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Advancing Free Trade
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APEC Connectivity Blueprint: The 2020 Mid-Term Review

APEC Policy Support Unit

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TABLE OF CONTENTS

ABBREVIATIONS

Abbreviations for APEC fora and other groups

Abbreviation	Name
ABAC	APEC Business Advisory Council
ACT	Anti-Corruption and Transparency Working Group
AD	Automotive Dialogue
ASCC	APEC Study Centers Consortium
ATCWG	Agricultural Technical Cooperation Working Group
BMC	Budget and Management Committee
BMG	Business Mobility Group
CD	Chemical Dialogue
CPLG	Competition Policy and Law Group
CTI	Committee on Trade and Investment
CTWG	Counter-Terrorism Working Group
DESG	Digital Economy Steering Group
EC	Economic Committee
ECSG	Electronic Commerce Steering Group
EGILAT	Experts Group on Illegal Logging and Associated Trade
EPWG	Emergency Preparedness Working Group
EWG	Energy Working Group
FMP	Finance Ministers' Process
GOS	Group on Services
HLPDAB	High Level Policy Dialogue on Agricultural Biotechnology
HRDWG	Human Resources Development Working Group
HWG	Health Working Group
IEG	Investment Experts' Group
IPEG	Intellectual Property Rights Experts' Group
LSIF	Life Sciences Innovation Forum
MAG	Market Access Group
OFWG	Ocean and Fisheries Working Group
PPFS	Policy Partnership on Food Security
PPSTI	Policy Partnership on Science, Technology and Innovation
PPWE	Policy Partnership on Women and the Economy
SCCP	Sub-Committee on Customs Procedures
SCE	SOM Steering Committee on ECOTECH (Economic and Technical Cooperation)
SCSC	Sub-Committee on Standards and Conformance
SMEWG	Small and Medium Enterprises Working Group
TELWG	Telecommunications and Information Working Group
TPTWG	Transportation Working Group
TWG	Tourism Working Group

EXECUTIVE SUMMARY

This report provides the mid-term review of the APEC Connectivity Blueprint that covers three pillars: physical, institutional and people-to-people. The approach of the review is to conduct both a qualitative assessment and a quantitative assessment by utilising data and information gathered directly from member economies as well as from secondary sources. The following are the key highlights of the review.

KEY HIGHLIGHTS FROM THE YEARLY REVIEW REPORTS

Physical Connectivity

The yearly review analysis shows the importance of both physical and digital infrastructure. Despite the rise of the digital economy and e-commerce, it is important to acknowledge that most supply chains still rely on physical infrastructure. This further highlights the importance of quality infrastructure in the development of ports, roads and other public infrastructure. Transportation infrastructure with strong quality elements will ensure that the services being delivered are efficient, resilient and sustainable.

The issue of resilience is also highlighted by several initiatives. Better emergency preparedness through public-private partnerships will support quick recovery during times of natural calamities. Stronger resilience can also be developed by adopting new technologies that are becoming more accessible and widespread. Improving resilience is also being considered as a regional initiative, particularly in the context of global supply chains and sustainability.

In terms of infrastructure financing, PPPs are mentioned as one of the key policies being adopted to encourage the development of connectivity and energy infrastructure. PPPs allow economies to share the risks across private and public entities more efficiently in addition to supporting the facilitation of more 'bankable projects' that will be able to attract funding from global investors.

Economies have also actively developed their ICT infrastructure to support the development of the digital economy and 'smart' infrastructure. Logistics facilities will need to be modernised in order to facilitate growing demand from e-commerce as well as to ensure secure trade. With sophisticated facilities, ports and customs will be able to perform risk management more effectively by having a more targeted inspection of goods and passengers. Businesses will benefit from the application of digital technology that allows for more visibility and traceability in the supply chain. A smart and intelligent transport infrastructure system will also help to reduce congestion and logistics costs as well as promote seamless connectivity.

Last but not least, the submitted initiatives show that high priority is also given to rural and remote areas. With the development of digital technologies and innovations, broader access of connectivity can be provided to remote and rural areas; this will help to bridge the digital divide and allow communities to be more resilient and sustainable. Efforts have also been made to build the necessary infrastructure to generate and distribute sustainable energy efficiently.

Institutional Connectivity

Initiatives submitted under this pillar focused on trade facilitation, regulatory reform, data flows, and inclusiveness. In terms of trade facilitation through cooperation, Single Window development in many economies has been geared towards interoperability and paperless or digital methods. Initiatives to integrate SMEs into AEO certification schemes aim to support stronger integration of SMEs into GVCs, while at the same time maintaining safe and secure trade.

Regulatory and structural reforms have been instrumental in facilitating trade, investment and services. Trade in goods such as medical and food products has benefited from harmonisation of standards and safe regulatory procedures. Facilitation of GVCs is being conducted through GVC-friendly provisions in RTAs/FTAs as well as by providing broader access for SMEs and women to participate in global production networks.

In the financial sector, an enabling environment for greater financial integration can be achieved by adopting a mutual recognition framework that envisions the harmonisation of investment rules and regulatory requirements. Multilateral mutual recognition arrangements provide opportunities to further waive or diminish key regulatory impediments to cross-border trade in managed funds.

The role of data has been growing in importance in supporting global trade and e-commerce. To ensure safe and secure e-commerce, initiatives to facilitate regional cooperation in data privacy and protection have been implemented: APEC Cross Border Privacy Rules (CBPR) System and APEC Framework for Securing the Digital Economy. CBPR helps to reduce compliance costs and hence facilitates cross-border connectivity and interoperability, while the APEC Framework emphasizes the importance of awareness, responsibility, cooperation and privacy to strengthen the resilience of APEC digital economies and facilitate electronic commerce.

To ensure a wider positive impact from trade, facilitation of women's access to global markets by implementing gender-responsive policies is encouraged to help overcome institutional challenges. Improving transparency of services regulations will also assist SMEs to grow and innovate in the global market.

People-to-People Connectivity

Cross-border science, technology and innovation exchanges promote high-quality innovation in the region. Addressing the skills gap is also important in developing a vibrant domestic economy. APEC members have been providing scholarships to facilitate the movement of scholars and researchers across the region in areas such as science, technology and engineering. Scholarships are also provided to promote long-term customs-to-customs cooperation.

Building entrepreneurship networks is also high on APEC economies' agenda as well as efforts in promoting youth and women employment. These efforts will address the issue of women and youth employability by helping to close the gap between education and skills. Additionally, mutual recognition of skills and credentials can play an important role in facilitating skilled labour mobility and addressing labour and skills shortages. Reforms and global cooperation in higher education will ensure that the quality of education is relevant to equip students with the skills and competencies required in a globally connected and competitive society.

Travel and tourism facilitation initiatives have been implemented to develop the tourism industry. The development of tourism facilitation policies and institutions serves to reduce the non-logistics costs and uncertainties associated with tourism. Several economies have implemented domestic measures to ease visa restrictions for tourists and have initiated programmes to improve immigration processing. Some of the visa facilitation measures include special visa waiver schemes and paperless platforms (including a Single Window facility for visas and work permits). Enhanced cultural understanding through cultural events can also improve tourism, investment and cross-border trade. Meanwhile, business travel facilitation helps to reduce the costs and uncertainties for business people to explore and maintain business opportunities and investments.

KEY HIGHLIGHTS FROM THE CASE STUDIES

China's Single Window experience highlighted the importance of organisation and coordination, as well as government support, as key factors in the successful implementation of a Single Window system. Good scientific design and innovative application of new technologies were also found to be imperative to its implementation. Lastly, the long-term success of the system depends on the optimisation of relevant legal systems necessary for its operation. The challenge of developing interoperability across different legal systems was also recognised by Chile. To address this issue, Chile acknowledged the need to ensure coordination between economies to integrate the systems and achieve interoperability, while also taking into account the different levels of technology development and overcoming the lack of standards.

Japan has developed a Smart City initiative to use new technologies to help solve various urban issues like over-crowding, inefficient energy and resource consumption, and constraints on services like healthcare and education. However, the lack of interoperable systems, similar infrastructure capacity and open data platforms across jurisdictions have posed problems for this initiative. In response, Japan is creating partnerships to develop integrated solutions across its various ministries and stakeholders. Given that cities want to construct smart cities that best fit their vision and strengths, the Japanese government is also developing legal support to allow for a more standardised and interoperable smart city development.

The Singapore government and members of the private sector have come together to ignite various knowledge communities into collectively working towards innovative solutions that would enable companies to recognise, transform and operate in the new post-COVID-19 environment. Riding on strong public-private sector partnerships, the National Innovation Challenges (NIC) programme aims to develop industry-led solutions for the immediate priorities of re-opening the economy as well as to offer longer-term stability that ensures sustainable growth and economic resilience. By jointly analysing industry problem statements and crowdsourcing for solutions, the NIC programme will quicken the pace of innovation, commercialisation, and adoption across industry sectors – allowing companies and government agencies to adapt more quickly by tapping the innovation capabilities of various technology, business and academic communities.

Thailand's broadband internet project for villages, Net Pracharat, aims to build digital infrastructure that will improve availability, accessibility and affordability of broadband internet service to people in rural and non-marketable areas, hence diminishing the digital divide. However, the initiative's implementation has had several challenges, such as the large scale of the project, instability of electricity connections, and insufficient Wi-Fi capacity in some bigger villages.

Viet Nam initiated a project to enhance stakeholder engagement in the implementation of the WTO-TFA through a one-day workshop. The discussions in the workshop relayed several challenges to the efficient implementation of the TFA, including gaps in data security, coordination issues between government agencies and between government agencies and the private sector, and a lack of human and financial resources. In Viet Nam, the enhancement of stakeholder cooperation in the implementation of the TFA has remarkably improved through better connectivity of the Single Window and development of the AEO programme. However, there is still a need to create transparent and effective assessment mechanisms to define the roles of each stakeholder.

KEY HIGHLIGHTS FROM ASSESSMENT OF SURVEY RESPONSES AND EXTERNAL INDICATORS

Physical Connectivity

Many economies have introduced PPP centres to promote the use of the PPP model. There has been a consistent increase in the number and investment value of transport infrastructure PPP projects. Data from several APEC economies showed that the number of transport projects under the PPP model grew from 147 projects in 2014 to 1,289 projects in 2019. The total value of PPP investments in road, rail, port and airport infrastructure rose from USD 93.9 billion to USD 609.3 billion between 2014 and 2019 based on data from six economies. Through these developments, investments in infrastructure as well as the use of the PPP modality have increased.

Most economies conduct comprehensive assessments when evaluating PPP projects. In 2018, APEC economies performed similarly or better than OECD economies in most respects — fiscal affordability assessment, financial viability or bankability assessment, and comparative assessment (value for money assessment) — with the exceptions of fiscal treatment of PPPs and environmental impact analysis. Several economies have also implemented legal, regulatory or administrative provisions to encourage people-centred investments and sustainably-financed investment projects. APEC economies made significant improvements with regard to incorporating good practices and principles in investment projects, especially in judicial processes. The quality of judicial processes and the strength of minority investor protection both improved. The index measuring the latter was higher for APEC economies than for OECD economies in 2019.

The capacity of all transport infrastructure improved during the assessment period; however, the average perceived quality scores for each type of transport infrastructure were lower than OECD's average scores and worsened in most cases. There is room for significant improvement across all transport networks by adopting new technologies to build resilient and more stable infrastructure.

Residents in APEC economies have experienced better internet connectivity as both the average fixed broadband subscriptions and the proportion of individuals using the internet have increased. The number of fixed broadband subscriptions per 100 people has steadily risen: the average number per 100 people in APEC increased from 15.7 in 2014 to 25.7 in 2019, that is, by 63.3%. In their efforts to further promote access to quality ICT throughout APEC, economies have introduced new ICT infrastructure projects and increased investment in the sector.

The quality of electricity supply — with respect to interruptions and reliability — improved sharply for APEC economies between 2014 and 2018. Average interruption frequency decreased from 7.3 times in 2014 to 3.5 times in 2018. Similarly, average interruption duration decreased from 10.0 hours to 5.5 hours over the same period. Overall, the perceived reliability of electricity supply improved from a regional average score of 6.1 to 6.8 (out of a possible 7). Furthermore, based on survey responses (6 economies), the regional average cost of electricity decreased from USD 0.146 per kWh in 2014 to USD 0.141 per kWh in 2019. Economies have increased investment and initiated several new projects in the development of energy infrastructure, including in the renewable energy sector, as well as initiatives to improve the access of firms to financing.

Institutional Connectivity

Most APEC economies have fully or partially implemented an Electronic Single Window (ESW) that connects to domestic agencies and, in certain cases, to Single Window systems of other economies. Based on UNESCAP data, 10 APEC economies had fully implemented an ESW by 2019 – up from seven economies in 2015. Additionally, seven APEC economies had partially implemented an ESW by 2019 – up from five economies in 2015. While some customs authorities may not have extensively cooperated with one another, many economies have automated cross-border data exchange systems to facilitate pre-arrival processing.

Twenty APEC economies have launched AEO programmes and the number of AEO-certified enterprises in the region rose between 2018 and 2019. Measures such as these have enabled APEC's customs clearance performance to improve. Most economies have recognised Trade Identification Numbers (TINs) for their AEOs (10 out of 14 respondents) and have also undertaken efforts to integrate SMEs into their domestic AEO programmes (11 out of 14 respondents). Cooperation among customs officials needs to be improved in the region. Only six out of 14 survey respondents indicated that their customs authority cooperates with those of other APEC economies for goods in transit. Moreover, only six of the 13 economies who responded to the survey noted that they have automated customs data exchange systems to facilitate pre-arrival processing with other APEC customs authorities on the movement of shipments. However, data from the World Bank showed improvements in clearance times: clearance times have decreased to an average of 2.6 days (with physical inspection) and 1.3 days (without physical inspection).

Supply chain performance in APEC has improved as the time and cost to trade decreased significantly between 2015 and 2019, albeit not as strongly as in OECD economies. Less time is required to complete documentary and border compliance procedures for export and import: traders in the region needed to spend almost 59 hours for export and 75 hours for import in 2019. In comparison, in 2015, the numbers were 69 hours for export and 89 hours for import. With regard to trade costs, the cost to export had been reduced to a regional average of USD 422 in 2019, while the cost to import had been reduced to a regional average of USD 476.

Adoption of good regulatory practices (GRPs) are visible through APEC economies' improvement in some indicators relating to two aspects of governance quality: open government and regulatory enforcement. Regulatory quality, FDI openness, and the application of GRPs have also improved. On the other hand, indicators measuring the perceived level of corruption and measuring government effectiveness have worsened in several economies since 2014, with the region recording lower scores than OECD. In addition, only a few economies have participated in the APEC-OECD Integrated Checklist on Regulatory Reform.

There has, however, been good progress with regard to improving markets, especially e-commerce. The region recorded a 5% higher *Doing Business* score in 2019 compared to 2015, reaching similar level as OECD. More people in APEC economies are also making and/or receiving digital payments, albeit lower than in OECD economies. Additionally, to support digital trade and e-commerce, the number of secure servers in APEC economies (per 1 million people) increased exponentially from 754 in 2014 to more than 17,000 in 2019. Globally, APEC economies host more than 65% of secure servers (totaling more than 50 million) in the world. Many economies have introduced structural reform initiatives, including the enactment of new laws and regulations to improve the e-commerce environment and expand the application of safe and trusted ICT.

With regard to standards for trade facilitation, APEC economies are active members of several accreditation and standards organisations. The number of regional trade agreements in force also increased between 2014 and 2020. Most economies have also undertaken domestic and APEC-wide initiatives to align domestic standards with international ones and strengthen conformity assessment capabilities.

People-to-People Connectivity

The APEC Business Travel Card (ABTC) facilitates cross-border travel among business persons across the region by streamlining entry processes. The number of active ABTC holders has steadily risen since 1999, while the weighted average pre-clearance processing time of applicants decreased from 45 days in 2006 to 19 days in 2019.

The number of intra-APEC cross-border students has increased for both industrialised and developing APEC economies. The target of having 1 million intra-APEC tertiary-level international students by 2020 was reached in 2015 when there were 1.02 million tertiary-level cross-border students within the region. Furthermore, the share of student exchanges going to developing economies has increased. To improve cultural and knowledge exchange, an increasing number of sharing events were held in APEC economies during the assessment period.

To facilitate labour movements, several economies have implemented a Domestic Qualifications Framework as well as a labour market and skills-monitoring framework, while others have introduced similar substitutes. However, key challenges in implementation exist for some economies. Obstacles include difficulty in introducing complementary reforms, disorganised levels of sector representation, and a lack of information on the supply of skills or employment trends.

International tourist arrivals to APEC have also continually increased since 1998. However, considerable increases are still needed to raise the number of tourist arrivals from 435 million in 2017 to the target of 800 million by 2025. With respect to visa restrictions, there have been significant visa facilitation efforts since 2014, with more than 32 origin-destination pairs in the APEC region having either lifted visa requirements or implemented measures such as e-visas or visas-on-arrival. Most economies have also undertaken efforts to reduce travellers' costs and uncertainties relating to tourism by adopting a Code of Conduct for travel providers domestically.

KEY HIGHLIGHTS FROM THE CONNECTIVITY INDEX

The PSU selected 14 indicators that would adequately represent the essential elements of connectivity for the purpose of this mid-term review, specifically to assess if there was progress from 2014 to 2018 within the three pillars. To arrive at the final connectivity index, the 14 indicators are combined using the weighted average method. The weights for each indicator are derived using the Principal Component Analysis method. The institutional connectivity pillar carries the highest weight in the index, with a share of 47%, followed by physical connectivity (33%) and people-to-people connectivity (20%).

Based on the connectivity index, the APEC average score increased from 0.44 in 2014 to 0.46 in 2018, an improvement of 4.95%. In comparison, OECD's progress is 4.57%, EU: 5.99%, and ASEAN: 5.06%. APEC's progress in the individual pillars was uneven. People-to-people connectivity exhibited the strongest progress at 9.09%, followed by physical connectivity (7.75%) and institutional connectivity (2.64%).

1. INTRODUCTION

In 2014, APEC Economic Leaders endorsed the APEC Connectivity Blueprint for 2015-2025.[1] It embodies the aspiration of APEC economies for a seamlessly connected and integrated Asia-Pacific region by strengthening connectivity through the following three pillars: physical, institutional, and people-to-people. For each pillar, key elements of connectivity have been identified and are highlighted in Table 1.1. The Connectivity Blueprint aims to facilitate and improve each of these elements across the Asia-Pacific region.

Table 1.1: Key elements of connectivity

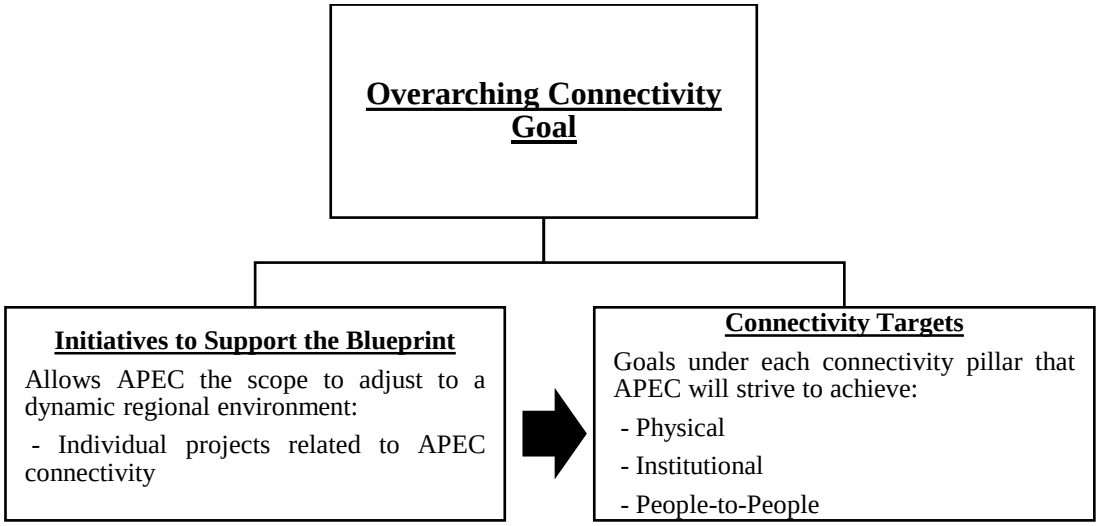
Physical Connectivity	Expand trade routes and corridors and strengthen regional quality transportation networks Advance cross-border energy networks and interconnections Achieve universal and high-speed broadband access Develop and improve well-designed, sustainable, and resilient infrastructure by implementing, at the outset, a multi-year plan on infrastructure development and investment
Institutional Connectivity	Advance logistics and transport facilitation Enhance regulatory coherence and cooperation and strengthen the implementation of good regulatory practices Advance APEC's agenda on structural reforms Modernise trade-related as well as customs and border agencies, including by progressing the development of Single Windows Promote cross-border financial cooperation 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
People-to-People Connectivity	Advance work on cross-border education, science, technology and innovation, and services Expand the facilitation of movement of tourists, business people, professionals and workers, women and youth

Source: APEC (2014b).

The 2014 *Report to Implement the APEC Connectivity Blueprint* describes initiatives to support the Blueprint and outlines a set of aspirational targets or objectives.[2] Figure 1.1 illustrates the monitoring framework for APEC Connectivity. As shown, monitoring the progress of APEC in terms of connectivity is two-pronged. "Initiatives to Support the Blueprint" provides member economies and relevant APEC fora "the scope to implement new initiatives and broaden the range of activities considered under the Blueprint". Meanwhile, "Connectivity Targets" are distinct targets classified under each pillar, which are expected to be accomplished by 2025. These aspirational targets are provided in Table 1.2.

[1] APEC (2014a).
[2] APEC (2014b).

Figure 1.1: Monitoring framework for APEC Connectivity



Source: APEC (2014b).

Table 1.2: Aspirational targets of the Connectivity Blueprint

Physical Connectivity
Sub-pillar 1: Public–Private Partnership • Promote public–private partnership (PPP) Sub-pillar 2: Quality of Infrastructure • Increase the quality of infrastructure in the Asia-Pacific region Sub-pillar 3: Other Important Principles of Infrastructure Development • 1) Enhance people-centered investment, and 2) good practices and principles Sub-pillar 4: Transportation • Increase the quality of APEC transport networks Sub-pillar 5: ICT Infrastructure Development • Increase broadband internet access throughout APEC Sub-pillar 6: Energy Infrastructure Development • Ensure quality electricity supply for all APEC members
Institutional Connectivity
Sub-pillar 1: Customs and Border Administration • To modernise customs and border agency Sub-pillar 2. Supply Chain Performance • Improve supply chain performance Sub-pillar 3: Regulatory Coherence and Cooperation and Good Regulatory Practices • Enable a whole-of-government approach in the development of regulations, including coordination across regulatory, standards, and trade agencies Sub-pillar 4: Structural Reforms • Fostering transparency, safety, competition and better functioning markets (including e-commerce) in the Asia-Pacific Sub-pillar 5: Trade Facilitation • Enhance trade facilitation through removal of technical barriers to trade
People-to-People Connectivity
Sub-pillar 1: Business Travel Facilitation • Meet preclearance processing time as established in the ABTC Operating Framework Sub-pillar 2: Cross-border Education Exchange • Increase the number of intra-APEC international students • Cultural exchange events by each economy in every other economy

- Advance work on cross-border science, technology, and innovation exchange

Sub-pillar 3: Tourism Facilitation

- Higher number of total tourist arrivals in APEC
- Reduce travelers' costs and uncertainties relating to tourism

Sub-pillar 4: Professional and Labor Mobility

- Establish an APEC-wide mechanism to monitor and respond to regional skills gaps
- Increase number of APEC-wide mutual recognition agreements for skilled and technical workers, where appropriate

Source: APEC (2014b).

FRAMEWORK FOR THE MID-TERM REVIEW

The 2020 Mid-Term Review of the APEC Connectivity Blueprint conducted by the APEC Policy Support Unit (PSU) includes qualitative and quantitative assessments as described below. The qualitative assessment incorporates some discussion on the impact of the COVID-19 pandemic on the connectivity outlook and trends. However, due to a lack of recent data on the relevant quantitative indicators measuring connectivity, we are unable to assess the impact of the pandemic on those indicators.

Qualitative Assessment using Yearly Reviews and Case Studies

Stocktaking of the initiatives or activities relevant to connectivity and identifying the impact and progress of those initiatives and activities

Each year, the APEC Secretariat prepares a Yearly Review Framework for the APEC Connectivity Blueprint 2015-2025. Submitted by both economies and APEC fora, this serves as a compilation of completed and on-going initiatives that are relevant to the three pillars of connectivity. Stocktaking of the initiatives is needed to understand what economies and fora are doing under each pillar of connectivity in order to achieve the connectivity objectives. The information from the stocktake will be used in this review to describe the impact of the initiatives and to identify relevant strategic priorities at the regional level.

Identification of good practices and a case studies analysis

Using the yearly review reports as the starting point, we attempt to identify relevant strategic good practices under the three connectivity pillars. The case study approach provides an additional tool to gather relevant evidence of progress and accomplishments made by the APEC members.

Quantitative Assessment of Connectivity Targets

Survey to APEC economies and utilisation of secondary/external indicators

Quantitative analysis of APEC's standing in terms of achieving the aspirational connectivity targets is conducted by assessing indicators that represent each pillar specified in Table 1.2. This is done through the use of a survey and through analysis of external indicators. The APEC PSU implemented a survey among the APEC members to attain data for the relevant indicators. In addition, external/secondary indicators were gathered and analysed to complement the survey.

Connectivity index

Another method for quantitative assessment is through the construction of an APEC-wide composite index. The index could be considered a tool which eases the interpretation of overall regional connectivity as the public/end-users will only have to look at a single index instead of having to interpret a plethora of indicators. The construction of a connectivity index should not be viewed as an end in itself: indicators only indicate, they do not explain.[3] The index should be regarded as an analytical tool for collaborative policy discussion and is interpreted with other evidence gathered during the Mid-Term Review.

The following chapters present the findings from the qualitative and quantitative reviews. Chapter 2 describes the progress of the implementation of the Blueprint based on the information submitted by economies in the last five years as well as the case studies submitted by members. Chapters 3, 4 and 5 cover the quantitative assessment. Chapter 3 presents the key results from the survey to APEC fora pertaining to the aspirational targets under the sub-pillars. Similarly, Chapter 4 examines quantitative progress based on relevant secondary or external indicators. Chapter 5 attempts to construct a connectivity index in order to assess overall progress using several key indicators that represent the three connectivity pillars. Chapter 6 provides the conclusion and the way forward.

[3] Eurostat (2014).

2. QUALITATIVE ASSESSMENT

A. TRENDS AND OUTLOOK IN REGIONAL INTEGRATION AND CONNECTIVITY

This section identifies trends in regional connectivity and provides some outlook for the future given current circumstances. It is important to understand the relevant global trends as they will provide a context for the discussion on implemented initiatives. These global trends were also used in selecting the key themes in this review.

Third wave of global integration?

The WTO's *World Trade Report 2018* depicts two major historical waves of global integration, each driven by advancements in ICT and transportation.[4] The first wave of integration was marked by the industrial revolution, which lowered transport and communications costs dramatically through inventions such as steamships, railways and telegraphs. These inventions, together with lower trade barriers in advanced economies, resulted in declining trade costs in some major economies by almost 25% relative to their domestic trade costs between 1870 and 1913. This in turn explained roughly 55% of trade growth in that period. Overall, the WTO report highlighted that international trade expanded by 486% between 1870 and 1913 – which is equivalent to annualised growth of 4.1%.

In the second wave, the use of containerisation, intermodal freight, high-speed trains and the invention of air freight, together with telecommunication facilities such as satellites and fibre optic cables, were notable key elements in reducing trade costs. According to the WTO report, trade costs are estimated to have fallen by a further 16% between 1950 and 2000, while ad valorem transport charges – the cost of transport as a share of the value of the traded good – declined from around 10% in the mid-1970s to around 6% in the mid-1990s.

These major waves of integration undeniably advanced global trade, but the trends continue to transform. In discussing the future of trade, Pascal Lamy, the former WTO Secretary General, highlighted the fact that in the 1990s, 60% of world trade was between developed economies, 30% was between developed and developing economies, and 10% was among developing economies, and that by 2020 total global trade will be divided equally three ways. He also noted that almost 60% of trade in goods in 2013 was in intermediates, i.e., goods used as inputs in production processes.[5]

In recent years, despite a relative slowdown in global growth, advancements in technological innovation, particularly in the ICT sector, have been strong and are increasing exponentially. Baldwin argues that the future of trade will be driven by 'Globalisation 4.0' or 'Industry 4.0' (digitisation of manufacturing). His argument is that "arbitrage drives globalization": ICT has enabled factories to cross borders, where the separation of stages of production or tasks are happening across borders geographically[6].

Several key factors are relevant in order to understand the context and outlook for the progress and the impact of connectivity in the global economy. These factors are discussed as follows.

[4] World Trade Organization (2018).
[5] Lamy (2013).
[6] Baldwin (2018).

Rise in middle class and urbanisation

The *Global Connectivity Outlook to 2030* report from the World Bank forecasts that the new middle class of two billion people in 2030 will shape global connectivity through their demand for internationally sourced manufactured goods, consumption of online content, use of e-commerce, and demand for outbound travel.[7] A majority of these new demands are expected to arise from rapidly growing economies in the Asia-Pacific region, supported by the emerging global/regional production networks in Asia (the 'Factory Asia' phenomenon).[8]

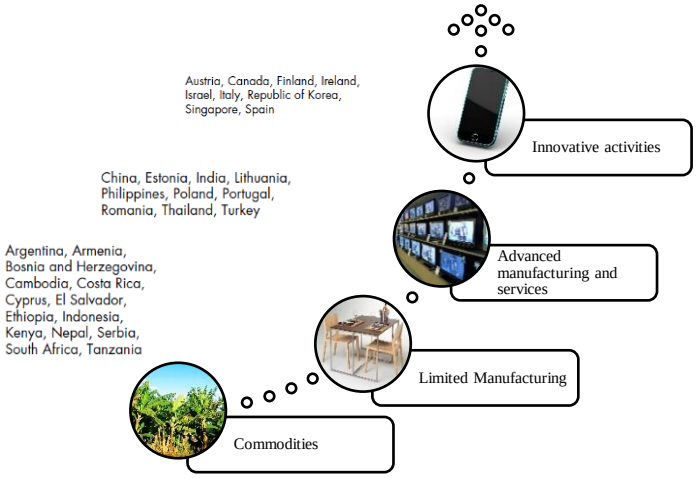
Inclusivity of global supply chains and services

Fragmentation of global production has enabled multinational corporations (MNCs) to split their production processes and tasks to different locations within and across economies. This is not a new phenomenon as MNCs have been implementing strategies for outsourcing and offshoring to manage, coordinate and expand their global business networks for years. However, the exponential growth of ICT innovation, especially in transportation and logistics industries, has enabled global value chains (GVCs) involving firms in developing economies to flourish, thus increasing the participation of developing economies in global trade. In certain cases, small firms have been able to successfully improve or upgrade their position in GVCs and take a leading role. Economies have also managed to improve or upscale their role in a GVC to a more sophisticated form of participation (Figure 2.1). Hence, digital connectivity has been prominent in enabling wider GVC participation and upgrading among firms in developing economies.

Some trends in value chain participation are more local. In some cases, emerging economies have built more comprehensive domestic supply chains such that their products become less trade-intensive as the firms are using less imported intermediate inputs.[9] In other cases, given that only 18% of goods trade is based on labor-cost arbitrage, firms may find proximity to consumers and demand to be more important than wage considerations, thus creating a more regionally concentrated network for certain products, like automotive, computers and electronic.[10]

[7] World Bank (2019a).
[8] Baldwin *et al.* (2014).
[9] Lund *et al.* (2019).
[10] Ibid.

Figure 2.1: Transitions between types of GVC participation, 1990-2015



Source: Adapted from the World Bank, *World Development Report 2020*.

Global productivity

Productivity could increase as economies improve their trade relations with other economies. IMF research has shown that as much as 12% of the increase in productivity over the 12 years from 1995 through 2007 can be attributed to China's integration into world trade.[11] The research further explains that trade improves productivity by: (1) exposing domestic firms to greater competitive pressure, while at the same time providing more access to inputs; (2) learning from global customers and through exposure to competition from foreign firms; and (3) fostering reallocation of productive resources between firms.

Similarly, enabling workers to move to higher productivity employment in other economies "contributed roughly $6.7 trillion, or 9.4%, to global GDP in 2015 – about $3 trillion more than they would have produced in their origin economies".[12] Moreover, labour migration can address skills gaps across borders.[13] Migration of labour at all skill levels increases the pool of available skills, enabling better skills matching which will in turn lead to improved productivity. Diaspora networks also encourage trade and foreign direct investment by eliminating informational barriers. Facilitation of migration could therefore support improvement in global productivity and in bridging economic and social gaps.

Adoption of digital technologies

Innovations that bring long-term, widespread benefits in welfare or productivity come from 'general-purpose technology', a technology "that has the power to continually transform itself, progressively branching out and boosting productivity across all sectors and industries".[14] Examples of such technologies are the steam engine, the electricity generator, the printing press, and the most relevant now: digital technology.

[11] Ahn and Duval (2017).
[12] Bughin and Woetzel (2019).
[13] International Labour Organization (2018).
[14] Mühleisen (2018).

The fast progress in advancing digital technologies has enabled widespread digital transformations affecting businesses and society as a whole. The digital transformation is happening not only in urban centers with the burgeoning trend of smart cities, but also in rural areas. Digital technologies can be applied in health and education to enable better service delivery in rural and remote areas, thus enabling greater reach of basic services.[15]A study suggests that 60% of the increase in productivity over the next 10 years could come from materialising the opportunities presented by digitization.[16]

Businesses have been quick in adjusting and applying new digital technologies in their operations. The growing use of e-commerce to reach new potential customers across the globe has proven to be effective in addressing the distance barrier and adopting real-time tracking has enabled firms to expand their global operations.

A McKinsey report finds that firms who are digital leaders have been harnessing advanced analytics and the Internet of Things to transform their operations, with those at the forefront reaping the benefits: companies that are digital leaders in their sectors have faster revenue growth and higher productivity than their less-digitised peers.[17] They improve profit margins three times more rapidly than average and are often the fastest innovators and the disruptors of their sectors. However, the forces of digital have yet to become fully mainstream, as on average, industries are less than 40% digitised.

Data flows, storage and security concerns

Data flows have been growing tremendously as the global economy becomes increasingly digitized, enabled by the availability of sophisticated data infrastructure across the world. In effect, the virtual nature of the digital economy cannot be separated from the physical nature of the supporting infrastructure and facilities. The summation of digital content (whether it is created, captured, or replicated) is predicted to grow from 33 zettabytes (ZB) in 2018 to 175 ZB by 2025.[18] Meanwhile, global IP traffic is forecast to reach an annual run rate of 4.8 ZB by 2022.[19] To illustrate, an exabyte (one-thousandth of a ZB) alone has the capacity to hold over 36,000 years' worth of high-definition video.[20]

Global mobile data traffic is expected to increase seven-fold between 2017 and 2022 (Table 2.1). The Asia-Pacific region experiences the largest monthly mobile data traffic and is predicted to also grow about seven-fold from 2017, reaching 43.2 exabytes by 2022. This staggering amount of data would need considerable investment in data infrastructure.

Table 2.1: Global Mobile Data Traffic

Region	2017	2018	2019	2020	2021	2022	CAGR
Asia-Pacific	5,877	10,351	15,908	22,815	31,807	43,166	49%
Middle East and Africa	1,222	2,052	3,251	5,009	7,564	11,171	56%
Central and Eastern Europe	1,379	2,153	3,119	4,317	5,834	7,752	41%
North America	1,261	1,804	2,500	3,405	4,485	5,846	36%
Western Europe	1,022	1,471	2,062	2,807	3,801	5,120	38%

[15] APEC (2019a).
[16] Remes, *et. al.* (2018).
[17] Manyika *et al.* (2015).
[18] Reinsel *et al.* (2018).
[19] Light Reading News (2018).
[20] Arthur (2011).

Latin America	752	1,178	1,720	2,418	3,308	4,439	43%

Source: Cisco (2019).

Concurrently, the issue of data security, data protection and privacy are also high on the agenda. In order for customers to be able to make purchases safely and confidently in an e-commerce environment, necessary regulatory and digital infrastructure needs to be in place as well. One estimate in 2018 suggested that close to USD 600 billion is lost to cybercrime annually, which is an increase from around USD 445 billion in 2014.[21] In certain areas of the digital economy, such as fintech, governments are seen to adopt a more cautious approach in developing necessary regulations. Hadfield noted that conventional approaches to producing regulation are increasingly unable to cope with the levels of complexity and scale of some new technologies.[22] Additionally, systems interoperability and different standards to data privacy, security and ownership are evolving issues that may hinder progress in this area.

Rising demand for sustainability

Given the above discussions on exponential progress in society and technology, issues of sustainability come to mind. Moore's law, which predicted exponential growth in ICT, also cautions that "the nature of exponentials is that you push them out and eventually disaster happens".[23] With the global population now reaching 7.6 billion, and expected to reach 8.6 billion by 2030, pressures on the environment in the form of climate change, energy consumption and food security are immense.

Global energy intensity, despite improving by 1.2% in 2018, is still below the average 3% annual improvement that was set by the International Energy Agency's Efficient World Strategy.[24] The difference between the optimum improvement rate and the existing one could mean a lost opportunity of USD 2.4 trillion in GDP. Certain key policy areas for improving energy intensity could focus on developing energy efficiency in buildings and in transportation (such as in the trucking industry).

Moreover, as climate change awareness and aspirations to reduce pollution in developing economies grow, more and more businesses are expected to shift towards adopting sustainable transport, power and industrial solutions.[25] These anticipated changes will affect infrastructure that has been developed to support a more fossil fuel dependent economy. Thus, new sustainability-based infrastructure, such as for wireless network technology, will need to be built to provide for a greener economy.

Reducing inequality and pursuing development

While growing trade and stronger regional economic integration have delivered benefits to businesses and increased the welfare of society, there is a concern that some groups are being left behind. Indeed, stronger global connectivity will bring increased competition and some firms may struggle to remain competitive. SMEs are reported to face difficulties in adopting certain standards in order to participate in particular GVCs, thus hindering their access to global markets. Inequality within GVCs can happen in the labor market as well; for example, women tend to be employed in lower value-added segments, which limit their opportunities to grow.

[21] Lewis (2018).
[22] Hadfield (2017).
[23] Atkinson (2017).
[24] International Energy Agency (2019).
[25] World Bank (2019).

At the firm level, some companies may also find themselves trapped in lower value-added activities which limit their chances to grow and innovate.[26] On the positive side, connectivity is said to enhance opportunities for GVC participation and promote specialisation in more advanced GVCs.[27]

With regard to technology, issues of digital divide could further widen the gap between urban and rural areas. Additionally, automation technology may reduce the number of available jobs and employability for certain skills groups. As such, appropriate development policies should be adopted by governments to narrow the gap, such as promoting e-literacy across the society, ensuring wide and affordable internet access, and providing incentives to SMEs to adopt and implement digital technologies.[28]

Disruptions caused by the COVID-19 pandemic

The current global pandemic has indeed brought disruptive changes to many aspects of life. It has slowed the operation of supply chains as workers have not been able to perform their jobs and functions. Limitations to people's mobility have prevented businesses from fully operating domestically, thereby further limiting their global business operations. The Baltic Dry Index, an indicator to measure dry bulk shipping costs (such as coal, iron ore and grain) as well as a general proxy for shipping market trends, dropped to its lowest point in four years in February 2020 and remains significantly below its average level of the past 20 years.[29]

Disrupted supply chains have resulted in the dumping of unsold products, especially of perishables such as food[30]. Global firms that have relied on sophisticated cross-border supply chains and production networks have experienced major delays as ports and ships continue to face various restrictions on vessels and crew.[31] These delays and disruptions cost firms and their suppliers billions of dollars as a single disruption may affect suppliers at different tiers. Large multinational companies may have 5,000 first-tier suppliers with each of them relying on another 250 second-tier suppliers; hence, the ripple-effect caused by the global pandemic can impact multiple companies.[32] Around 75% of businesses have claimed that the global pandemic has disrupted their supply chains.[33]

Guan *et al.* estimated that under the strictest lockdown scenarios with global spread, the global supply chain effects will result in losses ranging from USD 20.0 trillion under a 2-month duration to USD 22.7 trillion under a 4-month duration and USD 30.1 trillion under a 6-month duration.[34] Disruptions in production will also be reflected in major drops in international trade flows, with the WTO estimating that global merchandise trade will drop by between 13% and 32% in 2020.[35] Significant declines are expected in products that serve as intermediaries in production like textiles and electric and electronic equipment.[36]

[26] World Bank (2020a).
[27] Ibid.
[28] International Trade Centre (2017).
[29] Liang (2020).
[30] Hredzak (2020).
[31] Wilhelmsen, COVID-19 Global Port Restrictions Map.
[32] Braw (2020).
[33] Lambert (2020).
[34] Guan *et al.* (2020).
[35] World Trade Organization (2020).
[36] Seric *et al.* (2020).

On the labour side, workers have been affected directly due to precautionary health restrictions as well as indirectly by the lack of demand for their services. Moreover, in the long term, capital outflows and low levels of FDI may give rise to a second wave of impacts that could have more long-lasting effects on global production capacity.

Despite these challenges, APEC could continue to pursue stronger regional integration and connectivity. Obviously, major changes will need to be adopted in order to adapt to the 'new normal'. A business-as-usual approach will not work if economies want to achieve a quick and strong recovery. Supply chain reconfigurations and adaptations to mitigate interconnected risks may be one of the first things that businesses implement to limit the risk of future external disruptions. This may further reshape trade and FDI flows due to reshoring and redundancy to achieve stronger agility.[37] Thus, an open, resilient and stable global supply chain is of great importance and will also ensure that trade, particularly that of essential goods, can continue to flow during the COVID-19 pandemic.

B. STOCKTAKING OF THE INITIATIVES OR ACTIVITIES RELEVANT TO CONNECTIVITY

The following analysis relies on information gathered from the connectivity yearly review reports submitted by economies and fora from 2015 to 2019 and which includes both domestic and APEC initiatives that support connectivity goals and objectives. Using a word cloud approach and considering the earlier trends and outlook analysis regarding connectivity, the PSU has selected several key themes under each pillar and highlighted some relevant initiatives as submitted by member economies. It is, of course, not possible to include all initiatives as the number of initiatives submitted over the course of five years are numerous. In 2019 alone, around 145 activities were submitted by member economies and fora. The initiatives discussed in this chapter capture most of the trends highlighted in the previous section and will serve to illustrate the progress that has been made by APEC on different fronts relevant to connectivity.

