

Structural Reform and Digital Infrastructure

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*Companion Report to the 2018 AEPR: Structural Reform
and Infrastructure*



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Executive Summary

This report is a companion report to the 2018 APEC Economic Policy Report on ‘Structural Reform and Infrastructure’. The report frames the issues in terms of three dimensions that influence, and are influenced by, an economy’s system and structure of governance involving policy, regulatory and standards issues, namely (i) the telecommunications infrastructure that underpins the information technology of the digital economy; (ii) the scope and nature of the digital economy itself; and (iii) the regional environment for trading and standards, together with the degree of harmonisation that has been achieved to minimise non-tariff barriers to trade (NTBT). This framework is illustrated in Figure 1 of the Introduction.

The report is primarily concerned with policies that will enable and maximise the opportunities brought about by digital technologies. Using a framework of governance, markets and technologies, each of which interacts with the other, the report identifies structural reforms that are required in a digital age to keep them relevant. Key to effective governance is a cross-cutting capability that responds to the interconnected and interoperable nature of digital technologies, including areas such as payment systems, electronic identities (e-ID) for online services and communication systems. e-ID plays a central role in the digital economy because of its ability to facilitate secure access to online services and as a consequence, the management of an e-ID system is a priority, with examples ranging from Peru to the Philippines. A revision to the economy’s constitution is required in some cases to allow for foreign direct investment in areas of the digital economy, such as domestic information infrastructure projects.

The system of governance includes issues of policies and regulations and the adoption of domestic standards. In each of these areas, progress is only possible if there is a conscious awareness of the ramifications of policy-making, of the intended and unintended consequences insofar as it is possible to foresee these. Mistakes do get made, and that is a learning experience, not a problem unless they remain unrectified. A good example of such learning comes from South Korea’s experience in ramping up its e-government system, now widely regarded as among the world’s best. Therefore, policy developments should always be accompanied by a system of monitoring and evaluation; but that is the final stage of the policy implementation process.

In considering the far-reaching impacts digital transformation will have on economy and society, governments need to ensure that digital economy development is not undertaken in industry silos, but that a coordinated approach is instead applied. This gives policy-makers a broader picture of the needs of the digital economy that will reveal challenges and gaps in cross-sectoral areas, better enabling governments to tackle them. This will in turn inform policies that address, for example, the requirements of a new skillset, security framework, interconnectivity of networks and interoperable platforms.

To this end, the report identifies a roadmap for policy making as presented in Figure 2, which will ensure that a common digital economy vision that can be adopted across society. It begins with the need for a domestic vision, a statement of what, given digital developments, the economy wants to achieve in the medium-to-long term. This determines the objectives that a Mission statement should identify, followed by a series of more detailed sector plans that map out the Means of achieving these objectives or targets. The report focuses upon the governance requirements to move along this road, with assistance from APEC where appropriate. Appropriate ministries may need to be created and others merged. Table 1 details these for the APEC economies in terms of their domestic plans.

Throughout the report, the role of competition is recognised as a driver of digital growth and innovation, but competition needs to be rooted in firm foundations. If it is not, it can quickly morph into quasi-monopolies and lose the innovative impetus. The report gives reasons for investing in a fixed broadband

backbone to support services competition in both fixed and mobile networks, noting the leading role of the latter in areas such as online commerce, payments and financial inclusion. While too rigid policies and regulations can inhibit competition, they are nevertheless essential in many areas. Equal access provisions may be required for dominant networks to forestall discrimination against smaller competitors. To illustrate how correct policies can have positive impacts, transparent policies should be adopted for radio spectrum assignments where allocations may be set aside for new entrants, as they have been in PNG (Box 1) and Singapore. Licensing policies, for example to allow for mobile virtual network operators (MVNOs) is another way to encourage new entry. In other cases, questions of market share are difficult to square with the most cost-effective means of service delivery. Box 1 illustrates the way PNG has addressed this problem.

A useful way in which to think about the actions policy-makers arrive at to promote the digital economy across a nationwide range of sectors and service areas is to think in terms of a smart city. A smart city is a bucket containing many technologies, services and service-providers, applications, that serve to increase the welfare of citizens with the most economical use of scarce resources, and address the mega-challenges of environmental pollution, population aging, and large-scale migration of people from rural to urban, from developing economy to developed economy, and job migration from non-digital to digital. An essential feature of smart city development and management is the interconnectivity and interoperability of systems.

Where regulations are used to translate policies into practice, a smart city approach is to shift from ex-ante to ex-post approaches, which help to reduce the cost of doing business, and minimise risk without minimising innovation by using regulatory sandboxes.

The final part of the report homes in on issues of regional harmonisation and the need to recognise two challenges. First, policy issues such as cross-border data flows, industry standards, IPRs, on what and how to levy taxation, and cybersecurity with respect to the critical national information infrastructure (CNII) all need to be addressed to minimise disruption to trade and investment. APEC has an outstanding role to play here. Second, harmonisation requires an insightful understanding of cultural and social differences across economies. The welfare of citizens can be the undisputed common vision.

The report's conclusions are as follows:

1. A well-developed broadband infrastructure is key to enhancing the connectivity of digital economies. APEC economies that lack a good broadband infrastructure should assign a high priority to fixed line broadband. A higher fixed broadband penetration rate has been found to drive the uptake of cloud computing, which enables a whole suite of new digital services and technologies including the Internet of Things (IoT).¹
2. Clearly-defined structures of governance are required to produce visionary digital plans, along with policies for their implementation and regulations to make them happen. APEC should do what it can to assist economies that lack a capacity to develop in depth operational planning.
3. One driver of a digital economy that is in the hands of government is e-government, from online procurement to e-services. APEC could urge member economies to prioritise e-ID as a means of registering populations, widening the scope of digital and financial inclusion, and improving the security of commercial and vital domestic assets. Given the breadth of potential e-government initiatives, a priority should be given within government to the establishment of an Office of the

¹ Huawei (2017) Quantifying the Value of Digital Infrastructure Development, http://www.huawei.com/minisite/gci/files/gci_apec_report.pdf

Government Chief Information Officer (OGCIO) and the appointment of a CIO to steer cross-department and cross-agency e-government initiatives and to ensure their compliance with related laws, such as personal data privacy laws and cyber-security and data protection regulations.

4. An important part of these visionary statements is to reduce the costs of doing business and remove frictions in the market, such as excessive red tape, not least for start-ups who are often the most innovative. APEC could encourage plans to include measures to cut red tape to reduce the costs of doing business, and to promote local start-ups.²
5. Among the most compelling digital issues are data privacy, data protection and cybersecurity. APEC cybersecurity guidelines and assistance with expertise would be helpful, not least for the adoption of cloud computing. Several APEC economies already have 'cloud procurement' and 'cloud first' policies, but for others the sharing of the experience will be necessary, a role APEC can easily play.
6. Regional harmonisation is a crucial area for the growth of digital economies as cross-border trade in goods and services increasingly depends upon the exchange and transfer of data. APEC should give a strong priority to initiatives on regional harmonisation, and examine carefully roadblocks to progress.
7. Digital development is closely associated with smart city development, and nothing is smarter than creating a clean environment in terms of the quality of the air we breathe, the water we rely upon, the disposal of waste of all kinds, and creating the jobs and commercial opportunities that can go along with these efforts. APEC has an opportunity to add its voice and support to all its members in developing a green digital economy, probably the most important challenge for the planet.

² RMIT (2017) Digital Entrepreneurship Across the APEC Region,
<https://www.rmit.edu.au/content/dam/rmit/documents/college-of-business/industry/apec/rmit-apec-digital-entrepreneurship-report.pdf>

I. Introduction

This report is on the topic of ‘Structural Reform and Digital Infrastructure’ and is a companion report to the 2018 APEC Economic Policy Report on ‘Structural Reform and Infrastructure’. It has been commissioned by ABAC to present a private sector perspective.³ The organization of the report follows the conceptual approach presented in Figure 1.

Figure 1: Structural Reforms and the Digital Economy



Source: TRPC

The telecommunications infrastructure (left column) provides and supports the platforms of a digital economy, through broadband connectivity (fixed fibre, cable and wireless, and cellular mobile) enabling fast Internet access. The progress of reforms in terms of technology-neutrality and licensing, competitive markets and market entry, the removal of foreign direct investment caps, and policies to promote affordable access are reviewed. There follow examples of developments in the digital economy (right column) arising from both the spread of affordable broadband and Internet access, and policies such as cloud-first, the promotion of e-identities, e-government and open government initiatives, and regulatory developments such as the use of ‘sandboxes’ for FinTech innovation. Cross-cutting all these developments are issues of harmonisation (bottom-bar) across APEC and other economies of the region. The development of digital economies calls for the digitalization of trade, payments and procedures between APEC economies, such as efficient customs and excise arrangements, and the acceptance of common standards and type approvals relating to technologies, Mutual Recognition Arrangement (MRAs), and cyber security and Anti-Money Laundering- Combatting the Financing of Terrorism (AML-CFT) measures.

Conclusions arising from the findings from these areas of research, are discussed according to the central core of Figure 1, namely, in terms of governance, policy and regulatory reforms and standards which are central to a digital economy.

³ See also ABAC APEC: *Outcomes and Outlook 2016-2017* <https://apec.org/Publications/2017/02/APEC-Outcomes-and-Outlook-20162017>

II. Methodology

The methodology consists of the conceptualisation of the process, explaining the relevance of structural reforms to positive outcomes in the areas of infrastructure, digital economy and cross-border data and payments, or to failures which will point to the need to address the issues; desk-based Web searches; a review of relevant literature; an open-ended two-question questionnaire circulated by the ABAC Secretariat (Philippines) to ABAC representatives in APEC economies to elicit local views on what have been the most significant reforms within the local APEC economy and/or what remain as major challenges, with 13 replies, and follow-up emails. The report begins with an econometric analysis of the relationship between infrastructure and GDP per capita across the 21 APEC economies.

III. The Infrastructure Foundations of a Digital Economy

The foundations of a digital economy lie in a reliable broadband telecommunications network that can support ubiquitous access to the Internet at fast data speeds.⁴ That implies investment and lots of it, but there are no ‘one-size fits all’ models for the development of telecom networks. In economies with many mountainous and inaccessible locations, such as Papua New Guinea (PNG) and certain areas of Peru, and where per capita incomes are generally low, the barriers to entry are both physical and commercial. In a geographically compact, low-lying high-income economy such as Singapore, the commercial opportunities for telecommunications service providers are many; but even in Singapore the capital costs of building fixed-lined broadband networks are too high to sustain multiple wholesale carriers. Instead, the authorities in Singapore awarded the rights to a Passive Infrastructure Company (i.e. ‘NetCo’) to design, build and operationalise the nationwide fibre infrastructure (i.e. fibre and ducts), and an Active Infrastructure Company (i.e. ‘OpCo’) to design, build and operationalise the nationwide fibre network’s active infrastructure (i.e. bandwidth services). Structural separation and operational separation were required of the NetCo and OpCo respectively to ensure open access, and fair competition. The fixed-line broadband wholesale-retail model has also been adopted in Australia and Malaysia, although in both cases the incumbent retains ownership of the network, giving rise to cases of competitors complaining of unequal terms of access or excessive wholesale pricing giving rise to a ‘profits squeeze’.⁵ But in all three cases, governments have provided financial support for the network buildout, making them in effect public-private partnerships (PPP).

In other APEC cases, such as in the high-income economies of Canada; Hong Kong, China; Japan; Korea; and the USA, multiple private carriers have invested in fixed broadband networks, providing a strong framework to support highly competitive broadband mobile markets. Of the three APEC economies in Latin America, only Chile has a competitive market in fixed broadband, while incumbent carriers dominate the markets in Peru and Mexico. Both Chile and Peru have achieved competitive mobile markets, while in 2017, Mexico’s Supreme Court ruled that it is up to the regulator, not the policy-makers in the legislature, to enforce the rules of competition in the mobile market.

Several conclusions can be drawn from the above. First, although a fixed line broadband network is much costlier to build than a wireless mobile network, even when use is made of a mix of technologies

⁴ The ITU’s working definition of broadband as 256kbps seems woefully outdated. As early as 2003, the ITU’s Standardization Sector made Recommendation 1.113 to define broadband as a “transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbps)”. International Telecommunication Unit (ITU) (2003) The Birth of Broadband, <https://www.itu.int/osg/spu/publications/birthofbroadband/faq.html>

⁵ A ‘profits squeeze’ implies high wholesale prices shrink the retail margins of the incumbent and competitors alike, but the incumbent gains from a higher wholesale margin.

such as fixed wireless, microwave, and satellite to complement fibre, especially in the ‘last mile’ to buildings, there are conditions that can make this commercially viable. In Hong Kong, China for example, ‘economies of density’ arise from the short distances between the clustering of premises. In South Korea and Japan, population densities and thriving retail and Internet markets sustain a high-demand for long-distance transmissions, although government support in South Korea was forthcoming in the early build-outs. In Canada and the USA, long-distances connect the demand of major cities, but serving the rural areas remains a challenge which frequently requires additional funding.⁶ Second, if favourable local circumstances do not exist, fixed broadband networks may be regarded as a natural monopoly.

An alternative approach is to regulate the monopoly or dominant incumbent, including cross-subsidization of uneconomic services from those that generate a profit. In all the APEC economies there is a dominant player in the fixed line market. But even in PNG’s case, where the geographical conditions seem most hostile, there are options for a new generation of small HFS (high-frequency) low-earth orbiting satellite services to provide connectivity to Earth Stations in highly remote regions. However, equal access regulations are still necessary to ensure competition in downstream markets such as Internet services and mobile.

Third, without a reliable fixed broadband network, spanning at least the most important economic regions, the contribution of mobile networks to the digital economy will be distorted, for example, in areas such as e-commerce, m-payments, access to e-government services, and apps for a sharing economy, and eventually 4G and 5G platforms for smart city machine-to-machine apps and sensors connected to a range of industry applications. In other words, Fixed-Mobile Substitution (FMS)⁷ works at the access level, as users turn towards smart wireless devices, but not at the network connectivity level.

