infrastructure development and investment.[25] Each of these elements reflects the digital economy's need for a strong physical base. Research conducted over the past year highlights certain key priorities for policymakers in advancing these objectives.

2.1.1 Key trends

Digital goods and services are tethered to a physical base such that a certain set of base infrastructure capabilities are needed to access the digital economy. For instance, individuals and organizations need access to electricity and Internet bandwidth in sufficient quantity and quality to support digital economic activities[26], such as teleconferencing or selling goods on

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[25] APEC Policy Support Unit (PSU). (2014, November).
[26] Digital economy using almost 10% of the world's electricity. (2013). https://www.edie.net/news/6/Digital-economy-using-almost-10-of-the-worlds-electricity/25134/

online platforms.[27] In addition, people need access to the hardware and software that go along with digital activities.[28]

When access to this physical infrastructure is limited, the divide between digitally and non-digitally adept economies deepens.[29] Limited connectivity within an economy's borders also tends to have an uneven distributive effect: lower income or rural communities, as well as smaller firms, face greater barriers to digital economic participation than their wealthier, urban, or larger counterparts.[30] Policymakers should avoid exacerbating these disparities through the application of excessive taxes or fees on the products and services enabling online access, such as computers and Internet service providers. These dynamics have been highlighted in several case studies of emerging digital sectors.[31]

Creating high-functioning physical infrastructure and robust digital connections across economies is a top priority to improve digital connectivity around the APEC region. Technology for trade connects existing economic patterns, trade routes and procedures, and the digital economy into one symbiotic economic system.[32] Emerging technologies improve the trade process by integrating digital technology into common business practices such as AI-enabled supply chains that facilitate faster and more secure processing of goods across borders or within a supply chain.[33] These applications include real-time shipping monitoring via geolocation and satellite tracking; the integration of IT solutions that help to facilitate business compliance with regulatory requirements to process customs declarations speedily and securely; and the ability to complete enhanced screenings without unpacking shipping containers or offloading trucks and railcars.[34] Such technologies can both expedite the order-to-delivery process and enhance regulatory and security compliance at points of transit.

2.1.2   Best practices

Recent successful initiatives involve infrastructure development with an eye on being able to adapt to the economy of the future through integrating digital innovation into public works. Efforts (such as Smart Cities) merge public and private sector approaches to data usage, while simultaneously adapting infrastructure to the digital economy. Public-private partnerships (PPPs)[35] are being structured with greater flexibility to increase the attractiveness of these projects to investors, while governments are filling the gaps of small-scale infrastructure needs. Economies are also pursuing stronger supply chain visibility and digitalization for their trade infrastructure, such as Single Window (SW) and port facilities.

Successful PPPs have arisen in both the financing and design of digital infrastructure projects.[36] While governments can supply funds at a lower cost, the buy-in from private partners can

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[27] *Connecting for Inclusion: Broadband Access for All* (World Bank Brief) and OECD (2021, February 3).
[28] Pursel, B. (n.d.).
[29] *Connecting for Inclusion: Broadband Access for All* (World Bank Brief) and Shenglin, B., et. al. (2018, January 15).
[30] Huntzinger, C., et al. (2020).
[31] Ibid.
[32] World Economic Forum. (2020).
[33] Coombe, J. (2018).
[34] World Economic Forum (2020); Elyan, V., et al. (2005); Reed, W. A. (2011); Molder, C., et al. (2009).
[35] One definition of PPP as stated in the APEC Guidebook on Quality of Infrastructure Development and Investment is "a modality of infrastructure project which utilizes various capacities of the private sector". See APEC Committee on Trade and Investment (CTI). (2018, November).
[36] Rios, J. M. (2019, March 14-15).

positively affect the development and sustainability of the projects as well as better equip them to function in a digitally enabled economy. Examples include Japan's Smart Cities initiatives, which aims to use new technologies to help solve various urban issues (e.g., over-crowding) and constraints on public services (e.g., healthcare) through the creation of partnerships to develop integrated solutions across various stakeholders.[37] Transforming a city into a smart city can lead to the emergence of numerous smart industries, such as autonomous vehicles, smart grids, and smart tourism.[38] Thus, the city will act as a platform for digital transformation.[39]

Developing infrastructure projects to take into account the needs of digital enterprises can best be implemented by involving private firms in the design process. For instance, smart cities utilize sophisticated data collection and analysis to better suit the needs of residents through enhanced traffic and resource management. The data generated by these projects is of immense value to private firms. Partnerships between government and private firms can therefore help to design infrastructure to be of the greatest use, while the potential for access to data and consumers can attract more private contributions to PPPs.[40] For example, digital infrastructure such as Narrow Band-Internet of Things (NB-IoT), Wi-Fi, and 5G service have been adopted to develop Phuket Smart Tourism in Thailand to provide safety and convenience to residents and tourists. As a result of using this digital infrastructure, a value-based digital economy will be built so that entrepreneurs and enterprises can use big data to improve their commercial operations and to build new services. PPP arrangements are expected to fund the initial capital expenditures of USD 14 million for Phuket Smart Tourism.[41]

Additionally, leveraging private sector input into the design of this type of infrastructure can raise its quality and usage, something emphasized in the APEC Quality Infrastructure Framework, as private firms are often on the cutting edge of digital innovation.[42] Japan has experimented with several different constructions of smart cities and found private companies have sophisticated insights into consumer usage that can make the designs more durable and accessible. Since many of the leading firms in the digital space may be headquartered in another economy than the one pursuing infrastructure investment, these PPPs can also provide an attractive entry point for foreign direct investment.[43]

However, it should be emphasized that a viable smart city needs a clear and practical vision that is aligned with the needs and desires of its residents. Smart city initiatives may fail if the public is not engaged in the process and if too much emphasis is placed on technology[44]. There is also much potential for applying the Smart Cities Model to trade ports. Functioning much like Smart Cities, Smart Ports automatically manage the transit and permitting of trade through digital platforms.[45] One of the most appealing offerings of Smart Ports is the streamlining of the trade process, not just for the sake of speed, but also for the potential environmental benefits of more efficient transit. To a certain extent, such ports are already managing trade around the

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[37] Sakane, N. (2019, March 14-15).
[38] APEC SCE. (2021).
[39] Telefonica. (n.d.). The City as a Platform for Digital Transformation. Retrieved October 7, 2021.
[40] Ibid. ; Woetzel, J., Lin, D., Sridhar, M., & Yap, S. (2018, July).
[41] APEC SCE. (2021).
[42] APEC Committee on Trade and Investment. (2014).
[43] PwC and DUBAI FDI. (2016, January).
[44] Woetzel, J., Lin, D., Sridhar, M., & Yap, S. (2018, July).
[45] UNESCAP. (2021, February).

world through tech-enhanced monitoring and logistics support at some of the world's busiest seaports.[46]

Building a port capable of processing trade expeditiously – and that also makes use of the latest technology for enhanced security and rapid clearances – requires significant feedback from users. Incorporating logistics providers and shippers into these projects at the design stage can enhance their usability as well as defray government costs. Strengthening PPPs is one way that policymakers can build necessary digital economy infrastructure with greater cost-sharing and stakeholder participation in project design.

In some cases, the government must step in to provide a base of operations for smaller firms since micro, small and medium sized enterprises (MSMEs) do not often attract dedicated PPP support for infrastructure.[47] For example, China has taken action to address the particular challenges faced by MSMEs in accessing digital infrastructure. China has expanded cross-border e-commerce pilot zones to handle customs and processing for firms without the scale to do so in-house. China has also encouraged the building of overseas warehouses by Chinese businesses, thereby setting up a physical presence that can help to support greater digital activities.[48] The establishment of such systems can allow MSMEs to grow to the point where they have access to privately-funded infrastructure.

The role of PPPs in supporting innovation through investment in the digital economy is particularly important and should be reflected in laws governing PPPs.[49] Considerations like climate change or the COVID-19 pandemic – or even shortages in physical components like semiconductors – collectively present a set of challenges in the development of PPP-funded projects. Few companies will want to invest in large-scale infrastructure if they risk breach of contract due to circumstances beyond their control. Therefore, incorporating greater flexibility, transparency, and standards in PPP projects to both deal with unforeseen circumstances and facilitate relevant private sector innovations can be effective in attracting more investment and give private actors greater confidence in project feasibility.[50]

Technology for trade also plays an important role in facilitating trade and promoting increased digital connectivity.[51] Increased digitalization of customs clearance through better integration of the tech for trade discussed earlier can allow importers and exporters to clear customs through a single interaction with an economy's bureaucracy, thereby enhancing the transparency and productivity of trade infrastructure. By centralizing data collection and processing through a SW system, such as New Zealand's Trade Single Window (TSW), filing declarations, completing health and safety certifications, and receiving permits can be handled in one place. Data sharing between agencies within the SW system can also improve customs compliance by more easily identifying red flags.[52] Future integration of these technologies with trade infrastructure and increased ease of data sharing between checkpoints can aid in establishing 'end-to-end visibility' in supply chains, thereby further improving trade

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[46] Ibid.

[47] Chao, J., Toro, A. M. (2017, September 7); UNCTAD (2013, February).

[48] Keju, W. (2021, June 22); Xinxin, X., & Xiang, J. (2021, March 30); Wei, X. (2021, July 21); Dechen, K. (2021).

[49] Paul, C. (2020, September 24).

[50] Ibid.; World Bank (2021, October 25).

[51] New Zealand Customs Service (2020); WCO (2013).

[52] Vives, L., Bayhaqi, A., & Singh, S. K. (2018).

processing times. Efforts to create this sort of connectivity in a coordinated manner across the region are still in their infancy.

2.1.3 Challenges

The best practices discussed above suggest that there are gains ahead in pursuing greater digital connectivity throughout the APEC region. However, several challenges remain. For instance, private firm involvement in sensitive infrastructure design or data intensive projects such as smart cities give rise to greater privacy concerns. PPPs in the digital economy could give private firms increased access to personal data about citizens without necessarily obtaining their consent. These risks must be carefully managed by the implementing governments. Additionally, the appropriateness and approaches of sharing such data between economies remains an issue. Here, APEC's Cross-Border Privacy Rules system can offer guidance as to how data can be safely shared in a system that promotes cross-border regulatory compliance and addresses privacy concerns through enforceable standards.[53]

The availability of financing for infrastructure investments also remains constrained, delaying or preventing the development of these projects. Infrastructure projects tend to be debt financed at around 70-80% and the financial complexity of digital infrastructure can be relatively high.[54] Governments are the predominant source of funding for infrastructure projects in many APEC economies. Roughly only less than 5% of infrastructure spending in the APEC region comes from the private sector.[55] Widely sharing the burden of financing as well as making the investment climate more attractive is a top priority of APEC's Investment Facilitation Action Plan.[56] PPP approaches discussed earlier can help achieve these goals in addition to improving project quality.

Trade facilitation facilities such as SW systems also face challenges in order to maximize the benefits from greater digital connectivity. Interoperability is a complex, dynamic concept with a wide spectrum of possibilities. For example, there are significant gaps in compatibility between different types of technologies that are in place to manage these systems, which may limit the interoperability of SW systems across the APEC region. APEC economies should endeavor to: (i) develop actions or solutions that foster trust and a secure environment through ensuring proper laws, policies and procedures regarding security, data privacy and risk response are harmonized; and (ii) enable solutions that build or instill trust through application of the latest security technology and controls or authentication.[57]

Connectivity challenges and policies to overcome them do not exist solely in the physical realm. Institutional connectivity issues are also present and the way in which APEC economies address these issues will influence the design of the physical infrastructure that supports the digital economy. Additionally, many of these physical infrastructure projects will rely on skilled labor in their design and execution, which may be influenced by the movement of workers in the region.

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[53] https://www.apec.org/about-us/about-apec/fact-sheets/what-is-the-cross-border-privacy-rules-system
[54] Ng, K. S. (n.d.).
[55] Calculation is based from 2019 data taken from: https://infracompass.gihub.org/ (for 17 APEC economies).
[56] Asia Pacific Economic Cooperation. (2009).
[57] Vives, L., Bayhaqi, A., & Singh, S. K. (2018).

2.2   INSTITUTIONAL CONNECTIVITY

In order to facilitate flows of goods and services across borders, including those that are digitally enabled, APEC economies should achieve a certain level of institutional connectedness. Questions about everything from where a customs border lies to how to legally transfer data between economies should be resolved. Establishing regulatory cooperation, which does not necessarily entail identical regulations across economies and could include interoperability, will aid economies in achieving the promised benefits of the digital age. Policymakers will want to establish best practices for the treatment of digital data as well as their approach to governing digital activities, considering both public and private interests.

Presently, several approaches to regulating these activities exist across the APEC region. These approaches either contradict one another or require businesses to spend time and money to translate their digital practices between different regulatory apparatuses. This interoperability challenge, in addition to different approaches to the treatment of data within economies' borders, are some of the most important hurdles posed by the digital economy. Casalini et al. (2021) found that there is a 68% overlap in regulatory provisions concerning privacy and personal data protection among APEC member economies[58]. Such institutional considerations require serious attention from policymakers at the multilateral level.

Acknowledging the manifold challenges in this area, APEC's Connectivity Blueprint identifies several objectives for institutional connectivity: 1) Advance logistics and transport facilitation; 2) Enhance regulatory coherence and cooperation and strengthen the implementation of good regulatory practices; 3) Advance APEC's agenda on structural reforms; 4) Modernize trade-related as well as customs and border agencies, including by progressing the development of Single Windows; 5) Promote cross-border financial cooperation; 6) Expand the application of a safe and trusted ICT and e-commerce environment, especially in the area of electronic documents exchange, including electronic means of authentication and improved security methods.[59]

2.2.1   Key trends

Data policies are the first order of business in institutional approaches to the digital economy. Without standards and conformance procedures for the usage and exchange of cross-border data flows, the digital economy will not function optimally. Recent literature on the topic, as well as the policies of individual economies, reveals that data policies can either be facilitative or restrictive.[60] Limiting barriers on the transfer, flow, or storage of data is a facilitative approach to develop the digital economy and is akin to maintaining low to zero tariffs and few product standards for physical goods trade. At the other end of the spectrum, restrictive policies limit all sharing of data beyond customs borders, place local storage requirements on all domestically generated data, or even limit the ability to offer digital services to locally based businesses only. Governments must therefore strike a balance between enabling business activities and protecting personal data.

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[58] Casalini, F., J. López González and T. Nemoto (2021).
[59] APEC Policy Support Unit (PSU). (2014, November).
[60] World Economic Forum. (2020, May).

Institutional lag presents another key issue in determining the best approach to regulation in the digital era. As regulation of the digital economy often lags innovation, many of the most cutting-edge businesses offer digital goods and services to consumers before the creation of a regulatory environment.[61] Businesses operating in this space often operate in a legal grey area. Since businesses are likely to continue to innovate faster than governments regulate, taking a risk-based approach to the regulatory environment is important. While the type of policy chosen by an economy is undoubtedly important, lack of policy on the exchange of data or on data usage mires firms, domestic and foreign, in uncertainty, constraining the growth of the digital economy.

Regardless of the strategy a government chooses to balance data privacy and security along with business needs, the benefits from greater digital engagement are large. Researchers have found a high correlation between an economy's Networked Readiness Index (NRI) score and its Global Competitiveness Index (GCI) score. The NRI measures an economy's readiness for digital activities using data on indicators such as ICT investment, digital literacy among its population, and usage of online portals, while the GCI measures an economy's relative competitiveness in the global economy based on data on its regulatory environment, infrastructure efficiency, and workforce skills. Literature on the relationship between these measures suggests that higher Internet preparedness creates a more competitive economy.[62] Logically, as more of the global economy moves online, this relationship will only intensify.

Recent trade agreements have attempted to balance the various approaches to data privacy and security, while encouraging digital engagement.[63] Previous approaches have largely been built on extending frameworks developed for physical trade to the digital economy. However, there is growing acknowledgement that the digital economy will require novel rules. Policies are attempting to catch up to business reality by dealing with the complexity of applications for new and emerging technologies and managing the integration of traditional support services, like financing and logistics, into the digital economy.[64]

Agreements like the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), Regional Comprehensive Economic Partnership (RCEP), United States-Mexico-Canada Agreement (USMCA), and Digital Economy Partnership Agreement (DEPA) commit to broad principles of digital economic freedom, such as imposing no customs duties on electronic transmissions and digital products[65] and enshrining WTO principles of nondiscrimination for the digital space.[66] Each agreement also promotes liberal data flows by discouraging data localization requirements. The enforcement mechanisms differ and each recognizes certain key, but different, exceptions to these rules. CPTPP and USMCA both take a facilitative stance towards cross-border data flows,[67] recognizing the importance of compliance with measures to protect personal information and ensuring that any restrictions on

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[61] Bloomberg Law. (2019, September 27).

[62] Vega, D.M. (2013).

[63] Holleyman, R. (2021, January 9).

[64] Congressional Research Service. (2019, May 21).

[65] Based on the TAPED (Trade Agreements Provisions on Electronic-commerce and Data) dataset.

[66] Lester, S. (2021, April 14).

[67] Yin, J. (2018, October 5).

cross-border flows of personal information are necessary and proportionate to the risks presented.[68]

USMCA facilitates a principle of open access government data[69] and free financial data flows[70] on the premise of ensuring financial authorities' regulatory and supervisory rights, while not restricting the right to adopt necessary measures to protect personal data, personal privacy, and the confidentiality of individual records and accounts. CPTPP and USMCA also have provisions on cybersecurity management collaboration[71] and on prohibitions that require the transfer of source code as a condition for import (thus treating source code as a trade secret and barring forced technology transfers).[72] DEPA also prohibits forced transfers of technology[73] and is structured as a collection of "lift-out" modules, introducing a more flexible approach.[74]

Turning to institutional connectivity for trade support services, the digital economy poses a challenge to traditional trade financing and financial inclusion, even as digital finance expands opportunities for the economy as a whole. Access to financial services is not universal and the gap is possibly even wider in the digital world. Not only do small firms often lack the financial resources to establish digital payment systems, but they also may be unable to comply with complicated requirements for cross-border payments, a particular challenge for e-commerce in the Asia Pacific region.[75] Additionally, working across the different digital systems discussed earlier creates an impossibly high burden for some small firms due to the need to maintain several different compliance regimes.

Leadership in emerging technology can, and often does, generate outsized profits, dominant market share, and control over standards setting.[76] As a result, some counterintuitive incentives exist for governments when developing effective policies for the digital economy. For instance, banning technology transfer through restricting digital imports or exports can generate outsized gains for a particular locale because of the unique competitive dynamics in technology and the ability for firms to capture monopoly rents.[77] For example, an export ban on digital inputs by a technological leader may prevent technology diffusion and hinder potential competitors from entering the market[78].

Collectively, the lack of interoperability in data policies reinforces already existing borders. Additionally, the unique economics of the digital economy can sometimes create more incentives to maintain those borders in order for domestic firms to achieve economies of scale. However, without harmonized standards for data treatment, the global digital economy could splinter, while failure to address restrictions in digital services could prevent efficiency gains.[79]

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[68] Yin, J. (2018, October 5) and based on the TAPED dataset (column 1.24.5).
[69] New, J. (2018, October 5).
[70] See chapter 17 on financial services in the USMCA agreement.
[71] Suominen, K. (2021, August 9).
[72] https://ustr.gov/sites/default/files/TPP-Promoting-Digital-Trade-Fact-Sheet.pdf and based on the TAPED dataset (column 1.33).
[73] Armstrong, S., Sta Maria, R., Watanabe, T. (2021, April 11).
[74] G. Ramasubramanian (2020, July 10).
[75] Elms, D. (2021, April 28).
[76] Garcia-Macia, D., Goyal, R. (2021).
[77] Ibid.
[78] Garcia-Macia, D., & Goyal, R. (2021, November 20).
[79] Garcia-Macia, D., & Goyal, R. (2021, March).

If these policy challenges are not addressed, then the full anticipated economic gains of the digital economy may not be realized.

2.2.2 Best practices

Presently, APEC economies use a variety of regulatory approaches, particularly towards the provision of digital services. The OECD regularly measures trade restrictions on digital services, scoring policies from the most open and facilitative to the most closed and restrictive. Within Asia, scores span almost the full gamut, with many regulations falling on the more restrictive end of the scale.[80] The majority of these restrictions relate to data policies, including limits on data transfer, enhanced security for data storage, and requiring local treatment or analysis of the data. Digital services are concentrated in industries that handle some of the most sensitive personal data generated, such as financial and health data, and therefore protecting consumer information requires improved regulation.

The business impact of restrictive data policies is felt keenly by smaller enterprises. The OECD average level of services trade restrictiveness is equivalent to an estimated additional tariff of up to 14 percentage points on the exports of SMEs, relative to large firms.[81] For instance, complying with data localization policies that require data to be stored and processed within a particular economy's physical boundaries is expensive and can be proportionally high for smaller firms without the scale to defray these costs. In fact, a 2015 study found that computing costs are 30-60% higher for businesses that are restricted from transferring data abroad.[82] Furthermore, data localization measures are on the rise, increasingly raising costs for firms.[83] However, governments are pursuing domestic security objectives through some of these new restrictions, such as preventing sensitive personal information from being transferred to less secure locations. Effectively balancing the economic needs of small businesses and the data security of personal information forces governments to carefully tailor localization requirements and accept some tradeoffs.

The range of digital policies across economies illustrates the tough choices that policymakers must make between data protection and trade facilitation. Some economies are experimenting with workarounds to privacy concerns while supporting the digital economy and others are focused on developing flexible policy approaches. For example, Canada's Digital Charter, launched in 2019, will guide the modernization of Canada's marketplace frameworks in a manner that encourages trust in the digital marketplace, and enables organizations to harness the power of digital and data transformation. A set of actions was announced to implement the Charter's principles, highlighted by proposals to modernize Canada's privacy framework, the Personal Information Protection and Electronic Documents Act (PIPEDA). The modernization of this Act, which governs the use of personal information by private entities, will support continued trust and adoption of innovative technologies and business models. Canada's Digital Charter principles also align with key policy themes and challenges that have been identified in other fora, namely: access to digital infrastructures and data; effective use of emerging

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[80] Elms, D. (2020, December 23).
[81] OECD (2017, June 8).
[82] O'Connor, Brendan. (2015, June 24).
[83] Wu, E. (2021, July).

technologies and data; enabling innovation; inclusive job creation; prosperity for all; enhancing trust in the digital economy; supporting open business environments and interoperable regimes.