Physical Connectivity

The word cloud generated for physical connectivity as shown in Figure 2.2 highlights the key words captured from the yearly reviews submitted by member economies. The five words with the highest occurrences based on the word cloud are infrastructure, energy, investment, network, and public-private partnerships (PPP). The following words also frequently appear: power, port, service, development, connectivity, broadband, transport, quality, ICT, trade and access. Some of these words are interrelated with the top five words and will be addressed where relevant in discussing the key themes. Based on the yearly reviews, the key themes in physical connectivity are identified and discussed below.

[37] Altman (2020).

Figure 2.2: Yearly Review Word Cloud for Physical Connectivity

Development of Quality Infrastructure and Economic Corridors

The development of infrastructure that is of high quality, reliable, resilient and sustainable is essential to support economic growth and wellbeing. The 2018 APEC Economic Policy Report (AEPR) evaluated the region's infrastructure needs and found that ensuring quality infrastructure requires an integrated, interlinked approach across a range of policy areas.[38] With respect to APEC initiatives, Japan implemented a peer review and capacity building mechanism for mutual learning of "quality of infrastructure" and "people-centered investment, and good practices and principles as well as PPP" among APEC economies.[39] Indonesia; the Philippines; and Viet Nam have joined the peer review process. The peer review process also identified the capacity building needs in infrastructure development, covering topics such as viability gap funding, life cycle cost and value for money. Calls by APEC Economic Leaders to develop quality infrastructure have also materialised in the form of a guidebook, which notes the importance of building quality infrastructure that is aligned to development strategies, for example, by supporting the expansion of global supply chains (GSCs).

Domestic initiatives were also introduced to facilitate the expansion of GSCs through the development of economic corridors. Economic corridors generally involve a combination of three complementary components: a transport corridor, industrial production centers, and cities.[40] Although not affiliated with ongoing APEC projects or deliberations, one example is China's initiative of the Silk Road Economic Belt and 21st Century Maritime Silk Road (The Belt and Road Initiative). In addition, Canada's Asia-Pacific Gateway and Corridor Initiative

[38] APEC (2018a).
[39] APEC (2019d).
[40] Petrella (2018).

(APGCI) includes an integrated set of investment and policy measures developed to improve its trade with the Asia-Pacific Region.

Infrastructure Development for Sustainable and Inclusive Growth

To pursue sustainable growth and attract private sector involvement, a collaboration between CD, OFWG and ABAC in 2019 brought stakeholders and experts together to develop a pipeline of bankable waste management projects to build infrastructure for a circular economy. CD also developed a project on Promoting Efforts to Prevent Marine Litter through the Development of Solid Waste Management Instructure to reduce barriers to trade in sustainable materials. An example of an inclusive domestic initiative was the Philippines' "Build, Build, Build", which identified 75 high impact Infrastructure Flagship Projects envisioned to enhance connectivity and promote growth centers outside of the urban industrial region centered around Metro Manila.

Efforts have also been made to facilitate the development of necessary infrastructure to generate and distribute sustainable energy efficiently. The APEC Low-Carbon Model Town (LCMT) Project initiated by EWG seeks to promote low-carbon town development in order to manage rapidly growing energy consumption, especially in residential or industrial areas in the region. In addition, EWG developed the Integrated Energy System Planning for Equitable Access to Sustainable Energy for Remote Communities in the APEC Region using North Sulawesi, Indonesia for a pilot project. Among other things, the project aims to deliver APEC-wide benefits by modelling optimal least-cost, energy-efficiency based electrification scenarios centered on community needs.

Developing Resiliency in Infrastructure Development

APEC Economic Leaders have endorsed several initiatives that have an impact on remote area development. For example, APEC Internet and Digital Economy Roadmap; APEC Action Agenda on Economic, Financial, and Social Inclusion; and APEC Strategic Blueprint for Promoting Global Value Chains Development and Cooperation.[41] Two relevant initiatives in 2016 were 1) EWG's Workshop on Improving Energy Resiliency in Off-Grid Areas in APEC Member Economies, which aimed to help economies identify and address common challenges, lessons learned and best practices given the threat of natural disasters and the impact of climate change; and 2) the Philippines' development of the Philippine Scientific Earth Observation Microsatellite to provide real-time images for disaster risk management and other applications.

EPWG has also conducted several projects on remote area resilience given their higher risk to environmental disasters. In addition, EPWG aims to support capacity building and emergency preparedness in agricultural communities through "Plant Back Better" initiatives that focus on quick recovery of economic activities through public-private partnerships in order to tackle climate extremities and natural disasters.

Modernisation of Logistics Infrastructure and Facilities to Support Supply Chain Connectivity

Improved logistics connectivity can help to reduce costs and strengthen trade facilitation efforts. As such, the APEC Supply Chain Connectivity Framework Action Plan aims to improve the lack of coordinated border management and underdeveloped clearance procedures

[41] APEC Policy Support Unit (2018a).

through modernisation of logistics infrastructure. The APEC Port Services Network (APSN) enhances supply chain connectivity on a regional scale by strengthening economic cooperation, capacity building, information and personnel exchange among port and port-related industries and services in the region.[42] The APEC Port Connectivity Forum was also held in Peru in 2019 to promote dialogue, cooperation and technical exchanges in port and related sectors in the region. China also cooperates with ASEAN through its China-ASEAN Port Cities Co-op Network to promote regional supply chain connectivity.

Integrated logistics systems enable economies to ensure reliable, efficient and secure logistics services. Several domestic initiatives have been implemented to improve logistics performance. Korea developed the "Expansion of Multimodal Transport (Korea-China Multimodal Freight Truck Transport Project / Korea- Japan Towed Trailer Mutual Cooperation Pilot Program)" to establish a seamless logistics system and reduce logistics costs envisioned in Northeast Asia. Additionally, to integrate and improve logistics, Korea started the Intelligent Transport System (ITS) initiative, a future-oriented smart intelligent transport system based on the application of information communication control technologies to roads and motor vehicles, which will help to reduce traffic congestion and logistics costs worth around USD 11.3 billion per year. Korea also established an integrated platform of aviation logistics information, linking the previously divided transport and customs systems of aviation cargos at airports into a single entity, thereby reducing transport time, waiting time of imported and exported goods, working hours and costs of aviation logistics. In addition, the Asia-Pacific Model E-Port Network (APMEN) project on "Visualization of Sea Freight Logistics" aims to enhance the visibility, integrity and transparency of the maritime supply chain data exchange by facilitating port-to-port information sharing and building a data-sharing framework. A similar initiative by Thailand aims to study and design port communication systems to increase port efficiency by connecting the ICT systems of each of the port stakeholders. To promote paperless trade, a pilot APMEN project on "Digitalization of Air Freight Logistics" was developed to build an end-to-end paperless pre-clearance process for air cargo by replacing paper documents with digital information transmission.

Facilitation of Digital Innovation and Development of Smart ICT Infrastructure

Members have developed several APEC initiatives that promote digital innovation for better connectivity and stronger sustainability. Singapore held 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 also developed the "IPv6 Deployment Strategies in APEC Economies – Information Paper" to enhance mutual learning and understanding of IPv6 deployment strategies to facilitate smooth transition to the new Internet Protocol in economies' info-communication ecosystems.

APEC Chile 2019's priority on "Sustainable Growth" highlighted the need to develop smart cities to address challenges brought by urbanisation. In line with this, TELWG organised a project to facilitate cooperation in promoting the development of ICT infrastructure for Smart Sustainable City in the region. TELWG also organised an industry roundtable on "Facilitating Innovation and Diversity of 5G Network Ecosystems in APEC Region" to share initiatives for promoting diverse 5G ecosystems among stakeholders engaged in the 5G network. In addition, Russia supported the use of digital technologies to improve disaster resilience through its

[42] The APEC Port Services Network (APSN) was endorsed during the 14th APEC Economic Leaders' Meeting in 2006 to facilitate cooperation and communication among ports and related sectors in APEC member economies.

Earthquakes and Waterfloods Monitoring System project under TELWG, which promotes the use of the Internet of Things to allow early detection and predictability.

Promoting Inclusive Development through ICT Development and Collaboration

Access to the internet connects people even in the most remote of areas to vast opportunities. The APEC Business Advisory Council (ABAC) asserts that digital innovation could deliver massive gains by focusing on the transformative role of the digital economy to facilitate global engagement for small firms, women, those in remote communities, and others who might otherwise struggle to participate.[43]

In 2015, Ministers endorsed the APEC TELWG Strategic Action Plan 2016-2020, which prioritised the development of ICT innovations to foster resilience, greater inclusion and the formation of collaborative partnerships.[44] In order to improve inclusion through better digital connectivity, TELWG organised two roundtables: 1) Innovation Roundtable on Universal Broadband Access aimed to share best practice approaches to promote wider broadband access that may enhance digital literacy and improve an individual's capacity to fully participate in the digital economy; and 2) Industry Roundtable on Facilities Sharing and Open Access Regimes within APEC sought to increase availability, accessibility and affordability of ICT, including for the underserved or unserved groups of people in APEC economies. TELWG's "Getting Connected: TV White Space (TVWS)" project aims to provide a better understanding on how TVWS can be an ICT enabler for improving broadband penetration and socio-economic development. Meanwhile, the China-Myanmar International (CMI) optical cable system, a domestic initiative, seeks to improve telecommunication of the Asia-Pacific region with Europe and Africa by constructing CMI that connects Yunnan, China and Ngwe Saung, Myanmar.

With regard to collaboration, TELWG organised an Industry Roundtable on ICT Innovation 2016 to discuss ways to improve ICT innovation through PPP and MSME involvement, and a Workshop on Indicators of Information Society Development in the APEC Region to seek new ways of measurement. On the topic of measurement, Singapore organised the TELWG Workshop on "Digital Economy: Strategies and Measurements" to facilitate understanding on how the digital economy strategies of members may be effectively measured so as to identify areas for improvement. Additionally, ECSG recognised the need to encourage improvements in network access and mobile technologies to develop digital economies that can support employment, business growth and higher standards of living.[45]

Several domestic initiatives to develop broadband connectivity were also noted. Brunei Darussalam launched the "National Broadband Policy", which aims to build a nationwide world-class fibre-to-the-home broadband network for all individuals to access broadband technology and address key issues such as accessibility, affordability, quality and usage. Peru's Broadband Installation for Integral Connectivity and Social Development of Amazonas, Ancash, Apurimac, Arequipa, Ayacucho, Cajamarca, Cusco, Huancavelica, Huanuco, Ica, Junin, La Libertad, Lambayeque, Lima, Moquegua, Pasco, Piura, Puno, San Martin, Tacna and Tumbes regions intends to improve connectivity by expanding broadband transportation networks to reach district capitals and roll out access networks for social priority rural towns in these regions. The Philippines' Tech4ED and Integrated Government Philippines (iGovPhil)

[43] APEC (2019b).
[44] APEC (2015).
[45] APEC (2016).

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.

Development of Energy Infrastructure to Support Sustainable Growth

APEC Energy Ministers[46] acknowledged the need for energy infrastructure that can help the region pursue sustainable growth dating back to 1997. In 2015, APEC Energy Ministers instructed members to promote and collaborate on initiatives that help to develop an energy resilient APEC region. They also encouraged economies to adopt PPP to strengthen energy infrastructure development for connectivity, especially in remote regions.

Some APEC initiatives in this regard include a study by EWG on the benefits of the economic dispatch of 220kV power interconnection between Chile and Peru (Arica-Tacna). China also completed a report titled "Enhance Energy Infrastructure Connectivity in the APEC Region", which proposed the feasibility and pathway of enhancing electricity connectivity in Northeast Asia and Southeast Asia sub-regions in addition to analysing its prospects and challenges.

Several initiatives have been put in place by EWG to fill energy infrastructure gaps: 1) the Developing Solar-Powered Emergency Shelter Solutions (SPESS) as an Energy Resiliency Tool for Natural Disaster Relief in APEC Community project aims to strengthen the wider APEC region's energy resilience and sustainability by promoting low-carbon technology innovation and improving capacity in adopting science-based approaches for emergency preparedness; 2) the Strategy for Large-Scale Implementation of Biogas Capture from Palm Oil Mill Effluent and Reuse for Renewable Electricity Generation seeks to develop a strategy to attain PPP to finance and implement biogas capture and reuse on a large scale; and 3) the Energy Smart Communities Initiative intends to contribute to the advancement of green growth, sustainable development, long-term job creation and APEC's goal of energy intensity reduction of at least 45% by 2035.

Domestic initiatives include two regional energy infrastructure development initiatives by Malaysia. First, the Sarawak-West Kalimantan Power Interconnection project intends to establish a regional power transmission link that crosses Brunei Darussalam; Indonesia; and Malaysia. Second, the Melaka-Pekanbaru Interconnection project aims to support investment in strategic transmission assets that connect regions or economies to optimise power networks by removing transmission bottlenecks and transmitting cheaper power from one area to another, thereby addressing overall regional socio-economic and environmental improvement.

Enhancing Infrastructure Financing and Investment through PPP and Capacity Building

One of the necessary elements to develop quality infrastructure is to ensure its economic and financial soundness.[47] PPPs allow economies to do precisely that by sharing the risks across private and public entities. APEC Finance Ministers issued a joint statement in 2018 calling on APEC economies to encourage long-term finance and private sector involvement and to develop enabling conditions for attracting investments in pursuance of quality infrastructure development.[48] Some work in this area include IEG's "Capacity Building Workshop on Investor-State Dispute Settlement (ISDS) Prevention and Management" to improve the investment environment to attract investors. Guidebooks and studies have been developed to

[46] APEC (1997).
[47] APEC (2018b).
[48] APEC (2018c)

assist economies in infrastructure investment given the importance of financial soundness in developing quality infrastructure.[49] IEG developed a Guidebook on PPP Frameworks in the APEC Region, which introduces the idea of compiling information on PPP frameworks in member economies into a single guidebook as a facilitation tool for investment.

In addition, TPTWG's "Attracting Private Investment to Transportation Infrastructure Public-Private Partnerships (PPPs): Training APEC Economies to Better-Package Bankable Projects" helped economies to better understand what private investors and developers need to see in order to invest in a transportation infrastructure PPP project. There were some related domestic initiatives as well. Australia developed a framework to assist the participating economies to develop bankable PPP infrastructure projects to enhance transport supply chain connectivity. Korea conducted the Asia Public-Private Partnership Practitioners' Network (APN) Training to share knowledge and trends in PPP development as well as to develop a plan for the future of the Asian PPP Network for bilateral and multilateral cooperation in promoting PPP. To provide guidance to government agencies when dealing with PPP projects, Singapore developed a PPP handbook that contains information on how a PPP deal is structured, its procurement process, and how to manage a PPP relationship.

Other initiatives that have been implemented to improve infrastructure funding include Japan's "Promoting Quality Infrastructure Investment in Rapidly Urbanizing APEC Region" project under CTI which aims to further deepen the discussions on quality infrastructure investment in cooperation with multilateral development banks and related international organizations; and EPWG's "Enhancing Rural Disaster Resilience through Effective Infrastructure Investment" casebook on non-metropolitan and rural areas facing growing demands for infrastructure investment in the coming decades. Additionally, a Chilean domestic initiative involved the creation of a new Infrastructure Fund to develop, build, maintain and finance public multi-purpose infrastructure via cooperation with third parties.

Additionally, a Study on Infrastructure Investment in the APEC Region conducted by Japan under CTI aims to identify various rules and standards of infrastructure development and explore desirable infrastructure investment in terms of key elements such as sustainable and quality growth including people-centered investment. Meanwhile, the APEC Finance Ministers established the Asia-Pacific Financial Forum to discuss financial cooperation issues such as capital markets development in the region to achieve APEC's goal of creating a regional infrastructure financing market.

Institutional Connectivity

The word cloud generated for institutional connectivity as shown in Figure 2.3 highlights the key words captured from the yearly reviews submitted by member economies. The five words with the highest occurrences based on the word cloud are: trade, regulatory, customs, digital, and capacity. The following words also frequently appear: development, border, AEO, data, port, ICT, CBPR, privacy, food, safety, and risk. Based on the yearly reviews, the key themes in institutional connectivity are identified and discussed below.

[49] APEC (2018b).

Figure 2.3: Yearly Review Word Cloud for Institutional Connectivity

Trade Facilitation through Border Agency Cooperation, Transparency of Measures, Secure Trade, and Capacity Building

The World Trade Organization's Trade Facilitation Agreement (WTO-TFA) is considered an important breakthrough in trade agreements and APEC has been a strong supporter of the agreement. A Workshop on Enhancement of Stakeholder Engagement in the Implementation of the WTO-TFA by SCCP aimed to utilise best practices and experiences in implementing the WTO-TFA in APEC economies.

Border agencies play an instrumental role in trade facilitation. Single Window and Authorized Economy Operator (AEO) programmes enable greater cooperation across the agencies. Chile has started the Supply Chain Integration 4.0 initiative through the APEC Single Window Interoperability Action Plan under CTI, which aims to develop a pilot for the implementation of interoperability among APEC economies. Domestically, Chile; Colombia; Mexico; and Peru will strengthen the information exchange of their AEO Programs under the Cadena Project V.1.0 which is currently in its testing stage. The project, which uses blockchain technology, will allow economies to exchange information within the framework of a Mutual Recognition Agreement in real time once fully operational.[50] There is also a Joint Action Plan regarding the Mutual Recognition of their respective AEO programs between the Pacific Alliance and Mercosur.

The APEC Trade Repository (APECTR) is an online platform administered by the Philippines that contains trade and tariff-related information for each APEC member economy, in

[50] Corcuera Santamaria (2018).

furtherance of APEC's work towards trade facilitation, transparency, information dissemination, and connectivity.

In addition to making trade faster and cheaper, secure trade is also an integral part of border agencies' responsibilities. To improve participation in APEC secure trade, CTI has implemented an initiative to integrate SMEs in Authorized Economic Operators Certification. New Zealand and Australia are working together to develop a proof of concept for a Secure Trade Lane, which will put low risk traders through a more streamlined and cost-effective customs clearance process.

Capacity building activities are important to ensure effective implementation of trade facilitation efforts. Under the APEC Supply Chain Connectivity Framework, CTI implemented targeted and focused economy-based capacity building and provided technical assistance on pre-arrival processing and advanced rulings. TPTWG held an APEC Workshop/Seminar on Capacity Building for Preventing Accidents in Maritime Dangerous Goods and Containers Transportation in order to achieve safer transportation by enhancing APEC economies' understanding of the regulations for dangerous goods and container transportation. Additionally, domestic initiatives from Korea include several capacity building seminars for customs officials of ASEAN and LAC (Latin America-Caribbean) economies to enable customs modernisation and improvement of the clearance environment.

Development of Digital Trade Facilitation and Ensuring Safe and Secure Cross-Border Data Flows

Application and adoption of digital technology in trade facilitation is considered the low hanging fruit for many economies. Some domestic initiatives to promote Single Window Systems International Interoperability indicate good progress in implementing technological solutions. Examples include the e-Single Window interoperability project amongst the economies of the Pacific Alliance and Thailand's integration of the e-Matching System into its National Single Window (NSW). Singapore's TradeTrust is a framework based on globally-accepted standards to facilitate the trusted interoperability of digital documents used in international trade and logistics. The open-source digital utility of TradeTrust uses a public and permission-less blockchain technology that provides participants with proof of authenticity and provenance of trade documentation, which will address the inefficiencies of cross-border trade that are caused by excessive manual handling and verification processes.

The role of data has been growing in importance, particularly in supporting global trade and e-commerce. Effective data protection is an essential requirement to promote cross-border data flows. Efforts have been implemented to expand the adoption of the APEC Cross-Border Privacy Rules (CBPR) System, which aims to provide effective protection of personal information. A Workshop on "Key Building Blocks for Effective Privacy and Data Protection in the Global Digital Economy" was implemented by ECSG to assist with ensuring effective data protection. Additionally, ECSG also held a workshop on "Promoting Consumer Protection in Digital Trade: Challenges and Opportunities" to identify challenges in consumer protection in the digital economy era. Additionally, a "Workshop on Enhancing Online Connectivity for Unleashing the Potential of Digital Economy" was held by TELWG to discuss issues including on global data flows in view of developing interoperable and flexible regulatory and policy frameworks to minimise process disruption so that the internet will not be fragmented.

Box 2.1: APEC Cross-Border Privacy Rules

At present, each APEC economy has its own privacy laws and regulations, which leads to significant privacy compliance costs for firms with cross-border operations. This is an urgent issue to be addressed given increasing restrictions to cross-border data flows due to emerging data privacy regulations, and which particularly impact SMEs. The CBPR System provides a degree of certainty that reduces compliance costs and hence facilitates cross-border connectivity and interoperability.

One of the key driving factors for organisations to apply for CBPR certification is the facilitation of cross-border data flows, not only within the APEC region, but also across other regions in the world. For example, within the APEC region, CBPR certification allows transfer of data to other economies that are part of the CBPR System, and allows an organisation to take full advantage of domestic laws that recognise the CBPR System as a mechanism for transfer. This is the case of the Japanese personal information protection law, which requires companies to obtain consent before transferring data to another economy, but allows an exception for organisations that are CBPR-certified. Beyond the APEC region, CBPR certification can also bring concrete benefits as a basis for other certifications. For instance, the CBPR can be used as a basis for organisations applying for the European Union (EU) binding corporate rules (BCRs), which allow transfers of personal data out of the EU.

There are several reasons that could deter remaining APEC member economies to join the CBPR System. First is that some economies declared that they are unable to join the CBPR System due to a lack of data privacy laws. Another reason is the lack of awareness and multiplicity of privacy certifications: organisations may have less motivation to apply for CBPR certification if they do not see the benefits and potential of CBPR in improving their business competitiveness and value. Additionally, with many existing privacy regimes, organisations (particularly SMEs) that abide by these regulations face a challenge in designing applicable privacy programmes that fit their respective budgets.

Source: APEC Policy Support Unit (2018b).

Risks in the digital economy are beyond the traditional risks; they range from the risk of damage to brand value and reputation in social media to customer data breaches.[51] TELWG introduced the APEC Framework for Securing the Digital Economy to help APEC members identify common themes and frameworks in regional and global approaches so as to develop a secure, safe and trusted online environment. Japan organised a workshop on "Development of a Safe and Secure ICT Use Environment" with the following themes: countermeasures for spam, development of safe and secure internet environment for youth, and appropriate handling of user information related to ICT services. ECSG aimed to enhance global supply chain efficiency by collecting information on the current manifest procedures of APEC member economies, facilitating experience sharing on the implementation of the E-Manifest Exchange, and developing guidelines on promoting trade facilitation through paperless trading.

Trade Facilitation through Expansion of Access to Disadvantaged Groups

Providing broader access to SMEs and women participation in global supply chains and production networks is necessary to ensure vulnerable groups also benefit from the expansion of global trade. TWG's initiative on "SMEs' Integration into Global Value Chains in Services Industries" led by Peru seeks to help SMEs develop capacity and strategy for effective integration into GVCs. The "APEC Online-to-Offline (O2O) Initiative – Unleash the Potential of SMEs through Digital Transformation for a Shared Future" project by Chinese Taipei under SMEWG aims to optimise the digital innovation ecosystem, enhance SME competitiveness, and capitalise on O2O opportunities.

[51] Deloitte (2018).

SCSC has also implemented standardisation activities and related APEC projects to help MSMEs become more competitive and better integrated into regional and global markets through standardisation and conformance. CTI's "Inclusive Investments and Global Value Chains (GVCs): Opportunities for the Thai SMEs" project seeks to increase policymakers' awareness of barriers and opportunities in relation to participation in GVCs so as to enhance their capacity in supporting Thai SMEs to access GVCs. A domestic initiative by Malaysia to establish a Digital Free Trade Zone (DFTZ) using the concept of e-fulfilment hub, satellite services hub, and e-services platform attempts to facilitate SMEs' ability to capitalise on the exponential growth of the internet economy.

Several domestic initiatives have also been implemented to support women empowerment. Australia has supported women's access to global markets by implementing gender-responsive trade promotion policies and programs to assist Trade Promotion Organisations (TPOs) to overcome policy and institutional challenges. In the Philippines, the Gender and Development (GAD) electronic portals serve to ensure that gender-mainstreaming efforts and development efforts to promote economic, social and political empowerment of women continue.

Additionally, under SCE, the "Bridging Gap in Economic Development and Integration of Remote Areas for Sustainable Growth in the APEC region" initiative led by Russia seeks to support traditional crafts and small entrepreneurship amongst the indigenous population of APEC economies.

Development of Global Value Chains through Services and Investment Reforms

CTI has pursued several relevant initiatives on global value chain development, which has been a part of the APEC agenda since at least 2012. For example, the APEC Strategic Blueprint for Promoting Global Value Chains 2020-2025 aims to create an enabling environment for GVCs in accordance with new challenges facing the global economy. Additionally, the APEC Checklist of GVC-friendly provisions in trade and investment policy frameworks provides guidance to economies in making GVC-friendly decisions regarding trade and investment policies and negotiations of FTAs/BITs. Through the presentation of Australian case studies, a Services Trade Competitiveness workshop aimed to build the capacity of APEC economies to better understand domestic barriers to services trade competitiveness. Services have been considered as the 'glue' that keeps GVCs intact, connecting manufacturing processes and suppliers across different locations.

Essential structural reform in services could further support GVC performance through strengthening connectivity and logistics, particularly in services sectors that have a strong supporting role in the operationalisation of firms. Australia's Phase 4 update and expansion of the APEC Services Trade Access Requirements (STAR) Database has been implemented to improve the transparency of services regulations in APEC economies to assist SMEs. Australia has also initiated a CTI project to examine the role of services in GVCs by analysing case studies of market-opening services development in the APEC region and the effect it has had on GVCs. In addition, Japan conducted a study on "Improving the Investment Climate for GVCs Development" under CTI, which aimed to facilitate investment by making the investment climate more predictable and transparent in supporting GVC networks across borders.

Building Connectivity and Resiliency through Digital Innovation

Digital innovation brings opportunities to the development of seamless connectivity. Application of digital technology allows real-time and online traceability of cargo, thereby ensuring safe and secure delivery. The 2019 APEC Port Services Network (APSN) Forum focused on digital innovation trends in supply chain, digital innovation challenges in the maritime sector, and digital innovation initiatives at ports on how to improve port connectivity. The Promotion of Global Data Standards (GDS) to Enhance Supply Chain Connectivity initiative by Hong Kong, China under CTI aims to improve connectivity through the following: pilot projects on product traceability; capacity building for member economies involved in the pilot projects; and a study by the APEC PSU to assess the overall outcome of the pilot projects and make policy-based recommendations for future GDS initiatives.

As economies become increasingly connected, developing resilience becomes a regional issue: a single catastrophe can bring region-wide effects on value chains. Under the "Enhancing APEC Resilience through Science, Technology and Innovation for APEC Sustainable and Inclusive Growth" project, PPSTI and EPWG promoted the use of smart ICT to seek solutions to share regional challenges and disseminate real-time information on weather-related hazards in the APEC region as well as to facilitate data exchange and scientific findings through cross-fora collaboration on public-private partnerships.

Chinese Taipei's initiative on "Enhancing Regional Digital Preparedness on Natural Hazards to Safeguard Communities and Business in the Asia-Pacific" submitted to Senior Officials' Meeting (SOM) seeks to apply big and open data on natural hazards to directly benefit SMEs and vulnerable communities by improving decision-making in securing business activities in the preparedness and response phases. Additionally, EPWG's initiative to establish an APEC Emergency Preparedness Capacity Building Center (EPCC) seeks to promote joint efforts to build capacity and regional resilience against natural hazards. An "APEC Summit on Resilience and Capacity Building Training Workshop on Promoting Business Connectivity" was also held by EPWG to develop regional human capacity and to ensure resilient global supply chains through public-private partnerships.

Improvement of Regulatory Framework and Practices through International Regulatory Cooperation and Harmonisation

APEC has implemented several Good Regulatory Practices (GRP) initiatives. The 12th Conference on GRP under SCSC discussed the expansion of the application of GRP as a tool to reduce barriers to trade and encourage investment and economic growth. APEC has also been at the forefront in promoting regulatory harmonisation and convergence. For example, LSIF promotes regulatory harmonisation and convergence for medical products to help build capacity of regulators in the region and to achieve convergence for regulatory approval procedures for medical products.

SCSC reported that an Asia-Pacific metrology web portal is in development by two of APEC's Specialist Regional Bodies, the Asia-Pacific Metrology Programme (APMP) and the Asia Pacific Legal Metrology Forum (APLMF). To drive APEC's Silver Economy, SCSC has promoted further integration efforts and the harmonisation of silver economy standards and regulatory coherence across APEC. Several related domestic initiatives include the modernisation of the Bureau of Philippine Standards of the Department of Trade and Industry (DTI-BPS) Standards and Conformance Portal to serve as a one-stop information center on Standards, Technical Regulations and Conformity Assessment Procedures (STRACAP).

Additionally, the DTI-BPS Product Certification Information Management System (PCIMS), a web-based information system that supports the BPS in processing, monitoring, and managing Import Commodity Clearance (ICC) and Philippine Standard (PS) License applications, was established.

Issues of sustainability must also be taken into consideration in order to ensure strong regional economic growth. CTI's APEC Cooperation Network on Green Supply Chain (GSCNET) intends to facilitate knowledge sharing, best practices exhibition, regulations and policies review, and capacity building on Green Supply Chain. Under the Green Port Award System (GPAS), APSN aims to encourage ports in the APEC region to collectively deliver a sustainable port industry by adopting green port standards.

Regulatory Reform to Facilitate Trade, Investment, and Competition

When designed effectively, regulations can promote business competitiveness and innovation. EC has launched important initiatives that implement structural reforms by removing barriers to economic participation, encouraging competition, and strengthening institutions under the Renewed APEC Agenda for Structural Reform (RAASR) and the Ease of Doing Business (Phase II) Action Plan. The United States launched the "Promoting Competition International Best Practices to Implement APEC New Strategy on Structural Reform (ANSSR) Goals" project to enhance convergence around internationally recognised sound and effective competition policies and practices. The Regulatory Roundtable by TELWG on the role of competition policy in fostering infrastructure to bridge the digital divide explored views on the challenges of existing regulations and changing rules in the era of digital transformation to address affordability issues.

Improving regulatory coherence and cooperation are important steps to reduce trade and investment costs as well as to strengthen a competitive business environment. Hong Kong, China implemented domestic measures to promote the development of the reinsurance industry by conducting equivalence assessment on the insurance solvency regulatory regimes of China and Hong Kong, China. Additionally, a domestic initiative from Chinese Taipei added Regulatory Impact Assessment (RIA) to the regular curriculum for civil servant training in order to improve the quality of rule-making and reduce regulatory costs.

At the sectoral level, regulatory harmonisation has shown tangible results in reducing trade costs for businesses. APEC's CD has been working to promote broader and more consistent implementation of the Globally Harmonized System (GHS) on the Classification and Labeling of Chemicals by reducing unnecessary variations in GHS implementation across APEC economies. The harmonisation of maximum residue limits for pesticides was facilitated by the development of two practical tools to support the implementation of the APEC Guideline for import maximum residue limits (MRLs) for pesticides. The Guideline also discusses possible approaches to achieve alignment of international MRLs. The "Expert Workshop Harmonization of Pesticide Maximum Residue Limits for Imported Foods" by SCSC also aimed to increase information sharing and capacity building on work related to food and product safety. In addition, the Wine Regulatory Forum (WRF) by SCSC aims to expand wine production and trade through the voluntary adoption of the APEC Model Wine Export Certificate that may eliminate unnecessary export certifications in the food sector.

Businesses require a supportive domestic regulatory environment in order to maintain competitiveness. EC has been promoting competitive transportation markets by producing a framework and checklist to identify domestic regulations that limit competition in transport.

An EC workshop on International Regulatory Cooperation has illustrated the importance of sharing practical experiences of different member economies across the region to promote international regulatory cooperation. Additionally, an Australian initiative under SMEWG on "Harmonisation of Standards for the Movement of Data across APEC Economies" attempts to facilitate SME trade and participation in regional and global value chains. A domestic initiative by Malaysia on Reducing Unnecessary Regulatory Burden (RURB) attempts to ease processes for businesses by making commercial vehicle licensing easy, enhancing the cargo clearance process, facilitating value-added activities, and improving air freight service delivery.

Improvement of Investment and Dispute Resolution Framework to Strengthen Regional Economic Integration

Trade and investment issues are correlated as investment complements and facilitates cross-border trade in goods and services. In the financial sector, APEC initiated the development of an Asia Region Funds Passport (ARFP), a multilateral mutual recognition arrangement that waives or diminishes key regulatory impediments to the cross-border trade in managed funds. IEG held an Investment Policy Dialogue for policymakers and regulators to explore the different approaches and policy options to manage foreign investments.

The following domestic initiatives were initiated to support investment facilitation and the related institutional framework. The Philippines is supporting the ASEAN Capital Market Integration (CMI) Blueprint with the ultimate goal to create an enabling environment for regional integration by adopting a mutual recognition framework that envisions harmonisation of investment rules and regulatory requirements. Canada and Indonesia were working to improve the flow of private capital into infrastructure development in Indonesia and improving the institutional, legal and regulatory framework, including the setup of PPP structuring and financing functions within the Indonesian Ministry of Finance.

Under EC, the Strengthening Economic Legal Infrastructure (SELI) Group developed work plans for "Developing a Collaborative Framework for Online Dispute Resolution for MSMEs in B2B Transactions" and for "Use of Modern Technology for Dispute Resolution and Electronic Agreement Management". SELI also hosted a policy discussion on Online Dispute Resolution (ODR) to strengthen understanding and discuss issues and challenges in relation to working towards establishing an APEC-wide ODR framework.

People-to-People Connectivity

The word cloud generated for people-to-people connectivity as shown in Figure 2.4 highlights the key words captured from the yearly reviews submitted by member economies. The five words with the highest occurrences based on the word cloud are: education, tourism, training, skills, and mobility. The following words also frequently appear: cultural, ICT, exchange, travel, development, women, people, TVET, visa, and research. Based on the yearly reviews, the key themes in people-to-people connectivity are identified and discussed below.

Figure 2.4: Yearly Review Word Cloud for People-to-People Connectivity

Facilitation of Cross-Border Education Cooperation through Scholarships and Knowledge Sharing

Cross-border exchange of ideas helps to facilitate knowledge and skills transfer. Scholarship grants are regularly given by various APEC economies to increase cross-border talent flows and strengthen regional ties. The Australia-APEC Women in Research Fellowships initiative under PPSTI has been providing financial assistance to 10 fellowships each year from 2015 to 2019 for high-achieving female researchers from developing APEC economies to pursue research opportunities in Australian research institutions. Similar domestic initiatives include Brunei Darussalam's wide range of student exchange programme scholarships to various APEC economies to expose students to different educational systems. Korea's "Fostering ASEAN Future Leaders 2015/2016 (Daejeon University)" initiative granted 20 university students excelling in ICT or social sciences in ASEAN with a one-year scholarship to enable them to share and discuss relevant political, economic and social issues between ASEAN economies and Korea as well as a 2-month internship programme at several federal and international organisations.

Cross-border collaboration through knowledge exchange and capacity building also enhances the quality of skills and expertise in targeted sectors. The Philippines organised a PPSTI workshop on "Strategies to Address Non-Communicable Diseases (NCDs) through Science, Technology and Innovation: Nutrigenomics Approach" to encourage APEC economies that have already embraced the science of nutritional genomics to communicate ideas, impart research results, and share best practices so as to strengthen the regional health system, while also creating options for the transformation of the food and nutrition industry through regional collaboration and the creation of a regional nutrigenomics research consortium. Singapore implemented an initiative under HWG called A-TRACTION (Asian Tuberculosis Research

and Clinical Trials Integrated Organisational Network) to bring together selected tuberculosis hospitals and research institutes in high TB burden APEC economies to establish a unified platform to conduct high-quality TB clinical trials to investigate novel TB treatments. A domestic initiative by New Zealand Customs in conjunction with Massey University extended a scholarship to China Customs that offers participants the opportunity to gain understanding of the customs working environment in New Zealand in a bid to promote long-term customs-to-customs cooperation by building lasting relationships.

Cross-border cooperation in the education sector can also be facilitated by better data and visibility. The HRDWG APEC Cross-Border Higher Education Data Collection Project by Australia and other co-sponsoring economies seeks to quantify the extent of provider mobility in higher education within APEC economies, which contributes to the visibility of data on cross-border collaborations between higher education institutions.

Promoting Research, Innovation, and Entrepreneurship through Cross-Border Collaboration and Scholarships

Cooperation in the education sectors of APEC economies will foster innovative growth as students, researchers and education providers build scientific and technological communities. The APEC Community for Education Innovation (CEDI) Group under HRDWG, comprising six researchers and experts from four co-sponsoring economies, conducted joint research on subjects such as innovative education and human resource development to find successful practices and practical applications in public-private sectors. ABAC China implemented an "APEC GVC and CBET Workshop" initiative to promote digital innovation and entrepreneurship through two 12-day workshops across China to introduce best practices to representatives of SMEs, women-led enterprises and associated policymakers, while also providing a platform for the exchange of innovative ideas and networking opportunities with peers and potential partners.

Cross-border collaborations also enhance innovation and research developments that are increasingly critical to stimulating economic growth in knowledge economies. Australia's "APEC Guiding Principles for Research Integrity" project under HRDWG aims to reduce the complexities involved in researcher mobility and facilitate research cooperation across APEC by developing high-level, non-binding guiding principles for research integrity to provide a common reference point for the region's researchers.

Cross-border science, technology and innovation exchanges promote high-quality innovation in the region. The APEC Young Scientist Training (YST) programme at the postdoctoral fellow level was endorsed by PPSTI to provide young promising scientists from the region, especially from developing economies, with an opportunity to develop research strengths and capabilities through training, collaboration, and visits.

Stronger Cooperation of Education and Labour through Mutual Recognition Framework

Mutual recognition of skills and credentials play an important role in facilitating skilled labour mobility. Mutual recognition agreements (MRAs) increase the quality of workers by promoting qualification systems and benchmarking occupational skills.[52] TELWG, in partnership with relevant stakeholders including the South East Asian Regional Computer Confederation (SEARCC), will develop and promote a Common ICT Skills Recognition Framework within

[52] APEC (2017a).

the Asia-Pacific region to address current barriers to the mobility of ICT professionals. To increase skills recognition and support labour mobility in tourism across APEC economies, Australia launched the APEC Tourism Occupational Standards Development Project under HRDWG and TWG to produce occupational standards representing the core skills required for five occupations in the tourism sector across six participating economies. Similarly, to increase recognition of common core skills in transport and logistics across APEC economies, the Transport and Logistics Occupational Standards Development Project was launched by Australia under HRDWG.

In addition, the APEC Agreement under the International Engineering Alliance recognises the substantial equivalence of competence standards for professional engineers within APEC economies. APEC economies can apply to become members of the Agreement by demonstrating that they have in place systems which allow the competence of engineers to be assessed against the agreed international standard set by the Agreement.[53]

Harmonisation of standards and recognition of education and training across economies will also enhance student mobility. China launched an APEC-funded project titled "Research on Mutual Recognition of Credits among Universities in the APEC Region" to explore an effective mode of mutual recognition of credits in order to promote student mobility in APEC. At the domestic level, the Technical Education and Skills Development Authority of the Philippines signed an MOU for Cooperation in the Field of Technical and Vocational Education and Training (TVET) with the Ministry of Education and Culture of Indonesia and the Department of Education and Training of Australia to strengthen and broaden mutual cooperation in education, training and research on the basis of reciprocity as well as to develop benchmarking and comparability of standards and qualifications in priority sectors.

Cooperation through regional frameworks and shared platforms may also help to address labour imbalances across the APEC region. HRDWG developed an APEC Labour Mobility Framework to establish a policy platform for regional cooperation on labour mobility issues and to serve as a guide for economies as they consider the types of actions that can be taken to address labour imbalances and complexities associated with the international movement of workers. To promote international labour mobility in the region, HRDWG initiated a study on public employment services in the Pacific Alliance and their role in the management of regional mobility of labour in order to define a proposal for a cooperation scheme.

Structural Reform to Enhance Human Capital Development

Human capital development is key to building a skilled and productive labour force. To address structural barriers to human resource development, Australia organised a capacity building workshop under EC to help targeted APEC developing economy participants improve their capacity to manage and overcome specific structural barriers, including regulatory, institutional and policy barriers, to meet current and future labour market demands in a more sustainable manner. The 2017 APEC Economic Policy Report (AEPR) on Structural Reform and Human Capital Development discussed the issue of structural employment and highlighted the importance of developing active labour market policies as a coordination mechanism that links various aspects of skills training and development to skills matching and employment services.

[53] The following 14 APEC members have full rights of participation in the Agreement: Australia; Canada; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; New Zealand; Peru; the Philippines; Russia; Singapore; Chinese Taipei; and United States.

Reforms in higher education and ongoing development of curricula will ensure that the quality of education is kept up-to-date in order to equip students with the skills and competencies required in a globally connected and knowledge-based society. To promote cross-border education, Malaysia has gradually liberalised its higher education sector by allowing foreign universities to establish branch campuses as well as embarking on twinning programmes with foreign universities.

The APEC Learning Community for Shared Prosperity (ALCom) by Korea under HRDWG intends to implement international cooperative activities originating from the APEC Learning Community Builders (ALCoB) to narrow the digital divide within the region through online and offline education-related activities.

Empowerment of Women and Youth to Address Employability and Strengthen Entrepreneurship

Capacity building and improvement of skills and access to capital and assets is crucial to support economic empowerment of women, leading to pro-poor and inclusive economic growth. EC completed a project to connect various local and international funds from around the world with APEC women-led SMEs, serving as a cross-border capacity building platform to provide knowledge, strategies and experience in order to increase women SME entrepreneurs' access to finance. PPSTI's APEC Women in STEM Principles and Actions was launched at the 2019 APEC Women and the Economy Forum to promote greater skills development for women in science, technology, engineering and mathematics.

Cross-border collaboration also helps to increase economic participation of young people by cultivating labour quality and enhancing skilled labour mobility through the exchange of best practices and capacity building. HRDWG adopted the APEC Framework for Youth Education, Employment and Entrepreneurship that provides policy guidance and a framework for cooperation in order to boost youth employability and address skills deficits in the region. The APEC Skills Development Capacity Building Alliance led by Chinese Taipei under HRDWG has two main goals: 1) facilitating quality growth through upskilling by demonstrating best practices for youth employability, elevating vocational training standards, and promoting institute-to-institute connectivity; and 2) fostering a connected APEC by providing quality skills training, supporting policy development for vocational training, and facilitating labour and skills mobility.