This point should be highlighted for the following reason. Many previous studies which only looked at the relationship between economic growth and mobile, not fixed line broadband, inevitably found strong correlations.⁸ But the evidence from APEC economies 2010-2016 suggests that it is fixed broadband rather than mobile broadband, or mobile networks in general, that correlate significantly to the growth of GDP per capita.⁹ See Chart 3. This is entirely logical. Mobile data traffic can either connect directly to a router or to a mobile network. In the former case, it is transmitted over a fixed broadband connection to the fixed line exchange, which may also pass through an Internet Exchange Point (IXP). In the latter case, the data traffic is handed-off to a fixed line backhaul that has sufficient capacity to deliver it to the exchange system. The data traffic may then be handed back to a mobile

⁶ In January 2018, the Chair of the FCC proposed an order to “provide over \$500 million in additional funding for cooperatives and small rural carriers.” Federal Communications Commission (FCC) (2018) Chairman Proposes Over \$500 Million in Funding to Promote Rural Broadband Deployment, https://transition.fcc.gov/Daily_Releases/Daily_Business/2018/db0116/DOC-348723A1.pdf

⁷ Fixed-Mobile Substitution (FMS) is used in this context to describe the situation where high-speed 3G and 4G mobile data networks have replaced xDSL, cable or fibre fixed broadband, leading to reduced demand for fixed broadband connectivity. See also footnote 9.

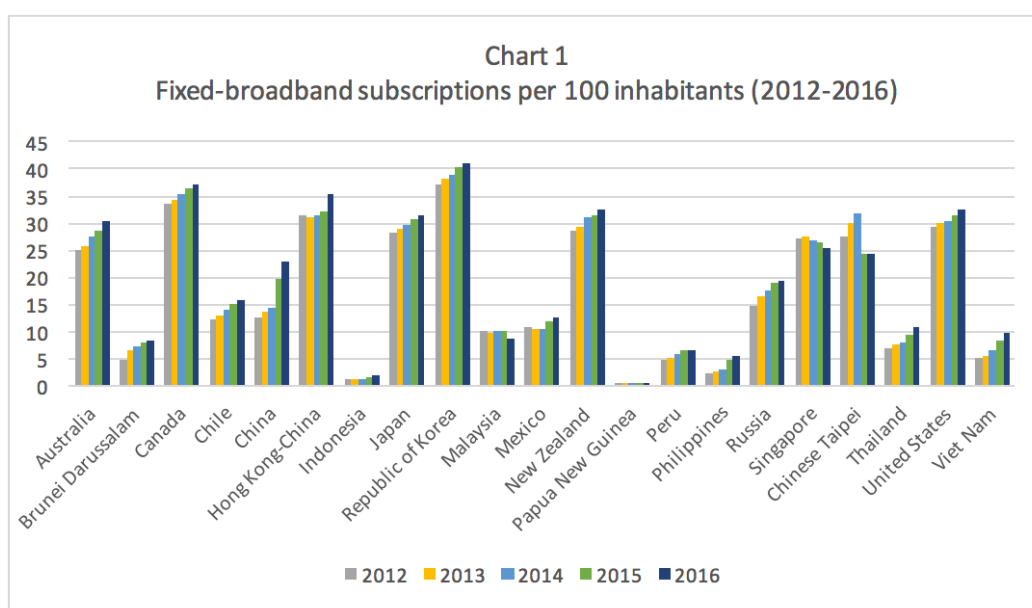
⁸ Examples include studies of a 10% investment in cellular at levels of teledensity of 5-15% on GDP growth at 0.3% (Torero et al., 2002), of 10% at 5.9% (Waverman et al., 2005), and of less than 20% at 7% (Sridhar & Sridhar, 2004); see Lee, R.C, Ure, J. and Lee H.C (2011) Quantifying the Impacts of Structural Reform in Telecommunications Markets, in APEC (2011) Economies’ in The Impacts and Benefits of Structural Reforms in Transport, Energy and Telecommunications Sectors, <https://www.apec.org/Publications/2011/01/The-Impacts-and-Benefits-of-Structural-Reforms-in-Transport-Energy-and-Telecommunications-Sectors#indi>. More recent similar studies include Edquist, et al., (2014, published 2017) who find GDP growth ranging from 0.6%-2.08%, <https://spiral.imperial.ac.uk/handle/10044/1/46208>.

⁹ A study even found a negative impact of mobile broadband in developing countries when it substitutes for fixed broadband. Thompson and Garbacz (2017) Productivity Impacts of Mobile versus Fixed Broadband Use, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.614.2101&rep=rep1&type=pdf>

network or to the fixed-line local loop for delivery. This may involve a long-distance transmission over a domestic fibre backbone, and/or submarine cable. While some mobile network-to-network traffic will remain wireless if it is local, most data traffic relies upon broadband fixed lines, hidden from the view of the average smartphone user. As the regression analysis shows, the stock of fixed broadband assets, not mobile assets, are statistically most closely associated with the growth of the economy. Without fixed broadband, broadband mobile cannot be an effective driver of the digital economy,¹⁰ and for this reason APEC economies need to give great attention to the ways and means to stimulate further investment in fixed broadband networks.¹¹

IV. Fixed Broadband

Charts 1 and 2, both sourced from ITU data, show marked differences in the levels of fixed and mobile broadband penetration, but for the most part similar steady rates of growth in fixed broadband (the slopes of the vertical bars). PNG is an outlier. Some economies show very slow growth, for example, Indonesia, Mexico, Peru and the Philippines until post-2015. Others show a decline which could be likely be attributed to fixed-mobile substitution (FMS) as in the case of Singapore, Chinese Taipei and possibly Malaysia. FMS represents no underlying problem, so long as the stock of fixed broadband assets remains sufficient to support broadband mobile and Internet access.



Source: ITU, Country ICT Data.¹²

V. Mobile Broadband

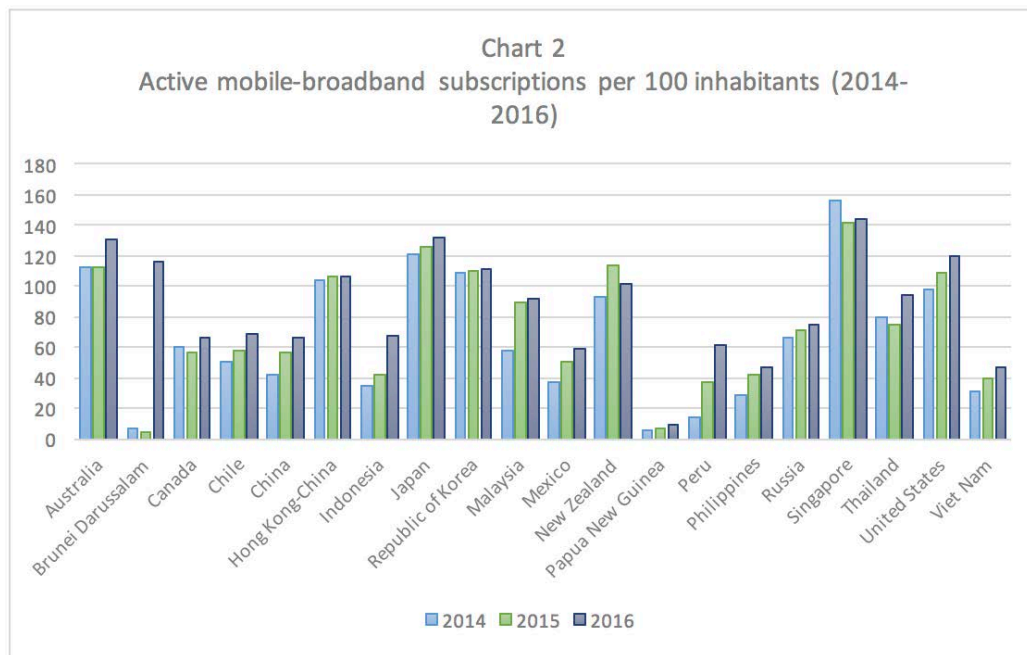
As would be expected, the growth of broadband mobile is quite vigorous across most of the APEC economies, where this includes 3G and 4G rollouts. Only three economies had penetration rates of below 60% by 2016, and of these, the Philippines and Viet Nam are showing steady growth, while in

¹⁰ As a response from ‘a leading Australian digital company’ noted: “The expansion of 4G and adoption of 5G are of course, dependent on the backbone of the non-wireless infrastructure.”

¹¹ The distinction between the demand for fixed and mobile broadband has been highlighted in FCC (2018) Fact Sheet on Draft 2018 Broadband Deployment Report, https://transition.fcc.gov/Daily_Releases/Daily_Business/2018/db0118/DOC-348770A2.pdf

¹² ITU (2017) Fixed Tel 2000-2016 Statistics, https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2017/Fixed_tel_2000-2016.xls

PNG, where geographical challenges are so extreme that increasing the penetration rate will remain an uphill process, progress is slowly being achieved.



Source: ITU World Telecommunication Development Indicators¹³

To determine the relative influence of fixed and mobile broadband penetration rates upon GDP per capita – the analysis found no correlation with absolute levels of GDP – two sets of regressions were run. First using 2016 penetration rates, and then 2010 penetration rates, and their influence upon 2016 GDP per capita, the hypothesis being that there is likely to be a time delay between investment, as represented by the stock of telecom assets, and outputs.

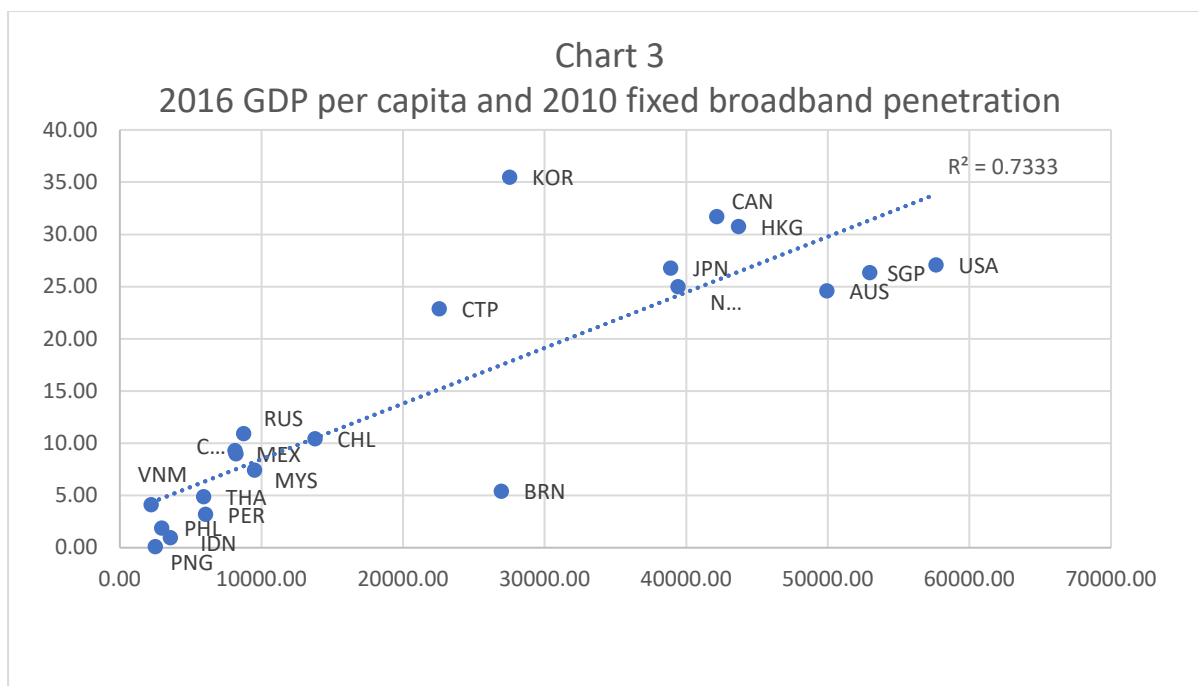
Running the first set of regressions showed that fixed broadband penetration rates appear to be a better explanation of variances (adjusted $R^2 = 63.5\%$)¹⁴ than broadband mobile (adjusted $R^2 = 61.3\%$), and when measured jointly, mobile broadband loses its statistical significance. The Internet penetration rate was found to account for 54% of the variance. Narrowband mobile does not register at all. This is strong evidence to suggest that the impact of both broadband mobile and Internet penetration upon economic growth derives from the spread of fixed broadband facilities.¹⁵

Chart 3 correlates 2010 levels of penetration of fixed broadband with GDP per capita in 2016. Penetration rates are shown down the Y-axis and GDP per capita along the X-axis.

¹³ ITU (2018) World Telecommunication/ICT Indicators Database 2017, <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>

¹⁴ Regression analysis was employed to understand if there is a linear relationship between fixed broadband penetration and mobile broadband penetration with GDP per capita, that is, how much variance in GDP per capita can be explained by the level of broadband penetration, either fixed or mobile. Data from 21 economies were used for the analysis and in view of the small sample size, we are more conservative and look at adjusted R2 instead of R2.

¹⁵ None of the variables was seen to correlate with absolute levels of GDP, and the stock of narrowband mobile had no impact on GDP per capita.