Approaches for improving institutional connectivity in the digital era include collaboration within multilateral bodies, greater harmonization of standards, and the use of new technologies. Collaboration within international or regional organizations may facilitate a discussion of harmonized approaches to cross-border data governance[84]. One of the top priorities of APEC's Connectivity Blueprint is to promote collaboration among APEC economies. Proactive solutions to data governance range from international regulatory bodies to model trade agreement provisions (such as DEPA) to a unilateral openness approach. [85] As discussed earlier, the tendency for digital innovation to evolve more rapidly than regulation presents a particular challenge. Proactive collaboration on digital issues can simultaneously create interoperable systems, while also averting regulatory shortfalls.

Due to the dynamic nature of the digital economy, agreed upon (i.e., harmonized) standards and conformance practices are as important as unified systems or technology. While an integrated economic alliance requires technological compatibility and digital coordination, a functioning global digital economy also needs common (living) standards on which to operate. Use of and conformance to those standards is vital to ensure fair competition, confidence and consistency in cross-border data flows. As long as consumers and businesses have clear rules, they will create management tools and learn how to operate within those structures. In this regard, collaboration across economies to unify data standards is important[86]. For example, the Eurasian Economic Union has made cross-border exchange and sharing of data (within the union) a top priority, acknowledging that doing so is essential for the digital economy to function across economies.[87]

New technologies, such as blockchain, have the potential to allow for greater institutional connectivity and reduce trade transaction times. While cryptocurrencies have limited present use in trade, the distributed ledger system underpinning them offers potential applications for trade, such as in supply chain visibility and document verification. Blockchain platforms could facilitate the effective functioning of "superconnectors" that virtually connect islands of digital networks, thus eliminating several stages of certification in a trade transaction and thereby accelerating the process considerably.[88] Recent experiments found that application of this technology could shorten trade transactions from settlement in five to ten days via conventional paper methods to under 24 hours using distributed ledger systems.[89] The utilization of such systems could increase global trade volumes by USD 1.1 trillion by 2026 from a 2018 base of USD 16 trillion. [90] However, integrating these systems does bring greater costs and sustainability concerns, including from the increased energy usage to run the systems.[91] Also, utilizing blockchain introduces new risks to trade financing due to its strict contract enforcement that limits flexibility in deliveries.

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[84] World Bank (2021).
[85] World Economic Forum. (2020, May).
[86] Global Challenges Foundation (2017).
[87] Russia (2021). Case Study: Strengthening internal markets in the framework of Eurasian Economic Union (EAEU).
[88] Superconnectors are trusted partied that serve as bridge among different networks of shippers, industry and trade business. (Ganesh, S. et al., 2018).
[89] Ganesh, S., Olsen, T., Kroeker, J., and Venkatraman, P. (2018, October 21).
[90] Ibid.
[91] Vota, W. (2019, February 27).

While many of the dynamics of the digital economy are unique, policymakers have dealt with similar challenges before. Utilizing best practices learned from those experiences, as well as allowing for innovation in the digital space, can support effective institutional connectivity. The policies highlighted above promote institutional connectivity in line with APEC's goals, such as securing cross-border data transfers through new technologies like blockchain or placing sensitive information in a third-party lock box; taking an adaptive approach to creating digital policies like in DEPA; and learning best practices from other industries in order to proactively adapt to security risks.

2.2.3   Challenges

Many of the challenges in institutional connectivity arise from a lack of policies rather than from specific policies themselves. The lack of data usage or digital policies creates confusion and slows trade. Domestic regulations often restrict cross-border movement of data, resulting in fragmented and sometimes contradictory rules. Many trade agreements contain commitments to the free flow of information across borders, but nonspecific language diminishes their usefulness.[92]

Regulatory cooperation presents manifold challenges in establishing an effective global system for the digital economy, encompassing everything from cross-border payments to data localization rules.[93] Conflicting regulations about what is permissible to do with data and how data must be treated prevents the interface of economies through trade, particularly in the financial realm where digital transactions often require the transfer of data from one economy to the other.

Additionally, how governments treat data created within or transferred through their borders remains an issue. Privacy concerns must be balanced with security concerns along with the information needed to maintain economic stability. Currently, an OECD commission is trying to establish best principles, but has yet to agree upon standards for government access to consumer generated data.[94] This lack of standards touches on a common theme, in which enterprises are constrained by the potential for stepping outside of boundaries they do not know exist.

Access to financial services, including trade finance, remains a challenge, especially for smaller firms. This issue was previously discussed, but merits consideration as a crucial problem since it sits at the intersection of several key challenges facing small businesses: financial access, digital access, competition, costs, and scale. Cross-border financial transaction times create high burdens for smaller firms. Delayed or slow processing of bank transfers, which are the current most prevalent method for settlement, can take several days, making cash flow management more difficult. A survey by the Asian Trade Centre found international electronic payments to be the largest bottleneck for services exporters.[95] Also, competitive dynamics in

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[92] Aaronson, S. (2021).
[93] *Digital Trade*. World Economic Forum. Retrieved: 22 November 2021.
[94] OECD. (2019, November 26).
[95] Elms, D. (2021, April 28).

which scale is the primary determinant of success can push small businesses out of digital platforms before they have a chance to succeed.[96]

The same scale challenge presents itself in digital security. The additional cost of securing data on consumer interactions, such as their payments, can be prohibitive for smaller firms.[97] In addition, some restrictions on digital activities effectively create a domestic monopoly on the provision of services. For example, if only local financial institutions are able to provide local financial services (and thus enjoy economies of scale), then it can result in constrained markets.

The digital economy in the APEC region continues to face many institutional challenges. Resolving the issues highlighted herein will determine the shape of the physical infrastructure needed to support the digital economy as well as the ways in which economic actors will interact in the digital economy. Importantly, institutional connectivity highlights the significance of making clear policy choices that allow for future adaption as the digital economy grows. While the digital economy presents new dynamics, several of its challenges (such as its usage of sensitive information) have been dealt with in other realms, namely the financial services industry. Several organizations point to the Financial Stability Board and cooperation between international financial institutions on managing financial risks in the post-GFC era as a model which could be duplicated for data and digital economy decisions around regulatory treatment, standards setting, and monitoring.[98] Australia's Consumer Data Right (CDR) system has also embraced a similar principle of an open banking regime.[99]

2.3   PEOPLE-TO-PEOPLE CONNECTIVITY

As with all other economic activities, people form the core of the digital economy. Consumers create the end demand for digital goods and services, using digital technologies to make purchases, work, and attain education. At each point in the digital economy supply chain, specialized labor is needed. Despite fears of labor replacement by increasing automation, by and large artificial intelligence and other technology-assisted labor strategies are instead changing the nature of work. At the same time, uneven access to the digital economy risks widening income and structural gaps.

Balancing these factors are key considerations for effective digital policy in 2021 and beyond. In keeping with the objectives of APEC's Connectivity Blueprint, people-focused policies also need to: 1) Advance work on cross-border education, science, technology and innovation, and services; and 2) Expand the facilitation of movement of tourists, business people, professionals and workers, including the movement of women and youth in these categories.[100] These objectives are complementary since the transit of people can facilitate innovation through the exchange of ideas. Recent advances in the practical applications of digital technology can further promote these goals as well as enable the digital economy to further increase the connectivity between people in the APEC region.

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[96] OECD. (2021, February 3).
[97] Ibid.
[98] World Economic Forum. (2020, May); Serena, J. M., Tissot, B., Doerr, S., Gambacorta, L. (2021, February).
[99] Charnley, B. (2020, December 21). The CDR: Why all eyes are on Australia. (2020, December 21). InnovationAus.
[100] Bayhaqi, A., Singh, S. K., Sangaraju, D., San Andres, E.A., & Choo, Q. K. (2020).

2.3.1 Key trends

The movement of tourists, business people, professionals and workers, including the movement of women and youth in these categories, is being facilitated by new technology and in some cases no longer requires physical relocation and interaction. Increased exchanges across borders through digital tools can foster innovation by making collaboration faster and easier. The human aspect of these exchanges faces several challenges, but strides are being made to foster greater personal connections within this area. Evidence from the past year highlights some of the rapid changes occurring in people-to-people connectivity.

Cross-border activities via digital tools (such as communication platforms) have risen in importance as the COVID-19 pandemic effectively halted the physical movement of people throughout much of the APEC region. Lockdowns, increased health risks from travel, and remote work arrangements curtailed in-person exchanges. To a certain extent, in-person working arrangements are unlikely to return to the level they were prior to the COVID-19 pandemic. As a result, future efforts to promote the transit of people are likely to focus on mitigating health risks and enabling remote or automated provision of services. Given this situation, several trends in virtual connectivity highlight the potential gains and drawbacks of an increasingly digital world.

The adjustment to remote work is unlikely to reverse, enabling more geographically diverse and less concentrated workforces, in addition to more specialized labor. The unexpected transition to remote work caused by the COVID-19 pandemic presented a live experiment in the applicability of virtual work arrangements. In some cases, workers are showing a preference for telework and companies are realizing the potential cost savings from no longer having to maintain office spaces.[101] Jobs which can be performed remotely disproportionately exist in professional services industries, meaning that increased specialization of these jobs is likely to continue.[102] If location is no longer the top requirement for these higher wage jobs, then clustering of these workers is likely to decline. Additionally, the ability to work anywhere will facilitate greater specialization of labor as firms will be able to subcontract specialized labor anywhere in the world with an Internet connection.[103]

An increasingly virtual labor market[104] that is less reliant on location carries additional implications for cross-border labor mobility. Some economies may have an easier time retaining talent within their borders, even if that specialized labor provides its services to a firm in another economy. Conversely, other economies may need to enact greater domestic protections on labor mobility if needed workers are able to virtually commute to cross-border jobs. These dynamics are likely to be highly localized in the sectors where teleworking is feasible[105], but governments are beginning to question how they will regulate virtual versus physical cross-border labor mobility.

From the consumer standpoint, increasingly geographically diverse workforces will mean a greater shift to digital delivery of services. Not only will consultations and reviews for business

[101] PriceWaterhouseCooper. (2021, January 12).
[102] Ibid.; Lund, S., Madgavkar, A., Manyika, J., & Smit, S. (2020, November 23).
[103] Malone, T.W., Laubacher, R., & Johns, T. (2011, July-August).
[104] Jain, S. (2021, April 29).
[105] OECD (2021, September 7).

move more online, other services, like education and training, will increasingly be delivered online. Education itself must also adapt to an increasingly digitalized world. This requires economies to seek greater knowledge sharing of educational practices and to integrate digital skills into curricula, thereby also contributing to a digitally literate workforce. Dedicated efforts from the education industry and from governments are underway in many APEC economies.[106]

Greater online education will have a major impact on universities with significant foreign student bodies and therefore on some economies, such as Australia, where a large share of services exports is comprised of foreign students. Within the APEC region, 1.4 million students crossed borders to receive tertiary education in 2017.[107] As more and more education services are available online, cross-border trade in education is likely to increase rapidly, while the number of students traveling to receive an education is unlikely to increase at the same pace.

Automated labor and service provisions by artificial intelligence (AI) is likely to replace some interactions that formerly were conducted person-to-person. The ability to limit disease spread through utilizing automated labor grew significantly more attractive as the COVID-19 pandemic progressed. Many businesses were already exploring automated options due to potential cost savings, skilled labor shortages, and increased efficiencies.[108] These tools are unlikely to fully replace the majority of workers, but will instead automate some routine processes. The integration of automation and usage of AI is likely to accelerate, however, which could displace some lower skilled workers.

Management of the movement of people across borders has changed during the COVID-19 pandemic, perhaps permanently. The global pandemic has altered the process of travel in two significant ways. First, more information is required to travel, such as tests for COVID-19 both pre- and post-travel and/or record of vaccination.[109] Second, governments and companies have had an increased incentive to reduce the level of contact between people during the travel process, such as at border crossing checkpoints.[110] The trend has been to increasingly make use of digital strategies to operationalize solutions to these problems. Digital technologies, such as digital visas and health records, are being used to share data between government officials and to help individuals transit across borders. Successful integration of these technologies can expedite travel. However, gaps in their usefulness, transferability, and accessibility remain.

2.3.2 Best practices

Adapting to these trends in people-to-people connectivity will require concerted regional effort by governments. Given the rise in remote work, labor policies within each economy will also increasingly affect other economies. In addition, the COVID-19 pandemic has reshaped cross-border travel. Although digital solutions exist for some of these challenges, they may come at a high cost to privacy and equality. Connecting people in the digital economy will also require greater efforts to bring populations online and to equip them with the necessary digital skills.

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[106] Korea. (2021). Case Study: *APEC School Leadership Program (ASLP): Cultivating School Leaders' Digital-Friendly Attitude, Catalyzing for Closing the Educational Gap Deepened by COVID-19*; China. (2021). Case Study: *Developing AI Competency, Enhancing Enterprise Competitiveness and Boosting AI Economy*.
[107] Bayhaqi, A., Singh, S. K., Sangaraju, D., San Andres, E.A., & Choo, Q. K. (2020).
[108] Karr, J., Loh, K., San Andres, E. A. (2020, June).
[109] Gilchrist, K. (2021, March 8).
[110] San Andres, E. A., Carranceja, J. C. O., Amry, M.A. (2021).

In addition to bringing more of the workforce into the digital economy, virtual services can enhance people-to-people connectivity, while the pandemic has further encouraged their adoption. For instance, alternative forms of tourism to physically crossing borders can have additional benefits beyond limiting health risks. Moving tourism online, such as virtual tours, can also encourage environmental sustainability by reducing carbon fuel usage and slowing the deterioration of historic and natural sites. Pilot programs implemented during the COVID-19 pandemic offered virtual tourists the ability to visit important cultural sites around the APEC region. Whether organized through a tour company or via free services like Google Earth, increased digital offerings can make travel more accessible to a wider range of people.[111] While virtual tourism is unlikely to be a substitute for physical tourism, greater utilization of this service can both encourage visitors to travel to new places and offer tourism opportunities to those without the means or ability to travel extensively.

Several economies have already explored different strategies for digitalizing the process of moving people across borders. The COVID-19 pandemic has added additional challenges to this undertaking, which some governments have used as an opportunity to add impetus to existing efforts to incorporate technology into transit procedures. Recognizing both health documents for travel and the treatment of data contained within will be important for interoperability in the post COVID-19 era. Understanding the potential health risks to and from tourists or other travelers is necessary for officials in any locale. However, the way health data is collected and reported, as well as the type of records kept, differs greatly across economies. Such differences limit cross-border understanding of health data and therefore also limit people's ability to travel. Maintaining an easy-to-understand format of health records is essential for travelers to cross borders in the COVID-19 era.[112]

Increasing digitalization of personal information naturally raises data security concerns, especially when it involves the health records that will be necessary for post-pandemic travel. Putting this sensitive information into online platforms and transferring it multiple times exposes highly personal data to greater security risks.[113] At the behest of governments, several firms have experimented with warehousing personal health data maintained locally rather than within travel documents themselves.[114] For example, a traveler submits their vaccination records and recent COVID-19 test results to a health authority, which analyzes that data and stores it for a pre-determined amount of time and then issues the traveler a health pass simply indicating whether or not they meet health requirements for travel. Such a system could provide assurance of personal data security while transiting borders and also allow travelers to retain some control of their data. Different formats of these systems are already being implemented in the United States to allow for a return to physical cross-border movement. In 2020, the APEC Business Advisory Council (ABAC) recommended the use of the APEC Business Travel Card (ABTC) "to assist in ensuring global health security," including the inclusion of biometric data that could enable cross-border travel.[115]

Creating a digitally adept workforce is another mounting priority to improve people-to-people connectivity. To advance cross-border collaboration on education and innovation, investments

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[111] Fitzgerald, R. (2020); *Temples of Angkor Wat*. (n.d.). Google. Retrieved November 28, 2021.
[112] UNWTO. (2020, May 28); and *Why vaccine passports are causing chaos* (2021, October 26). The Economist.
[113] *Building a Covid Travel Passport Is a Serious Tech Challenge.* (2021, March 24). Bloomberg.Com.
[114] Lee, N. T., Lai, S., & Skahill, E. (2021, June 28).
[115] ABAC (2020, July 1).

in raising digital literacy and in training for the digital economy are needed. Several initiatives to promote these types of investment have been proposed, with many arising from the private sector and tailored to meet specific industry needs. [116] The APEC Human Resources Development Working Group (HRDWG) has also pursued a digital skills education agenda through its Roadmap to Closing the Digital Skills Gap[117] by 2030 together with programmatic support from regional governments and companies.[118] Additionally, according to APEC Policy Support Unit (PSU) research on the future of work, upskilling and retraining should focus on 1) credentialing, lifelong learning, and online/distance learning and 2) specific segments of the labor force, including older workers, younger workers, and women workers.[119]

2.3.3   Challenges

Enhancing connectivity between people presents a challenge for both government and industry, especially in the post COVID-19 society. Policymakers have several key considerations when implementing policies in order to meet the objective of facilitating greater movement of people. These factors include access to the digital economy at a basic level, data privacy and cybersecurity concerns, skills gaps, and different standards for worker treatment across economies. To succeed, many of these initiatives will also require concomitant progress on the physical and institutional connectivity fronts.

The digital divide at the individual level is an obstacle for many to reach their full economic potential. While the online population is growing, there is still a significant portion of the global population left without access. Roughly 60% of the world's population is online, with around 300 million new Internet users[120]. Southeast Asia alone has 400 million users who connect primarily through their phones.[121] Even so, there are still 3.4 billion people who do not use mobile Internet despite living in areas with mobile broadband connections[122]. Locale makes a big difference in the digital divide. China and the United States are home to firms that make up 90% of the market capitalization of the 70 largest digital platforms, meaning people within those economies often have more access to digital goods and services.[123]

While overcoming gaps in physical connectivity has an obvious role to play in connecting people to the digital economy, additional barriers to entry in the forms of skills, education, and opportunities also exist.[124] Labor in developing economies often demonstrates gaps in digital skills, setting up another hurdle to participation in the digital economy.[125] Digital inclusion is essential for equitable inclusion in economic growth as digital platforms can allow entry into

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[116] World Economic Forum and Boston Consulting Group (2020, July).

[117] In the APEC HRDWG report, digital skills are classified as: basic tech skills (digital literacy skills to access email and basic applications); applied tech skills (skills to use enterprise software and platforms); software & hardware tech skills (skills to build software and hardware); disruptive tech skills (skills for designing and developing new technologies such as artificial intelligence).

[118] APEC Human Resources Development Working Group. (2020, December); China. (2021). Case Study: *Developing AI Competency, Enhancing Enterprise Competitiveness and Boosting AI Economy*; Korea. (2021). Case Study: *2020 APEC e-Learning Training Program (AeLT)*.

[119] Karr, J., Loh, K., San Andres, E. A. (2020, June).

[120] Kemp, S. (2021, April 21).

[121] Elms, D. (2021, April 28); Davis, S., et al. (2020, November).

[122] GSMA (2020).

[123] Huntzinger, C., Kvačková, K., & Mauer, D. (2020, November).

[124] Chernoff, A., & Warman, C. (2021, February 2).

[125] APEC Human Resources Development Working Group. (2020, December).

the formal economic sector.[126] The educational approach to closing these gaps should start early by teaching digital skills in primary and secondary education in order to universalize basic digital skills and literacy.[127] A study by PwC and UNICEF (2020) highlights that to cross the digital divide and thrive in the digital economy, young people need to have four stepping stones: connectivity, access, digital literacy and work-ready skills[128].

As more work moves increasingly online and remote work opportunities grow, those without consistent online access will fall further behind. As a result, income disparities are likely to rise as the global economy becomes increasingly digital. The shift to remote work also makes the issue of worker rights increasingly complex. The trend towards subcontracting across borders largely leaves the digital labor market unregulated and workers with fewer protections. Workers offering their services to employers or clients across borders face an increasingly complicated regime of laws governing their treatment. This problem exists on all sides of the company-employee-client relationship as each must navigate an increasing number of employment regulations as services trade moves across more borders.

Finally, the connections between people in the APEC region will undoubtedly be shaped by the COVID-19 pandemic, which may permanently alter the way people move around the region. Digital health passes could exacerbate existing inequalities in access to healthcare, infrastructure, and economic opportunities. Given the investment and formal health records needed to establish a digital health passport and interoperable digital travel records system, these passes will likely only be available to a small set of well-off travelers. This could limit many in the APEC region from accessing cross-border work opportunities or migrating to other economies.

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[126] Digital Future Society (2019, December).
[127] Burns, T. and F. Gottschalk (eds.). (2019).
[128] UNICEF, PwC and Generation Unlimited. (2020, November).

3. APPROACHES TO DIGITAL CONNECTIVITY IN APEC

APEC economies have undertaken many actions to promote digital connectivity, especially in responding to the COVID-19 pandemic and supporting economic recovery. Over the past year, many APEC members have retooled approaches to adapt to the COVID-19 pandemic and integrated emerging technologies. While some economies have implemented best practices described in the previous chapter, others have experimented with new and innovative policy solutions to challenges discussed earlier, signaling a proactive approach by APEC members to facilitate greater digital connectivity. Nevertheless, key challenges remain in order to further improve digital connectivity throughout the region, namely, the increasing needs to reduce the digital divide, improve cross-border interoperability of digital systems and ensure data security, foster greater regulatory cooperation to support the digital economy, and maximizing digital dividends.

3.1 CASE STUDY SUBMISSIONS

The APEC Policy Support Unit (PSU) received eight case studies from four APEC members covering initiatives and programs that promote physical, institutional, and people-to-people connectivity. The submissions cover a wide range of topics, including Internet protocols, digital identification, data portability, skills building, e-learning strategies, and cross-border interoperability of systems. The case studies submitted by the APEC members are attached in the Appendix of this report. Each case study is summarized below, highlighting the relevant measures and the impact on connectivity.