To further enhance youth employment, an HRDWG "APEC Workshop on Regional Industry-Academia Collaboration for Talent Development: An Exchange of Skills Training, Internships, and Jobs" was held in Taipei to address the issue of youth employability by closing the gap between education and skills. This project re-strategises collaborative partnerships among APEC economies by highlighting a new model of exchange that includes professional and technical skills training, internships, talent mobility, and workplace experiences for APEC youth. Chinese Taipei also organised a forum under HRDWG called "Youth Innovation & Entrepreneurship: Inclusive Growth and Collaborative Connectivity for Young Entrepreneurs" for students, young entrepreneurs, and potential entrepreneurs. At the domestic level, Chile has developed a programme with the Pacific Alliance economies to evaluate strategies in order to better facilitate the mobility of young apprentices at a technical and technological level.

Developing skills and facilitating mobility of women and young people serves to accumulate human capital and promote innovative economic growth in the region. The APEC BEST Award, a contest organised for women entrepreneurs under PPWE, seeks to draw the attention

of businesses and society to the importance of women's entrepreneurship development, replication of successful business models and best practices, as well as the popularisation of success stories of women entrepreneurs in the region. Malaysia also launched the "MyAPEC Youth Connect" initiative, which offers work placements of four to 12 months in APEC economies, in order to create a network of young people with local insights and a global perspective of doing business in the APEC region.

Travel Facilitation and Security Measures to Promote Cross-Border Mobility of Professionals and Tourists

The development of travel facilitation policies serves to reduce and/or eliminate the non-logistical costs and uncertainties associated with travel procedures. To this end, efforts have been made to establish an APEC-wide Code of Conduct for Travel Providers to enhance cross-border mobility of business people and tourists in the region. Several domestic initiatives have also been implemented to enhance cross-border mobility through increased convenience and opportunities for travelling. Under Canada's Can+ Program, Mexicans and Peruvians who have travelled within the last 10 or 5 years, respectively, to Canada or the United States are eligible for expedited visa processing, making it easier and faster for experienced and trusted travellers to obtain a visa to visit Canada. Meanwhile, Korea plans to conclude more Working Holiday Program (WHP) memorandums of understanding with APEC economies to encourage youth mobility and mutual cultural understanding.

Since visa restrictions can deter tourism despite efforts to reduce other travel costs, several economies have implemented domestic measures to ease tourist visa restrictions in a bid to increase the number of total tourist arrivals in APEC to 800 million by 2025. For instance, Korea has implemented several related projects, including exempting visas for individuals of 15 APEC economies under the Initiative to Expand Visa Waiver as well as the No-visa Entry for Foreigners in Transit, expanded use of Smart Entry Service (SES), and expanded issuance of Electronic Visa schemes. Thailand is working on implementing a Single Window for Visas & Work Permits System, a new e-service channel to bring in foreign experts through a one-time online application. Malaysia improved its Visa on Arrival scheme by extending the facility for Chinese and Indian tourists to an additional six entry/exit points across its international airports, ferry terminals, and immigration checkpoints.

Travel security is vital for the safety of passengers and the region at large. CTWG's APEC Travel Facilitation Initiative aims to make travel easier, faster and more secure through six pillars, comprising airport partnership, APEC Business Travel Card, trusted traveller, facilitation of passenger security screening, advance passenger information, and checked baggage facilitation. The Secure Travel Workshop on "Countering Foreign Terrorist Fighters (FTFs) Travel" under CTWG highlighted the threat that FTFs and their travel pose to the region and explained the need for inter-agency cooperation in implementing Advance Passenger Information (API) Systems as well as international cooperation and information sharing to effectively mitigate the threat.

Box 2.2: Utilising Passenger Name Records to Facilitate Travel

Passenger Name Record (PNR) is a list of passengers' identification data sent by transportation service providers to pertinent authorities. Some form of PNR has been used for more than 60 years by the aviation sector and immigration and customs authorities around the world. There are other related terms used interchangeably with PNR – e.g., Advanced Passenger Information (API) and Advanced Passenger Processing (APP) – but they are not the same. The broader information provided by PNR from airlines is useful for risk assessment and law enforcement.

In introducing the PNR system, there are concerns about data privacy and protection. Given that some PNR data are personal in nature – such as personal identification, travel plans, and billing/payment information – there are concerns about who has access to the data, how they are used, and with whom they are shared. To ensure the appropriate and effective use of PNR data, some economies have introduced a dedicated unit called the Passenger Information Unit (PIU). PIU is a centralised unit that solely utilises PNR data for analysing and assessing passengers. Having a PIU can respond to concerns of data privacy as it ensures that data access is limited.

PNR can offer significant cost reductions for governments, airlines, and legitimate travellers in the longer run. For passengers, PNR can reduce processing time at immigration and customs since authorities already have their data and initial screening has been done prior to arrival. For airlines, after the initial costs of setting up and adjusting to new systems and requirements, substantial savings can be obtained from efficient electronic communications and data compatibility. Airlines also benefit from reducing passenger clearing times, reducing costly delays and waiting time at gates.

Source: APEC Policy Support Unit (2018b)

Development of Tourism Industry through Cultural Exchange and Tourism Cooperation

Development of the tourism workforce is necessary for ensuring a vibrant economy. To support tourism employment, build capacity, and respond to labour and skills shortages in the APEC region, TWG has implemented a project that explores barriers and benchmarks approaches to facilitate labour mobility, improve career pathways, increase retention, and enhance access to improved training. Cross-border cultural exchanges also help to enhance mutual understanding, promote goodwill, and build trust and affinity amongst residents across APEC economies. Additionally, enhanced cultural understanding through the exchange of ideas can increase opportunities for cross-border trade, investment and tourism. TWG under its Cross-Border Education Exchange initiative aims to ensure that at least one cultural awareness event is organised by each APEC economy in every other APEC economy per year.

Several APEC members have implemented domestic initiatives to promote cultural awareness. China has held several cultural exhibitions, festivals and performances on Chinese arts and culture in other APEC economies. To promote cultural exchanges, mutual understanding and friendship between China and Latin American economies, China organised a series of cultural events in Mexico and Peru under the framework of the China-Latin American Cultural Exchange Year. The year 2020 has also been designated as Malaysia-China Year of Tourism and Culture in a bid to strengthen cooperation and exchange in the field of tourism, culture and arts. Japan is implementing the JENESYS programme and the KAKEHASHI project, which are bilateral and multilateral youth exchange programmes to promote global understanding of Japan's attractions, develop mutual trust and understanding, and build a basis for future friendship and cooperation.

As part of strengthening tourism cooperation, some other domestic initiatives include the Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay (Greater Bay Area) of the People's Republic of China to support the development of Hong Kong, China into

an international tourism hub, a core demonstration zone for multi-destination tourism, as well as a diverse tourism platform in the Greater Bay Area. Enhancement of tourism services and investment will also facilitate growth of the tourism industry. Singapore and Australia signed a five-year MOU on strengthening tourism cooperation, which aims to enhance tourism services by improving cooperation in the areas of tourism industry supply-side development, research partnerships and data-sharing, sharing of tourism information and insights, facilitating opportunities in investments, and enhancing tourism infrastructure.

Application of Digital Technology to Promote Cross-Border Mobility of Professionals and Tourists, and Education

Business travel facilitation helps to reduce the costs and uncertainties for professional travellers to explore and maintain business opportunities and investments. The ABTC is a major development in this area that helps facilitate short-term business travel within the region by streamlining the entry process into APEC economies. Recently, a mobile application platform to provide ABTC holders with a modern, digital version is in development and is currently in Stage Two testing. The ABTC Online Lodgement System Design Workshop by Australia sought to scope both a customised web-service solution for those economies that already have a specified means of online lodgement and a generic web-service online lodgement capability for economies that do not currently have online lodgement available to domestic applicants.

Apart from the ABTC, there are also efforts to improve protection of cross-border workers. For example, Chinese Taipei is implementing a Joint Research Project with APEC economies on "The Impact of Regional Integration in the Digital Age on Social Security Protection for Cross-border Workforce in APEC Economies and Related Responses" under HRDWG to establish comprehensive social security protection policies for cross-border workers.

Employing digital technologies in the tourism industry will also help to facilitate travel. A TWG workshop on Leveraging the Digital Economy to Provide an Inclusive Tourism Industry was held to explore how APEC economies can leverage digital tools to promote travel and tourism as well as identify regulatory and capacity-related barriers to participation in the digital tourism economy with an emphasis on enabling women and MSMEs to engage in the industry. To increase the number of total tourist arrivals, several domestic initiatives have been implemented as well. Chinese Taipei has instigated an e-gate since 2012 in major international airports, enabling travellers to clear customs via automated gates in a fast and convenient manner. The Single Window of Tourism (VUT) is a tool developed to facilitate tourism investment in Peru by allowing those interested in providing tourism services to manage the procedures for obtaining permits, certificates, licenses and other authorisations through an electronic portal, while also reducing associated processing times and costs.

With regard to facilitation of online learning for students, the HRDWG APEC Quality Assurance in Online Education project intends to help governments and quality assurance agencies develop a clear understanding of best practices in high quality online learning by providing a toolkit on the quality assurance of online education, thereby enabling greater flexibility in cross-border education delivery and recognition of qualifications delivered through online education in the region.

C. CASE STUDIES AND IDENTIFICATION OF GOOD PRACTICES

This section provides a summary of the case studies of connectivity related initiatives as submitted member economies. The case studies cover the experiences of APEC members in developing Single Window systems and ICT infrastructure, promoting innovation to mitigate the impact from the COVID-19 pandemic, and the implementation of the WTO TFA.

Single Window Implementation in Chile and China

High costs and time in trade operations are a threat to productivity. According to the World Bank's *Doing Business Report 2020*, on average, APEC economies spent more money and time in importing and exporting compared to OECD member economies. APEC economies spent USD 421.9 and 58.6 hours on exporting, while OECD economies spent USD 184.5 and 15.5 hours.[54] Similar significant differences are also noted between the two groups in the case of importing. APEC economies spent 257.5% more money and 454.4% more time to import compared to OECD economies. These large inefficiencies in performance can be improved by implementing digital technologies like the Single Window.

Domestically, China developed a Single Window Development Working Group in 2016 to administer the process of creating an economy-wide Single Window that would act as a 'one-stop' trade service platform. The plan was for the system to cover all ports in China by 2017, to be applied in 80% of main businesses like cargo and transportation by the end of 2018 and all main businesses by 2019, and to cover the entire chain of international trade management by the end of 2021.

However, China encountered several challenges in the implementation of their Single Window, especially in the case of cooperation. They had to ensure that there was cross-sectoral and cross-regional collaboration at the central and local levels as well as cooperation on development, operation, and maintenance. China also recognised the challenge of incorporating new and advanced technologies in the development of their Single Window, while also ensuring harmonisation to existing international standards and norms.

The experience made China recognise the importance of organisation and coordination, including government support, as a key factor in the successful implementation of a Single Window system. Good scientific design and innovative application of new technologies was also found to be imperative to its implementation. Lastly, the long-term success of the system depends on the optimisation of relevant legal systems necessary for its operation.

China has now successfully developed its Single Window, which covers all sectors of international trade, and which has a 100% application rate, more than 3.3 million registered users, and more than 9.5 million declarations per day. The in-depth implementation of the Single Window, which features online approval and paperless processing, has helped to cut the declaration time for imported and exported goods from 4 hours to 5-10 minutes and the declaration time for ships from 36 hours to 2.5 hours. Further, it is expected that the Single Window implementation will help to save RMB 9 million annually in labour and paperwork related costs.

Meanwhile, Chile has already developed a fully functioning economy-wide Single Window that is interoperable with the systems of the other Pacific Alliance members. Chile now plans

[54] World Bank (2019b).

to achieve interoperability of Single Windows systems across APEC economies. An APEC Single Window interoperability pilot is currently being conducted among several economies and will eventually be expanded to include more economies in the region.

This initiative is expected to not only reduce costs and improve efficiency, but also improve the lack of information and transparency, thereby also helping to reduce risks in the foreign trade supply chain. For example, the sharing of ePhyto certificates will reduce fraud related risks and enable easier identification of high-risk cargo to support arrival planning. Better information will make the supply chain more predictable and efficient, while the use of commercial and electronic regulatory data will improve track and trace capabilities. This will allow traders to reduce their expenses in storage, documentation errors, and courier costs.

However, attaining interoperability across many economies with differing legal systems and at various levels of technology adoption is challenging. Chile recognises the need to ensure coordination between the economies in order to integrate the systems and achieve interoperability, while also taking into account the different levels of technology development and overcoming the lack of standards. Lessons learnt from the experiences of implementing interoperable Single Window systems among the Pacific Alliance members and ASEAN members are expected to help guide further implementation.

Expansion and Development of Smart Cities in Japan

Japan has developed a Smart City initiative as a step towards realising Society 5.0. The initiative aims to use new technologies (such as Artificial Intelligence, Big Data and autonomous driving) to help solve numerous urban problems such as over-crowding, inefficient energy and resource consumption, and constraints on services like healthcare and education. The development of smart cities requires the collaboration of various ministries to ensure compatibility and convenience. At the same time, appropriate handling of personal information is very important. Hence, the sharing of information, best practices, and data is key to this initiative while preventing misuse of personal information.

Japan's ministries have been implementing model projects within their jurisdictions and lending support to private developers for the development of smart city blocks. However, the lack of interoperable systems, similar infrastructure capacity, and open data platforms have posed problems for this initiative. In response, Japan is creating partnerships to develop integrated solutions across its various ministries and stakeholders.

In 2019, relevant Japanese ministries agreed to commence a joint study meeting to discuss architecture construction and promised to reflect the results of the study in their specific projects. In line with this agreement, each ministry has been strongly promoting business and data cooperation. Japan also implemented horizontal deployment by examining the data use policy of businesses in each ministry's smart city and applying it to specific businesses, enabling economy-wide smart city projects to function on a common foundation. A "Smart City Public-Private Partnership Platform" consisting of 484 public and private businesses has been established to promote smart city-related businesses and provide hands-on support to ensure common policy application and standardisation for data interoperability.

Currently, relevant ministries and agencies are collaborating with local governments, companies and universities to promote smart city initiatives, exceeding 100 projects in total. This can be challenging given that some companies such as Panasonic and Toyota have come up with their own smart city concepts and are leading their construction. Moreover, cities are

constructing smart cities that best fit their vision and strengths, leading to a lack of standardisation. For example, Kakogawa city is aiming to become a "town selected by families with children". In order to realise this, the city is promoting initiatives that utilise ICT platforms which focus on safety and security to improve the living environment for families with children and strengthen the community's network. The city also enacted ordinances focusing on collection and protection of personal information based on consensus of citizens. In order to overcome these challenges, Japan has focused on broadening stakeholder involvement, increasing partnerships with universities, and developing legal support to allow for a more standardised and interoperable smart city development. In Aizu-wakamatsu City, the local government have established a platform that aggregates and analyzes various data to provide regional information and administrative guidance through a mobile application. The data platform is also open to users who are interested in using the data collected in the system. The data are collected from only those who have opted in.

Singapore Open Innovation Platform

The COVID-19 pandemic has altered our way of life in many aspects. Across the globe, local economies have been disrupted, businesses are struggling to adapt, and jobs remain uncertain. To respond to the fast-evolving marketplace, enterprises must embrace digital innovation at unprecedented speeds and scales. However, no one entity has the physical nor human capital to tackle the situation in its entirety. Instead, there is a need to leverage the collective and collaborative potential of institutions and individuals across various backgrounds and capacities.

To help businesses in this whirlwind journey, the Singapore Government and members of the private sector have come together in solidarity to ignite various knowledge communities into collectively working towards innovative solutions that would enable companies to recognise, transform and operate in the new post-COVID-19 environment. Riding on strong public-private sector partnerships, the National Innovation Challenges (NIC) programme aims to develop industry-led solutions for the immediate priorities of re-opening the economy as well as to offer longer-term stability that ensures sustainable growth and economic resilience. Up to SGD 40 million in funding has been dedicated to the NIC programme to ramp-up the development, deployment and adoption of innovative solutions.

In an Open Innovation Call jointly issued by Enterprise Singapore (ESG), Infocomm Media Development Authority (IMDA) and the National Research Foundation Singapore (NRF) on 22 July 2020, seven Challenge Statements across five sectors – transport and logistics, built environment, MICE (Meetings, Incentives, Conventions and Exhibitions), tourism, and maritime were featured. By jointly analysing these industry problem statements and crowdsourcing for solutions, the NICs programme will quicken the pace of innovation, commercialisation, and adoption across industry sectors – allowing companies and government agencies to adapt more quickly by tapping the innovation capabilities of various technology, business and academic communities.

Village Broadband Internet Project of Thailand

Thailand has developed a broadband internet project for villages, Net Pracharat, in order to build digital infrastructure that will improve availability, accessibility and affordability of broadband internet service to people in rural and non-marketable areas. This initiative will help to reduce the digital divide and provide all Thais with a wider range of opportunities.

The Net Pracharat initiative aims to tackle the challenges to Thailand's broadband development, which include: 1) a lack of telecommunications infrastructure, especially in rural and non-marketable areas, which impedes the economy's productivity; 2) a lack of integration between agencies and redundant investments which hinder broadband management; and 3) the high price of broadband access which prevents fast penetration.

In response to these challenges, Net Pracharat's main objective is to strengthen the economy-wide broadband network by expanding the high-speed internet network to reach all villages in Thailand. By the end of 2017, the installation of fiber optic cable networks to 24,700 target rural villages had been completed. In addition, the government had provided villages with 24,700 free public Wi-Fi hotspots. As of July 2019, there were about 6.6 million users registered to access Net Pracharat Wi-Fi, with the newly registered increasing by about 200,000-300,000 per month. The government has also developed a curriculum on internet applications to educate the public and promote the use of Net Pracharat. About 1,000 teachers have been trained to provide training in their communities.

The initiative's implementation has had several challenges, such as the large scale of the project, instability of electricity connections, and insufficient Wi-Fi capacity in some bigger villages. The government is working to address these challenges and aims to significantly improve the quality of life in rural areas by providing access to education, healthcare and government services, and businesses and income opportunities.

Viet Nam: Enhancement of Stakeholder Engagement in the Implementation of the WTO-TFA

APEC has continually supported its members in implementing the WTO-TFA, which seeks to expedite the movement of goods at international borders by improving transparency and predictability. At the 2016 APEC Ministerial Meeting, Ministers approved the commitment to "support the complete and effective implementation of the WTO-TFA as soon as possible". In 2017, APEC Ministers Responsible for Trade affirmed the importance of fully implementing the WTO-TFA and developing new relevant capacity building projects.

To support these calls, Viet Nam initiated a project to enhance stakeholder engagement in the implementation of the WTO-TFA. The project consisted of a one-day workshop that was attended by representatives from 13 APEC economies and the private sector. The main objectives of the project were to 1) determine the challenges, best practices and lessons learnt in developing stakeholder engagement for trade facilitation; 2) develop a regulatory framework for better cooperation among stakeholders, including recommendations for improving infrastructure, human resources and technology adoption; and 3) provide recommendations and guidelines to customs and other border agencies and the private sector to implement the TFA.

The discussions relayed several challenges to the efficient implementation of the TFA, including gaps in data security, coordination issues between government agencies and between government agencies and the private sector, and a lack of human and financial resources. These conversations brought out suggestions for members to build on action plans and engage all relevant entities. In Viet Nam, enhancement of stakeholder cooperation in the implementation of the TFA has remarkably improved through better connectivity of the Single Window and development of the AEO programme. However, Viet Nam still needs to create a transparent and effective assessment mechanism to define the roles of each stakeholder.

After the completion of the project, Viet Nam Customs used the outcomes to determine the next steps for the WTO-TFA implementation in Viet Nam. At the regional level, the application of the agreement targets another important goal for the region, that is, improving trade security to protect global supply chains.

3. QUANTITATIVE ASSESSMENT OF CONNECTIVITY TARGETS

Each pillar of the Connectivity Blueprint is made up of several sub-pillars that work towards their objectives through relevant policy actions. The aspirational targets for the individual pillars are listed in Table 1.2 (in Chapter 1). Each of the pillars and sub-pillars are assessed using survey responses and external indicators to measure APEC's progress since the endorsement of the APEC Connectivity Blueprint. In some cases, OECD data is used as a comparison of progress.[55]

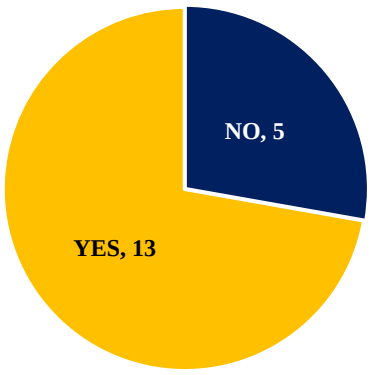
Physical Connectivity

Sub-pillar 1: Public Private Partnership (PPP)

This pillar aims to promote public-private partnerships, particularly within infrastructure, through the establishment of PPP centres in the Asia-Pacific region and increased use of the PPP model for infrastructure financing. The first policy action in this sub-pillar is to establish PPP centres in APEC economies to promote the use of the PPP model. These centres or units, are "government teams concentrating skills in PPPs with the public administration". Their functions often vary across economies, which reflect the different priorities and constraints. PPP centres, through their capacity building efforts and technical expertise, serve to effectively facilitate, implement and advise on the development of robust PPP frameworks in economies. Their benefits include the ability to help governments better manage risks within multiple PPP agreements, provide expertise on legal and financing issues, streamline deal flows, and create institutional memory with regard to best practices and lessons learned.[56]

Responses to the survey on the presence of PPP centres differed within economies, which could be related to the fact that some PPP centres may only cater to specific sectors within an economy. Thirteen APEC economies indicated that they have introduced PPP centers (Figure 3.1). Additional information from the World Bank on some PPP centres in selected APEC economies is provided in Table 3.1.

Figure 3.1: Does your economy have a Public-Private-Partnership (PPP) Centre?



[55] OECD members as of March 2020: Australia; Austria; Belgium; Canada; Chile; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Israel; Italy; Japan; Korea; Latvia; Lithuania; Luxembourg; Mexico; Netherlands; New Zealand; Norway; Poland; Portugal; Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Turkey; United Kingdom; and United States.
[56] Lemma (2013).

Note: Survey responses were used for Australia; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; Mexico; Papua New Guinea; Peru; Singapore; and Thailand. Data from PPP Knowledge Lab was used for the Philippines and Viet Nam. Data from the World Bank Public-Private-Partnership Legal Resource Center was used for Canada; Russia; and United States.
Source: APEC Connectivity Blueprint Survey Responses; PPP Knowledge Lab; and World Bank Public-Private-Partnership Legal Resource Center (PPPLRC).

Table 3.1: PPP units

Economy	Total number of PPP units	PPP units
Canada	5	PPP Canada; Canadian Council for PPPs; Institut Pour Le Paternariat Public-Privé; Partnerships British Columbia; Infrastructure Ontario
Chile	1	Ministerio de Obras Públicas - Coordinación de Concesiones de Obras Públicas
China	1	Public-Private Partnerships Center
Indonesia	2	Indonesia Infrastructure Guarantee Fund; PPP Directorate of Bappenas
Korea	1	Pimac-PPP Investment Management Center
Malaysia	1	PPP Unit
Papua New Guinea	1	Department of National Planning and Monitoring
Peru	1	ProInversión

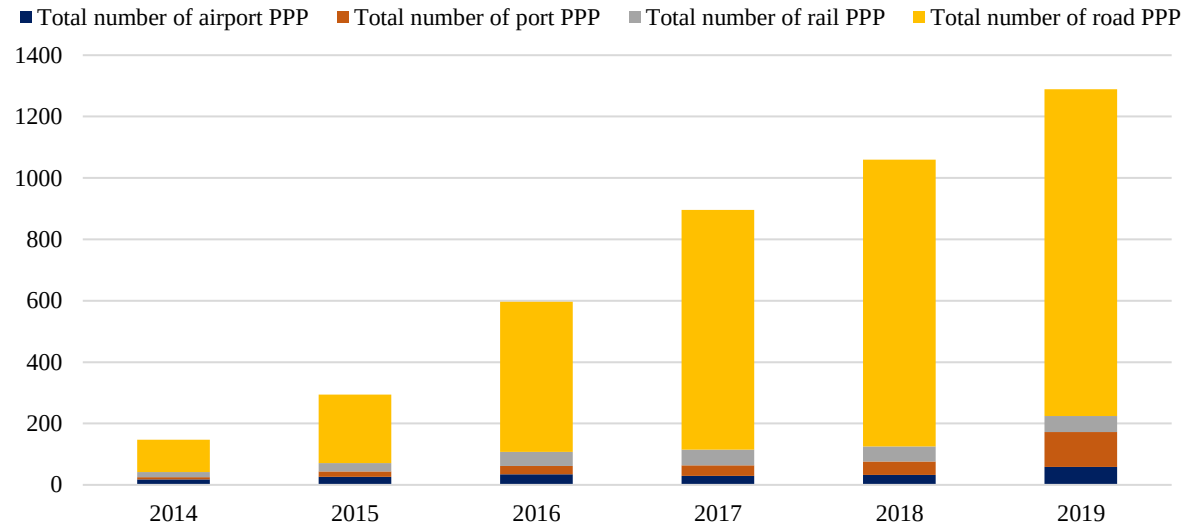
Source: World Bank Public-Private-Partnership Legal Resource Center.

The scope of these PPP centers is diverse. For instance, Korea's PPP centre supports procuring authorities in PPP driven procurement as well as develops and operates capacity building programmes for the public sector both domestically and overseas. Chile's General Directorate of Concessions under the Ministry of Public Works manages the project design, bid process, selection of concessionaires, and supervision of concessions during construction and operations. Similarly, China's Public-Private Partnership Center focuses on policy research, consultancy and training, capacity building, financial support, and international exchange, while Papua New Guinea's National Procurement Commission implements most of its PPP projects within the economy. The diversity of functions shows that there is often no standard definition for PPP centres and that economies have had to tailor their own PPP centres to reflect their respective institutional arrangements and needs.

Among the 5 economies who have not introduced a PPP centre, one reported that it had introduced a unit which plays a very similar role in promoting PPPs with other ministries, while two others do not currently have plans to introduce them. Possible reasons for why PPP centres have not been advanced by these economies could be attributed to PPPs not yet being used extensively within the economy or that private sector involvement in infrastructure is low.

The second policy action in this sub-pillar aims to prioritise infrastructure financing through PPP. To better understand APEC's progress in this area, the survey asked respondents to provide data on transport infrastructure within their economy, specifically information on PPPs. In terms of the number of transport projects under the PPP model, the APEC total, based on submissions from seven economies, grew from 147 projects in 2014 to 1,289 projects in 2019 (Figure 3.2). This increase has been predominantly driven by new road PPPs.

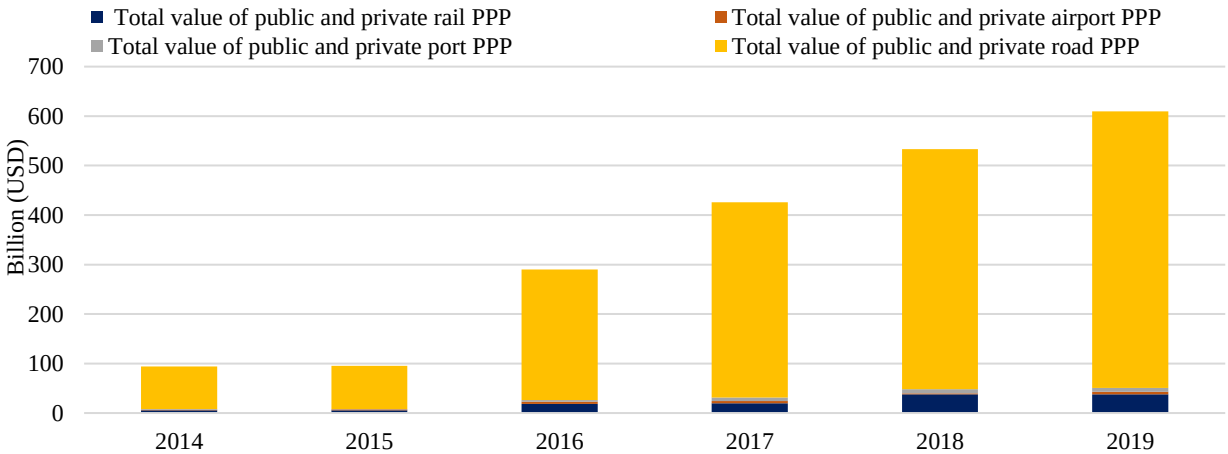
Figure 3.2: Number of transport PPPs in the APEC region



Note: For road, rail and airport PPP projects, data were provided by China; Indonesia; Japan (airport only); Korea; Mexico; and Peru. For port PPP projects, data were provided by China; Indonesia; Mexico; Peru; and Thailand.
Source: APEC Connectivity Blueprint Survey Responses.

Further to this, the size of the PPP market in an economy can be illustrated by the value of these investments over time (Figure 3.3). According to the survey submissions, the total value of investments in road, rail, port and airport PPPs in the APEC region grew from USD 93.9 billion in 2014 to USD 609.3 billion in 2019. This trend is encouraging given the benefits of pursuing PPPs within transportation projects. A study conducted by APEC outlined the main objectives economies identified in pursuing PPPs: reduce the costs of providing transportation infrastructure, complete projects on time and within budget, ensure the proper allocation of risk, and ensure greater service coverage for users.[57]

Figure 3.3: Total value of public and private transport infrastructure PPP investments in the APEC region



Note: Data were provided by China; Indonesia (road and rail only); Korea (road and rail only); Peru; and Chinese Taipei (rail only). Where applicable, data not available for particular years were filled with data from either the preceding or subsequent year.
Source: APEC Connectivity Blueprint Survey Responses.

[57] APEC (2017b).

Sub-pillar 2: Quality of Infrastructure

The quality of infrastructure is a particularly important aspect of infrastructure development. This sub-pillar intends to improve the quality of infrastructure in the Asia-Pacific region by increasing the number of APEC economies that adopt a comprehensive assessment method in proposal evaluation of infrastructure projects. This includes considering not only the purchasing price but also key quality elements — performance, durability, maintainability, safety and environmental impacts — that will ensure the development of quality infrastructure. Furthermore, adopting specific methodologies would ensure consistency in evaluation across projects.[58]

Responses from 17 respondents to the survey indicated that all but one economy had implemented comprehensive assessment methods. Several economies shared examples of their practical implementation through specific frameworks. For instance, Transport Canada has implemented comprehensive assessment methods through its optimisation of project evaluation and selection. It considers the impact on bottlenecks, fluidity of trade corridors, and the environmental and safety impact of projects. Indonesia regulates the implementation of the comprehensive assessment method under the Ministry of National Development and Planning, which uses a two-stage method where projects have to meet specific criteria, such as complying with the National/Regional Mid-Term Development and Strategic Plan, as well as with spatial planning and other considerations.

Data from the World Bank's *Procuring Infrastructure Public-Private Partnerships Report 2018*, World Bank's *Doing Business* (DB) and Logistics Performance Index (LPI) databases, and survey responses allows for a review of APEC economies' performances in several key areas of the PPP life cycle, that is, risk identification, economic analysis assessment, several fiscal assessments — fiscal affordability assessment, financial viability or bankability assessment, fiscal treatment of PPPs, and comparative assessment (value for money assessment) — and environmental impact analysis.

As illustrated in Figure 3.4, all 18 APEC economies included in the dataset conducted risk identification in preparing PPPs as of 2018. Twelve of the 18 APEC economies, that is, 66.7%, had developed a specific methodology to identify these risks. In comparison, four of the 32 OECD economies covered by the data did not identify risks in preparing PPPs.[59] Moreover, only 18 of them (56.3%) have developed a specific methodology to identify risks.

Several examples of risk identification methods were provided in the survey responses. One of them is from the Philippines. It adopted the Generic Preferred Risk Allocation Matrix (GPRAM), which provides guidance to government entities and the private sector to identify risks to PPP projects and to propose risk allocation schemes and possible risk mitigation strategies. Identified risks include site risks; design, construction and commissioning risks; sponsor and financial risks; operating risks; demand risks; network and interface risks; industrial relations risks; and legislative and government policy risks.

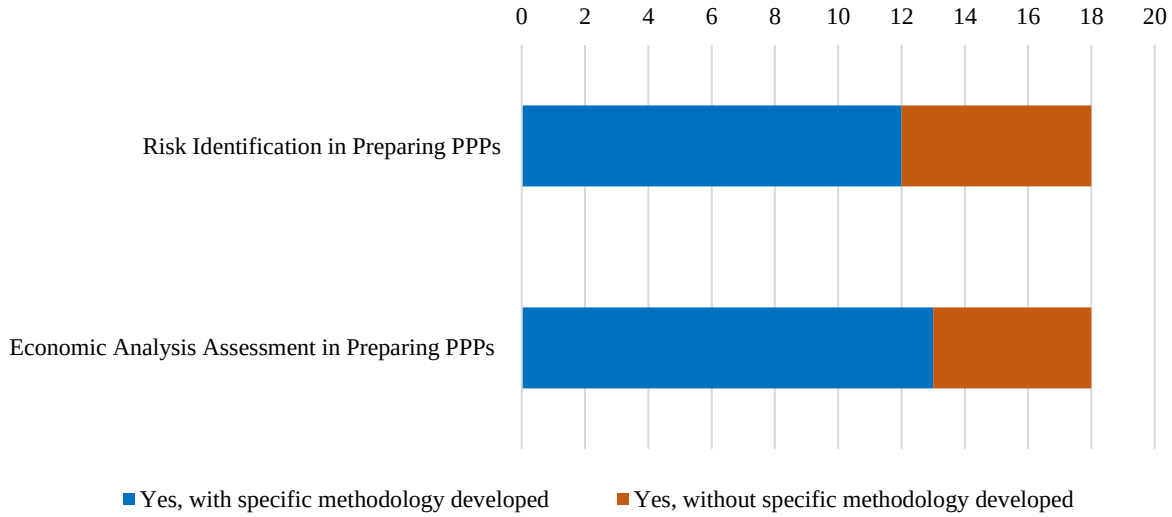
According to World Bank data, all APEC economies conducted economic analysis assessments as of 2018 and most of them had developed a specific methodology. Only five did not have a

[58] World Bank (2018).
[59] The report does not cover Iceland; Israel; Luxembourg; and Norway.

specific methodology. In comparison, half of the OECD economies did not have a specific methodology and five of them did not even conduct economic analysis assessments.

A practical example from the survey responses includes Chile's assessment method for infrastructure projects which considers many elements other than the purchase price, including a social evaluation of cost-benefits comprising the welfare and financial profitability of projects, in order to determine those that are more beneficial for the economy. Social assessments include the evaluation of travel time, fuel costs, freight costs, operational costs, workforce, and carbon costs as well as analysis of the long-lasting asset value and stability of cash flows within infrastructure projects.

Figure 3.4: Risk identification and economic analysis in preparing PPPs



Note: Data shown cover Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Thailand; United States; and Viet Nam.
Source: World Bank (2018).

Fiscal affordability assessments have not been conducted as widely as economic analysis assessments (Figure 3.5). About 60% of APEC economies have a specific methodology in place to assess fiscal affordability. Only one of the 18 APEC economies covered by the dataset did not conduct any affordability assessment. OECD economies have performed similarly; about 53.1% of the 32 economies included in the dataset had a specific methodology in place.

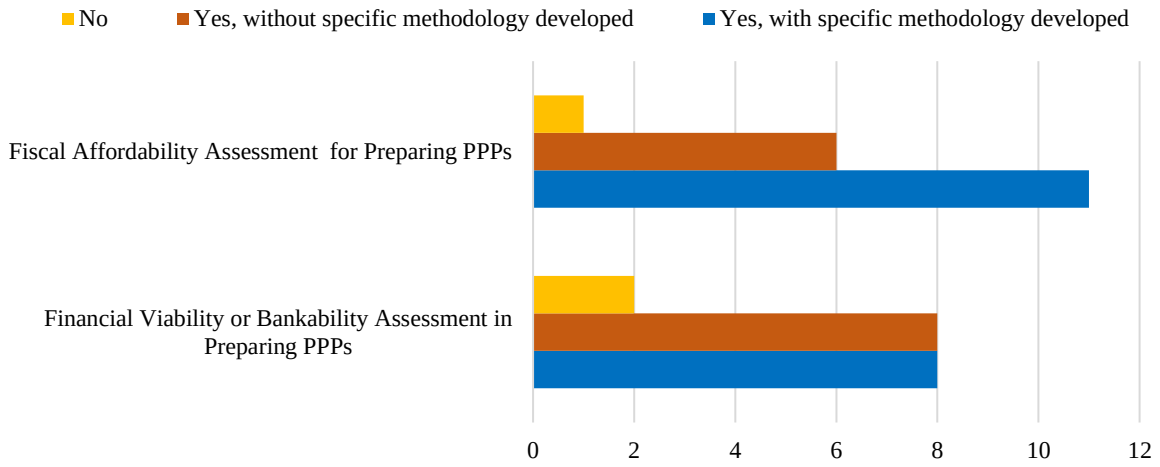
A practical example from the survey responses includes the United States' Public-Private Transportation Act (PPTA) which regulates that the responsible public entity requires the private entity to pay the costs for an independent audit for projects with an estimated construction cost of over USD 50 million. Guidance on the specific methodology including the PPTA Audit Requirements is provided in the PPTA Implementation Manual which comprises, among others things, 1) the identification and quantitative assessment of anticipated public costs and potential liabilities to which taxpayers could be exposed and 2) qualitative assessment of cost and revenue projections relative to other similar projects.

APEC performed slightly better than OECD economies in ensuring financial viability when preparing PPPs as of 2018. Almost 90% of APEC economies assess financial viability of their PPPs, while half of them have developed a specific methodology to do so. In contrast, 84.4%

of OECD economies assess financial viability and less than half of them have developed a specific methodology for it.

For example, Korea reported in the survey responses that it measures the economic efficiency of PPP projects through the computation of benefit-cost ratio (B/C ratio), net present value (NPV) and internal rate of return (IRR) as well as a sensitivity analysis, if necessary, to estimate the impact of changes in key variables such as demand, unit price and discount rates.

Figure 3.5: Fiscal affordability and financial viability assessments in preparing PPPs



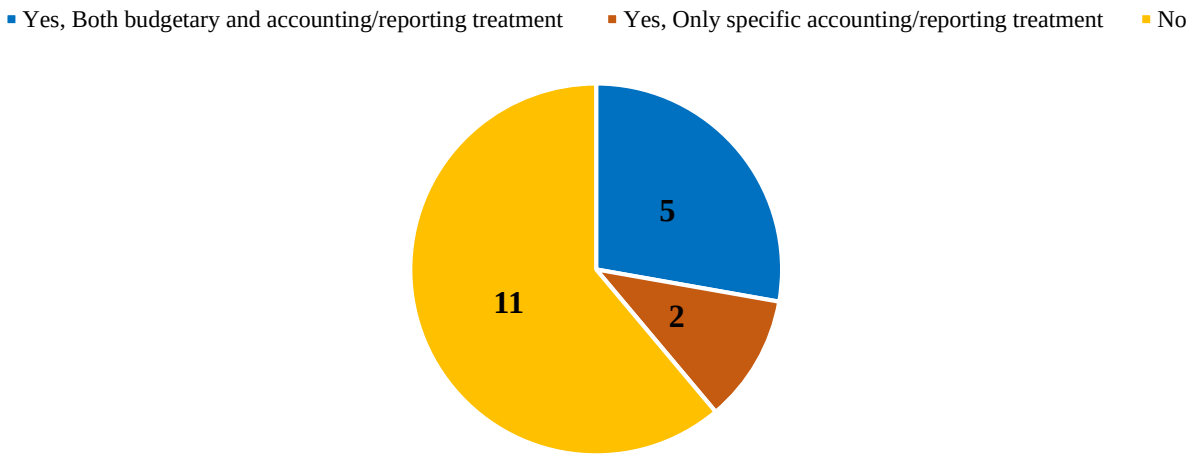
Note: Data shown cover Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Thailand; United States; and Viet Nam.
Source: World Bank (2018).

Fiscal treatment of PPPs through budgetary and/or accounting/reporting treatment were conducted by relatively few economies in APEC. Eleven of the 18 economies covered by the World Bank dataset did not conduct any budgetary or accounting/reporting treatment of PPPs. Five APEC members conducted both budgetary and accounting/reporting treatment, while only two economies carried out specific accounting/reporting treatment of PPPs (Figure 3.6). OECD performed far better than APEC economies in this regard. While eight of the 32 economies conducted both budgetary and accounting/reporting treatment, 19 economies conducted specific accounting/reporting treatment.

A practical example from the survey responses includes Mexico's provisions of the Federal Budgeting and Fiscal Responsibility Law (LFRPH) that require future commitments of PPPs to be defined and calculated. Accounting for direct and contingent liabilities that would be incurred from PPP contracts would prevent these projects from bypassing budgetary and fiscal controls, which would otherwise be detrimental to the overall fiscal sustainability of the economy.[60]

[60] World Bank (2018).

Figure 3.6: Fiscal treatment of PPPs

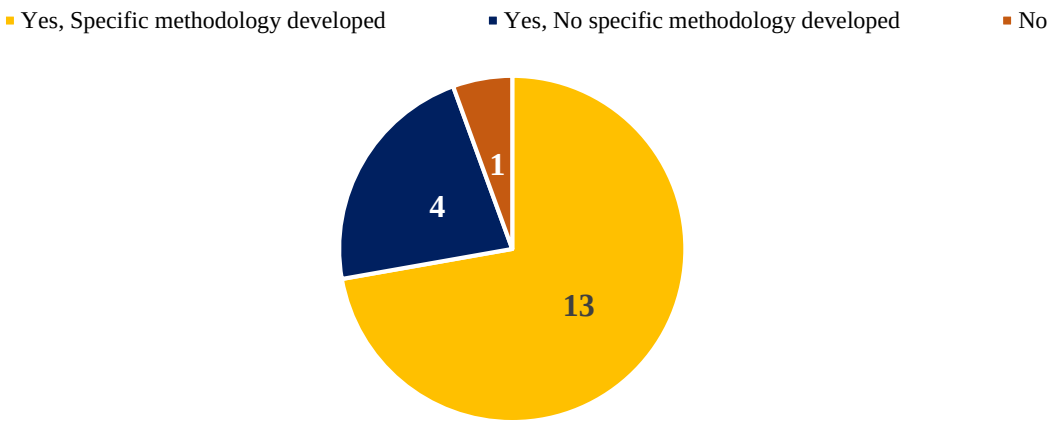


Note: Data shown cover Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Thailand; United States; and Viet Nam.
Source: World Bank (2018).

As shown in Figure 3.7, comparative assessments to analyse value for money were conducted by all but one of the APEC economies (94.4%). About three-fourths of those economies also had a specific methodology in place. A lower fraction of OECD economies (84.3%) conducted this assessment.