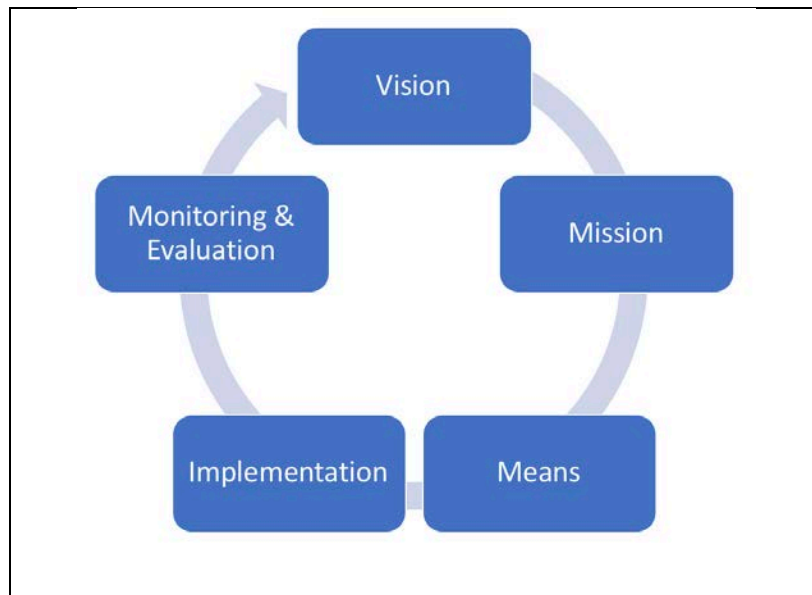
Source: TRPC

When the 2010 penetration rates are regressed against 2016 GDP per capita, the variance of fixed broadband increases to an adjusted $R^2 = 0.719$, shown in Chart 3. When mobile broadband for 2010 was regressed against 2016 GDP per capita, the variance explained by it fell to adjusted $R^2 = 0.531$. It is entirely feasible that there are time lags between investment in telecommunications networks and an impact upon GDP per capita, as these results suggest. The 2010 fixed broadband penetration rate explains more of the variance across 21 APEC economies than do the 2016 rates. In both cases, the policy implication for APEC economies is clear: ensure a resilient and nationwide coverage of fixed broadband and the investments that are necessary to achieve it.

VI. Vision, Mission and Means

A review of progress towards a digital economy needs to cover a lot of ground. A useful approach is a roadmap of the steps that need to be taken: from defining a vision of a digital economy and society, to constructing a mission statement that provides a sense of what needs to be done, to defining the means of accomplishing the aims of the vision and the objectives or goals of the mission, to policy and regulatory implementation, and finally, to the monitoring and evaluation of the outcomes. Figure 2 illustrates the process.

Figure 2: Digital Economy Policy-making Cycle



Source: TRPC

The need for a roadmap goes beyond delineating the steps needed to realise the Vision that starts each cycle; it should focus attention on how a digital transformation of the economy and society begins to change everything, including the structure of the economy, the nature of the business models that drive investment and innovation, the skill sets required, revenue sources for public sector expenditures, the new ways in which information is being disseminated, the need to revisit policies and regulations as industry sectors ‘go digital’, the measures designed to protect data privacy and security.

The complete cycle in Figure 2 positions the economy to move on to the next stage of development. This cycle can be applied to any sector of the economy, and indeed to any business. For example, the programmes of the Mekong River Commission (MRC), a World Bank-supported NGO advising the governments of Cambodia, Lao PDR, Thailand and Viet Nam in the joint management of shared water resources and the sustainable development of the Mekong River. The MRC employs five-year development cycles in its planning and operations.¹⁶ The remainder of this report focuses on the Vision, Mission and Means segments of the cycle. However, it is equally important for economies to fine-tune their implementation practices and, not least, to monitor progress, evaluate outcomes, and prepare for the next round. In all these cases APEC has a role to play in assisting member economies.

This roadmap can be used in each economy to measure the progress made by each of the components of the conceptual model, as outlined in Figure 1: the required infrastructure, the components of the digital economy itself, the issues that call for cross-border harmonisation of procedures and standards, all seen through the structures of governance, policy making, regulations and the adoption of industry standards. The composition of these elements will vary across economies, with different mixes of public and private sector involvement. This section briefly examines the first three steps along the roadmap: Vision, Mission and Means.

1. **Vision of a Smart Society:** without an adequate broadband infrastructure it is difficult to develop a *vision* of a society fully engaged with a digital economy, covering areas such as communications, connected production processes, online sales and payments and the delivery

¹⁶ MRC (N.D.) Completion of strategic cycle 2011-2015, <http://www.mrcmekong.org/about-mrc/completion-of-strategic-cycle-2011-2015/>

of e-services. But in addition, there is also the architecture of the IT systems that access broadband connections. By the 1990s, the trend of client-server, whereby desktop and personal computers uploaded and download programmes and applications to and from a remote server, was turning to fat servers – thin clients whereby the programmes and applications were not downloaded but were available from any authorised computer in any location. This freed up processing power in the computer, reduced costs and assisted flexible and collaborative work patterns, as any number of computers could access the same applications. The IT architecture underlining a vision of a ‘smart society’ has now taken a further step forward with a shift from client-server models towards peer-to-peer (P2P) networking. Computational devices, such as smartphones and tablets, can communicate directly with each other, form their own virtual networks, helped especially by the advances in broadband wireless technologies. This is exemplified in the rapid growth of the apps of the ‘sharing economy’, P2P finance, distributed digital ledgers, etc., supported by cloud computing – that is, by access to infrastructure, data and programmes via the Internet on an as-needs (*and therefore affordable*) basis.

2. **Mission of a Digital Economy and Information Society:** to meet the challenges of embedding a smart society, which should be regarded as the challenge of a *citizen-centric societal development*, it is important for governments, the enterprise sector and communities to work closely together at a series of different levels.

a. **Mega issues:** these are overwhelming long-term challenges, including environment, population aging, economic migration, that require smart solutions starting now. For example, green technologies to reduce the carbon footprint. Digitally-empowered solutions are required.

b. **Reforms:** the speed of technological transformation is a challenge for both the enterprise and public sectors, requiring the adaption of both business models and policies and regulations, and the removal of red-tape procedures and supply-chain bottlenecks that raise the cost of doing business and have outgrown their sell-by date.

Below there is a review of these challenges across APEC economies.

3. **The Means:** to promote and facilitate the transition to a digital economy as the essential stepping stone towards a smart society, certain concrete steps need to be taken. Structural issues involve (i) improved forms of governance, laws and regulations that can encourage investment and innovation in the digital economy, and remove barriers to cross-border transactions, and (ii) the role of multi-stakeholder participation in policy-making, transparency and accountability and incentive regulations. Below such structural reforms are examined.

Macro/Micro policies: will vary across economies owing to their circumstances, but there are common threads. Each economy will have its individual innovation system and within each of these there will be policies to promote investment in R&D and start-ups, cloud-procurement policies and cyber-security projects, effective competition, or the regulation of – often state-invested – natural monopolies in ways that provide equal access to scarce-resources to the enterprise sector, sector-specific programmes, ways to assist flexible labour markets for skills upgrading to parallel the fungibility of finance capital, the adoption of industry standards, and a commitment to harmonise across borders, while at the same time protecting the most vulnerable in society and the personal data of citizens. Below examples of such policies are provided from selected APEC economies.

VII. Visions – Domestic Plans for a Digital Economy

As economies make progress towards becoming *smart societies* driven by digitalised processing of goods and services and information platforms, that progress is often in siloes associated with verticals, such as health, utilities, transport and logistics, government, education. This needs to give way to the interconnectivity of networks running through these sectors, and to the interoperability of their platforms to allow for data sharing, data analysis and the economies of scope in the use of apps. As one ABAC respondent says of global payment systems, “interoperable payment standards help scale adoption of new technology.” Ultimately, these are decisions that need to be made. Any economy that is highly influenced by international trade will very quickly feel the adverse effects of not making them.

The motivation begins with a vision of what a digital economy can mean in terms of its benefits to the local economy, such as e-commerce trading opportunities; but also needs to simultaneously embrace a vision of sharing those benefits across the whole of society, such as facilitating extensive access to micro-finance and using ICTs to create a greener, healthier, environment. The current global malaise of increasingly divided societies is dangerous for social stability and ultimately ‘bad for business’.

Domestic digital plans, including consultation papers, are often the starting point for government and stakeholder deliberations on how to promote a digital economy and information society. Australia, for example, in September 2017, released the *National Digital Economy Strategy* as a consultation paper,¹⁷ to which there were over 140 published responses.¹⁸ Australia has also developed several sector-specific plans, such as Australia’s *National Digital Health Strategy*.¹⁹ These are visionary commitments to be translated into mission statements that detail aims and objectives and timelines, followed by specific measures, the means, to implement these policies.

Another example is Russia’s Federal *Digital Economy 2017-2024* programme,²⁰ the fulfilment of which has been delegated to the Council for Strategic Development and Priority Projects for building up a digital economy by 2024.²¹ According to an ABAC respondent, the main goals cover policies and regulations, skills and education, research competences and technical capacities, an information infrastructure and information security. *The Digital Economy Implementation Programme*²² is the mission management statement outlining the means to realise this vision. The main priorities for 2018 are Big Data, neuroethologies and Artificial Intelligence, distributed digital ledgers, quantum technologies, new manufacturing technologies, industrial Internet, robotics and sensors, wireless communications and virtual realities, together with the metrics for monitoring and evaluating goals and achievements. This list will sound familiar to anyone following new technologies.

¹⁷ Australian Government Department of Industry, Innovation and Science (2017) Australia’s Digital Future, <https://industry.gov.au/innovation/Digital-Economy/Pages/default.aspx>

¹⁸ Australian Government Department of Industry, Innovation and Science (2017) Digital Economy Strategy: Published Responses, https://consult.industry.gov.au/portfolio-policy-and-innovation-strategy/the-digital-economy/consultation/published_select_respondent

¹⁹ Australian Digital Health Agency (2017) Safe, seamless and secure: Evolving health and care to meet the needs of modern Australia, [https://www.digitalhealth.gov.au/about-the-agency/publications/australias-national-digital-health-strategy/ADHA-strategy-doc-\(2ndAug\).pdf](https://www.digitalhealth.gov.au/about-the-agency/publications/australias-national-digital-health-strategy/ADHA-strategy-doc-(2ndAug).pdf)

²⁰ Dekuzu (2017) The new program for Russian digital economy has been adopted, <http://www.dekuzu.com/en/2017/08/the-new-program-for-russian-digital-economy-has-been-adopted.html>

²¹ Xinhuanet (2017) Russia to invest 3.4 bln USD in digital economy this year: Putin http://www.xinhuanet.com/english/2017-07/06/c_136420642.htm

²² Analytical Center for the Government of the Russian Federation (2017) Digital Economy Program Implementation, <http://ac.gov.ru/en/projects/014097.html>

Changes in Governance

Because changes of government also bring about changes in approaches and priorities, the digital planning *process* itself can get changed. Typically, this can involve a change in the governance of digital policy making. In Thailand, a previous planning process has given way to the creation of a new Ministry of Digital Economy and to a Digital Economy Policy Committee presiding over the implementation of *Digital Thailand 4.0*, a vision that includes a broadband digital infrastructure, innovative ecosystem, technology for a more equitable society, e-government services, human capital development and holistic frameworks for a Digital Thailand that break down siloed development.²³ Among the Latin American APEC economies, a good example is Chile's *Digital Agenda 2020*,²⁴ following the formation of a Committee of Ministers for Digital Development in 2016, it was given responsibility to advise the President on the formulation of the *National Digital Development Policy*.²⁵ The two broad tasks were to produce a framework for digital development, and for civil rights within that framework, examples of which would cover personal data privacy and IT literacy skills. In parallel to plans for the digital economy, APEC economies are also supporting the *UN Sustainable Development Goals*,²⁶ many of which depend upon extending digital access to all sections of society, through national commitments such as Peru's *Agenda 2030*, designed by the National Institute of Statistics and Informatics (INEI) and promoted by the National Center for Strategic Planning (CEPLAN).²⁷

Visionary Plans

Not all APEC economies yet have digital plans. The very fact of having them is indicative of an awareness of their relevance to the future prosperity of the society, and their absence *may* indicate a lack of capacity to articulate the vision necessary to design them. This is an important area in which APEC could offer to assist, identifying the outstanding challenges, the priorities and the most practical solutions. Table 1 provides a synopsis of APEC visionary plans for the advancement of a digital economy, in some cases articulated in fully-developed plans, in others they remain at the stage of partial plans and policy objectives associated with different ministries and state agencies.

Table 1: APEC Economies' Digital Plans

Economy	Ministry/Agency	Digital Plans
Australia	Ministry of Communications	National Broadband Network (NBN)
	Dept. of Industry, Innovation & Science	The Digital Economy: Opening Up the Conversation
Brunei Darussalam	Ministry of Communications	National Broadband Policy (NBP)
	Ministry of Energy	Digital Government Strategy
Canada	Canadian Radio-television and Telecommunications Commission (CRTC)	CRTC Three Year Plan 2017-2020
Chile	Ministry of Transport and Telecommunications	Imagine Chile Digital Agenda 2013-2020

²³ ITU (2016) Thailand Digital Economy and Society Development Plan, https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2016/Apr-Digital2016/S2_Present_Pansak_Siriruchatapong.pdf

²⁴ Committee of Ministers for Digital Development (2016) Digital Agenda 2020, <http://www.agendadigital.gob.cl/#/agenda/que#top-page>

²⁵ Committee of Ministers for Digital Development (2016) Committee of Ministers, <http://www.agendadigital.gob.cl/#/quienes-somos/comite#top-page>

²⁶ United Nations (2015) Sustainable Development Goals, <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

²⁷ CEPLAN (2016) Peru to 2030 – Progress to December 2016, <https://www.ceplan.gob.pe/portfolio/peru-al-2030-avances-a-diciembre-del-2016/>