3.1.1 Consumer Data Right (CDR) [Australia]

Consumer Data Right (CDR) is a regulatory framework for data portability designed to empower consumers to benefit from the data Australian businesses hold about them. The CDR enables both businesses and individuals to securely share data held about them with accredited and trusted third parties to derive benefits. It gives consumers more choice and makes it easier to switch products and services, driving competition and delivering savings to households and businesses. It is underpinned by strong data privacy and security features and encourages data-driven and consumer-centered tech innovation. The CDR is an economy-wide reform and is being implemented through a process of assessment and designation. It has been rolled out to key datasets in the banking and energy sectors with the telecommunications sector to follow. In future, there may be opportunities to develop interoperable data portability frameworks among APEC economies that can enhance trade by enabling data-driven tech companies to scale up across the region and allowing consumers to access products and services from other markets.

3.1.2 Digital Identity System [Australia]

Using the Australian Government's identity provider, myGovID, people can create a digital identity online and use it to access government services connected to the Government's Digital Identity System. For instance, it provides a way for people and businesses to log in to myGov, the primary portal to access Australian Government digital services. The Digital Identity System is already used by over 2.5 million individuals and almost 1.3 million businesses, transforming the way Australians and businesses interact with the government services they use every day. Australia is currently developing the capability for biometric verification in the

Digital Identity System, which will enable digital access to more services end-to-end. It is expected that this feature can save Australians up to 4 hours applying for services and up to 4 weeks waiting to prove their identity.

3.1.3 Large-Scale Deployment of Internet Protocol Version 6 (IPv6) [China]

Through collaborative efforts, China has helped to boost the large-scale deployment of Internet Protocol Version 6 (IPv6), which will significantly improve the carrying capacity and service level of the Internet. China's Tsinghua University, Huawei, China Telecom, China Mobile, and other institutions actively participated in the formulation of new technology standards relating to IPv6, thereby helping to ensure interoperability. By June 2021, the number of active IPv6 users in China had reached 533 million, accounting for 53.9% of all Internet users in China, and there were 1.6 billion users with an assigned IPv6 address. The three major telecom operators in China have already completed the end-to-end IPv6 transformation for LTE networks in 30 provinces across the economy and launched the IPv6 service bearer function. Through such innovation of network information technology, the rapid development of emerging technologies such as 4G/5G, cloud computing, big data, and artificial intelligence can be supported more efficiently.

3.1.4 Smart Customs, Smart Borders and Smart Connectivity [China]

In 2021, China launched the 'Smart Customs, Smart Borders and Smart Connectivity' (3S) initiative to facilitate greater adoption of innovative measures and application of new-generation technologies to improve customs control, governance, and cooperation. Efforts to put the initiative into action were strengthened and China Customs has now carried out 78 pilot projects across the economy. Three examples of the pilot projects are 1) 'Click & Clear' by Guangzhou Customs, which uses electronic data interchange and smart technology to create a one-stop system for the supervision of parcels coming to Guangdong Province from Hong Kong, China and Macau, China; 2) China-ASEAN SPS Cooperation Information Website, which provides one-stop SPS-related services, including regulation inquiry, notification, and risk information; and 3) Digital Border Information Connectivity Project, a connectivity platform that integrates data exchange and other functions, significantly improving the efficiency of cargo clearance between China and Singapore.

3.1.5 APMEN (Asia-Pacific Model E-Port Network) Visualization of Sea Freight Logistics and Digitalization of Air Freight Logistics [China]

This case study is comprised of two components: the Visualization of Sea Freight Logistics and the Digitalization of Air Freight Logistics through E-port. The Visualization of Sea Freight Logistics project was tasked with enhancing the transparency, integrity, and visibility of cross-border trade to address trade facilitation challenges and contribute to the implementation of the WTO Agreement through its promotion of connectivity. The project focused on critical sea freight data exchange between APEC port operators that are members of APMEN in order to address the lack of unified standards for the supervision and operation of various ports as well as for the development of information levels and the operation of port business processes. The Digitalization of Air Freight Logistics Pilot Project aimed to eliminate paper documents from both air import and export processes through system interconnection and data exchange between industry stakeholders based on the model of 'Single Window + Air Freight Logistics'. By using IATA industry standards on business processes and messaging, a number of measures were implemented (such as automatic data validation, updating security systems, and

monitoring and analyzing data) to improve the visibility and transparency of the air logistics chain through the exchange of high-quality and accurate air freight data.

3.1.6   2020 APEC e-Learning Training (AeLT) Program [Korea]

During the COVID-19 pandemic, many APEC members implemented online learning to ensure educational continuity. To support e-learning policies and practices, "Educational Policies and Responses in the Post COVID-19 era: Cases from the Republic of Korea and APEC member economies" was chosen as the theme for the 2020 APEC e-Learning Training (AeLT) Program, a virtual capacity building program for education policymakers. The Program involved online lectures, collaborative study sessions, and workshops focusing on e-learning case studies and best practices, with contributions from e-learning experts, so as to ensure quality, inclusive, and sustainable teaching and learning in the region. The 2020 AeLT Program resulted in a total of 11 Action Plans that identified e-learning issues and addressed possible solutions.

3.1.7   APEC School Leadership Program (ASLP) [Korea]

The COVID-19 pandemic is causing unprecedented learning discontinuity and learning loss around the world, bringing about challenges to ensuring outcome and quality of formal education. The APEC School Leadership Program (ASLP) acknowledges that strong school leadership contributes to student learning outcomes and plays a critical role in setting the digital education system as well as its implementation. This capacity-building program aims to enhance school leaders' understanding on educational technologies and help them to better operate remote/hybrid learning. The ASLP is composed of two parts: 1) convention of a week-long virtual workshop to share best practices and to cooperate on regional education innovation; and 2) creation of the Online Campus for School Leaders in APEC (OCSLA), which will serve as a digital archive of case studies on developing digital-friendly school environments as well as a virtual platform to connect school leaders.

3.1.8   Strengthening Digital Connectivity in the Eurasian Economic Union (EAEU) [Russia]

Russia undertook four major initiatives in line with its participation in the Eurasian Economic Union's (EAEU) Digital Agenda to integrate more information and communication technologies and to lay the groundwork for future digital collaboration. The projects include 1) Integrated Information System (IIS), which intends to automate and integrate over 80 customs and inter-agency communication processes to increase intra-EAEU trade; 2) Unified Search System 'Work Without Borders', which aims to create a search engine across the EAEU that will provide information on current vacancies and jobseekers, enabling greater cross-border labor mobility; 3) Ecosystem of Digital Transport Corridors in the EAEU, which establishes logistics information sharing platforms between economies to expedite transit with enhanced security; and 4) Transboundary Space of Trust, which is a set of approved legal, organizational, and technical conditions to build trust in the cross-border exchange of data and e-documents between authorized bodies.

3.2   CASE STUDIES AND MEASURES SUBMITTED FOR THE APEC CONNECTIVITY BLUEPRINT 2020 MID-TERM REVIEW

In addition to the case studies submitted for this report, APEC members provided case studies and information on relevant initiatives for the 2020 Mid-Term Review of the APEC

Connectivity Blueprint. At that time, a number of measures relating to digital connectivity had been initiated or implemented by APEC members. These initiatives include measures to improve digital connectivity domestically, such as expanding broadband access and digitalizing government services, as well as several measures that helped to advance regional connectivity, including capacity building initiatives to improve PPP projects so as to build high quality ICT infrastructure. A selection of some of these major initiatives and projects, both domestic and regional, are described in Table 3.1.

Table 3.1. Selected actions relating to digital connectivity submitted by APEC members for the APEC Connectivity Blueprint 2020 Mid-Term Review

Economy	Action
Australia	Conducted the 'ABTC Online Lodgement System Design Workshop', which sought to scope both a customized web-service solution for those economies that already have a specified means of online lodgement available to domestic applicants of the APEC Business Travel Card (ABTC) and a generic web-service online lodgement capability for economies that do not currently have online lodgement.
Brunei Darussalam	Launched the economy-wide broadband policy, which aims to build a world-class fiber-to-the-home broadband network by addressing key issues such as accessibility, affordability, quality, and usage so that all individuals can access broadband technology.
Canada and Indonesia	Collaborated to improve the flow of private capital into infrastructure development in Indonesia by improving the institutional, legal, and regulatory framework, including the setting up of PPP structuring and financing functions within the Indonesian Ministry of Finance.
China	Implemented an economy-wide SW system that relied heavily on scientific design and innovative application of new technologies as well as an optimization of relevant legal systems necessary for its operation.
Japan	Developed the Smart Cities initiative to use new technologies to help solve various urban issues such as over-crowding and inefficient energy and resource consumption as well as constraints on public services like healthcare and education through the creation of partnerships to develop integrated solutions across various ministries and stakeholders.
Japan	Implemented a peer review and capacity building mechanism among APEC economies for mutual learning of quality of infrastructure and people-centered investment as well as best PPP practices and principles.
Japan	Conducted the 'APEC Tokyo Conference on Quality Infrastructure' under the 'Promoting Quality Infrastructure Investment in Rapidly Urbanizing APEC Region' project to raise awareness of good practices and lessons learned and to identify the challenges and possible solutions in order to implement quality infrastructure.
Korea	Launched the APEC Learning Community for Shared Prosperity (ALCom) to implement cross-border cooperative activities originating from the APEC Learning Community Builders (ALCoB) so as to narrow the digital divide within the region through online and offline education-related activities.
Korea	Conducted the 'Asia Public-Private Partnership Practitioners' Network (APN) Training' to share knowledge and trends in PPP development as well as to design a plan for the future of the Asian PPP Network for bilateral and multilateral cooperation in promoting PPP projects.

Economy	Action
Peru	Launched the 'Broadband Installation for Integral Connectivity and Social Development' initiative to expand broadband networks to district capitals of 21 regions and roll out access networks for social priority rural towns in those regions.
The Philippines	Implemented the 'Technology for Education, Employment, Entrepreneurs, and Economic Development' (Tech4ED) project and the 'Integrated Government Philippines' (iGovPhil) program, which aim to provide access points for individuals and communities to bridge the digital divide as well as to provide the necessary infrastructure and software needed for e-governance.
Singapore	Drafted the 'IPv6 Deployment Strategies in APEC Economies – Information Paper' to enhance mutual learning and understanding of IPv6 deployment strategies to facilitate a smooth transition to the new Internet Protocol in economies' info-communication ecosystems.
Singapore	Conducted a workshop on 'Small Cell Deployment in APEC Economies' to enhance the ICT industry ecosystem by driving the adoption of technology to support existing and new wireless applications and services.
Singapore	Developed a PPP handbook that contains information on how PPP projects are structured, the procurement process, and management of the relationship to provide guidance to government agencies.
Thailand	Implemented 'Net Pracharat' (Village Broadband Internet Project) to build digital infrastructure necessary to improve the availability, accessibility, and affordability of broadband Internet service to people in rural and non-marketable areas, targeting 24,700 villages.

3.3   INSIGHTS FROM THE CASE STUDIES

The submitted case studies and relevant measures that have been undertaken illustrate several approaches by APEC economies towards advancing digital connectivity in the region. Whether addressing labor force readiness for the digital economy, formalizing data rights, or sharing best practices for high quality PPPs, the case study initiatives and actions undertaken tackle many of the digital connectivity challenges that were described in Chapter 2. Based on a review of the case studies submitted for this report, the approaches among APEC members to improve digital connectivity can be grouped into three major themes: 1) building a reliable data ecosystem; 2) developing interoperable data systems to facilitate digital transformation; and 3) improving digital education and e-learning strategies to better equip the workforce for the digital economy. A deeper analysis of these economies' experiences offers insights and instructive examples for policymakers in other economies as they consider how best to support or regulate the digital economy as well as provides a better understanding of what challenges remain in order to improve digital connectivity throughout the region.

3.3.1   Building a reliable data ecosystem

Balancing sometimes conflicting objectives of privacy, protection, and free information exchange is something many economies have struggled with in their data policies. Tackling the regulatory challenges of data usage policies, Australia's CDR takes into account the global economic landscape and the needs of its residents. To quote the Australian Treasury, "A balanced approach is needed to realize meaningful benefits to consumers and grow

participation in the data ecosystem." [129] Under these circumstances, Australia pursued a domestically focused strategy of individual protection of data rights. The CDR combines several legal principles to better protect the use of consumer data and to increase competition in the digital economy.

CDR presents an opportunity for connectivity within the Asia-Pacific region, particularly as other APEC members, such as New Zealand and Singapore, are also developing government-led consumer data portability frameworks. To enhance connectivity, there are opportunities to encourage the development of interoperable data portability frameworks. Interoperability can enhance trade by enabling data-driven tech companies to scale up across the region and allow consumers to access products and services from other markets while at the same time give consumers and businesses confidence that their data is protected, regardless of where it flows. Integrating these considerations into data policy can potentially simplify the regulatory landscape in a way that supports the digital economy. The implementation of the CDR to successive industries does, however, subject different industries to different regulations towards reaching a comprehensive digital framework. This strategy could slow the process of economy-wide collaboration and could pose additional regulatory challenges.[130] Nevertheless, a single process for controlling data enables easy audit access, an important regulatory tool policymakers may want to consider in other projects. This case study highlights the need for economies to determine domestic data policies, while also considering how those policies might affect their interaction with the global economy.

Russia's projects under the Eurasian Economic Union's (EAEU) Digital Agenda, as described in its case study, focus on standardizing the method and process of information sharing in order to create base conditions for easy and rapid data transmission within the EAEU. Standardizing both the data format and the processing procedures enables not only effective data transfer between economies within the union, but also more efficient inspection by customs authorities. This sort of holistic approach has been highlighted by policymakers as not only essential for regulatory cooperation between economies, but also to keep pace with digital advances.[131]

Also included in the EAEU Digital Agenda is the development of an ecosystem for digital transport corridors, which provides an open digital environment for sharing information about logistics. Platforms and systems in the ecosystem are owned and operated by businesses and public agencies and they contain information on vehicles, crews, cargoes, permits, and associated documents at every stage of transportation or technological activity. By eliminating transportation and logistics paperwork and establishing data sharing, the digital transport ecosystem will create a transparent and integrated surveillance system that is based on data analysis.

One of the major concerns arising from increasingly digital activities is the risk of exposure of the private data of individuals, businesses, and organizations. Accessing digital services, particularly health or financial services, requires identity verification and validation, increasing the risk of fraud which also has the potential to expose highly personal and sensitive information.[132] A case study from Australia features its Digital Identity System, which enables a variety of government services to be accessed through a single online portal using a trusted

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[129] Commonwealth of Australia. (2020, October).
[130] Deloitte. (2020, September).
[131] APEC Committee on Trade and Investment (CTI). (2019, November).
[132] Hancock, A. (2020, August 31).

digital identity. This initiative promotes greater efficiencies in access to services, while Australia also anticipates that the risk of fraud would be reduced since the system provides greater certainty as to the identity of the user and since users would also no longer need to maintain multiple online identities in order to access various services. In fact, Australia estimates that the Digital Identity System could save up to AUD 11 billion per year by reducing service costs, fraud costs, and improving customer experiences.[133]

This approach also ties together solutions for several challenges in the digital space since warehousing identification can enable many types of economic activities.[134] This has important implications in the post COVID-19 era as many businesses and border authorities seek to implement secure methods of checking health data or low-touch ways of verifying identities. Some companies have already seized the opportunities for providing these services in conjunction with an official government digital identity.[135] However, a major concern of having one digital identity that is integrated into access to government services is the heightened security risk within that system as it gives hackers a single target as well as the potential risk to privacy through an economy-wide integrated system.

Some possible success factors in developing an integrated digital ID system may involve adopting people-centered perspectives (rather than focusing on the technological architecture) in the design; assuring user consent, control, and oversight of personal data; minimizing the risk of exclusion; and doing extensive public engagement or consultation in order to improve public trust and accountability.[136]

3.3.2   Developing interoperable systems to facilitate digital transformation

The lack of interoperability of digital systems between economies is a major challenge. For instance, customs information that may be easily accessible online within one economy may operate on a conflicting system in another. A case study on "Smart Customs, Smart Borders and Smart Connectivity" describes how China has implemented a number of pilot projects to deepen cross-border customs cooperation through smart and innovative approaches. These projects focus on developing interoperable digital systems to support trade, shorten customs clearance times, and enhance the effectiveness and efficiency of customs control. This creates a better business environment for enterprises due to lower customs clearance costs, improved customs procedures, and increased customs clearance efficiency. The challenge is in scaling up these pilot projects so that they apply across the entire spectrum of data and documents required for cross-border trade and are interoperable with many other economies.

Through the use of common standards, trade stakeholders could collaborate and exchange data virtually. Another case study submitted by China, the APMEN sea freight visibility project, describes how Electronic Product Code Information Services (EPCIS) are used to create and exchange visibility event data, both within and across enterprises. The EPCIS system enables trading partners to share information regarding the physical movement and status of products throughout the supply chain, from business to business and ultimately to the consumer. The GS1 EPCIS standard has been approved by ISO/IEC for improved traceability and anti-counterfeiting and enables visibility into the entire supply chain. Similarly, the APMEN air

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[133] Australia Post (2016, December).
[134] ibid.
[135] Thales Group. (2021, June 17).
[136] World Bank. (2019, October).

freight digitalization project demonstrates how industry standards can help facilitate paperless trade processes that improve efficiency. Measures such as automatic data validation, an improved security system, and data monitoring and analysis have greatly improved data quality and accuracy. Consequently, the average air cargo import process time was improved by 80%, reducing overall handover times from 2.5 to 0.5 hours.

Lastly, China's collaborative efforts to accelerate the large-scale deployment and application of IPv6 are fundamental to help build the physical and institutional infrastructure needed to support greater digital connectivity. The IPv6 protocol has several benefits over its predecessor IPv4, including that it can handle data packets more efficiently, thereby improving Internet performance, which will become increasingly important as more and more devices connect to the Internet (i.e., Internet of Things). In addition, IPv6 has built-in Internet Protocol Security (IPsec), a group of protocols that encrypts and authenticates the entire data packet so that connections between devices are more secure.

However, only around 35% of global Internet users are currently accessing through IPv6 capable networks, with its adoption uneven among Internet service providers (ISPs) within an economy and between economies.[137] One reason for the lag in IPv6 adoption is that not all ISPs and telecommunication companies are financially capable of making the investment required to set up the infrastructure needed to support IPv6. In general, shifting to a new platform is not easy because large investments may have already been made in the older one. As such, the adoption of a new platform will not happen until firms are able to earn sufficiently high and increasing returns from the new technology to offset their previous investment in the older one.[138] Alternatively, firms may make the switch if maintaining the outdated technology becomes too costly, causing them to miss out on business opportunities and growth.[139]

The transition from IPv4 to IPv6 presents difficulties in interoperability since a new standard of compatibility has been adopted that is incompatible with a previous standard.[140] To further increase the adoption of IPv6 among economies, and thereby improve both intra- and inter-regional network interconnections, it will be important to accelerate the adoption of Internet standards through a strengthening of industry and technology exchanges. In accelerating the adoption of IPv6, the importance of network externalities or effects should also be taken into consideration.[141] User access to Internet content over IPv6 is dependent on IPv6 adoption decisions made by Internet service providers (ISPs) and Internet content providers (ICPs). As the size of the IPv6 user base increases, it has a positive feedback effect on IPv6 adoption by ICPs, which in turn has a positive feedback effect on ISPs, leading to a positive upward spiral of adoption.[142]

3.3.3 Improving digital education and e-learning strategies

A key challenge in further developing the digital economy is the gap between the skills required and those that are available in the general population or labor market. Furthermore, there is often a lack of technical training programs to prepare workers for digitally-enabled industries.

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[137] Data from https://www.google.com/intl/en/ipv6/statistics.html#tab=ipv6-adoption [retrieved 7 December 2021].
[138] Bresnahan, T.F., & Greenstein, S. (1999).
[139] Logicalis (2015, October 19).
[140] OECD. (2014, November 6).
[141] Rysman, M. (2009).
[142] Pickard, J., Angolia, M., & Chou, T. (2018).

Developing a digitally literate workforce with the appropriate skills to succeed in the digital economy should therefore be a top priority for educators across the APEC region. Case studies submitted by Korea describe approaches to develop an effective education system and a skilled workforce in order to help enable the digital economy to grow.

The two capacity-building case studies submitted by Korea describe how economies can collaborate in order to meet the education challenges of the digital era. The APEC School Leadership Program (ASLP) and the APEC e-Learning Training (AeLT) Program provide opportunities for the sharing of best practices and learning from other educators and experts across the region. Importantly, these programs have allowed for the sharing of exemplary examples of school operation and management during the COVID-19 pandemic. Collectively creating best practices from inputs throughout the region ensures that the policy solutions can be more easily implemented across different education systems.

In addition, the warehousing of online resources, combined with regular training sessions and collaborative online community platforms, enables educators to better prepare a digitally adapted educational experience for their students, both in terms of effective teaching through digital tools and preparing a digitally literate student body. To ensure continued success, it is important that the insights and resources developed through participation in the ASLP and AeLT programs are diffused throughout the entire education system of an economy.

The AeLT case study also shows how public-private collaboration can be critical to facilitate digital learning. In support of the online opening of schools and implementation of e-learning during the COVID-19 pandemic, Korea identified public-private collaboration as being an important factor in achieving utilization of ICT in education and training. For example, through a multi-agency government effort and together with private companies, Korea offers digital devices (laptops and smartphones) and subsidized Internet subscription fees to disadvantaged students as part of an economy-wide program. In this regard, the AeLT Program encourages delegates and member economies to pursue and realize public-private collaboration in order to maximize digital connectivity in education.

3.4 KEY CHALLENGES TO GREATER DIGITAL CONNECTIVITY

Significant progress towards advancing the objectives of the APEC Connectivity Blueprint has been made by APEC members. However, several key challenges remain in order to achieve greater digital connectivity throughout the region. Many of these obstacles are already acknowledged and will entail governments as well as the private sector to experiment with innovative solutions. Managing and recovering from the COVID-19 pandemic has brought new urgency to these challenges and requires effective responses to ensure that growth, particularly in the digital economy, is both inclusive and sustainable. This section discusses four main challenges facing the region: 1) reducing the digital divide; 2) improving cross-border interoperability of digital systems and ensuring data security; 3) fostering greater regulatory cooperation to support the digital economy; and 4) maximizing digital dividends and spillover benefits. Illustrative examples of innovative policies and actions from APEC members to address these challenges are highlighted throughout the section.