Several examples of risk identification were provided in the survey responses. One of them is from Malaysia, which notes that a PPP proposal will only be considered if the government determines there to be a need after considering the benefits/probity as a whole in terms of value for money and cost savings to the government, among other considerations. Guidance on the specific methodology is provided within Malaysia's PPP Guidelines, which defines Value for Money as "the optimal combination of whole life cost and quality to meet the users' requirements". It is achieved through risk transfer allocating risks optimally between the public and private sectors; long-term nature of contracts embodying whole life costing; and private sector management expertise and skills.

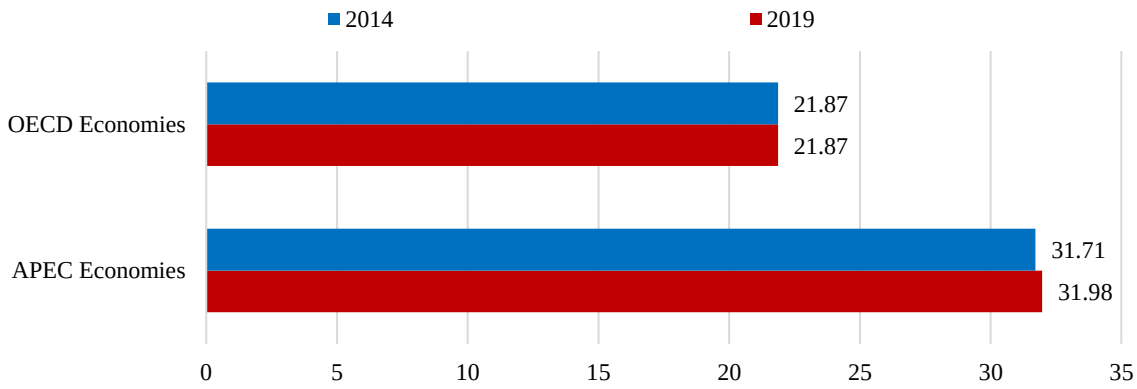
Figure 3.7: Comparative assessment (value for money analysis) in preparing PPPs



Note: Data shown cover Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Thailand; United States; and Viet Nam.
Source: World Bank (2018).

The financial soundness of an investment can also be assessed by considering the cost of enforcing contracts, as a percentage of claim. Using data from the World Bank's *Doing Business* database, it was found that the average cost of enforcing contracts increased very slightly for APEC in the five years between 2014 and 2019, while the average cost for OECD maintained status quo during this period (Figure 3.8). The average cost of enforcing contracts was about 10 percentage points lower for OECD than for APEC. More efforts are necessary within APEC to lower attorney fees and court and enforcement costs to enhance the investment climate and attract private investments.

Figure 3.8: Cost (% of claim) of enforcing contracts

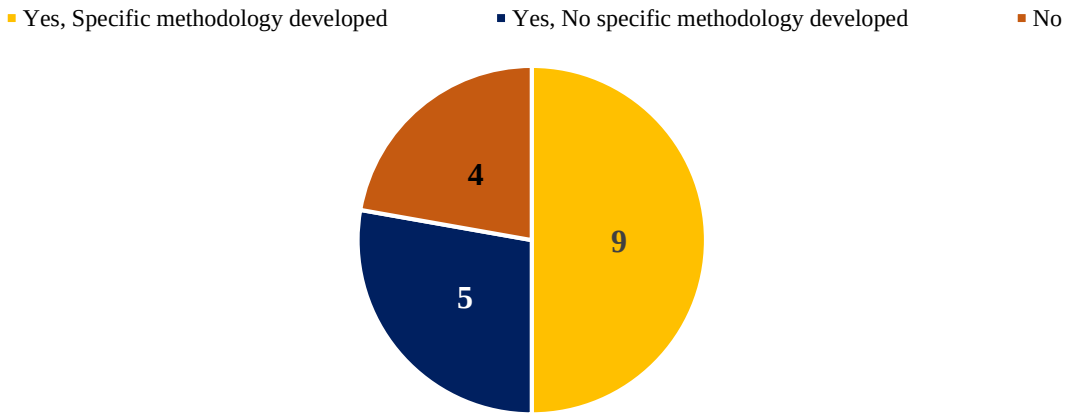


Source: World Bank, Doing Business database.

With regard to assessing the environmental impact of investments, data found that nearly all OECD economies conduct environmental impact analyses in preparing PPPs as compared with three-fourths of APEC economies as of 2018 (Figure 3.9). While 90.6% of all OECD economies have developed a methodology to assess environmental impacts, only half of APEC economies have done the same.

A relevant practical example from the survey responses notes that Canada's National Trade Corridors Fund (NCTF) conducts a thorough assessment of road, rail, airport and port infrastructure projects through the Comprehensive Project Proposals (CPPs) review process, which requires a cost-benefit analysis; legal, regulatory and other requirements including a preliminary environmental review; a greenhouse gas emissions analysis; and Aboriginal consultations. Moreover, where possible, CPPs must also include a climate change adaptation and resilience assessment or describe a plan to study climate change vulnerabilities and address them through appropriate measures.

Figure 3.9: Environmental impact assessment in preparing PPPs

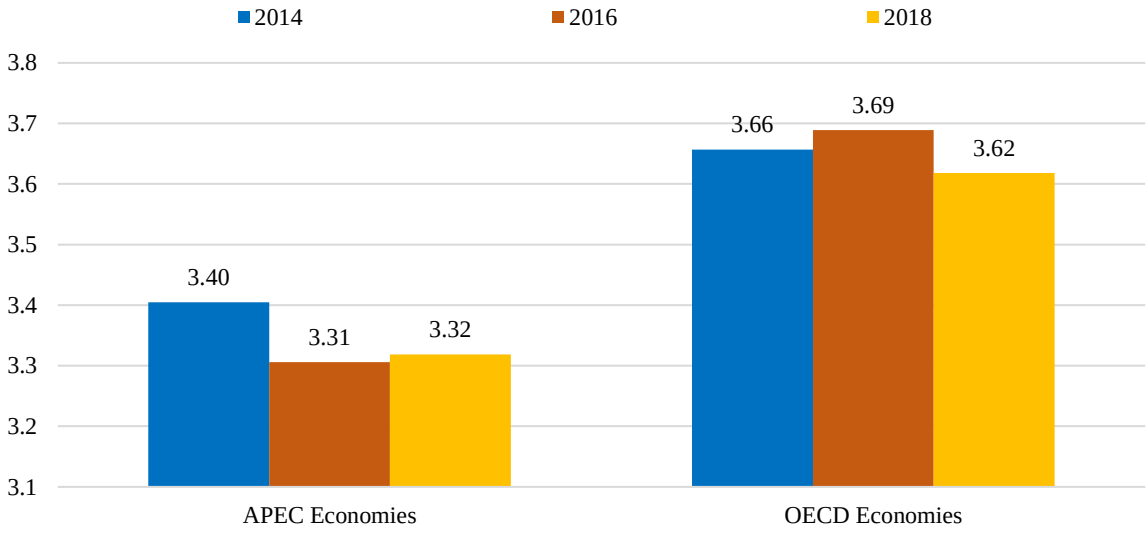


Note: Data shown cover Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Thailand; United States; and Viet Nam.
Source: World Bank (2018).

In general, APEC economies have implemented positive reforms to develop better quality infrastructure. However, data on the quality of trade and transport related infrastructure from the World Bank's Logistics Performance Index has shown some signs of worsening performance. The average quality of infrastructure in the APEC region decreased slightly from 3.4 to 3.3 (out of a possible 5) between 2014 and 2018 (Figure 3.10). Moreover, there is a gap between APEC and OECD economies: OECD's average quality of trade and transport infrastructure scored 3.6 in 2018, while APEC scored 3.3. The *APEC Guidebook on Quality of Infrastructure Development and Investment* enlisted five principal elements to ensure quality of infrastructure: alignment with development strategy/openness/transparency/fiscal soundness; stability/safety/resiliency; economic and financial soundness; social and environmental sustainability; and local high-quality development.[61] More efforts targeting these key quality elements will be necessary across APEC economies to catch up with OECD economies.

[61] APEC (2018b).

Figure 3.10: Quality of trade and transport infrastructure



Note: Scores range from 1 (low) to 5 (high).
Source: World Bank, Logistics Performance Index database.

Sub-pillar 3: Other Important Principles of Infrastructure Development

This sub-pillar considers other important principles of infrastructure development, such as enhancement of people-centred investment by emphasising the importance of having as many local people as possible enjoy the economic benefits derived from creating local employment, advancing capacity building, and enhancing social resilience. The sub-pillar also intends to enhance good practices and principles, such as environmental and social considerations, transparency, and financial soundness and accountability, in planning and implementing investment projects.

To evaluate APEC's progress on this sub-pillar, the survey asked respondents if investment laws/regulations include people-centred provisions within them. In terms of whether legal, regulatory or administrative provisions have been implemented to encourage people-centred investments, all 17 economies indicated "Yes". These have been implemented through various means. For instance, Australia introduced such provisions through its Competition and Consumer Act where it protects the long-term interests of consumers by promoting competition, achieving any-to-any connectivity between end-users, and encouraging the efficient use and investment in telecommunications infrastructure. Similarly, Canada ensures its investments are people-centred through its Community Employment Benefits framework, which aims to ensure that communities benefit from employment, training, and procurement opportunities through infrastructure investments. The G20, which nine APEC economies are members of, endorsed the "G20 Principles for Quality Infrastructure Investment" at the G20 Osaka Summit in June 2019, containing international standards. It aims to maximise the positive economic, environmental, social, and development impact of infrastructure and create a virtuous circle of economic activities, while considering openness, transparency, economic efficiency and debt sustainability.

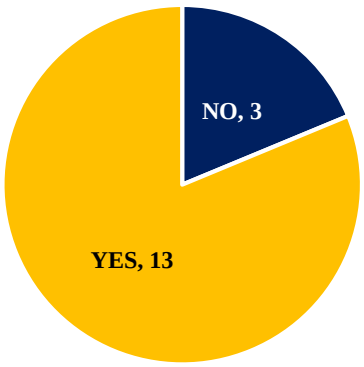
In general, economies have found various means to introduce legal, regulatory or administrative provisions to ensure that investments maximise the positive impact of infrastructure on people, which include:

- introducing laws and regulations that help to reduce costs for infrastructure operators that get passed on to consumers;
- promoting competition so that consumers can benefit from reduced costs;
- distributing opportunities generated through infrastructure investments;
- promoting diversity, inclusion and equality of opportunity through investments made;
- introducing laws and regulations to encourage investments;
- directing investments towards marginalised communities (e.g., remote areas); and
- requiring that social and environmental impact assessments be carried out.

In the case of sustainably financed investment projects, 13 economies indicated that legal, regulatory or administrative provisions had been introduced (Figure 3.11). For example, Peru introduced the National System of Multi-year Programming and Investment Management, Regulation and Directive to ensure sustainability of investments. In accordance with its guiding principles, this new legal framework aims to close gaps in infrastructure or access to public services for the population.

Economies have also noted that these regulations may not always be at the federal level and instead may be introduced at the local level. For instance, in Mexico, many of its sustainability provisions are at the local government level, one of which is in Mexico City where it has introduced a Certification Program for sustainable buildings. Regarding practical examples where sustainability provisions have been implemented, China's Belt and Road initiative aims to build an open financing system where the private sector will mainly lead funding.[62] China has also developed a set of Green Investment Principles for the initiative to ensure that environmental impact, climate resilience and social inclusivity are considered within its projects.

Figure 3.11: Are there any legal, regulatory or administrative provisions to encourage sustainably financed investment projects?



Note: Based on responses from the following 16 economies: Australia; Canada; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Mexico; Papua New Guinea; Peru; Russia; Singapore; Chinese Taipei; Thailand; and United States.
Source: APEC Connectivity Blueprint Survey Responses.

To assess the enhancement of good practices and principles in investment projects, we evaluate two World Bank *Doing Business* indicators, namely: quality of judicial processes index and strength of minority investor protection index. The quality of judicial processes index measures

[62] *Bloomberg News* (2019).

the adoption of good practices in four areas of the court system, that is, court structure and proceedings, case management, court automation, and alternative dispute resolution. Better quality judicial processes provide accountability, which in turn improve investors' confidence. Both APEC and OECD economies have made significant improvements in this indicator. APEC's average score rose by 0.8 points and OECD's average score increased by 0.6 points between 2015 and 2019 (Figure 3.12). Despite the larger improvement, APEC's average quality of judicial processes remains lower than OECD's: APEC's average index score was 11.1 (out of a possible 18), while OECD's was 11.7 in 2019.

Strong minority investor protection regulations help to ensure that businesses are held accountable and facilitate strong corporate governance. The average strength of minority investor protection in APEC improved between 2015 and 2019, from 33.3 to 35.1 (out of a possible 50) (Figure 3.13). In contrast, the average index score for OECD increased only marginally and was lower than APEC's in 2019. APEC economies should continue to enhance such good practices and principles in investment.

Figure 3.12: Quality of judicial processes index

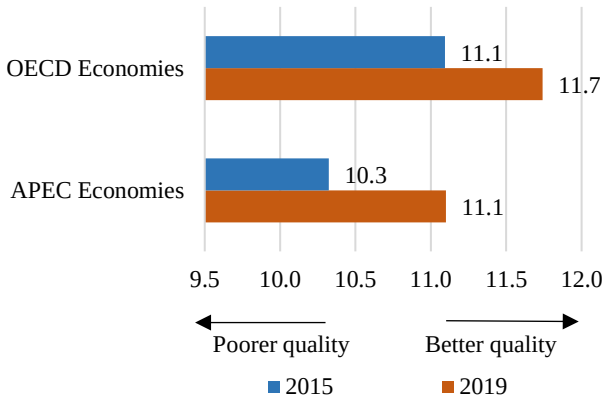
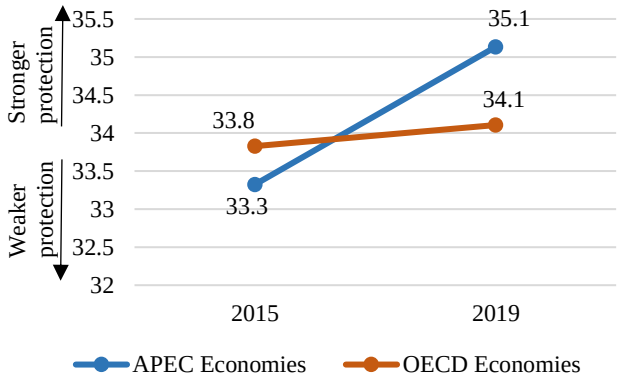


Figure 3.13: Strength of minority investor protection index



Note: The quality of judicial processes index scores range from 0 to 18 and increases as the quality of judicial processes improves. The strength of minority investor protection index scores range from 0 to 50 and increases as minority investor protection strengthens.
Source: World Bank, Doing Business database.

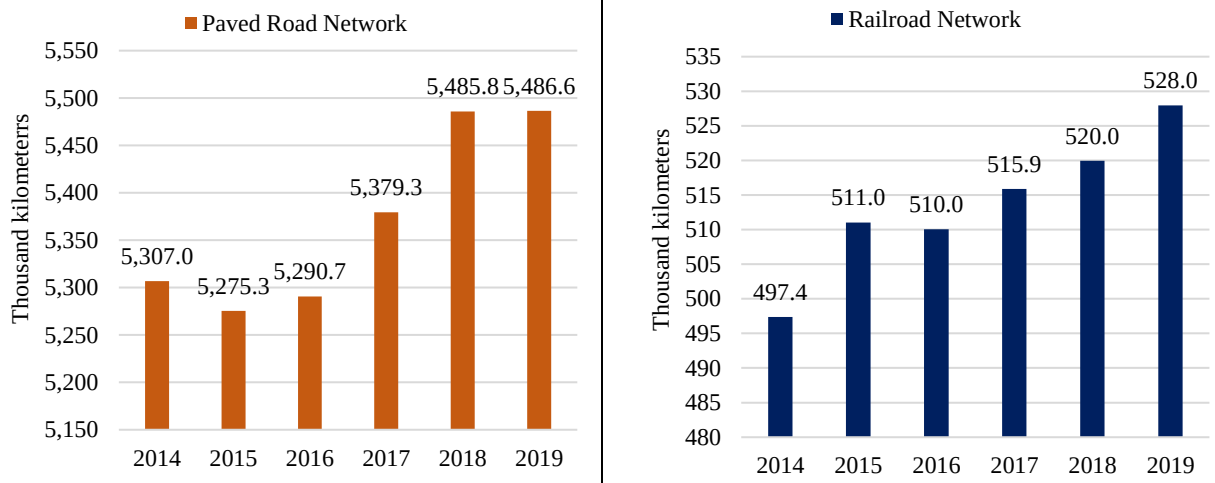
Overall, based on the survey responses and indicators, APEC economies are on track with regard to enhancing people-centred investments and good practices and principles in planning and implementing investment projects. Continued efforts to consistently apply these principles in infrastructure development will be highly beneficial in developing sustainable infrastructure.

Sub-pillar 4: Transportation

This sub-pillar's objective is to increase the quality of APEC's transport networks. Compared to the other aspects of infrastructure quality discussed earlier, this sub-pillar focuses on the capacity of transportation infrastructure in the APEC region. The evaluation of this sub-pillar is supported by survey responses, data from UNCTAD and the World Bank on the capacity of ports and airports, and data from the World Economic Forum on the perceived quality of road, railroad, port and air transport infrastructure.

Road and railroad infrastructure are crucial in facilitating domestic freight transportation and establishing local supply chain networks. APEC economies have had mixed results with regard to road networks, but are making good progress in the development of railroad networks. Responses to the survey on questions regarding the capacity of transport infrastructure in APEC show that the length of paved road and rail networks increased between 2014 and 2019 (Figure 3.14). For the paved road network, there was an increase in length from 5,307.0 thousand km in 2014 to 5,486.6 thousand km in 2019. Meanwhile, the length of the railroad transport network increased from 497.4 thousand km to 528.0 thousand km over that same period.

Figure 3.14: Total length of paved road network and railroad network (in thousand km)



Note: For paved road network, data shown cover Canada; Chile; Hong Kong, China; Japan; Peru; Singapore; Chinese Taipei; Thailand; and United States. For railroad network, data shown cover Canada; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Mexico; Peru; Russia; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam. Where applicable, data not available for particular years were filled with data from either the preceding or subsequent year.
Source: APEC Connectivity Blueprint Survey Responses; World Bank, World Development Indicators (for railroad network data for Indonesia; Mexico, Russia; and Viet Nam).

However, the perceived average quality of road infrastructure in APEC worsened slightly between 2014 and 2017, despite an improvement in 2017 over 2016 (Figure 3.15). On the other hand, APEC's average score concerning quality of railroad infrastructure improved between 2014 and 2017, from 4.1 to 4.2 (Figure 3.16). In comparison, the average score for OECD economies for quality of roads and railroad infrastructure declined slightly over the same period but continues to remain higher than APEC's average scores.

Figure 3.15: Quality of road infrastructure

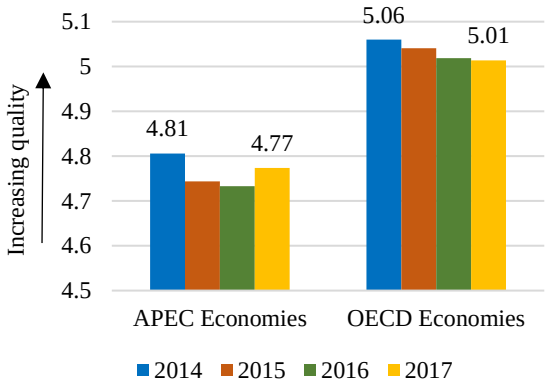
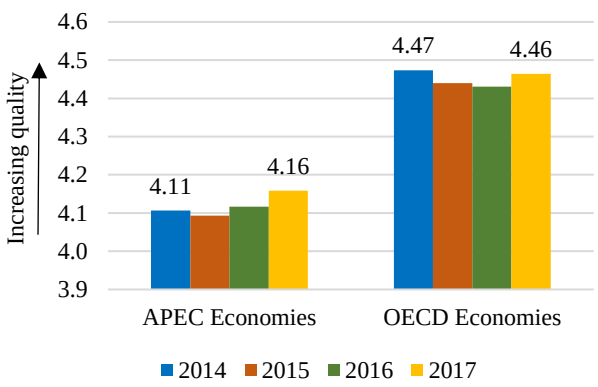


Figure 3.16: Quality of railroad infrastructure

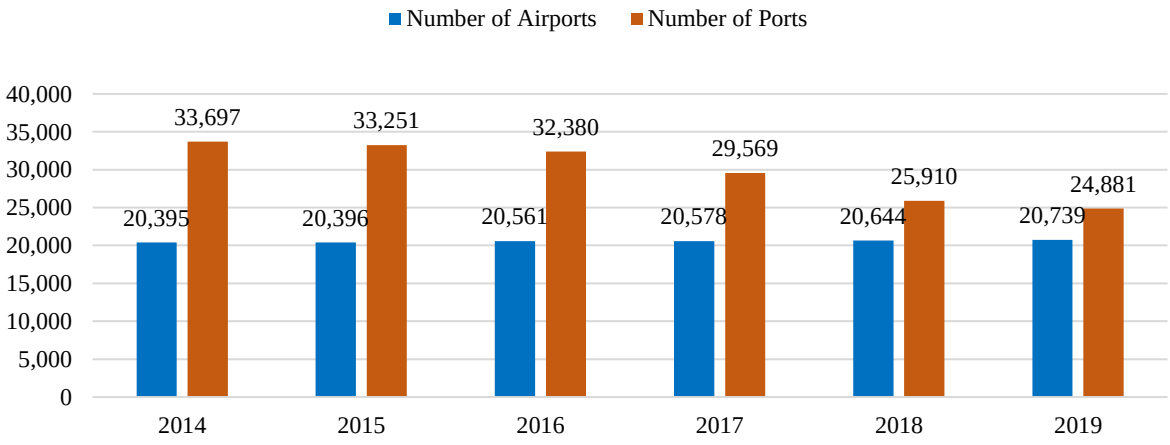


Note: Data shown cover 20 APEC (data for Papua New Guinea are not available) and 36 OECD economies. The score ranges from 1 to 7. The better the quality of infrastructure, the higher the score.
Source: World Economic Forum, Global Competitiveness Index database.

Members highlighted road and railroad infrastructure projects that are in progress as well as those that are in the pipeline in their survey responses. For roads, China has indicated that it has made progress on developing the Daxing-Yanqing Expressway, Guiyang-Weng'an Expressway, Lishui North interchange of Jinliwen Expressway and Linxiang-Qingshuihe Expressway projects, while Singapore noted its ongoing plan to construct the North-South Corridor. For railways, Mexico discussed plans to introduce a metropolitan and inter-municipal state train between Guanajuato and Querétaro, a suburban train in Monterrey, and an expansion of the electric train in the Guadalajara Metropolitan Area.

Since the majority of international trade is conducted through sea ports or airports, having sufficient capacity to handle global demand is crucial. Based on survey data from 10 economies, the number of airports increased from 20,395 to 20,739 between 2014 and 2019, while the number of ports declined from 33,697 to 24,881 over that same period (Figure 3.17). The fall in the number of ports could potentially be attributed to a consolidation of ports within several economies.

Figure 3.17: Number of airports and ports in the APEC region



Note: Based on responses from the following 10 economies: Canada; China; Hong Kong, China; Japan; Korea; Peru; Singapore; Chinese Taipei; Thailand; and United States.
Source: APEC Connectivity Blueprint Survey Responses.

APEC increased its port and airport handling capacity significantly between 2014 and 2018 (Figure 3.18 and Figure 3.19). In both measures, APEC's per capita capacity increased, but continues to remain smaller than OECD's.

Figure 3.18: Container port throughput per 1000 population[a]

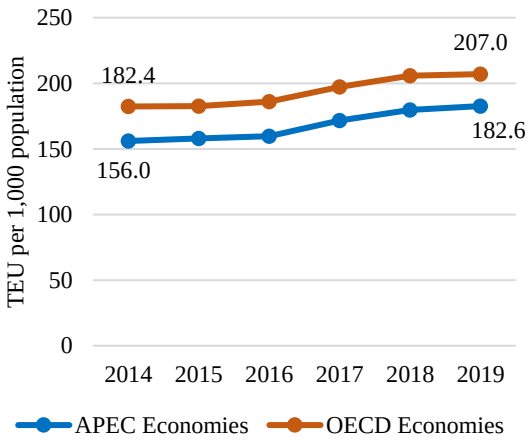
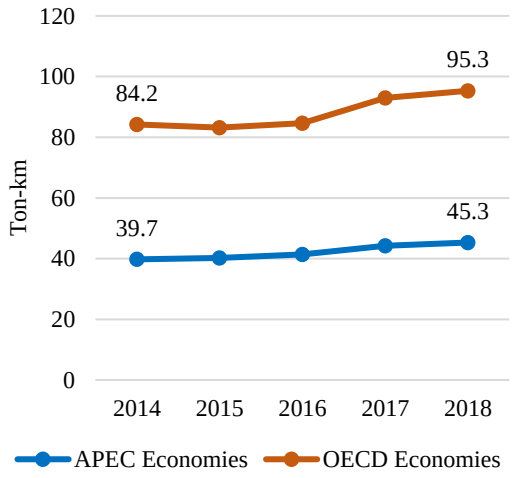


Figure 3.19: Air freight per capita[b]



Note: Data shown cover a) 21 APEC and 31 OECD economies; b) 20 APEC (data for Chinese Taipei are not available) and 32 OECD economies.
Source: UNCTAD, UNCTADstat database; World Bank, World Development Indicators database.

Despite having improved capacity since 2014, APEC economies did not fare as well with regard to quality of port and air transport infrastructure. The average score for the perceived quality of port infrastructure declined between 2014 and 2016, such that an increase in 2017 could not make up for the initial decline (Figure 3.20). Meanwhile, the average score for OECD experienced a continual decline from 2014 through 2017. Given that over 90% of global trade is transported by sea, it is important that members make efforts to improve the quality of their port infrastructure by adopting new digital technologies.[63]

Similarly, APEC's average score for the perceived quality of air transport infrastructure exhibited a continual slight decline over the 2014-2017 period, while OECD's average score showed a continual slight improvement over that period (Figure 3.21). According to research commissioned by the International Air Transport Association (IATA), a 1% improvement in air cargo connectivity translates to a 6.3% increase in trade.[64] Improving facilitation of air cargo calls for modernisation of the industry through introduction of electronic processing of freight and implementation of single window processing and risk management controls at borders. Adoption of such digital technologies and increased cross-government cooperation will support the quality of air transport infrastructure.

[63] International Maritime Organization (IMO) webpage.
[64] Shepherd *et al.* (2016).

Figure 3.20: Quality of port infrastructure

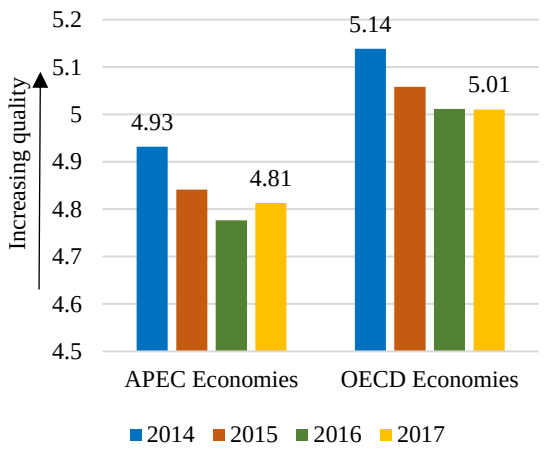
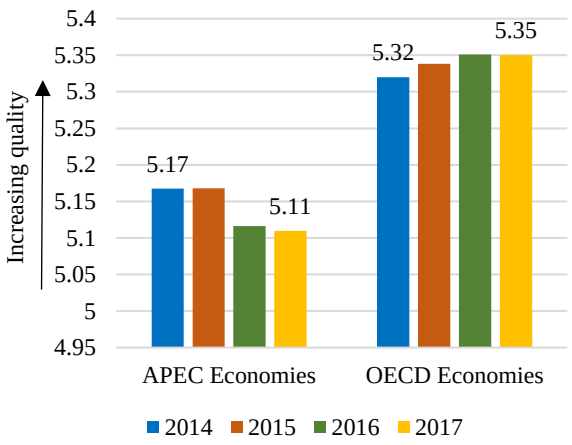


Figure 3.21: Quality of air transport infrastructure



Note: Data shown cover 20 APEC (data for Papua New Guinea are not available) and 36 OECD economies. The score ranges from 1 to 7. The better the quality of infrastructure, the higher the score.
Source: World Economic Forum, Global Competitiveness Index database.

Members highlighted some on-going port and airport development initiatives in the survey responses. In terms of ports, Singapore has been developing its Tuas Port, which, when completed in 2040, is anticipated to become the largest single fully automated container terminal in the world. As for airports, Indonesia is in the process of moving towards financial close for a new Labuan Bajo Airport, which will help in expanding air connections as well as in supporting strategic economic local sectors. Meanwhile, the Hong Kong International Airport has increased capacity and functionality through a series of projects, including building a three-runway system, enhancing the two-runway system, and the expansion of terminal and apron capacity.

In summary, APEC is on track with increasing the capacity of their transport networks; however, the average quality scores for each type of transport infrastructure are lower than OECD's average scores and declining in most cases. Hence, there is room for significant improvement across all transport networks by adopting new technologies to build resilient and more stable infrastructure.

Due to the growing global population and increasing connectivity across economies, some members are already planning for major expansion initiatives. For instance, Canada increased its budget for the National Trade Corridors Fund (NTCF) by CAD 400 million in 2019; the NTCF has now invested in a total of 85 projects. Peru also launched the National Infrastructure Plan for Competitiveness in 2019 under which 52 projects were prioritised, thereby boosting investment in these projects, in order to close the gap in infrastructure and public services. Additionally, the United States has dedicated USD 7.9 billion for eleven rounds of National Infrastructure Investments to fund projects.

Sub-pillar 5: ICT Infrastructure Development

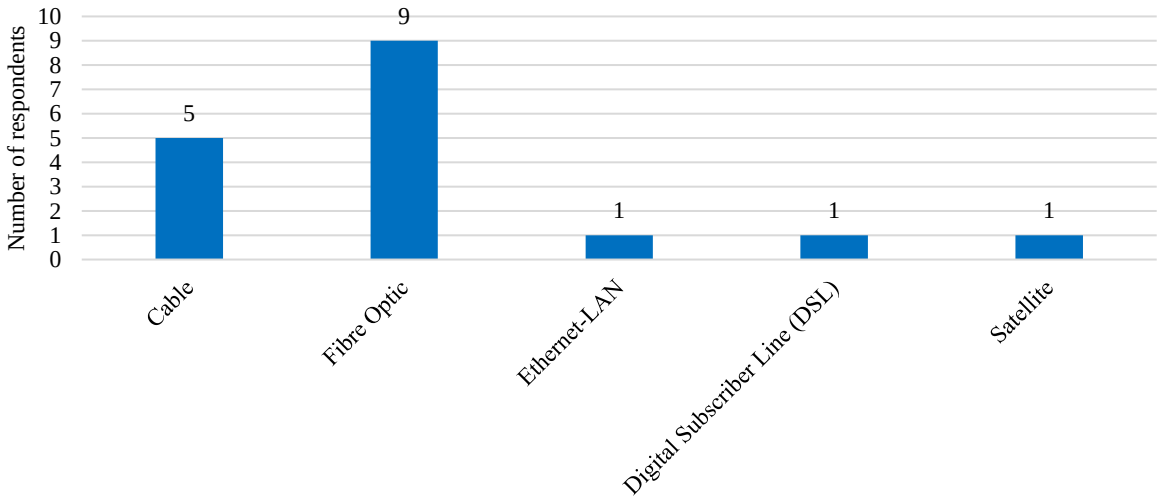
This sub-pillar aims to increase broadband access throughout the APEC region by achieving universal access to broadband and collaborating to increase access to next generation high-speed broadband. Universal access to broadband allows exploitation of digital technologies. It also improves connectivity, especially in remote regions, as it provides access to business and

educational opportunities. Data from the survey, World Bank, International Telecommunication Union, and World Economic Forum is used to assess this sub-pillar. While fixed broadband may have been dominant in the past, it no longer is. Hence, an analysis of mobile broadband has also been carried out within this section to provide a more holistic assessment. (Note that the survey results discussed in this section are based on responses received from less than half of the APEC members.)

Fixed Broadband Technology

Respondents were asked about the most widely used technology in their economy based on the number of subscribers. APEC economies highlighted a range of technologies from Data Over Cable Service Interface Specification (DOCSIS) to fibre optic broadband. The most common technology was fibre optic, while cable modem also continues to be popular across the region (Figure 3.22).

Figure 3.22: Most popular fixed broadband technologies in APEC

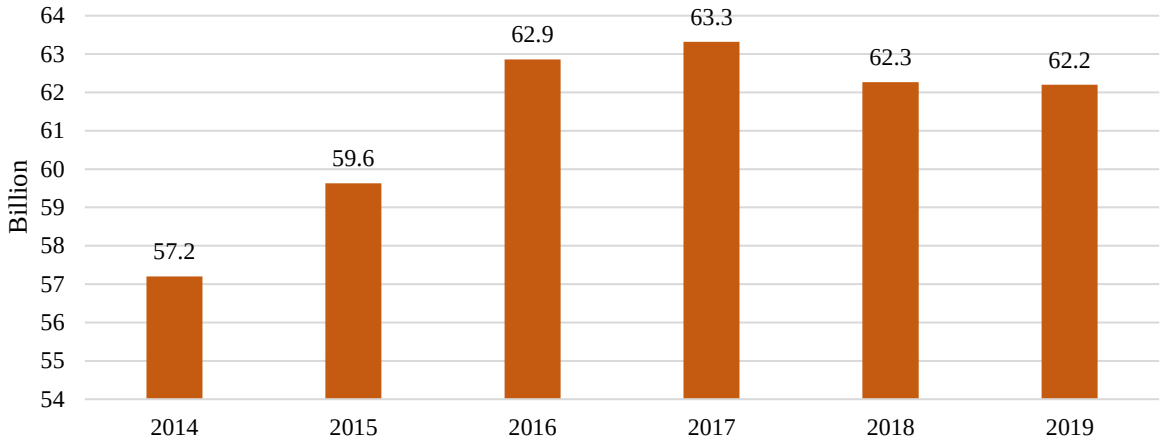


Note: Based on responses from the following 13 economies: Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Mexico; Peru; Russia; Singapore; Chinese Taipei; Thailand; and United States. Members were able to select more than one technology.
Source: APEC Connectivity Blueprint Survey Responses.

It is important to note that while members may have identified a particular technology as the most popular, the technology itself may not be available across the entire economy and is dependent on factors such as the level of development and remoteness of regions within an economy. For instance, in Canada, while cable technology is predominant (53.3% of its population), urban and suburban areas were more likely to have access to fixed wireline technology, while rural and remote areas were more likely to have access to fixed wireless and satellite technology.

Based on survey responses, as of 2019, a total of USD 62.2 billion has been invested by the private sector in fixed broadband networks within the APEC region (Figure 3.23). Although there has been a substantial increase since 2014, the amount of private sector investment in fixed broadband declined slightly after 2017.

Figure 3.23: Total private sector investment in fixed broadband within the APEC region



Note: Based on responses from Canada; Indonesia; Peru; Chinese Taipei; and United States. Where applicable, data not available for particular years were filled with data from either the preceding or subsequent year.
Source: APEC Connectivity Blueprint Survey Responses.

Despite the reduction in private sector investments, the number of fixed broadband subscriptions per 100 people has been steadily rising, enabling a larger percentage of the population to use the internet. The average number per 100 people in APEC increased from 15.7 to 25.7, that is, by 63.3%, between 2014 and 2019 (Figure 3.24). A smaller increase is noted among the OECD economies, from an average share of 28.2% to 32.4% over that same period.

While a lower percentage of individuals use the internet in APEC as compared with OECD, there has been considerable improvement in the past four years, whereby the average percentage increased from 52.3% in 2014 to 63.6% in 2019 (Figure 3.25). Among the OECD economies, the average percentage of individuals using the internet rose from 74.0% to 84.4% between 2014 and 2019.

Figure 3.24: Fixed broadband subscriptions (per 100 people)

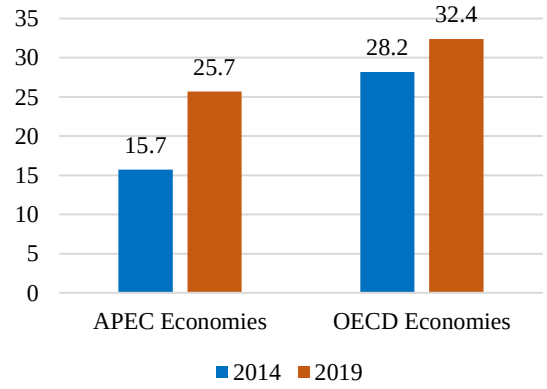
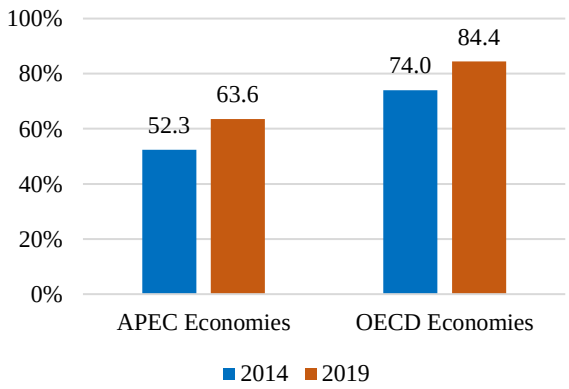


Figure 3.25: Percentage of individuals using the internet



Note: Data shown cover 21 APEC and 36 OECD economies. For both indicators, regional aggregates are weighted or normalised by population as appropriate.
Source: World Bank, World Development Indicators database; International Telecommunication Union, online statistical data.

Economies noted their efforts to increase capacity of fixed broadband networks in their survey responses. These actions range from an increase in funding and access for rural areas to new fixed broadband infrastructure projects across the economy. For instance, Australia provided funding of approximately AUD 34 billion dollars to extend coverage of the fixed broadband network. It also introduced a new digital connectivity package called the Regional Connectivity Programme to enable individuals to better participate in the digital economy. Similarly, China constructed 37,000 4G base stations to increase coverage in rural and remote areas, while Chinese Taipei introduced the Infrastructure for Broadband Access in Remote Areas programme to facilitate internet access to remote areas and expand fixed internet broadband service to 100 Mbps in every main village. The United States also made efforts to increase private sector investment in rural areas through the Rural Digital Opportunity Fund; it is expected that up to USD 20.4 billion will be directed to unserved rural areas.

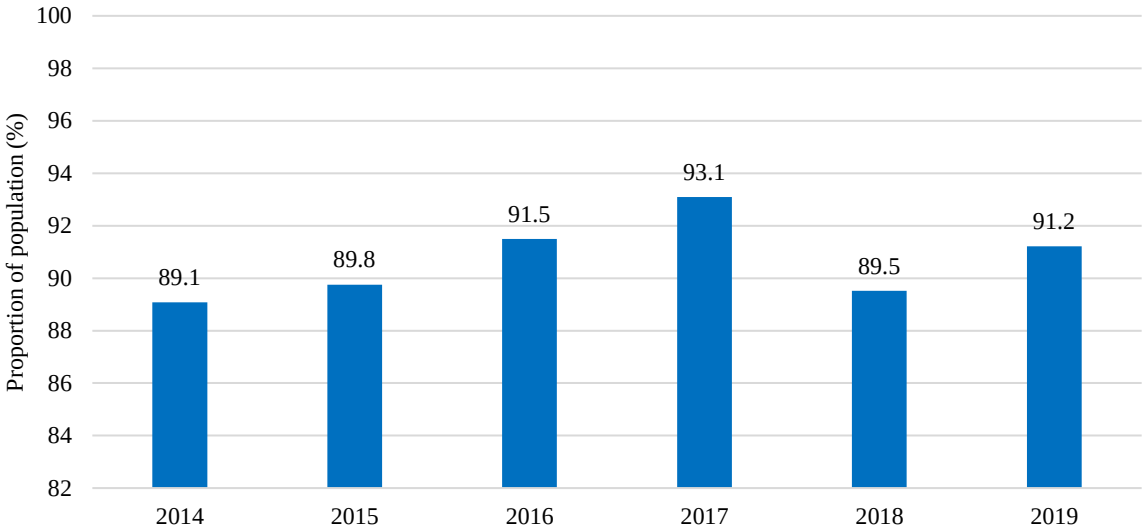
Regarding investment, Canada highlights that it promotes investments through loans and equity to support commercially viable infrastructure projects that are deemed to be of public interest. Similarly, to increase both access to fixed broadband and service quality to 100 Mbps, Chinese Taipei increased investment to NTD 1.6 billion, half of which is contributed by the private sector. Apart from increasing physical access to infrastructure, some economies have reduced the cost of access. In 2019, Mexico made internet service free of charge in selected areas. Hong Kong, China has also implemented a subsidy scheme since 2019 to provide fixed network operators with financial incentives of approximately USD 100 million to extend fibre-based networks to villages in remote areas.

Mobile Broadband Technology

Survey respondents were asked about the type of mobile cellular technology that is most widely used in terms of the number of subscribers. The results found 4G technology to be most prevalent in the Asia-Pacific region, followed by LTE and 4G-LTE. While in some economies 2G and 3G continue to exist (such as in Indonesia), they have been discontinued in others (such as Singapore). Most economies were able to provide information on the number of subscribers for each type of technology, while one economy indicated that such data are not collected.

Based on survey responses, the proportion of the APEC population covered by mobile cellular networks has increased from 89.1% in 2014 to 91.2% in 2019 (Figure 3.26). Although there was a steady increase between 2014 and 2017, the proportion of the APEC population covered by the mobile cellular network fell in 2018.

Figure 3.26: Proportion of population covered by mobile cellular network



Note: Data shown are a weighted average based on population. Based on responses from the following 13 economies: Australia; Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Peru; Russia; Singapore; Chinese Taipei; Thailand; and United States. Where applicable, data not available for particular years were filled with data from either the preceding or subsequent year.
Source: APEC Connectivity Blueprint Survey Responses.

With an ever increasing number of people accessing the internet, there is a need for investment in infrastructure in order to accommodate more users as well as to provide better quality mobile broadband. Several economies described major investments in mobile broadband, many of which are in the area of 5G technology. For instance, China officially released 5G commercial licenses to operators in June 2019 and has since built 130,000 5G base stations across the economy. Similarly, Korea highlighted that all three of its major telecommunications providers had invested in 5G technology as of 2018. Korea also introduced the 5G+ Strategy for Realization of Innovative Growth to help use 5G technology to drive long-term economic growth. Singapore advanced its plans to introduce 5G following a call for proposals, in which two winners will be awarded with radio frequency spectrum to deploy 5G networks. The United States also made efforts to introduce 5G technology through the 5G Fast Plan, which includes creating three different bands of spectrum for 5G service, encouraging private sector investment in 5G networks, and modernising 5G networks. Meanwhile, Russia passed a decision in 2014 to cover all federal, regional and cross-municipality roads with mobile broadband and also introduced a project to achieve complete coverage by 2024 through PPPs along with federal funding of RUB 28 billion.