Economy	Ministry/Agency	Digital Plans
China	Ministry of Industry and Information Technology (MIIT)	13 th Five Year Plan
Hong Kong, China	Innovation and Technology Bureau	Digital 21 Strategy-Hong Kong Smart City Blueprint
Indonesia	Ministry of Communication and Informatics	2014 National Broadband plan
	Ministry of National Development Planning	Medium Term Development Plan 2015-2019 (RPJMN 2015-2019)
Japan	Cabinet Office	5th Science and Technology Basic Plan
Republic of Korea	Ministry of Science, ICT and Future Planning (MSIP)	Mid-to Long-Term Master Plan in Preparation for the Intelligent Information Society
Malaysia	<i>Ministry of Communications and Multimedia (MCM)</i>	HSBB-1; HSBB-2; Nationwide Fiberisation Plan (NFP)
	Economic Planning Unit (EPU)	Eleventh Malaysia Plan 2016-2020
Mexico	The President	2013 Telecoms Reform enacted
	Federal Telecommunications Institute	Special Programme for Science, Technology and Innovation (PECITI) (2014-18)
New Zealand	Ministry of Economic Development	Government ICT Strategy and Actin Plan to 2017
Papua New Guinea	National Information & Communications Technology Authority of Papua New Guinea (NICTA)	National Broadband Policy
Peru	Organization for the Supervision and Private Investment in Telecommunications (OSIPTEL)	N.A.
Philippines	Department of Information and Communications Technology (DICT)	National Broadband Plan (NBP)
Russia	Ministry of Digital Development, Communications and Mass Media of the Russian Federation	State programme: Information Society, 2011-2020, 2014 Federal Programme on bridging digital divide, Digital Economy Programme 2017-2024 (sub-programme on information infrastructure).
Singapore	Infocomm Media Development Authority (IMDA)	Infocomm Media 2025 Digital Economy Framework for Action
Chinese Taipei	National Communications Commission (NCC)	Digital Nation and Innovation Economic Development Plan (2017-2025)
	National Development Council	Four Year National Development Plan
Thailand	Ministry of Digital Economy and Society (MDES)	Five-Year Digital Government Development Plan (2017-2021)
	The National Broadcasting and Telecommunications Commission (NBTC)	Telecommunications Master Plan
USA	Department of Commerce	Digital Economy Agenda 2016
Viet Nam	Ministry of Information and Telecommunications (MIC)	Information and Communication Technology Development Project

VIII. Mission and Means – How to Achieve Objectives and Overcome Obstacles

Visions are by their nature aspirational, but without the capacity to produce detailed operational sector-specific plans, or the interoperability of digital systems, or the resource management and project development skills required to implement them, progress will be frustratingly slow. The devil is always in the details, and if major IT projects are undertaken without clear-sighted future-proof architectures using modular designs that are adaptable to technological change and to changes in the product specifications of different vendors, both time and money can be wasted. Accountability and transparency need to accompany these processes so that monitoring and evaluation (M&E) can identify problems as they arise. No governments have all the skills required, so outsourcing part or the whole of digital design projects is necessary, but how to ensure accountability and transparency in the public-private partnership (PPP) model is also a major challenge. A common problem is where governments select the cheapest rather than the best procurement outsourcing contract, imposing unrealistically narrow margins on the vendor, leading to contract failures or what appear as cost overruns, but in reality, may be overdue adjustments to the true costs. For efficient and well-run businesses, it is equally important that there are efficient and well-run governments who can be business-wise and responsible partners, not simply awarding contracts to cut costs and offload responsibilities.

Making room for PPP and other forms of private sector investment in the digital network infrastructure, and in the provision of services, sometimes requires an APEC economy to revise policies and reform regulations, or amend a National Constitution where these unduly prohibit or cap FDI. In the Philippines, for example, the government is openly discussing the need to raise the cap on foreign investment to attract a third telecommunications company into a market dominated by a local duopoly.²⁸ Below, is an overview of the policy reforms and challenges that are common across APEC economies.

Government IT Infrastructure and Services

By its nature, the capacity of digital technology is continuously growing and changing, through chip design and most recently through the application of Artificial Intelligence (AI). Governments need to keep abreast of these changes for two clear reasons: to deliver the range of services expected of them by the community, and to upgrade the security requirements of public systems. The most advanced APEC economies in terms of digitalisation are also the most likely to be upgrading. Thus, for example, the US Congress in 2017 passed the *Modernizing Government Technology (MGT) Act* which establishes “agency-specific IT modernization funds and [authorizes] the U.S. Office of Management and Budget (OMB) to oversee a government-wide IT modernization fund in the U.S. Department of Treasury to be administered by the General Services Administration (GSA).”²⁹ While the US policy approach builds upon already strong private IT sector development, in other cases the state plays a more direct role in supporting investment in the digital economy. In Malaysia, for example, the Malaysia Digital Economy Corporation (MDEC) is an agency specifically tasked with the digital transformation of Malaysia’s economy, having begun as the managing agency of the Multimedia Super Corridor (MSC), an IT-

²⁸ Bloomberg (2017) Philippines Plans Charter Change to Ease Foreign Ownership Limit, <https://www.bloomberg.com/news/articles/2017-10-01/philippines-plans-charter-change-to-ease-foreign-ownership-limit>; BusinessWorld (2017) The Philippines looks to foreign investment to liberalize trade, <http://bworldonline.com/philippines-looks-foreign-investment-liberalize-trade/>

²⁹ United States Congress (2017) House Report 115-129 – Modernizing Government Technology Act of 2017, <https://www.congress.gov/congressional-report/115th-congress/house-report/129/1>

development area in the 1990s, and most recently as the promoter of a Digital Free Trade Zone.³⁰ Malaysia is already a middle-income economy and many lower-income countries face an uphill challenge getting to this point. An important role for APEC should be to support technical assistance programmes to low-income member economies where there is a lack of the digital technology expertise and specialist knowledge within the public sector.

Costs of Doing Business

Digital technologies demand agility on the part of adopters, especially innovators, but regulations too often remain stuck in Industry 3.0 rather than Industry 4.0. This ramps up the costs of doing business and slows down the process of innovation. The Philippines has recently expanded its initiatives to combat red tape through the use of technologies in simplifying business processes. The recently expanded anti-red tape program (ARTA)³¹ has introduced a range of measures to reduce business costs, including a Philippine Business Data Bank (PBDB), a National Single Window using the TradeNet platform that became operational in December 2017 to process trade documents online,³² and an ongoing computerisation programme at the Department and the Bureaus of Internal Revenue (BIR) and of Customs (BOC).³³ Notably, the PBDB will allow the online processing of business permits down to the local government level and targets to cover all 1,634 local government units (LGUs) nationwide within a two-year period. The recently launched Electronic Business Process and Licensing System has substantially reduced the processing time for business permits from 5 days to 1-2 working days. Also the Company Registration System, launched by the Securities and Exchange Commission in November 2017, facilitates online registration and verification of company names as well as filing and paying fees.

The problem of red tape was highlighted by the two incumbent telecom carriers, PLDT and Globe, who pointed out that for local permissions such as ducting, cell sites and towers, no fewer than 25 permits are required, tower fees and property taxes are non-standardized across LGUs, and it takes at least eight months to obtain the permits.³⁴ These are not uncommon problems in most economies, but they add to costs and to delays. Table 2 gives two measures of the cost of doing business in APEC economies, from the World Bank Group. The column headed **DB** is a ‘Doing Business’ ranking of all economies, while the column headed **DTF** is the ‘Distance to Frontier’ score of falling short of achieving 100 points.

Table 2: Ease of Doing Business Ranking

Economy	DB Rank	2018	DTF Score	Economy	DB Rank	2018	DTF Score
Australia	14		80.14	Mexico	49		72.27
Brunei Darussalam	56		70.60	New Zealand	1		86.55
Canada	18		79.29	PNG	109		59.04
Chile	55		71.22	Peru	58		69.45
China	78		65.29	Philippines	113		58.74

³⁰ <https://mydftz.com/>

³¹ OpenGov Asia (2017) Philippines Business Data Bank launched by DOF, DICT and DILG to streamline application and renewal of business permits, <https://www.opengovasia.com/articles/philippines-business-data-bank-launched-by-dof-dict-and-dilg-to-streamline-application-and-renewal-of-business-permits>

³² The Philippines Star (2017) TradeNet operational by December, <http://www.philstar.com/business/2017/09/11/1737751/tradenet-operational-december>

³³ Philippines Information Agency (2018) Digital platforms, others measures launched in 2017 to improve ease of doing business, <http://pia.gov.ph/news/articles/1003634>

³⁴ Rappler (2017) Globe ‘ready’ for faster internet but permits are ‘biggest hurdle’, <https://www.rappler.com/business/191600-globe-telecom-high-speed-internet-bottlenecks-permits>

China-HK	5	83.44	Russia	35	75.50
Indonesia	72	66.47	Singapore	2	84.57
Japan	34	75.68	Chinese Taipei	15	80.07
Korea	4	83.92	Thailand	26	77.44
Malaysia	24	78.43	USA	6	82.54
			Viet Nam	68	67.93

Source: World Bank Group *Doing Business 2018*, (p.4) ³⁵

The economies ranked with the least-cost barriers to doing business are New Zealand; Singapore, Korea; Hong Kong, China; the USA, Australia and Chinese Taipei, in that order. Canada is close. Those ranked with the highest costs of doing business (DB above 100 and DTF below 60) are PNG and especially the Philippines, hence the need for the ARTA in the Philippines.

Innovation and Competition

A further step planned in the Philippines is a proposal to establish a National Innovation Council (NIC) headed up by the President,³⁶ to produce a National Innovation Agenda and Strategy Document (NIASD). This would support the National Broadband Plan (NBP) by the Department of Information and Communications Technology (DICT),³⁷ which is proposing to contribute public telecom assets, such as towers, to a privately-funded backbone broadband network which is urgently needed if widespread access to broadband Internet is to be achieved. Policy commitment such as these above, and regulatory reforms at the level of the market, can have dramatic results. Nowhere across the APEC economies are the challenges literally more mountainous than in PNG, yet as Box 1 indicates, policy reforms can have widely beneficial effects for the advancement of digital technologies.

Box 1

Telecoms Reform and Competition in Papua New Guinea

Despite PNG's often impenetrable terrain, in 2005 a decision was taken to open the telecoms market to competition. The Ministry of Information and Communication Services (PANGTEL) was created in 2007, and the National Information and Communications Technology Authority (NICTA) was formed in 2010 to regulate the sector. In addition to Telikom PNG, the fixed line and mobile incumbent, Dataco was created by the government to build a National Transmission Network to supply broadband on a wholesale basis to Telikom, and to new entrants Digicel, Bmobile (Vodafone) and others.³⁸ The impact has been stark. Narrowband feature phone mobile penetration has risen from 28% in 2010 to 49% in 2016, while according to ITU data, broadband mobile, has gone from zero to nearly 10%. Given that only 20% of PNG's population of around 8 million is urban, the penetration rates in these areas is considerably higher.

³⁵ World Bank Group (2018) *Doing Business 2018: Reforming to Create Jobs*, <http://www.doingbusiness.org/~media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB2018-Full-Report.pdf>

³⁶ NewsBytes (2018) Solon seeks House approval of 'Philippines Innovation Bill', <http://newsbytes.ph/2018/01/13/solon-seeks-house-approval-of-philippine-innovation-bill/>

³⁷ Republic of the Philippines Department of Information and Communications Technology (DICT) (2017) *The National Broadband Plan*, <http://www.dict.gov.ph/national-broadband-plan/>

³⁸ Kumul (2018) PNG DataCo Limited, <https://www.kch.com.pg/portfolio/png-dataco-limited/>

The challenge in PNG is how to ensure effective competition when the dominant cellular player, Digicel, has around 95% of the market,³⁹ the result of steady investment and acquisitions.⁴⁰ The first step taken by NICTA was to issue dozens of technology-neutral licences, many of them never used, to monitor the market outcome. But, when one player rises so far above the rest, consolidation of the competition is inevitable, and in 2017 the networks of Bmobile, Telikom and Dataco were allowed to merge. Another step for regulatory intervention is on issues such as equal access. The NICTA has required Digicel to end higher prices for off-net calls, has required Telikom to reduce interconnection charges to its international gateway, has managed to steer Telikom wholesale prices downwards, as a result of which customers now pay for bandwidth rather than data usage charges. NICTA has also acted to have SIM cards registered and to protect consumers' phone credits on SIM cards from disappearing from premature expiry of cards. But mobile number portability (MNP), which is a cost to implement but which can assist customers changing operators, has not yet been introduced, but is under review.

The scarce resource in the mobile market is not so much investment as much as spectrum. As the NICTA acknowledges, if one company is powering ahead, prepared to invest in new areas, "they need spectrum. We have no reason to say 'No'."⁴¹ On the one hand this reinforces the dominant player, on the other hand, if a well-run and innovative carrier is delivering the goods, that is in the interests of consumers. The role of the regulator is to ensure competitors have an equal chance to compete, and customers have the right to choose; it is not to pick winners. In the longer-run, when the broadband networks are fully available to most potential users, the business models will shift towards data packages, content and e-commerce, and then the nature of competition and the competitors will change. The PNG story illustrates how pro-competition policy and regulatory reforms can transform the digital communications landscape in less than a decade. It might also be noted that the CIO of NICTA was appointed the chair of the Pacific ICT Regulatory Resource Centre in Fiji.

The role of competition is crucial to innovation and cost-based pricing. In this regard, Peru is another example of an APEC economy that has achieved growth through competition and the establishment of a transparent and competent regulatory regime, through licensing new entrants including MVNOs, and introducing MNP. To cite the regulator⁴²

"In Peru we are destroying the myth that too much competition reduces investment. In 2014 we saw an increase in investment and a jump in the number of users in the mobile market from around 30m to 31.8m. This happened at the same time that two new players entered the market. Competition is not only generating lower prices and enhancing the overall quality of the market; it is also creating high-quality jobs. The experience in Peru shows that a virtuous circle can exist between competition and investment."