3.4.1 Reducing the digital divide

The digital divide within economies is a pernicious challenge to achieving inclusive growth and one that the COVID-19 pandemic has brought to the fore. Unfortunately, there is a lack of

precise data to quantify and fully assess the digital divide. The number of fixed broadband subscriptions or estimates on the number of individuals using the Internet are typically used as proxy indicators to gauge the digital divide. However, the digital divide includes a wide variety of issues, ranging from the need for more physical ICT infrastructure in rural and remote areas to building greater digital skills in the general population. Thus, a fundamental aspect to ensuring sustainable economic recovery in the post COVID-19 era must include substantial efforts by economies to reduce the digital divide.

Many APEC members have, in fact, made significant progress in extending high-speed Internet access across their economy. These projects often present considerable challenges in order to build the necessary physical ICT infrastructure to reach remote areas. Thailand, in its case study submitted for the 2020 Mid-Term Review of the APEC Connectivity Blueprint, described its experiences with 'Net Pracharat' (Village Broadband Internet Project). Although Thailand successfully completed the installation of fiber optic cable networks to 24,700 target rural villages along with free public Wi-Fi access hotspots, ongoing issues include instability of electricity connections and insufficient Wi-Fi capacity in some larger villages.

Similarly, Peru's 'Broadband Installation for Integral Connectivity and Social Development' initiative covers 21 out of 25 Peruvian regions. The project excludes the three Amazonian regions of Loreto, Ucayali, and Madre de Dios owing to the difficult rainforest terrain in these regions.[143] However, only around 30% of the population in the Peruvian Amazon have access to the Internet.[144] Their exclusion from initiatives such as this may further isolate these remote communities from the digital economy. To ensure that internet access is accessible in all regions, Peru is exploring solutions to reach those communities located within the Amazon. In 2021, the Ministry of Transport and Communications (MTC) launched the USD 20 million 'Conecta Selva' (Connected Jungle) initiative, which intends to provide satellite Internet service to cover 1,034 locations in isolated areas of the Amazon, benefitting 200,000 people.[145] This three-year project aims to connect 1,316 education institutions and health centers along with providing free Wi-Fi access hotspots to improve digital connectivity in the region.

It is important to note that the need for greater physical ICT infrastructure in order to help reduce the digital divide not only applies to developing economies – advanced economies also face challenges in expanding high-speed Internet access to rural areas. For example, while 87.4% of households across Canada have access to broadband (at 50/10 Mbps), only 45.6% of households in rural communities have access to this service.[146] To reduce the connectivity gap in the economy, Canada has launched the Universal Broadband Fund as part of their 'High-Speed Access for All' initiative. This CAD 2.75 billion project funds broadband infrastructure projects, with a focus on rural and remote communities, so that at least 90% of Canadians will be connected to high-speed Internet by 2021 and 98% by 2026.[147]

The private sector is also involved in developing innovative approaches in order to expand Internet access. For example, Alphabet's Project Loon experimented with using high-altitude

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[143] The region of Callao, which is located within the Lima Metropolitan Area, is also excluded from the initiative.
[144] Bnamericas. (2021, February 5).
[145] Government of Peru (2021, June 1).
[146] Information available on the Canadian Radio-television and Telecommunications Commission (CRTC) webpage. Retrieved 19 September 2021.
[147] Information available on Innovation, Science and Economic Development Canada's (ISED) Universal Broadband Fund webpage. Retrieved 19 September 2021.

balloons in the stratosphere to create an aerial wireless network that would provide mobile Internet access for people living in remote areas. Despite some success, including in helping to provide emergency connectivity following natural disasters in Peru,[148] the company ended the project due to being unable to lower costs enough to build a long-term, sustainable business.[149] Even though this particular initiative did not come to fruition, such inventive approaches to improve connectivity are necessary to ensure that all individuals can take part in the digital age. APEC members are encouraged to consider exploring pioneering solutions together with private enterprise so as to not only improve Internet access in remote areas, but also to support the development of high-tech industries in their economies.

The construction of ICT facilities between economies could also strengthen connectivity. For example, in 2013, submarine cable infrastructure carried an estimated USD 10 trillion a day in global transactions, while the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network uses undersea fibre-optic communications cables to transmit financial data to more than 8,300 member financial institutions in 195 economies.[150]

Another obstacle to reducing the digital divide concerns a lack of necessary hardware for people to access the Internet. Although a computer is no longer required since other devices such as smartphones can also provide access, larger screens can still be useful to conduct tasks such seeking and applying for jobs as well as engaging in e-commerce activities. Hardware barriers exist across the region and can be a particular problem for lower income households, isolating these vulnerable individuals from full participation in the digital economy. For example, a recent survey found that 41% of adults with lower incomes in the United States did not have a desktop or laptop computer, while 59% did not own a tablet computer and 24% did not have a smartphone.[151] As more and more services are moved online, including vital government services, it is increasingly important to ensure that all individuals have the physical devices to access them.

Similarly, it is also necessary for economies to promote the development of digital skills in the general population so that all individuals are able to use the digital tools required to access the digital economy. For example, to support Thailand's 'Net Pracharat' initiative, the Ministry of Digital Economy and Society (MDES) developed curricula on the basic use of the Internet as well as on Internet applications for career building and income supplement. In collaboration with the Ministry of Interior, this training had been provided to over 1.2 million people as of September 2018.[152] Training efforts such as these are essential to improve the overall level of digital skills in an economy. Not only is this crucial for inclusive growth, it can also help to spur innovation as more and more people are able to access the digital economy.

Incorporating digital education into school curricula can be an effective way to not only improve digital skills more generally, but also to better prepare the future workforce for the digital economy. For example, Singapore has made a 10-hour coding course mandatory for all upper primary school students beginning in 2020.[153] In an example from outside of the APEC

[148] Holley, P. (2019, May 31).
[149] Koksal, I. (2021, January 23).
[150] APEC Policy Support Unit (PSU). (2013, February).
[151] Vogels, E. A. (2021, June 22).
[152] Asia-Pacific Telecommunity (APT). (2019, August). .
[153] Tan, Z. (2019, July 11).

region, Sweden's 'Digitalisation Strategy for the School System' integrated the use of digital tools into all aspects of the education system in order to ensure that students develop the necessary digital skills.[154] Given the fast pace of technological change, efforts to improve and maintain the necessary digital skills available in the workforce – as well as in school and training curricula – require an ongoing response.

Meanwhile, the COVID-19 pandemic has greatly accelerated the use of educational technology in teaching as many schools around the world were suddenly forced to switch to online and e-learning strategies. Although this has brought about many valid concerns regarding the quality and outcome of education, the upshot is that students will become increasingly proficient in using digital tools from an early age. In this regard, the teaching and learning resources that are available to students are becoming even more important. A lack of necessary hardware or of quality teachers capable of teaching curricula using educational technology can further entrench existing inequities in education. This problem has been compounded by the COVID-19 pandemic as children in low-income households often do not have access to the necessary digital hardware and Internet connection in order to participate in online learning.

Using data from its Programme for International Student Assessment (PISA) 2018, the OECD found that there are severe differences in digital access between students in advantaged schools and those in disadvantaged schools.[155] For instance, although 88% of students in advantaged schools in Peru have access to a computer at home, just 17% of those attending disadvantaged schools have access to one.[156] Similarly, in Mexico, 94% of students in advantaged schools have a link to the Internet in their homes, while just 29% of those in disadvantaged schools have Internet access at home. To address these disparities, governments will need to ensure that all schools in the economy have a communications network and the requisite hardware for digital access.

For example, Japan has equipped nearly all elementary and junior high schools with computer devices for students under its 'GIGA (Global and Innovation Gateway for All) School Program'.[157] Although the program, which began in 2019, was originally intended to be rolled out through March 2024, the plan was moved forward by three years due to the sudden disruption to teaching caused by the COVID-19 pandemic.

Lastly, in order to improve digital connectivity between APEC economies, it is also necessary to reduce the digital divide between members. For instance, while there were 41.48 fixed broadband subscriptions per 100 inhabitants in Korea in 2017, there were just 0.21 per 100 inhabitants in Papua New Guinea.[158] Likewise, 95.1% of people in Korea were Internet users in 2017 compared to just 11.2% in Papua New Guinea. Given such a wide disparity in digital access that exists across the APEC region, capacity building is necessary to improve both physical ICT infrastructure and digital skills in those economies in which it is limited.

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[154] Information available on the European Union Digital Skills and Jobs Platform webpage. Retrieved 20 September 2021.

[155] A socioeconomically disadvantaged (advantaged) school is a school whose socioeconomic profile (i.e., the average socioeconomic status of the students in the school) is in the bottom (top) quarter of the PISA index of economic, social and cultural status amongst all schools in the relevant economy.

[156] OECD. (2020, April 3).

[157] Government of Japan (2021, April 15).

[158] Data are from International Telecommunication Union (ITU) (2017 is the most recent year that data are available for all APEC members). Retrieved 19 September 2021.

There are, in fact, numerous examples of capacity development in this area in the APEC region. For instance, Canada and Indonesia continue to collaborate to improve the flow of private capital into infrastructure development in Indonesia by strengthening the institutional, legal, and regulatory framework and the setting up of conditions to ensure high-quality PPPs. These efforts can help in building the necessary physical ICT infrastructure that is required to achieve more widespread digital access in the economy. Meanwhile, Korea has taken the lead in spearheading several initiatives, including the APEC e-Learning Training Program and the APEC School Leadership Program, to develop teacher competency and to improve the quality of digital education in the region. As technology continues to advance, causing both the underlying infrastructure and the requisite skills to change, capacity building throughout the region needs to be an ongoing effort to ensure that all APEC members can continually take advantage of the benefits of the digital economy.

3.4.2   Improving interoperability of digital systems and ensuring data security

Reducing the digital divide and improving connectivity throughout the region will also allow for more opportunities to develop interoperable digital systems between economies. Greater integration of digital systems through innovative technologies can bring about many regional benefits, ranging from increased trade efficiency to improved facilitation of border procedures for travelers. This section will discuss two major areas to illustrate how (cross-border) interoperability of digital systems is important to further implement the APEC Connectivity Blueprint: progressing towards greater integration of Single Windows in the region and developing interoperable digital health passes to facilitate the movement of people across borders in a post COVID-19 era. However, as digital systems become more interconnected – and therefore more complex – ensuring that those systems are safe and resilient through strong data security frameworks will be essential.

3.4.2.1   Cross-border paperless trade and Single Window (SW) systems

Although APEC members have indeed made progress in the facilitation of cross-border paperless trade, further work to implement the technical and legal frameworks in order to establish integrated paperless systems is needed. Based on data from the UN Global Survey on Digital and Sustainable Trade Facilitation, most measures relating to cross-border paperless trade have only been partially implemented in the APEC region (Figure 3.1). Many members have fully developed the relevant legal frameworks for cross-border electronic transactions and for the recognition of certification authorities. However, according to the most recent available dataset for 18 APEC economies, there is just one member (New Zealand) that has fully implemented electronic exchange of customs declarations and of certificates of origin and only one member (Canada) that has fully implemented electronic exchange of SPS certificates.

Figure 3.1. Cross-border paperless trade measures as of 2021

	AUS	BD	CDA	CHL	PRC	INA	JPN	ROK	MAS	MEX	NZ	PNG	PE	PHL	RUS	SGP	THA	VN
Laws and regulations for electronic transactions																	↑	
Recognised certification authority																		
Electronic exchange of Customs Declaration			↑										↑			↑		
Electronic exchange of Certificate of Origin		↑												↑				
Electronic exchange of Sanitary & Phyto-Sanitary (SPS) Certificate						↑			↑									
Paperless collection of payment from a documentary letter of credit											↑				↑		↑	

Fully implemented	Partially implemented	Planning stage	Not implemented	Not known	↑ = Improvement from 2019

Note: Data for Hong Kong, China; Chinese Taipei; and the United States are not available.
Source: UN Global Survey on Digital and Sustainable Trade Facilitation 2021, online database. Available at https://www.untfsurvey.org

Continued digitalization of cross-border trade processes, if done well, will not only further reduce transaction costs and time, but will also increase regulatory compliance as well as enable greater engagement of SMEs in international trade, thereby helping to make trade more inclusive and supportive of sustainable development.[159] The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) estimates that full implementation of cross-border paperless trade measures can reduce existing transaction costs by 10-30%, depending on the current state of paperless trade development in the economy.[160]

Implementing quality measures that enable the legal recognition and electronic exchange of trade-related data and documents along the entire global supply chain is the goal to achieving fully integrated digital systems and realizing the full benefits of digitalization for greater trade facilitation. In the regard, initiatives such as the United Nations Commission on International Trade Law (UNCITRAL) Model Law on Electronic Transferable Records (MLETR), which aims to enable the legal use of electronic transferable records both domestically and across borders, can facilitate greater e-commerce by improving the speed and security of data transmission, permitting the reuse of data, and automating certain trade-related transactions.[161] Additionally MLETR allows trade finance to be conducted remotely in a paperless manner, allowing staff to work from home[162]. Domestic legislation based on or influenced by the MLETR has been enacted in five economies globally, including Singapore.

APEC has been very active in promoting the development of Single Windows (SWs) that serve as a one-stop point of entry and exit for regulatory documentation relating to cross-border trade, thereby reducing the non-tariff barriers associated with goods trade. Results from a recent empirical study of trade between 176 economies from 1995 through 2017 suggest that the amount of trade between two economies that both have functioning SW increases by about 23% for exports and 14% for imports.[163] Indeed, most APEC members currently have a fully implemented electronic SW.

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[159] Bajt, D., & Duval, Y. (2020, February).
[160] UNESCAP (2020, December 25).
[161] UNCITRAL. (2017).
[162] The International Chamber of Commerce. (2020).
[163] Martínez-Zarzoso, I., & Chelala, S. (2020).

However, Single Windows are long-term transformations and their development usually occurs in stages given the amount of coordination that is required between government agencies at the domestic level. As a result, once the system has been implemented, it may not be interoperable with that of another economy in exchanging certain documents and information. Also, differing laws and regulations across economies concerning electronic transactions pose an additional barrier to the integration of systems. As such, the interoperability of electronic SW systems between economies remains a challenge. A recent APEC PSU report explored these issues in-depth and found that achieving interoperability of SW systems is a complex process that involves legal and regulatory settings, governance and technology standards, as well as drivers from the business community.[164]

To achieve interoperability of Single Windows in the APEC region, economies will need to ensure greater coordination in the ongoing development and implementation of their SW systems. There are some examples in which APEC members have worked together to integrate their SW systems. For example, the seven APEC economies that are also members of ASEAN have joined the ASEAN SW, an electronic platform that connects and integrates their domestic Single Windows.[165] In December 2019, all members were able to electronically exchange certificates of origin through the ASEAN SW and are also expected to have the ability to exchange customs declarations within 2021[166].

Also, the Pacific Alliance (PA), which includes the three APEC members of Chile; Mexico; and Peru, along with Colombia, launched an interoperability project of their Single Windows in 2016. By enabling data to be exchanged in line with international technical standards – and adjusting to each economy's regulatory and technological frameworks – the PA members were able to exchange data on SPS certificates in 2017 and on certificates of origin in 2018.[167] Chile estimates that the exchange of SPS certificate data through the interoperable SW platform reduced the time needed to authenticate and validate SPS certificates from four days to just a few minutes, resulting in savings of around USD 250 per trade, while Mexico estimates that it has reduced processing times from two weeks to only 30 minutes.[168]

3.4.2.2 Digital health passes

More recently, the impact of the COVID-19 pandemic on cross-border travel underscores the importance of developing interoperable systems across economies, while also ensuring that non-digital solutions continue to be recognized, in order to also promote connectivity in other areas. The lack of a standard format and verification method for COVID-19 vaccinations and test results has created a confusing system of recognition for travelers to navigate. As many economies around the world rush to develop digital applications for the verification of health certifications relating to COVID-19, there is a real risk that these systems will not be interoperable with those developed in other economies, further hindering cross-border travel. This can present a serious obstacle for business travel, tourism, and short-term educational and training exchanges, thereby preventing greater people-to-people connectivity throughout the APEC region.

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[164] Vives, L., Bayhaqi, A., & Singh, S. K. (2018).
[165] The seven APEC members that are also ASEAN members are Brunei Darussalam; Indonesia; Malaysia; the Philippines; Singapore; Thailand; and Viet Nam. For more information on the ASEAN Single Window, see https://asw.asean.org
[166] https://asw.asean.org/component/content/?view=featured. Retrieved 29 October 2021.
[167] Rivas, I. M., & Maday, M. (2019, August 2).
[168] Ibid.

Several organizations have taken the lead in developing digital applications that enable sharing of COVID-19 health certifications to help facilitate cross-border travel during the pandemic. Examples include the International Air Transport Association (IATA) Travel Pass, which is a digital mobile application that allows travellers to store and manage their verified certifications for COVID-19 vaccines and tests. There are currently over 50 airlines trialling the IATA Travel Pass, which enables them to verify that a passenger meets the government-mandated requirements for travel.[169] CommonPass, developed by the Commons Project Foundation and the World Economic Forum, is another digital health pass that allows users to store and share their health data relating to COVID-19 and is currently being trialled by several international airlines.[170]

Most notable among the recently developed digital applications for health certifications is the European Union's (EU) Digital COVID Certificate (DCC). This system, which was launched on 1 July 2021, is currently accepted in all 27 EU member economies as well as in over 15 non-EU economies. The DCC, available in both digital and paper formats, uses a QR code that contains a digital signature that has been assigned to the medical authority or institution that has issued the certification.[171] This allows for a quick verification process, while also protecting personal information and preventing the use of fraudulent certifications. The DCC can also be used to facilitate entry into domestic venues that require proof of health status, such as large events and museums, which will be a very useful tool for travelers visiting another economy.

IATA recently announced that it considers the DCC to be the "global standard for digital vaccine certificates" and that up to 60 other economies are currently looking to use the DCC specification for their own certification.[172] The DCC meets several key criteria to be effective as a digital health certificate, including its flexible format and its use of a QR code that ensures data security and privacy. APEC members are therefore encouraged to consider examining how domestic digital health passes can be developed and/or integrated into existing regional systems to help ensure interoperability, as well as ensuring the recognition of non-digital solutions, in order to create a global system for health certifications that can facilitate and support cross-border travel in the post COVID-19 era.

3.4.2.3 Data security

Lastly, given the fact that interoperable systems across economies result in large amounts of personal and private data being shared across borders, members will need to ensure that digital infrastructure and digital processes are resilient. However, the increasing interconnectedness of digital systems creates more complexity, making it very challenging to ensure data security since the potential impact from a breach of just one system can result in multiple systems being affected. The recent cyberattack of SolarWinds offers an instructive lesson as to the enormous challenges that interconnected systems face in order to ensure data security. The incident involved hackers having entered malicious code into a routine update of SolarWinds' network monitoring and management software called Orion, which then enabled malware to spread to

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[169] For more information on the IATA Travel Pass, see https://www.iata.org/en/programs/passenger/travel-pass/ [Retrieved 28 November 2021]

[170] For more information on CommonPass, see https://commonpass.org [Retrieved 28 November 2021]

[171] For more information on the EU DCC, see https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/safe-covid-19-vaccines-europeans/eu-digital-covid-certificate_en#how-does-it-help-free-movement [Retrieved 28 November 2021]

[172] IATA (2021, August 26).

the customers that installed the update. As a result of the breach, the networks, systems, and data of over 18,000 SolarWinds' customers were exposed, including those of many multinational companies and government agencies.[173]

Ensuring the security of data in complex interconnected digital systems, especially those involving critical infrastructure, will indeed continue to pose a major challenge for policymakers. Many APEC members have developed strategic plans in order to protect the data systems of their critical infrastructure. Notably, Canada has taken a number of steps to mitigate the increasing threats from cyberattacks. Following a comprehensive 'Cyber Review' that began in 2016 to better understand the challenges, Canada's 'Cyber Security Strategy' along with its 'Cyber Security Action Plan (2019-2024)' were released in 2018.[174] Together, these documents lay out a roadmap of specific actions to be implemented in order to achieve the following three goals: 1) secure and resilient systems, 2) an innovative and adaptive cyber ecosystem; and 3) effective leadership, governance and collaboration. Among these measures include the creation of the Canadian Centre for Cyber Security and the Cybercrime Coordination Unit.

3.4.3 Fostering greater regulatory cooperation to support the digital economy

While the digital economy may be borderless, regulations are often not. As such, it is essential to design a regulatory framework that both supports the digital economy and promotes cross-border digital trade. As economies develop regulations to respond to domestic developments in the digital economy, international collaboration in this area has been lacking. This section will highlight two aspects of regulatory cooperation relating to the implementation of the APEC Connectivity Blueprint so that economies are able to take greater advantage of the benefits of the digital age: facilitating greater cross-border digital trade and supporting flexible working arrangements across borders.

The cross-border digital economy involves the data flows, digital payments, and delivery of digital services from one economy to another. The digital economy can be hindered by a number of barriers, ranging from outdated regulations to a lack of international functionality of payment systems. Policies relating to the digital economy were discussed in Chapter 2 and include those on cross-border data flows and data localization rules as well as those on cross-border payments and electronic transactions. Whilst not a perfect indicator of overall digital trade policy, the OECD's Digital Services Trade Restrictiveness Index (Digital STRI) enables a quantitative analysis of some of the regulatory barriers that affect trade in digitally enabled services by examining specific information in the following five areas:

- infrastructure and connectivity – measures such as regulations on interconnections among network operators, rules on limiting or blocking the use of communications services, and policies on cross-border data flows and data localization;
- electronic transactions – issues such as discriminatory conditions for issuing licenses for e-commerce activities, measures inhibiting the use of electronic authentication, and the lack of effective dispute settlement mechanisms;

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[173] Cimpanu, C. (2020, December 15).
[174] Canada's 'National Cyber Security Strategy' is available at https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/ntnl-cbr-scrt-strtg/index-en.aspx and Canada's 'National Cyber Security Action Plan (2019-2024)' is available at https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/ntnl-cbr-scrt-strtg-2019/index-en.aspx [Retrieved 23 November 2021].