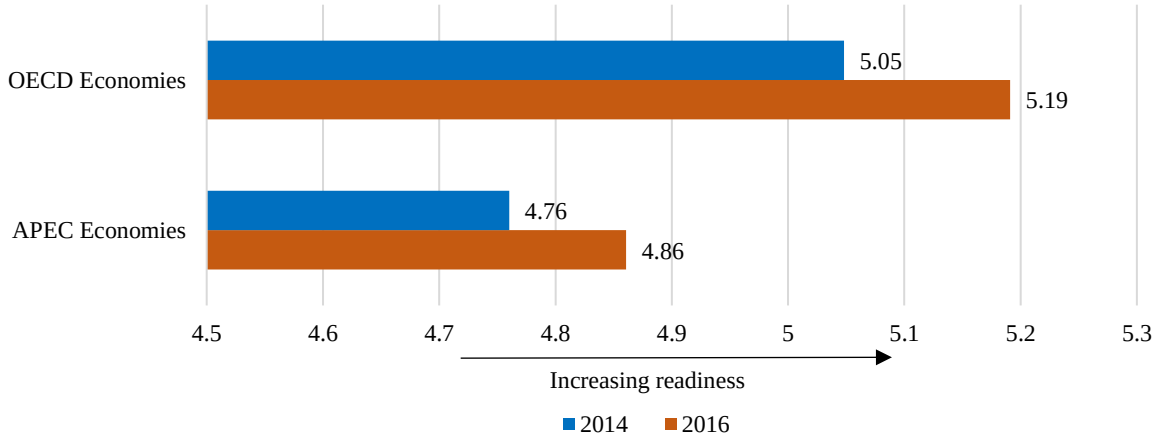
An interesting trend is noted when comparing the access populations have to both broadband and mobile cellular networks. While some economies may have performed poorly in terms of access to fixed broadband networks (less than 10% of the population), they have performed well in terms of access to mobile cellular networks with at least more than half of their population having access. This partly explains the push by economies to further develop their mobile cellular infrastructure as well as to improve the existing technology.

In general, to improve internet access, APEC will need to be more network-ready. This can be achieved by improving ICT infrastructure, affordability and digital skills.[65] Both APEC and OECD improved their average network readiness index score between 2014 and 2016 (Figure

[65] World Economic Forum (2016).

3.27). However, OECD economies are more network-ready compared with APEC economies: in 2016, APEC attained an average score of 4.9 (out of a possible 7), while the OECD had an average score of 5.2. Overall, APEC economies have made significant progress with regard to this sub-pillar. Despite not being at the level of OECD, APEC economies are continually improving to catch up.

Figure 3.27: Network readiness index



Note: Data shown cover 20 APEC (data for Papua New Guinea are not available) and 36 OECD economies. The score ranges from 1 to 7. The more network ready an economy is, the higher the score.
Source: World Economic Forum, Network Readiness Index database.

Sub-pillar 6: Energy Infrastructure Development

This sub-pillar aspires to ensure quality electricity supply for all APEC economies. Universal connectivity depends on universal electrification, as remote places without electricity will not be able to connect to the internet. The sub-pillar is assessed using data from the survey, World Bank's *Doing Business* and the World Economic Forum. *Doing Business* data looks at several aspects relating to the quality of electricity supply, specifically, interruption duration and frequency and also reliability of supply.

APEC economies have made substantial progress in providing quality electricity supply as can be seen by the reductions in frequency and duration of interruptions. Average interruption frequency in the APEC region decreased by 51.4%, that is, from 7.3 times in 2014 to 3.5 times in 2018 (Figure 3.28). Similarly, average interruption duration decreased by 44.8% from 10.0 hours to 5.5 hours over the same period (Figure 3.29). OECD economies, which have relatively fewer and shorter outages, experienced only marginal changes in both indicators. APEC economies are well on track to reach OECD's levels with continued similar improvements.

Figure 3.28: System Average Interruption Frequency Index

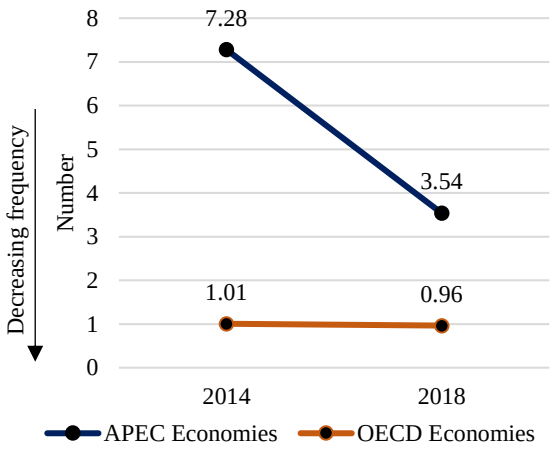
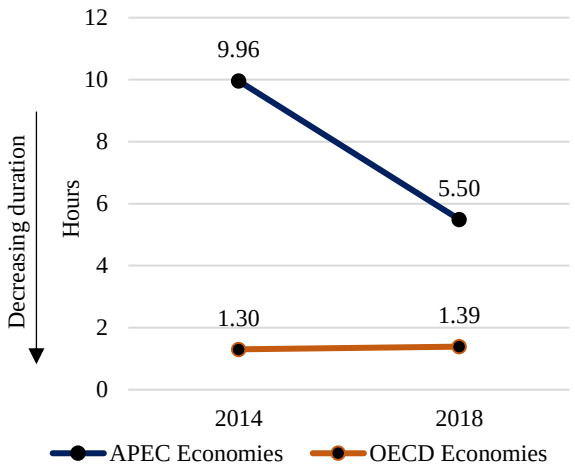


Figure 3.29: System Average Interruption Duration Index



Note: The system average interruption frequency index measures the average number of service interruptions experienced by a customer in a year. The system average interruption duration index measures the average total duration of outages (in hours) experienced by a customer in a year.
Source: World Bank, Doing Business database.

Another *Doing Business* indicator made up of six components, including duration and frequency of outages as well as tools to monitor supply and accessibility of tariffs, helps to measure the quality of electricity supply. This encompassing index shows that both APEC and OECD economies have improved the reliability of their electricity supply and the transparency of their tariffs between 2014 and 2019 (Figure 3.30). The improvement has been steeper for APEC economies who are close to catching up with OECD economies.

The Word Economic Forum also provides data on the perceived quality of electricity supply in the form of a score ranging from 1 to 7, with 7 being the best quality. The average quality of electricity supply in APEC economies was poorer than OECD economies at 5.7 compared to 6.2, respectively, in 2017 (Figure 3.31). However, APEC achieved an increasing average score since 2014 and continued efforts will allow the region to catch up with OECD.

Figure 3.30: Reliability of supply and transparency of tariff index[a]

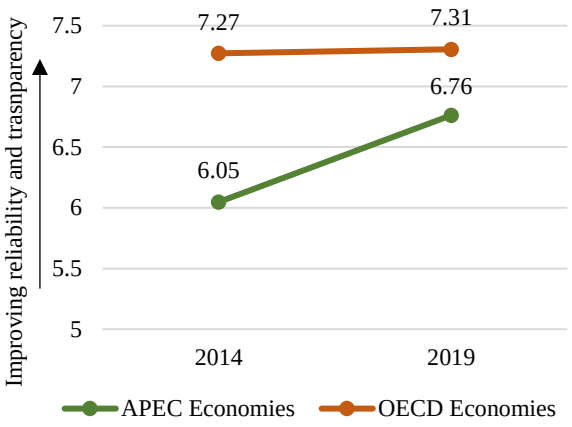
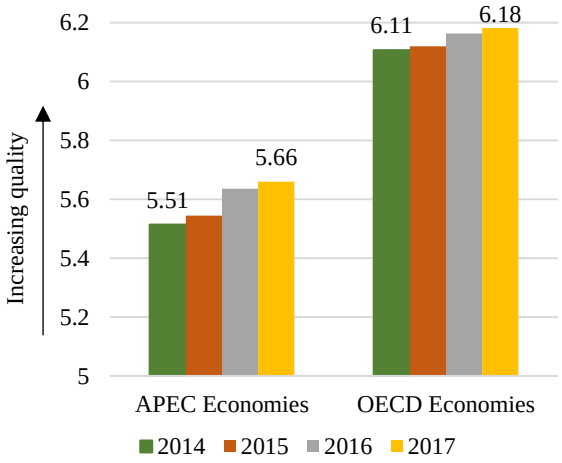


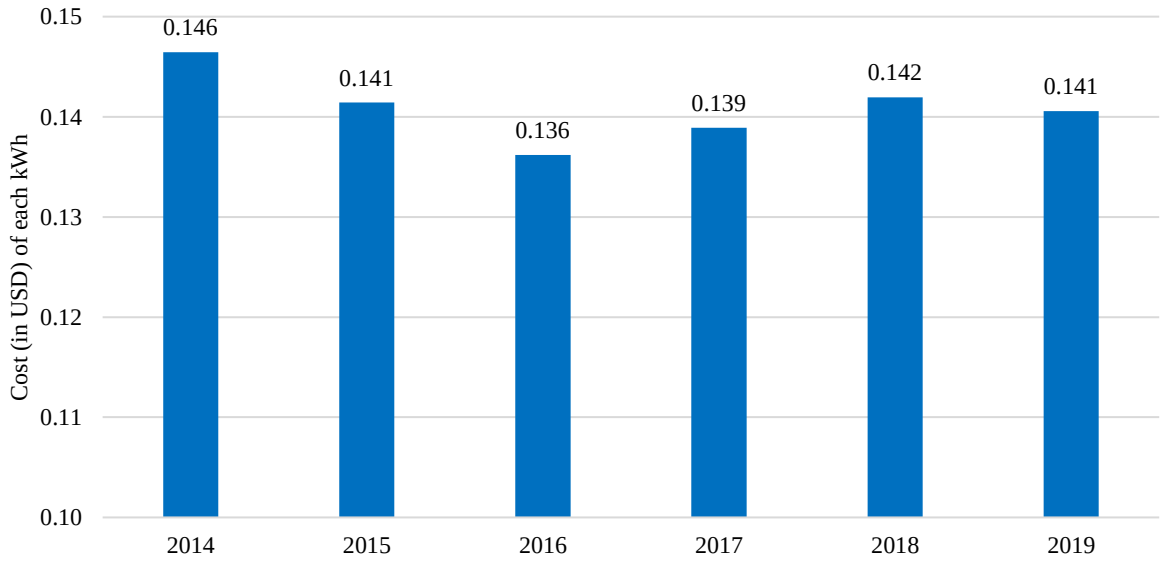
Figure 3.31: Quality of electricity supply[b]



Note: Data shown cover a) 21 APEC and 36 OECD economies; b) 20 APEC (data for Papua New Guinea are not available) and 36 OECD economies. The reliability of supply and transparency of tariff index assesses the duration and frequency of power outages; tools to monitor power outages and restore power supply; regulatory monitoring of utilities' performance; financial deterrents aimed at limiting outages; and transparency and accessibility of tariffs. The score ranges from 0 to 8; the higher the score, the higher the reliability and transparency. The quality of electricity supply score ranges from 1 to 7; the higher the score; the better the quality.
Source: World Bank, Doing Business database; World Economic Forum, Global Competitiveness Index database.

The affordability of electricity is as important as its reliability to ensure widespread access. Based on survey data, the average cost of power in the APEC region fell from USD 0.146 per kWh in 2014 to USD 0.141 per kWh in 2019 (Figure 3.32). Even though the regional average cost of electricity is lower in 2019 than it had been in 2014, it is important to note that the cost increased between 2016 and 2019.

Figure 3.32: Cost of each kWh of electricity in the APEC region



Note: Survey responses were used for Australia; Hong Kong, China; Japan; Korea; Chinese Taipei; and Viet Nam. Data from Foster and Witte (2020) were used for Chile; China; Indonesia; Malaysia; the Philippines; and Thailand. Where applicable, data not available for particular years were filled with data from either the preceding or subsequent year.

Source: APEC Connectivity Blueprint Survey Responses; Foster and Witte (2020).

The survey responses noted that data on energy infrastructure is limited, with some members identifying a lack of data collection due to the size of the economy and/or various demographic distributions. Given the differences in units of measurement as well as the limited data available, it is difficult to analyse this indicator over time. However, in the survey responses, economies noted several major investments in energy/power infrastructure that were made between 2015 and 2019.

For example, Australia introduced the Grid Reliability Fund to provide loans for investments in energy storage, transmission and distribution, as well as grid stabilising technology. Similarly, Chinese Taipei introduced power plant renewal and expansion projects and is also carrying out important power transmission and substation construction projects. In addition, Japan reinforced the Hokkaido-Tohoku transmission lines in 2019 to facilitate cross-regional transmission and core transmission to ensure a stable electricity supply, promote cross-regional competition, and facilitate the maximum use of renewable energy.

Some projects were in the renewable energy sector. For instance, Australia noted that the Australian Renewable Energy Agency (ARENA) provided AUD 87 million in grants towards 12 projects in three regions. Furthermore, Australia made commitments of AUD 8 billion through its Clean Energy Finance Corporation to more than 160 clean energy transactions. Between 2015 and 2019, China expanded its renewable energy generation capacity by over 80% to 794 gigawatts, mainly in wind and solar energy, both of which have now exceeded 200 gigawatts. Chinese Taipei also made efforts in this area through its offshore wind project, which is currently in Phase 1.

According to the World Economic Forum, the electricity industry is in the midst of a transformation that promises greater efficiency, decarbonisation, and value by deploying enabling infrastructure, adopting digital systems, and reforming regulations.[66] APEC economies have made significant improvements with respect to energy infrastructure development. In all of the indicators used to assess this sub-pillar, APEC's improvement has been faster than OECD's (albeit from a lower base). Greater efforts to improve related infrastructure development will further fasten the pace at which APEC economies can catch up with OECD.

Institutional Connectivity

Sub-pillar 1: Customs and Border Administration

This sub-pillar aims to modernise customs and border agencies by incorporating new technologies and participating in mutual recognition programmes, like the development of Single Window (SW) systems and Authorised Economic Operator (AEO) schemes. The fast progress of ICT has enabled customs or trade Single Windows to expand their functionality by extending certain automated services to traders or stakeholders. These services include publishing and disseminating information on the internet, using automated clearance systems to make declarations, performing risk management, and processing validations and approvals.[67] New technologies are also being used to improve AEO schemes. For example, the Inter-American Development Bank is leading an initiative named CADENA under an AEO scheme,

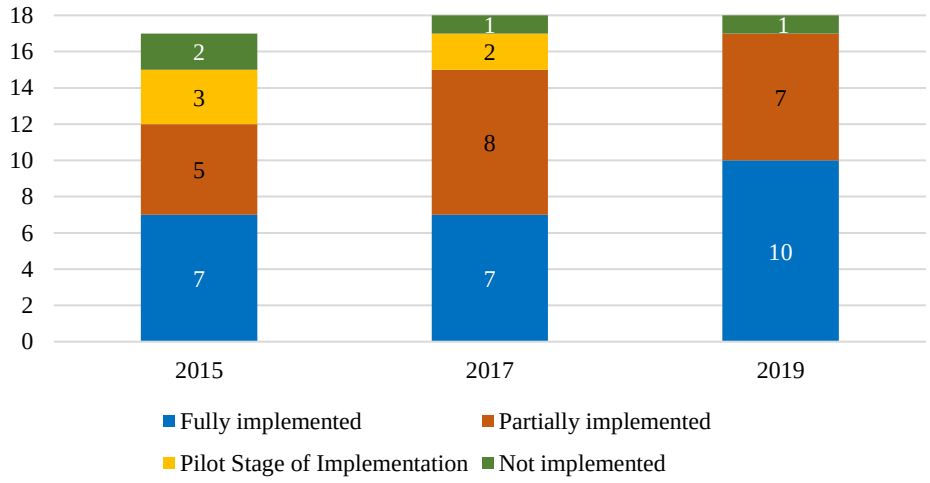
[66] World Economic Forum (2017).
[67] Mikuriya (2016).

where Chile; Colombia; Costa Rica; Mexico; and Peru are cooperating to use blockchain technology to develop an AEO information exchange platform under multilateral MRAs.[68]

Single Window Systems

By providing the convenience of sharing and viewing information on the internet, Single Window systems help to facilitate the flow of trade. Based on UNESCAP data, 10 APEC economies had fully implemented an Electronic Single Window (ESW) by 2019 – up from seven economies in 2015 (Figure 3.33). Additionally, seven APEC economies had partially implemented an ESW by 2019 – up from five economies in 2015.

Figure 3.33: Electronic Single Window implementation



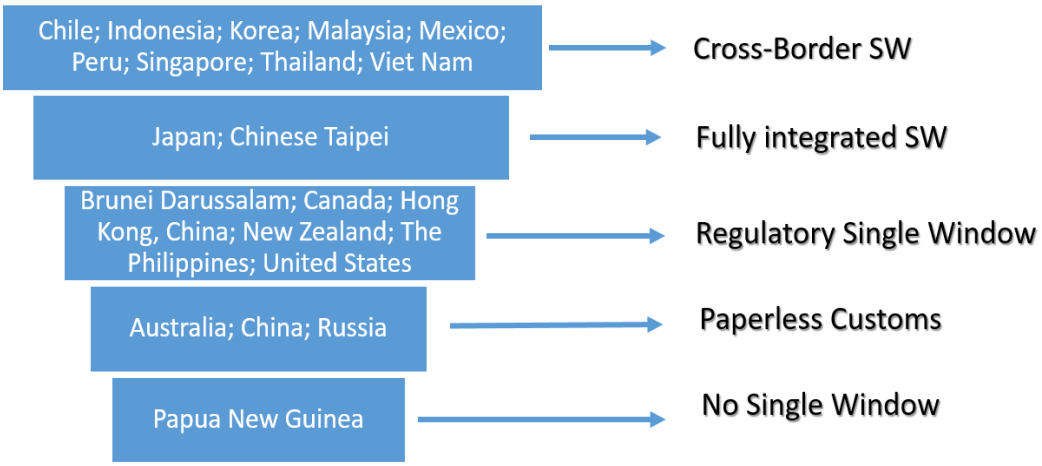
Note: Data shown cover 17 APEC economies in 2015 and 18 APEC economies in 2017 and 2019.
Source: UNESCAP, UN Global Survey on Trade Facilitation and Paperless Trade Implementation.

Survey respondents highlighted some challenges faced in connecting domestic agencies to the Single Window. These include: 1) poor coordination between public agencies and Single Window systems; 2) different processes across public agencies; 3) different levels of technology development in each public agency; 4) poor best practices adoption in terms of processes; 5) lack of data harmonisation; 6) different understanding of Single Windows and different informatisation levels; 7) conflict in business requirements; 8) shortage of funds for system development; 9) lack of official mandate; and 10) challenge in gaining consensus among related government agencies.

A recent APEC Committee of Trade and Investment report on Single Windows classified APEC economies' SWs into several categories according to their level of maturity (Figure 3.34).

[68] Sierra Galindo and Domínguez Rodríquez (2020).

Figure 3.34: Categorising APEC economies by Single Window (SW) maturity

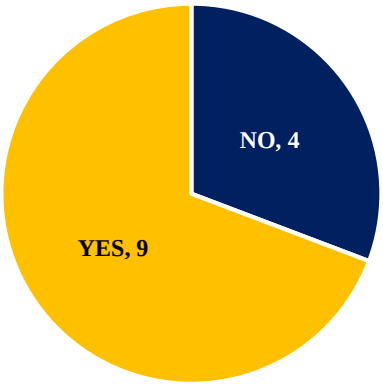


Source: APEC (2019c).

Electronic Single Windows serve a range of different functions. For example, Australia's Single Window allows for fees and taxes to be collected through the system, supports government departments on bio security, and serves as part of the border risk assessment process. Other noteworthy features of Single Windows among the APEC members include Chile's system, which provides connections to other port systems within the economy as well as to other economies. Similarly, Peru's Single Window is not only interoperable within the Pacific Alliance Agreement framework, but also extends beyond interoperability and allows for the compliance of formalities and procedures related to the issuance of Certificates of Origin.

Apart from connecting with domestic agencies, Single Windows can also be connected to those of other economies. Among the respondents to this question, nine indicated that their Single Window was connected to that of another economy (Figure 3.35). Some examples of interoperability include those between Chile; Mexico; and Peru under the Pacific Alliance Agreement. Also, seven APEC economies are a part of the ASEAN Single Window system. In addition to connecting through MRAs, Korea highlighted that its Single Window connections with other economies had also been implemented through FTAs, such as those between Korea and China and between Korea and Indonesia. China noted that it was connected to Singapore's Single Window system, while Singapore highlighted the introduction of the Electronic Origin Data Exchange System (EODES) in 2019 to allow for the electronic exchange of Preferential Certificate of Origin and Certificate of Non-Manipulation between Singapore and China.

Figure 3.35: Is your economy's Single Window system connected to another economy's Single Window system?



Note: Based on responses from the following 13 economies: Australia; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Peru; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Despite the significant costs of setting up a Single Window, the benefits in terms of trade facilitation are considerably high. For example, Thailand invested USD 7.5 million in setting up an economy-wide Single Window, resulting in annual savings in logistics costs of USD 1.5 billion.[69] The Korea Customs Service invested approximately USD 7.8 million in developing a Single Window facility over nine years. It reached its break-even point on the investment in 2009 (the fourth year of operation) and achieved benefits of more than six times the system's investment in 2011.[70]

Authorized Economic Operators (AEOs)

AEOs support trade facilitation as well. Some benefits commonly granted to them are identification as low-risk cargo, streamlined clearance/use of fast lanes at borders, expedited procedures and a lower percentage of customs inspections, prioritisation of the clearance of merchandise, and priority treatment in case of trade disruption or disaster.[71] Twenty APEC economies have launched an AEO programme and the number of AEO-certified enterprises in the APEC region rose by 4.5% between 2018 and 2019. AEO's share of trade is also significant at above 20% for four out of nine economies where data are available, reaching as high as 60% in Mexico (Table 3.2).

Table 3.2: Number of AEOs and their share of trade, 2019

Economy	Number of AEO importers and/or exporters	AEOs share of trade	Economy	Number of AEO importers and/or exporters	AEOs share of trade
Australia	325	11.4%	**New Zealand**	125	45.0%
Canada	2,088		**Peru**	85	17.0%
Chile	2	0.02%	**Singapore**	193	9.1%
China	3,200		**Chinese Taipei**	122	26.2%
Hong Kong, China	38	5.3%	**Thailand**	182	

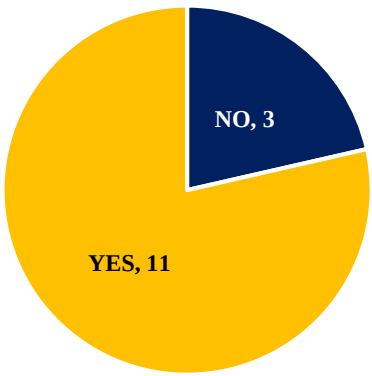
[69] United Nations Economic Commission for Europe (2019).
[70] Cantens *et al.* (2012).
[71] Sierra Galindo and Domínguez Rodríquez (2020).

Japan	60		**United States**	11,579	
Malaysia	70		**Viet Nam**	69	34.4%
Mexico	631	60.0%			

Source: Sierra Galindo and Domínguez Rodríquez (2020).

The participation of small and medium-sized enterprises (SMEs) in international trade can be increased through their integration into AEO programmes. Based on the survey responses, 11 out of 14 responding economies have introduced initiatives to integrate SMEs (Figure 3.36). For example, Australian Trusted Trader (ATT) dedicates resources to help SMEs through the application process, while Hong Kong, China developed an Online Self-Learning Kit to assist companies, particularly SMEs, in ensuring compliance for accreditation purposes. Meanwhile, other economies have made efforts to reduce requirements. For instance, Chinese Taipei removed its minimum trade volume requirement for AEOs, while Japan has allowed for a fewer number of individuals to be required within each department of the company as well as allowing individuals to take on dual roles. Economies have also provided specific assistance to disadvantaged groups. For example, Chile introduced a pilot programme targeting women that aims to collaborate with SMEs, disseminate AEO programme requirements, and compile difficulties faced in obtaining AEO certifications. Regulations are also in the process of being amended to better integrate SMEs. For instance, Indonesia is currently discussing amendments to its AEO Regulation to include SMEs as a new type of AEO operator.

Figure 3.36: Has there been any initiative to integrate small and medium enterprises (SMEs) into your AEO program?



Note: Based on responses from the following 14 economies: Australia; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Papua New Guinea; Peru; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

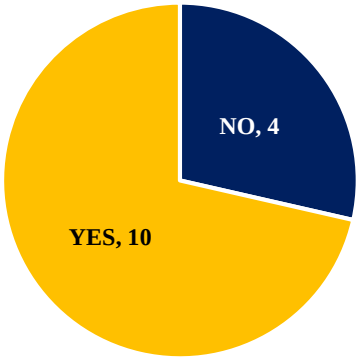
Trade Identification Numbers (TINs) refer to the unique number assigned to each AEO operator so as to aid with identification. The usefulness of TINs is recognised by the World Customs Organization in order to enable efficient implementation of AEO MRAs and to strengthen customs cooperation.[72] The benefits of TINs as highlighted by APEC members in the survey results are listed in Table 3.3. However, a major cost in enabling TINs is in preparing and developing the necessary IT systems. Based on the survey responses, 10 out of 14 responding APEC members indicated that TINs are recognized in their economy (Figure 3.37).

[72] World Customs Organization (2018).

Table 3.3: Summary of the benefits of TINs as highlighted by economies

Benefits of Trade Identification Numbers
• Makes recognition of AEOs in Single Windows easier • Expedites AEO processing within customs operations in transactional systems (e.g., reduced inspection rates, faster clearance, prioritisation of measurement) • Allows for preferential measures set through MRAs to be provided easily • Reduces mistakes and inefficiencies involved with manual identification

Figure 3.37: Does your economy recognise "Trade Identification Numbers"?

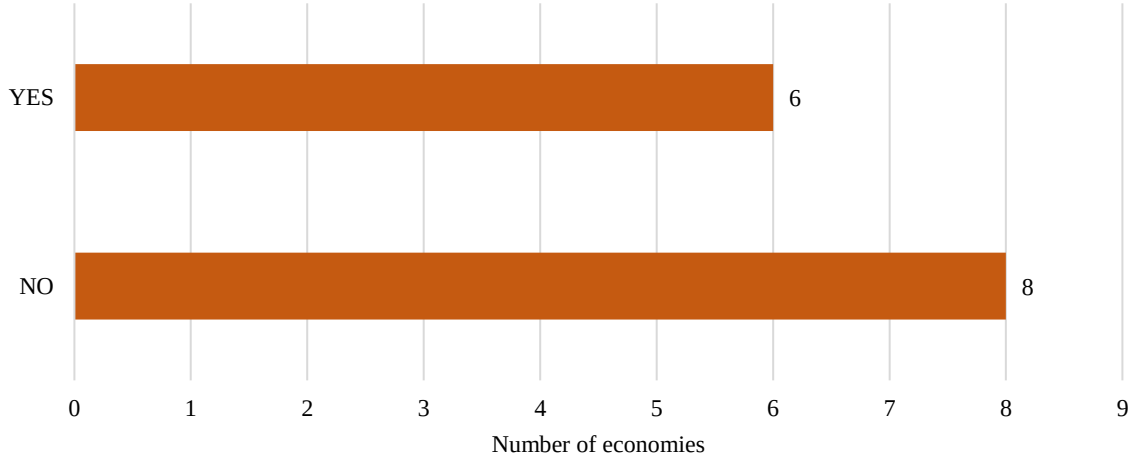


Note: Based on responses from the following 14 economies: Australia; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Papua New Guinea; Peru; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Customs Cooperation

Cooperation among customs officials is essential to facilitate the smooth flow of trade. Among the 14 economies that responded to whether their customs authorities have collaborated with those of other economies, only six indicated “Yes” (Figure 3.38). For those that have cooperated, initiatives that have been undertaken include regional ones such as the ASEAN Customs Transit System, which is currently piloting activities among 10 of its member economies.

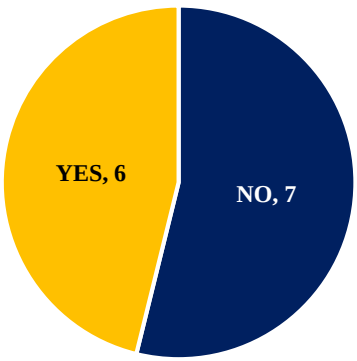
Figure 3.38: Does your economy's customs authority cooperate with customs authorities from other APEC economies for goods in transit?



Note: Based on responses from the following 14 economies: Australia; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Papua New Guinea; Peru; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Although customs authorities may not have cooperated extensively throughout the region, they have increasingly shared data across borders to facilitate pre-arrival processing. Six of the 13 economies who responded to the survey indicated that they have automated customs data exchange systems (Figure 3.39). For example, China has carried out preliminary data exchange with Russian customs and similar exchanges with other non-APEC economies. Similarly, Korea introduced the Electronic Origin Data Exchange System with Indonesia in March 2020 and is currently in talks to also introduce it with Viet Nam. While some economies have yet to introduce a facility for data exchange, many currently have plans to do so. For instance, Chile and Peru are developing an online advance data exchange system through which information such as company information, cargo details, and date of issuance can be exchanged. There are also plans to exchange information on international goods traffic between Peru and Chile through the International Customs Transit Information System (SINTIA) within the framework of the Latin American Integration Association (ALADI).

Figure 3.39: Does your economy have a facility for customs data exchange system(s) to facilitate pre-arrival processing with other APEC customs authorities on the movement of shipments?



Note: Based on responses from the following 13 economies: Australia; China; Hong Kong, China; Indonesia; Japan; Korea; Papua New Guinea; Peru; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Given the efforts made by APEC economies to facilitate customs processes, data from the World Bank's Logistics Performance Index from 2015 and 2017 shows an improvement in terms of clearance times: clearance times have decreased to an average of 2.6 days (with physical inspection) and 1.3 days (without physical inspection) (Table 3.4). However, a broader measurement that includes all border control agencies, showed no change in performance in terms of clearance efficiency between 2015 and 2017.

Table 3.4: APEC customs clearance performance (APEC average)

Indicator	2015	2017
LPI clearance time with physical inspection (days)[a]	2.8 days	2.6 days
LPI clearance time without physical inspection (days)[b]	1.6 days	1.3 days
Efficiency of the clearance process (i.e., speed, simplicity and predictability of formalities) by border control agencies, including customs[c] (score 1-5; 5=highest performance)	3.2	3.2

Note: (a) Data shown cover 15 economies; (b) data shown cover 12 economies; (c) data shown cover 21 economies.
Source: World Bank, Logistics Performance Index dataset.

Sub-pillar 2: Supply Chain Performance

This sub-pillar intends to improve supply chain performance, in particular, by advancing logistics and transport facilitation and improving supply chain performance with regard to time, cost and uncertainty. In terms of time, several indicators from the World Bank's Logistics Performance Index (LPI) and *Doing Business* show certain improvements. According to the LPI, lead times had been reduced to an average of 3.4 days for import and 2.3 days for export in 2017, the latter being lower than OECD's lead time (Table 3.5). Despite these improvements, the LPI overall index for APEC remained at an average score of 3.4 (out of a possible 5) between 2015 and 2017, which is considered to fall at the borderline between 'consistent performers' and 'logistics friendly'.[73]

Similar trends are also apparent from *Doing Business* indicators that measure the time and cost to trade: less time is required to complete documentary and border compliance procedures for export and import. To complete documentary and border compliance, traders needed to spend almost 59 hours for export and 75 hours for import in 2019. In comparison, in 2015, the numbers were 69 hours for export and 89 hours for import. With regard to cost, the average cost to export had been reduced to USD 422 in 2019, while the average cost to import had been reduced to USD 476. OECD's average cost and time to trade in 2019 were much lower than APEC's.

Table 3.5: Time and cost to trade (APEC average)

Indicator	2015	2017	OECD 2017
LPI lead time to export (days)[a]	2.4 days	2.3 days	2.4 days
LPI lead time to import (days)[b]	3.5 days	3.4 days	2.7 days

[73] According to the World Bank's Logistics Performance Index (LPI) reports, 'consistent performers' includes economies rated better on logistics performance than most others in their income group, while 'logistics-friendly' includes top-performing economies (i.e., top LPI quintile), most of which are in the high-income group.

LPI Overall Index[c]	3.4	3.4	3.6
Indicator	**2015**	**2019**	**OECD 2019**
DB Time to Export	68.9 hours	58.5 hours	15.3 hours
DB Time to Import	89.4 hours	75.3 hours	13.2 hours
DB Cost to Export	USD 442.2	USD 421.8	USD 184.5
DB Cost to Import	USD 498.5	USD 475.5	USD 132.9

Note: LPI Overall Index score ranges from 1 (low) to 5 (high). (a) Data shown cover 15 APEC and 28 OECD economies; (b) data shown cover 15 APEC and 27 OECD economies; (c) data shown cover 21 APEC and 36 OECD economies.
Source: World Bank, Logistics Performance Index database; World Bank, Doing Business database.

Uncertainty can be measured in the form of delays or accidents that happen along the supply chain. To assess this aspect, we look at the LPI survey which asks questions about the sources of major delays from five incidents: compulsory warehousing/transloading; pre-shipment inspection; maritime transshipment; criminal activities; and solicitation of informal payments. Existing data indicate that APEC's average value showed a large improvement in all items since 2014 except for compulsory warehousing/transloading: 11.3% of respondents identified compulsory warehousing as often or always being the cause of major delays in 2018; only 3.6% of respondents in OECD economies indicated the same (Table 3.6). In 2018, the highest concern for delays in APEC was due to compulsory warehousing/transloading and solicitation of informal payments. On the contrary, maritime transshipment was regarded as an often cause of major delays in OECD economies.

Table 3.6: Sources of major delays (%)

Sources of Major Delays	2014	2016	2018	OECD 2018
Compulsory warehousing/transloading	9.4	7.0	11.3	3.6
Pre-shipment inspection	17.5	14.3	7.5	3.5
Maritime transshipment	17.7	10.3	6.0	4.3
Criminal activities (e.g., stolen cargo)	12.6	7.6	3.3	1.4
Solicitation of informal payments	19.9	12.5	10.3	1.7

Note: Data shown are the share of survey respondents identifying the incident as an often or always source of major delays. Data shown cover 17 APEC economies and 32 OECD economies.
Source: World Bank, Logistics Performance Index database.

Overall, respondents to the LPI survey felt that positive changes had occurred in the logistics environment in both APEC and OECD. The strongest improvements for APEC were noted in customs clearance procedures and private logistics services (Table 3.7).

Table 3.7: Changes in the logistics environment since 2015 (%)

Percent of respondents answering improved or much improved	APEC	OECD
Customs clearance procedures	68.5	54.8
Other official clearance procedures	61.8	46.9
Trade and transport infrastructure	56.3	47.0
Telecommunications and IT infrastructure	61.3	63.1
Private logistics services	67.1	62.6
Regulation related to logistics	45.8	30.3
Solicitation of informal payments	47.7	35.3

Note: Data shown cover 20 APEC economies and 32 OECD economies.
Source: World Bank, Logistics Performance Index, 2018 Dataset.

Sub-pillar 3: Regulatory Coherence, Cooperation and Good Regulatory Policies

The sub-pillar of Regulatory Coherence and Cooperation and Good Regulatory Practices (GRPs) aims to enable a whole-of-government approach in the development of regulations, including coordination across regulatory, standards, and trade agencies. Three categories of GRPs were identified in the 2011 APEC Economic Leaders' Declaration:

1. Develop, use, or strengthen processes, mechanisms, or bodies to enable a whole of government approach in the development of regulations, including coordination across regulatory, standards, and trade agencies.
2. Develop, use, or strengthen mechanisms for assessing the impact of regulations, which involves effective and consistent use of the tools and best practices for developing new regulations and reviewing existing regulations.
3. Implement the principles related to public consultation of the 2005 APEC-OECD Integrated Checklist on Regulatory Reform section on regulatory policy and the 2004 Economic Leaders' Statement to Implement the APEC Transparency Standards.[74]

At a broader level, two indicators from the World Justice Project (WJP) are relevant to assess the quality of GRPs: 'Open Government' and 'Regulatory Enforcement'. The APEC average score for 'Open Government' increased marginally, from 0.61 in 2015 to 0.62 in 2020 (Table 3.8). Two elements under this indicator, namely 'The laws are publicized and accessible' and 'Official information is available on request' showed significant increases from 2015, whereas the other components, such as 'Right to petition the government and public participation' and 'The laws are stable' worsened slightly.

The APEC average for 'Regulatory Enforcement' also increased, from 0.62 in 2015 to 0.64 in 2020, with improvements in the following elements: 'Government regulations are effectively enforced' and 'Government regulations are applied and enforced without improper influence'; all other indicators maintained status quo (Table 3.8).

Table 3.8: Quality of regulations (APEC average score, 0-1)

Factors	2015	2016	2017-18	2019	2020
Factor 3: Open Government	0.61	0.62	0.62	0.62	0.62
3.1. The laws are publicized and accessible	0.58	0.58	0.62	0.62	0.62
3.2 The laws are stable	0.62	0.62	0.61	0.60	0.61
3.3 Right to petition the government and public participation	0.61	0.61	0.60	0.60	0.60
3.4 Official information is available on request	0.63	0.66	0.65	0.66	0.67
Factor 6: Regulatory Enforcement	0.62	0.63	0.63	0.64	0.64
6.1 Government regulations are effectively enforced	0.60	0.60	0.61	0.61	0.62
6.2 Government regulations are applied and enforced without improper influence	0.70	0.70	0.71	0.74	0.74

[74] APEC (2011).

6.3 Administrative proceedings are conducted without unreasonable delay	0.61	0.62	0.62	0.61	0.61
6.4 Due process is respected in administrative proceedings	0.59	0.58	0.59	0.59	0.59
6.5 The Government does not expropriate without adequate compensation	0.63	0.65	0.65	0.64	0.63

Note: Data shown cover 18 economies. Data for Brunei Darussalam; Papua New Guinea; and Chinese Taipei are not available. Higher scores reflect better performance (0 to 1).
Source: World Justice Project, Rule of Law Index dataset.

The World Bank's Worldwide Governance Indicators (WGI) project reports aggregate and individual governance indicators for over 200 economies, combining the views of a large number of enterprises, individuals and expert survey respondents to measure six dimensions of governance: Voice and Accountability; Political Stability and Absence of Violence; Government Effectiveness; Regulatory Quality; Rule of Law; and Control of Corruption. The indicator to measure 'Regulatory Quality' – which reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development – exhibited a mixed performance: the average score for APEC rose steadily until 2014 to 0.84 before beginning to fluctuate, attaining 0.82 in 2018 (Figure 3.40).

FDI inflows can be important in promoting the development of PPPs for large infrastructure projects. In this context, OECD's FDI Regulatory Restrictiveness Index showed an improvement as the average index value for APEC dropped from 0.21 to 0.18 between 2010 and 2018 (Figure 3.41).

Figure 3.40: Regulatory quality

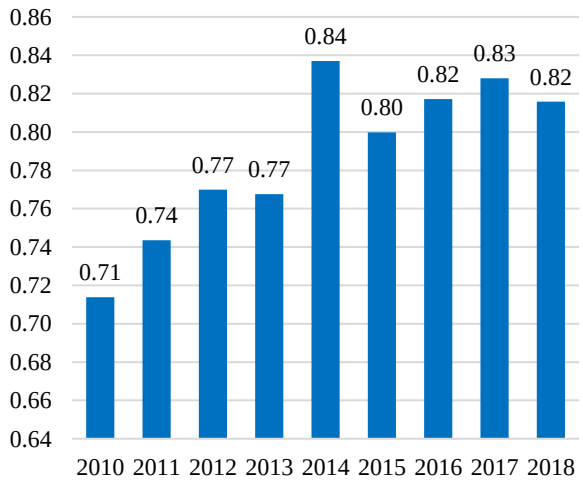
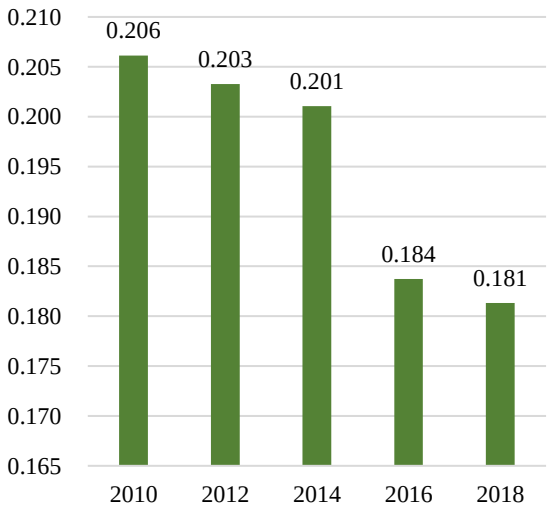


Figure 3.41: FDI Regulatory Restrictiveness Index

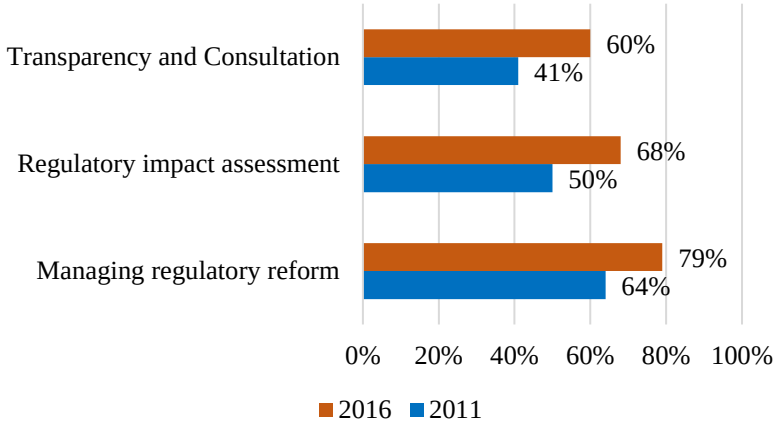


Note: The World Bank's WGI Regulatory Quality score is an estimate measured on a scale from approximately -2.5 to +2.5; higher values correspond to better governance. The OECD's FDI Regulatory Restrictiveness Index decreases as restrictiveness reduces.
Source: World Bank, Worldwide Governance Indicators, 2019 Update; OECD, OECD.Stat online database.