³⁹ National Information and Communications Technology Authority (2016) Status of Spectrum Management: Papua New Guinea, https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2016/Nov-SM-Economics/Presentations/Day%201%20-%20Session%203_Hans%20Adeg_PNG.pdf

⁴⁰ Oxford Business Group (2018) New operators and reforms in Papua New Guinea set to transform telecoms sector, <https://oxfordbusinessgroup.com/overview/competitive-bet-new-operators-and-government-reforms-are-set-transform-telecoms-industry>

⁴¹ DevPolicyBlog (2017) Telecommunication and broadcasting regulation in Papua New Guinea – in conversation with the regulator, <http://devpolicy.org/telecommunication-and-broadcasting-regulation-in-papua-new-guinea-in-conversation-with-the-regulator-20170321/>

⁴² Oxford Business Group (2018) Gonzalo Ruize, President, OSIPTEL: Interview, <https://oxfordbusinessgroup.com/interview/forming-new-lines-obg-talks-gonzalo-ruiz-president-osiptel>

Digital Identity and e-Government

Many economies are starting to introduce digital identities for their citizens. These offer security and access to online digital services. From December 2017 in Thailand all new SIM card registrations will require a biometric ID card.⁴³ One of Peru's outstanding achievements is the introduction of a National Electric ID card (DNIe) by the National Registry of Identification and Civil Status (RENIEC), a programme that won the accolade of being the best example of e-ID on the continent at the Latin American Conference on Security, 2015,⁴⁴ not least because by 2012 over 96% of Peru's 10 million children had been provided with an ID card, a result that was recognised in 2013 by a UN Public Service Award. An e-Identity will be a fundamental asset for citizens in a digital economy wanting to access online government and private services. But as always, the devil resides in the details. First, how much personal information should be stored in a smart ID card. Since 2017 in the Philippines, Congress has been debating whether 21 data points, including information about parents and siblings, is over-reach in the proposed law.⁴⁵ After the Senate passed the new Philippine Identification System (PhilSys) bill in March 2018,⁴⁶ it has been submitted to the Bicameral Conference Committee in May 2018. Second, how much data should be stored in a centralised database that could be subject to a cyber-attack. (See section below)

In e-government, Korea has been a world leader.⁴⁷ The World Bank Group (2016) *Bringing Government into the 21st Century: The Korean Digital Governance Experience*⁴⁸ provides a candid assessment of how Korea has achieved its pole position, a good example for many APEC economies. Before success could be achieved, Korea had to ride a learning curve of errors.

“One such error was an inability to identify and capitalize on emerging global market trends due to concentrating too heavily upon domestic technological development and standards. Korea also suffered from redundancies and instances of over-investment in e-governance infrastructure, as well as the hasty inclusion of premature technologies in pilot projects that ultimately did not materialise. A final and particularly important critical finding is the lack of methodical and systematic follow-up evaluation of many IT investments, which could have prevented downstream mistakes and restrained the mainstreaming and scaling up of underperforming projects.” (p.8)

The Digital Economy and Technologies

A useful way to conceptualize the development of a digital economy is through three parameters: policy and regulations, technologies and standards, and markets and evolving business models. These endogenous forces frame most public and private sector investment decisions. Exogenous shocks to the system, such as natural disasters, armed conflicts, and the like, have only short-to-medium term impacts, depending upon their scale. But environmental issues, notably global pollution and global warming, are

⁴³ Reuters (2017) Thailand to roll out biometric checks for SIM cards nationwide, <https://www.reuters.com/article/us-thailand-telecoms/thailand-to-roll-out-biometric-checks-for-sim-cards-nationwide-idUSKBN1D611A>

⁴⁴ Reconnaissance (2016) Peru's E-Passport Wins Best ID Document Award, <https://www.reconnaissance.net/news/peru-wins-best-id-document-2016/>

⁴⁵ Inquirer.net (2017) House approves National ID System, <http://newsinfo.inquirer.net/928908/house-approves-national-id-system>

⁴⁶ NewsBytes (2018) Senate approves proposed law on national ID system, <http://newsbytes.ph/2018/03/19/senate-approves-proposed-law-on-national-id-system/>

⁴⁷ Centre for Public Impact (2016) Building world-beating e-government in South Korea, <https://www.centreforpublicimpact.org/case-study/building-a-world-leading-e-government/>

⁴⁸ World Bank Group (2016) *Bringing Government into the 21st Century: The Korean Digital Governance Experience*, <http://documents.worldbank.org/curated/en/934391468011726182/pdf/106581-REVISED.pdf>

among the mega-issues that must be endogenized. They should be factored into investment decisions, policy decisions and market outcomes, either as threats or as opportunities to apply digital solutions to these over-riding challenges, such as green technologies with minimum carbon footprints. Diagram 1 illustrates the conceptual framework within which the progress and challenges of the digital economy for APEC economies can be considered.

Diagram 1: Interplay of Parameters



Source: TRPC

This framework can be useful in exploring progress towards a digital economy, from the mission of smart cities to the detailed means of implementation.

Smart Cities

What makes a city smart in the twenty-first century is the way it adopts digital technologies to improve the quality and sustainability of life for its citizens. Economically this usually involves doing more with less, for example, using less energy. It also means the use of information, especially Big Data – processing lots of data from a wide range of sources – with the help of AI and algorithms to plan responses to the challenges of city management. Some of the implementation will be ‘low hanging fruit’ such as using lamp posts to mount traffic sensors and WiFi routers, others will be major policy initiatives, such as carbon emission taxes to incentivise the use of green technologies. The issue of lamp posts is instructive. In Singapore, they are already being widely used as the City-State makes the transition to a Smart Nation, experimenting with everything from smart homes to self-driving automated vehicles (AVs). By contrast, Hong Kong, China is having to change governance to allow lamp posts to be used for a wider-range of applications, a policy direction being overseen by a Smart City Steering Committee chaired by Hong Kong, China’s CEO.⁴⁹

Most smart city projects that capitalise upon emerging digital technologies tend to fall into one of two categories: either low-hanging fruit that offer quick gains, and which are very visible and naturally attractive of public appreciation; or medium-term projects, such as universal access to broadband, which often require public-private partnerships to manage the investment and commercial risks involved. But

⁴⁹ Office of the Government Chief Information Officer (2018) Hong Kong Smart City Blueprint, <https://www.smartcity.gov.hk/>

the biggest challenges that smart city projects need to address are in realising the long-term opportunities to use advances in digital technologies to guarantee the security and sustainability of the economy and society. Some of the key socioeconomic challenges today involve the environment, aging populations, and terrorism and cyber-attacks. These are all areas in which the policies of governments are central to the solutions.

The issue of the environment is an outstanding example, and an important area for APEC. Crisis-levels of pollution now make it the world's number one killer according to the World Health Organization (WHO); "more than 1 in 4 deaths of children under 5 years of age are attributable to unhealthy environments."⁵⁰ Until it was recently overtaken by India, China suffered the highest number of annual fatalities, but China is also taking some of the boldest steps to reduce pollution and Greenhouse Gases (GHGs) with an ambitious carbon tax and other measures.

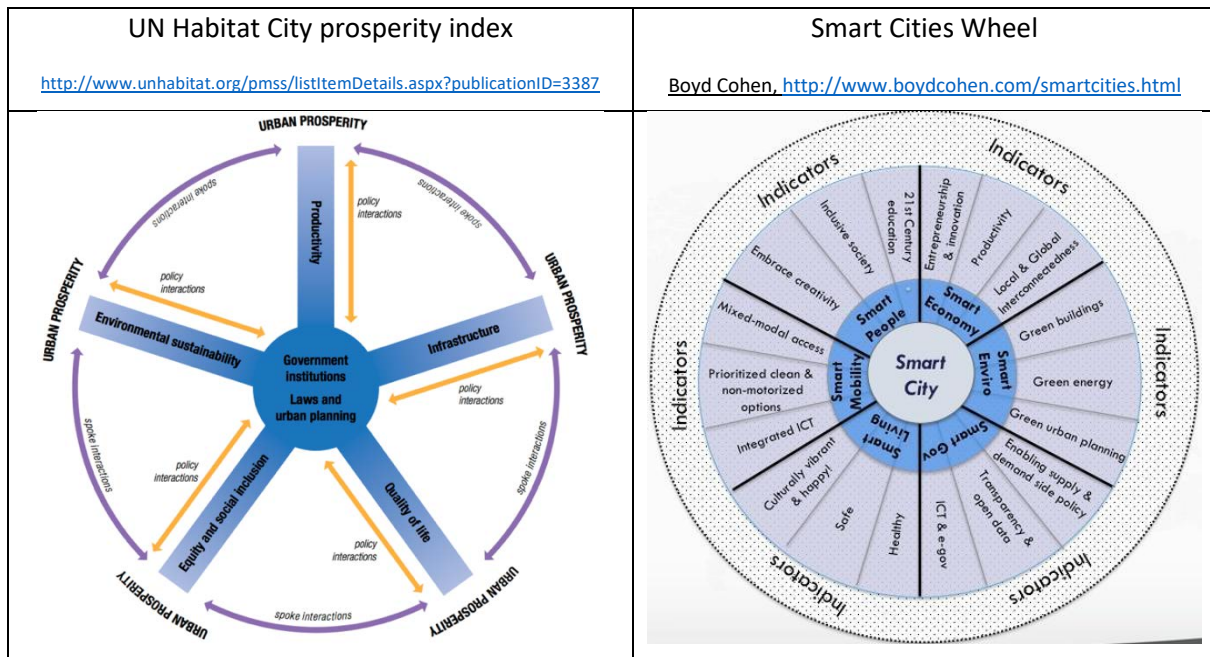
"China will lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level by 2030 and increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level by 2030. China will promote green power dispatch, giving priority, in distribution and dispatching, to renewable power generation and fossil fuel power generation of higher efficiency and lower emission levels. China also plans to start in 2017 its domestic emission trading system, covering key industry sectors such as iron and steel, power generation, chemicals, building materials, paper-making, and nonferrous metals. China commits to promote low-carbon buildings and transportation, with the share of green buildings reaching 50% in newly built buildings in cities and towns by 2020 and the share of public transport in motorized travel reaching 30% in big- and medium-sized cities by 2020. It will finalize next-stage fuel efficiency standards for heavy-duty vehicles in 2016 and implement them in 2019. Actions on HFCs continue to be supported and accelerated, including effectively controlling HFC-23 emissions by 2020."⁵¹

Given the severity of pollution globally, nothing is smarter than tackling the problem of pollution, and green and renewal energy technologies now exist to provide some important responses. However, there are many metrics by which to judge a city as moving in the direction of becoming smart. Two are shown in Diagram 2.

⁵⁰ World Health Organization (WHO) The cost of a polluted environment: 1.7 million child deaths a year, says WHO, <http://www.who.int/mediacentre/news/releases/2017/pollution-child-death/en/>

⁵¹ National Development and Reform Commission (NDRC) (2015) China-U.S. Joint Presidential Statement on Climate Change, http://en.ndrc.gov.cn/newsrelease/201509/t20150929_755626.html

Diagram 2: Two Representations of Smart City Indices



Source: TRPC (2015) *Background Briefing paper: Smart Cities, Smart Nation*⁵²

In Latin America, Chile lists 11 cities as becoming smarter,⁵³ and in Mexico, both Guadalajara⁵⁴ and Mexico City⁵⁵ have entered the lists of smart cities. Lima, the capital of Peru, is seeking investment from Spanish companies with an expertise in smart city developments.⁵⁶ In one index, over the last decade Lima has jumped from 26th to 8th for the ease of doing business in Latin America.⁵⁷ No city can become ‘smart’ overnight, but every city can become smarter, and APEC economies should be well placed to create the right mix of technologies, policies and regulations, and markets, especially if APEC encourages the openness to foreign participation demonstrated by Lima.

Policies and Regulations

Pro-competition policies and regulations need to be a priority in economies aiming at a transition to a digital economy. Competition drives innovation. Even in China’s model of political economy, where the state is highly pro-active, the policy has been to promote competition between ‘national champions’, some state-invested such as telecom companies, others from the non-state sector, such as Baidu, Alibaba, Ten Cent (BAT), and many others. (See *Markets*).

⁵² TRPC (2015) Briefing Paper: Smart Cities, Smart Nation, <http://trpc.biz/wp-content/uploads/Smart-Cities-19-May-Briefing-Paper.pdf>

⁵³ United Nations Commission on Science and Technology for Development (2016) Smart Cities in Latin America, http://unctad.org/meetings/en/Presentation/CSTD_2015_ppt05_Cartajena_en.pdf

⁵⁴ IEEE Smart Cities (2018) Smart City, Smart Future: Guadalajara, Mexico, <https://smartcities.ieee.org/articles-publications/smart-city-smart-future-guadalajara-mexico.html>

⁵⁵ Mxcity (2017) Mexico City in the 2016 Smart Cities List, <http://en.mxcity.mx/2016/12/2016-smart-cities-list/>

⁵⁶ Living in Peru (2017) Peru Looks to Bring Smart City Companies from Spain, <http://www.livinginperu.com/peru-looks-bring-smart-city-projects-spain/>

⁵⁷ Uno Magazine (N.D.) Lima: The impetus of the Peruvian capital, <http://www.uno-magazine.com/uno-29/lima-the-impetus-of-the-peruvian-capital/>

Start-Ups and Science & Technology Parks

Digital transformation requires investments in innovation, and a major source of new ideas comes from young entrepreneurs who add inspiration to their perspiration. But access to funding, to business experience, even to emerging technologies, are challenges. The clustering of start-ups and more established companies for their mutual benefit has become one of several approaches, promoted by a range of agencies, such as productivity councils, science and technology parks, research institutes, and so on. Examples from Latin America the NAFIN fund, a government sponsored co-investment fund in Mexico,⁵⁸ state-sponsored *StartUp Perú* which has announced plans to provide funding to more than 350 newly-formed local companies by the end of 2018,⁵⁹ and the government-sponsored accelerator programme *Start-Up Chile* which has funded a thousand start-ups over the past four years.⁶⁰ Science and technology parks are a major feature of digital economies, many of them privately-run, others sponsored by universities and research bodies. A UNESCO report lists nine in Australia and one in New Zealand,⁶¹ but there is also a new private park in New Zealand.⁶² Many of the parks in other APEC economies of the Pacific Rim are listed by UNESCO.⁶³

Closely associated with science and technology are initiatives to increase the supply of persons with IT skills. According to one report, by 2024 there will be a 12% increase in roles requiring digital skills.⁶⁴ This is often presented as a need for STEM education (Science, Technology, Engineering, Mathematics) but the development and application of technologies for social purposes requires another element, that of social science to appreciate the role of cultural issues. This has been called STEAM, with “Arts” included in the curriculum. See Box 2.

Box 2

STEAM and Canada’s Digital Skills Gap ⁶⁵

Canada’s Information and Communications Technology Council (ICTC) launched its first domestic digital talent strategy, *Digital Talent: Road to 2020*,⁶⁶ in 2016 after finding that the economy was facing an impending skills shortage as the growth in digital jobs had outpaced the overall economy by more than four times in the previous two years. If the economy’s digital skills shortage was not addressed, Canada would stand to lose CAD27.3 billion in GDP.