- payment systems – measures that affect payments made through electronic means, such as access to certain payment methods and whether domestic security standards for payment transactions are in line with international standards;
- intellectual property rights – policies such as the existence of appropriate enforcement mechanisms to address infringements relating to copyrights and trademarks, including those occurring online; and
- other barriers affecting trade in digitally enabled services – measures such as mandatory use of local software and encryption, restrictions on online advertising, and commercial or local presence requirements.[175]

Although data are available for only 14 APEC members, the OECD's Digital STRI reveals that measures relating to infrastructure and connectivity comprise the largest share of digital trade restrictions in the region, followed by those concerning electronic transactions and other digital trade barriers (Figure 3.2). In contrast, APEC members perform well with respect to policies on payment systems and intellectual property rights, with most having no restrictive measures in these areas. Although there was an improvement in the regional score between 2014 and 2015, most of the economies for which there are data exhibited either no change while a few slightly tightened their regulatory environment for digital trade between 2015 and 2020. In fact, only Indonesia made progress in improving its Digital STRI score over this period. As such, renewed efforts for further regulatory cooperation will be necessary in order to create more competitive markets for digital trade and maximize the benefits that come from increasing digitalization.

Figure 3.2. OECD Digital Services Trade Restrictiveness Index, APEC aggregate
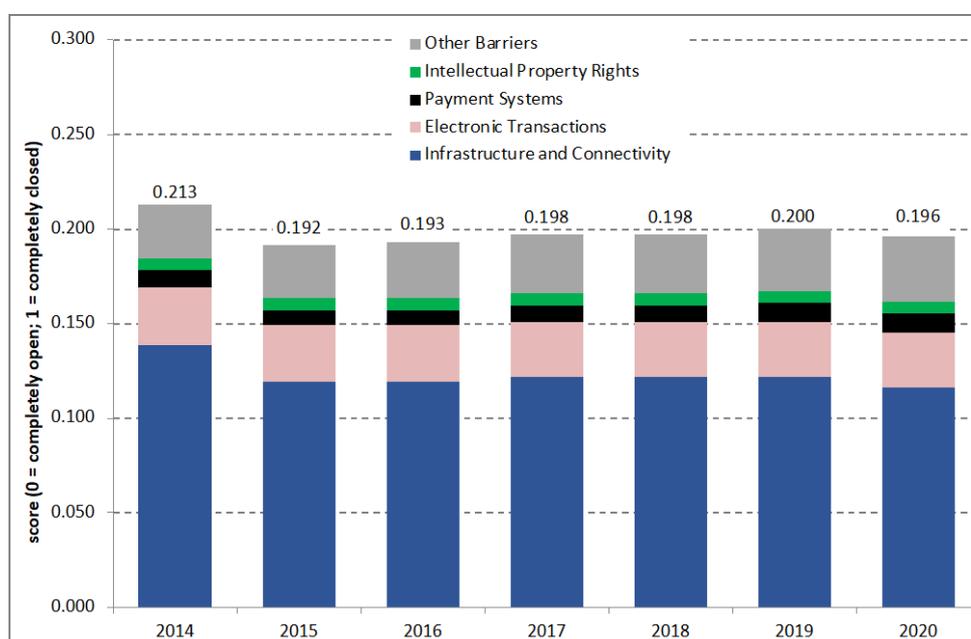
Note: Scores range from 0 (completely open) to 1 (completely closed). Overall Digital STRI scores in each year are shown at the top of each column. APEC aggregate is a simple average of the scores for the following 14 economies: Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Peru; Russia; Thailand; and the United States. (Data for Brunei Darussalam; Hong Kong, China; Papua New Guinea; the Philippines; Singapore; Chinese Taipei; and Viet Nam are not available.)

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[175] Ferencz, J. (2019).

Source: OECD Digital Services Trade Restrictiveness Index, online database. Available at https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL

As governments around the world begin to place greater importance on addressing existing barriers to digital trade, there has been an increasing number of bilateral digital trade agreements in recent years. In the APEC region, the United States-Japan Digital Trade Agreement, which entered into force in January 2020, comprehensively addresses many digital trade barriers between the two economies. Commitments include prohibiting customs duties on digital products transmitted electronically, prohibiting restrictions on cross-border data flows (including in financial services), prohibiting data localization requirements, permitting the use of electronic authentication and electronic signatures for digital transactions, and promoting collaboration on cybersecurity.[176]

Singapore has taken the lead in pursuing Digital Economy Agreements (DEAs) that establish digital trade rules and collaborate on the digital economy with the aim of developing international frameworks to foster interoperability of standards and systems.[177] The Singapore-Australia Digital Economy Agreement (SADEA) entered into force in December 2020, followed by the Digital Economy Partnership Agreement (DEPA) between Chile; New Zealand; and Singapore, which entered into force in January 2021. The provisions in these agreements go beyond the conventional aspects of digital trade agreements such as paperless trading measures and data localization policies. They also focus on aligning digital rules and standards and fostering interoperability, such as in electronic payments. Notably, the DEAs also include cooperation on developing principles and standards for emerging technologies such as AI and a commitment to expand digital inclusion by enabling opportunities for SMEs to engage in digital trade and e-commerce.

As digitalization continues to accelerate – and as a way to support economic recovery and sustainable and inclusive growth following the COVID-19 pandemic – there are also calls for a multilateral approach to regulatory cooperation in order to support digital trade. The 2021 G7 Roadmap for Cooperation on DFFT includes the following key areas for policy cooperation: data localization, regulatory cooperation, government access to data, and data sharing for priority sectors.[178] Think20 (T20), a G20 engagement group providing recommendations and proposals to the G20 process in 2021, recently released a policy brief that emphasizes the increasing need to manage the heterogeneity of domestic regulations which threatens to fragment the global digital economy.[179] Recommendations in the report include aiming for a successful conclusion of the WTO e-commerce negotiations; ensuring interoperability of data privacy approaches; intensifying collaboration on international standards relevant to data flows and digital transactions; and providing technical assistance and capacity building for developing economies to improve data protection laws.

Lastly, rapid digitalization has also given rise to flexible working arrangements such as the ability to work remotely. The COVID-19 pandemic has greatly accelerated this trend as an unprecedented number of employees around the world have begun to engage in remote work.

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[176] For more information on the United States-Japan Digital Trade Agreement, see https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2019/october/fact-sheet-us-japan-digital-trade-agreement [Retrieved 23 November 2021].

[177] For more information on Singapore's Digital Economy Agreements, see https://www.mti.gov.sg/Improving-Trade/Digital-Economy-Agreements [Retrieved 23 November 2021].

[178] G7 Digital and Technology Track – Annex 2: G7 Roadmap for Cooperation on Data Free Flow with Trust. Retrieved 23 November 2021.

[179] Drake-Brockman, J., Gari, G., Harbinson, G., Hoekman, B., Nordås, H. K., & Stephenson, S. (2021, September).

A growing challenge is on how firms can provide flexible working arrangements, while also ensuring compliance with local tax and labor laws for workers across borders. For instance, if a firm would like to hire a worker located in another economy to work remotely, this could create a tax obligation in that economy for the firm, even if the firm does not have a physical presence in that economy. The firm will also need to ensure compliance with local labor laws in the economy of the worker, such as mandatory contributions to social benefit schemes (e.g., health, pension, unemployment), as well as with employment protection regulations (e.g., contract type, working hours, paid leave).

Multinational companies are typically able to circumvent these issues since they have a physical presence in multiple jurisdictions and can therefore hire a worker in one economy to work remotely for the company in another. However, if a firm does not have a physical presence in the economy of the worker, then these compliance issues become very costly and time-consuming to manage. To ensure that the company does not run afoul of local labor and tax laws, firms tend to engage these remote workers as independent contractors and, as such, these workers are often not afforded full employment rights.

As workers increasingly demand flexible working arrangements and companies seek to hire and retain talent, these labor market challenges in the digital era are looming on the horizon. Many economies already have bilateral treaties to prevent double taxation, and some even have social security totalization agreements, which help to facilitate labor mobility, but these have become outdated in the digital era. As such, further regulatory cooperation is needed to address the various compliance issues relating to tax and labour laws that arise for both firms and workers due to cross-border remote work. Mitigating these challenges can allow economies to fill skills gaps and also enable firms to become more competitive.[180] APEC can therefore play a leading role in developing innovative regulatory solutions to these labor market challenges as a result of digital transformation in the workplace in order to facilitate greater people-to-people connectivity in the region.

3.4.4   Maximizing digital dividends and spillover benefits

The benefits from digital transformation as highlighted by the case studies and other initiatives from APEC economies are apparent. Successful digital transformations offer tremendous benefits to businesses, governments, and society at large. Although some of these transformations predate the COVID-19 pandemic, many are now being fast-tracked in order to support robust business recovery.[181] For example, as an economy-wide reform, the CDR framework could support the trade logistics sector in solving the lack of digitalization that has cost Australia approximately AUD 1 billion in inefficient supply chain practices and would also lead to an increase in productivity.[182] It is estimated that an increase in logistics productivity by just 1% would boost GDP by AUD 2 billion.[183]

At the global level, the economic potential due to the application of digital IDs in emerging economies (which currently have modest coverage) could reach roughly 6 percent of GDP per economy in 2030, with over half of the potential economic value of a digital ID being captured

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[180] Mulholland, P. (2021, April 14).
[181] de Nicola, F., Timmis, J., & Akhlaque, A. (2020, September 10).
[182] Blundell, R. (2018, May 28).
[183] Australian Logistics Council (2014).

by individuals. The benefits could come in the form of access to financial services, reduction in payroll fraud, hours saved through streamlined e-government services, ID-enabled formalization for workers, and reduction in customer onboarding costs. Furthermore, digital IDs have the potential to enable private and public services for 2.4 billion people without formal identification records.[184]

Meanwhile, the EAEU Digital Agenda will have a significant impact on promoting services trade and transforming value chains to become more competitive in that region.[185] The potential of digital transformation of the services sector in the EAEU may bring the following dividends: removal of existing regulatory barriers (USD 42.3 billion); digitalization of government procurement (USD 1.6 billion); open government services (USD 1.3 billion); and the introduction of cross-border electronic services (USD 0.5 billion) (Figure 3.3).Similarly, cross-border platforms such as the ASEAN Single Window could potentially reduce document courier costs and container storage costs by USD 15.2 million per year in Indonesia.[186] Also, one of the APEC Global Data Standards pilot projects that used the Electronic Product Code Information Services (EPCIS) platform reported that the prevention of detention at customs borders resulted in savings as high as USD 112,867 per shipment and reduced time spent in customs clearance.[187]

Figure 3.3. Potential digital dividends (in USD billion) from the introduction of the EAEU Digital Agenda (2018-2025)
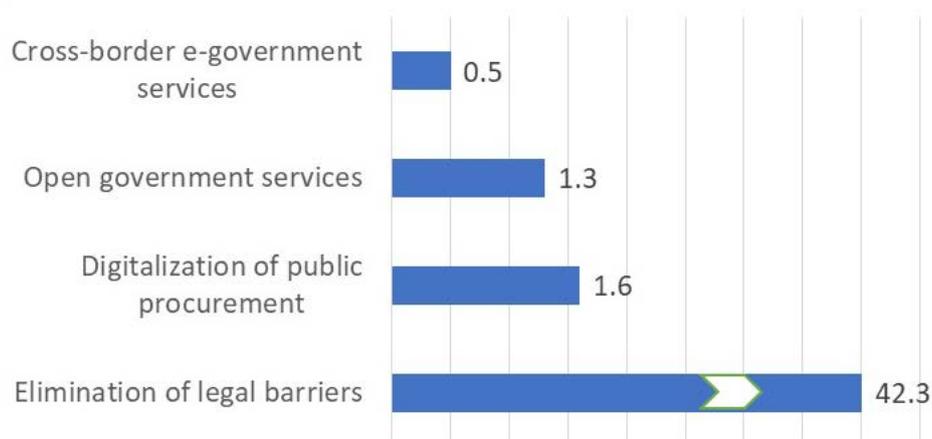
Source: World Bank Group (2018), retrieved from: https://roscongress.org/en/materials/tsifrovaya-povestka-evraziyskogo-ekonomicheskogo-soyuza-do-2025-goda-perspektivy-i-rekomendatsii/

In addition, digital technologies could improve productivity in the workplace and in the classroom: by automating tasks, workers can focus their attention to higher value tasks; by using online tools to teach, teachers can give more attention to students; by using a digital library, researchers can avoid duplication of work and more effectively build on the work of other researchers.[188] However, these digital dividends are not yet being maximized nor being

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[184] World Bank Group. (2016).
[185] UNCTAD. (2019). The Eurasian Economic Commission Written Submission. *Intergovernmental Group of Experts on E-commerce and the Digital Economy, Third session*. Retrieved 23 November 2021.
[186] Vives, L., Bayhaqi, A., & Singh, S. K. (2018).
[187] APEC Policy Support Unit (PSU). (2017, November).
[188] World Bank Group. (2016).

distributed equally due to the emerging risks and the lack of safeguards in managing the digital revolution. These risks, such as the issues of digital divide and data security and privacy, prevent the maximum gain that can be achieved by economies. Transformation of analog to digital has been hindered by less-than-optimal adoption of digital technologies by businesses. For example, a 2017 survey found certain digital technologies, such as 3D printing and blockchain, to be considered mainly as 'interesting but unclear usefulness' and 'irrelevant' with respect to supply chain strategy (Figure 3.4). Adoption of these new digital technologies may require certain incentives for digital entrepreneurs to reduce risks in exploring the application of these new technologies in the workplace.[189] Additionally, regulatory uncertainty prevents a comprehensive transformation of analog to digital.[190]

Figure 3.4. Important digital technologies with respect to supply chain strategy
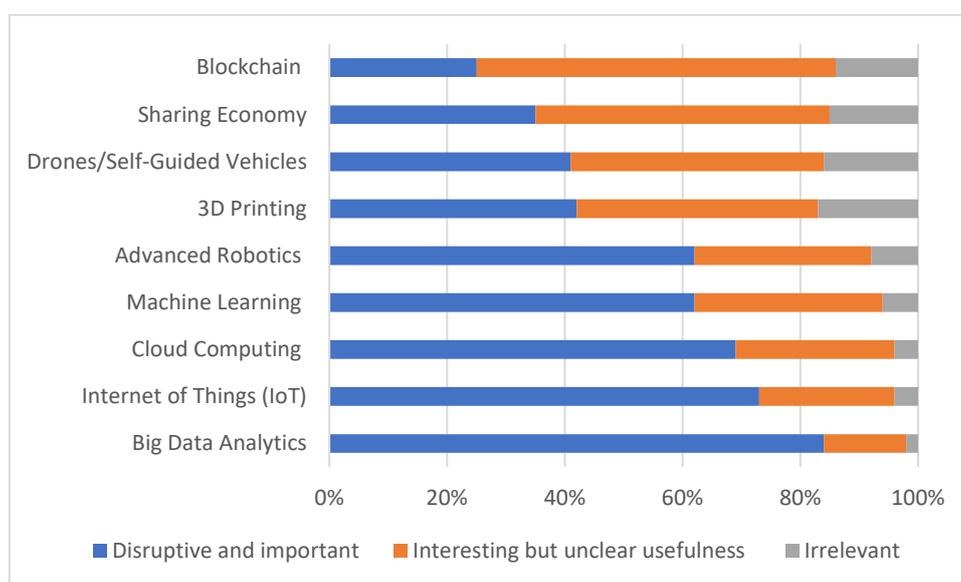
Source: Stank, T., et al. (2018). "A Savvy Guide To The Digital Supply Chain: How To Evaluate And Leverage Technology To Build A Supply Chain For The Digital Age", Global Supply Chain Institute, The University of Tennessee (Knoxville). Retrieved from: https://www.supplychainmanagement.utk.edu/uploads/A-Savvy-Guide-to-the-Digital-Supply-Chain.pdf

The World Bank estimated that the digital economy contributed around 4-5% of global GDP.[191] Another estimation, using the value being produced by digital assets, found that the digital economy contributed USD 11.5 trillion or 15.5% of global GDP with 35 percent of value being produced in the United States, 13 percent in China, 8 percent in Japan and around 25 percent in the European Economic Area.[192] The latter approach estimated that every USD 1 invested in digital technologies adds, on average, USD 20 to GDP due to digital spillover effects, whereby innovation adopted by a company spreads to others sending productivity gains across the supply chain.[193] Maximizing the digital dividends and spillover benefits for the digital economy requires supportive digital infrastructure and investments; the promotion of digital

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[189] Huawei & Oxford Economics. (2017).
[190] World Bank Group. (2016).
[191] Ibid.
[192] Huawei & Oxford Economics. (2017).
[193] Ibid.

entrepreneurship; and the adoption of certain digital safeguards, such as privacy policies and social protection to handle informalization and job displacement.

4. CONCLUSION AND RECOMMENDATIONS

In 2014, APEC members agreed to the APEC Connectivity Blueprint, which identified the following key challenges to connectivity: 1) disparity in access to and quality of physical and information and communications technology (ICT) infrastructure; 2) existing regulatory constraints or lack of capacity; and 3) existing barriers to interaction and mobility of people. The Blueprint also stated the need to connect growth poles in the region and bring the region closer together as a community. Fast forward to 2021 and the global landscape has changed as many economies grapple with economic recovery and adapting to a new post COVID-19 reality.

The digital economy has grown exponentially in recent years and digitalization processes are underway in all APEC economies. Collectively, APEC economies are more connected in the digital realm than ever before. The COVID-19 pandemic has further solidified our reliance on digital connections and has greatly accelerated recent trends in digital connectivity as people are increasingly working, learning, and communicating through digital technology. As economies begin to recover and develop policies for the post COVID-19 era, facilitating greater digital connectivity can help APEC members to ensure a more sustainable economic recovery following the disruptions brought about by the pandemic. The COVID-19 pandemic has revealed opportunities to accelerate and expand the trends of digital transformation during the recovery process since the current technology supports interoperability among businesses, service providers, and governments.[194]

This report discusses recent trends in the digital economy and presents a number of best practices to promote greater digital connectivity in the region. Developments in the digital world from the perspectives of physical, institutional, and people-to-people connectivity emphasize that, while none exist independent of each other, they each require a different sort of policy response. Efforts to improve physical infrastructure range from ensuring access to a stable Internet connection to incorporating advanced technologies into screenings by customs agencies. In order to enhance cross-border trade in the digital era, APEC economies must also achieve a certain level of institutional connectedness. At the same time, uneven access to the digital economy risks widening existing divides, while increased digitalization and transfer of personal information creates potential risks to data security and privacy.

The APEC PSU received eight case studies from four APEC members that describe initiatives to advance physical, institutional, and people-to-people connectivity in the region. The submissions cover a wide range of topics, including Internet protocols, digital identification, data portability, skills building, e-learning strategies, and cross-border interoperability of systems. The approaches taken in these case studies can be grouped into three major themes: 1) building a reliable data ecosystem; 2) developing interoperable data systems to facilitate digital transformation; and 3) improving digital education to better equip the workforce for the digital economy.

Indeed, APEC members have made significant progress in advancing the objectives of the APEC Connectivity Blueprint, especially in responding to the COVID-19 pandemic and supporting economic recovery. Over the past year, many members have retooled approaches

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[194] Walker, A. (2021, July 13).

and integrated emerging technologies, while some have experimented with new and innovative policy solutions. However, key challenges remain in order to achieve greater digital connectivity throughout the region. Many of these obstacles are already acknowledged and will require governments as well as the private sector to experiment with innovative solutions.

This report discusses four main challenges in digital connectivity currently facing the region: 1) reducing the digital divide; 2) improving interoperability of digital systems and ensuring data security; 3) fostering greater regulatory cooperation to support the digital economy; and 4) maximizing digital dividends and spillover benefits. Strengthening efforts in the implementation of the APEC Connectivity Blueprint in these areas will allow economies to reap the greatest potential benefits that are provided by the digital economy. Managing and recovering from the COVID-19 pandemic has brought new urgency to these challenges and requires effective responses to ensure that growth, particularly in the digital economy, is both inclusive and sustainable.

In order to promote greater digital connectivity in the region and progress towards achievement of the goals of the APEC Connectivity Blueprint, APEC members are encouraged to consider the following policy recommendations as shown in Table 4.1:

Table 4.1. Policy recommendations to enhance implementation of the APEC Connectivity Blueprint in the digital era

Main Challenge	Policy Recommendation
Reducing the digital divide	Build the physical infrastructure needed to extend high-speed Internet access across the entire economy, including to populations in rural and remote areas.
	Ensure that all students in the economy, especially those in socioeconomically disadvantaged schools, are equipped with the necessary physical devices to access the Internet.
	Promote the development of digital skills in the general population through training courses so that all individuals are able to use the digital tools required to access the digital economy.
	Incorporate digital education, including coursework to develop specific skills, into school curricula to better prepare the future workforce for the digital economy.
	Engage in capacity building to reduce the digital divide between members and improve digital connectivity in the region so that all APEC members can take advantage of the benefits of the digital economy.
Improving cross-border interoperability of digital systems	Continue efforts to digitalize trade processes to further increase trade efficiency as well as enable greater engagement of SMEs, thereby helping to make trade more inclusive and supportive of sustainable development.
	Implement the technical frameworks needed to establish cross-border paperless systems to progress towards greater integration of SW systems to further improve trade facilitation in the region.
	Examine how domestic digital applications for COVID-19 health certifications can be developed and/or integrated into existing regional systems to ensure interoperability and help facilitate cross-border travel.

Main Challenge	Policy Recommendation
	Ensure that digital infrastructure and digital processes are resilient by developing and implementing strong data security frameworks to protect increasingly interconnected digital systems against cyberattacks.
Fostering greater regulatory cooperation	Renew efforts to reduce regulatory barriers, such as those concerning electronic transactions, in order to facilitate greater cross-border trade and also promote the digital economy.
	Participate in multilateral collaborative efforts to develop frameworks that align rules and standards relevant to trade in the digital era, such as by fostering interoperability of systems, thereby helping to support economic recovery and sustainable and inclusive growth.
	Develop innovative regulatory solutions to address the compliance issues relating to tax and labor laws that arise due to cross-border remote work, thereby supporting flexible working arrangements and enabling firms to become more competitive.
Maximizing digital dividends and spillover benefits	Promote digital entrepreneurship through the use of incentives to reduce risks associated with the application of new technologies.
	Adopt certain digital safeguards, such as data privacy policies and social protection, to address informalization and job displacement.