A recent study highlighted the progress of APEC economies in implementing GRPs and noted that significant progress had been achieved in several key areas, such as using centralised web portals to consult stakeholders and integrating trade and competition principles into regulatory

reviews and analysis.[75] According to the study, APEC achieved significant progress between 2011 and 2016 under the following areas of GRPs: managing regulatory reform; regulatory impact assessment; and transparency and consultation (Figure 3.42). The study also highlighted several areas where economies could undertake improvements, including making more directive and smaller commitments to specific reforms, larger and more commitments, as well as capacity building and promoting experiences.

Figure 3.42: Composite indicators of application of GRPs in APEC economies

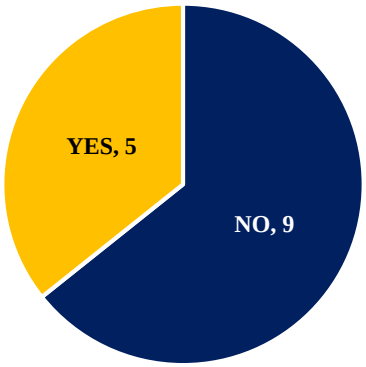


Note: The values indicate the percent of APEC economies adopting the relevant GRPs.
Source: Nathan Associates (2017).

There is a strong emphasis on a whole-of-government approach in developing regulations as well as in coordinating across regulations, standards and trade agencies within this sub-pillar. One means by which APEC has promoted this approach is through the voluntary APEC-OECD Integrated Checklist on Regulatory Reform. Based on the survey results shown in Figure 3.43, the uptake of this initiative continues to be low in the region. Only five out of 14 responding economies indicated that they had participated. These economies identified several benefits of the Checklist, including increased awareness of regulatory reform, optimisation of inter-agency coordination, introduction of a Regulatory Impact Assessment, identification of areas of improvement, and facilitation of shared experiences and lessons learnt. Encouragingly, several economies noted that while they have not implemented the Checklist, they may consider participating in the future based on domestic developments such as a potential review of the regulatory policy framework.

[75] Nathan Associates (2017).

Figure 3.43: Has your economy participated in the APEC-OECD Integrated Checklist on Regulatory Reform?

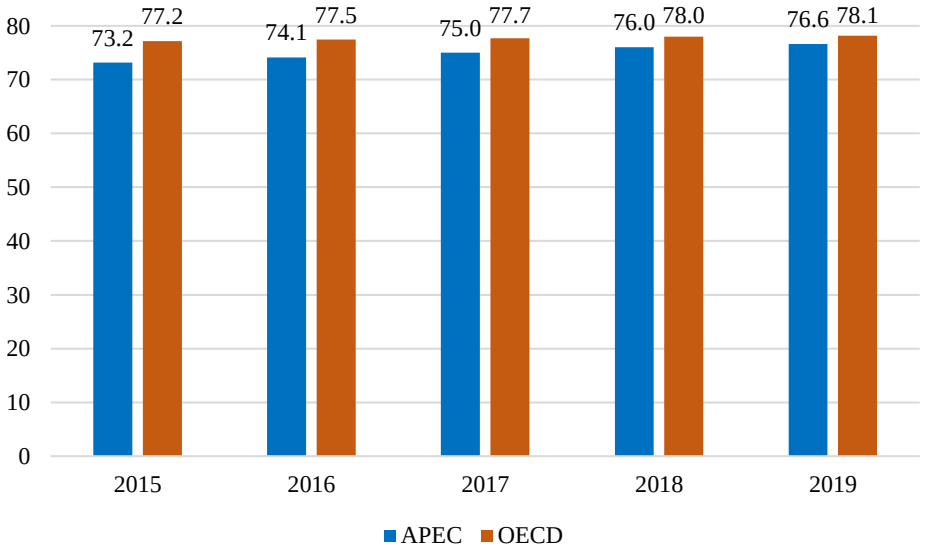


Note: Based on responses from the following 14 economies: Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Mexico; Peru; the Philippines; Russia; Singapore; Chinese Taipei; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Sub-pillar 4: Structural Reforms

The objective of this sub-pillar is to foster transparency, safety, competition and better functioning markets (including e-commerce) in the Asia-Pacific region. The *Doing Business* score is an all-encompassing measure that captures the level of regulatory performance of economies. From 2015 to 2019, the average APEC *Doing Business* score increased from 73.2 to 76.6, a 4.76% increase (Figure 3.44). In comparison, OECD's average scores were slightly higher than APEC's, reaching 78.1 in 2019 by increasing by 1.27% over the same period.

Figure 3.44: Doing Business scores, 2015-2019



Source: World Bank, Doing Business database.

The 'Absence of Corruption' indicator from the WJP allows us to measure the transparency of governance by assessing the absence of corruption in public agencies. The indicator showed little fluctuation, although there was a notable decline in the perceived level of corruption in

the legislative branch (Table 3.9). Furthermore, APEC economies are not on par with OECD economies; with regard to absence of corruption, APEC lagged behind OECD by 0.12 points in 2020.

Table 3.9: Absence of Corruption (APEC average score, 0-1)

Factors	2015	2016	2017-18	2019	2020	OECD 2020
Factor 2: Absence of Corruption	0.64	0.62	0.62	0.63	0.62	0.74
2.1 Government officials in the executive branch do not use public office for private gain	0.64	0.63	0.62	0.63	0.62	0.71
2.2 Government officials in the judicial branch do not use public office for private gain	0.67	0.67	0.71	0.71	0.71	0.87
2.3 Government officials in the police and the military do not use public office for private gain	0.71	0.69	0.68	0.69	0.69	0.84
2.4 Government officials in the legislative branch do not use public office for private gain	0.55	0.50	0.48	0.48	0.46	0.54

Note: Data shown cover 18 APEC (data for Brunei Darussalam; Papua New Guinea; and Chinese Taipei are not available) and 28 OECD economies. Higher scores reflect better performance (0 to 1).
Source: World Justice Project, Rule of Law Index dataset.

The World Bank's WGI indicators relating to improvement in the regulatory environment are 'Control of Corruption' and 'Government Effectiveness'. APEC's performances were relatively unchanged with regard to these two indicators between 2014 and 2018 (Table 3.10).

Table 3.10: Quality of governance (APEC average score, -2.5 to +2.5)

	2014	2015	2016	2017	2018	OECD 2018
Control of Corruption	0.53	0.51	0.52	0.51	0.53	1.18
Government Effectiveness	0.88	0.85	0.84	0.83	0.87	1.25

Note: The score is an estimate measured on a scale from approximately -2.5 to +2.5; higher values correspond to better governance.
Source: World Bank, Worldwide Governance Indicators, 2019 Update.

Apart from improving the regulatory environment, this sub-pillar aims to expand the application of safe and trusted ICT and e-commerce environment. Data from the World Bank is used to assess APEC's performance in facilitating e-commerce. The data show that the share of the population (age 15+) that made or received digital payments increased in nearly all APEC economies between 2014 and 2017 (Table 3.11). In 2017, more than 1.5 billion adults in the APEC region had 'made or received digital payments in the past year' and almost 1.4 billion had 'made digital payments in the past year', which are significant increases from 1.1 billion adults and 1.0 billion adults, respectively, in 2014. The APEC average for these two financial inclusion measures was 65.9% and 58.9%, respectively, in 2017. In comparison, a larger fraction of the OECD population in 2017 had made or received digital payments in the past year: 82.5% made or received at least one digital payment in the past year, while 78.3% made digital payments in the past year. The rise in the number of people using digital payments shows an improvement in the degree of financial inclusion as well as the rise of e-commerce. Other benefits of digitising payments are greater efficiency by increasing the speed of payments

and reducing the cost of disbursing and receiving them; better security of payments and lower associated crime; better transparency and less corruption; and higher savings.[76]

Table 3.11: Making and receiving digital payments (% of population)

Economy	Made or received digital payments in the past year (% age 15+)		Made digital payments in the past year (% age 15+)	
	2014	2017	2014	2017
Australia	95	96	93	94
Canada	96	98	95	97
Chile	53	65	47	56
China	44	68	38	61
Hong Kong, China	81	85	76	77
Indonesia	22	35	16	27
Japan	89	95	80	89
Korea	86	92	83	91
Malaysia	58	70	46	60
Mexico	29	32	25	23
New Zealand	98	97	96	96
Peru	22	34	18	25
The Philippines	20	25	18	14
Russia	53	71	44	62
Singapore	87	90	85	84
Chinese Taipei	78	77	69	69
Thailand	33	62	22	43
United States	91	91	88	89
Viet Nam	18	23	11	16
APEC (weighted) average	50.7	65.9	44.7	58.9
OECD (weighted) average	79.0	82.5	74.9	78.3

Note: Data shown cover 19 APEC and 35 OECD economies.
Source: World Bank, The Global Findex Database 2017; APEC Policy Support Unit staff calculations.

Also important for e-commerce are secure servers, which facilitate safe and secure internet transactions, hence reducing the possibility of cybercrime. One definition of a secure server is "a server that offers security for the online transaction or web hosting, protecting information from being accessed by an unauthorised person, viruses, and arbitrary code execution".[77] The number of secure servers in APEC economies (per 1 million people) increased exponentially from 754 in 2014 to more than 17,000 in 2019 (Table 3.12). However, the number in APEC was much lower than in OECD, which stood at 51,829 secure servers per 1 million people in 2019. Globally, as of 2019, APEC economies host more than 65% of secure servers (totaling more than 50 million) in the world.

Table 3.12: Secure Internet servers (per 1 million people)

Economy	2014	2015	2016	2017	2018	2019
Australia	3,939	4,574	9,810	21,545	32,904	36,721

[76] Demirgüç-Kunt *et al.* (2018).
[77] Elisha Sawe (2017).

Brunei Darussalam	242	574	612	1,621	1,989	10,720
Canada	2,698	3,387	10,221	26,567	30,953	35,901
Chile	165	224	1,237	7,258	8,073	11,014
China	10	20	48	209	447	735
Hong Kong, China	1,554	2,332	3,873	10,485	19,404	60,546
Indonesia	12	18	306	1,281	1,283	1,684
Japan	1,377	1,504	2,110	5,980	11,671	18,701
Korea	407	558	721	1,199	2,065	4,544
Malaysia	151	234	946	4,918	5,713	6,724
Mexico	41	58	120	185	226	271
New Zealand	3,491	3,933	6,430	14,980	17,835	20,375
Papua New Guinea	11	13	15	31	50	57
Peru	38	46	73	219	257	385
The Philippines	16	21	41	88	93	111
Russia	120	321	1,164	3,541	5,191	9,339
Singapore	2,544	3,585	19,061	58,690	84,714	122,481
Thailand	52	69	146	578	954	1,404
United States	5,131	6,361	11,440	30,351	65,864	124,014
Viet Nam	20	33	279	1,349	1,769	2,597
APEC (weighted) average	754	940	1,828	4,997	9,764	17,449
OECD (weighted) average	2,412	3,053	6,462	17,153	31,366	51,829

Note: Data cover 20 APEC (data for Chinese Taipei are not available) and 36 OECD economies.
Source: World Bank, World Development Indicators online database.

APEC members have undertaken several major initiatives to improve the e-commerce environment. For instance, China introduced the 13th Five-Year Plan for Development of E-commerce to strengthen the momentum of e-commerce, while Indonesia introduced a Roadmap on E-Commerce to enhance the e-commerce environment. Similarly, Malaysia expanded its National E-Commerce Strategic Roadmap to include the adoption of cyber security in order to increase awareness on safe e-commerce transactions, including data privacy, so as to increase the level of trust consumers place on e-commerce.

Meanwhile, Hong Kong, China introduced an electronic identity programme (iAM Smart), which aims to facilitate the development of innovative e-services and promote e-commerce, digital trade, and online payments in a simple, convenient, and secure manner. Economies have also introduced new laws and regulations and revised existing ones. For example, Chinese Taipei passed the Telecommunications Management Act, which is expected to eliminate barriers of entry as well as build a more innovative, free and competitive industrial market. Japan has been evaluating and clarifying how the Civil Code and other relevant laws are applied to various legal issues surrounding e-commerce and the outcomes of the evaluation are released annually.

Sub-pillar 5: Trade Facilitation

The objective is to enhance trade facilitation through the removal of technical barriers to trade. In this sub-pillar, aligning domestic standards to international standards and strengthening conformity assessment capabilities are important. Participation in international accreditation and standards programmes promotes technical cooperation and provides proof of quality of products and services. These measures boost trade, reduce costs, and encourage innovation and

product improvement.[78] APEC economies are members of several international standards and conformance organisations such as the Asia Pacific Accreditation Cooperation, the International Accreditation Forum, and the International Bureau of Weights and Measures (Table 3.13). While membership in these organisations is important, active participation in these bodies is also necessary to ensure that international standards meet the needs of different individual economies now and in the future.

Table 3.13: Membership to accreditation organisations

Signatory	APAC MRA	IAF MLA	ILAC	IAAC MLA	BIPM MRA	OIML Members	EEMRA	APMP
Australia	●	●	●		●	●	●	●
Brunei Darussalam							●	●
Canada	●	●	●	●	●	●		
Chile		●	●	●	●		●	
China	●	●	●		●		●	●
Hong Kong, China	●	●	●		●		●	●
Indonesia	●	●	●		●	●	●	●
Japan	●	●	●		●	●	●	●
Korea	●	●	●		●	●	●	●
Malaysia	●	●	●		●		●	●
Mexico	●	●	●	●	●			
New Zealand	●	●	●		●	●	●	●
Papua New Guinea			●				●	●
Peru		●	●	●	●		●	
The Philippines	●	●	●		●		●	●
Russia	●		●		●	●	●	●
Singapore	●	●	●		●		●	●
Chinese Taipei	●	●	●		●		●	●
Thailand	●	●	●		●	●	●	●
United States	●	●	●	●	●	●		
Viet Nam	●	●	●		●	●	●	●
APEC	17	18	20	5	19	10	18	16

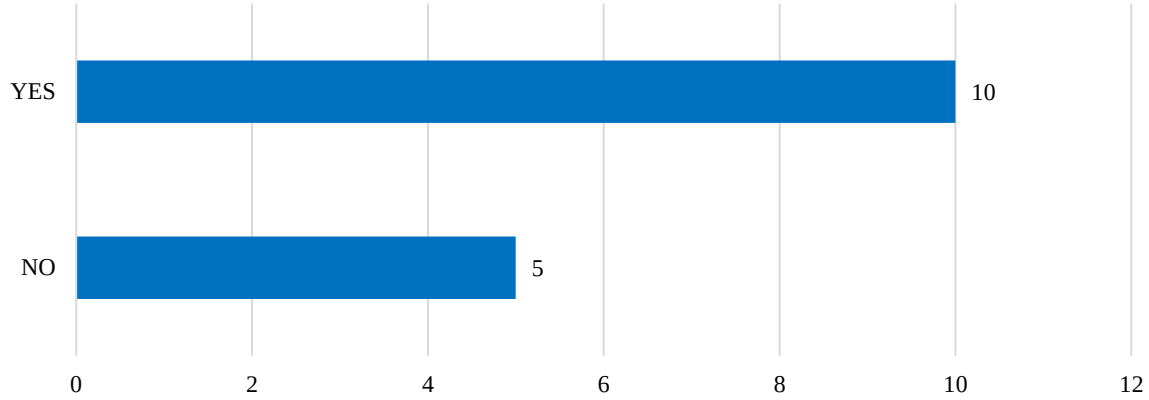
Note: The abbreviations shown in the table are as follows: Asia Pacific Accreditation Cooperation (APAC); International Accreditation Forum (IAF); International Laboratory Accreditation Cooperation (ILAC); InterAmerican Accreditation Cooperation (IAAC); International Bureau of Weights and Measures (BIPM); International Organization of Legal Metrology (OIML); APEC Electrical and Electronic Equipment Mutual Recognition Arrangement (EEMRA); The Association of Proposal Management Professionals (APMP).
Source: Respective organisation websites.

Developing an APEC framework for the harmonisation of standards and conformity assessment procedures will be beneficial for facilitating trade within the region. Ten out of 15 APEC members that responded to the survey indicated that they had carried out initiatives to formulate an APEC framework (Figure 3.45). Economies noted several challenges in

[78] Kellermann (2019).

harmonising standards, including a lack of resources; prioritisation of domestic standardisation as compared to APEC-wide standardisation; a lack of control over the determination of standards, which at times tends to rest with the private sector; and a lack of a domestic standards body to develop and issue domestic standards.

Figure 3.45: Has your economy carried out initiatives to formulate an APEC framework for the harmonisation of standards and conformity assessment procedures?



Note: Based on responses from the following 15 economies: Australia; Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; New Zealand; Peru; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Members also highlighted domestic initiatives they have undertaken to further this goal. China introduced the National Standardization System Construction and Development Plan, which aims to bring consumer product standards in line with international standards. Additionally, Malaysia has brought 60% of its domestic standards in line with international standards. Peru also made efforts to align its technical standards to international ones and currently has adopted 1,264 international standards, which account for 25% of all its technical standards. In addition, New Zealand reformed its standards development system. Among the many changes made, a key change was the introduction of a new independent authority to approve New Zealand's standards.

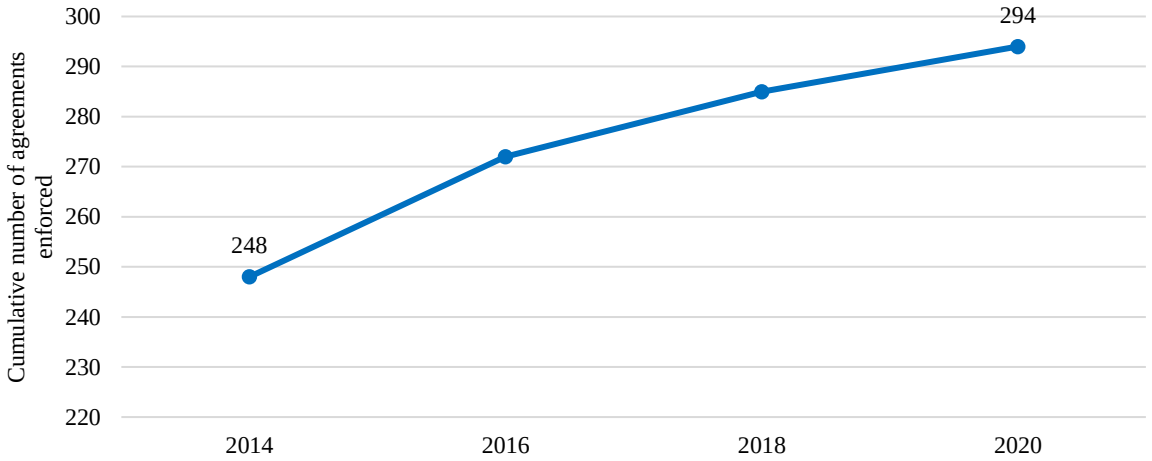
Examples of initiatives to promote standards harmonisation at the regional level include Australia's co-sponsoring of projects such as the "APEC Workshop on Approaches for Communicating Cybersecurity Practices to Stakeholders" and "Addressing Standardization in Emerging Technologies: Distributed Ledger Technologies (DLT) and Blockchains". Singapore has also contributed to these efforts through its self-funded project titled "Developing Indicators to Assess the Strength of Standards and Conformance (S&C) Infrastructure in APEC". Meanwhile, Japan has led the Voluntary Action Plan alignment works in SCSC since 1995, which investigates the alignment of domestic standards with international ones.

Regional trade agreements (RTAs) also help to develop institutional infrastructure that fosters integration. The World Bank notes that RTAs improve alignment with international standards, harmonisation of procedures, and transparency, which in turn boosts trade and investment.[79] In

[79] Maur (2008).

this regard, APEC economies have signed and enforced 46 additional RTAs since the beginning of the APEC Connectivity Blueprint (Figure 3.46).

Figure 3.46: Cumulative RTAs enforced



Source: World Trade Organization, Regional Trade Agreements Database.

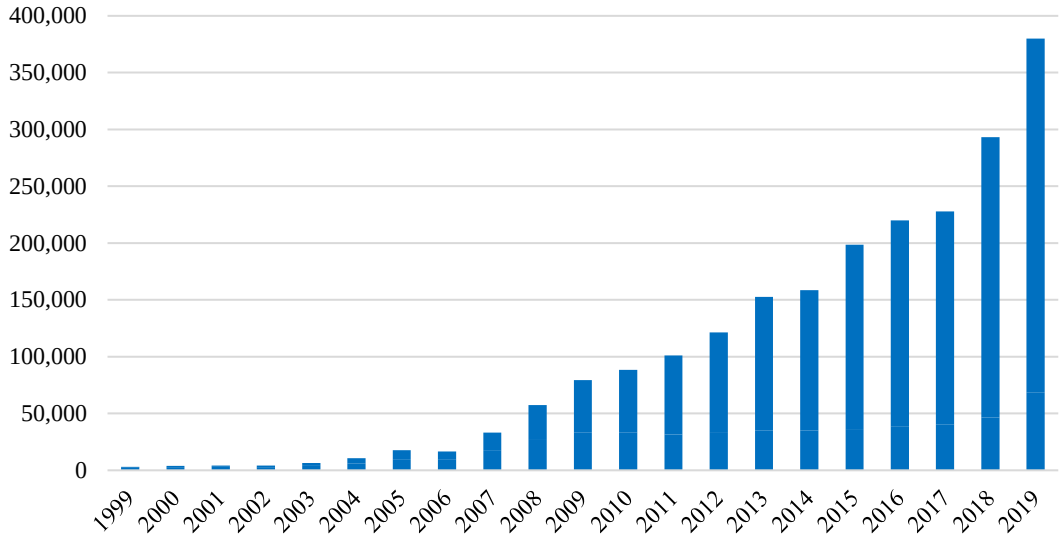
People-to-People Connectivity

Sub-pillar 1: Business Travel Facilitation

The APEC Connectivity Blueprint highlighted the prominent role of the APEC Business Travel Card (ABTC) in facilitating cross-border travel among business persons across the region by streamlining entry processes. All APEC economies except for Canada and the United States conduct pre-clearance and allow permission to enter without the need for a visa or entry permit for the validity period of the card. Economies highlighted several benefits achieved through the implementation of the ABTC in their survey responses, which include its ability to: (1) facilitate business travel to APEC economies; (2) reduce the cost of applying for visas; (3) increase the validity period of visas; (4) promote the integration of regional business and trade; (5) enhance information exchange through card issuance, border security management, and cross-border issues; (6) enhance cooperation in the Asia-Pacific region; (7) reduce the need for business people to have a separate visa; (8) increase time savings; (9) promote business opportunities; and (10) offer travellers to transitional member economies with expedited appointments for visa interviews.

Given the numerous benefits, between 2014 and 2019, the number of active ABTC holders more than doubled from 158,461 to 380,017, growing at an average rate of 17.5% per year (Figure 3.47).

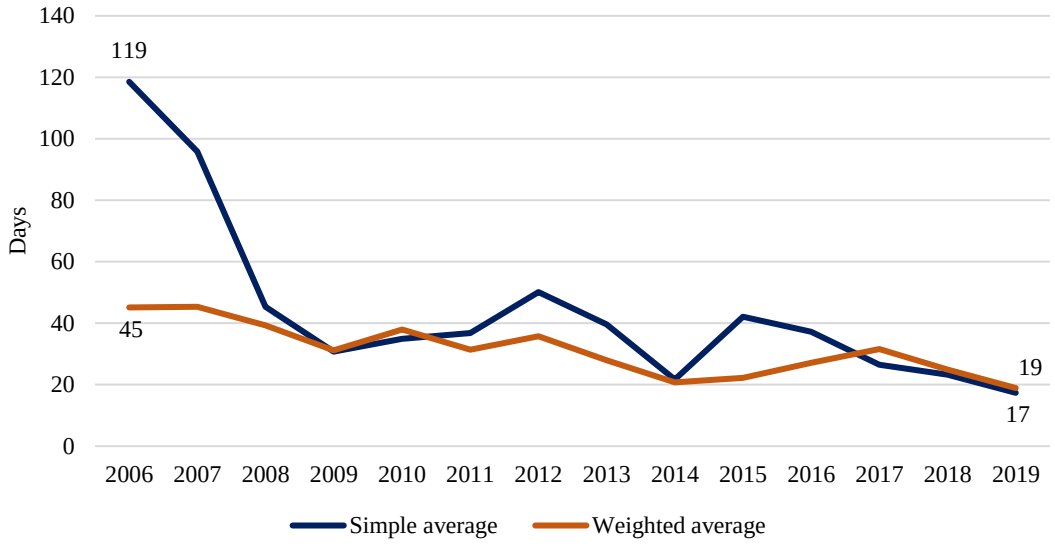
Figure 3.47: Number of active ABTC holders, 1999-2019



Source: APEC Business Mobility Group data, APEC Policy Support Unit staff calculations.

A target of this sub-pillar is to reduce the time spent for processing pre-clearance of applicants to two weeks. Full members participate in the pre-clearance of business travellers, thereby removing their need to apply for a visa or entry permit. When a business traveller applies for an ABTC, their home economy will assess their application and, if found to meet the relevant criteria, will request the other fully-participating economies to conduct their own assessment of whether to grant pre-clearance to the applicant. APEC members have achieved some progress in reducing the average ABTC pre-clearance processing time in line with the objectives of the APEC Connectivity Blueprint. As of 2019, it took 17 days to process ABTC applications based on a simple average and 19 days based on a weighted average (Figure 3.48). This is the lowest average processing time since 2006 and is a significant improvement from 2015 when it took an average of 42 days (simple average) or 22 days (weighted average) to process pre-clearance of ABTC applicants.

Figure 3.48: Average ABTC preclearance processing time, 2006-2019



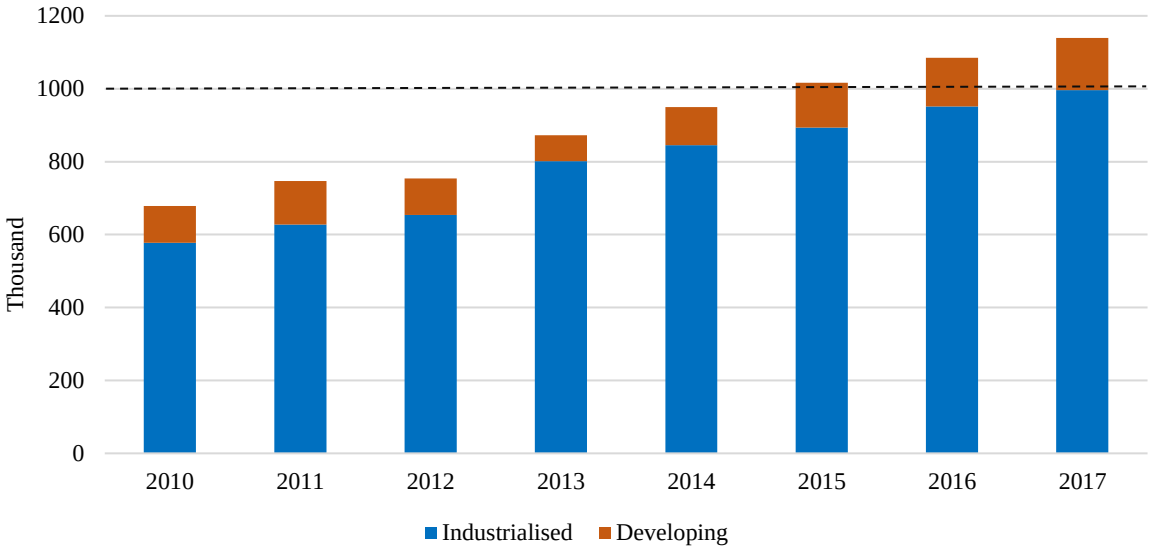
Note: Data do not include ABTC transitional members. Weighted average refers to the average processing time weighted by the number of ABTC holders in the economy.
Source: APEC Business Mobility Group data, APEC Policy Support Unit staff calculations.

Sub-pillar 2: Cross-Border Education Exchange

In 2013, APEC Economic Leaders endorsed the target of having 1 million intra-APEC tertiary-level international students by 2020, which was also reflected in the APEC Connectivity Blueprint.[80] Based on data from UNESCO, this target was achieved as of 2015 when there were 1.02 million tertiary-level cross-border students within the APEC region (Figure 3.49). Note that this target may have been achieved earlier as the UNESCO data do not cover all APEC economies. Since 2015, there have consistently been more than 1 million cross-border tertiary students within the APEC region. The APEC Scholarship and Internship Initiative was launched in 2015 with the aim of promoting intra-APEC cross-border student exchanges. Scholarships are offered for courses in 20 economies, while internship opportunities are available in four economies as well as with the APEC Secretariat and the APEC Policy Support Unit.

[80] 2014 APEC Economic Leaders' Declaration.

Figure 3.49: Intra-APEC cross-border students by destination, 2013-2017



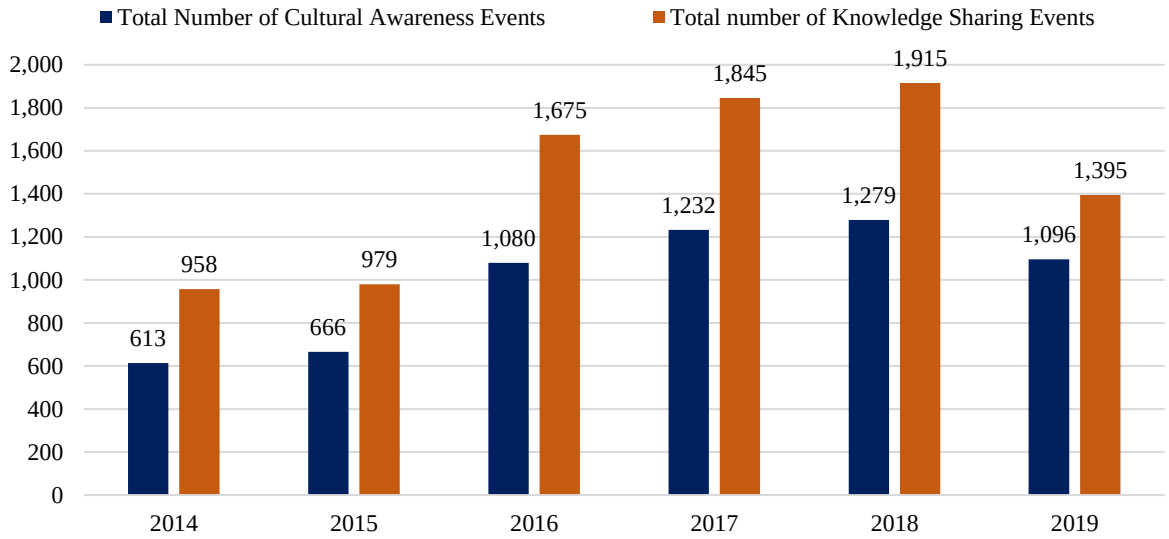
Note: Data indicates the number of tertiary-level students from APEC economies going to other APEC economies. Data are not available for China; Papua New Guinea; Peru; the Philippines; Singapore; and Chinese Taipei.
Source: UNESCO Institute for Statistics; APEC Policy Support Unit staff estimates.

A related target in the Connectivity Blueprint is to increase the number of student exchanges going to developing economies in the APEC region. In 2014, there were about 104,000 intra-APEC tertiary students going to developing economies; by 2017, this number had increased to more than 143,000. As a result, the share of international intra-APEC students going to developing economies increased from 11.0% in 2014 to 12.6% in 2017. It should be reiterated that this may be an underestimation as student exchanges to six APEC economies are not covered by the UNESCO data.

An additional target aims to improve cultural exchange and knowledge exchange on cross-border science, technology and innovation though events. Cultural exchanges improve understanding and create trust and affinity between individuals from different economies in the region. Meanwhile, knowledge sharing events facilitate technology transfers and stimulate capacity building efforts. Based on survey responses from nine members, the number of cultural awareness events held in other economies steadily increased each year from 2014 to 2018, before falling slightly in 2019 (Figure 3.50). Respondents highlighted the numerous benefits achieved through such events, including 1) the exchange of ideas and values across economies; 2) building of common approaches in response to challenges; 3) better understanding of each other's culture; 4) establishment of an export platform for cultural goods and services; 5) creation of synergy between art, culture and industry; 6) deepening of mutual understanding and friendship; and 7) promotion of SMEs.

As with cultural awareness events, the number of knowledge sharing events also increased each year from 2014 to 2018, before falling in 2019. Nevertheless, the number of events conducted in 2019 was considerably higher than those registered in 2014. These events are noted to 1) improve mutual exchange and learning; 2) transfer knowledge; 3) promote local tourism, culture and products; 4) share information and exchange good practices; and 5) help economies to achieve long-term success.

Figure 3.50: Total number of cultural awareness and knowledge sharing events organised in another APEC economy



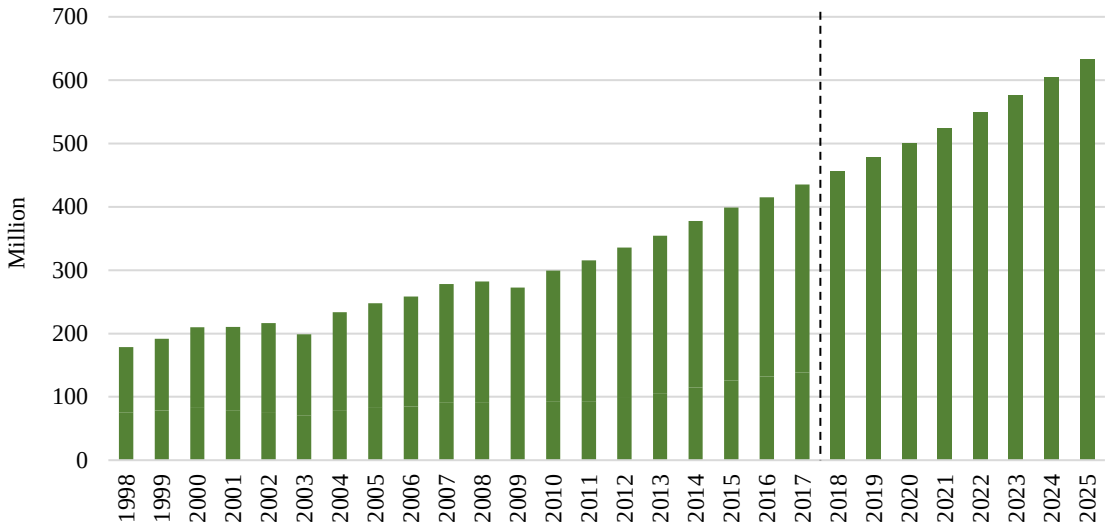
Note: Cultural awareness events cover data from Canada; Chile; China; Hong Kong, China; Indonesia; Korea; Peru; Thailand; and United States. Knowledge sharing events cover data from Canada; Chile; China; Indonesia; Malaysia; New Zealand; the Philippines; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Sub-pillar 3: Tourism Facilitation

In 2014, APEC Tourism Ministers agreed to the goal of reaching 800 million international tourist arrivals in the region by 2025.[81] In that year, 377 million tourists visited APEC economies, rising to 435 million arrivals in 2017 (Figure 3.51). This represents a three-year compound annual average growth rate of 4.7%.

[81] 2014 APEC Tourism Ministers' Statement.

Figure 3.51: International tourist arrivals by destination, 1998-2025



Note: Data for 2018-2025 are forecasts based on average annual growth for 2014-2017.
Source: World Bank, World Development Indicators (WDI) online database; Chinese Taipei's Directorate General of Budget, Accounting and Statistics (DGBAS); and APEC Policy Support Unit staff estimates.

If we assume that the annual average growth rate for 2014-2017 is maintained for 2018-2025, then there will be about 630 million tourist arrivals by 2025 – this is 170 million tourists short of the 800 million target as set by Tourism Ministers in 2014. Note that these forecasts do not take into account the expected significant decrease in international tourist arrivals in 2020, and most likely also in 2021, due to the COVID-19 pandemic. If the 800 million tourist arrivals target is to be reached by 2025, then more efforts at improving travel connectivity and easing travel restrictions may need to be implemented.[82]

Since 2014, APEC economies have implemented measures to either remove visa restrictions on travellers from other APEC economies or to facilitate travel through e-visas or visas-on-arrival. Out of 420 possible origin-destination pairs in the region, 108 require a consular visa application while 312 are either visa-free or use facilitated visa processing (Figure 3.52). Compared to 2014, more than 32 origin-destination pairs have either lifted visa requirements or implemented measures such as e-visas or visas-on-arrival, with significant visa facilitation efforts from Papua New Guinea; Chinese Taipei; and Viet Nam.

[82] See APEC Policy Support Unit (2016) for a discussion on improving travel connectivity.

Figure 3.52: Visa Restrictions in APEC economies

Origin \ Destination	AUS	BD	CDA	CHL	PRC	HKC	INA	JPN	ROK	MAS	MEX	NZ	PNG	PE	PHL	RUS	SGP	CT	THA	USA	VN
AUS		o	o	o	x	o	o	o	o	o	o	o	o	o	o	x	o	o	o	o	o
BD	o		o	x	o	o	o	o	o	o	x	o	o	o	o	o	o	o	o	o	o
CDA	o	o		o	x	o	o	o	o	o	o	o	o	o	o	x	o	o	o	o	o
CHL	x	x	o		x	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
PRC	x	o	x	x		x	o	x	x	o	x	x	o	x	x	x	x	x	o	x	x
HKC	o	o	o	o	x		o	o	o	o	o	o	o	o	o	o	o	o	o	x	o
INA	x	o	x	o	x	o		o	x	o	x	x	o	o	o	x	o	x	o	x	o
JPN	o	o	o	o	o	o	o		o	o	o	o	o	o	o	x	o	o	o	o	o
ROK	o	o	o	o	x	o	o	o		o	o	o	o	o	o	o	o	o	o	o	o
MAS	o	o	x	o	x	o	o	o	o		o	o	o	o	o	x	o	o	o	x	o
MEX	x	x	o	o	x	o	o	o	o	o		o	o	o	o	x	o	x	o	x	o
NZ	o	o	o	o	x	o	o	o	o	o	o		o	o	o	x	o	o	o	o	o
PNG	x	x	o	x	x	o	o	x	x	o	x	x		o	o	x	o	x	o	x	o
PE	x	o	x	o	x	o	o	x	o	o	o	x	o		o	o	o	x	o	x	o
PHL	x	o	x	x	x	o	o	x	x	o	x	x	o	o		x	o	o	o	x	o
RUS	x	o	x	o	x	o	o	x	o	o	o	x	o	o	o		o	o	o	x	o
SGP	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	x		o	o	o	o
CT	o	o	o	o	x	o	o	o	o	o	x	o	o	o	o	x	o		o	o	x
THA	x	o	x	o	x	o	o	o	o	o	x	x	o	o	o	o	o	o		x	o
USA	o	o	o	o	x	o	o	o	o	o	o	o	o	o	o	x	o	o	o		o
VN	x	o	x	o	x	x	o	x	x	o	x	x	o	x	o	x	o	x	o	x	

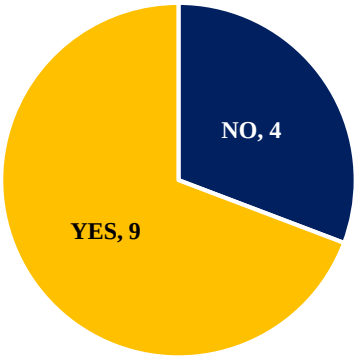
Note: Rows indicate the origin of the traveller as indicated in their travel document and columns indicate the destination. An 'O' means there are no visa restrictions and an 'X' means visa restrictions exist. For the purposes of this table, visa restrictions are defined as a requirement of ordinary travellers to obtain a visa or other documentary equivalent from a representative office or agency to visit an economy prior to arrival. Hence, visas on arrival or online electronic visas are not considered a form of visa restriction.
Source: Compiled by APEC Policy Support Unit from various sources.

To facilitate travel, survey respondents identified the importance of tourism codes of conduct in that they 1) strengthen the management of tourism agencies; 2) safeguard the legitimate rights and interests of tourists and travel agencies; 3) promote healthy development of the tourism industry; 4) encourage travel providers to participate in sustainable tourism; and 5) provide travel providers with information on best practices. Nine out of 13 responding economies have introduced a code of conduct for travel providers in their economy (Figure 3.53). For example, Singapore introduced a Tourist Guide Code of Conduct in 2017 to raise professionalism of the tourist guide community, while Indonesia introduced the Certification of Tourism Business in 2016. China amended several relevant regulations relating to travel agencies and tourism law. Similarly, Chinese Taipei introduced several regulations governing travel agencies, tourist amusement enterprises, and hotel enterprises.

At the regional level, in 2014, APEC Economic Leaders committed to "establishing an APEC-wide Code of Conduct for Travel Providers in order to reduce travelers' costs and uncertainties relating to tourism". In 2016, Tourism Ministers agreed to develop the Code of Conduct by 2025 as part of the TWG Strategic Plan 2015-2019.[83]

[83] APEC Tourism Working Group (TWG) Strategic Plan 2015-2019.

Figure 3.53: Is there a Code of Conduct for Travel Providers in your economy?

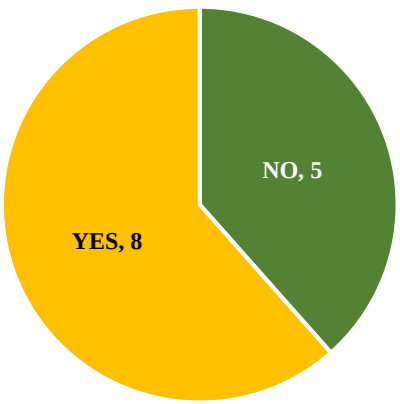


Note: Based on survey responses from the following 13 economies: Brunei Darussalam; Chile; China; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; Peru; Singapore; Chinese Taipei; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

Sub-pillar 4: Professional and Labor Mobility

This sub-pillar focuses on establishing an APEC-wide mechanism to monitor and respond to regional skills gaps as well as to increase the number of APEC-wide MRAs for skilled and technical workers. To evaluate whether skills gaps are being monitored, the survey asked economies if they had a Domestic Qualifications Framework in place – only 8 out of 13 economies indicated "Yes" (Figure 3.54). For example, China introduced an Occupational Qualifications Catalogue in 2017 that differentiates professional qualifications from technical ones and provides information on entry requirements for jobs that are of public interest. Similarly, Korea introduced a Qualifications Framework in 2019, which serves as an integrated system that combines both educational and occupational qualifications. Indonesia also introduced a Qualifications Network to equalise and integrate education, training and work experience in providing recognition of competence. While some economies may not have introduced a Qualifications Framework, similar systems have been introduced instead. For instance, Singapore has developed sector-specific Skills Frameworks to provide information on the sector, its career pathways, and occupations.

Figure 3.54: Does your economy have a Domestic Qualifications Framework?