The government has allocated funds towards equipping the future work force with the necessary digital skills, as well as retraining mature workers in sunseting industries who may need to acquire a different

⁵⁸ Nathan Lustig (2017) Mexico Venture Capital Overview, <http://www.nathanlustig.com/2016/12/15/mexico-venture-capital-overview/>

⁵⁹ Latin American Private Equity & Venture Capital Association (LAVCA) (2017) Startup Peru to Fund More Than 350 Startups by 2018, <https://lavca.org/tags/startup-peru/>

⁶⁰ LAVCA (2017) SCL Energia Activa Invests in Chile’s Solarity Energia, <https://lavca.org/tags/start-up-chile/>

⁶¹ United Nations Educational, Scientific and Cultural Organization (2017) Science Parks in Australia and New Zealand, <http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-parks-around-the-world/science-parks-in-australia-and-new-zealand/>

⁶² New Zealand Technology Park (NZTP) Introducing NZTP, <http://www.nztp.com/default.asp>

⁶³ UNESCO (2017) Science Parks in Asia, <http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-parks-around-the-world/science-parks-in-asia/>

⁶⁴ Accenture (2017) New Skills Now: Inclusion in the digital economy, https://www.accenture.com/t20171011T185302Z_w_us-en/acnmedia/PDF-63/Accenture-New-Skills-Now-Inclusion-in-the-digital.pdf

⁶⁵ New Zealand Digital Skills Forum (2017) Digital Skills shortage should sound warning bell, <https://digitalskillsforum.nz/2017/12/18/digital-skills-shortage-should-sound-warning-bell/>

⁶⁶ ICTC CTIC (2016) Digital Talent 2020, https://www.ictc-tic.ca/wpcontent/uploads/2016/03/ICTC_DigitalTalent2020_ENGLISH_FINAL_March2016.pdf

skill set to fill empty positions in the digital economy.⁶⁷ Such measures include investing CAD300 million over three years to launch a new pilot project to enable adults who wish to return to school after spending several years in the workforce to qualify for student financial assistance, and CAD50 million over two years to teach primary and secondary students digital skills and coding to move from a STEM to “STEAM” (Science, Technology, Engineering, Arts and Math) system.

Data and Cybersecurity

Without question, the issues of data protection and privacy are of paramount importance in the digital economy, including the rules governing the collection and use of data, who carries the responsibilities of ensuring the rules are observed, and how to enforce rules across jurisdictions.

The value of data of all kinds, but especially of personal that offers companies an opportunity to predict consumer preferences, has moved to the forefront of policy and regulatory concerns. Laws that directly protect personal data exist in most APEC economies, although the scope and terms of the laws, for example, in Indonesia,⁶⁸ do not always match best practice. In Thailand and Viet Nam there are no personal data protection laws as such, and data protection falls under several regulations, such as those relating to children and to cybersecurity, as it does in China. In Brunei Darussalam, a personal data protection order is currently under draft.

While personal data protection laws focus on misuse, the growing problem of cyber-hacking is being addressed through a raft of cybersecurity laws, which is why in China, Thailand and Viet Nam data protection is currently being seen principally in these terms. Protecting an economy’s Critical National Information Infrastructure (CNII) is now often at the top of the agenda. For example, China’s Cyber Security Law that came into effect in June 2017. An unfortunate but seemingly unavoidable issue is the restriction on imports of security software and dual-use equipment and FDI into CNII which may be considered a domestic risk. This threatens to restrict trade in telecommunications and information technologies across a wide range of products. Unless APEC can facilitate quarantine facilities for type approvals in these products it is difficult to see an answer.

Technologies and Standards

The adoption of technology-neutral policies and regulations is widely regarded as ‘best practice’, allowing industry to evolve and innovate as the digital economy intensifies. There are clear areas where governments need to take an interest, most notably where health and safety issues are involved, and the choice is between either mandating standards or monitoring standards arising from the industries themselves. An ABAC respondent from the USA gives the example of the payments sector where the decision of government is not to impose technology-specific security standards on industry. The card payment sector, for example, has developed a PCI-DSS (Payment Card Industry - Data Security Standard) that allows for different technological paths of development.⁶⁹

But governments do consciously encourage standards, their interoperability and their security. Cybersecurity as a growing factor for digital products and services is reflected in China’s *Cyber Security Law* that came into effect in June 2017. The *Catalogue of key Internet Equipment and Cybersecurity*

⁶⁷ Government of Canada (2017) Canada’s Innovation and Skills Plan, https://www.budget.gc.ca/2017/docs/themes/Innovation_en.pdf

⁶⁸ Baker McKenzie (2017) Indonesia: New Regulation on Personal Data Protection, <https://globalcompliance.com/argentina-regulation-personal-data-protection-20170125/>

⁶⁹ PCI Security Standards Council (2010) PCI DSS Quick Reference Guide, <https://www.pcisecuritystandards.org/documents/PCI%20SSC%20Quick%20Reference%20Guide.pdf>

Products and drafts of the Critical Information Infrastructure Protection Regulation and Methods for Security Evaluation of Cross Border Flow of Personal Information and Important Data were also released. Although a major part of the *Cyber Security Law* is devoted to issues of data privacy and protection, a report points out that it also requires all “Critical network equipment and special cybersecurity products can only be sold or provided after being certified by a qualified establishment, and are in compliance with domestic standards.” And further that, “China’s cyberspace administrative bodies and the relevant departments under the State Council will draft a catalogue of critical network equipment and special products. Critical information infrastructure operators that purchase network products and services that might affect domestic security must pass a domestic security review.”⁷⁰ These measures have raised concerns among foreign vendors their intellectual property may be at risk in China because of these inspections. Foreign companies are also required to store data collected in China in data centres in China using Chinese partners. Although the details are particular to China, the overall security concerns are being reflected in other APEC economies.

Cloud Computing

Among the most compelling of the new technologies is cloud computing, and one many governments and central banks have been reviewing for security reasons. Several APEC economies have adopted ‘cloud procurement’ policies, and some ‘cloud first’ policies, opening prospects for anytime, anywhere e-government services, but also for pay-as-you-use networks, platforms, programmes and applications which can save treasuries money. Cloud services can also reduce downtime risk and ensure business continuity and disaster recovery management for essential services.

In Malaysia, a ‘Cloud First’ strategy is being introduced as an extension to the National Big Data Analytics Framework.⁷¹ In South Korea, the Korean National Assembly passed the world’s first Cloud Computing Act in March 2015. The *Cloud Computing Act* encourages public institutions to prioritize the use of cloud.⁷² Australia has implemented a Cloud-First Policy through the *Information Security Management Guidelines*, but the Department of Defence has warned of the risks to government and caution in procurement procedures. In April 2011, the Department of Finance and Deregulation published the *Cloud Computing Strategic Direction Paper: Opportunities and applicability for use by the Australian Government*, setting out a vision for whole-of-government principles and a risk-based approach to adopting cloud computing.⁷³ The Philippines released a Cloud First policy in January 2017.

In 2013, Thailand took its first step to G-Cloud computing overseen by the Electronic Government Agency (EGA).⁷⁴ As part of Thailand’s Five-Year Plan in 2017, the Government proposes to build a cloud data centre.⁷⁵ Although adoption of cloud technology in the financial sector is limited due to privacy and security issues, the Bank of Thailand decided upon public cloud adoption in early 2017. Guidelines were also issued for the use by financial institutions of cloud services. In New Zealand, government agencies are encouraged to adopt cloud computing, but subject to plan approval of the

⁷⁰ KPMG (2017) Overview of China’s Cybersecurity Law,

<https://assets.kpmg.com/content/dam/kpmg/cn/pdf/en/2017/02/overview-of-cybersecurity-law.pdf>

⁷¹ New Straits Times (2017) Najib unveils Malaysia’s digital ‘to-do list’ to propel digital initiatives implementation,

<https://www.nst.com.my/news/nation/2017/10/292784/najib-unveils-malaysias-digital-do-list-propel-digital-initiatives>

⁷² Asia Cloud Computing Association (ACCA) (2017) Cloud Readiness Index 2016,

http://www.asiacloudcomputing.org/images/documents/cr2016_acca.pdf

⁷³ Australian Government Department of Finance (2012) Cloud Computing Strategy,

www.finance.gov.au/files/2012/04/final_cloud_computing_strategy_version_1.doc

⁷⁴ Electronic Government Agency (EGA) (2016) Development of Government Cloud (G-Cloud),

<https://www.ega.or.th/en/profile/905/>

⁷⁵ DatacenterDynamics (2017) Thai government plans cloud data center, <http://www.datacenterdynamics.com/content-tracks/colo-cloud/thai-government-plans-cloud-data-center/98248.fullarticle>

government CIO and must abide by the Cloud Computing Information Security and Privacy Considerations.⁷⁶

A different approach has been adopted by Singapore, where a “Singapore G-Cloud” has been created, comprising three technology-based “assurance zones”: (1) public cloud, (2) computing resources shared with non-government entities, and (3) a pool of government-only physically dedicated computing resources (for the highest level of security). A CloudStore for procurement has also been created. By late-2015, 54 agencies with 184 systems resided on G-Cloud. Singapore’s approach is instructive for APEC economies because it assumes cyberattacks will be launched and keeps its most highly classified data off the Internet. In effect, by introducing a new calculus between risk and efficiency, Singapore is challenging long cherished beliefs in the efficacy of the Internet. But Singapore is also one of the most forward in giving banks a green light to use the cloud. See Box 3.

Box 3

Singapore Banks and the Cloud

The Monetary Authority of Singapore (MAS) published its updated Guidelines on Outsourcing in July 2016. This has changed Singapore’s financial services sector’s perception of cloud services, and dispelled a common misconception among Singapore’s financial institutions that MAS did not approve of the use of cloud, which had been a key blocker to cloud adoption.⁷⁷

The updated guidelines have simplified the administrative procedure of cloud outsourcing. This entailed the removal of two regulatory requirements: the expectation that financial institutions should pre-notify MAS of all “material outsourcing” arrangements,⁷⁸ and the need for FSIs to respond to a detailed questionnaire before engaging in any “significant” IT outsourcing agreement. The Technology Outsourcing Questionnaire had become a heavy administrative burden for both financial institutions and cloud service providers alike and was not ideal for FSIs’ cloud adoption given the rising complexity of cloud outsourcing arrangements.

Markets

The issue with markets is not their range from natural monopolies to almost perfectly competitive, but that they are rarely unchanging. A natural monopoly today can become a contestable market tomorrow due to new digital technologies, such as advances in wireless communications, and those that have given rise to social media and over-the-top (OTT) services that by-pass the traditional business models of utility companies. By the same token, a highly competitive market can give way to concentration as leading companies take advantage of economies of scale and economies of scope. Some of the markets in e-commerce are a good example. It is therefore important for policy makers and regulators to develop a clear understanding of these markets, when it is time to intervene and when it is time to hold back. A good regulatory practice, that has been used in Hong Kong, China since the 1990s, is to consult and exchange information with parties prior to a considered merger or takeover to reduce commercial

⁷⁶ OECD (2016) Digital Government in Chile: Strengthening the Institutional and Governance Framework, http://chile.gob.cl/ocde/site/artic/20170804/asocfile/20170804210854/estudio_gobierno_digital_en_chile.pdf

⁷⁷ Forrester (2016) Ensuring Agility And Trust In A Rapidly Changing Financial Services Market, <https://ncmedia.azureedge.net/ncmedia/2016/06/Cloud-in-Banking-Whitepaper.pdf>

⁷⁸ Monetary Authority of Singapore (MAS) (2016) FAQ on MAS Guidelines on Outsourcing, http://www.mas.gov.sg/~media/MAS/Regulations%20and%20Financial%20Stability/Regulatory%20and%20Supervisory%20Framework/Risk%20Management/Outsourcing%20Guidelines%20Jul%202016_FAQ.pdf

friction. Another good practice is to switch from a ‘positive list’ to a ‘negative list’. Box 4 is an example from South Korea.

Box 4

Competition Policy in South Korea

“In line with President Moon Jae-in’s promise to do away with outdated policies and over-regulation, the Republic of Korea’s Korea Communications Commission (KCC) has promised to cut down on regulations to allow local and international players to compete in a fair environment, and formed a new body to oversee key policy issues in the Internet business sector and mediate public and private concerns.

The KCC is also set to discuss deregulation to support businesses engaged in new technologies and new business models. It aims to push for the adoption of a “negative regulation” framework for Internet businesses, which explicitly blacklists certain items. Such a framework is aimed at reducing regulatory risk and giving businesses more freedom to innovate. With the current “positive regulation” system, items which are not white-listed are automatically considered banned, effectively restricting innovation from occurring at a faster pace than regulatory updates. Such a “negative regulation” framework has also been adopted by the US.”⁷⁹

Net Neutrality and the Role of Competition

Another area in which competition can decide an outcome is the decision by the FCC in the USA to reclassify Internet services from Title II to Title I as information services and not carrier class services. This has challenged, in the eyes of many across APEC economies, the concept of net neutrality. Whether this is so may less likely hinge upon the impact of the de-regulation as such and more upon the state of competition in the market for access to Internet services. Both vendors of content and consumers of content will choose the service providers most advantageous to them if there are competing ISPs of equal stature. If there are not, then APEC economies that believe net neutrality should be a requirement, can only assure it through regulatory intervention. But net neutrality must be understood to mean equal treatment for equal access. It is common practice for different data packages to be priced differently when carrier services are used, such as broadband mobile.

An important role of the regulator is to ensure that, where net neutrality policy is adopted, throttling and other violations of net neutrality principles are not being surreptitiously applied disguised as network management issues. Singapore, for example, adopted a net neutrality position in 2011, citing that net neutrality is generally defined “as treating all sources of Internet content equally, and the right of a consumer to access content and services on the Internet on a non-discriminatory basis”⁸⁰. After considering factors such as having a competitive internet market, internet providers in Singapore are allowed to offer niche and differentiated services (e.g. lower latency, higher Quality of Service (QoS)) as long as they meet existing fair competition, information transparency and QoS requirements. A useful rule-of-thumb guide for regulators was developed by two American academics in 2009. See Box 5.