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6. APPENDIX: CASE STUDY SUBMISSIONS

6.1 AUSTRALIA

> **Consumer Data Right (CDR)**
>
> **Pillar: Institutional Connectivity**
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>
> I.   Introduction
>
> Australia's Consumer Data Right (CDR) is a significant, economy-wide reform designed to empower consumers to benefit from the data businesses hold about them. As a key foundation of the growing digital economy, the CDR will drive competition, innovation and productivity.
>
> The CDR enables consumers (both businesses and individuals) to securely share data held about them with accredited and trusted third parties, known as Accredited Data Recipients[195], to derive direct benefits[196]. The CDR gives consumers more choice and makes it easier to switch products and services, which drives competition and will deliver savings to households and businesses. CDR also encourages data-driven and consumer-centred tech innovation to support economic growth. The CDR regulatory framework is underpinned by strong privacy and security features and data standards[197].
>
> The CDR is a key initiative of the Australian Government's Digital Economy Strategy[198], which outlines the settings, infrastructure and incentives necessary to secure Australia's digital future. Following its launch in the banking sector in July 2020, the CDR is now entering a multi-year expansion with extension to the energy sector now being implemented, and the telecommunications sector the third sector assessed for rollout. The CDR is designed to be an economy-wide reform and will be activated across sectors and datasets to deliver greatest benefit to consumers.
>
> Australia is one of the first economies in the world and the first Asia-Pacific economy to establish an economy-wide consumer data portability framework. CDR presents an opportunity for connectivity within the Asia-Pacific region, particularly as other APEC economies, such as New Zealand and Singapore, are also developing government-led consumer data portability frameworks.
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>
> II.   Key issues/problems or objectives
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> Households and businesses generate a huge volume of data in modern life – when we pay for goods and services electronically, manage our bills and mortgages, and use metered energy services. Businesses like banks and energy providers hold this data as part of delivering their products and services to consumers.

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[195] For further information about Accredited Data Recipients, see - https://www.cdr.gov.au/for-providers
[196] For further information about how the CDR works, see - https://www.cdr.gov.au/how-it-works
[197] The CDR regulatory framework comprises of Part IVD of the Commonwealth *Competition and Consumer Act (2010),*
which includes the Consumer Data Right privacy safeguards, and the CDR Rules.
[198] Australian Digital Economy Strategy, https://digitaleconomy.pmc.gov.au/

As technology has transformed data into a hugely valuable resource, there has been a greater recognition of the benefits available by harnessing the power of data, and consumers have rightly expected more access and control over the data collected about them.

The Australian Government introduced the CDR to empower consumers by improving access to and benefits from data held about them. The CDR will fundamentally change the way Australian consumers and business engage, understand and benefit from data, and in doing so transform the economy by driving competition, innovation and productivity gains. It is a cornerstone upon which a thriving data economy can be built – creating an economy-wide, comprehensive right to allow consumers and business to access and control their data.

As the CDR expands it will transform data from being an inaccessible resource used by businesses for profit, to an invaluable tool that consumers can access and share for their own benefit. By giving users greater ability to understand their options, businesses will be forced to pass benefits on to consumers.

Data sharing is not a new concept, however the processes through which it is currently possible may rely on poor cybersecurity processes, for example, sharing usernames and passwords and 'screen scraping', or are inconvenient, time consuming and make it difficult to be used and linked, for example methods relying on providing raw data as a PDF or paper print out.

The CDR is a regulatory framework that creates the secure infrastructure, or 'rails', to facilitate access to and transfer of data, as directed by the consumer with the ability for the consumer to derive insights and benefits from that data and the linking with other data. The CDR recognises that a consumer's choice to share data will depend on their individual preferences and circumstances. Privacy and security considerations are key to ensuring that information within the CDR system is held, used and disclosed securely, allowing confidence in the system to grow. Sharing data within the CDR system creates an audit trail so that, if need be, it will be clear who has accessed specific data, at what time and under what circumstances.

Data holders are the Australian businesses that generate and hold data about consumers[199] and can be obligated to share the data they hold about a consumer with a third party at the direction of, and in accordance with the terms of consent set by the consumer. The obligation to provide access to and share data is enabled through a formal designation of data sets and data holders – see below for further detail.

Accredited Data Recipients (ADRs) are third parties that have been accredited by the Australian Competition and Consumer Commission[200] for the purpose of the CDR to receive and use CDR data on behalf of the consumer, for example a fintech or regtech business. The process of accreditation is similar to a licencing regime and requires to the business to meet certain criteria, such as information security and privacy requirements, and comply with certain obligations in the handling of consumer data.

By enabling the secure transfer of data from data holders (for example, banks or energy companies) to accredited and trusted data recipients, the CDR can facilitate competition and improve market

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[199] More information about current data holders - https://www.cdr.gov.au/find-a-provider?page=1&providerType=Data%2520Holder

[200] Authorised deposit-taking institutions can apply to become reciprocal data holders, thereby offering the functionality of a data holder and an Accredited Data Recipient. For example, Commonwealth Bank of Australia and Regional Australia Bank are both data holders and Accredited Data Recipients.

efficiency. Competition may be enhanced by lowering the barriers to entry for new industry participants by enabling the dispersion of valuable consumer data across the industry. This should enable market participants to offer more suitable services to consumers. It may also assist in overcoming any market power gained by data holders through the collection of data. In sectors of the Australian economy where competition is low, the CDR will mean that businesses will need to improve their offerings to consumers or pass benefits on to consumers, or risk becoming uncompetitive in their sector.

The CDR was conceived following a range of inquiries and reviews. In 2014, a Financial System Inquiry[201] recognised that increased data sharing could improve financial services outcomes. In 2015, a Competition Policy Review[202] recommended that better consumer outcomes could be achieved through improving the access individuals have to their own data. In May 2017, the Australian Productivity Commission published its report from the Inquiry into Data Availability and Use[203], which proposed the creation of an economy-wide, comprehensive right to enable consumers and small/medium business to control and use their data. In its response to the Productivity Commission's Inquiry, the Australian Government subsequently announced the creation of the CDR as an economy-wide approach to data portability.

III. Implementation of the initiative

The CDR was established through changes to the *Competition and Consumer Act 2010*, which effectively established a broad consumer data portability right.

The CDR is being implemented on a sector-by-sector basis. The Minister for Superannuation, Financial Services and the Digital Economy is responsible for deciding which sectors the CDR will apply to, based on criteria provided in the legislation[204]. The Minister considers a range of factors such as the impact on consumers, competition, data-driven innovation, privacy and confidentiality, and whether the data may contain intellectual property. As part of the development of rules for new sectors, a public consultation must be carried out for a minimum of 28 days.

Once a sector or dataset has been designated, CDR rules and standards apply, and sector-specific revisions to rules and standards may need to be developed if there are sector-specific issues (e.g. complaint handling mechanisms) and to specify the timetable by which data sharing obligations will commence.

The CDR is being applied to key datasets and sectors across the economy through a process of assessment and designation, with a strong focus on datasets that deliver tangible benefits for consumers either as a single dataset or in combination with others. For example, the CDR could help households to make informed choices about adopting energy efficient home appliances or solar panels by giving personalised insights based on energy usage data. Combined with financial data, this could help people to manage their monthly household budget more easily.

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[201] Financial System Inquiry Final Report, 2014 - https://treasury.gov.au/publication/c2014-fsi-final-report
[202] Competition Policy Review, 2015 - https://treasury.gov.au/publication/p2015-cpr-final-report
[203] Productivity Commission Inquiry into Data Availability and Use, 2017 - https://www.pc.gov.au/inquiries/completed/data-access/report
[204] *Competition and Consumer Act 2010,* Part IVD - https://www.legislation.gov.au/Details/C2021C00248/c169f125-c42c-4058-8359-bfef6d0e3930

Sectoral and functional expansion of the CDR

In May 2021, the Australian Government committed to accelerating the expansion of the CDR to future sectors by assessing and designating a new sector or data sets every year. As noted above, the Telecommunications sector was also announced as the third priority sector with the assessment process completed in 2021.

To inform the prioritisation and sequencing of future assessment and designation processes a strategic assessment has been undertaken that will inform a roadmap for expansion of the CDR to other sectors and datasets. Public consultation to inform the strategic assessment was conducted between 22 July 2021 to 2 September 2021, supported by targeted engagement with international and domestic stakeholders.

Given the significance and potential of the CDR to revolutionise Australia's digital economy, the Australian Government also commissioned an independent Inquiry into Future Directions for the CDR in 2020. The final report [205] was published in December 2020 and made 100 recommendations on ways to expand the CDR's functionality and to further support innovation and competition. In particular, the Inquiry made recommendations about extending the CDR beyond consumers accessing and sharing their data, to providing for accredited third parties to initiate actions and payments on behalf of a consumer, which could by way of analogy operate similar to a digital power of attorney. The Government Response[206] to this Inquiry was released in December 2021 and 'agrees' or 'agrees in-principle' to 94 recommendations, including the central recommended reforms to extend and enhance CDR functionality to facilitate action and payment initiation, commencing with the banking sector. The implementation of the Government's response will build on the existing consent, authentication and authorisation processes that form the foundation of the CDR data sharing framework to enable trusted and regulated service providers to initiate actions, such as making a payment, via the CDR at the direction of a consumer. Work is currently underway to develop a roadmap to prioritise and implement the recommendations of the Inquiry which will be informed by close engagement with industry, consumer groups and other government agencies.

Governance arrangements

Responsibility for the CDR framework is shared across three key government agencies.

The Consumer Data Right Division within the Australian Treasury is responsible for the overall governance and coordination of the CDR program, as well as specific functions such as policy development, rule-making and sectoral assessment. The Data Standards Body is a dedicated function within Treasury responsible for developing data, technical and consumer experience standards.

The conduct of data holders and ADRs is overseen by two Australian regulators:

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[205] Report of the Inquiry into Future Directions for the Consumer Data Right, https://treasury.gov.au/publication/inquiry-future-directions-consumer-data-right-final-report

[206] Government Response to the Inquiry into Future Directions for the Consumer Data Right, https://treasury.gov.au/publication/p2021-225462

- the Australian Competition and Consumer Commission (ACCC) is responsible for regulatory oversight of the CDR, including compliance and enforcement of data holder and ADR requirements, accreditation functions, including establishing and running the accreditation platform and conformance testing capabilities;
- the Office of the Australian Information Commissioner (OAIC) is responsible for regulatory oversight and enforcement of privacy requirements, including supporting a 'privacy-by-design' approach to CDR policy and regulatory setting.

IV. Key impact

At the individual level, the CDR will help people access better services and products, ultimately saving time and money. For businesses, better access to data will also support more efficient processes, with savings flowing through to consumers.

The CDR framework is also enhancing data-driven innovation in Australia's tech industry to create new products, services and jobs to support Australia's economic growth and help with post-COVID-19 economic recovery. Examples of new Australian companies include Frollo (a personal financial management app) and Adatree (which helps businesses participate in the CDR system). The CDR framework can also help support international trade by creating opportunities for Australian companies to provide data-driven services in the global marketplace.

Tangible benefits for consumers are already being seen from the rollout of the CDR in the banking sector. For example:

- Quicker loan applications – Regional Australia Bank is using CDR to leverage real-time, accurate financial data to streamline the credit approval process, rather than relying on the time-consuming collection of paperwork[207].
- Financial wellbeing – the Australian company Frollo uses CDR to enable its customers to easily share their banking data. Their personal finance management app displays real-time aggregated account and transaction data, and supports financial wellbeing by providing tailored insights and personalised savings goals[208].
- Finding the best products tailored to the consumer's situation – Finder, an Accredited Data Recipient, is developing a feature in its app in which consumers can consent to share their CDR data to produce personalised banking product recommendations[209].

As the CDR expands across sectors, the number of Accredited Data Recipients increase and CDR capability grows, the benefits to consumers, competition and innovation will accelerate.

V. Lesson learned

Frequent and targeted engagement with data holders, tech innovators, and consumer advocacy and privacy groups has been key to successful implementation of the CDR so far. These groups have helped inform the design of the CDR regulatory framework and have identified issues and risks

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[207] More information on Regional Australia Bank's use of CDR data is available at: https://www.regionalaustraliabank.com.au/what-is-cdr-data

[208] For more information, see Frollo's Open Banking page: https://frollo.com.au/open-banking/?gclid=EAIaIQobChMIhbXDuIH48QIVH5VLBR13pQIKEAAYASAAEgJOJfD_BwE

[209] For more information, see Finder's accreditation announcement: https://www.finder.com.au/finder-achieves-cdr-accreditation

early in implementation. When organisations have actively participated in the development of the CDR, they also advocate for the benefits of CDR – attracting more interest among others.

A key policy challenge for any data portability system is raising awareness among consumers about the importance of safe and secure data sharing practices and building confidence, trust and data literacy to facilitate consumers making more informed choices while at the same time supporting innovation to flourish. A fundamental design feature of the CDR is robust privacy and security protections and informed consent mechanisms that empower consumers to determine what data is shared, with whom and for what purpose, as well as when it must be deleted.

Australia is sharing experiences with other economies that are either developing or considering similar consumer data portability frameworks, and welcomes contact from other interested APEC economies.

VI.   Way forward for improved digital connectivity

Other APEC economies, such as New Zealand and Singapore, are also developing government-led consumer data portability frameworks.

To enhance connectivity among APEC economies, there are opportunities to encourage the development of interoperable data portability frameworks. Interoperability can enhance trade in the Asia-Pacific region by enabling data-driven tech companies to scale up across the region and allow consumers to access products and services from other markets. Interoperable data portability frameworks with strong privacy protections will also give consumers and businesses confidence that their data is protected, regardless of where it flows.

APEC members have committed to working together on data portability – for example, under the Australia-Singapore Digital Economy Agreement[210], a Memorandum of Understanding on Data Innovation includes 'exchanging information and knowledge on data portability.' In a joint statement from the annual Australia-New Zealand Leaders' Meeting on 31 May 2021, Prime Minister Morrison and Prime Minister Ardern jointly committed to continue work towards interoperability on Consumer Data Rights[211].

Digital Transformation

Pillar: Institutional Connectivity

The Australian Government's Digital Identity system is transforming the way that Australians and Australian businesses engage with the government services they use every day.

As Australia's digital economy expands, the Australian Government's interoperable Digital Identity system will be increasingly used across more government and private sector services. People can create a Digital Identity through a simple, streamlined online process, using the Australian Government's identity provider, myGovID. Once people have created a Digital

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[210] Department of Foreign Affairs and Trade, Australia-Singapore Digital Economy Agreement https://www.dfat.gov.au/trade/services-and-digital-trade/australia-and-singapore-digital-economy-agreement
[211] Joint Statement - Prime Ministers Jacinda Ardern and Scott Morrison, https://www.pm.gov.au/media/joint-statement-prime-ministers-jacinda-ardern-and-scott-morrison

Identity, they can reuse it across any government and commercial services that are connected to the Digital Identity system.

The Digital Identity system is already used by over 2.5 million individuals, saving them time and money. It provides a way for people to log in to myGov, the primary portal to access Australian Government digital services. It also helps almost 1.3 million businesses to access over 77 Government services, improving their efficiency and productivity. Together, Digital Identity and myGov ensure people can access many of the government services they need digitally.

The Australian Government is currently expanding both systems.

- The Digital Identity system is developing the capability for biometric verification to enable a stronger identity strength and access to more services end-to-end digitally. In the future, this can save Australian families up to 4 hours applying for services and up to 4 weeks waiting to prove their identity. The Australian Government is also developing legislation to support a broader rollout of Digital Identity to services provided by states, territories, and the private sector.
- myGov is being enhanced as a central place for people to discover, access and manage their interactions and services with government. It will develop new capabilities to transform the experience for all Australians interacting digitally with government. This follows five successful myGov Beta releases through 2020-21.

Many Australians used Digital Identity and myGov to access government services and support safely and securely during the 2019-20 Australian bushfires and COVID-19 pandemic.

Digital Identity is supported by the Trusted Digital Identity Framework (TDIF), which details the rules and requirements for governance, accreditation and operation of all parts of the system. This ensures a safe and secure digital identity system for the Australian economy.

6.2   CHINA

Smart Customs, Smart Borders and Smart Connectivity

Pillar: Institutional and Physical Connectivity

I.   Introduction

To enhance connectivity in the digital era, improve the capacity for institutional innovation and effective governance, deepen international customs cooperation, build consensus among Customs authorities, safeguard multilateralism and better tackle global challenges, President Xi Jinping proposed "strengthening Customs cooperation on 'Smart Customs, Smart Borders and Smart Connectivity' (3S) for trade security and faster clearance" at the start of 2021. China Customs put the 3S Initiative into action immediately and has now carried out 78 "3S" pilot projects economy-wide (with the number of pilot projects continually increasing).

II.   Key issues/problems or objectives
- The clearance time and effectiveness and efficiency of Customs control
- Large mail volumes

- Providing one-stop SPS-related services
- The creation of a connectivity platform integrating such functions as data exchange and information sharing

III.   Implementation of the initiative

1. "Click & Clear" project by Guangzhou Customs

Under the philosophy of "Smart Customs, Smart Borders and Smart Connectivity", Guangzhou Customs launched the project "Click & Clear" in cooperation with Hong Kong Customs, Macau Customs, and Postal Services of Guangdong province, Hong Kong SAR and Macau SAR. With the application of digital approach and smart technology, this project has created a one-stop system for smart supervision over parcels coming to Mainland China from Hong Kong SAR and Macau SAR.

At the declaration stage, Postal Services in Hong Kong and Macau will send the postal data to Guangzhou International Mail Exchange Bureau via electronic data interchange (EDI) before the arrival of the parcel. After receiving the data, Guangdong Post Office will make pre-arrival declaration to Guangzhou Customs by submitting complete and truthful EDI data.

Regarding the transportation, the Customs' mail supervision area is equipped with smart gates and has smart parking places for mail trucks that enable Customs officers to effectively monitor the loading and unloading operations. With the application of electronic seals, GPS devices and gate control system, mail trucks are automatically inspected and released, which shortens the average clearance time by 2 hours.

（Picture: a mail truck is entering the Customs' mail supervision area through the smart gate）

At the clearance stage, after the parcels arrive at the Guangzhou International Mail Exchange Bureau, the Customs will conduct big data analysis when reviewing the digital declaration documents and give different instructions. Then, the parcels will be sorted automatically according to the instructions, during which AI-based image scanning and nuclear radiation detection equipment are used for comprehensive and effective inspection. At the end of the sorting process, parcels that meet the entry requirements will be released and all customs formalities will be finished altogether.

（Picture: automatic sorting of parcels）

"Click & Clear" project is also connected to China Customs' "Customs-Post E-Clearance System", allowing 28 Customs formalities (e.g., declaration, taxpaying, tracking, application for return, etc.) to be handled online in a paperless manner. With just a few clicks on the phone, customers can enjoy the service of one-stop smart clearance of parcels.

（Picture: the interface of Customs-Post E-Clearance System）

For Customs, the "Click & Clear" project has helped shorten the clearance time and enhanced the effectiveness and efficiency of Customs control. The application of smart technology has helped

to deal with larger mail volumes with less human resources. For postal enterprises, the provision of better service has enhanced their competitiveness and public image. Costs are saved as a result of faster clearance. For customers, the "Click & Clear" project makes it possible for them to quickly handle Customs formalities online anytime and anywhere, thus meeting their needs for efficiency, convenience and transparency.
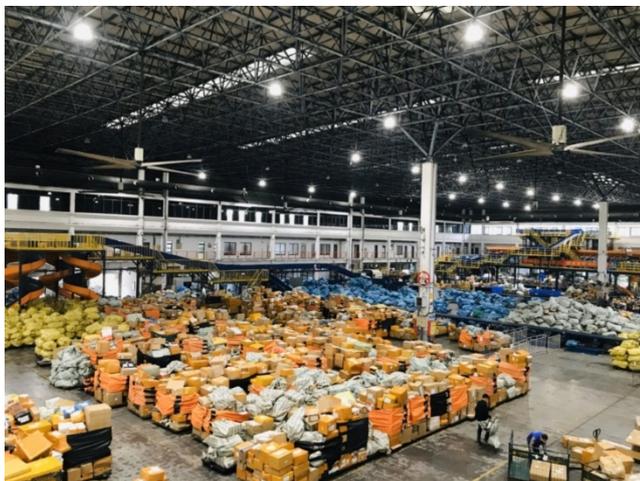
(Picture of mail bags in the mail supervision area)

2. China-ASEAN SPS Cooperation Information Website

China-ASEAN SPS Cooperation Information Website was jointly built by the General Administration of Customs of China (GACC) and the ASEAN Secretariat in 2012. It is the only website providing one-stop SPS-related services including SPS regulation inquiry, notification, comparison and comments, trade concerns, risk information, etc.
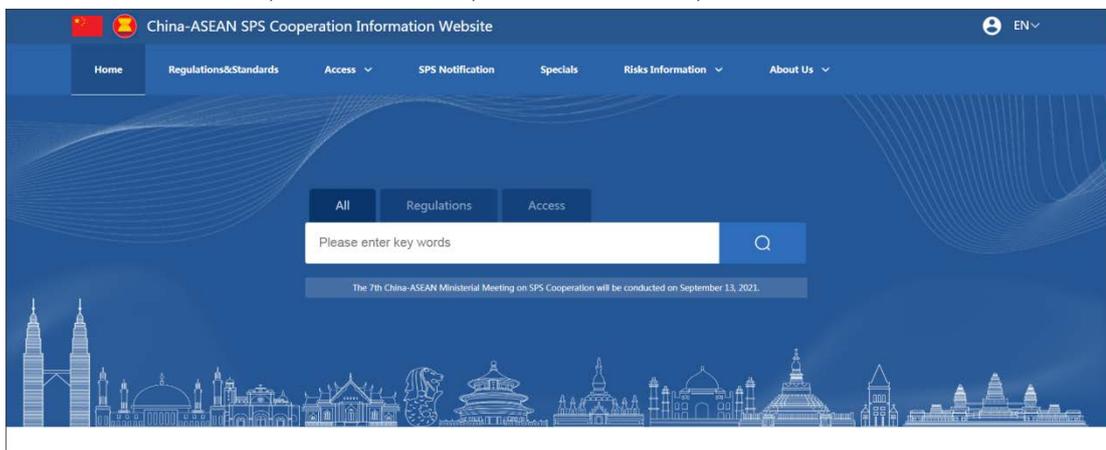
(Picture: Website Interface)

It is a smart website with multiple functions. According to different aspects of the global supply chain of agricultural and food products, the website features 5 key sections, namely, SPS regulations and standards, access requirements for agricultural products, SPS notification, trade in agricultural and food products and risk information; covering 9 practical functions such as SPS calendar and SPS regulation database, etc. It connects relevant regulatory authorities, traders, and consumers in China and ASEAN economies. With rich sources of information, the website enables smart supervision and smart cooperation, and serves as the first smart SPS-related communication

platform under China-ASEAN cooperation framework. Among its functions, "SPS calendar" shows the users, through clear indicators, which regulations and standards will become valid or invalid soon, thus reminding the users to be prepared for such changes; "access inquiry" provides users with the access status of animal and plant products and food products that need risk assessments through simple input of keywords such as commodity names, so that the users will know the basic regulation requirements of the export market.