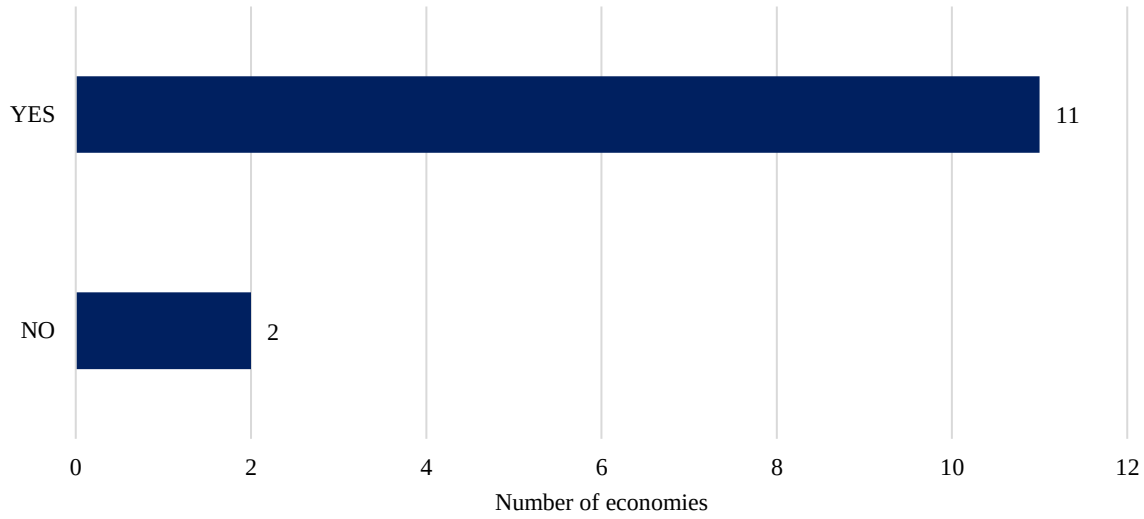


Note: Based on survey responses from the following 13 economies: Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Mexico; Peru; Russia; Singapore; Chinese Taipei; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

APEC members without a Qualifications Framework noted several difficulties in developing such a system. For instance, some economies highlighted a high turnover of officials as a complexity in creating the framework. Economies also mentioned that the framework often requires complementary reforms that may be difficult to introduce and that the level of representativeness of the various sectors is often disorganised, thereby hindering decision-making and the development of standards.

Economies were also asked if a labour market and skills-monitoring framework had been implemented. Out of 13 respondents, 11 stated that their economy had introduced one (Figure 3.55). For example, Indonesia developed a Skill Monitoring system, which aims to align the educational programme with the skills required in business and industry. Similarly, Chinese Taipei introduced a labour and skills monitoring framework that is supported by relevant ministries. For economies that have not introduced such a framework, several challenges remain, such as a lack of information on the supply of skills and/or on employment trends within the economy.

Figure 3.55: Does your economy have a labour market and skills-monitoring framework?



Note: Based on survey responses from the following 13 economies: Canada; China; Hong Kong, China; Indonesia; Japan; Korea; Mexico; Peru; Russia; Singapore; Chinese Taipei; United States; and Viet Nam.
Source: APEC Connectivity Blueprint Survey Responses.

In addition, the APEC Skills Mapping Tool was developed in 2013 with data provided by economies on a voluntary basis. It contains data on seven economies from 1990 through 2015 and projections for 2019.[84] However, data availability and completeness vary among the contributing economies, with the number of data series per contributing economy ranging from one to 605.

Nevertheless, members have made efforts to narrow the skills gaps in their economies. For instance:

[84] The APEC Skills Mapping Tool includes data from the following APEC members: Australia; Hong Kong, China; Indonesia; Korea; Mexico; New Zealand; and the Philippines.

- China’s initiatives with regard to work experience have been to promote apprenticeships;
- Indonesia has attempted to enable provision of local and global internships;
- Chinese Taipei introduced surveys to better gauge the demand of talent and provide such information to job seekers, and is developing occupational competency standards and competency training programmes for private sector groups unable to afford such trainings;
- Peru provides training pathways to the underemployed or unemployed based on several factors such as work experience, potential and capabilities;
- Japan has implemented vocational training for job seekers, existing workers and new graduates on the skills required within industry so as to improve productivity; and
- Hong Kong, China has provided subsidies to aid in upskilling adults, investing a total of HKD 16.2 billion.

In the APEC context, China has proposed projects on skills development through lifelong learning to enhance the exchange of expertise and good practices among APEC economies. Peru; Russia; and the EDNET Coordinator led the development of the APEC Education Strategy in 2016, which serves as a living document to foster educational cooperation across economies in the region. In addition, the United States supports an APEC roadmap to close the digital skills gap and aims to create a tool to measure the regional digital gap as well as create a digital readiness checklist.

4. CONNECTIVITY INDEX

This section attempts to develop a connectivity index that can measure the region's connectedness based on the concept of connectivity that is adopted in the APEC Connectivity Blueprint. The construction of the index is solely for the purpose of supporting the assessment of economies' measures to enhance connectivity across the three pillars. The indicators adopted to construct the index are specified in Table 4.1 below.

Table 4.1: Overview of indicators used

Element	Indicator	Sub-pillar
Physical Connectivity		
Infrastructure development and investment	Infrastructure score (LPI)	Quality of Infrastructure, Transportation, Public–private Partnership
Trade and transportation networks	Air freight (WDI)	Transportation
	Liner shipping connectivity index	Transportation
	Foreign value added - Global value chain	Supply chain performance
Broadband	Percentage of individuals using internet	ICT Infrastructure Development
Institutional Connectivity		
Modernisation of customs/trade-related agencies	Customs score (LPI)	Customs and Border Administration
Structural Reforms	Aggregate time required to import - transformed (DB)	Supply chain performance
	Business impact of rules on FDI (WEF)	Public–private Partnership
Regulations	Regulatory quality (WGI)	Regulatory Coherence and Cooperation & Good Regulatory Practices; Structural Reforms
	Regional trade agreements count	Trade Facilitation
E-commerce	Number of secure servers	Structural Reforms
People-to-People Connectivity		
Cross-border education, science, technology and innovation, and services	Inbound mobility	Cross-border Education Exchange
	International migrant stock	Business Travel Facilitation; Professional and Labor Mobility
Tourists, business people, professionals and workers, women and youth	International tourist arrivals (% of population)	Tourism Facilitation

These indicators have been selected for the following reasons:

1. They are closely related to the elements or pillars of the APEC Connectivity Blueprint.
2. They are simple and easy to interpret in the context of the pillars' aims. The importance of this has been highlighted by De Lombaerde who emphasised that a good indicator should be relatively easy to understand and should reflect or represent something essential beyond the literal definition of what the indicator is supposed to measure.[85]
3. The indicator values are calculated/collected by credible institutions and are widely used in existing literature.

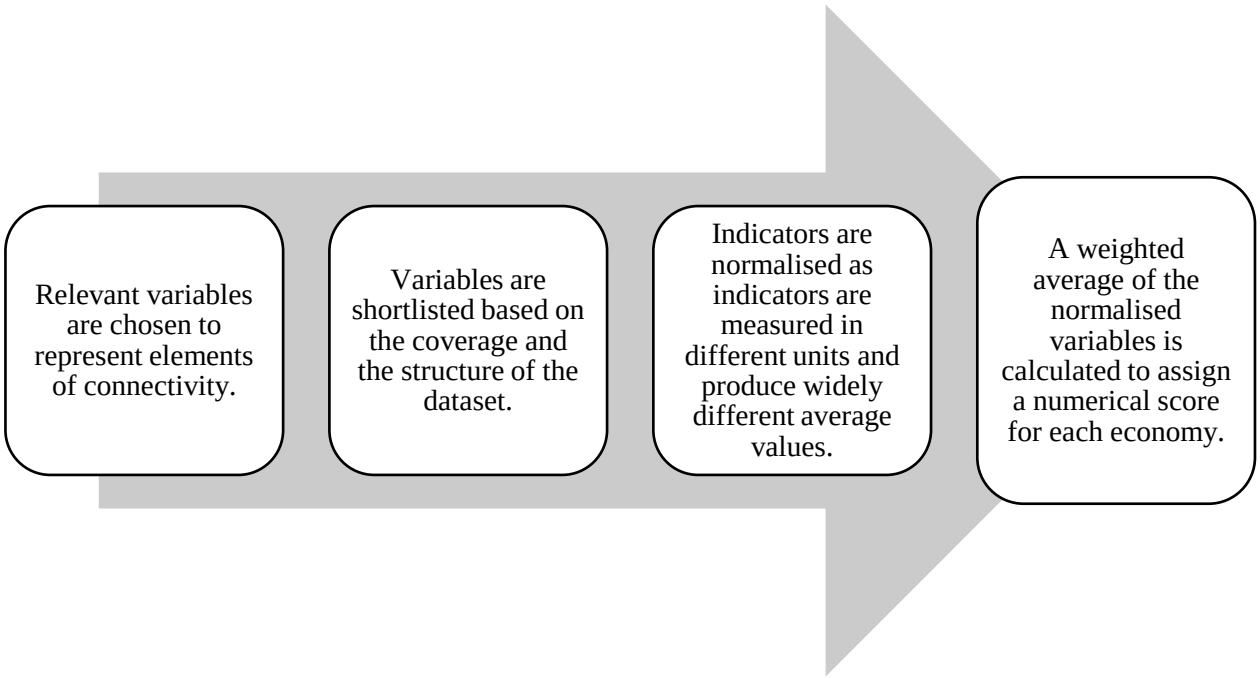
[85] De Lombaerde (2006).

4. The indicators have good data coverage across economies to allow for meaningful international comparisons.

In addition, the following steps and procedures are applied to build the connectivity index:[86]

- Missing data are imputed when necessary to provide a complete dataset.[87]
- Multivariate analysis (Principal Component Analysis) is conducted to determine the overall structure of the dataset and assess its suitability for aggregation as well as to determine individual weights for each indicator.[88]
- Data are normalised or rescaled to allow for comparability of the selected indicators as well as to allow for easier interpretation. The rescaling converts the individual indicators to a value between 0 and 1 with higher values corresponding to better performance (min-max normalisation).[89]

In summary, the following stages are applied in constructing the connectivity index:[90]



Before arriving at the final set of indicators, the PSU considered several alternative indicators such as container throughput, container port traffic, and air transport passengers; however, these indicators were not included as their as their KMO (Kaiser–Meyer–Olkin) and (squared)

[86] OECD (2008).

[87] Imputation of data is done by carrying over data from earlier years, using extrapolation method, or by applying regression analysis and predictive mean matching where appropriate.

[88] Principal Component Analysis (PCA) detects patterns of correlations within a set of observed variables, identifies sets of highly correlated variables, and infers an underlying factor structure. Filmer and Pritchett (1998) assert that "the first principal component is that linear index of the underlying variables that captures the most common variation among them". As such, we have used the loadings from the first principal component to determine the weights of each indicator. A non-technical explanation of the PCA method can be found here.

[89] The formula is as follows: (value – min_value)/(max_value – min_value).

[90] See also the methodology used to construct the University of Warwick Centre for the Study of Globalisation and Regionalisation (CSGR) Globalisation Index.

principal component loading scores were low.[91] For a discussion on PCA, please refer to Appendix A.

Components of the Connectivity Index

The connectivity index (CI) is calculated using the indicators described in Appendix B. All indicators are normalised or rescaled into an index score using the following formula:

$$\frac{V - min\_value}{max\_value - min\_value}$$

To arrive at the final connectivity index, the 14 indicators are combined using the weighted average method. The weights for each indicator are derived using Principal Component Analysis.[92] The respective weights for each indicator are provided in Table below. The institutional connectivity pillar carries the highest weight in the index, with a share of 47%, followed by physical connectivity (33%) and people-to-people connectivity (20%) (Table 4.2).93 Indicators that contribute high shares in the connectivity index are: regulatory quality (13.54%), LPI customs score (12.48%), LPI infrastructure score (12.12%), and percentage of individuals using the internet (11.37%).

Table 4.2: Individual weights for selected indicators

No	Indicators	Weight
	Physical Connectivity	**33.24%**
1	Logistics Performance Index (LPI) – Infrastructure score	12.12%
2	World Development Indicators (WDI) – Air Freight	2.26%
3	Liner Shipping Connectivity Index (UNCTAD)	2.95%
4	Percentage of individuals using internet - (ITU)	11.37%
5	Foreign Value Added - Global Value Chain	4.54%
	Institutional Connectivity	**46.69%**
6	Customs Score (LPI)	12.48%
7	Business impact of rules on FDI (WEF)	5.92%
8	Secure servers (WB/Netcraft)	4.12%
9	Regulatory Quality (WGI)	13.54%
10	Regional Trade Agreements count (WTO)	1.97%
11	Time required to import - transformed (DB)	8.66%
	People to People Connectivity	**20.08%**
12	Tertiary Inbound Mobility (UNESCO)	8.50%
13	International Tourist Arrivals (UNWTO)	2.82%

[91] A low (squared) principal component loading score reflects less significance of that particular indicator in describing the variation in the data. The component loadings could be interpreted as the correlation coefficients between a variable and their respective principal component. See Bartholomew *et al.* (2011).

[92] The PSU applied the weighting procedure used by Huh and Park (2017) by using the square of loadings of principal component; the square of loadings represents the proportion of the variance in a variable that is explained by the principal component. However, we only use the first principal component following Filmer and Pritchett (1998) that used the first principle component in determining the weights for the construction of an asset index.

[93] In order to make the index comparable over time, the PSU pooled the 2014 and 2018 data and estimated the principal components over the combined data. This follows the procedure explained in Cavatassi, Davis and Lipper (2004) and in Demeke and Zeller (2009).

14	International migrant stock (as a percentage of total population)	8.76%

Data on 58 economies are included in the index calculation; the economies cover members of OECD[94], EU, APEC, and ASEAN.

2014 Results

In 2014, the following 15 economies received the highest scores for the Connectivity Index (CI).

Table 4.3: The 15 Economies with the highest Connectivity Index scores, 2014

	Economy	Region	CI 2014
1	Luxembourg	EU/OECD	0.78
2	Singapore	APEC/ASEAN	0.75
3	Hong Kong, China	APEC	0.68
4	Netherlands	EU/OECD	0.68
5	United Kingdom	OECD	0.67
6	Switzerland	OECD	0.67
7	Germany	EU/OECD	0.66
8	Belgium	EU/OECD	0.65
9	Sweden	EU/OECD	0.64
10	Ireland	EU/OECD	0.63
11	Norway	OECD	0.63
12	Denmark	EU/OECD	0.62
13	Australia	APEC/OECD	0.62
14	New Zealand	APEC/OECD	0.61
15	Canada	APEC/OECD	0.61

The APEC average score for the 21 economies is 0.44 (Table 4.4). In comparison, the average score for OECD (37 economies) is 0.54, while for EU (27 economies) and for ASEAN (10 economies), the average scores are 0.53 and 0.31, respectively.

Table 4.4: Connectivity Index scores for APEC economies, 2014

	Economy	CI 2014
1	Australia	0.62
2	Brunei Darussalam	0.35
3	Canada	0.61
4	Chile	0.43
5	China	0.34
6	Hong Kong, China	0.68
7	Indonesia	0.21
8	Japan	0.54

[94] Includes all 37 members, including the newly joined Colombia.

9	Korea	0.53
10	Malaysia	0.49
11	Mexico	0.34
12	New Zealand	0.61
13	Papua New Guinea	0.12
14	Peru	0.27
15	The Philippines	0.28
16	Russia	0.26
17	Singapore	0.75
18	Chinese Taipei	0.50
19	Thailand	0.38
20	United States	0.56
21	Viet Nam	0.25

2018 Results

In 2018, the following 16 economies received the highest scores for the Connectivity Index (CI).

Table 4.5: The 16 Economies with the highest Connectivity Index scores, 2018

	Economy	**Region**	**CI 2018**
1	Luxembourg	EU/OECD	0.78
2	Singapore	APEC/ASEAN	0.77
3	Netherlands	EU/OECD	0.73
4	Hong Kong, China	APEC	0.72
5	Germany	EU/OECD	0.70
6	Denmark	EU/OECD	0.70
7	Switzerland	OECD	0.69
8	Sweden	EU/OECD	0.69
9	Austria	EU/OECD	0.68
10	United Kingdom	OECD	0.68
11	Belgium	EU/OECD	0.65
12	Australia	APEC/OECD	0.65
13	Finland	EU/OECD	0.64
14	New Zealand	APEC/OECD	0.64
15	Canada	APEC/OECD	0.62
16	United States	APEC/OECD	0.62

The APEC average score for all 21 economies is 0.46 (Table 4.6). In comparison, the average score for OECD (37 economies) is 0.57, while for EU (27 economies) and for ASEAN (10 economies), the average scores are 0.56 and 0.33, respectively.

Table 4.6: Connectivity Index scores for APEC economies, 2018

	Economy	**CI 2018**
1	Australia	0.65
2	Brunei Darussalam	0.37
3	Canada	0.62
4	Chile	0.47
5	China	0.40

6	Hong Kong, China	0.72
7	Indonesia	0.24
8	Japan	0.58
9	Korea	0.53
10	Malaysia	0.48
11	Mexico	0.36
12	New Zealand	0.64
13	Papua New Guinea	0.11
14	Peru	0.28
15	The Philippines	0.27
16	Russia	0.30
17	Singapore	0.77
18	Chinese Taipei	0.51
19	Thailand	0.38
20	United States	0.62
21	Viet Nam	0.31

Based on the connectivity index, the APEC average score increased from 0.44 in 2014 to 0.46 in 2018; an improvement of 4.95%. In comparison, OECD's progress is 4.57%, EU: 5.99%, and ASEAN: 5.06%.

APEC's progress in the individual pillars was uneven. People-to-people connectivity exhibited the strongest progress at 9.09%, followed by physical connectivity (7.75%) and institutional connectivity (2.64%).

Comparison with similar International Indices

The connectivity index (CI) uses indicators that are closely related to the elements of the APEC Connectivity Blueprint. Encouragingly, the results of the CI are relatively similar to those of other international indices such as the Logistics Performance Index, the Doing Business Index, and the DHL Global Connectedness Index. The APEC Connectivity Index has a strong correlation with these indices as indicated by the correlation coefficients shown in Table 4.7.[95]

Table 4.7: Connectivity Index Correlation Coefficients with other similar indices

	Connectivity Index 2018	Logistics Performance Index 2018	Doing Business 2019	Global Connectedness Index 2017
Connectivity Index 2018	1.00			
Logistics Performance Index 2018	0.88	1.00		
Doing Business 2019	0.79	0.72	1.00	
DHL Global Connectedness Index 2017	0.86	0.76	0.69	1.00

[95] The correlation coefficient is a statistical measure of the strength of the relationship between variables. Higher values indicate a stronger relationship, with values ranging from 0 to 1.

5. CONCLUSION AND WAY FORWARD

In general, notable progress has been achieved in the three pillars of connectivity. In physical connectivity, to facilitate infrastructure financing, most APEC economies have established PPP centres and have conducted financial viability or bankability assessments. APEC economies have had mixed results with regard to road networks, but are making good progress in the development of railroad networks. The quality of electricity supply — with respect to interruptions and reliability — has improved significantly for APEC economies. Economies have also actively developed ICT infrastructure and digital economy by providing broader internet access to the wider population. The issue of resilience is also highlighted by several initiatives. Better emergency preparedness through public-private partnerships will support quick recovery during times of natural calamities. Stronger resilience can also be developed by adopting new technologies that are becoming more accessible and widespread.

For institutional connectivity, 10 out of 18 economies had fully implemented an ESW by 2019, up from 7 in 2017. Single Window development has been geared towards interoperability and paperless or digital means. Additionally, 20 economies launched AEO programmes and the number of AEO-certified enterprises rose by 4.5% between 2018 and 2019. Adoption of good regulatory practices (GRPs) is visible in some indicators relating to two aspects of quality of governance — open government and regulatory enforcement. To facilitate safe and secure e-commerce, the number of secure servers (per 1 million people) increased from 754 in 2014 to more than 17,000 in 2019. Initiatives have also been implemented to integrate SMEs in AEO certification, thereby supporting stronger integration of SMEs into GVCs, while maintaining safe and secure trade.

Efforts have been strong in building entrepreneurship networks under people-to-people connectivity. Active ABTC holders rose from 158,461 to 380,017 between 2014 and 2019 with the average pre-clearance processing time decreasing from 45 to 19 days between 2006 and 2019. In promoting cross-border educational exchanges, the target of having 1 million intra-APEC tertiary-level international students by 2020 had been reached in 2015. The number of cultural events increased from 613 to 1,279 between 2014 and 2018, with a slight decrease in 2019 (survey responses from 8 economies). However, considerable increases are needed to raise tourist arrivals from 435 million in 2017 to the target of 800 million by 2025 as the global pandemic has hurt the travel and tourism business.

The findings from the yearly reviews, survey to APEC economies and fora, and external indicators for each of the three pillars of the APEC Connectivity Blueprint are summarised below.

PHYSICAL CONNECTIVITY

The outlook for regional integration identifies the importance of digital infrastructure. However, despite the rise of the digital economy and e-commerce, most supply chains still rely on physical infrastructure. In response, economies have invested significantly in improving their infrastructure, particularly through PPP modalities. There was a consistent increase in the number and value of investments in transport infrastructure PPP projects from 2014 to 2019. For instance, the regional number of transport projects under the PPP model increased from 147 projects to 1,289 projects over that period. Many economies have also introduced PPP centres to further promote the use of the PPP model, with 13 members having at least one PPP centre. The projects undertaken by economies have focused extensively on connectivity and

energy infrastructure. The initiatives submitted by the APEC members have shown priority in improving connectivity in rural and remote areas. Resiliency can also be improved, especially in remote areas, through new technologies that are now becoming more accessible and widespread.

In addition to investing large amounts in infrastructure, there is a need to ensure quality infrastructure. Infrastructure with strong quality elements will ensure that services are delivered efficiently, securely and sustainably. In response, most APEC economies conduct comprehensive assessments to better evaluate infrastructure projects.

Economies have actively developed their ICT infrastructure to support the development of the digital economy and 'smart' infrastructure. The weighted average proportion of the population in the APEC region with access to fixed broadband networks (grew from 15.7% to 25.7%) and internet access (grew from 52.3% to 63.6%) increased between 2014 and 2019.

Efforts have also been made to build the necessary infrastructure to generate and distribute sustainable energy efficiently. Economies have initiated several new projects and investments in energy infrastructure development and the renewable energy sector. The quality of electricity supply — with respect to interruptions and reliability — also improved much more sharply in APEC economies than in OECD economies between 2014 and 2019. Average interruption frequency decreased from 7.3 times in 2014 to 3.5 times in 2018. Similarly, average interruption duration decreased from 10.0 hours to 5.5 hours over the same period. The cost of each kWh of electricity in the APEC region also fell between 2014 and 2019 from USD 0.15 to USD 0.14.

INSTITUTIONAL CONNECTIVITY

Efforts under this pillar aimed to improve trade facilitation, promote regulatory reform, increase digital flows, and build greater inclusiveness. The adoption of digital technologies was key within this pillar as well. Based on UNESCAP data, 10 APEC economies had fully implemented an Electronic Single Window (ESW) by 2019 — up from seven economies in 2015. Additionally, seven APEC economies had partially implemented an ESW by 2019 — up from five economies in 2015. The number of Authorised Economic Operators (AEOs) increased for both importers and exporters between 2014 and 2019. Specific to border agency cooperation, 9 out of 14 survey respondents reported to having an operational ESW system that connects to the Single Window systems of other economies. Most economies (10 out of 14 respondents) have also recognised Trade Identification Numbers (TINs) for their AEOs and have undertaken efforts to integrate SMEs into their domestic AEO programmes.

In addition, based on data from the World Bank's *Doing Business* initiative, less time is required to complete documentary and border compliance procedures for export and import. To complete documentary and border compliance, traders in the APEC region needed to spend almost 59 hours for export and 75 hours for import in 2019. In comparison, in 2015, the numbers were 69 hours for export and 89 hours for import. With regard to trade costs, the cost to export had been reduced to a regional average of USD 422 in 2019, while the cost to import had been reduced to regional average of USD 476.

Regulatory and structural reforms have been instrumental in facilitating trade, investment and services. While only a few economies have participated in the APEC-OECD Integrated Checklist on Regulatory Reform, regulatory coherence and the use of good regulatory practices (GRPs) has improved over the years. The adoption of GRPs are visible through APEC

economies' improvement in some indicators relating to two aspects of governance quality: open government and regulatory enforcement. APEC economies are also active members of several accreditation and standards organisations, which help to promote harmonisation.

Many economies have also introduced structural reform initiatives, including the enactment of new laws and regulations to improve the e-commerce environment and expand the application of safe and trusted ICT. The number of secure servers in APEC economies (per 1 million people) increased exponentially from 754 in 2014 to more than 17,000 in 2019. Globally, APEC economies host more than 65% of secure servers (totaling more than 50 million) in the world. In the financial sector, the multilateral APEC Region Funds Passport framework provides opportunities to waive or diminish key regulatory impediments to cross-border trade in managed funds.

Essential structural reforms in services could further support global value chain (GVC) performance, particularly in services sectors that have a strong supporting role in the operationalisation of firms. To ensure a wider positive impact from trade, gender-responsive policies are encouraged to help overcome institutional challenges and improve the facilitation of women's access to global markets. The survey found that 11 out of 14 economies surveyed had introduced initiatives to integrate SMEs into AEO programmes.

PEOPLE-TO-PEOPLE CONNECTIVITY

Cross-border science, technology and innovation exchanges promote high-quality innovation in the region. The number of intra-APEC cross-border students has increased, with the target of having 1 million intra-APEC tertiary-level international students by 2020 having been achieved in 2015 when there were 1.02 million tertiary-level cross-border students within the region.

Addressing the skills gap is also important to develop a vibrant domestic economy. Mutual recognition of skills and credentials can play an important role in facilitating skilled labour mobility and addressing labour and skills shortages. Several economies have implemented a Domestic Qualifications Framework as well as a labour market and skills-monitoring framework, while others have introduced similar substitutes. Additionally, reforms and cooperation in higher education can ensure that the quality of education is relevant to equip students with the skills and competencies required in a globally connected and knowledge-based society. Building entrepreneurship networks is also high on APEC economies' agenda as well as efforts to promote youth and women employment. This will address the issue of women and youth employability by helping to close the gap between education and skills.

In addition, travel and tourism facilitation initiatives have been implemented to develop the tourism industry among the APEC economies. The development of tourism facilitation policies and institutions serves to reduce the non-logistics costs and uncertainties associated with tourism. Visa facilitation efforts have been implemented by many economies through special visa waiver schemes and paperless platforms (including Single Window facility). Several economies have implemented domestic measures to ease visa restrictions for tourists and have initiated programmes to improve immigration processing. With respect to visa restrictions, there have been significant visa facilitation efforts since 2014, with more than 32 origin-destination pairs in the APEC region having either lifted visa requirements or implemented measures such as e-visas or visas-on-arrival. Efforts such as these have helped to enable international tourist arrivals to APEC to continually increase since 1998. However,

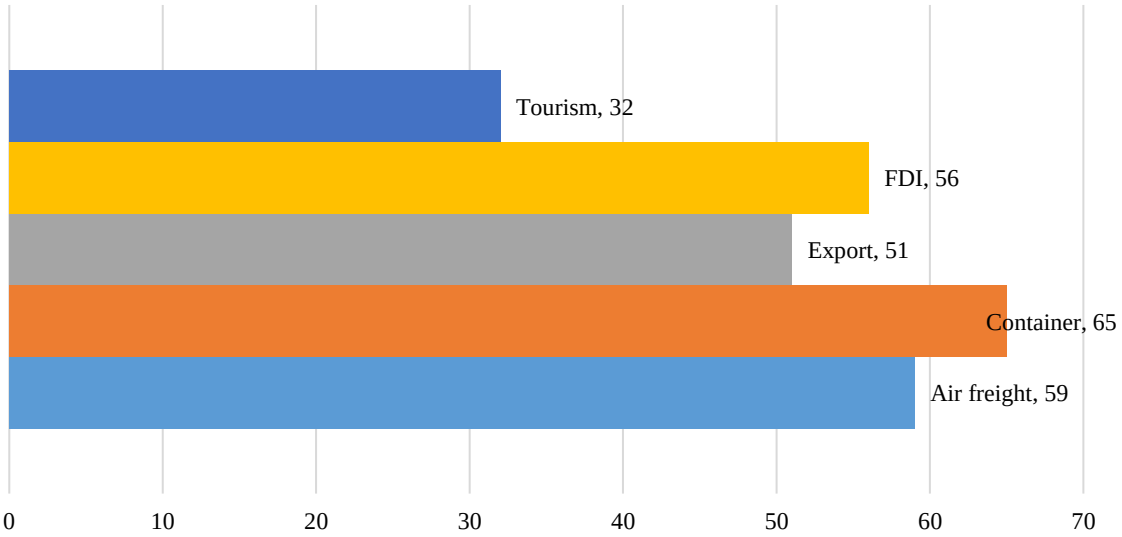
considerable increases are still needed to raise the number of tourist arrivals from 435 million in 2017 to the target of 800 million by 2025.

Business travel facilitation also helps to reduce the costs and uncertainties for business people to explore and maintain business opportunities and investments. The number of active ABTC holders has steadily risen since 1999, while the average pre-clearance processing time of ABTC applicants has decreased from 45 days in 2006 to 19 days in 2019. Finally, APEC members have also enhanced knowledge sharing and cultural understanding through events, which also help to promote and improve cross-border trade, investment and tourism.

WAY FORWARD

The Asia-Pacific region has been at the centre of global flows and networks, supported by the surge of flows from the developing economies. For example, the flows and networks of trade, capital and people in Asia are said to have redefined globalisation.[96] Globally, APEC economies contributed 51% of exports, 65% of container flows, 59% of air freight, 56% of FDI, and 32% of tourism arrivals in 2018 (Figure 5.1). These figures show the undeniable importance of connectedness for the region.

Figure 5.1: APEC share of global flows in 2018 (%)



Source: World Bank, World Development Indicators online database; United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), online data; and APEC Policy Support Unit staff calculations.

The current COVID-19 pandemic shows how the three pillars of connectivity — physical, institutional and people-to-people — are strongly intertwined. The disruptions in supply chains are not because of inadequate or damaged infrastructure facilities, but rather because employees are unable to work due to health-related restrictions. For example, truck drivers, warehouse staff, and port workers may be affected by quarantine measures.[97] The shipping sector, in particular, has been severely affected as vessels may need to be placed under quarantine for weeks before entering ports, causing delays, congestion, and high demurrage

[96] Tonby *et al.* (2019).
[97] Paris (2020).

costs, with some cargo being ruined or damaged as a result.[98] Additionally, certain sectors like tourism and the airline industry are expected to face serious challenges in the years ahead as international airline passengers are expected drop by 44-80% in 2020.[99] International travel is looking pretty bleak for the foreseeable future: IATA estimated that global passenger traffic (business and tourism) will not return to pre-COVID-19 levels until 2024.[100]

Global supply chain configurations are expected to adjust. Thus, there is a possibility of long-term shifts in global supply chains. In this context, it is of great importance to ensure supply chains remain open, resilient and stable. Businesses are now incentivised to strengthen their supply chains to become more resilient and agile. However, this could also lead to supply chains that are less efficient as businesses may need to embrace redundancies in anticipation of certain risks. Some experts have highlighted the possibility of re-shoring or near-shoring, leading future supply chains to become more regional. To improve connectivity, manufacturers and suppliers could also adopt digital technologies more extensively to allow greater digital collaboration.[101]

Companies may now need to rely on 'shorter' supply chains to minimise the risks of disruptions and to be closer to final customers. The process of automation may also enable certain leading firms to re-shore their production facilities.[102] This re-orientation of supply chains at the regional and company level will also create shifts in FDI patterns. Economies may need to strengthen their manufacturing base to remain competitive and to also attract and retain foreign investors and pursue high-tech manufacturing. Learning from economies that were most successful in surviving past global recessions, it was observed that although they had high levels of technology or well-developed digital economies, their base in manufacturing and production was also still strongly maintained.[103]

The big question is how to recover quickly and emerge stronger from the current situation. Flattening the recession curve and maintaining open trade policies should be the primary goal for economies.[104] Some economies have already initiated trade facilitation policies to promote recovery. For example, China has launched an emergency plan to promote cross-border trade facilitation, which "emphasized simplified customs procedures and reduced port charges, inspections and quarantine".[105]

Moving forward, the following recommendations may be considered by economies to maintain strong progress and recovery under the Connectivity Blueprint:

1. Maintain an open environment to global trade and investment. While highly connected economies may be more vulnerable to economic shocks, they are able to recover more quickly as recovery starts to build in their respective networks. Improving connectivity of supply chains will become essential for economic recovery.
2. Improve digital connectivity is an important element to build resilience. Being digitally connected allows firms to expand their supplier networks, enabling greater flexibility,

[98] Kumar (2020).
[99] Altman (2020).
[100] https://www.iata.org/en/pressroom/pr/2020-07-28-02/
[101] Dawkins (2018).
[102] Zachariadis (2019).
[103] Gu (2019).
[104] World Bank (2020b)
[105] Ugaz and Sun (2020).

and to have a more transparent supply chain that supports collaboration. This will allow firms to be more agile, to recover more quickly, and to resume normal operations faster.

3. Adoption of digital technology will allow faster progress in the three pillars of connectivity. Application of digital technology will allow interoperability of single windows, integration of SMEs under AEO programmes, broader internet access to reduce digital divide, as well as providing seamless facilitation of business people and travellers.
4. Continue to support APEC's regional economic integration agenda by implementing measures that support resiliency within GVCs. This may mean strengthening 'regional' value chains as geographical proximity may provide additional agility and resilience to existing supply chains. Regional value chains should be seen as building blocks and complementary to GVCs.
5. Re-orientation of supply chains at the regional and firm level will also create shifts in FDI patterns that may require economies to strengthen their manufacturing base to remain competitive and to also attract and retain foreign investors.

REFERENCES

Ahn, JaeBin and Romain Duval (2017). "How trade with China boosts productivity", IMFBlog, International Monetary Fund, Washington, D.C.

Altman, Steven A. (2020). "Will COVID-19 Have a Lasting Impact on Globalization?", *Harvard Business Review*, 20 May 2020.

APEC (1997). 1997 APEC Energy Ministers' Meeting Statement, APEC Secretariat, Singapore.

APEC (2011). "Annex D: Strengthening Implementation of Good Regulatory Practices", 2011 Leaders' Declaration, APEC Secretariat, Singapore.

APEC (2014a). "Annex D: APEC Connectivity Blueprint for 2015-2025", 2014 Leaders' Declaration, APEC Secretariat, Singapore.

APEC (2014b). *Report to Implement the APEC Connectivity Blueprint*, APEC Secretariat, Singapore.

APEC (2015). *APEC Telecommunications and Information Working Group Strategic Action Plan 2016-2020*.

APEC (2016). "APEC Makes Digital Economy Inclusion Push", News Release, APEC Secretariat, Lima, 18 August 2016.

APEC (2017a). *Enhancing Mutual Recognition and Regional Cooperation for Skills and Job Qualifications in the APEC Region*, APEC Secretariat, Singapore.

APEC (2017b). *Public-Private Partnerships for Transportation in the APEC Region: An Analysis and Literature Review*, APEC Secretariat, Singapore.

APEC (2018a). *APEC Economic Policy Report 2018: Structural Reform and Infrastructure*, APEC Secretariat, Singapore.

APEC (2018b). *APEC Guidebook on Quality of Infrastructure Development and Investment (2018 Revision)*, APEC Secretariat, Singapore.

APEC (2018c). 2018 APEC Finance Ministers' Meeting Statement, APEC Secretariat, Singapore.

APEC (2019a). *Proceedings of the APEC Workshop on Leveraging Digital Technology to Improve Education in Rural and Remote Areas*, APEC Secretariat, Singapore.

APEC (2019b). "The Digital Economy Can Deliver Massive Gains – If We Get Policies Right", News Release, APEC Secretariat, Atlanta, 5 March 2019.

APEC (2019c). *Compendium of Best Practice Technology Solutions for Single Window Interoperability*, APEC Secretariat, Singapore.

APEC (2019d). Reference Guide for Peer Review and Capacity Building on APEC Infrastructure Development and Investment, APEC Secretariat, Singapore.

APEC Policy Support Unit (2015). *APEC Connectivity Blueprint*, APEC Secretariat, Singapore.

APEC Policy Support Unit (2016). *Tourist Arrivals and Inclusive Growth*, APEC Secretariat, Singapore.

APEC Policy Support Unit (2018a). *Development and Integration of Remote Areas in the APEC Region*, APEC Secretariat, Singapore.

APEC Policy Support Unit (2018b). *Case Studies on Addressing Connectivity Challenges in APEC Economies*, APEC Secretariat, Singapore.

Arthur, Charles (2011). "What's a zettabyte? By 2015, the Internet will know, says Cisco", *The Guardian*, 29 June 2011

Atkinson, Robert D. (2017). "In Defense of Robots", *National Review*, 17 April 2017.

Baldwin, Richard, Tadashi Ito, and Hitoshi Sato (2014). "Portrait of Factory Asia: Production network in Asia and its implication for growth – the 'smile curve'", Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO), Joint Research Program Series No. 159, Chiba.

Baldwin, Richard (2018). "If this is Globalisation 4.0, what were the other three?", Centre for Economic Policy Research, VoxEU.org, 19 December 2018.

Bartholomew, David J., Fiona Steele, Jane Galbraith, and Irini Moustaki (2011). *Analysis of Multivariate Social Science Data*, 2nd edition, Chapman and Hall/CRC, Boca Raton.

Bloomberg News (2019). "China Pledges to Build 'Open' Financing System for Belt and Road", *Bloomberg News*, 25 April 2019.

Braw, Elisabeth (2020). "Blindsided on the supply side", *Foreign Policy*, 4 March 2020.

Bughin, Jacques and Jonathan Woetzel (2019). "Navigating a world of disruption", Executive Briefing, McKinsey Global Institute.

Cantens, Thomas, Robert Ireland, and Gaël Raballand (2012). *Reform by Numbers: Measurement Applied to Customs and Tax Administrations in Developing Countries*, World Bank, Washington, D.C.

Cavatassi, Romina and Davis, Benjamin and Lipper, Leslie (2014). Estimating Poverty Over Time and Space: Construction of a Time-Variant Poverty Index for Costa Rica (2004). ESA Working Paper No. 04-21, 2004.

Charumilind, Sarun, Matt Craven, Jessica Lamb, and Matt Wilson (2020). "Preventing future waves of COVID-19", Executive Briefing, McKinsey & Company.

Chin (2020). The impact of food supply chain disruptions amidst COVID-19 in Malaysia. *Journal of Agriculture, Food Systems, and Community Development*, 9(4), 161–163. https://doi.org/10.5304/jafscd.2020.094.031.

Cisco (2019). *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2017-2022*, White Paper.

Corcuera Santamaria, Sandra (2018). "CADENA, a blockchain enabled solution for the implementation of Mutual Recognition Arrangements/Agreements", WCO News 87, World Customs Organization, October 2018.

Dawkins, Brent (2018). "Supplier Connectivity Boost Supply Chain Performance", *Industry Today*, 13 August 2018.

De Lombaerde, Philippe (Ed.) (2006). *Assessment and Measurement of Regional Integration*, Routledge, London.

Deloitte (2018). *Managing Risk in Digital Transformation*.

Demeke, Abera Birhanu & Zeller, Manfred (2009). "Using panel data to estimate the effect of rainfall shocks on smallholders food security and vulnerability in rural Ethiopia," Research in Development Economics and Policy (Discussion Paper Series) 57994, Universitaet Hohenheim, Department of Agricultural Economics and Social Sciences in the Tropics and Subtropics.

Demirgüç-Kunt, Asli, Leora Klapper, Dorothe Singer, Saniya Ansar, and Jake Hess (2018). *The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution*, World Bank, Washington, D.C.

Elisha Sawe, Benjamin (2017). "Best Access to Secure Internet Servers in the World", *World Atlas*, 25 April 2017.

Eurostat (2014). Towards a harmonised methodology for statistical indicators — Part 1: Indicator typologies and terminologies.

Filmer, D., & Pritchett, L. (2001). Estimating Wealth Effects without Expenditure Data-or Tears: An Application to Educational Enrollments in States of India. Demography, 38(1), 115-132. Retrieved September 25, 2020, from http://www.jstor.org/stable/3088292

Foster, Vivien and Samantha Helen Witte (2020). "Falling Short: A Global Survey of Electricity Tariff Design", Policy Research Working Paper No. 9174, World Bank, Washington, D.C.

Fugazza, Marco and Jan Hoffmann (2017). "Liner shipping connectivity as determinant of trade", *Journal of Shipping and Trade*, Vol. 2, No. 1, December 2017.

Gu, Vanessa (2019). "South Korea's secret for growth? Keep manufacturing", *GovInsider*, 10 April 2019.

Guan, D., Wang, D., Hallegatte, S., Davis, S., Huo, J., Li, S., Gong, P. (2020, June 03). Global supply-chain effects of COVID-19 control measures. Retrieved September 25, 2020, from https://www.nature.com/articles/s41562-020-0896-8

Hadfield (2017). "Superregulation: Competitive Approved Private Regulators". Unpublished paper. Available at: http://works.bepress.com/ghadfield/63/.

Hredzak (2020). "Food Security Response Measures to COVID-19". APEC Policy Support Unit (September, 2020). Available at: https://www.apec.org/Publications/2020/10/Food-Security-Response-Measures-to-COVID-19.

Huh, Hyeon-Seung and Cyn-Young Park (2017). *Asia-Pacific Regional Integration Index: Construction, Interpretation, and Comparison*, ADB Economics Working Paper Series No. 511, Asian Development Bank, Manila.

International Labour Organization (2018). "Skills for migration and employment", Skills for Employment Policy Brief, Geneva.

International Trade Centre (2017). 'Closing the Small-Business and Gender Gap to Make Trade More Inclusive' in *Aid for Trade Global Review 2017: Promoting Trade, Inclusiveness and Connectivity for Sustainable Development*, World Trade Organization and OECD, Geneva.

Kellermann, Martin (2019). *Ensuring Quality to Gain Access to Global Markets: A Reform Tookit*, World Bank, Washington, D.C.

Kumar, Ambrish (2020). "Covid 19: Effect of the Pandemic on Logistics and Supply Chain", *Entrepreneur*, 17 April 2020.

Lambert, L. (2020). 75% Of Companies Report Coronavirus Has Disrupted Their Supply Chains. [online] Fortune. [Accessed 25 September 2020].

Lamy, Pascal (2013). "Global value chains, interdependence, and the future of trade", Centre for Economic Policy Research, VoxEU.org, 18 December 2013.

Lemma, Alberto (2013). *Literature Review: Evaluating the Costs and Benefits of Centralised PPP Units*, Overseas Development Institute, London.