⁷⁹ The Korea Herald (2017) Korea to form new body for discussing fair IT policy direction, <http://www.koreaherald.com/view.php?ud=20171213000797>

⁸⁰ Infocomm Development Authority of Singapore (IDA) (2011) Decision Issued by the Info-Communications Development Authority of Singapore: Net Neutrality, https://www.imda.gov.sg/-/media/imda/files/inner/pcdg/consultations/20101111_netneutrality/netneutralityexplanatorymemo.pdf

Box 5

Red Flags in Network Management

- When management techniques are applied in or below the transport layer affecting transit between networks;
- When tools involving termination or blocking as opposed to traffic shaping and queueing;
- If the request is a unilateral decision rather than coming from the user end or the source end; and
- When a network management tool applies to (i) apps, (ii) source/destination, (iii) the service provider, and (iv) the payments processor – if only to traffic based on (ii) or (iii).

Source: Scott Jordan and Arijit Gjosh (2009) *How to determine whether a traffic management practice is reasonable*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1999845

Over-The-Top (OTT) services are a hot topic involving Internet online content, not least because they substantially challenge the business models of traditional service providers, many of which may be state-invested companies or are domestic broadcasting corporations. The switch to digital terrestrial TV (DTT) which will be completed in many economies by 2018 or 2020, has already induced policy changes. For example, Singapore abolished its TV licence in 2011 as more viewers download content over the Internet to computers and connected TVs. The market response has been for TV companies and telecom IPTV companies to adapt to non-linear programming schedules, and become local distributors and subscription gateways for some of the more popular OTT services. TRPC provided an overview of the policy, regulatory and business issues to the ASEAN Telecom Regulators Council meeting in Bangkok, September 2017.⁸¹

Financial Services

FinTech is very much to the fore in the thinking of APEC economies, notably the use of regulatory sandboxes, with monetary authorities adopting a cautionary rather than a negative stance with respect to risk. Australia; China; Hong Kong, China; New Zealand; Russia; and Singapore are just some of the APEC economies using sandboxes to test, for example, distributed digital ledgers (or ‘blockchain’) for FinTech services. An initiative for regional sandboxes to be recognised on a regional basis has also been proposed. (See *Regional*). Sandboxes are also being used in other sectors, such as for trials of Automated Vehicles (AVs), in China; Hong Kong, China; Singapore; the USA, and for flying drones in Australia. Drones are having ever widening commercial applications, but also raise issues of personal privacy and aeronautical safety.

The adoption of cloud services is another area in which central banks and monetary authorities in APEC economies have found it necessary to change regulations. In Singapore, the Monetary Authority updated Guidelines on Outsourcing, which were published in July 2016.⁸² The updated guidelines sought to reduce compliance barriers to cloud adoption for financial institutions by removing the requirement that financial institutions should pre-notify MAS of all “material outsourcing” arrangements,⁸³ and the

⁸¹ TRPC (2017) Over-the-top (OTT) Briefing Paper, http://trpc.biz/wp-content/uploads/ATRC_OTT_Background-Briefing-Paper.pdf

⁸² Forrester (2016) Ensuring Agility And Trust In A Rapidly Changing Financial Services Market, <https://ncmedia.azureedge.net/ncmedia/2016/06/Cloud-in-Banking-Whitepaper.pdf>

⁸³ MAS (2016) FAQ on MAS Guidelines on Outsourcing, http://www.mas.gov.sg/~media/MAS/Regulations%20and%20Financial%20Stability/Regulatory%20and%20Supervisory%20Framework/Risk%20Management/Outsourcing%20Guidelines%20Jul%202016_FAQ.pdf

burdensome need for FSIs to respond to a detailed questionnaire before engaging in any “significant” IT outsourcing agreement.

But in some economies restrictions or reservations on foreign payment services have been introduced. In Korea, for example, the Financial Supervisory Service (FSS) has advised card issuers to charge lower annual fees than international card brands, and to give preference to local brands for customers not using international transactions.⁸⁴ In Malaysia, the *Bank Negara Malaysia draft Interoperable Credit Transfer Framework (October 2017)* requires credit transfers between banks, other banks, and e-wallet holders be processed in Malaysia via a single payments operator. Similar regulations have been promulgated in Indonesia,⁸⁵ Thailand,⁸⁶ and Viet Nam where, as one respondent puts it, a draft revision to the Tax Administration Law issued by Ministry of Finance requires cross-border services providers to process payments through the NAPASS domestic payment gateway “with the intention of enabling tax authorities to control the revenues.”⁸⁷

Other Sectors

Digital initiatives are taking place in every sector of economy and society. Two examples from the healthcare sector will illustrate. In Japan, robotic nurses are providing healthcare to the elderly. The 65 and up age group currently is 21% of the economy’s population and is expected to rise to 40% by 2050.⁸⁸ The financial strain on the public healthcare system is forecast to reach 13.5% of GDP by 2035,⁸⁹ with an expected shortage of 380,000 nurses by 2025.⁹⁰ To fill the healthcare professional gap, the Japanese government has encouraged the use of nursing-care robots to deliver long-term elder-care, with subsidies on the development and adoption of nursing-care robots (carebots) having been made available since 2013.⁹¹ As of 2017, 600 nursing-care homes had adopted carebots while 5,000 were testing.⁹² The Ministry of Economy, Trade and Industry (METI) estimates that the market for carebots will grow by 25 times to USD3.7 billion by 2035.⁹³

⁸⁴ Financial Supervisory Service “Notification of Consideration for International Credit Card” memo (November 2008) and “Notice of Matters to Heed Concerning Issuance of Cards Bearing an International Brand” memo (October 2012)

⁸⁵ Bank Indonesia issued a regulation *PBI 19/8/2017* stopping domestic or international networks from processing domestic transactions from ATM and point-of-sale domestic debit transactions. New licences will be issued requiring onshore processing of transactions, a cap of 20% on foreign ownership, and the mandatory use of at least two of the four domestic switches and the adoption of the local pricing regulations. Foreign payment companies complain that, as one respondent put it, this forces them “to relinquish control over ownership, pricing and branding.” One concern is that these new ‘localization’ regulations will also be applied to e-commerce.

⁸⁶ In Thailand arise from the *Electronic Transaction Commission Notice No. 2/2016 (August 2016)* requires all issuer banks to utilize the services of a local network, all acquirer banks to accept local network debit cards, and all domestic debit transactions to be done in country.

⁸⁷ State Bank of Vietnam regulations Bank Card Operation Circular (Circular 19) require payments companies to use the “National Payments Gateway” (NPG).

⁸⁸ McKinsey&Company (2009) Improving Japan’s health care system, <https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/improving-japans-health-care-system>

⁸⁹ McKinsey&Company (2009) Improving Japan’s health care system, <https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/improving-japans-health-care-system>

⁹⁰ Nikkei Asian Review (2016) Japan’s Diet votes yes to more foreign care workers, <https://asia.nikkei.com/Politics-Economy/Policy-Politics/Japan-s-Diet-votes-yes-to-more-foreign-care-workers>

⁹¹ Ministry of Health, Labour and Welfare (N.D.) About Ministry of Health, Labour and Welfare, http://www.mhlw.go.jp/english/org/pamphlet/dl/pamphlet-about_mhlw.pdf

⁹² The Economist (2017) Japan is embracing nursing-care robots, <https://www.economist.com/news/business/21731677-around-5000-nursing-care-homes-across-country-are-testing-robots-japan-embracing>

⁹³ Channel NewsAsia (2017) Solving Japan’s ageing population woes with robots, <https://www.channelnewsasia.com/news/asiapacific/solving-japan-s-ageing-population-woes-with-robots-9125394>

In Singapore, the Ministry of Health in 2015 issued *National Telemedicine Guidelines*,⁹⁴ to establish a broad framework and provide best practices for the various categories of telemedicine service providers. The Health Sciences Authority (HSA) subsequently put out a *Regulatory Guideline for Telehealth Products* in 2017, which clarifies that telehealth medical products that would be regulated as medical devices. The telehealth products that are regulated need to fulfil the same regulatory requirements as regular medical devices, including obtaining product registrations and dealer licenses⁹⁵. As telemedicine continues to grow both in scope and acceptance, the Ministry will also be regulating the service under the upcoming Healthcare Services Act in 2020. To prepare the telemedicine landscape for licensing, and as a broader approach to allow safe growth of innovative modalities, the Ministry also launched a Regulatory Sandbox in 2018. The sandbox, enables such models to be developed in a safe and controlled environment, by setting clear boundary conditions, data governance measures and risk mitigation strategies.

If APEC economies are to meet mega challenges, such as pollution and ageing issues, government and private sector partnerships are very much needed, and priorities should be assigned to these long-term issues, for example, in the selection of projects governments prioritise in smart city development.

Taxation

The rise of the digital economy has placed tax reforms on the agenda of many APEC member economies.⁹⁶ As traditional sources of tax revenues decline with the shrinkage of the non-digital sectors, opportunities to substitute tax revenues from digital companies are proving elusive. This is especially true when the companies are operating from outside the tax jurisdiction and/or when the payments are made overseas. The structure of tax regimes varies according to the structure of the economy. An APEC study in 2015 found that the travel and tourism sector in Peru contributes 1.0% of tax revenue and 9.7% of GDP, whereas in the Philippines, the sector contributes 7.1% of tax revenue, but only 8.9% of GDP.⁹⁷ In the Philippines, travel and tourism are an important part of the economy, whereas in Peru, mining makes a greater contribution. But as societies make the digital transition, the structure of taxation regimes can be expected to change with them. Revenues generated in a digital economy are no longer confined to the direct domestic purchase of goods and services, but involve both e-commerce and international payments systems, and the substitution of direct payments, for example, subscriptions to media, with the monetization of data by companies ranging from social media to traditional commercial enterprises. As more traditional sources of tax revenues decline, changes in taxation systems are inevitable, but they can have unintended consequences if they become disincentives to investment.

⁹⁴ Ministry of Health (2015) National Telemedicine Guidelines, https://www.moh.gov.sg/content/dam/moh_web/Publications/Guidelines/MOH%20Cir%2006_2015_30Jan15_Telemedicine%20Guidelines%20rev.pdf

⁹⁵ Telehealth medical devices refer to telehealth products intended for medical purposes. Telehealth products are defined by the HSA as instruments, apparatus, machines or software (including mobile applications) that are involved in the provision of healthcare services over physically separate environments via infocomm technology (including mobile technology). Health Sciences Authority FAQ and Regulatory Guidelines for Telehealth http://www.hsa.gov.sg/content/dam/HSA/HPRG/Medical_Devices/Updates_and_Safety_reporting/Regulatory_Updates/FAQ-REGULATORY%20GUIDELINES%20FOR%20TELEHEALTH%20PRODUCTS%20Rev%202.0.pdf
http://www.hsa.gov.sg/content/dam/HSA/HPRG/Medical_Devices/Updates_and_Safety_reporting/Regulatory_Updates/REGULATORY%20GUIDELINES%20FOR%20TELEHEALTH%20PRODUCTS%20Rev%202.0.pdf

⁹⁷ APEC (2015) Assessment of the role of Taxation in the Promotion of Travel and Tourism Growth in the APEC Region: Final Report, <https://www.apec.org/groups/som-steering-committee-on-economic-and-technical-cooperation/working-groups/~media/0211236DDBFB48CBA88890923ADE080.ashx>

The issues hinge to a large extent upon whether taxation regimes can be harmonised, where taxation can be set at levels that balance the needs of governments to pay for public services, with the investment needs of the private sector, or alternatively, does each economy tax according to recognised local presence of the transactors irrespective of the international nature of the transaction. Without the harmonisation approach, APEC economies may well find themselves in a ‘localisation race’ that requires payments to pass through local gateways and foreign trading companies to register a local presence – see *Financial Services*.

Regional

The harmonisation of cross-border rules and regulations is always a necessary, but sometimes difficult to achieve, means of reducing the costs of business and opening markets, and APEC is uniquely positioned to achieve this. Cross-border data flows (CBDFs) is one area in which several APEC economies have made progress following the Cross-border Privacy Enforcement Arrangement (CPEA), which creates a framework for regional cooperation in the enforcement of Privacy Laws. Currently, seven APEC Economies are part of CBPR, namely Canada, Japan, Mexico, United States, South Korea, the Philippines, and most recently Singapore,⁹⁸ with Australia planning to join soon.⁹⁹ The remaining APEC economies should join.

Following a recommendation of the Sub-Committee on Customs Procedures (SCCP) in 2007, the Asia-Pacific Economic Cooperation (APEC) Single Window System was created, and in 2011 set a goal of including every APEC member by 2020 under a Collective Action Plan. Over half the APEC economies had joined by the end of 2017. Hong Kong, China and China are implementing the SWS in three phases, to be completed by 2023. Viet Nam has reported the implementation of their National Single Window (NSW) with 11 out of 16 Ministries having already been connected and has also discussed its plan to establish a legal framework to facilitate the exchange of electronic customs related documents among APEC member countries.¹⁰⁰ It is important that the 2020 target is met by most economies. A notable success has been TradeNet in Singapore, introduced as early as 1989. It has reduced the time taken to process trade documents from two days to under ten minutes and reduced the number of forms to be processed from over twenty to just one.¹⁰¹ Singapore focused its efforts on increasing awareness among traders (including MSMEs) about the benefits of a single window system to their businesses. Keeping the fee for electronic processing lower than the manual processing cost acted as a further incentive to go digital. The same applies to the operation of the CBPR system if MSMEs are to participate.