(Picture: SPS Calendar)

(Picture: Access Inquiry)

Information connectivity is achieved through participation of multiple parties. As a jointly built cooperation platform, the website serves the China-ASEAN Ministerial Meeting on Quality Supervision, Inspection and Quarantine (SPS Cooperation) and facilitates the multilateral communication and cooperation among ASEAN Secretariat and SPS authorities. All parties can

upload their domestic regulations and standards to the website, discuss specific matters, exchange information and share resources.

High-quality information for a wide group of users. Featuring powerful interactive functions, the website facilitates the communication of relevant authorities under China-ASEAN cooperation framework, and allows traders to provide feedback on the impact of technical trade measures in an easier way. It helps agriculture and food products regulatory authorities of China and ASEAN economies quickly find relevant regulations and standards, and provides enterprises with more authoritative, comprehensive, professional and timely information.

3. Digital Border Information Connectivity Project

For the purpose of facilitating trade between China and Singapore, and guided by the philosophy of "Smart Customs, Smart Borders and Smart Connectivity", Chongqing Customs cooperates with enterprises, including those from Singapore, to advance the Digital Border Information Connectivity Project, for the creation of a connectivity platform integrating such functions as data exchange and information sharing.

Data exchange. Enterprises can, on a voluntary basis, enter the cargo container number into the platform. The Chinese government and relevant enterprises can automatically capture the entered data through the data channel docked with the platform, and immediately feedback the status of containers to the platform, realizing the real-time interaction of dynamic logistics information of containers between Chongqing and Singapore ports. The enterprises of the two economies can carry out real-time tracking and smart inquiry of the whole process of cargo logistics between the two sides, thus increasing predictability of customs clearance and transportation, and enabling enterprises to adjust sales and production plans quickly. Since the kick-off of the platform one year ago, the dynamic information of 224,700 batches of containers has been exchanged, effectively lowering the threshold for enterprises especially small and medium-sized ones, to participate global trade.

Information sharing. With the principles of mutual benefit, win-win cooperation, fairness and reciprocity, Chongqing Customs and Singapore Customs focus on sharing of such information as reports on risks of infectious disease at ports, animal and plant epidemic notification, quality and safety risk monitoring of imports and exports, border intellectual property infringement cases, etc., which helps the two sides carry out risk assessment and customs control.

Through the implementation of the Digital Border Information Connectivity Project, the efficiency of customs clearance of goods between China and Singapore has been significantly improved, and the effectiveness of coordinated governance and cooperation and mutual trust between the two governments have been enhanced, creating a better business environment for enterprises with lower customs clearance costs, improved customs procedures and increased clearance efficiency.

IV.   Key impact
- Shorten the clearance time and enhanced the effectiveness and efficiency of Customs control.
- High-quality information for a wide group of users, facilitates the communication of relevant authorities, and allows traders to provide feedback on the impact of technical trade measures in an easier way.

- Creating a better business environment for enterprises with lower customs clearance costs, improved customs procedures and increased clearance efficiency.

China Accelerates the Large-scale Deployment and Application of IPv6 and Promotes Digital Interconnection

Pillar: Institutional and Physical Connectivity

I.   Introduction

In 2017, China issued the Action Plan for Promoting the Large-scale Deployment of the Internet Protocol Version 6 (IPv6) (hereinafter referred to as the Action Plan), which clearly put forward the overall objective, road map, key tasks and timetable for the development of next-generation Internet based on IPv6. The Action Plan is a guideline for accelerating the large-scale deployment of IPv6 in China, and promoting the evolution and upgrading of the Internet and digital interconnection. In 2021, Cyberspace Administration of China in collaboration with relevant departments issued and implemented the Notice on Accelerating the Large-scale Deployment and Application of Internet Protocol Version 6 (IPv6), the Three-year Special Action Plan for IPv6 Traffic Increase (2021-2023), and other policy documents. Government departments, basic telecommunications enterprises, Internet-based enterprises, equipment manufacturers and scientific research institutions have given active responses, accelerated the large-scale deployment and application of IPv6, and participated in the formulation of IPv6 international standards and international conference exchanges, playing a positive role in promoting digital interconnection.

II.   Key Objectives and Results

Through joint efforts, China has made some breakthroughs in the large-scale deployment of IPv6, significantly improved the carrying capacity and service level of the Internet. As a result, the rapid development of emerging technologies such as 4G/5G, cloud computing, big data and artificial intelligence gains efficient support, and the collaborative innovation of network information technology, industry and application is effectively promoted. By June 2021, the number of active IPv6 users in China reached 533 million, accounting for 53.91% of all Internet users in China, and there were 1.592 billion users with assigned IPv6 address. The three major telecom operators already completed the end-to-end IPv6 transformation for LTE networks in 30 provinces across China, and launched the IPv6 service bearer function. All backbone network devices supported IPv6. Major telecom operators and education networks have cumulatively opened international inward and outward channels that support IPv6, with a total bandwidth of 3.11 Tbps.

In terms of international standards formulation, Tsinghua University, Huawei, China Telecom, China Mobile and other institutions actively participated in the formulation of Internet Engineering Task Force (IETF) IPv6 related new technology standards. In 2021, Huawei accelerated the formulation of Segment Routing IPv6 (SRv6) network programming technical standards. The standards were supported by mainstream network equipment manufacturers in the industry such as Huawei, Cisco, ZTE, H3C, Juniper and Nokia, and realized the interconnection testing of SRv6's main functions and the interconnection of important network features such as basic functions of SRv6, L3VPN, traffic engineering and fast reroute. For example, G-SRv6 compression technology, which is an important feature of SRv6, has been supported by 12 equipment and chip

manufacturers around the world. And a series of interoperability tests and pilot deployment have been completed.

In terms of international exchanges and cooperation, in July 2020, Chinese scientific research institutions participated in the 108th IETF meeting, thoroughly explored and discussed around IPv6 with more than 1,000 experts from many equipment manufacturers, operators, Internet companies, research institutions, universities and other institutions, and shared views on the latest work trends of IETF.

III.   Lessons Learned

It is suggested to strengthen regional policy, industry and technology exchanges, share the latest research achievements in the Internet field and domestic industrial policies, accelerate the formulation of Internet standards, product research and development, and promote intra-regional and inter-regional network interconnection to bridge the digital divide.

APMEN (Asia-Pacific Model E-Port Network) Visualization of Sea Freight Logistics and Digitalization of Air Freight Logistics

Pillar: Institutional and Physical Connectivity

I.   Introduction

At present, more than 80% of all intercontinental cargo uses maritime mode. Maritime moves all kinds of cargo and impacts all sectors in the economy. But, maritime mode is often regarded as "black box" and highly unreliable especially in terms of timings, affecting planning. The standardized exchange of data among stakeholders in the supply chain has the potential to transform trade in the Asia-Pacific region with improved visibility and efficiencies. APEC has set targets to make supply chains more efficient and is working hand in hand with the private sector to reach the supply chain improvement targets under the Supply Chain Connectivity Framework Action Plan.

According to International Air Transport Association (IATA), each air cargo shipment accounts for 30 pieces of paper on average as it makes its way from shipper to consignee, via the freight forwarder, trucking company, terminal operator, airline, ground handler and customs authority. Digitalization is a crucial transformation for bringing transparency and efficiency in current processes, and for reducing potential errors and delays, leading to overall improved customer service.

APMEN Visualization of Sea Freight Logistics Pilot Project

The APMEN Visualization of Sea Freight Logistics project was commissioned to improve the visibility, integrity and transparency of cross-border trade in the Asia-Pacific region by the exchange of sea freight data between APMEN members. The project included stakeholders from the APMEN members (container terminal operators) of Shanghai, Xiamen, Singapore, Hong Kong China, Singapore, and Sydney.

APMEN Digitalization of Air Freight Logistics Pilot Project

The APMEN Digitalization of Air Freight Logistics Pilot Project aims to remove paper documents for both air import and export process through system connection and data exchange between the involved industry stakeholders in compliance with IATA recommended business process and message standards.

The implementation of the Digitalization of Air Freight Logistics Pilot Project is a cooperation between APMEN and Administration of Xiamen Area of China (Fujian) Pilot Free Trade Zone on the basis of the Xiamen International Trade Single Window platform operated by Xiamen Pilot Free Trade Zone E-Port Co., Ltd., to realize the information interconnection of all participants in the air freight logistics chain.

II.   Key issues/problems or objectives

APMEN Visualization of Sea Freight Logistics Pilot Project

In order to fully align with APEC priorities, the project assists APEC economies to adopt and implement GDS in order to enhance the overall performance of supply chains. By doing so the project contributes to the APEC Supply-Chain Connectivity Framework Action Plan Phase II (SCFAP II) by addressing chokepoints 1 and 2 as per below:

1. Chokepoint 1 on Lack of coordinated border management and underdeveloped border clearance and procedures.
2. Chokepoint 2 on Inadequate quality and lack of access to transportation infrastructure and services.

In addition, the objectives for this project included:

1. Develop comprehensive data standards to support the exchange of critical sea freight data between ports and other key process stakeholders.
2. Based on successful pilot outcomes to develop recommendations regarding the use and implementation of data standards for e-Port visibility.

APMEN Digitalization of Air Freight Logistics Pilot Project

With the aim to remove paper documents at Xiamen airport for both import and export processes, and to improve the visibility and transparency of air logistics chain with exchange Air Freight data between the involved industry stakeholders by using IATA industry standards on business process and message standards.

The objectives for this project included:

1. Paperless transportation process for air freight import and export in Xiamen airport.
2. System connection between involved industry parties and visualization of operation process information can be shared electronically.
3. Proof of concept for industry collaboration.

III.   Implementation of the initiative

APMEN Visualization of Sea Freight Logistics Pilot Project

Through confirming sea freight import and export process, the project identified key events of logistics information that can be shared through discussion and research with multiple project participants. The project focused on critical sea freight data exchange between port operators in the APEC region. Finally, according to the results of the pilot project, recommendations for APMEN and APEC regarding the use and implementation of Global Data Standards for e-Port Visibility has been made.

The project followed the APEC principles of cooperation, voluntarism, and consensus building. All the data sharing implemented by the project is agreed by the member ports. Two phases of this project have been conducted with the support and active participation from APMEN members and GS1 since 2018.

The first phase of the project was run among participating ports to capture 8 basic events of sea freight logistics including: gate in, customs clearance, container loading, vessel departure for export, vessel arrival, container unloading, customs clearance, gate out for import. The eight basic events were uploaded to the GS1 EPCIS Sandpit and sharing of the data via reporting queries.

Based on the outcome of phase 1, phase 2 worked on the deployment of a decentralized network which could enable the participants to exchange the data capture and sharing automatically. Considering the data privacy and security, each participant is responsible for the software maintenance as a public platform and data hub to realize the connectivity among members.

Within the context of APEC, the project aimed to fully align with APEC priorities and assist APEC governments to adopt and implement Global Data Standards (GDS) as part of the overall performance of supply chains; this is in alignment with the APEC SCFAP II, Chokepoints 1 and 2:

- Response to chokepoint 1: Focus on leveraging Global Data Standards (GDS) in coordinated border management to ensure improved visibility across APEC supply chains.
- Response to chokepoint 2: By focusing on the action plan item: Data exchange to realize end-to-end data visibility for sea freight.

APMEN Digitalization of Air Freight Logistics Pilot Project

The methodology adopted for the project started from identifying the pain points during the current as-is process and streamline the e-Freight pilot run process for import and export through discussion and research internally with the project team and externally with the industry stakeholders as well.

| Identify pain points | Confirm e-Freight pilot run process | Identify & agree on key events | Investigation & demand analysis | Functional design & system deployment | Adjust process and pilot outcomes |

There are two phases in the pilot project.

Phase 1 is e-Freight / e-AWB Implementation for Import at Xiamen airport, which was initiated with investigation and evaluation by the project team. The project team determined that the initial step of the project was to identify the pain points in the operation process. By drawing a flowchart

and sorting out the main steps of operation process, the project team determined the key events for information sharing to improve visualization of air transportation. In this stage, a series of transport information, such as air waybills, accompanying documents, and freight status updates, have been provided to platform subscribers or platform users in real time.

Phase 2 is e-Freight Implementation for Export at Xiamen airport. The project team first started to carry out extensive research on export e-Freight pilots with local air freight logistics companies, listed all the pain points faced, analyzed the requirements from customers, reviewed the as-is process, streamlined and optimized the process, constructed the system architecture and completed the functional design, and realized consistent optimization and improvement of operation process.

IV.   Key challenges and impact

APMEN Visualization of Sea Freight Logistics Pilot Project

The key risks and challenges involved in the project are shown below:

1. At present, the supervision and operation standards of various ports are not unified, the development of information level & the operation process of port business are not unified. Once a participant has incompatibility problems or it is difficult to develop interfaces, the entirety of the business processes will be at lower speed.
2. In addition, the network between different economies and overseas access restrictions will affect the normal use of the data exchange platforms, this leads to the possibility not to be able to guarantee normal operation all the time.
3. Due to the outbreak of the COVID-19 pandemic, manpower limitations among project partners also impacted the project implementation.

Through communication and coordination with multiple parties, the risks of the project were reduced to the greatest extent.

Overall, through the sharing of cross-border sea freight logistics data between regional ports or e-port operators, the pilot project has promoted better cross-border connectivity and trade facilitation. Building on the foundation for reinforcing and deepening international cooperation and exchange among Asia-Pacific ports, established by this project.

The main positive impacts are as follows:

1. The APEC Supply-Chain Connectivity Framework Action Plan Phase 2 by addressing chokepoints. By focusing on leveraging Global Data Standards (GDS) in coordinated border management to ensure improved visibility across APEC supply chains and to address chokepoint 1. By focusing on the action plan item: data exchange to realize end-to-end data visibility for sea freight and to address chokepoint 2.
2. Making contributions to the APEC Connectivity Blueprint under the pillar of institutional connectivity, where the project support progress in jointly addressing issues of trade facilitation, as well as transport and logistics facilitation.
3. Making contributions to WTO Agreement of Trade Facilitation implementation. By promoting connectivity, the project addresses trade facilitation challenges and contributes to the implementation of the WTO Agreement.

APMEN Digitalization of Air Freight Logistics Pilot Project

Key challenges during the pilot included:

1. Lack of efficient data exchange between some airlines and their ground handling agencies (GHA): Some airlines and their GHA lack reliable and effective data exchange, which is closely related to the level of information construction of each airline, especially the lack of information chain in the original process.
2. Mutual recognition of security status release: Even the security e-release identification mark has been adopted, the security status standards (similar to IATA e-CSD) still need to be improved in order to be accepted by international stakeholder, as different security scheme is applied in China, the IATA e-CSD standards can not be adopted directly.
3. The application program interface of system are not uniform: Different airlines have different systems which will bring difficulties in system connection and data exchange.
4. Data quality of special cargo: The accuracy, integrity and timeliness of data transmission is the key element for implementation of the project.

The project key benefits included:

1. Operational efficiency: The handover efficiency of cargo import operation increased 80% with overall handover time reduced from 2.5 hours to 0.5 hours.
2. Regulatory compliance: This project is in compliance with the advance declaration requirement by government regulators for cargo information, and improves the efficiency of customs clearance at Xiamen airport.
3. Data Quality: This project improves data quality and accuracy. Data redundancy has been avoided. Measures such as automatic data validation, an upgrade of security system, and data monitoring and analysis have greatly improved data quality.
4. Innovation: Industry collaboration and system interconnection are realized through the 'Single Window + Air Freight Logistics' model.
5. Sustainability: This project provides a successful experience for digital air cargo adoption which can be reproduced and widely used in other airports.

V.   Lesson learned

APMEN Visualization of Sea Freight Logistics Pilot Project

During the implementation of the project, APMEN and GS1 were able to coordinate with various parties and held online meetings regularly to promote the progress of the project, which was very helpful for the implementation of the project. However, there are several participants in the project, and different situations and conditions of project participants which also hindered the implementation process of the project. The implementation progress of the project was therefore inconsistent. Therefore, through summarizing the project experience, the relevant project recommendations are as follows:

1. Use comprehensive data standards in the sea freight cross-border supply chains process in APEC, due to observed opportunities for improved business processes and data sharing.
2. Ensure that standards change requests, will be issued (where required) to ensure any gaps in the standards are addressed prior to moving into production implementations.

3. Clear project goals including business model need to be set for future pilot project to maximize the enthusiasm of participants and create work tasks to promote and guarantee the effective implementation of the project.

The project achievements and next steps are shown below.

Through the APMEN Visualization of Sea-Freight Logistics project, the problems of inconsistent information standards and un-exchangeable information in port logistics has been addressed by technical methods, increasing the efficiency of port logistics.

This project follows the APEC cooperation principles, forms best practice case that can be promoted for APEC members, which is of great value to the realization of APEC Connectivity Blueprint.

In the future, the project will promote sea freight information exchanges to better cross-border connectivity as well as trade facilitation, and build on a foundation for reinforcing and deepening cooperation among Asia-Pacific ports in the field of sea freight information exchanges. Next step is to invite and encourage more APMEN members to join this project in alignment with APEC CTI priorities, work together on increased efficiencies and implementation of automatic data sharing.

APMEN Digitalization of Air Freight Logistics Pilot Project

The project successfully removed some paper documents which have long been traditionally used in the industry through system connection and data aggregation; shared the key events in the import and export process for Customs release status and shipment status, which improved customer experience; and implemented security e-release authentication mark to replace the security stamp being put on the paper documents, which is the essential step for e-Freight export process. This means that the objectives of this two-phased pilot project have been achieved successfully.

The success of the project relied on the cooperation and collaboration between government agency and the industry stakeholders. It pioneered the innovative model of 'Single Window + Air Freight Logistics' in China, which can be considered to be a significant demonstration and promotion as a best practice under free trade zone scheme for future phases and subsequent e-Freight implementation in other airports.

Project Recommendations:

1. Further assess technical and policy requirements regarding security release data standards, improve the standards for issuing security status.
2. Extend participation to other key stakeholder groups.
3. Expand the scope in the e-Freight pilot run.
4. Encourage local industry stakeholders to participate in the industry group, raise the local needs on the basis of being compliance with international standards.

6.3 KOREA

Title of the initiative: APEC School Leadership Program (ASLP): Cultivating school leaders' digital-friendly attitude, catalysing for closing the educational gap deepened by COVID-19

Pillar: People-to-People Connectivity

I. Introduction

The COVID-19 has been impacting education sector. Particularly, it is causing an unprecedented learning discontinuity and learning loss around the world. Thus, APEC member economies are implementing distance learning and digital education at K-12 and higher education levels. Depending on the preparedness to the ICT utilization in school curriculums, the APEC member economies are experiencing different levels of shift to remote/hybrid learning.

II. Key issues/problems or objectives

The key issue begins by acknowledging the importance of school leadership in educational emergency. The COVID-19 brought us challenges of ensuring quality and outcome of formal education. School leadership play critical role in setting the digital education system as well as implementation. Thus, the ASLP aims to enhance school leaders' (principals and teachers, who are principals-to-be) understanding on educational technologies and help them to better operate remote/hybrid learning.

III. Implementation of the initiative

The ASLP is composed of two parts: convention of one-week-long virtual workshop and creation of an online platform.

First, the virtual workshop will invite school leaders from APEC member economies. They will take 1) a keynote lecture on importance of school leadership to foster future talents, and engage in 2) a talk concert on school innovation, 3) sharing of the best cases concerning school reformation, 4) collaborative studies and 5) virtual field trip to schools in APEC economies.

To ensure the program sustainability, the ASLP will develop an Online Campus for School Leaders in APEC (OCSLA). The website will deposit case studies on developing digital-friendly school environments. The OCSLA will serve as a virtual platform to connect school leaders, as well as educational professions in the times when the regional and global solidarity is most needed.

IV. Key impact

The ASLP will share exemplary cases of K-12 school operation and management in the COVID-19 times. Thus, it will benefit both participating individuals and APEC member economies.

In this connection, the ASLP serve as a capacity-building program for school leaders. Prior to the program, as well as Upon the program completion, the participants will take survey questionnaire.

At the same time, the ASLP will be an opportunity for member economies to cooperate on regional education innovation.

The program effects and impacts will be measured as enhanced understanding of education technologies (edtech) at individual level and application of digital technologies in school settings at APEC level.

Particularly, the program will invite more than 30~50% of women speakers and participants, which is an effort to implement 'The La Serena Roadmap for Women and Inclusive Growth (2019-2030)".

Both male and female participants will be equipped with the following outcomes:

1. Enhanced school leadership competencies required to combat COVID-19 pandemic (i.e. Comparison of participants' Ante- and Ex-post survey results)
2. School leaders' digital-friendly attitude nurtured for more agile implementation of education in response to COVID-19 pandemic (i.e. Comparison of participants' Ante- and Ex-post survey results regarding utilization of computer software for educational purposes)

As per APEC member economies, the key impact are as follows:

1. Sustainable School Leaders' Network for Education Innovation, which increases educational resilience (i.e. Establishment of the Online Campus for School Leaders in APEC (OCSLA), which will be composed of membership of 200 persons and more, who are future ASLP Alumni)
2. Better understanding and utilization of APEC-wide School Leadership Competency Model (i.e. Development and utilization of the ASLC Model by member economies, as the model will be introduced on the OCSLA website)

V.   Lesson learned

The Korean Ministry of Education has implemented the ASLP as pilot program in the years 2019 and 2020. The program outcomes illustrated that learning community of teachers (i.e. Korean Minister of Education appointed 'the community of 10,000 representative teachers' during the COVID-19 pandemic to share ideas, information, and advices on online education) is critical to the success of educational continuity in the times of emergency.