Lewis, James Andrew (2018). *Economic Impact of Cybercrime – No Slowing Down*, The Center for Strategic and International Studies (CSIS) and McAfee, Washington, D.C.

Liang, L., 2020. BDI Plunges To Four-Year Low, Capesize Vessels Hardest Hit. [online] Seatrade Maritime. Available at: <https://www.seatrade-maritime.com/dry-cargo/bdi-plunges-four-year-low-capesize-vessels-hardest-hit> [Accessed 25 September 2020].
International Energy Agency (2017). *Energy Efficiency 2017*, Paris.

Light Reading News, "Cisco: Global Internet traffic to hit 4.8 zettabytes per year by 2022", 27 November 2018.

Lund, Susan, James Manyika, Jonathan Woetzel, Jacques Bughin, Mekala Krishnan, Jeongmin Seong, and Mac Muir (2019). "Globalization in transition: The future of trade and value chains", McKinsey Global Institute.

Manyika, James, Sree Ramaswamy, Somesh Khanna, Hugo Sarrazin, Gary Pinkus, Guru Sethupathy, and Andrew Yaffe (2015). "Digital America: A tale of the haves and have-mores", McKinsey Global Institute.

Maur, Jean-Christophe (2008). *Regionalism and Trade Facilitation: A Primer*, Policy Research Working Paper, No. WPS 4464, World Bank, Washington, D.C.

Mikuriya, Kunio (2016). "Digital Customs, the opportunities of the Information Age", WCO News 79, World Customs Organization, February 2016.

Mold, Andrew and Anthony Mveyange (2020). "Trade in uncertain times: Prioritizing regional over global value chains to accelerate economic development in East Africa", The Brookings Institution, Washington, D.C.

Mühleisen, Martin (2018). "The long and short of the digital revolution", *Finance & Development*, vol. 55, no. 2, June 2018, pp. 4-8, International Monetary Fund, Washington, D.C.

Narishkin, Abby, Medha Imam, and Clancy Morgan (2020). "Why potato farmers are stuck with billions of pounds of potatoes", *Business Insider*, 30 June 2020.

Nathan Associates (2017). *2016 Final Report on Good Regulatory Practices in APEC Economies*, APEC Secretariat, Singapore.

Niérat, Patrick and David Guerrero (2019). *UNCTAD maritime connectivity indicators: review, critique and proposal*, Article No. 42 [UNCTAD Transport and Trade Facilitation Newsletter N°84 - Fourth Quarter 2019].

OECD (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*, Paris.

Paris, Costas (2020). "Coronavirus wreaks growing damage on Italian shipping, supply chains", *The Wall Street Journal*, 25 March 2020.

Petrella, Stephanie (2018). "What Is an Economic Corridor?", Center for Strategic and International Studies, Washington, D.C.

Poot, Jacques (2015). "Cross-border migration and travel: A virtuous relationship", IZA World of Labor.

Reinsel, David, John Gantz, and John Rydning (2018). "The Digitization of the World: From Edge to Core", White Paper US44413318, International Data Corporation (IDC), Framingham.

Remes, Jaana, James Manyika, Jacques Bughin, Jonathan Woetzel, Jan Mischke, Mekala Krishnan (2018). "Solving the Productivity Puzzle: The Role of Demand and the Promise Of Digitization". McKinsey Global Institute.

Saisana, Michaela, Andrea Saltelli, and Stefano Tarantola (2005). "Uncertainty and Sensitivity Analysis Techniques as Tools for the Quality Assessment of Composite Indicators", *Journal of the Royal Statistical Society*, Vol. 168, No. 2, March 2005, pp. 307-323.

Seric, Adnan, Holger Görg, Saskia Mösle, and Michael Windisch (2020). "Managing COVID-19: How the pandemic disrupts global value chains", Department of Policy Research and Statistics, United Nations Industrial Development Organization (UNIDO), Vienna.

Sharpe, Andrew (2004). "Literature Review of Frameworks for Macro-indicators", CSLS Research Report 2004-03, Centre for the Study of Living Standards, Ottawa.

Shepherd, Ben, Anirudh Shingal, and Anasuya Raj (2016). *Value of Air Cargo: Air Transport and Global Value Chains*, International Air Transport Association (IATA), Montreal.

Sierra Galindo, María Elena and Gloria María Domínguez Rodríguez (2020). *AEO in APEC Economies: Opportunities to expand Mutual Recognition Agreements and the inclusion of SMEs*, Inter-American Development Bank, Washington, D.C.

Tonby, Oliver, Jonathan Woetzel, Wonsik Choi, Karel Eloot, Rajat Dhawan, Jeongmin Seong, and Patti Wang (2019). "The Future of Asia: Asian flows and networks are defining the next phase of globalization", Discussion Paper, McKinsey Global Institute.

Ugaz, Pamela and Sijia Sun (2020). "Case Study: China's Trade Facilitation Responses to the COVID-19 Pandemic", UNCTAD Transport and Trade Facilitation Newsletter, Special COVID-19 Edition, 22 May 2020.

United Nations Economic Commission for Europe (2019). "UN/CEFACT to showcase country experiences of using Single Windows to streamline cross-border trade", News Release, Geneva, 10 October 2019.

Wilhelmsen, COVID-19 Global Port Restrictions Map.

World Bank (2016). *Benchmarking Public-Private Partnerships Procurement 2017*, Washington, D.C.

World Bank (2018). *Procuring Infrastructure Public-Private Partnerships Report 2018*, Washington, D.C.

World Bank (2019a). *Global Connectivity Outlook to 2030*, Washington, D.C.

World Bank (2019b). *Doing Business 2020*, Washington, D.C.

World Bank (2020a). *World Development Report 2020: Trading for Development in the Age of Global Value Chains*, Washington, D.C.

World Bank (2020b). *World Bank East Asia and Pacific Economic Update, April 2020: East Asia and Pacific in the Time of COVID-19*, Washington, D.C.

World Customs Organization (2018). *Guidelines on Trader Identification Number*, Brussels.

World Economic Forum (2016). *The Global Information Technology Report 2016*, Geneva.

World Economic Forum (2017). *The Future of Electricity: New Technologies Transforming the Grid Edge*, Geneva.

World Trade Organization (2018). *World Trade Report 2018: The future of world trade*, Geneva.

World Trade Organization (2020). "Trade Statistics and Outlook: Trade set to plunge as COVID-19 pandemic upends global economy", Press Release 855, 8 April 2020.

Zachariadis, Ioannis (2019). "Global and regional value chains: Opportunities for European SMEs' internationalisation and growth", Briefing, European Parliamentary Research Service (EPRS).

APPENDIX

APPENDIX A: USING PRINCIPAL COMPONENT ANALYSIS (PCA) TO MEASURE CONNECTIVITY

Principal Component Analysis (PCA) is a multivariate analysis which intends to reveal the patterns of association and relationship of indicators (variables) with each other. It tries to explain the variance of the observed indicators through multiple linear combinations of the original data. There are two ways in which PCA can be used in measuring connectivity and developing the connectivity index: 1) as a weighting scheme to be used in building a composite indicator, and 2) as a selection method to shortlist indicators which are most useful to the analysis. The practical description is presented below.

Weighting scheme to build a composite indicator

There are several ways to construct a composite indicator. The simplest way is by averaging the normalised form of a basket of indicators. This method will ascribe equal weights for the indicators, which could lead to two potential problems: 1) double counting, and 2) unbalanced structure of the composite index. Double counting occurs when there is a high correlation between the indicators. At the same time, simply ascribing equal weights to all indicators might result in an unbalanced structure in the overall composite index. As such, if the composite indicator (index) was computed by pillars (or groups), those with a higher number of indicators would carry higher weights. It is also conceptually problematic as this method assumes that all indicators have equal contributions to multi-dimensional concepts such as connectivity.

Ideally, weights of the indicators should have an empirical basis. There are several methods to implement this, and PCA is among the popular ones. PCA resolves the aforementioned problems by finding interrelationships ("patterns of correlation") among numerous indicators, which could be used as a weighting scheme to build a composite indicator. The creation of a composite indicator allows for more convenience in analysing a multi-dimensional concept as end-users would only have to look at a single index rather than each of the indicators. Some institutions that have applied PCA as the weighting method in developing an index include the Asian Development Bank (Asia-Pacific Regional Integration Index) and the World Bank (Logistics Performance Index).

In the Asia-Pacific Regional Integration Index of the ADB in 2017[106], the authors mainly used the following statistics from PCA: 1) normalised square of loadings, and 2) the proportion of explained variance. The loadings represent the correlation coefficient between a variable (representing an indicator) and the component, while the square of loadings correspond to the variance. Note that only the relevant principal components were considered. In this paper, the PSU used only the first principal component; as such, the weights used are the square of loadings.

[106] Huh and Park (2017).

Selection of indicators

While generating a composite indicator (index) allows for the simplification of complex information, it comes with disadvantages. For instance, some statisticians criticise this simplification for reducing valuable information to a single metric of dubious significance.[107] As such, the merit of creating a composite indicator instead of simply looking at indicators separately is still a subject of academic debate. Moreover, there is no universally accepted weighting scheme; hence, the selection of the scheme is often arbitrary.[108]

Given the above criticisms on the generation of a composite indicators/index, another option is to use PCA as an indicator selection method instead of as a weighting scheme. In this endeavour, PCA is used in shortlisting a large number of indicators based on their explanatory power. If PCA is used as a selection method, then only the first principal component will be used as reference. It is assumed that the first principal component is the appropriate summary measure as it explains the maximum possible variation in the original set of indicators. For instance, when analysing numerous variables representing a multi-dimensional concept, PCA could help to pinpoint those that are most relevant. This is done by looking at the loadings of the variables under principal component. Those with high loadings will be retained for further analysis; thus, making the analysis simpler as unnecessary variables which explain only minimal variation in the multi-dimensional concept can be left out.

Another PCA-related method is the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy.[109] Basically, after a PCA calculation, we could generate KMO statistics for each individual indicator as well as for the overall indicators. In general, it is advisable to drop the individual indicators with the lowest individual KMO statistical values, such that overall KMO rises above 0.6.[110]

[107] Saisana *et al.* (2005).
[108] Sharpe (2004).
[109] For a discussion, see "Postestimation tools for pca and pcamat" of the Stata User's Guide: Release 13.
[110] OECD (2008).

APPENDIX B: DEFINITION OF INDICATORS FOR THE CONNECTIVITY INDEX

The following briefly discusses each of the selected indicators used to construct the connectivity index.

Physical Connectivity

Infrastructure score – Logistics Performance Index (LPI)

This indicator is part of the World Bank's LPI indicators and attempts to measure and assess the quality of trade and transport infrastructure, such as ports, railroads, roads, and information technology, and is rated from "very low" (1) to "very high" (5).

The *Logistics Performance Index* 2018 report highlighted the following nature of LPI indicators:

1. LPI scores are constructed based on industry perceptions of relative performance. As such, worsening scores in some economies may reflect industry's perceptions that other economies are improving faster and may not necessarily reflect a worsening condition or performance of any particular economy.
2. The LPI score does not purely measure current performance as it may also include expectations and trends of planned improvements.
3. LPI assessments may also be influenced by the types of cargo handled.
4. For large economies that have sizable domestic markets and domestic logistics systems, LPI is biased towards the performance of the main import gateways.

Air freight – World Development Indicators (WDI)

The air freight data (in million ton-km) is provided by the International Civil Aviation Organization (ICAO), Civil Aviation Statistics of the World, and ICAO staff estimates. Air freight is the volume of freight and express carried on each flight stage (operation of an aircraft from takeoff to its next landing), measured in metric tons times kilometers traveled.[111] This indicator is used to reflect trade connectivity for air cargo. A higher score in terms of air freight can be used as a proxy to measure the quality of air transportation networks considering more cargo can now be transported. Within PCA calculations made, the value of this indicator is divided by the population to control for size.

Liner Shipping Connectivity Index – UNCTAD

The Liner Shipping Connectivity Index (LSCI) measures the average of five components of the maritime transport sector: number of ships, their container-carrying capacity, maximum vessel size, number of services, and number of companies that deploy container ships in an economy's ports. This indicator is calculated by UNCTAD and is essentially an indicator for the supply of liner shipping services.

[111] Source: https://datacatalog.worldbank.org/air-transport-freight-million-ton-km-1

Niérat and Guerrero noted that while the LSCI considers the position of an economy globally, in certain cases, an economy with very good connections to some economies (due to their close trading relations), but poor connections to others, may receive an average score. As such, even if economies are well connected with their most important trading partners, they could be 'penalized' for not having a connection with the rest of the world, even if this lack of connection is due to valid economic reasons.[112] Hence, low LSCI scores do not always mean that an economy is inaccessible as economies with low LSCI scores may be well connected to their main trading partners. Similarly, high LSCI scores may not guarantee higher trade with other economies. Nevertheless, Fugazza and Hoffmann showed that a weak direct maritime connection with a trading partner is associated with lower values of exports and also that any additional transshipment is associated with a 40% lower value of bilateral exports.[113]

Percentage of individuals using the internet - International Telecommunication Union (ITU)

Internet users are persons who have used the Internet via a computer, mobile phone, personal digital assistant, games machine, digital TV, etc. in the last three months.[114] The data are provided by the International Telecommunication Union and are published in the World Telecommunication/ICT Development Report and database. This indicator is also included in the Networked Readiness Index (2012-2016) constructed by the World Economic Forum.

Foreign value added - Global Value Chain

Cross-border trade has been dominated by trade in intermediaries, signifying the importance of global value chains (GVCs). The reason to include a GVC related indicator is to capture the extent of services within trade. The foreign value added (FVA) indicator is taken from the UNCTAD-Eora Global Value Chain (GVC) database.[115] The FVA share measures the share of foreign value added in total exports; this indicator is the most fundamental GVC indicator to measure the rate of GVC participation and linkages.

Initially, trade as a percentage of GDP was considered as an indicator, but the trade to GDP data had a negative correlation coefficient with the rest of the indicators in this pillar and was hence removed.

Institutional Connectivity

Customs score – LPI

This indicator from the Logistics Performance Index (LPI) looks at the efficiency of the clearance process by border agencies (including customs) from an overall logistics environment using a 1-5 scale with 5 being the best. The efficiency factors assessed are speed, simplicity, and predictability of formalities.

[112] Niérat and Guerrero (2019).
[113] Fugazza and Hoffmann (2017).
[114] Source: https://datacatalog.worldbank.org/individuals-using-internet-population
[115] Available here.

According to the 2014 LPI report, the efficiency of border processes affects import lead times. Higher lead times are common in low-performing economies that practice physical inspection of goods at the arrival border.

Business impact of rules on FDI – World Economic Forum (WEF)

Investment is one of the key elements in the Connectivity Blueprint. Several indicators were considered to reflect investment in the connectivity index, such the FDI share of GDP and the OECD's FDI Regulatory Restrictiveness Index. The business impact of rules on FDI from the WEF was chosen since the indicator had a higher component loading score based on the PCA method.

This indicator is based on the WEF's Executive Opinion Survey responses to the following question: "In your (economy), how restrictive are rules and regulations on foreign direct investment (FDI)? [1 = extremely restrictive; 7 = not restrictive at all]".

Number of secure servers – World Bank/Netcraft

Electronic commerce is on the rise and is considered to be one of the drivers of future global trade. The World Trade Organization (WTO) noted that in 2016, the value of e-commerce transactions totalled USD 27.7 trillion, of which 86% were business-to-business e-commerce transactions.[116]

This indicator tries to capture the importance of e-commerce by measuring the number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Server Survey (per 1 million people). The Netcraft Secure Server Survey examines the use of encrypted transactions through extensive automated exploration, tallying the number of websites using HTTPS.[117]

Regulatory quality – Worldwide Governance Indicators

The regulatory quality indicator of the World Bank's Worldwide Governance Indicators project "captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development".

The indicator covers aspects such as competition policy, price controls, discriminatory tariffs and taxes, prevalence of non-tariff barriers, stringency of environmental regulations, and business and investment regulations.[118] This indicator is used to reflect the following sub-pillar of the Blueprint: "Structural Reform: Fostering transparency, safety, competition and better functioning markets (including e-commerce in the Asia-Pacific)".

[116] World Trade Organization (2018).
[117] Source: https://www.indexmundi.com/facts/indicators/IT.NET.SECR.P6
[118] Source: https://info.worldbank.org/governance/wgi/Home/Documents

Regional trade agreements count – World Trade Organization

A regional trade agreement (RTA) is a treaty between two or more governments that define the rules of trade among them. RTAs grant more favourable conditions than for trade with other WTO members and depart from the guiding principle of non-discrimination.[119]

This indicator is based on Mario Larch's Regional Trade Agreements Database, which includes all multilateral and bilateral RTAs as notified to the World Trade Organization from 1950 to 2019.[120]

Time required to import (transformed) – Doing Business

This indicator is taken from the World Bank's *Doing Business* initiative, under the trading across borders topic. The data are collected based on a questionnaire administered to local freight forwarders, customs brokers, port authorities, and traders. The time to import is a summation of two processes: documentary compliance and border compliance. Time spent for documentary compliance captures 1) time associated with compliance with the documentary requirements of all government agencies of the origin economy, the destination economy, and any transit economies, including time spent to get the document issued and stamped; 2) time spent gathering information to complete the customs declaration or certificate of origin; 3) time spent waiting for the relevant authority to issue a phytosanitary certificate; 4) time spent showing a port terminal receipt to port authorities; and 5) time spent submitting a customs declaration to the customs agency in person or electronically.[121] For border compliance, the time spent for import includes the time needed to comply with customs regulations and with regulations relating to other mandatory inspections, such as the time spent for conducting a phytosanitary inspection.

As higher values of this indicator reflect lower performance, this indicator is rescaled using the following formula, where *v* refers to the variable value:

$$\frac{max\_value - V}{max\_value - min\_value}$$

People-to-People Connectivity

Tertiary inbound mobility – UNESCO

The inbound mobility rate measures the number of students from abroad studying in a given economy, expressed as a percentage of total tertiary enrolment in that economy.[122] This number is calculated by UNESCO and serves to measure the cross-border flows of tertiary education.[123] Note that this indicator is also used in the construction of the World Intellectual Property Organization's Global Innovation Index[124] and the DHL Global Connectedness Index.[125]

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[119] See the User Guide for the World Trade Organization's Regional Trade Agreements Database here.
[120] See the methodology of the World Trade Organization's Regional Trade Agreements Database here.
[121] See the methodology of the World Bank's *Doing Business* Trading across Borders topic here.
[122] Source: http://uis.unesco.org/en/uis-student-flow
[123] Data for regional groupings are taken from here.
[124] World Intellectual Property Organization, Global Innovation Index.
[125] DHL Global Connectedness Index.

International tourist arrivals – World Tourism Organization (as a percentage of total population)

International inbound tourists (overnight visitors) are the number of tourists who travel to another economy for a period not exceeding 12 months and whose main purpose for visiting is not business. There are some variations as to how the data are collected: for some economies, the number of arrivals is limited to arrivals by air, while for others arrivals staying in hotels are included. Similarly, some include arrivals of diaspora, while others exclude them.[126] Note that this indicator is also used in the DHL Global Connectedness Index.

International migrant stock (as a percentage of total population)

An international migrant is defined as any person who changes his or her economy of usual residence. Stocks are defined as "the total number of international migrants present in a given economy at a particular point in time".[127]

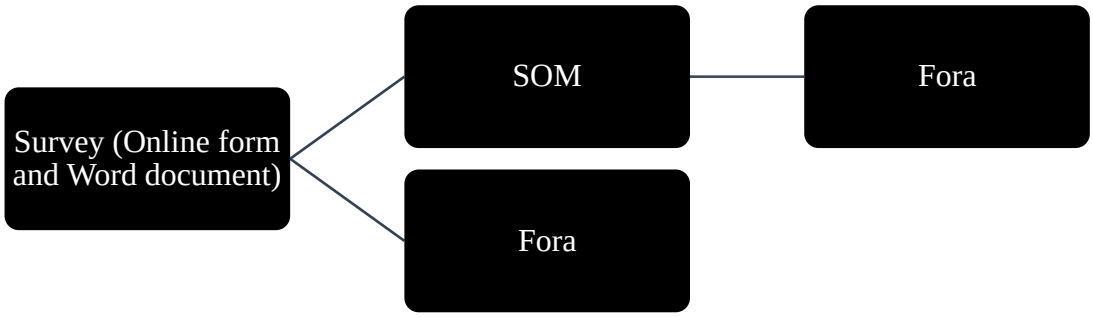
International migrants as a percentage of total population is used to estimate labor mobility in each economy. A community of diaspora may strengthen global business networks leading to stronger trade and cooperation; easier global mobility may facilitate this process.[128] The data are taken from the 2019 revision of the United Nations data on international migrant stock.[129] Note that this indicator is also used in the DHL Global Connectedness Index.

[126] Source: https://datacatalog.worldbank.org/international-tourism-number-arrivals-0
[127] Source: https://migrationdataportal.org/themes/international-migrant-stocks
[128] Poot (2015).
[129] Source: https://www.un.org/en/development/desa/population/migration/index.asp.

APPENDIX C: OVERVIEW OF SURVEY METHODOLOGY

Methodology

Given the technical nature of the questions, the survey was disseminated to both Senior Officials and relevant fora, which include: IEG; TPTWG; TELWG; DESG; EWG; SCCP; EC; HRDWG; TWG; BMG; SCSC; and CTI. Submissions were requested from each APEC economy in each forum as well as those within Senior Officials' Meeting (SOM). In addition to specific questions directed towards SOM as well as fora, Senior Officials were given the option of providing additional responses to all questions through the online form.



The collection period for survey responses was between 23 April 2020 and 31 July 2020. The initial deadline for submissions was set for 9 May 2020; the PSU provided several extensions to submit the survey. In general, responses to the survey for all 21 APEC economies were received over the response collection period.

Table C.1: Overview of responses received

	April	May	June	July	August
Number of responses received	9	98	31	1	2

Some questions in the survey were assigned to more than one forum. When multiple responses to a question were received from an economy, responses from the different fora were aggregated for analysis. The PSU reached out to the respective forum representatives when further clarification was required.

Overview of Survey Questionnaire

The survey was designed to cover all aspirational targets for each of the three pillars as highlighted in "Annex B: Aspiration Targets for the Individual Pillars" of the APEC Connectivity Blueprint.[130] Table C.2 provides an overview of the questions that respondents were asked under each sub-

[130] APEC Policy Support Unit (2015).

pillar. The survey covers all sub-pillars and was structured to complement information collected through external indicators as part of the quantitative assessment presented in this report.

Table C.2: Questions matched with Sub-Pillars of the Connectivity Blueprint

Pillar	Sub-pillar	Description	Questions
Physical Connectivity	1	Promote public–private partnership (PPP)	2; 5; 6; 7; 8
	2	Increase the quality of infrastructure in the Asia-Pacific region	1
	3	Enhance (1) people centered investment and (2) good practices and principles	3; 4
	4	Increase the quality of APEC transport networks	9; 10
	5	Increase broadband internet access throughout APEC	11; 12; 13; 14; 15; 16; 17
	6	Ensure quality electricity supply for all APEC members	18; 19
Institutional Connectivity	1	Modernise customs and border agencies	1; 2; 3; 4; 5; 6; 7; 8; 9; 10
	2	Improve supply chain performance	11
	3	Enable a whole-of-government approach in the development of regulations, including coordination across regulatory, standards, and trade agencies	12
	4	Fostering transparency, safety, competition, and better functioning markets (including e-commerce) in the Asia-Pacific region	14
	5	Enhance trade facilitation through removal of technical barriers to trade	13
People-to-People Connectivity	1	Meet pre-clearance processing time as established in the ABTC Operating Framework	1
	2	- Increase the number of intra-APEC international students - Cultural exchange events by each economy in every other economy - Advance work on cross-border science, technology, and innovation exchange	2; 3; 4; 5
	3	- Higher number of total tourist arrivals in APEC - Reduce travelers' costs and uncertainties relating to tourism	6; 7
	4	-Establish an APEC-wide mechanism to monitor and respond to regional skills gaps - Increase number of APEC-wide mutual recognition agreements for skilled and technical workers, where appropriate	8; 9; 10; 11; 12

Under physical connectivity, there are six sub-pillars. Corresponding to each of these sub-pillars, the survey solicited specific information on the following areas:

- To promote public-private-partnership: presence of PPP centres; investment in road, rail, airport and port infrastructure
- To increase quality of infrastructure in the Asia-Pacific region: usage of comprehensive assessment methods in infrastructure evaluations; quality and sustainability characteristics integrated in road, rail, airport, port and ICT infrastructure investments
- To enhance people-centred investment as well as good practices and principles: presence of legal, regulatory, or administrative provisions to encourage investment projects that are people-centred and sustainably financed

- To increase quality of APEC transport networks: capacity of transport infrastructure network; major capacity expansion initiatives for transport infrastructure
- To increase broadband Internet access throughout APEC: type of broadband technology used; coverage of broadband network; broadband speeds; investment in broadband networks; regional collaboration to develop next-generation high-speed broadband
- To ensure quality electricity supply for all APEC members: information on power/electricity infrastructure; investment made to develop power/electricity infrastructure

Under institutional connectivity, there are five sub-pillars. Corresponding to each of these sub-pillars, the survey solicited specific information on the following areas:

- To modernise customs and border agencies: status and type of Single Window System; domestic agencies' interoperability to the Single Window; Authorised Economic Operator (AEO) importers and exporters; inclusion of small and medium enterprises (SMEs) into AEO programmes; recognition of Trade Identification Numbers; facilitation of pre-arrival processing
- To improve supply chain performance: participation in global or regional supply chain initiatives
- To enable a whole-of-government approach in the development of regulations, including coordination across regulatory, standards, and trade agencies: participation in the APEC-OECD Integrated Checklist on Regulatory Reform
- To foster transparency, safety, competition, and better functioning markets, including e-commerce in the Asia-Pacific region: structural reform expanding the application of safe and trusted ICT and e-commerce environment
- To enhance trade facilitation: APEC framework for the harmonisation of standards; conformity assessment procedures; alignment of domestic standards to international standards and/or strengthening of conformity assessment capability

Under people-to-people connectivity, there are four sub-pillars. Corresponding to each of these sub-pillars, the survey solicited specific information on the following areas:

- To meet pre-clearance processing time as established in the ABTC Operating Framework: information on the cost, time, and usage of the ABTC scheme
- To increase the number of intra-APEC international students, cultural exchange events, and cross-border science, technology and innovation exchanges: extent of cross-border student exchanges; cultural awareness events; knowledge sharing and dissemination events
- To increase the number of total tourist arrivals and reduce travellers' costs and uncertainties: tourist arrivals; adoption of a Code of Conduct for Travel Providers
- To establish an APEC-wide mechanism to monitor and respond to regional skills gaps and increase the number of APEC-wide mutual recognition agreements for skilled and technical workers: adoption of a Domestic Qualifications Framework and a labour market and skills monitoring framework; efforts to narrow skills gaps; Mutual Recognition Agreements (MRAs) on labour mobility for skilled and technical workers

Overview of Survey Responses

Economies responding within each group (SOM and fora)

The number of economies within each group that responded to the survey ranged from 6 to 16 (Table C.3). The largest number of responses received were from SOM. Despite receiving responses from all groups, the proportion of APEC economies responding within each group was only slightly more than half for most groups. Considering the response rate, the PSU complemented the survey data with relevant data from secondary sources.

Table C.3: Number of economies responding within each group

APEC Group	Number of Economies that Responded
BMG	10
CTI	11
DESG	6
EC	13
EWG	9
HRDWG	12
IEG	12
SCCP	12
SCSC	14
SOM	16
TELWG	12
TPTWG	13
TWG	14

Issues with the survey responses received

While the survey was helpful in gathering data and information directly from economies in order to better assess connectivity targets, there are a few limitations. First, the number of respondents for each question was low with most questions having less than half of APEC economies responding. Arguably, this is understandable given that the COVID-19 pandemic has required economies to divert their attention elsewhere. For instance, half of the survey responses were collected after the first deadline extension (15 May 2020). However, this resulted in a lack of information collected and, as such, may result in the information not being entirely representative of the APEC region.

Second, due to varying context and circumstances of each economy, some members noted that they do not gather the information requested in some questions. Examples of such information include the popularity of certain broadband technology within an economy and the number of AEO operators distinguished by importers and exporters. Possible reasons include practical constraints, such as cost and difficulties in collecting such information, as well as the sensitivity of some information.

Third, due to the unique features of economy-specific initiatives, further elaboration or a more detailed explanation is typically required for an accurate analysis and assessment of the initiatives' contribution to the respective connectivity targets. For instance, in questions on comprehensive assessment methods in infrastructure evaluations, economies were asked to provide some

examples on how they have been incorporated. While examples of actual projects introduced were very useful, they did not always provide elaboration on how these comprehensive assessment methods were used in these projects.

Lastly, while economies provided data for some questions in the survey, the data were often sparse and had not been provided for all the years requested. Hence, this made comparing across years difficult. To address this issue, the responses from economies were supplemented with data from external sources or filled with data from either the previous or following years. In all instances where this was done, it is indicated explicitly in the source or note of the corresponding figure.

APPENDIX D: TIME SERIES DATA USED FROM SURVEY RESPONSES

Australia

	2014	2015	2016	2017	2018	2019
Proportion of population covered by mobile cellular network	87.0	94.0	98.0	99.0	99.4	99.4
Cost of electricity (in USD/kWh)	0.26	0.22	0.18	0.22	0.23	0.21

Brunei Darussalam

	2014	2015	2016	2017	2018	2019
Number of tourist arrivals from APEC economies (in millions)	0.17	0.18	0.19	0.21	0.23	0.29
Number of tourist arrivals from non-APEC economies (in millions)	0.035	0.035	0.031	0.045	0.043	0.045

Canada

	2014	2015	2016	2017	2018	2019
Total length of railroad network (in KM)	45,254	45,200	41,449	41,465	-	-
Total length of paved road network (in KM)	-	-	449,000	-	-	-
Total number of airports	558	561	534	517	483	564
Total number of ports	559	559	559	558	557	555
Proportion of population covered by a fixed broadband network	97.0	98.0	98.4	98.7	98.8	-
Total private sector investment in fixed broadband (in million USD)	6,426.8	6,412.3	6,940.2	7,473.4	7,485.6	-
Proportion of population covered by mobile cellular network	99.0	99.0	99.0	99.4	99.5	-
Total number of cultural awareness events	-	-	315	442	439	298
Total number of knowledge sharing events	-	-	457	531	444	339

Chile

	2014	2015	2016	2017	2018	2019
Total length of railroad network (in KM)	5,487	5,487	5,487	-	-	-

Total length of paved road network (in KM)	19,556	19,85	20,319	20,582	20,681	-
Total number of cultural awareness events organised	55	47	57	63	53	41
Total number of knowledge sharing events	1	1	-	-	-	7
Number of tourist arrivals from APEC economies (in millions)	0.87	0.93	1.01	1.02	1.07	1.09
Number of tourist arrivals from non-APEC economies (in millions)	2.80	3.55	4.63	5.43	4.65	3.43

China

	2014	2015	2016	2017	2018	2019
Total number of road PPPs	-	115	376	666	821	882
Total number of rail PPPs	-	8	27	32	27	28
Total number of port PPPs	-	5	15	22	28	30
Total number of airport PPPs	-	7	14	11	9	10
Total value of public and private road PPP (in million USD)	-	77,077.62	254,346.55	384,686.23	477,633.08	551,503.72
Total value of public and private rail PPP (in million USD)	-	3,955.05	16,786.87	17,623.07	34,947.32	34,537.74
Total value of public and private port PPP (in million USD)	-	958.65	3,240.28	6,998.33	8,904.23	8,287.03
Total value of public and private airport PPP (in million USD)	-	1,425.94	4,614.36	4,299.61	1,532.66	4,773.91
Total length of railroad network (in KM)	112,000	121,000	124,000	127,000	131,000	139,000
Total number of airports	202	210	218	229	235	238
Total number of ports	31,705	31,259	30,388	27,578	23,919	22,893
Total capacity of airports (in Millions of passengers)	831.5	914.8	1,016.4	1,147.9	1,264.7	1,351.6
Total terminal capacity in airports (in Million TEU)	13.6	14.1	15.1	16.2	16.7	17.1
Total capacity of ports (in million TEUs)	202.44	211.56	217.98	236.8	249.8243	261.07
Proportion of population covered by a fixed broadband network	-	77.0	82.0	95.0	97.0	98.0
Proportion of population covered by mobile cellular network	-	-	-	95.0	96.0	98.0
Total number of cultural awareness events	257	290	351	379	391	451
Number of tourist arrivals from APEC economies (in millions)	100.07	103.44	107.81	110.01	111.78	113.72
Number of tourist arrivals from non-APEC economies (in millions)	28.43	30.38	30.64	29.47	29.42	31.59

Hong Kong, China

	2014	2015	2016	2017	2018	2019
Total number of road PPPs	0	0	0	0	0	0
Total value of public and private road PPP (in million USD)	0	0	0	0	0	0
Total length of paved road network (in KM)	2,099	2,101	2,107	2,112	2,123	2,127
Total length of railroad network (in KM)	-	652.2	674.7	674.7	747.4	759.4
Total number of airports	2	2	2	2	2	2
Total number of ports	1	1	1	1	1	1
Proportion of population covered by mobile cellular network	100	100	100	100	100	100
Cost of electricity (in USD/kWh)	0.15	0.15	0.15	0.14	0.15	0.15
Total number of cultural awareness events	-	2	1	1	2	-
Number of tourist arrivals from APEC economies (in millions)	57	56	53	55	61	52
Number of tourist arrivals from non-APEC economies (in millions)	4	4	4	4	4	4

Indonesia

	2014	2015	2016	2017	2018	2019
Total number of road PPPs	-	3	4	1	2	-
Total number of rail PPPs	-	-	-	-	-	1
Total number of port PPPs	-	-	-	-	2	4
Total number of airport PPPs	-	-	-	-	2	5
Total value of public and private road PPP (in million USD)	-	-	2,251.70	3,436.95	1,590.00	1,355.35
Total value of public and private rail PPP (in million USD)	-	-	-	-	-	70.68
Total private sector investment in fixed broadband (in million USD)	-	-	232.0	230.7	216.9	218.2
Proportion of population covered by mobile cellular network	129.12	132.68	149.04	166.17	120.53	127.31
Total number of cultural awareness events	143	168	175	187	187	248
Total number of knowledge sharing events	1	2	2	3	1	2
Number of tourist arrivals from APEC economies (in millions)	7.25	7.52	8.29	9.73	10.22	10.99
Number of tourist arrivals from non-APEC economies (in millions)	2.19	2.71	3.24	4.32	5.6	5.12

Japan

	2014	2015	2016	2017	2018	2019
Total number of airport PPPs	-	1	2	-	3	3
Total length of paved road network (in KM)	340,810.6	342,126.2	344,689	345,767	347,404.8	-
Total length of railroad network (in KM)	20,022.00	20,132.00	20,117.00	20,117.00	-	-
Total number of airports	97	97	97	97	97	97
Total number of ports	994	994	994	994	994	993
Proportion of population covered by a fixed broadband network	99	99	99	99	99	99
Proportion of population covered by mobile cellular network	99	99	99	99	99	99
Cost of electricity (in USD/kWh)	-	-	0.19	0.19	0.21	-
Number of tourist arrivals from APEC economies (in millions)	12.04	18.06	22.11	26.6	28.88	29.22
Number of tourist arrivals from non-APEC economies (in millions)	1.36	1.67	1.92	2.08	2.31	2.65

Korea

	2014	2015	2016	2017	2018	2019
Total number of road PPPs	89	92	94	95	97	-
Total number of rail PPPs	13	15	15	15	18	-
Total number of port PPPs	0	0	0	0	0	0
Total value of public and private road PPP (in million USD)	3,023.85	4,161.22	3,249.65	2,492.87	1,226.72	-
Total value of public and private rail PPP (in million USD)	783.50	1,015.77	714.39	811.20	955.02	-
Total value of public and private port PPP (in million USD)	0	0	0	0	0	0
Total value of public and private airport PPP (in million USD)	0	0	0	0	0	0
Total length of railroad network (in KM)	3,590.0	3,873.5	4,039.9	4,138.7	4,134.9	-
Total number of airports	15	15	15	15	15	15
Total number of ports	60	60	60	60	60	60
Proportion of population covered by mobile cellular network	112.9	115.5	119.7	123.9	128.6	133.2
Cost of electricity (in USD/kWh)	0.11	0.10	0.10	0.10	0.10	0.09
Total number of cultural awareness events	29	36	44	30	33	39
Total number of knowledge sharing events	21	26	25	21	129	64

Number of tourist arrivals from APEC economies (in millions)	10.2	9.4	13.1	9.5	11.4	13.4
Number of tourist arrivals from non-APEC economies (in millions)	0.7	0.7	0.8	0.9	1.0	1.0

Malaysia

	2014	2015	2016	2017	2018	2019
Number of tourist arrivals from APEC economies (in millions)	23.93	22.59	23.03	23.39	22.97	23.01
Number of tourist arrivals from non-APEC economies (in millions)	3.47	3.13	3.73	2.57	2.86	3.10

Mexico

	2014	2015	2016	2017	2018	2019
Total number of road PPPs	-	-	-	-	-	165
Total number of rail PPPs	-	-	-	-	-	19
Total number of port PPPs	-	-	-	-	-	66
Total number of airport PPPs	-	-	-	-	-	22
Total number of cultural awareness events	-	-	-	-	1	-
Total number of knowledge sharing events	-	-	-	-	5	2

Peru

	2014	2015	2016	2017	2018	2019
Total number of road PPPs	16	16	16	16	16	16
Total number of rail PPPs	4	4	4	4	4	4
Total number of port PPPs	7	7	7	7	8	8
Total number of airport PPPs	18	18	18	18	18	18
Total value of public and private road PPP (in million USD)	3,717.10	3,620.42	3,704.52	4,000.63	4,140.45	4,168.08
Total value of public and private rail PPP (in million USD)	597.31	785.88	1,089.86	1,525.27	2,009.12	2,432.31
Total value of public and private port PPP (in USD)	287.84	289.75	226.96	57.05	46.04	142.21
Total value of public and private airport PPP (in USD)	547.81	511.25	497.05	534.57	527.48	539.23

Total length of railroad network (in KM)	1,976.2	1,976.2	1,976.2	1,976.2	1,976.2	1,976.2
Total length of paved road network (in KM)	17,411	18,420	24,747	25,780	27,461	28,227
Total number of airports	136	126	134	125	128	130
Total number of ports	7	7	7	7	8	8
Total number of passengers in airports (in Millions)	17.4	19.0	20.8	22.7	24.6	26.2
Total terminal capacity in airports (in Million TEU)	0.34	0.34	0.32	0.31	0.31	0.29
Total private sector investment in fixed broadband (in USD)	1,133.0	1,170.0	2,147.1	1,025.6	1,001.0	989.5
Proportion of population covered by mobile cellular network	42.0	49.0	62.0	69.0	74.0	77.0
Total number of cultural awareness events	15	15	15	15	15	15
Total number of knowledge sharing events	1	1	20	10	3	4
Number of tourist arrivals from APEC economies	1.72	1.85	1.98	2.06	2.19	2.28
Number of tourist arrivals from non-APEC economies	1.49	1.61	1.77	1.97	2.23	2.10

Russia

	2014	2015	2016	2017	2018	2019
Proportion of population covered by mobile cellular network	152.79	156.77	157.72	156.19	157.43	-

Singapore

	2014	2015	2016	2017	2018	2019
Total length of railroad network (in KM)	183.0	198.6	-	228.4	-	-
Total length of paved road network (in KM)	3,495	3,500	3,512	3,503	-	-
Total number of airports	2	2	2	2	2	2
Total number of ports	1	1	1	1	1	1
Proportion of population covered by mobile cellular network	-	-	-	-	-	153.9
Number of tourist arrivals from APEC economies	11.90	11.90	12.80	13.50	13.07	14.70
Number of tourist arrivals from non-APEC economies	3.20	3.30	3.60	3.90	5.40	4.40

Chinese Taipei

	2014	2015	2016	2017	2018	2019

Total number of road PPPs	0	0	0	0	0	0
Total length of railroad network (in KM)	1,405	1,405	1,405	1,405	1,405	1,405
Total length of paved road network (in KM)	6,198	6,211.7	6,286	6,312	6,322.9	6,371.8
Total number of airports	17	17	17	17	17	17
Total number of ports	7	7	7	7	7	7
Total private sector investment in fixed broadband (in USD)	855.7	639.2	516.8	684.6	645.5	583.5
Proportion of population covered by mobile cellular network	99.3	99.45	99.5	99.6	99.9	99.9
Cost of electricity (in USD/kWh)	0.099	0.083	0.076	0.082	0.088	0.088
Total number of knowledge sharing events	2	4	8	18	20	17
Number of tourist arrivals from APEC economies	9.56	10.44	10.29	10.31	10.58	11.36
Number of tourist arrivals from non-APEC economies	0.35	0.48	0.40	0.43	0.47	0.51

Thailand

	2014	2015	2016	2017	2018	2019
Total number of port PPPs	-	6	6	6	6	6
Total length of railroad network (in KM)	-	-	-	-	-	4,034
Total length of paved road network (in KM)	-	-	-	-	-	52,084.86
Total number of airports	6	6	6	38	38	38
Total number of ports	2	2	2	2	2	2
Proportion of population covered by mobile cellular network	97.0	97.0	98.0	98.0	98.0	98.0
Total number of cultural awareness events	4	8	7	6	6	4
Total number of knowledge sharing events	2	3	3	3	4	-

United States

	2014	2015	2016	2017	2018	2019
Total length of railroad network (in KM)	197,258	198,380	198,442	198,737	198,544	198,554
Total length of paved road network (in KM)	4,416,316	4,401,889	4,387,984	4,474,121	4,577,176	-
Total number of airports	19,360	19,360	19,536	19,536	19,627	19,636
Total number of ports	361	361	361	361	361	361
Total private sector investment in fixed broadband (in USD)	48,556.0	51,178.0	53,028.0	53,903.0	52,921.0	-

Proportion of population covered by mobile cellular network	99.2	99.6	99.6	99.8	99.9	-
Total number of cultural awareness events	110	100	115	109	152	-
Total number of knowledge sharing events	930	942	1,160	1,259	1,309	960
Number of tourist arrivals from APEC economies	51.16	51.26	50.91	51.41	52.70	51.96
Number of tourist arrivals from non-APEC economies	24.22	26.52	25.50	25.77	27.05	27.30

Viet Nam

	2014	2015	2016	2017	2018	2019
Cost of electricity (in USD/kWh)	0.072	0.075	0.076	0.074	0.076	-
Number of tourist arrivals from APEC economies	6.20	6.20	7.90	10.10	12.20	14.20
Number of tourist arrivals from non-APEC economies	1.60	1.70	2.10	2.80	3.30	3.80