Data privacy and protection issues (see above) also require cross-border application. In August 2017, the APEC Electronic-Commerce Steering Group’s Data Privacy Subgroup (DPS) held talks with the European Commission on personal data protection regulations and facilitation of cross-border data flows. With the EU’s General Data Protection Regulation (GDPR) going into effect in May 2018, the DPS and European Commission are exploring the scope for interoperability between GDPR and

⁹⁸ Personal Data Protection Commission Singapore (PDPC) (2018) Singapore joins APEC Cross-Border Privacy Rules and Privacy Recognition for Processors Systems, <https://www.pdpc.gov.sg/pdpc/news/press-room/2018/03/singapore-joins-apec-cross-border-privacy-rules-and-privacy-recognition-for-processors-systems>

⁹⁹ The National Law Review (2018) As GDPR Looms, Australia to Participate in APEC’s CBPR Program, <https://www.natlawreview.com/article/gdpr-looms-australia-to-participate-apec-s-cbpr-program>

¹⁰⁰ CustomsNews (2017) Outcomes of the Single Window and AEO in APEC Vietnam 2017, <http://customsnews.vn/outcomes-of-the-single-window-and-aeo-in-apec-vietnam-2017-2779.html>

¹⁰¹ APEC Business Advisory Council (ABAC) (2015) Driving Economic Growth Through Cross-Border E-Commerce in APEC: Empowering MSMEs and Eliminating Barriers, <https://www2.abaonline.org/assets/2015/4%20Manila/MSMEEWG%2035-053%20USC%20Marshall%20SMMEs%20in%20e-Commerce%20Research%20Project%20Full%20Report.pdf>

APEC's Cross-border Privacy Rules (CBPR).¹⁰² The outcome of these talks will impact upon all APEC economies.

Another area of regional harmonisation that has made slow progress over the years is the use of Mutual Recognition Arrangements (MRAs). Where they exist, Conformity Assessment Bodies (CAB) act to ensure that local test laboratories in the case of equipment type approvals, or association qualification standards in the case of professionals such as lawyers and health workers, meet the minimum requirements for cross-border acceptance. Australia has been especially active in promoting the use of MRAs, such as with the European Community,¹⁰³ and Singapore.¹⁰⁴ Resistance to MRAs from entrenched local interests are a Non-Tariff Barrier-to-Trade (NTBT).

Tantamount to an MRA is a proposal for the monetary authorities across the ASEAN region to establish a region wide sandbox for FinTech. As the Governor of the Philippines Central Bank explained "When they come to our jurisdictions, they don't have to replicate the experiment. It's more cost-effective. Instead of a country sandbox, it's a regional sandbox."¹⁰⁵ This is an idea that should win support across APEC economies as well, especially given the overlap in membership with ASEAN. In fact, Singapore and Thailand have plans to link their respective PayNow and PromptPay digital payments systems, with plans to further expand the scale of the transnational digital payments platform through similar deals with China and India.¹⁰⁶ And the Monetary Authority of Singapore (MAS) and the Hong Kong Monetary Authority (HKMA) have also partnered on a project on developing infrastructure for cross-border trade and trade finance using distributed ledger technology, which will become live in 2019.¹⁰⁷

In January 2018, eleven APEC economies joined the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP or TPP-II), which includes many of the provisions of TPP-I but suspends agreement on others, such as public procurement, intellectual property rights (IPR), environment and transparency.¹⁰⁸ It is important that, if they are not already being addressed in the CPTPP, that the principals of free and open trade and markets are extended to all digital goods and services and cross-border transfers of data and payments, in the near future.

Values and Cultures

The challenge of cultural differences is both within and between economies. Social stability, essential for development, needs to be founded upon profound understanding and respect for such differences. The problem of accentuating differences is one of the bad side effects of the growth of online communications, and especially of social media. It often manifests itself in media content. Australia,

¹⁰² APEC (2017) Data Privacy Subgroup Meeting with European Union, <https://www.apec.org/Groups/Committee-on-Trade-and-Investment/Electronic-Commerce-Steering-Group/Data-Privacy-Subgroup-Meeting-with-European-Union>

¹⁰³ Australian Government Department of Industry, Innovation and Science (2013) European Community-Australia Mutual Recognition Agreement,

<https://www.industry.gov.au/industry/IndustryInitiatives/TradePolicies/TechnicalBarrierstoTrade/Pages/ECAustMRA.aspx>

¹⁰⁴ Australian Government Department of Industry, Innovation and Science (2011) Australia-Singapore Mutual Recognition Agreement on Conformity Assessment,

<https://www.industry.gov.au/industry/IndustryInitiatives/TradePolicies/TechnicalBarrierstoTrade/Pages/Australia-SingaporeMutualRecognitionAgreementonConformityAssessment.aspx>

¹⁰⁵ The Philippine Star (2018) BSP pushes reg'l 'sandbox' for fintech,

<http://beta.philstar.com/business/2018/01/08/1775533/bsp-pushes-regl-sandbox-fintech>

¹⁰⁶ Government of Singapore (2017) S'pore, Thailand to link up e-payment systems,

<https://www.gov.sg/news/content/today-online---spore-thailand-to-link-up-epayment-systems>

¹⁰⁷ MAS (2017) Singapore and Hong Kong launch a joint project on cross-border trade and trade finance platform,

<http://www.mas.gov.sg/News-and-Publications/Media-Releases/2017/Singapore-and-Hong-Kong-launch-a-joint-project-on-cross-border-trade-and-trade-finance-platform.aspx>

¹⁰⁸ The Straits Times (2018) 6 things to know about the trans-Pacific trade pact CPTPP,

<http://www.straitstimes.com/world/6-things-to-know-about-the-trans-pacific-trade-pact-cptpp>

for example, classifies social media platforms, and a tier-2 social media platform such as Facebook is required to delete offensive content within 48 hours.¹⁰⁹

A good example of cultural difference as they may impact upon the digital economy itself is a populations attitudes to personal data, such as facial recognition systems. China excels in the use of facial recognition for all manner of uses, such as access to an ATM. A widespread use of facial recognition for security surveillance by China's police forces combines CCTV cameras with Artificial Intelligence to identify persons of interest. One successful Chinese company can draw upon over 500 million data points harvested by police cameras across China to feed its AI algorithms.

“by turning the original video into structured data, it makes it much easier to store and search so you can find, for example, a woman in a white T-shirt with a blue bag with a BMW next to her.” (CEO of SenseTime *Financial Times* (25 January 2018) ‘China face scan start-ups capture a lead’)

There is both cost and benefit to China in that there is no obvious public hostility to being easily identified in this way. In other cultures, there would be enormous resistance. In China, the MIIT issues warnings to companies to respect the data privacy laws, but the commercial – such as the use of facial recognition for m-commerce – and security gains are given priority as they are seen to be assisting China's insecure development.

There are inevitably ethical issues involved in advanced technologies. One area is in robotics. The Ministry of Internal Affairs and Communications in Japan has proposed a certification system for AI and robots to be implemented by 2018.¹¹⁰ All the countries involved in robotics manufacturing – in terms of numbers, China is the leader – look to the standards set by the International Standards Organization.¹¹¹ But it is not just the manufacturing economies of APEC that need to develop guidelines, but also the economies that use robots. These issues are therefore universal in APEC, and should receive considered opinion.

IX. Conclusions

This report has traced the role, with examples, of governance, policies and regulations, and industry standards, that are enabling APEC economies to progress towards becoming digital economies. Despite the unevenness of development across APEC, the report finds plenty of progress, and important policy commitments to promote market entry, foreign investment and competition. The case of PNG (Box 1) is a good example of this with respect to telecoms. However, regulators sometimes are facing hurdles in enforcing those policies, as the case of Mexico illustrates. The following conclusions reference the potential role of APEC.

1. A well-developed broadband infrastructure is key to enhancing the connectivity of digital economies. **Recommendation - APEC economies that lack a good broadband infrastructure should assign a high priority to fixed line broadband.**

¹⁰⁹ The Australian (2018) Cyber-bullying spike puts heat on Facebook, <http://www.theaustralian.com.au/national-affairs/cyberbullying-spike-puts-heat-on-facebook/news-story/e6d4ebdd82f3e80f103c609bd0590dbb>

¹¹⁰ Nikkei Asian Review (2016) Japan eyes safety certification for AI tech, <http://asia.nikkei.com/Politics-Economy/Policy-Politics/Japan-eyes-safety-certification-for-AI-tech>

¹¹¹ International Organization for Standardization (ISO) (2015) ISO/TC 299 Robotics, <https://www.iso.org/committee/5915511/x/catalogue/>

A regression analysis reveals that investment in fixed line broadband can explain more of the variance in GDP per capita across the APEC economies than investment in broadband mobile. This is logical insofar as fixed line broadband is a prerequisite for broadband mobile usage. Previous studies of mobile have usually been undertaken in isolation, revealing the obvious, that the spread of broadband mobile is an important driver of the digital economy, but the findings of this report imply that, although managing investment in fixed lines is often problematic – and the report briefly surveys the different models being adopted – investment in a fixed broadband backbone network should be considered a priority.

2. Clearly-defined structures of governance are required to produce visionary domestic digital plans, along with policies for their implementation and regulations to make them happen. **Recommendation: APEC should do what it can to assist economies that lack a capacity to develop in depth operational planning.**

The role of governance, policies, regulations and standards have been examined in relation to a variety of digital developments and market issues. Table 1 indicates that all APEC economies have domestic digital plans of one kind or another, but while many are specific as to the priorities and ways forward, others remain at the aspirational level. The report does not investigate those plans in depth, but does suggest that APEC assistance to economies looking to develop digital development plans in more defined ways could play a vital role.

3. One driver of a digital economy that is in the hands of government is e-government, from online procurement to e-services. **Recommendation: APEC could urge member economies to prioritise e-ID as a means of registering populations, widening the scope of digital and financial inclusion, and improving the security of commercial and vital domestic assets.**

Peru's National Electric ID Card (DNIe) is cited as an award-winning initiative to spread online access to citizens, and the experience of e-government in South Korea is cited as a global best practice, but not one that came without hurdles which are admirably investigated in a World Bank publication, and which can serve as a text-book lesson for others to learn from.

4. An important part of these visionary statements is to reduce the costs of doing business and remove frictions in the market, such as excessive red tape, not least for start-ups who are often the most innovative. **Recommendation: APEC could encourage plans to include measures to cut red tape to reduce the costs of doing business, and to promote local start-ups.**

The Philippines' recently expanded Anti-Red Tape Programme (ARTP) and Ease of Doing Business initiatives are examples to be followed. Several economies also have an innovation system planned out, and APEC would do well to promote this concept further by identifying specific actions governments can take, such as encouraging start-ups and an eco-system of venture capital, incubators, accelerators, R&D, science and technology parks, etc. Several examples of the latter are cited in the report. This is especially true for economies that lack 'national champions' or R&D centres funded by multinationals, and where MSMEs are predominant.

5. Among the most compelling digital issues are data privacy, data protection and cybersecurity. APEC cybersecurity guidelines and assistance with expertise would be helpful, not least for the adoption of cloud computing. **Recommendation: several APEC economies already have 'cloud procurement' and 'cloud first' policies, but for others the sharing of the experience will be necessary, a role APEC can easily play.**

Although data privacy laws vary widely across APEC economies, they do exist in one form or another. There is ample evidence that to be able to trade successfully in the world digital economy, adequate data protection policies, including intellectual property, are increasingly important. This is even more important to the smaller APEC economies than to large ones, because they lack the scale required to become poles of attraction. Solid and well-implemented data protection laws, and rigorous cybersecurity can to some extent compensate an economy for lack of market size. Becoming a ‘Switzerland’ of safe data storage and cybersecurity, for example, in Latin America, can offer competitive advantages.

6. Regional harmonisation is a crucial area for the growth of digital economies as cross-border trade in goods and services increasingly depends upon the exchange and transfer of data. **Recommendation: APEC should give a strong priority to initiatives on regional harmonisation, and examine carefully roadblocks to progress.**

Pro-competitive market policies are required to unleash the potential of digital economies. An example is given in Box 4 from South Korea, including the role of competition in assuring non-discriminatory Internet access, and advances in different sectors of the economy, such as in financial services and healthcare. The challenges differ across sectors. With FinTech, monetary authorities are concerned with prudential issues, security and risk, and several examples are offered. But the challenges also include local restrictions on payments systems and the mandatory use of selected gateways, and a lack of interoperability across systems. An example of overcoming this problem is the proposal within ASEAN to introduce a regional sandbox and to make payment systems interoperable across economies. In healthcare, examples include the use of nursing-care robots for the elderly in Japan. Sharing examples, and exploring lessons learned, by APEC will help.

Taxation is another issue that urgently requires cooperation across economies to develop a consensus-based solution. The rise of a digital economy can mean the decline of traditional sectors and the tax base. Tax reforms are inevitable, and it is important they should not become forms of competition in themselves.

Steps are being taken to harmonise policy development on a regional and global basis, such as cross-border data transfers and payments systems. APEC’s Cross-Border Privacy Rules system (CBPR) is a good example, but yet to be widely adopted. The report ends examining other examples of issues that need a regional approach, such as type approvals – which the regional sandbox is also designed to achieve – and cross-border data flows (CBDF). In all these cases, an understanding and appreciation of cultural diversity and value systems is needed. This is a challenge APEC is very well-used to.

7. Digital development is closely associated with smart city development, and nothing is smarter than creating a clean environment in terms of the quality of the air we breathe, the water we rely upon, the disposal of waste of all kinds, and creating the jobs and commercial opportunities that can go along with these efforts. **Recommendation: APEC has an opportunity to add its voice and support to all its members in developing a green digital economy, probably the most important challenge for the planet.**

In many APEC economies there are cities that are on their way to becoming ‘smarter’. In every smart city project there are a plethora of initiatives that have either immediate or medium-term prospects of achievement, from the Internet-of-Things using sensors and smart meters, to electric

vehicles (EVs) and autonomous vehicles (AVs). This report suggests there are another set of challenges, mega-issues, such as aging, environmental pollution and the long-run of climate change, that urgently need attention. While governments cannot do it all, they are in the best position to give the lead, and involve the private sector and local communities. For example, although China suffers from some of the worst effects of pollution and Green House Gases (GHGs), China is also among the global leaders in green technologies and policies such as clean energy and carbon certificate trading which is designed to incentivise the use of ICTs to reduce GHGs.