Yet, the virtual capacity program is better to be operated either off-line and/or in a hybrid manner. Face-to-face interaction between speakers, participants and stakeholders enrich the program.

Especially, once the international travel is allowed, it is better to conduct off-line capacity building program. It is easier to organize off-line site visits (i.e. digital school/classroom visits). Also, when participants could meet each other at the same space and at the same time zone for certain duration, active ASLP alumni network will be created at on- and off-line levels.

In this connection, the ASLP serves as a useful APEC project, which enhances people to people connectivity in educational field.

VI.   Way forward for improved digital connectivity

The ASLP workshop will be held in January 2022 for five days. During the virtual workshop, the participating school leaders will introduce their experiences of school reform and classroom innovation and learn how to use digital tools in education.

Prior to the program implementation, the school leaders are requested to join one-month-long pre-training program to get familiar with the school leadership model and school system in APEC member economies. During the course, the participants will develop individual digital competencies.

Upon the completion of the program, the school leaders will share their lessons learned during the ASLP with their colleagues. After the program, the ASLP alumni will develop digital-friendly classrooms and schools in member economies in response to the COVID-19.

In the long-term, systemic change is critical to transform digital teaching and learning in APEC economies. For instance, online education infrastructure and policies are required foundations to maximize the positive impacts of digital education.

Thus, the ASLP connects school leaders and their peers in member economies in a hybrid manner during and after the workshop. This will result in enhanced people-to-people connectivity in the education sector and promote further advancement of physical and institutional connectivity in APEC.

Title of the initiative: 2020 APEC e-Learning Training Program (AeLT)

Pillar: People-to-People Connectivity

I.   Introduction

During the COVID-19, many economies implemented online and e-learning to ensure educational continuity. To support APEC member economies' e-learning policies and practices, the Ministry of Education, Republic of Korea chose "Educational Policies and Responses in the Post COVID-19 era: Cases from the Republic of Korea and APEC member economies" as 2020 AeLT theme and operated a virtual capacity building program for education policymakers and experts.

The program invited a total of 23 delegates (12 females and 11 males) from 10 APEC member economies[212]. The delegates took lectures and shared exemplary policies and case studies to ensure quality, inclusive and sustainable teaching and learning amidst of global educational emergency.

In addition to the 2020 AeLT program participants, the APEC e-Learning Training Center organized the 5th APEC e-Learning Training Program (AeLT) Alumni Day on 9 December. The AeLT Alumni Day served as an opportunity to share the application examples of AeLT lessons to individual work experiences and current APEC member economies' e-learning policies and practices.

II.   Key issues/problems or objectives

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[212] Brunei Darussalam; Chile; Indonesia; Malaysia; Papua New Guinea; Peru; the Philippines; Russia (Sakha Republic); Thailand; and Viet Nam.

The AeLT aims to narrow down the digital gap in the APEC region. Utilization of ICT in education is a key issue for all 21 APEC member economies, as digital literacy is one of the 21st Century competencies and skills.

However, the outbreak of COVID-19 has facilitated the adoption of e-learning in classrooms and schools. The UNESCO (2020) estimates about 1.725 billion learners worldwide are affected due to school closures from the COVID-19.

Thus, innovative e-learning policies and pedagogies, which encompass distance and hybrid learning are widely accepted in K-12 schools, TVET institutions, higher education institutes and also lifelong learning institutes.

The Republic of Korea announced online opening of schools in April 2020 and postponed the college entrance examination schedule. Korea's experiences are summarized as follows:

1) "Responding to COVID-19: Online Classes in Korea" (June 2020, link)
2) "White Paper: 2020 Education Response to COVID-19" (May 2021, link)
3) "Distance Learning in Korea in response to COVID-19" (2020, link)
4) "Reopening Schools in Korea amid the COVID-19 Pandemic" (2020, link)

To support the digital education paradigm shift and urgent needs in education sector, the Republic of Korea proposed and prepared 2020 AeLT program and AeLT Alumni Day to share its knowhow and experiences with APEC member economies.

III.   Implementation of the initiative

2020 AeLT is composed of online lectures, collaborative studies, workshops and forum. The participants join the pre-training, virtual training and post-training activities.

The delegates are recommended by the Ministries and Departments of Education from APEC member economies. Upon nomination and invitation, the delegates are asked to submit economy reports as assignments. They illustrate the current e-learning policies and issues in the Asia-Pacific region. Then, the AeLT professors and experts cooperate with the delegates to identify possible subjects for the e-learning policy/practice Action Plans.

During the AeLT program, the delegates take online lectures, which are uploaded on the YouTube. On the other hand, delegates access the Google Classroom, which is utilized as the Learning Management System (LMS) and submit their reflections.

At the same time, the AeLT delegates join real-time conference via zoom for opening/closing ceremony as well as collaborative study sessions, workshops and forum. This serves as an opportunity for delegates to share individual progress on Action Plan assignments and get experts/peer review.

Upon the program completion, the delegates are invited to the AeLT Alumni group. Once in a year, AeLT Alumni Day is held to strengthen cooperative relationship among 909 members. Outstanding delegates are invited as speakers and present their work experiences, which are relevant to AeLT outcomes.

IV.   Key impact

A total of 55 persons, who are from member economies' Ministries and Departments of Education, academic scholars[213] and specialists and experts from governmental and public organizations[214] also joined the 2020 AeLT program.

As a result, through 2020 AeLT, 23 delegates drafted a total of 11 Action Plans and 23 Economy Reports, which focus on e-learning policies and practices. The action plans are:

1. Developing Awareness on Sustainable Digital Learning Approaches in Teaching and Learning (Brunei Darussalam)
2. Assessment and Feedback during Online Teaching and Learning (Chile)
3. Approaches to enhance Teacher Pedagogy and ICT Literacy Using Digital Education Learning Initiative Malaysia (DELIMa) (Malaysia)
4. Enhancing Teachers' Competency using DELIMa in Teaching and Learning (Malaysia)
5. Advanced Teacher Digital Training Method to support hybrid learning for education services during and after the COVID-19 (Indonesia)
6. Access of ICT in Secondary School Sector of Papua New Guinea (PNG)
7. Effective Educational Service in Times of Pandemic: Use of Tablet PCs (Peru)
8. Educational Strategies and Initiatives for enhancing the Digital Literacy of Instructors (Sakha Republic, Russia)
9. E-learning Training Program for Enhancing the Digital Literacy of Instructors (Thailand)
10. ICT Enabled Teaching and Learning (the Philippines)
11. Preparing Vietnamese Teachers for effective and sustainable lessons in the new normal (Viet Nam)

At the final step of the AeLT program, the delegates give AeLT Action Plan presentation. These Action Plans are strategic documents, which identify e-learning issues and address possible solutions for APEC member economies. The Action Plan topics are relevant to the delegates' professional works and current e-learning policy focus.

As of December 2020, the total number of accumulated AeLT alumni is 909 persons from 12 APEC member economies. They are connected via online AeLT alumni group and engage in networking and information sharing activities.

Thus, the AeLT Alumni further cooperate with one another to develop and implement concrete and sustainable educational policies and practices with their action plans. Their efforts impact the educational field in APEC member economies with a short, mid- and long-term goals.

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[213] Chung-Ang University, Chungnam National University, Daegu Jinwol Elementary School, Gyeongin National University of Education, Ewha Womans University, Jeonju University High School, Korea National Open University, Seoul National University, Open Cyber University of Korea
[214] Ministry of Education of Korea, Institute of APEC Collaborative Education (IACE), Korea Education and Research Information Service (KERIS), Educational Broad Casting System (EBS), Daegu Metropolitan Office of Education, Gyeonggi Paju Office of Education, National Institute of Special Education (NISE)

V. Lesson learned

The 2020 AeLT participants showed great satisfaction about the overall program. In the survey, the participants scored AeLT as 4.67 out of 5.00 points.

The outcome report of 2020 AeLT can be found on the APEC Project Database website. (link)

Specifically, the delegates mentioned that collaborative study session with e-learning experts was helpful. The real-time study session (held as zoom video conference) was an opportunity for delegates to discuss exemplary solutions and draft Action Plans to advance digital learning policies in their respective economies.

In addition, the delegates expressed their appreciation to the lecturers. There were 10 special lectures, which focused on:

1. Classroom of the COVID-19 (Mr. Byungsun Yoo, English Teacher, Jeonju University High School, Republic of Korea)
2. Korea's answer to the COVID-19: e-Education! (Dr. Hyunsook Chung, Executive Director, Educational Broadcasting System, Republic of Korea)
3. Educational Policies and Supports from Daegu Metropolitan Office of Education against the COVID-19 Pandemic (Mr. Dong Uk Yu, Education Supervisor, Daegu Metropolitan Office of Education, Republic of Korea)
4. Future APEC Educational Cooperation in the COVID-19 Era (Prof. Dong Sun Park, Lead Shepherd, APEC HRDWG)
5. Responding to COVID-19 Online Classes in Korea (Dr. Sang-Hyun Jang, Director, Higher Education Academic Research, Korea Education and Research Information Service)
6. Management Plan for Effective Online Course (Prof. Hyeree Min, Research Professor, Center for Teaching and Learning, Seoul National University)
7. New Teacher Leadership in Times of Pandemic (Mr. Chanwoong Kim, Education Supervisor, Gyeonggi Paju Office of Education, Republic of Korea)
8. E-Learning via COVID-19 to the Future (Prof. Tae In Han, Korea National Open University)
9. Support Case for Handicapped Student Learning for Engagement Education in the Pandemic Era (Mr. Dongkyu Kim, Education Supervisor, National Institute for Special Education)
10. Improving Students' Participation and Collaboration with Adjusting CLOUD Education Platform During the Real-Time Interactive Class (Mr. Minchul Shin, Teacher, Daegu Jinwol Elementary School, Republic of Korea)

The Korean Ministry of Education shared its experiences behind online learning with AeLT delegates and explored possibilities of future cooperation among APEC member economies concerning e-learning.

From the Republic of Korea's experience behind online opening of schools and implementation of e-learning during the COVID-19 crisis, it has identified that the Public-Private Partnership (PPP) is most essential and critical element to facilitate digital learning. Good governance, socio-economic infrastructure and education policy are pre-requisite factors, which serve as positive ground to achieve utilization of ICT in education and training.

In this connection, the AeLT recommends delegates and member economies to seek and realize PPP to maximize the digital connectivity in educational field.

VI.   Way forward for improved digital connectivity

The 2021 AeLT is composed of the 49th, 50th and, 51st rounds of virtual capacity building programs and one AeLT Alumni Day event. With its focus on "Changes of the Educational Environments and Policies in the Untact Society", the AeLT will continue to enhance people-to-people connectivity in the e-learning field.

The COVID-19 situation is an ongoing circumstance, causing difficulties in direct face-to-face interaction. Thus, 2021 AeLT will be held in a virtual manner to contribute as a capacity building program for education policymakers in APEC.

The APEC e-learning Training Center wishes to contribute digital connectivity in the region. The AeLT Center will advocate expanding on-line learning as well as hybrid learning at all levels of education and training.

Our partners include diverse range of stakeholders, including officials from the Ministries and Departments of Education, teachers and experts from K-12 schools, technical and vocational training institutions, higher education institutes, lifelong learning institutes, as well as on-the-job training centers in member economies.

By assisting people-to-people connectivity in e-learning sector, the AeLT will bolster improved digital connectivity in the APEC region.

6.4   RUSSIA

Title of the initiative: Developing AI Competency, Enhancing Enterprise Competitiveness and Boosting AI Economy

Pillar: Institutional and People-to-People Connectivity

I.   Introduction

In 2017, the Supreme Eurasian Economic Council (EEC; under Eurasian Economic Union – an integration block, to which Russia is a party) approved the main areas for implementation the Eurasian Economic Union's digital agenda until 2025.

The document defines the goals, principles, objectives, areas and mechanisms of cooperation between the Members of the Union in the digital sphere. The digital agenda focuses on keeping up to date the established mechanisms of integration cooperation within the Union taking into account the global challenges of digital transformation, ensuring qualitative and sustainable economic growth in the EAEU Members, particularly for an accelerated transition of economies to a new technological paradigm and developing new industries, markets and labor resources.

II.   Key issues/problems or objectives

Areas of digital agenda implementation until 2025:

- Digital transformation of economic sectors and cross-industry transformation in the Union.
- Digital transformation of markets of goods and services, capital and labor.
- Digital transformation of integration management processes in the Union.
- Evolution of the digital infrastructure and protection of digital processes.

III.   Implementation of the initiative

There are several projects currently realised by EAEU. Among them are:

1) Integrated Information System (IIS)

The integrated information system is a geographically distributed information system that ensures communication for the purposes of implementing common processes, interstate exchange of data and electronic documents as well as the activities of the Union's governing bodies.

The idea of the project was born back in 2009. According to the Decision of the Customs Union Commission dated October 21, 2009, the system was named "Integrated Information System of External and Mutual Trade of the Customs Union (IISEMT)". In 2014, the Treaty on the Union stipulated the establishment, operation and development of the Union's integrated information system as part of enhancing the IISEMT's functionality, and more than 80 common processes between the authorized bodies of the Union's Member Economies were to be automated. Over the course of six years, 19 common processes have been automated.

On September 18, 2020, the Council of the Eurasian Economic Commission issued a disposition to perform a comprehensive technical expert examination of the integrated information system (IIS) with a view to developing recommendations on the modernization and improvement of the system as well as analyze the possibility of using the existing tools and services in project implementation in line with the Eurasian Economic Union's (EAEU) digital agenda until 2025. The initiative is aimed at elaborating new possible approaches to the development and modernization of the integrated information system.

2) Unified Search System "Work Without Borders"

The launch of the Unified Search System "Work Without Borders" project was approved by Decision No. 89 of the Eurasian Economic Commission's Council dated September 9, 2019.

The project mainly aims to create a search engine which will provide access to the information on current vacancies and jobseekers stored in relevant information systems of the Member Economies.

It utilizes the existing domestic systems of the Eurasian "five" economies. As a result, the users (job seekers and employers) will be able to look for a job or recruit people in one or several EAEU Members, create any search request in the domestic information systems, have access to job descriptions and CVs as well as communicate with each other. All features with regard to job search and employee recruitment will be free for the users of the system (citizens of the Member Economies as well as companies based there). Project participants are domestic customers-coordinators and consortium of operators of domestic components.

The project has already undergone stages of mobilization, synchronization and development and launch.[215] The latter includes development of standard software and API methods; integration of standard software and API methods with the domestic information systems of the EAEU Members; component and integration tests as well as pilot operation of the standard software and API methods.

3) Ecosystem of Digital Transport Corridors in the EAEU

The ecosystem of digital transport corridors is an open digital environment for sharing information about logistics. It comprises various digital platforms and information systems owned and operated by businesses and (or) public authorities. The ecosystem includes information about vehicles, crews, cargoes, permits and accompanying documents at all stages of transportation or technological activities.

The project addresses the following issues: elimination of transportation and logistics paperwork and shift to data sharing; establishment of common standards for transport and logistics services; shift to a transparent integrated surveillance system based on data analysis that spares transport operators the administrative burden. The action plan for the creation of an ecosystem of digital transport corridors was approved by Disposition No. 4 of the Eurasian Intergovernmental Council dated January 31, 2020.

As part of the project, the following has already been done:

- Selection of authorized bodies (organizations) responsible for different aspects of the plan implementation.
- As a result of the meetings of expert panels and authorized bodies held on August 20 and August 24, 2020, it was decided to early approve the draft disposition of the Council prepared by the Commission "On the list of services and digital infrastructure implemented for the creation of an ecosystem of digital transport corridors of the Eurasian Economic Union" and to request the Commission to include it in the agenda of the next meeting of the Commission's Board for approval.

4) Transboundary Space of Trust

Transboundary space of trust is a set of legal, organizational, and technical conditions approved by the EAEU Members to build trust in the interstate exchange of data and e-documents between the Union's authorized bodies.

In the Eurasian Economic Union, transboundary space of trust is established in the Protocol on Information and Communication Technologies and Information Interaction within the Eurasian Economic Union, constituting Annex No. 3 to the Treaty on the Eurasian Economic Union. The Protocol establishes the key concepts of transboundary space of trust: electronic documents, trusted third parties, general infrastructure for documenting the information in an electronic form and subjects of electronic interaction. Furthermore, Clause 19 determines the general principle of interaction in the transboundary space of trust: "exchange of information on electronic documents between the subjects of electronic interaction that have different mechanisms of electronic documents protection shall be ensured through the use of services provided by the operators of the

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[215] More details on page 6 of the Report "Facts and Figures: Internal markets, informatization and ICT"
http://www.eurasiancommission.org/en/nae/news/Pages/29-03-2021-facts.aspx

general infrastructure for documenting information in an electronic form, including the services of a trusted third party." Clause 20 introduces "the operators of services of a trusted third party", that is the Eurasian Economic Commission and authorized bodies of the Members or organizations selected (accredited) by them.

In 2019, the Concept of Transboundary Information Interaction was approved by Decision No. 7 of the Eurasian Intergovernmental Council dated August 9, 2019 aimed at ensuring transboundary interaction in B2B and B2G segments, which defined the transboundary space of trust as the key driver for implementing information interaction within the EAEU.

Furthermore, the provisions of this Concept with regard to the information interaction between the legal entities of the Members are non-binding. The EAEU Members and the Commission are engaged in developing the transboundary space of trust in accordance with the Concept of Services and Legally Binding Electronic Documents Used in Interstate Information Interaction, approved by Decision No. 73 of the Eurasian Economic Commission's Council dated September 18, 2014, and the Strategy for Developing the Transboundary Space of Trust approved by Decision No. 105 of the Eurasian Economic Commission's Board dated September 27, 2016.

The Concept of Services and Legally Binding Electronic Documents Used in Interstate Information Interaction defines the principles of interstate exchange of legally binding electronic documents through the EAEU's integrated information system using the services provided by trusted third parties. The Strategy for Developing the Transboundary Space of Trust which relies upon the principles of this Concept, sets goals and objectives, as well as defines the stages of developing the transboundary space of trust in order to ensure the use of services and legally binding electronic documents by both legal entities and individuals.

The Strategy for Developing the Transboundary Space of Trust Sets the Following TST Development Goals:

- building productive and trustworthy relationships for international information interaction that provides for the use of legally binding electronic documents by the subjects of such interaction;
- speeding the process of electronic communication within the EAEU;
- improving the efficiency of the EAEU's integrated information system;
- reducing the costs of interaction between the EAEU Members' public authorities, legal entities and individuals.

The following steps have been done:

- development and operation of an integration platform and integration gateways of the EAEU Members and the Commission ensuring an exchange of information during the implementation of the common processes within the EAEU (electronic digital signatures are not required so far);
- setting up of the EAEU Members' trusted third parties on the basis of their own decisions or a standard decision made by the Commission's trusted third party;
- interstate testing of the certifying center of the trusted third party, a subsystem of the Commission's trusted third party, and the Commission's certifying center;
- approval of the pilot operation program developed by the certifying center of the third trusted party in the Eurasian Economic Union's integrated information system.

IV.   Key impact

Implementation of the enumerated projects allows to synchronize the digital transformations and create conditions for the evolution of the industries in the EAEU Members. As a result, not only will information communication technologies be applied to the implementation of the digital agenda, but also new business processes, digital models and digital assets will be created.

V.   Lesson learned

It is the understanding of Russia and its EAEU partners that consecutive, gradually evolving mechanisms are required to ensure high quality digital transformation. Thus, there have been distinguished three stages of digital agenda:

1) Modeling of digital transformation processes, elaboration of the first initiatives and launch of flagship projects considering the priorities of the initiative's development.
2) Formation of digital economy institutions and digital assets as well as development of digital ecosystems.
3) Implementation of digital ecosystems and digital cooperation projects on global, regional, domestic and sectoral scales.

VI.   Way forward for improved digital connectivity

1) Integrated Information System (IIS)

On September 18, 2020, the Council of the Eurasian Economic Commission issued a disposition to perform a comprehensive technical expert examination of the integrated information system (IIS) with a view to developing recommendations on the modernization and improvement of the system as well as analyze the possibility of using the existing tools and services in project implementation in line with the Eurasian Economic Union's (EAEU) digital agenda until 2025. The initiative is aimed at elaborating new possible approaches to the development and modernization of the integrated information system.

According to the disposition of the Commission's Council, all findings (including the recommendations on the modernization and improvement of the system) of the IIS comprehensive technical expert examination shall be submitted to the Board by the end of Q1 2021. Then a report on performance shall be provided to the EEC Council.

2) "Unified Search System "Work Without Borders"

The next step to be executed is designated as "Evolution". It embraces: execution of a report on the transfer of the standard software, API methods and project technical documentation to the domestic customers coordinators; conclusion of the license agreement and the acceptance certificate by the EAEU Members with regards to granting the right to use the Unified Search System "Work Without Borders" standard software; exchange of experience among the public authorities and organizations of the Member Economies as well as other project participants with regard to the introduction and development of IT in the area of employment and occupation; development of an action plan for the further implementation of the project.

3) Ecosystem of Digital Transport Corridors in the EAEU

The proposals of the Republic of Belarus and the Russian Federation in respect of its implementation are being reviewed, including ways (methods, forms) for introducing the ecosystem's priority services and digital infrastructure.

4) Transboundary Space of Trust

The next step envisages establishment of an electronic notarial institution on the basis of the trusted third party's office and other interstate electronic services, including labor migration, which will involve individuals in the process of transboundary electronic interaction (provided that the EAEU Members agreed on joint approaches to legal, organizational and technical support of the transboundary space of trust and phased implementation of the requirements for the encryption of the transboundary space of trust by the EAEU Members).